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A health systems and policy analysis to inform universal child oral health coverage and Irish oral health reform

A thesis submitted to the National University of Ireland, Cork for the degree of Doctor of Philosophy

Thesis presented by

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Publication-based PhD requirements

This PhD thesis is presented as a publication-based thesis in accordance with the guidance specified by University College Cork. Specifically, these guidelines require 'one paper published in a peer-reviewed academic journal or equivalent, and others in press, submitted or planned for submission'. In line with this guidance, each manuscript formed one chapter of the PhD (Chapters 4, 5 and 6) and the text used represented the final draft of the manuscript submitted prior to publication.

List of Works

The research conducted as part of this PhD has produced two publications (Studies One and Two), one journal article 'accepted for publication' at BMC Oral Health along with various conference presentations and contributions, listed below:

Peer reviewed publications:

- McAuliffe, Ú., Whelton, H., Harding, M. *et al*. 'Toothless'—the absence of political priority for oral health: a case study of Ireland 1994–2021. *BMC Oral Health* **22**, 95 (2022). Available at: https://doi.org/10.1186/s12903-022-02125-1. Published: 27th March 2022. **[PhD Study One**]

- McAuliffe, Ú., Eaton, K., Harding, M. *et al.* 'At a tipping point': a comparative analysis of oral health coverage for children across six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain. *BMC Oral Health* **25**, 492 (2025). https://doi.org/10.1186/s12903-025-05773-1. Published: 5th April 2025. **[PhD Study Two].**

- McAuliffe Ú, Woods N, Barrett S et al. Comparing oral health systems for children in six European countries to identify lessons learned for universal oral health coverage: A study protocol. [version 1; peer review: 2 approved, 1 approved with reservations]. HRB Open Res 2022, 5:5. Available at: https://hrbopenresearch.org/articles/5-5. Published: 17th January 2022. [**Protocol for PhD studies two and three].**

Journal article *'accepted'* for publication at BMC Oral Health:

- McAuliffe, Ú., Whelton, H., Harding, M. *et al*. *Assessing child oral healthcare indicators of oral disease prevalence and oral workforce in six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain*. **[PhD Study Three].**

Additional publications during PhD:

Invited reviewer:

- European Observatory on Health systems and Policies. Oral health care in Europe: Financing, access and provision. Health Systems in Transition, Vol. 24 No. 2. Available at: https://eurohealthobservatory.who.int/publications/i/oral-health-care-in-europe-financing-access-and-provision#:~:text=This%20Health%20Systems%20in%20Transition,dentistry%20and%20cross%2Dborder%20care. Published: 9th June 2022.

Co-author:

- Winkelmann, J., Gómez Rossi, J., Schwendicke, F. et al. Exploring variation of coverage and access to dental care for adults in 11 European countries: a vignette approach. BMC Oral Health 22, 65 (2022). https://doi.org/10.1186/s12903-022-02095-4. Published: 9th March 2022.
- Cosgrave E, Sheridan A, Kavanagh P, McAuliffe U, Burke S, Harding M, Johnson H. Inequalities in oral health service utilisation in Ireland: results from the Healthy Ireland Survey. European Journal of Public Health, Volume 33, Issue Supplement_2, October 2023, ckad160.769. https://doi.org/10.1093/eurpub/ckad160.769. Published: 24 October 2023.

Conference awards:

- *Second Prize Winner*, Haleon Health Research Awards, for the presentation of: *'At a tipping point: A comparative analysis of oral health coverage for children across six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain'*. *European Association of Dental Public Health Congress*, Heraklion, Crete, 4 October 2024.

Conference presentations:

- McAuliffe Ú. 'Oral Health matters. Policy, implementation, and translation.' *Oral presentation at: The British Association for the Study of Community Dentistry. 50th Anniversary Annual Scientific meeting*. 15th- *16th June 2023*.
- McAuliffe Ú. Toothless the absence of political priority for oral health. *Oral presentation at the 9th Annual SPHeRE Conference. 23rd February 2023.*

- McAuliffe Ú. Access to dental care. Trends in service, provision and reforming dental coverage in Europe. Oral Presentation. *European Observatory for Health Systems and Policies. Virtual conference. 29th November 2022.*
- McAuliffe U, Harding M. 'Putting the Head on the Shoulders'. *Oral presentation: Next steps for Sláintecare: A holistic approach to health, wellbeing and integrated healthcare. The Policy Forum for Ireland Keynote Seminar. Virtual conference. Tuesday November 16th, 2021.*
- McAuliffe Ú, Harding M. A proposed recall service for children with a history of dental extractions under general anaesthesia. *Oral presentation at: British Association for the Study of Community Dentistry Autumn Scientific Meeting. 15th November 2018*.

Conference poster

- McAuliffe Ú, Harding M. A proposed recall service for children with a history of dental extractions under general anaesthesia. Poster session presented at*: British Association for the Study of Community Dentistry Autumn Scientific Meeting. 15th November 2018.*

Other contributions:

Presentation to National Oral Health Office of the Health Service Executive

- McAuliffe Ú. Oral presentation: Gaps in Public Dental Services for Children. *National Oral Health Office of Health Service Executive, Ireland. July 2019.*

Implications of the research

- **Irish Dental Association: '*Towards sustainable national oral health services'*.** This consultative narrative is informed by sources including Study One of this PhD (Appendix 1).

List of Abbreviations

BASCD: British Association for the Study of Community Dentistry

BZÄK: Bundeszahnärztekammer

CAPP: Oral Health Country/Area Profile Project

CECDO: Council of European Chief Dental Officers

DOH: Department of Health

DMFT: Decayed, Missing and Filled Teeth Index

DMS-V: Fünfte Deutsche Mundgesundheitsstudie

DTBS: Dental Treatment Benefit Scheme

DTSS: Dental Treatment Services Scheme

EHFA: European Health for All

GBD: Global Burden of Disease

GBE: Gesundheits-Bericjterstattung Des Bundes

GDC: General Dental Council

GHO: Global Health Observatory

GP: General Practitioner

GOHSR: Global Oral Health Status Report (GOHSR)

HSE: Health Service Executive

ICADS: The International Caries Detection and Assessment System

IHME: Institute of Health Metrics and Evaluation

INE: Instituto Nacionale de Estadistica

KZBV: Kassenzahnärztliche Bundesvereinigung

MSF: Multiple Stream Framework

NCDs: Non-Communicable Diseases

NDIP: National Dental Inspection Programme

NEAK: National Institute of Health Insurance Fund Management

NHS: National Health Service

NKK: The National Public Health Centre

OECD: Organisation for Economic Cooperation and Development (OECD)

OHP: Oral Health Professional

OOP: Out of Pocket Payments

PADI: Programa de Asistencia Dental Infantil

PDS: Public Dental Service

SCOR: Sundhedsstyrelsens Centrale Odontologiske Register

SHI: Social Health Insurance

UHC: Universal Healthcare

WHO: World Health Organisation

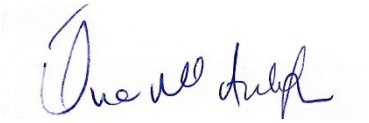
WHO (OHCP): World Health Organisation: Global oral health status report - country profiles.

WHS: World Health Survey

WTE: Whole Time Equivalent

Declaration

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism.



Signed: _____

Úna McAuliffe

Date: 14/04/2025

Statement of Contribution

The PhD candidate was responsible for study design, data collection, data analysis, and reporting of all research presented in this thesis. The research was supported by four PhD supervisors, the candidate's Post-Graduate Research Committee and SPHeRE Academic Panel.

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I was privileged to be selected as a Scholar of the HRB's Structured Population Health, Policy and Health-Service Research Education PhD training programme (SPHeRE), on almost this exact date in 2018. The support and education I received from SPHeRE has provided me with a skill-set that will shape the rest of my career. I want to sincerely thank the SPHeRE directors, lecturers and wider team, past and present, for all they do in making such a high-quality programme a reality.

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Denis, Jack and Muireann this thesis is dedicated to you.

Thesis abstract

Background

Oral diseases are among the most prevalent of all non-communicable diseases, with dental caries in children representing a significant public health concern. Access to preventive oral healthcare improves oral health outcomes, yet oral healthcare is often excluded from general health systems and policies. Globally calls are emerging for oral health system and policy reform under the universal health coverage agenda (UHC). However, research on oral health systems and policies remains limited. In Ireland, oral health coverage for the entire population, including children, is restricted, and oral health system reform has historically been minimal. 'Smile agus Sláinte' Ireland's national oral health policy published in 2019, represents the first policy update in over 25 years. A robust evidence base to inform oral health policy implementation and potential system reform is therefore needed.

Aim

The overall aim of this PhD is to carry out a health systems and policy analysis that informs the delivery of oral health reform for children through the implementation of Ireland's national oral health policy, Smile agus Sláinte, in line with the global policy aim of universal oral health coverage.

Objectives

This thesis had three objectives:

1. To generate an in-depth understanding of the key factors that impeded or promoted the development and implementation of oral health policy in Ireland during the period 1994 to 2021.
2. To provide a detailed description and mapping of publicly funded oral health coverage for children across six European each representative of a different oral health system model, and to report on that coverage in line with the World Health Organisation Coverage Cube.
3. To describe and compare two key oral health 'indicators' of child universal oral health coverage, (i) oral disease, specifically dental caries prevalence at age 12 years and (ii) oral health workforce, across the same European countries.

Methods

Three studies were conducted to address the thesis aim and objectives.

Study One involved a detailed oral health policy analysis adopting a case study approach with triangulation, including documentary analysis and semi-structured interviews with elite participants. Data analysis was guided by the Multiple Streams Framework.

Study Two employed an inter-country comparative analysis to describe and map publicly funded oral health coverage for children across six European countries representative of oral health system models (Denmark, Germany, Hungary, Ireland, Scotland and Spain). A multiple case study approach was adopted, combining documentary analysis with in-depth interviews with local experts. The WHO Universal Health Coverage Cube guided data collection and analysis.

Study Three involved a narrative literature review of peer-reviewed and grey literature to assess the two key indicators across the six countries. Data were verified by two local experts per country (n=12).

Results

A strong and persistent finding from this research was the low political priority afforded to oral health in Ireland. This was illustrated by the exclusion of oral health from broader health polices and by repeated non-implementation of evidence, including a national oral health policy. It also contributed to an absence of oral health advocates in positions of influence within the health system, leading to poor visibility for oral health particularly when competing for scarce resources during times of fiscal constraint. This perpetuated a system hallmarked by unequal access to publicly funded oral healthcare for large sectors of the population, including children.

Findings from Study Two identified two clear models of oral health coverage for children across the countries analysed: systems adopting 'universal' approaches whereby all children were eligible for almost all care without cost (Denmark, Germany, Scotland, and Hungary) and systems adopting 'targeted' approaches, restricting coverage by age and/or geography (Ireland and Spain).

The private sector was found to play a dominant role in 'targeted' systems, and, in Hungary owing to difficulties accessing its 'universal' system. Most universal systems were characterised by good access to care, prioritisation of prevention utilising a broad oral health

workforce, and evidence of effective reform underpinned by political commitment, stakeholder collaboration, and high-quality data.

Study Three expanded upon these findings by examining oral health workforce and dental caries indicators. It revealed significant methodological inconsistencies across the countries studied, underscoring the broader challenges of making meaningful international comparisons between oral healthcare systems. Ireland was found to have the lowest overall ratio of oral health professionals, including dentists and dental hygienists, among the countries studied, highlighting a structural barrier to system reform.

Conclusion

Oral healthcare for children in Europe is 'at a tipping point' in 2025 with targeted systems seeking expanded coverage and universal systems remaining 'alert' to maintain the coverage they have. In Ireland, progress on implementing 'Smile agus Sláinte' has been limited. However, global momentum toward universal oral health coverage, along with Ireland's broader political commitment to universalism, presents an opportunity for meaningful reform. Advancing UHC for oral health, both globally and nationally, will require a renewed emphasis on prevention, a commitment to addressing inequalities and strategic advocacy underlined by reliable, high-quality data.

Chapter 1 Introduction

1.1 Chapter outline

Chapter one introduces the background and rationale for this PhD thesis. The research aim and objectives follow, before the chapter concludes with an overview of the programme of PhD research setting the scene for the thesis.

1.2 Introduction

Good oral health is a basic human right, inextricably linked to overall health and well-being (Watt *et al.*, 2019; World Health Organisation, 2024a). Yet oral diseases are among the most common, non-communicable diseases globally, despite being almost entirely preventable (Bernabe *et al.*, 2020; World Health Organisation, 2024a).

Dental caries is one such condition, affecting populations across all countries and income levels (Fraihat *et al.*, 2019). It is the most common chronic disease of childhood. Even when identified at an advanced stage, dental caries affects up to 60-90% of school-aged children (Petersen *et al.*, 2005; Casamassimo *et al.*, 2009). The consequences of dental caries in children are well established and include pain and infection, difficulties eating, speaking, and socialising, in addition to delayed physical development and academic achievement (Sheiham, 2006; Jackson *et al.*, 2011; BaniHani *et al.*, 2018; Watt *et al.*, 2019). From an economic perspective dental caries is associated with a significant economic burden and remains among the costliest of all non-communicable diseases (NCD) (Vujicic and Listl, 2020).

There is also strong evidence that preventive interventions, particularly those involving fluoride are effective in improving oral health outcomes (Walsh *et al.*, 2019; Centers for Disease Control and Prevention (CDC), 2020; Iheozor-Ejiofor *et al.*, 2024). Early access to preventive oral healthcare, in combination with population-level interventions, has been shown to improve oral health outcomes (Moraes *et al.*, 2021; Goldfeld *et al.*, 2022).

However, oral diseases are hallmarked by significant inequality, disproportionately impacting vulnerable and lower socio-economic groups (Peres *et al.*, 2019). Thus, access to prevention,

early intervention and diagnosis of oral diseases is 'unattainable for millions of people' (World Health Organisation, 2020a).

The implementation of national oral health policies have been shown to mitigate inequalities in accessing oral health services (Galvão and Roncalli, 2021). While healthcare systems that offer and encourage access and attendance at oral healthcare services have shown improvements in children's oral health (Goldfeld *et al.*, 2022; Khairuddin *et al.*, 2024).

Despite this, oral health has been neglected on the public health and policy agenda globally (Leake and Birch, 2008; Benzian *et al.*, 2011; Watt *et al.*, 2019). While in many countries oral health services are considered non-essential components of the healthcare system and therefore excluded from 'benefit baskets' and system reform (Winkelmann *et al.*, 2022).

In response, global calls are emerging, led by the World Health Organisation and numerous dental public health experts, for the reorientation of oral health systems/services, inclusion of oral health under the universal health coverage domain (UHC) (Fisher *et al.*, 2018; Peres *et al.*, 2019; Watt *et al.*, 2019; Glick *et al.*, 2021; World Health Organisation, 2021, 2022, 2024a).

Ireland is one such country with very restricted oral health coverage for the entire population and historically limited oral health system reform (Johnston *et al.*, 2020).

In March 2019, Ireland's national oral health policy, 'Smile agus Sláinte' was published representing the first update to policy guidance in over one quarter of a century (Department of Health, 2019a).

1.3 Thesis aim and objectives

The overall aim of this PhD is to carry out a health systems and policy analysis that informs the delivery of oral health reform for children through the implementation of Ireland's national oral health policy, Smile agus Sláinte, (Department of Health, 2019a) in line with the global policy aim of universal oral health coverage (Figure 1-1)

Health policy analysis is 'essential to facilitate health system reform' (Walt and Gilson, 1994). It is useful retrospectively and prospectively to understand past policy successes and failures and to inform future policy development (Walt and Gilson, 1994). While policy analysis in the realm of general health policy is well versed in international literature (Walt *et al.*, 2008; May

et al., 2014; Burke *et al.*, 2016, 2021), there is limited oral health policy analysis literature (Singh *et al.*, 2010; Etiaba *et al.*, 2015; Pucca *et al.*, 2015; Leck and Randall, 2017).

To the best knowledge of this PhD candidate and supervisory team, no previous national oral health policy analysis has been conducted in the Irish setting. This research will contribute to original knowledge by conducting the first study of this kind in Ireland (**PhD Study One**). It will also seek to support policy implementation and successful oral healthcare reform with the intention of contributing to better oral health outcomes, especially those of children.

1.3.1 Objective one:

To generate an in-depth understanding of the key factors that impeded or promoted the development and implementation of oral health policy in Ireland during the period 1994 to 2021.

To build on the findings for an individual country in Study One, Study Two seeks to examine six different oral health systems for children using examples of countries with one of these six types of oral health system in place (Widström and Eaton 2004), to determine lessons learned that could be broadly applied to children's oral health coverage, particularly within the universal domain.

There is limited information available on how public dental systems are organised in Europe, their position within the UHC domain, what services are delivered and the reforms that have been implemented (Winkelmann *et al.*, 2022). This thesis will build on the findings from the in-depth policy analysis in an individual country, by providing a detailed description and mapping of coverage for children across six European countries, each representative of a different oral health system model (**PhD Study Two**).

1.3.2 Objective two:

To provide a detailed description and mapping of publicly funded oral health coverage for children across six European each representative of a different oral health system model, and to report on that coverage in line with the World Health Organisation Coverage Cube (World Health Organisation, 2008).

Oral health indicators are critical for monitoring oral health policy implementation and population oral health, with indicators of oral health workforce and oral disease prevalence recognised by the WHO as important markers of progression towards UHC (World Health Organisation, 2022).

However, there are deficiencies in the oral health data currently available and variations in the methods used to collate that data (Patel *et al.*, 2016; Winkelmann *et al.*, 2022). This PhD research further informs the sparse evidence pertaining to caries and workforce data by providing an update of most recent and best evidenced data. This will be further expanded on by critiquing the methods used to inform them nationally and internationally for six European countries, thereby contributing to better monitoring of universal child oral health (**PhD Study Three**).

1.3.3 Objective three:

To describe and compare two key oral health 'indicators' of child universal oral health coverage, (i) oral disease, specifically dental caries prevalence at age 12 years and (ii) oral health workforce, across the same European countries.

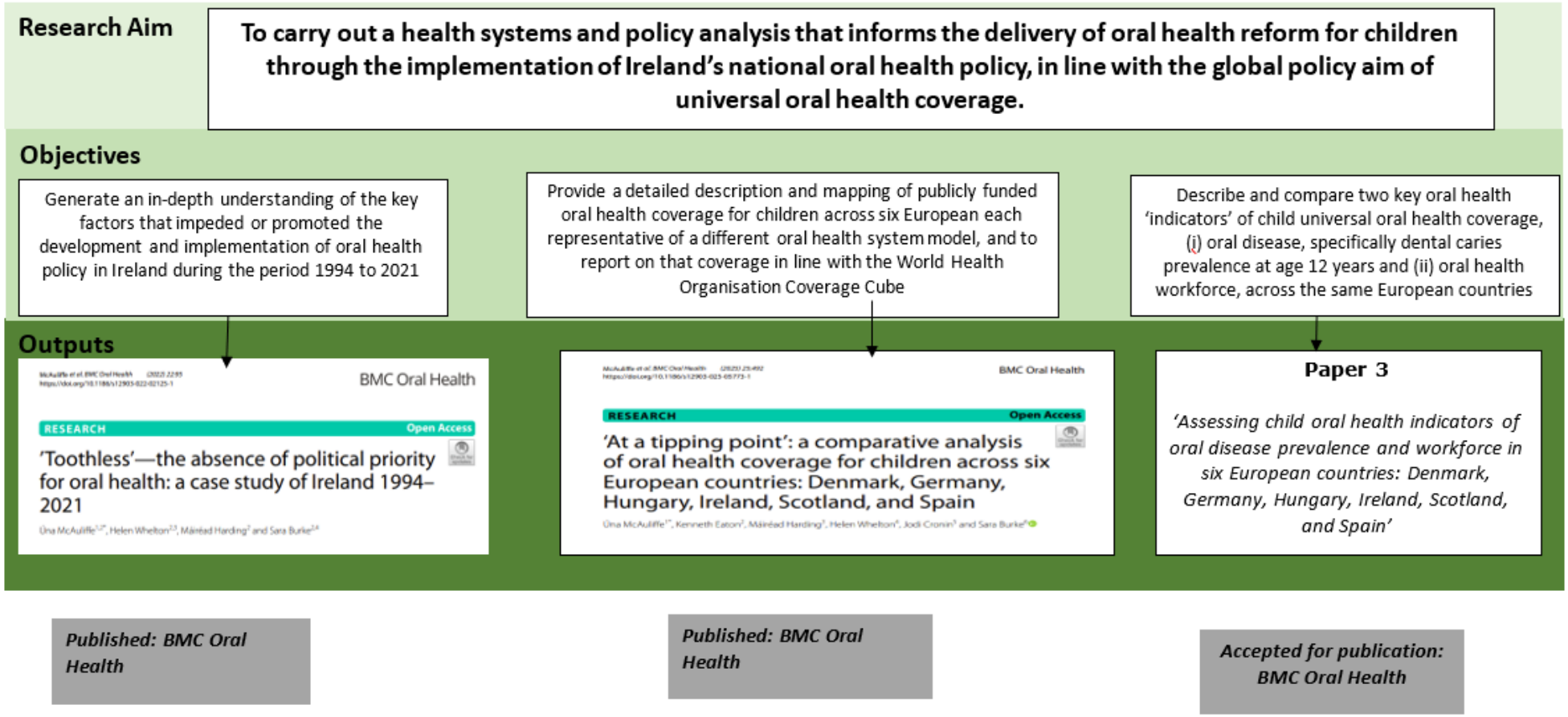


Figure 1-1 An overview of the PhD research

1.4 Thesis outline

This PhD thesis is structured into seven chapters, which altogether encompass three studies the results of which are formatted as papers submitted for peer review and publication in an academic journal.

Chapter two comprises the background literature informing the programme of research for this PhD. This includes an overview of children's oral health, the factors influencing oral disease prevalence and the evidence base for universal oral health coverage. An overview of the Irish oral health system and policies completes the chapter and contextualises the research aim. In line with the format of a publication-based PhD thesis background literature pertaining to each individual paper is presented in the papers' chapters (4-6).

Chapter three outlines the research methods and methodology employed throughout the thesis to achieve each of the stated objectives. Justification for the approach adopted is provided and methodological limitations are explicitly recognised.

Chapter four presents Study One, an in-depth, peer-reviewed policy analysis of Irish oral health policy conducted over a 30-year period. **[PhD Study One].**

Chapter five, also a published and peer-reviewed study, builds on the findings from the Irish context by providing a detailed description and mapping of publicly funded oral health coverage for children across six European countries, each representative of a model for the provision of oral healthcare. **[PhD Study Two].**

Chapter six expands upon the previous studies by reviewing and updating the best available evidence pertaining to dental caries prevalence and oral health workforce composition in national and international databases. **[PhD Study Three – accepted for publication]**

Chapter seven presents a unified synthesis of the policy analysis, inter-country comparative analysis and narrative review. It then provides a discussion of the thesis, including the findings of the three studies along with their strengths and limitations. It concludes with detailed oral health policy and system recommendations, as well as suggestions for future research. Through these chapters this thesis navigates historical, contextual, political, and methodological landscapes generating in-depth considerations for oral health policy

implementation and system reform for children through the lens of universal oral health coverage.

Chapter 2 Background

2.1 Chapter outline

Chapter two outlines the background literature informing the programme of research conducted for this thesis. An overview of children's oral health and the factors influencing oral disease prevalence in children is included. The literature pertaining to universal oral health coverage and the various models of oral health systems in Europe are discussed followed by a summary of the Irish oral health system and national oral health policy. The chapter concludes with the rationale for the research and an overview of the PhD aim and objectives along with the research papers which present, describe, and discuss the research results.

2.2 Oral health

Oral health is 'integral' to overall health and is a basic human right (Watt *et al.*, 2019; World Health Organisation, 2024a). According to the World Health Organisation oral health encompasses not only the 'state of the mouth, teeth, and orofacial structures', but also psychosocial dimensions 'such as self-confidence, well-being and the ability to socialise and work without pain, discomfort and embarrassment' (World Health Organisation, 2024a).

The World Dental Federation further expands this definition by suggesting that oral health should also account for a person's values, perceptions and expectations, in addition to their quality of life (Glick *et al.*, 2016). While the United Nations General Assembly has described oral health as a critical component of healthcare calling for a scaling up of efforts to support it (United Nations General Assembly, 2019a).

2.2.1 Oral diseases

Despite the strength of such definitions and statements, oral diseases are among the most prevalent of all diseases worldwide (Bernabe *et al.*, 2020). The common oral diseases include dental caries, periodontal diseases, tooth loss, oral cancers, HIV/AIDS oral lesions, oro-dental trauma and noma (Petersen *et al.*, 2005; World Health Organisation, 2023a).

Although most oral diseases are preventable, they impact an estimated 3.5 billion people, amounting to a global prevalence of 45%, higher than any other non-communicable disease

(World Health Organisation, 2022, 2023b). They are widespread throughout the life-course and have 'substantial' negative effects on individuals, communities and society as a whole (Peres *et al.*, 2019).

Oral diseases are also hallmarked by significant inequalities, disproportionately impacting lower socioeconomic and vulnerable populations including those with disabilities and minority groups (Peres *et al.*, 2019) with the disparities in oral health persisting throughout life (Petersen and Kwan, 2011). Furthermore, oral health inequalities appear to be increasing. Recent research in England found relative inequalities in dental caries between the most and least deprived 5-year-olds have increased between 2008-2019. While 'highly consistent evidence' was found for social inequalities in dental attendance, access to oral healthcare and between different areas and regions (Public Health England, 2021).

The high prevalence of oral diseases also poses economic challenges for both health systems and individuals, with poor oral health considered among the 'most costly' health domains including diabetes and cardiovascular diseases (World Health Organisation, 2021). The global economic burden of dental caries (tooth decay) alone was estimated at US$245 billion in 2015 (Vujicic and Listl, 2020). While the inequalities of oral health expenditures are 'striking' with the average per capita spending in high-income countries up to 500 times more than that spent in low-income countries (World Health Organisation, 2022).

2.3 Child oral health

Oral health is an integral part of the overall health of children (Krol *et al.*, 2023). Despite this, it is an oral disease, dental caries, that is the most common of all childhood diseases (Bernabe *et al.*, 2020). Dental caries, the most common oral disease in children, is the focus of this thesis. It occurs due to a complex interaction between acid-producing bacteria and fermentable carbohydrates over time, influenced by additional host factors including teeth, saliva, health behaviours and the wider social determinants of health. Dental caries can arise in very early childhood as aggressive tooth decay (Early Childhood Caries) that affects the primary teeth of infants and children under age 6 years (Selwitz *et al.*, 2007; World Health Organisation, 2020b).

The following section provides an overview of dental caries measurement and reporting in both the primary and permanent dentition of children. These issues are further expanded upon in Chapter 6 (PhD Study Three), which includes a critical appraisal of the indicators used, including caries thresholds, the limitations of DMFT index, and the challenges posed by national and international oral health databases.

2.3.1 Dental caries measurement

Dental caries as evidenced in preceding sections is a common disease in childhood, it is therefore essential that the disease is measured and trends or changes in disease levels with interventions documented. The most common index that has been used is the DMF (Decayed, Missing due to caries, Filled due to caries), it is a cumulative index with dental caries identified when an unmistakable cavity into dentine exists. With the index uppercase letters denote permanent teeth (Klein *et al.*, 1938). When describing dental caries in the primary dentition lower case letters dmf are used. The index can be used to describe individual teeth (T/t) or surfaces (S/s). The index has undergone modifications and been adopted and modified by the WHO over the years, with the use of (World Health Organisation, 2013). Despite the modifications challenges still exist as the threshold at which the caries process is recorded in epidemiological studies varies (Fejerskov *et al.*, 2024), which is not always made explicit, or the process is recorded well beyond the stage at which preventive strategies can be implemented (Pitts, 1997; Selwitz *et al.*, 2007).

To address some of these challenges the International Caries Detection and Assessment System (ICDAS) was developed with three levels to allow flexibility and comparability in detection and classification of caries in education, clinical practice, and research (Pitts and Stamm, 2004). The intention of the system is to move away from the single stage diagnosis 'no obvious decay' or 'obvious decay'. Given the understanding of the caries process and intention to move towards prevention the flexibility of ICDAS would seem appropriate (ICCMS Caries Management, 2025).

However, despite the misgivings with the use of the DMF index and its modifications it is still recommended by the WHO in reporting dental caries (World Health Organisation, 2013). Furthermore, despite knowledge of risk assessment and caries in the primary dentition (Hall-Scullin *et al.*, 2017; Featherstone *et al.*, 2021) it is the permanent dentition that is typically

reported in international databases (Council of European Chief Dental Officers, 2023; World Health Organisation, 2024b).

2.3.2 Dental caries reporting

One of the most common ways of describing the amount of disease in a population is to report the prevalence, which can be defined as the proportion of individuals in a specific population with the factor of interest/disease at a specified point in time, presented as a percentage (%) (Peres *et al.*, 2021). The reporting of dental caries is derived from the stage at which the disease is recorded; the dental caries iceberg, and the choice of index, which will in turn result in variation in reported prevalence (Pitts, 1997; Selwitz et al., 2017), meaning that differences between populations could be a consequence of the level at which dental caries is reported rather than the proportion of the population affected by the disease.

The mean number of lesions in a population is also reported, for the WHO Basic Methods 4th Ed. (2013) this is calculated as the mean DMFT by summing the individual DMFT values and dividing by the total number in the specified population. It is therefore important that the proportion with the disease is reported in addition to the mean DMFT. A mean value spread across all the population can be misleading, particularly when not each individual in the population has the disease.

2.3.3 Dental caries consequences

Dental caries is a public health problem across low, middle and high-income countries, most especially impacting children (Fraihat *et al.*, 2019; Goldfeld *et al.*, 2022). It is the single, most common, chronic disease of childhood affecting up to 60-90% of school-aged children (Petersen *et al.*, 2005; Casamassimo *et al.*, 2009). Over 512 million children worldwide have been reported as suffering from dental caries of primary teeth, a predictor for caries in the permanent dentition posing a major population health challenge (Hall-Scullin *et al.*, 2017; World Health Organisation, 2023b).

In addition to causing children pain and infection, dental caries can lead to delayed overall development by way of lower body weight and height, difficulty eating and impaired speech (Sheiham, 2006). It can also significantly impact children's psychological and social wellbeing along with their quality of life (BaniHani *et al.*, 2018; Peres *et al.*, 2019). While lower academic

performances are reported stemming from pain, disrupted sleep and absences from school (Jackson *et al.*, 2011). The harmful effects of the disease are not only felt by the child but can extend to the wider family unit due to potential lost workdays and the financial burden that may ensue from accessing oral healthcare (Casamassimo *et al.*, 2009).

Additionally, due to the practical difficulties in managing dental caries in children, treatment under dental general anaesthesia may be required which not only has significant health implications for the child but can exacerbate health system pressures with high associated costs (McAuliffe *et al.*, 2017; Peres *et al.*, 2019). This is an issue found globally with dental extractions of primary teeth previously cited as the number one reason for hospital admission of young children in Australia and England (Chrisopoulos, 2016; Levine, 2021).

2.3.4 Oral disease prevention

Just as the disease dental caries is complex so too are the influences on children's oral health, which Fisher-Owens *et al.*, (2007) have brought together in their conceptual model (Figure 2-1), indicating influences from those in the oral cavity, to the child, family and community, including the characteristics of the dental care system.

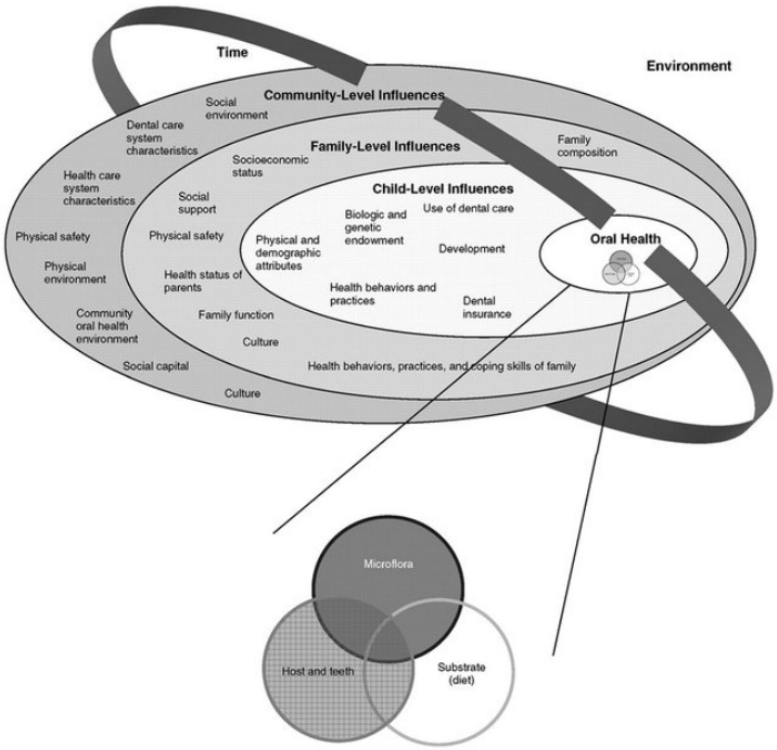


Figure 2-1 Model of influences on oral health outcomes of children. (Fisher-Owens et al., 2017)

Factors for disease development in children have been identified including a high-sugars intake (World Health Organisation, 2015; Moores *et al.*, 2022) and poor oral hygiene with parental behaviour considered a 'significant predictor', emphasising the impact of local, child and family factors (Östberg *et al.*, 2017; Watt *et al.*, 2019).

Despite these complexities there is a well-established evidence base supporting caries preventive modalities in children and adolescents, with the positive impact of preventive approaches to improving child oral health outcomes (Peres *et al.*, 2019; Tinanoff *et al.*, 2019; Petersen *et al.*, 2020). The following dental caries preventive measures are supported in the literature for children and adolescents:

- Community water fluoridation (CWF) (Iheozor-Ejiofor *et al.*, 2024);
- Fluoride-based applications such as toothpaste, varnish, mouthrinse (Marinho *et al.*, 2016; Walsh *et al.*, 2019);
- Oral health assessments (Petersen *et al.*, 2020);
- Pit and fissure sealants in permanent teeth (Ahovuo-Saloranta *et al.*, 2017; Kashbour *et al.*, 2020; Levine, 2021);
- Interventions in the early years (Khairuddin *et al.*, 2024);
- School oral health programmes (Bramantoro *et al.*, 2021);
- Parental counselling (Arpalahti *et al.*, 2016).

Healthcare systems that offer and encourage access to oral healthcare have shown meaningful reductions in dental caries and the social inequalities that impact children's oral health (Goldfeld *et al.*, 2022).

2.3.5 Barriers to children accessing oral healthcare

One of the barriers to children achieving optimal oral health is limited access to oral health services. Evidence suggests that obstacles to accessing care can be observed at three levels:

- The patient level: influenced by socio economic status, belief systems and attitudes;
- The provider level: influenced by geographic accessibility, availability, provider participation in publicly funded care and provider interest in treating children;

- The system level: influenced by different types of health systems, facilities, and resources both economic and oral health personnel. (Yu *et al.*, 2017)

As mentioned, poor oral health disproportionately impacts those most vulnerable. There is evidence to show that families disadvantaged by low income and/or educational status have higher levels of dental caries across both high-income and low-income countries (Petersen *et al.*, 2005; Rouxel and Chandola, 2018; Watt *et al.*, 2019). Furthermore, those children who are most susceptible to dental caries are less likely to access and receive oral healthcare (Darmawikarta *et al.*, 2014), or present in the early years with caries related problems (James *et al.*, 2021).

Evidence shows those with higher household income are more likely to receive care than those with less income (Yu *et al.*, 2017). Additionally, those of lower socioeconomic position are more likely to seek care for treatment and not for prevention. While those children who access oral healthcare irregularly have higher levels of untreated dental caries and poorer oral health related quality of life (Machry *et al.*, 2013; Menegazzo *et al.*, 2020).

One factor contributing to inadequate access at the provider level is geographic distribution. It is found in both low and high-income countries that there is inequity in dentist-to-population ratios in rural areas and in areas of social deprivation (Chung and Chan, 2021). Evidence shows that paediatric dentists are more likely to work in large urban populations, with higher numbers of general dental surgeons also employed and where the patient population has high income and education levels (Surdu *et al.*, 2019).

Within the dental profession itself there is a reluctance to care for children, most especially young children under-age-two (Casamassimo *et al.*, 2018). This is thought to be influenced by reimbursement rates for payment, while 'discomfort with small children' was cited as a common reason for not providing care (Garg *et al.*, 2013; Chalmers and Compton, 2017). Children are not small adults and challenges exist with respect to the size of the mouth, behavioural issues, that children with dental caries tend to have multiple teeth affected and importantly they are reliant on others to facilitate access to dental care.

Female dentists are 'overrepresented in paediatric dentistry' (Ivanoff *et al.*, 2018; Fleming *et al.*, 2023). This has implications in terms of service availability for children with the feminisation of dentistry associated with an increase in part-time working, recruitment

challenges in rural areas and with females occupying less influential positions within the health system (McKay and Quiñonez, 2012; Fleming *et al.*, 2023).

Finally, health system design is said to serve as either a barrier or a facilitator to children accessing oral healthcare (Goldfeld *et al.*, 2022). The utilisation of oral healthcare services and oral health outcomes are 'influenced by enabling factors including accessibility, cost, and type of oral healthcare'. With dental attendance serving as an 'important predictor of oral health' (Khairuddin *et al.*, 2024).

Systems offering 'universal coverage' (UHC) reduce barriers to care which subsequently enables prevention and prompt treatment of caries (Goldfeld *et al.*, 2022). Evidence from the United States illustrates that coverage via dental insurance is an 'important driver for dental care use' and an 'enabling factor to dental care access' that can result in unmet dental needs because of cost (Manski *et al.*, 2015; Yu *et al.*, 2017). While research in Brazil found that children who have access to publicly funded oral healthcare services had lower levels of untreated dental caries. While also finding that early and continuous access to care can minimise the future consequences of caries due to the establishment of healthy habits (Moraes *et al.*, 2021). Evidence has suggested that an absence of UHC may be a global risk indicator for early childhood caries (ECC) (Anil and Anand, 2017) with a lower prevalence of ECC seen in countries with good UHC (El Tantawi *et al.*, 2018; Macpherson *et al.*, 2019).

In contrast, although as mentioned it must be recognised that the underlying aetiology of caries is complex, 'high prevalence of caries is partly because many services have been dismissed as a nonessential component of health systems' (Foote *et al.*, 2023). This most especially impacts those who are underprivileged who are among those with the highest levels of disease. Globally this cohort are serviced inadequately by primary oral healthcare and the subsequent treatment of oral disease is 'costly and unfair' (Petersen *et al.*, 2020).

2.4 Universal oral health coverage

Although early access to preventive oral healthcare is fundamental to improving children's oral health, reducing costs, and establishing lifelong practices, there have been scant efforts to implement such policies (Watt *et al.*, 2019; World Health Organisation, 2020a). Instead, evidence points to national governments 'slow, limited and uneven' adoption of measures to enhance access to publicly funded oral healthcare most especially for children and the socially deprived (Crall and Vujicic, 2020).

This 'neglect' of oral health is thought to arise from its exclusion from general health systems and consequently a failure to consider oral health as an essential component of any health system reform (Watt *et al.*, 2019). This is perpetuated by low political interest in oral health and a failure to fully appreciate the impact of oral diseases (Benzian *et al.*, 2011). While the historical consignment of oral health to that of personal responsibility and the limited power of oral health professionals within the global public health landscape have contributed to a failure to drive system reform (Benzian *et al.*, 2011; Wang *et al.*, 2020; World Health Organisation, 2022).

However, evidence also points to the responsibility of modern dentistry itself which has contributed to the neglect of promoting oral health and it is 'in a state of crisis' (Watt *et al.*, 2019). International experts are calling for reform of dental systems that are treatment dominated, highly expensive, technological, and driven by aesthetics (Watt *et al.*, 2019).

The features of an 'ideal' oral health system were recently described by the Lancet oral health series (Peres *et al.*, 2019) and include systems that are:

- Integrated with the mainstream health system;
- Emphasise health promotion and disease prevention;
- Monitor and respond to population needs;
- Evidence-based, and both clinically and cost effective;
- Equitable and universal (Tomar and Cohen, 2010).

To reform downstream, treatment-focused systems to resemble the above characteristics, a 'fundamentally different approach' is required (Peres *et al.*, 2019). To prioritise universal accessibility and address the isolation and separation of oral health from mainstream health

systems, integration, particularly with primary healthcare services is proposed. As such the 'global drive for universal health coverage' is urged as an 'ideal opportunity for this integration' (Watt *et al.*, 2019).

According to the WHO, Universal Health Coverage 'means that all people have access to the full range of quality health services they need, when and where they need them, without financial hardship. It covers the full continuum of essential health services, from health promotion to prevention, treatment, rehabilitation, and palliative care across the life course' (World Health Organisation, 2023c). In recent years there has been increased recognition of the neglect that has been suffered by oral health at a systems and policy level and 'oral health is finally on the global agenda' (Eaton *et al.*, 2023). This increased focus has been led by the WHO and numerous academics including those responsible for The Lancet oral health series along with the European Observatory for Health System and Policies publishing the first Health Systems in Transition report on oral healthcare in Europe (Peres *et al.*, 2019; Watt *et al.*, 2019; Winkelmann *et al.*, 2022; World Health Organisation, 2021, 2022, 2024a).

In January 2021, the World Health Assembly adopted a 'historic' resolution on achieving better oral health as part of the universal health coverage and non-communicable disease agendas towards 2030 (World Health Organisation, 2021). It recognised the global burden of oral disease particularly amongst children and the inequalities that prevailed before demanding the inclusion of oral health in UHC benefit packages. The resolution was followed by the publication of the 'Global oral health status report: towards universal health coverage for oral health by 2030' in 2022 (World Health Organisation, 2022). In it the WHO concluded that the status of oral health was 'alarming' and warranted 'urgent action' also providing country specific profiles for all 194 member states on 'key markers' for oral health monitoring. These reports culminated in the publication of the WHO Global Oral Health Action Plan (OHAP) in 2023 outlining two central goals: that 80% of people worldwide would have access to essential oral healthcare and that there would be a 10% reduction in the prevalence of the main oral diseases (World Health Organisation, 2024a).

However, significant challenges to the implementation of universal oral health coverage are identified in the literature. Oral health services are expensive in comparison to most primary health sectors and in countries that do offer UHC, oral healthcare is frequently not included or only partially covered by the benefit packages. This is most especially true for preventive

oral healthcare (Wang *et al.*, 2020; Winkelmann *et al.*, 2022). To progress oral health within UHC, political and government engagement will be required along with funding. This is challenging in a domain, where in Europe for example, only one third of spending on oral health is publicly financed (Winkelmann *et al.*, 2022).

A further challenge pertains to monitoring implementation and progress toward UHC. While monitoring progress towards the achievement of these goals is urged by the WHO in their 2022 report, there is ample evidence of the limitations of oral health data currently available. Agrasuta et al., (2021) have described the lack of global-level indicators for oral health monitoring as 'one of the major deficiencies in driving national and global universal health coverage agendas.' Previous research examining dental caries data found data were 'inadequate for planning the provision of oral healthcare across Europe on a scientific basis' (Patel et al., 2016). While a detailed analysis of oral healthcare systems across Europe emphasised, the limited data affecting all areas of oral healthcare particularly when compared to general healthcare (Winkelmann *et al.*, 2022). This report called for an improved and strengthened evidence base to allow 'meaningful assessments and comparisons of health systems performance' (Winkelmann *et al.*, 2022).

While this chapter has outlined the key components of effective oral health systems, including UHC and will consider essential oral healthcare and workforce, the translation of these principles into effective policy implementation remains highly variable across settings. The political, structural, and professional challenges of moving from policy to action are explored in further detail in Chapter 7.

When considering how countries are situated globally relative to UHC and essential oral healthcare, it becomes clear that progress is uneven. While some countries, including Denmark (Winkelmann *et al.*, 2022), Thailand (Sitthisettapong *et al.*, 2021) and Brazil (Pucca *et al.*, 2015; Galvão and Roncalli, 2021), offer comprehensive or near-universal child oral health services integrated within broader health systems, others, such as the United States (Fellows *et al.*, 2022) and Australia (Trinh *et al.*, 2022), rely on fragmented or targeted models with significant access gaps.

A core element in this discussion is the definition and delivery of essential oral healthcare (EOHC), a foundational building block of universal oral health coverage, but one that remains inconsistently interpreted across health systems (Eaton *et al.*, 2023).

2.4.1 Essential oral healthcare

As part of the pathway toward universal oral health coverage (UHC), the WHO's Global Strategy and Action Plan on Oral Health identifies the delivery of 'essential oral healthcare' (EOHC) as a foundational step. EOHC represents a pragmatic approach to expanding equitable access, particularly in resource-constrained settings. This refers to 'a defined set of safe, cost-effective interventions at the individual and community levels to promote oral health, as well as to prevent and treat the most prevalent and/or severe oral diseases and conditions' (World Health Organisation, 2024a). It has a strong emphasis on prevention, early intervention, and equitable access for vulnerable groups, including children. Suggested 'essential' interventions include oral health promotion, fluoride-based measures, atraumatic restorative treatment (ART), pain relief, and basic restorative care delivered at the primary care level (World Health Organisation, 2024a).

Despite growing consensus on the need to define EOHC nationally, its implementation across countries remains fragmented and inconsistent and there is a question over what constitutes 'essential care' (Benzian *et al.*, 2021; Eaton *et al.*, 2023). This will be dependent at an individual country level on 'cost, workforce availability and capacity and education of the oral health workforce', however there needs to be a re-emphasis on prevention to ensure the underlying aim of reduced oral disease prevalence is met (Eaton *et al.*, 2023).

In practice, countries have interpreted and implemented EOHC in markedly different ways, reflecting variations in health system capacity, financing, workforce, and political commitment (Eaton *et al.*, 2023). For example, recognition to progress toward a more universal model has long been recognised in Brazil. The 'Programa Brasil Sorridente' seeks to deliver preventive and restorative oral healthcare at scale, with strong links to family health teams, although implementation varies across states (Pucca *et al.*, 2015; Galvão and Roncalli, 2021).

While in Thailand under UHC, all Thai children under-age-12 can receive free-of-charge oral health promotion and prevention (oral examination, extra- and intra-oral radiographs, fluoride application, and sealants) and dental treatments (filling, pulpal therapy, extraction at all dental

clinics in the public (government) sector. Even where essential services are provided, such as in Thailand, early childhood caries levels remain high, emphasising the importance of addressing social determinants alongside service delivery (Sitthisettapong *et al.*, 2021; Eaton *et al.*, 2023).

While some countries provide some publicly funded oral healthcare services following targeted approaches. In Australia, the federally funded Child Dental Benefits Schedule (CDBS) benefit which are capped at just over $ASD 1,000, over two years for eligible children aged 0–17, to access preventive and basic restorative dental services (Australian Government, 2024). However, there is poor utilisation, with only 22% of eligible children seeking treatment under this scheme (Trinh *et al.*, 2022) and access remains inequitable with most funding of Australian oral healthcare via direct out-of-pocket payments (*Oral health and dental care in Australia, Summary*, 2024).

Canada is also instigating oral health policy reforms, with the recently launched Canadian Dental Care Plan (CDCP), a federal programme that aims to expand access to essential oral healthcare for low- and middle-income families without private insurance. The plan includes coverage for children under 18-years of age with services focused on prevention and basic care. While promising, questions remain about capacity and coordination between federal and provincial programmes (Flood *et al.*, 2023).

Some high-income countries with advanced healthcare systems do not define essential oral healthcare or deliver it universally. In the United States for example, publicly funded dental coverage is fragmented and primarily limited to emergency care for adults, with more generous but still variable coverage for children under Medicaid (Fellows *et al.*, 2022). While even in countries with universal models of oral healthcare, such as those in Scandinavia, there is variation in what is considered ‘essential’ and how it is delivered. In Denmark for example, essential oral healthcare for children is broad and universal, however, adults are entitled to subsidised care (Winkelmann *et al.*, 2022).

The WHO Action Plan now calls for countries to define EOHC nationally, to embed it within UHC benefit packages, and ensure its delivery through people-centred primary care. The Plan emphasises integration with broader public health systems and encourages the use of shared monitoring frameworks to track progress, particularly in child oral health services (World

Health Organisation, 2024a). However as illustrated by the wide degree of international variation without a clearly defined and institutionally supported EOHC framework, countries risk continued fragmentation, unmet need, and widening inequalities in oral health outcomes. Strengthening the integration of oral health within primary healthcare is a key step toward the effective delivery of EOHC, particularly for children and underserved populations (Peres *et al.*, 2019).

2.4.2 Oral health policy

A key recommendation to support expanded coverage under the umbrella of UHC is to ensure that oral health is integrated within national health policies (Eaton *et al.*, 2023). Health policy refers to decisions, plans, and actions that are undertaken to achieve health goals within a society, which includes oral health (World Health Organisation, 2023d).

Policies focused on children's oral health generally have two broad aims: to minimise the impact of oral diseases on children and to reduce barriers that limit access to necessary oral healthcare services (Crall and Vujicic, 2020; Galvão and Roncalli, 2021). Examples of successful policies pertaining to oral health include community water fluoridation, national oral health programmes and policies expanding coverage for oral health services (Crall and Vujicic, 2020).

Implementation of policies in the United States supporting preventive programmes including dental screening, counselling, and fluoride application led to improved oral health outcomes for children (Kranz *et al.*, 2015). While policy reform to expand coverage for fissure sealants in South Korea led to a reduction in dental caries (Sohn *et al.*, 2019). The implementation of the National Oral Health Policy in Brazil led to an expansion in free of charge access to oral healthcare leading to 'a tendency toward reduction of absolute inequality, especially among children and adolescents' (Galvão and Roncalli, 2021).

Recent research examining data from nineteen OECD countries found national policies on child oral healthcare and prevention 'vary' across all the high-income countries included in the analysis. It concluded that the presence of a 'legal policy mandating dental care for children is associated with a reduction in the countries DMFT index' and 'a slight increase in oral health expenditure' (Foote *et al.*, 2023). This research also found the countries with no national oral health policies were also those countries operating under privatised oral

healthcare models i.e. where dental care was largely excluded from the main source of public funding and provided by private practitioners via out-of-pocket payments (Foote *et al.*, 2023).

Despite oral health policies being recognised as a key strategy to mitigate inequalities impacting access to oral healthcare services, oral diseases have failed to receive priority in broader health and public policies (Leake and Birch, 2008; Benzian *et al.*, 2011). Historically oral health has been 'isolated and marginalised' from health policy developments (Peres *et al.*, 2019). The WHO has identified the 'low priority' afforded to oral health, 'lack of political commitment' and poor advocacy for essential oral healthcare within the broader health system, as contributory factors to the poor integration of oral health within national policies (World Health Organisation, 2021).

To counter this, the 'Global Target 1' of the OHAP states that 'by 2030, 80% of countries have an operational national oral health policy, strategy or action plan and dedicated staff for oral health at the Ministry of Health or other national governmental health agency'. The WHO also proposes actions for member states including either the development or review of existing national oral health policies to ensure its integration with both the NCD and UHC agendas. It suggests national implementation frameworks and monitoring of national oral health policies be undertaken within the 'Ministry of Health' or equivalent government health agency (World Health Organisation, 2024a).

2.5 Models of oral health systems in Europe

Universal oral health coverage policy implementation is complicated by the different political structures, systems of healthcare funding and orientation of public healthcare across respective countries (Eaton *et al.*, 2023). In Europe, based on patterns of organisation and financing, six different oral health system 'models' are evident (Widström and Eaton, 2004). They are the Nordic, Bismarkian, Beveridgian, Southern European, Eastern European and Hybrid models (Widström & Eaton, 2004) (*Table 2-1*)

The depth of public financing, the scope of services available, density and distribution of dentists working in primary care and the breadth of population coverage varies across each system (Patel, 2012; The Platform for Better Oral Health in Europe, 2015; Glick *et al.*, 2021).

In Europe, general healthcare systems are publicly financed via general taxation or compulsory social health insurance often supplemented by private contributions from either voluntary insurance and/or direct out-of-pocket payments (OPP) by individuals (Sinclair *et al.*, 2019). Specific to publicly funded oral healthcare for children, the child population covered, extent of cover and the financing arrangements in place also vary extensively (*Table 2-1*).

For example, in Denmark and Germany, examples of the Nordic and Bismarckian systems respectively, access to oral healthcare and almost all treatment is provided universally, free-of-charge, to all children and young adults (Christensen *et al.*, 2010; Ziller *et al.*, 2015). The Nordic model is typically characterised by a large public dental service for children delivered by salaried oral health professionals (Kravitz *et al.*, 2015). The Danish system is tax-financed while in Germany there is statutory health insurance system split into public social insurance (SHI) and private health insurance within which almost all dentists work (Kravitz *et al.*, 2015; Ziller *et al.*, 2015).

Similarly, in the Beveridgian system, unique to the United Kingdom, the entire population is eligible for oral healthcare delivered by dentists contracted via the tax funded National Health System (NHS) (Anderson *et al.*, 2022). In 2006, the NHS payment system changed in England, Wales, and Northern Ireland. However, it remained largely unchanged in Scotland, where oral healthcare including orthodontics is free of charge to all children under the age of 18 years and young adults under the age of 26 (Sinclair *et al.*, 2019; The Scottish Parliament, 2023).

In most Eastern European systems there has been a move away from largely free public provision to oral healthcare dominated by the private sector (Widström and Eaton, 2004). Hungary, an example of an Eastern European system, is financed by contributions from employed persons and employers with all children eligible for free care until the age of 18. However, in Hungary there are reported difficulties in accessing care due to dentist participation in publicly-funded schemes and the numbers of dentists willing to treat children (Kivovics and Csadó, 2010; Hajdu *et al.*, 2023).

In Spain, an example of a 'Southern European' system, although there is universal general healthcare, eligibility for publicly funded oral healthcare is entirely dependent on a child's age and where they live, with the private sector playing a significant role (Bravo *et al.*, 2015). The general health system is primarily tax financed and organised nationally and regionally with health competencies transferred to each of the seventeen Autonomous Communities (AC) (Bernal-Delgado *et al.*, 2018). There is wide variation in the eligibility of children for care throughout Spain dependent on the oral health policy in place in each individual AC (Bravo *et al.*, 2015). Ireland is an example of a Hybrid model and Ireland's oral healthcare system is described in detail below (Section 2.5).

Table 2-1 Models of oral healthcare delivery in six European countries

Country	Model	Main source of general healthcare financing	Children's oral health cover
Denmark	Nordic	Tax financed	Universal
Germany	Bismarckian	Social Health Insurance	Universal
Scotland	Beveridgian	Tax financed	Universal
Hungary	Eastern European	Social Health Insurance	Universal
Ireland	Hybrid	Tax financed	Targeted*
Spain	Southern European	Tax financed	Targeted*

*Targeted systems offer coverage for oral healthcare at specific ages and or in specific regions/locations

2.6 Oral health workforce and skill-mix

As discussed, the WHO advocates for inclusion of oral health under the universal health coverage (UHC) agenda to counteract this marginalisation (World Health Organisation, 2024a). However, a well-functioning health workforce is a core pillar of any health system, and oral health is no exception (World Health Organisation, 2014, 2020c, 2024a). Strengthening the oral health workforce in terms of sufficient numbers, distribution, and optimised skill mix is of paramount concern for progressing the universal oral health coverage agenda (Fisher *et al.*, 2018; Gallagher *et al.*, 2024; World Health Organisation, 2024a).

The WHO Global Strategy and Action Plan emphasises workforce development. It identifies a need to 'develop innovative workforce models and expand competency-based education to respond to population oral health needs' as a key strategic objective (World Health Organisation, 2024a). While at an overall level, the strategy calls for research agendas which should support evidence-based workforce planning, for example, by urging Member States to 'create and continuously updated context and needs specific research' on public health aspects of oral health. Overall, these global directives emphasise that bolstering the oral health workforce, through both policy and research is crucial to overall oral health system strengthening (World Health Organisation, 2021).

2.6.1 Workforce distribution and density

Ensuring an adequate supply and equitable distribution of oral health is important for child oral health, given the importance of early access to preventive care (Nation *et al.*, 2023). Yet the oral health workforce remains unevenly distributed and, in many settings, insufficient to meet population oral health needs (Gallagher *et al.*, 2024). Globally, there are approximately 3.3 dentists per 10,000 population (with a total oral health workforce of about 5.3 per 10,000 when including all dental personnel). This figure masks striking inequalities: for example, in the WHO African region there are approximately 0.4 dentists per 10,000 people, compared to about 5.9 per 10,000 in the European region (Gallagher *et al.*, 2024).

Even within high-income regions, large variations in dentist-to-population ratios persist (Winkelmann *et al.*, 2022). In most Western European countries, the dentist-to-population rations only increased slightly or even decreased between 2008 and 2019 (Winkelmann *et al.*,

2022). Indeed, a maldistribution of oral health providers, with concentration in urban and affluent areas alongside shortages in rural and socioeconomically deprived communities, is identified as a barrier to equitable care (Northridge *et al.*, 2020; Winkelmann *et al.*, 2022; Gallagher *et al.*, 2024).

A recent global analysis by Gallagher *et al.* (2024) confirms that urbanisation and national income level are strong predictors of dentist density, and that rural areas in both low- and high-income countries tend to be underserved. Such distributional inequalities mean rural or low-income areas have limited access to oral healthcare services, exacerbating oral health inequalities. Addressing where oral health providers practice, not only how many there are, is therefore a crucial aspect of system strengthening. International policy bodies now explicitly acknowledge that an 'uneven distribution of the oral health workforce' undermines access to care and must be remedied as part of UHC efforts (Fisher *et al.*, 2018; FDI World Dental Federation, 2021).

2.6.2 Skill-mix and workforce innovation

Beyond the numbers and location of providers, how the oral health workforce is configured is a key dimension of health system performance. In dentistry, the term 'skill-mix' is used to describe the combinations of dentists and oral healthcare professionals (e.g. dental nurses/assistants, hygienists, therapists, technicians, and even non-dental primary care workers) delivering activities that are commonly established by their level of education, training and scope of practice (Wilson *et al.*, 2021). While within workforce planning considerations there are 'horizontal' (i.e. within profession skill mix) and vertical (i.e. skill mix outside the dental profession) (Balasubramanian *et al.*, 2021).

The benefits of skill-mix to dentistry include increased practice efficiency and effectiveness in service provision and increased workforce capacity (Freeman *et al.*, 2013; Brocklehurst and Macey, 2015). International examples of the potential benefits of this approach have been illustrated via the use of dental therapists and aids in Alaska (Senturia *et al.*, 2018) and Tanzania (Paterson *et al.*, 2019) and through using community health workers in the African region (World Health Organisation, 2023e; Gallagher *et al.*, 2024).

There is growing consensus that to progress toward UHC for oral health, greater consideration needs to be given to the use of skill-mix beyond the traditional focus on dentists

(Balasubramanian *et al.*, 2021; Gallagher *et al.*, 2024). This is particularly relevant in child oral health, where auxiliary roles such as dental hygienists, therapists, and nurses have historically been deployed to deliver school-based preventive interventions, oral health promotion, and early intervention services (Patel, 2012; Kravitz *et al.*, 2015; Macpherson *et al.*, 2015; Winkelmann *et al.*, 2022).

Many high-performing systems leverage a broader dental team: for example, dental hygienists and therapists focused on preventive care, or dental assistants and health workers outside the profession delivering basic services and health education (Kravitz *et al.*, 2015; Macpherson *et al.*, 2015; Richard *et al.*, 2022; Winkelmann *et al.*, 2022). Higher-income countries tend to make greater use of such workforce skill mix than lower-income countries, which often have very few auxiliary dental personnel. For example, there are 176 times a higher proportion of professionals such as dental assistants/therapists in high-income than low-income countries (Gallagher *et al.*, 2024).

Dental therapists, for instance, have been integral to school-based dental programmes in countries like New Zealand (Nash *et al.*, 2008) while dental hygienists are a traditional feature in the delivery of oral healthcare in Nordic countries (Widström and Eaton, 2004; Kravitz *et al.*, 2015; Richard *et al.*, 2022). In Scotland, the Childsmile programme uses an integrated team of extended duty dental nurses, dental health support workers, and health visitors to deliver fluoride varnish applications, supervised toothbrushing, and oral health education in nursery and school settings. It demonstrates the effective use of 'the whole dental team', not only oral healthcare auxiliary workers but personnel without formal dental qualifications (Gnich *et al.*, 2014; Macpherson *et al.*, 2015).

According to a systematic review investigating the role of skill-mix in the oral health workforce (Wilson *et al.,* 2021), key enablers to its utilisation include:

1. Clearly defined policy and regulatory frameworks with appropriate incentivisation;
2. A needs-led approach to dental service models and funding;
3. Improved productivity, efficiency and team-work;
4. Positive perceptions and support from professionals and patients.

However, despite the potential of skill-mix innovations, many countries continue to rely almost exclusively on dentists for the delivery of oral healthcare (Watt *et al*., 2019). Barriers

to effective skill-mix implementation include remuneration systems that disincentivised the utilisation of skill-mix, underutilised referral systems and negative perceptions from professionals and patients alike (Watt *et al.,* 2019, Wilson *et al.,* 2021). While at a systems level this is exacerbated by the marginalised nature of dental training (Watt *et al.*, 2019), the positioning of 'dentists' at the centre of the profession entrusted with providing leadership (Balasubramanian *et al.*, 2018) and even further to that, dental specialists who often serve as the gatekeepers of the dental profession (Balasubramanian *et al.*, 2021).

Overall, evidence suggests that shifting the dentist-centred model of care towards a team-based approach is 'essential' to the global oral health agenda and should be supported by 'integrated community-based models of training' (Watt *et al.*, 2019) and 'creative workforce development' (Gallagher *et al.*, 2024).

2.6.3 Workforce data availability

Despite the recognised importance of workforce planning for oral health system strengthening, a persistent barrier to progress is the lack of reliable, standardised data on the oral health workforce (Balasubramanian *et al.*, 2021; Winkelmann *et al.*, 2022; Gallagher *et al.*, 2024). Many countries fail to routinely collect and report key indicators such as workforce headcount, full-time equivalents (FTE), scope of practice, or geographic distribution, particularly for auxiliary professions like hygienists, therapists, and dental nurses (Gallagher *et al.*, 2024; World Health Organisation, 2024a). Even within Europe, substantial inconsistencies exist in the methods and definitions used to measure the oral health workforce, undermining the comparability of data across countries (Winkelmann et al., 2022).

Furthermore, granular data on rural versus urban deployment, work patterns (e.g. part-time or dual practice), public/private sector participation are frequently absent or incomplete (Balasubramanian *et al.*, 2021). For example, dentists may remain on a 'register' although they are not actively practising due to retirement or unemployment, or they work in other settings without providing clinical care to patients (Winkelmann *et al.*, 2022). This limits the capacity of health systems to plan effectively for future service delivery needs, which has particular relevance to child oral health and the delivery of prevention, which arguably is best delivered via a well-distributed, multidisciplinary team (Watt *et al.*, 2019).

While international strategies now promote essential oral healthcare, expanded skill mix, and improved workforce distribution as key elements of universal oral health coverage, translating these principles into sustained national reform remains challenging. Across a variety of contexts, implementation is hindered by factors such as fragmented governance, poor data infrastructure, limited professional engagement, and a lack of sustained political commitment (Watt *et al*., 2019; Winkelmann *et al*., 2022; World Health Organisation, 2024a).

As highlighted in the wider health systems literature, policy development alone is insufficient; effective implementation requires robust governance structures, intersectoral coordination, and accountability mechanisms to drive delivery (Howlett, 2019; Hudson *et al.*, 2019). These challenges are explored in greater detail in Chapter 7, where this thesis discusses the barriers and enablers to moving from policy to action, drawing on both national evidence and international good practice.

2.7 Irish oral healthcare system

2.7.1 Ireland's general health system

The Republic of Ireland (Ireland) is a small island country in Northwestern Europe with a population of just over 5.1 million people (Central Statistics Office, 2022). The general healthcare system in Ireland is 'complex' with access to care often dependent on the capacity to pay rather than need (Johnston *et al.*, 2020). Ireland has a national health service largely funded through general taxation. However public sources accounted for just 77.4% of total health spending in 2021 a 'lower share' than the EU average of 81.1% (OECD/European Observatory on Health Systems and Policies, 2023).

Almost half of the Irish population purchase private health insurance, the second highest share in the EU, primarily to avoid waiting lists in accessing diagnostic care, specialist treatment and public hospital care (OECD/European Observatory on Health Systems and Policies, 2023). Ireland's health system is 'unusual within the EU in not providing universal health coverage for all residents' and remains the only country in Western Europe that does not offer universal coverage for primary care (OECD/European Observatory on Health Systems and Policies, 2023). This is despite Ireland having the fifth highest per capita GNP, as assessed by the Atlas method (US$ 79,730 in 2022) in the world according to the World Bank. This is a higher GNP per capita for any European country other than Switzerland, Luxembourg or Norway (World Bank Group, 2022).

The Irish 'Department of Health' (DoH) is responsible for setting health policy, strategic governance and allocating budgetary spend. While the 'Health Service Executive' (HSE) established in 2005 is responsible for the management and delivery of health and social care services (Houses of the Oireachtas, 2004). This care is delivered through a network of providers including hospitals and community healthcare organisations (Johnston *et al.*, 2020).

Broadly speaking the Irish population is divided into two primary entitlement categories, 'Category I'-those who qualify for 'medical cards' (c. 32% of the population in 2024) and 'Category II' those without medical cards – the rest of the population (OECD/European Observatory on Health Systems and Policies, 2023; Health Service Executive, 2024). People with medical cards are eligible for free primary and hospital care and prescription charges at

a low cost. While adult medical card holders are eligible for very minimal oral healthcare without charge.

Medical cards are primarily allocated through an assessment of means testing that considers income, savings, investments, and property. A small quota of individuals qualify for medical cards based on 'undue hardship'. There are other schemes which provide additional benefits: a GP (General Practitioner) visit card which covers GP charges for children under 8, adults over 70 and those on low incomes; the 'Long-Term Illness Scheme' which provides free medicines and appliances for people living with certain chronic conditions-regardless of income and the high-tech drug scheme which reimburses certain drugs (OECD/European Observatory on Health Systems and Policies, 2023).

Ireland's health system was significantly impacted by the global financial crises in 2008. After a period of notable prosperity, Ireland experienced one of the most extreme economic crises of any OECD country between 2008 and 2014 (Nolan *et al.*, 2014). During this time substantial austerity measures which had a significant and long-lasting impact on all areas of the health system, including restricting access to oral healthcare, were introduced (Williams and Thomas, 2017; Johnston *et al.*, 2020). However, by 2017 the Irish economy had recovered and in 2022 Ireland had the highest annual GDP growth rate in the European Union (Houses of the Oireachtas, 2017; Central Statistics Office, 2024).

A consequence of Ireland's health system complexity are significant gaps in coverage. This has particularly impacted oral healthcare with 'the whole population' having 'very restricted' publicly funded care (Johnston *et al.*, 2020). The absence of universal coverage and specifically universal primary care means that Ireland remains an outlier when compared with similar high-income countries with respect to its health system (Johnston *et al.*, 2020; OECD/European Observatory on Health Systems and Policies, 2023).

In response, in 2017, an Irish parliamentary cross-political party committee devised a 10-year-plan (called Sláintecare) for health reform including the development of a universal single tier health system where individuals are treated solely based on need and not the ability to pay (Houses of the Oireachtas, 2017). The implementation of Sláintecare has been slow with some successful initiatives including expanding GP care and abolishing patient charges in public hospitals. However, long waiting lists in public hospitals and workforce shortages are hindering

implementation with inequalities persisting from the two-tiered health system design (OECD/European Observatory on Health Systems and Policies, 2023).

2.7.2 Oral healthcare in Ireland

As mentioned, Ireland is an example of a 'hybrid' oral health system model where delivery is via a public/private mix of service provision (Widström and Eaton, 2004; Woods *et al.*, 2017). However, the greater proportion of dental care is privately financed. In direct contrast to Irish general health system financing, 77% of dental care in Ireland was privately funded across the population in 2018 (Central Statistics Office, 2020). Most of this figure relates to direct out-of-pocket payments (OOP) as private health insurance offers only 'limited coverage' of dental care. Thus, gaps in publicly funded oral healthcare impact large sections of the population including very young children, adults, and vulnerable groups. This results in high OOP with research finding that such costs in Ireland cause financial hardship (Central Statistics Office, 2020; Johnston *et al.*, 2020; Donovan, 2021).

Publicly funded dental services are delivered via three schemes outlined below, each of which was significantly impacted by austerity measures introduced in 2010. The broad eligibility and benefits are as follows:

- The Public Dental Service (PDS) (children and special needs groups); (See section 2.5.3)
- The Dental Treatment Services Scheme (DTSS) (Adults, Category I medical card holders)
    - Covers c. 32% of the population;
    - One oral examination provided annually along with two fillings and unlimited dental extractions with further treatment requiring additional health service 'approval';
- The Dental Treatment Benefit Scheme (DTBS) (Adults with three years social insurance contributions);
    - Up to 2 million contributors (2018);
    - One annual examination and a scale and polish provided.

(Department of Health, 2019a)

A significant proportion of the population (20% in 2016) were ineligible for any scheme and paid direct out-of-pocket payments for all oral health care (Woods *et al.*, 2017).

2.7.3 Child oral healthcare in Ireland

The 'Public Dental Service' (PDS) is the only state-funded oral health system for Irish children (Department of Health, 2019a). The Health Service Executive (HSE) has statutory responsibility for the PDS and a legal requirement to provide free oral healthcare for preschool and school aged children (Houses of the Oireachtas, 2009a). The PDS is delivered in state owned dental clinics, by salaried staff directly employed by the HSE (Department of Health, 2019a). The HSE also funds and monitors community water fluoridation, Irelands key oral health preventive programme covering 71% of the total population (James *et al.*, 2021).

At time of writing, within the PDS, 'emergency' oral healthcare is available for all children under-age-sixteen. While a 'primary oral healthcare service' aims to 'target' children for 'comprehensive care' including restorative and preventive care, in 'three designated classes in primary and secondary schools' (Department of Health, 1994a). Comprehensive oral healthcare is therefore restricted to children typically aged between 7-8 years, aged 9-10 years and aged 11-12-years (Department of Health, 2019a).

The PDS experienced significant enforced cutbacks due to austerity measures in 2010 resulting in variations in service coverage and delayed or deferred care in different regions of Ireland (Duane *et al.*, 2017). This was compounded by the onset of the COVID-19 pandemic with restricted service delivery owing to public health measures and 23% of dental professionals employed by the HSE were redeployed to COVID-19 related work (Houses of the Oireachtas, 2021a).

By 2023, there were an estimated 100,000 children awaiting an appointment with the PDS, over 3,000 children waiting for treatment under dental general anaesthetic and 14,000 awaiting orthodontic care (Houses of the Oireachtas, 2023).

As the PDS is the only source of state-funded dental care for children this results in significant gaps in coverage which may require high out of pocket payments. In any system where costs are high, children, most especially those whose families are of limited means, are at increased

risk, and unable to afford care (Watt *et al.*, 2019). This can result in inequalities in access to services and ultimately poorer oral health (Wang *et al*., 2020).

2.7.4 Child oral health in Ireland

Based on Ireland's most recent national oral health survey conducted in 2002 and published in 2006, 42% of 5-year-olds, half of 12-year-olds and 75% of 15-year-olds suffer from dental caries (Whelton *et al.*, 2006). While the mean DMFT for 12-year-olds was 1.4 for those in receipt of CWF (53.5% caries prevalence) and 1.8 for those without (62% caries prevalence), caries prevalence, recorded once caries had progressed into dentine. It is usual in the Republic of Ireland to report results for populations with CWF and No CWF (Whelton *et al.*, 2006).

These data are the most recently available national information with respect to DMFT in Ireland. A 2017 study examining the impact of reducing water fluoride on dental caries and fluorosis in one urban and two rural areas of Ireland, found 'no statistically significant difference in caries prevalence or severity between 2017 and 2002' for 8-year-old schoolchildren, selected in phase 1 of the Fluoride and Caring for Children's Teeth (FACCT) (James *et al.*, 2018). In 2017, caries prevalence in 8-year-olds (primary teeth dmft(cde), recorded once caries had progressed into dentine) was 55% in Dublin (full CWF) and 56% in Cork-Kerry (full CWF), mean dmft(cde) among children with caries was 3.4 and 3.7 respectively, while in Cork-Kerry (No CWF) caries prevalence was 65% and mean dmft(cde) among children with caries was 4.2 (James *et al.*, 2021).

While according to Ireland's national oral health policy in 2019: 'It is estimated that one in 10 children in Ireland (or up to approximately one in five children, depending on their socioeconomic status and their access to water fluoridation) has a disproportionate level of dental decay compared to their peers'. There are no national data on the oral health of preschool children (Department of Health, 2019a).

2.8 Irish national oral health policy

The current Irish publicly-financed oral health system is still delivered under the policy direction detailed in the 1994 Dental Health Action Plan (DHAP). This action plan was published by the Department of the Health, in tandem with Ireland's first general health policy (Department of Health, 1994b). The DHAP was the 'first clear statement on the aims and health objectives of the dental services in Irish history' (Department of Health, 1994a).

The DHAP proposed goals for reduced dental caries across the population by the year 2000 and increased fluoride use. With respect to children's care, it consolidated and extended 'targeted' schools dental services (Department of Health, 1994a). The action plan also pointed to the absence of organised care for pre-school children and that care for primary school children was uneven (Department of Health, 1994a).

Over twenty years ago, a report commissioned by the Department of Health described absence of care for young children as a 'disgrace' (Gelbier, 2002). Further age-related inequity is evident whereby all adults are eligible for an annual publicly funded dental examination, but children are not (Irish Oral Health Services Guideline Initiative, 2012).

In April 2019, a new national oral health policy titled 'Smile agus Sláinte' was published, aiming to bring about a 'major change' in publicly funded oral healthcare and improve oral health outcomes. The policy aligns with broader Sláintecare reforms (Department of Health, 2019a). The two overarching goals of the policy are: (1) to support each individual to achieve their best oral health, and (2) to reduce inequalities across the population.

Smile agus Sláinte adopts a primary care and prevention-oriented approach, proposing the delivery of structured oral healthcare 'packages' across the life course (Department of Health, 2019a). These are grouped into three service levels: preventive care (e.g., fluoride applications, oral health education), routine primary care (e.g., fillings and periodontal care), and complex care (e.g., endodontics, prosthetics). For children aged 0–16, the policy outlines eight preventive packages delivered by local general dental practitioners, covering oral health assessments, emergency care, referrals, and preventive treatments, including fissure sealants and restorations. These packages are aligned with specific age bands, with the intention of delivering care closer to home and promoting continuity and choice for families. Importantly,

the policy also maintains Ireland's community water fluoridation programme as a core public health measure. However, it does not recommend supervised toothbrushing schemes for children under age six, citing concerns about dental fluorosis risk (Department of Health, 2019a).

The policy reorients the Public Dental Service (PDS)—the salaried dental service—towards the delivery of oral healthcare for vulnerable groups, including people with disabilities, older adults, those in residential care, and marginalised populations. More complex oral healthcare needs are to be met in designated advanced oral healthcare centres, such as dental hospitals and specialist units (Department of Health, 2019a).

An Oral Health Evaluation Programme is also proposed, providing free oral health assessments at key ages (5, 12, 15–19, 35–44, and 65+). Data from these assessments will inform a new Oral Health Observatory, intended to monitor policy implementation and evaluate progress toward improved oral health outcomes nationally (Department of Health, 2019a).

To support delivery, the policy identifies 41 actions structured across three strategic strands: (1) health promotion and protection, (2) service provision, and (3) population health surveillance. Priority actions for the first three years include the maintenance of water fluoridation, development of preventive packages, integration of fluoride advice into practice, workforce reform (e.g., expansion of auxiliary roles), and legislative updates, including revision of the Dentists Act 1985 (Department of Health, 2019a).

Smile agus Sláinte represents the first update to oral health guidance in over one quarter-of-a-century, and its proposed large-scale reform of publicly funded oral healthcare in Ireland is considered 'challenging' by policymakers (Department of Health, 2019a). Despite the ambition of Smile agus Sláinte, in 2025, the policy remains largely unimplemented.

2.9 Overarching aim

The overall aim of this PhD is to carry out a health systems and policy analysis that informs the delivery of oral health reform for children through the implementation of Ireland's national oral health policy, Smile agus Sláinte, (Department of Health, 2019a), in line with the global policy aim of universal oral health coverage. This research comprised three distinct but inter-connected studies to address this aim.

2.9.1 Individual research objectives and associated research papers

- **Study One:** To generate an in-depth understanding of the key factors that impeded or promoted the development and implementation of oral health policy in Ireland during the period 1994 to 2021.

- ***Paper One:*** McAuliffe, Ú., Whelton, H., Harding, M. et al. 'Toothless'—the absence of political priority for oral health: a case study of Ireland 1994–2021. *BMC Oral Health* **22**, 95 (2022). Available at: https://doi.org/10.1186/s12903-022-02125-1. Published: 27th March 2022. **[PhD Study One].**

- **Study Two:** To provide a detailed description and mapping of publicly funded oral health coverage for children across six European countries, each representative of a different oral health system model, and to report on that coverage in line with the World Health Organisation Coverage Cube (World Health Organisation, 2008).

- ***Paper Two:*** McAuliffe, Ú., Eaton, K., Harding, M. *et al.* 'At a tipping point': a comparative analysis of oral health coverage for children across six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain. *BMC Oral Health* **25**, 492 (2025). https://doi.org/10.1186/s12903-025-05773-1. Published: 5th April 2025. **[PhD Study Two].**

- ***Original study protocol****: McAuliffe Ú, Woods N, Barrett S et al. Comparing oral health systems for children in six European countries to identify lessons learned for universal oral health coverage: A study protocol. [version 1; peer review: 2 approved, 1 approved with reservations]. HRB Open Res 2022, 5:5.*

- **Study Three**: To describe and compare two key oral health 'indicators' of child universal oral health coverage, namely (i) oral disease, specifically dental caries prevalence at age 12 years and (ii) oral health workforce, across those representative European countries.

  Paper Three: *McAuliffe, Ú., Whelton, H., Harding, M. et al. Assessing child oral healthcare indicators of disease prevalence and workforce in six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain.* ***[PhD Study Three, accepted for publication at BMC Oral Health].***

The methodology and methods employed to conduct this PhD research will be described in chapter three. This will be followed by study results formatted as papers submitted for peer review and publication in academic journals, beginning with Study One in chapter four and concluding with Study Three in chapter six. A discussion and overall conclusion are then presented in chapter seven. The complexities of translating policy into meaningful action are also further explored in chapter seven, which critically examines the barriers and enablers of oral health policy implementation, drawing on national and international examples before generating specific recommendations to advance Irish oral health policy implementation.

Chapter 3 Methodology and Methods

3.1 Chapter overview

This chapter firstly provides an overview of the methods used in this research, and the rationale for choosing them. Secondly, a detailed description of the approaches undertaken to meet the objective of each sequential study is provided. Finally, researcher positionality and reflexivity, the influence of the COVID-19 pandemic in the context of this thesis and ethics are discussed.

3.2 Aim and objectives

The overall aim of this PhD is to carry out a health systems and policy analysis that informs the delivery of oral health reform for children through the implementation of Ireland's national oral health policy, Smile agus Sláinte (Department of Health, 2019a), in line with the global policy aim of universal oral health coverage. This research comprised three distinct but inter-connected studies to address this aim.

Those study objectives were to:

1. Generate an in-depth understanding of the key factors that impeded or promoted the development and implementation of oral health policy in Ireland during the period 1994 to 2021.
2. Provide a detailed description and mapping of publicly funded oral health coverage for children across six European countries, each representative of a different oral health system model, and to report on that coverage in line with the World Health Organisation Coverage Cube (World Health Organisation, 2008) (The Cube) (Figure 3-2)
3. Describe and compare two key oral health 'indicators' of child universal oral health coverage, (i) oral disease, specifically dental caries prevalence at age 12 years and (ii) oral health workforce, across the same European countries.

These objectives were met by conducting a detailed oral health policy analysis in Study One (McAuliffe *et al.*, 2022), with the findings from the Irish context further elaborated on by way of an inter-country comparative analysis, guided by the WHO Cube (World Health

Organisation, 2008) in Study Two (McAuliffe *et al.,* 2025). The final objective of examining two key indicators monitoring universal oral health coverage for children was addressed via a narrative literature review in Study Three.

3.3 Methodological approach

According to the literature, an overarching research aim should serve as a navigational tool for selecting the most appropriate study methodology (Creswell and Poth, 2016). As outlined above, this research sought to generate rich descriptions of oral health systems and coverage along with developing an in-depth understanding of the varying influences on oral health policy, including the 'how' and 'why' behind policy decisions made and not made (Walt *et al.,* 2008).

Qualitative methods of enquiry have been identified as those best placed to 'explore, narrate and explain phenomena' (Morse and Field, 2013) by producing 'rich, descriptive data' (Munhall, 2012). This sentiment was further emphasised by Long et al., (2023) with respect to health systems research who concluded that qualitative methods were: 'an appropriate method to understand "how" norms and stakeholders influence the design and function of health systems, "why" intended outcomes are achieved or are not achieved, and "what" the unintended outcomes are'.

Purely quantitative approaches, which serve to establish generalisable facts under controlled settings, would fail to fully explore the deeper contextual understanding sought from this research (Polit and Beck, 2010). However, evidence also points to the fact that qualitative and quantitative methods are not wholly in conflict, rather they address different aspects of the same research problem (Stewart *et al.*, 2008).

In the context of this thesis, an understanding of the importance of quantitative procedures is paramount when considering the outcomes of oral health coverage, most especially with respect to oral disease measurement and relevant indicators (Mahoney and Goertz, 2006).

Therefore, although this research is predominantly situated in qualitative methods, the choices with respect to the appropriate methodology are explicitly guided at each stage by the research question under consideration (Mays and Pope, 2000).

3.3.1 Qualitative research methods

Qualitative research provides 'a deep, contextualised understanding of social phenomena through intensive studies of cases under natural settings' (Polit and Beck, 2010). According to Creswell (2017), 'good' qualitative research questions should invite a process of 'exploration and discovery' with broader, generative questions setting the stage for sub-questions and the potential to construct questions 'that flow from one another' (Agee, 2009). However, maintaining an integrated design and ensuring continuous review is 'essential' to ensure effective qualitative research (Fossey *et al.*, 2002).

Some of the key strengths of engaging qualitive methods in the realm of health research include:

1. Facilitating richness and depth in healthcare exploration (Alasuutari, 2010).
2. Allowing humanistic and person-centred approaches to uncover 'thoughts and actions' of individuals (Renjith *et al.*, 2021).
3. Understanding patterns of health behaviours, examining healthcare needs and designing healthcare interventions (Draper, 2004).
4. Allowing patient perspectives and experience to be accurately and actively engaged both in the participation and design of research (Rolfe *et al.*, 2018).

Historically, qualitative approaches were considered 'the exact opposite' of quantitative methods and presented as 'antagonists' (Al-Busaidi, 2008). This premise emerged due to the origins of each method; quantitative research is determined by structure, based on experimental methods and is deductive (seeking to prove a hypothesis) in nature. While, as mentioned, qualitative research is inductive in nature, moving from specific observations to broader generalisations and theories (Creswell and Creswell, 2017).

However, there is growing recognition that the qualitative-quantitative tension is 'unnecessary' and that neither method is superior to the other, with weaknesses and strengths inherent to both (Pope *et al.*, 2002). Evidence reaffirms that the 'crucial' consideration must be knowing when to use what method to best answer the research question under investigation (Hammarberg *et al.*, 2016). It is also thought the improved conduct, rigour and reporting of qualitative research has led to greater appreciation of its

importance among clinicians and researchers trained within a predominantly quantitative ethos (Mays and Pope, 2000; Barbour, 2001).

3.3.2 Qualitative methods in oral health research

Traditionally the 'vast majority' of research on oral health has been conducted via quantitative methodologies (Stewart *et al.*, 2008; Chai *et al.*, 2021). It is thought the practice of dental research being situated in the quantitative paradigm stemmed from the 'dearth of researchers' with experience in the practice of qualitative methods. This had implications both in enabling the conduct of qualitative research on oral health but also in educating dentists and oral health professionals in appreciating its value. Furthermore, there were practical constraints in publishing qualitative research with many dental journals previously restricting qualitative reporting due to limitations in terms of structure and word count (Newton and Scambler, 2010).

Nonetheless, there has been a growing interest in qualitive research in oral health in recent years. It is increasingly recognised as a method which provides a 'new perspective' of exploring dental knowledge and clinical practice (Lambert and McKevitt, 2002). It is now considered useful to reveal insights, values and beliefs that could not be informed by quantitative methods alone. As such qualitative research has seen a rise in its importance within oral health, primarily within dental public health and is recognised as an optimal approach when investigating issues and perspectives with respect to policy (Bower and Scambler, 2007; Chai *et al.*, 2021).

3.3.3 Challenges of qualitative research

As expected with any singular approach to research, there are concessions that may result in methodological limitations if not properly accounted for in research planning. Potential challenges within qualitative research that have been identified in the literature include the:

1. Generalisability of study findings (Hammarberg *et al.*, 2016)
2. Role of the researcher and potential bias influencing study findings (Anderson, 2010)
3. Management of and maintaining rigor (Johnson, 2015)
4. Large volumes of data making analysis and interpretation time consuming (White *et al.*, 2012)

5. Acceptance of findings by the professional community (Long and Jiang, 2023)

The validity of findings within qualitative research can be substantiated by several techniques including the use of triangulation, constant comparison, respondent validation and the use of multi-disciplinary teams (Anderson, 2010). Further actions in data analysis include the use of a conceptual framework, assessment of information 'power' and ensuring accurate presentation and transparency of data findings, all serving to enhance methodological rigour (Mays and Pope, 2000; Malterud *et al.*, 2016).

In this research, potential methodological limitations and the steps taken to address them will be dealt with for each individual study in sections 3.5 to 3.7 while an overall critique of the methodological approach adopted is provided in the thesis discussion (Chapter 7, section 7.8.2.4). Researcher positionality within the research process will also be discussed in section 3.8.

In addition to these methodological considerations, it is important to outline the analytical frameworks that informed the design, analysis, and interpretation of each study. The upcoming section critically examines the health systems and policy analysis frameworks selected for this research, including their rationale, application, and limitations.

3.4 Critique of health systems and policies analysis models

Health policy and systems research (HPSR) is challenging owing to the multifaceted nature of health systems, the complexity of policy development and implementation, and the sociopolitical, cultural and economic contexts influencing them (Alliance for Health Policy and Systems Research, 2024).

HPSR is considered 'critical' in developing health systems to better meet the health needs of their populations (Gilson and World Health Organization, 2012). Within 'general' healthcare systems it has emerged in recent decades as a field that 'generates effective policies and policy content for achieving health and health system goals' (Shroff *et al.*, 2017). While notable examples of HPSR's impact are evident in its contribution to health system reforms across Africa, Asia and Latin America in recent decades in moving towards the goals of universal health coverage (Strachan *et al.*, 2023).

However, HPSR research within the context of oral health systems is limited and is highlighted as a domain requiring research attention (Listl *et al.*, 2023). Owing to the marginalisation of oral health within broader health systems and policies, HPSR within oral health requires a robust and nuanced methodological approach. Analytical frameworks are considered essential tools in HPSR to enable structured approaches to generating comprehensive understanding of such complex health systems and policies (Papanicolas *et al.*, 2022).

Study One of this PhD is an oral health policy analysis (McAuliffe *et al.*, 2022), while Study Two is an inter-country comparison of oral health coverage representing a health systems approach (McAuliffe *et al.,* 2025). The following section will critique commonly used health policy and systems analysis frameworks, highlighting their strengths and weaknesses before justifying the selection of the Multiple Streams Framework (Howlett, 2019) employed in Study One and the WHO Universal Health Coverage Cube (World Health Organisation, 2008; Allin *et al.*, 2020) in Study Two respectively. The section will also discuss how the limitations of those models were addressed through qualitative research methods.

3.4.1 Commonly used analytical frameworks in health policy analysis

3.4.1.1 The Health Policy Triangle (HPT) (Walt and Gilson, 1994)

This frequently used framework focuses on four aspects of policy- context, content, process, and actors, to provide a broad analysis of health policies (Walt and Gilson, 1994). It is extensively used in policy analysis because of its simplicity, adaptability and wide-ranging structure. It is especially suitable for novice policy analysts as evidenced by its wide use in lower-and-middle-income countries, where there is less of a tradition of health policy analysis (Walt and Gilson, 1994). This was also shown by its effective use in oral health in a high-quality analysis of oral health policy in Nigeria which has been cited over fifty times and published in a high-ranking academic journal (Etiaba *et al.,* 2015).

According to the literature, the key strengths of the HPT are its:

1. Comprehensive approach - by way of four inter-connected domains it facilitates analysis of the major components of policy (Walt and Gilson, 1994)
2. Generalisability – allowing for analysis of diverse health-related topics (O'Brien *et al.,* 2020)
3. Clear and intuitive structure – this helps to organise analysis systematically meaning it is suitable for a range of stakeholders from policy makers to politicians to researchers or clinicians (Walt *et al.*, 2008).

Despite the recognition of the HPT a valuable tool as outlined there are notable limitations pertaining to its use, namely:

1. A risk of oversimplification –its clear structure facilitates analysis, however, equally, health policies are complex often involving multiple layers of interaction with the HPT triangle limited in its ability to capture such dynamics (Zahidie *et al.,* 2023).
2. A limited focus on implementation – the focus on analysis of policy means there is a lack of explicit consideration of policy implementation challenges and issues such as resource allocation and stakeholder participation (Walt *et al.,* 2008).
3. A lack of consideration of policy outcomes (O'Brien *et al.,* 2020).

3.4.1.2 The Multiple Steams Framework (MSF) (Kingdon, 1984)

The multiple streams framework (MSF) developed by John Kingdon in 1984 is a prominent model for analysing policy-making across a variety of policies and countries demonstrating its versatility and theoretical richness (Hoefer, 2022). It was used by Leck and Randall (2017) who conducted an oral health policy analysis examining access to oral care for a vulnerable group and the role of dental therapists.

Kingdon's model examines how issues rise and fall on government agendas and suggests that this is facilitated by three streams – the problem, policy and politics streams. Once the three streams align a 'policy window' opens thus creating an opportunity for policy change (Kingdon, 1984).

According to the literature its key strengths are:

1. An emphasis on policy dynamics – the streams facilitate an understanding of the complex nature of the policy environment by way of the convergence of multiple societal phenomena to precipitate an 'idea whose time has come' (Kingdon, 1984; Béland and Howlett, 2016)
2. Including political contexts – Kingdon extends traditional frameworks by incorporating political influences and recognising the impact of those on health policy decisions (De Wals *et al.*, 2019)
3. Versatility - its flexible structure is demonstrated by its application over several decades across different health policy scenarios in different health settings and political climates (Béland and Howlett, 2016).

While the MSF is proven beneficial in understanding policy formulation there are some inherent limitations in its use including the:

1. Analysis of agenda-setting phase only – Kingdon's framework focuses on the agenda setting phase and does not take into consideration other critical components of the policy process such as formulation, implementation and evaluation. This narrow focus restricts its use and applicability in generating a comprehensive policy analysis (Béland and Howlett, 2016)
2. Underemphasis on the importance of problem definition – it is suggested that insufficient importance is assigned to the problem stream. To generate effective policy solutions, policy entrepreneurs need to accurately define the policy problem. A failure

to account for the complexities involved and the ambiguity that ensues can complicate the overall policy process (Hoefer, 2022).

3. Overemphasis on 'windows' of opportunities – a tendency to focus on unique windows for change may oversimplify complex protracted policy processes that are many years in fruition (Walt *et al.,* 2008).

3.4.1.3 Stages Heuristic (The Policy Cycle)

A third example of a policy analysis framework is the 'Stages Heuristic'. This follows the 'classic' way to study policymaking across each of its 'stages', i.e., agenda setting, policy formulation, legitimation (legislatures and other decision makers design and enact policies), implementation, evaluation and maintenance (Walt *et al.,* 2008). The strength of this framework lies in its simplicity of use and broad applicability. However, this also represents some inherent limitations because critics have highlighted the presumed linearity to the process that's proposed that does not exist within the real-world context (Walt *et al.,* 2008).

3.4.1.4 Multiple Streams Framework (Howlett, 2019) (Figure 3-1)

As evidenced above, there is no ideal analytical framework (Cairney and Jones, 2016). Research pertaining to the appropriate selection of models for policy analysis, points to the importance of selecting frameworks that match both the research context and overall research objectives. The importance of careful framework selection prior to conducting a health policy analysis is emphasised owing to the risk that mismatched frameworks may lead to incomplete or biased analyses (Walt *at al.,* 2008)

This process was carefully managed in the preparatory phase of Study One of this PhD, where extensive scoping of the literature was undertaken ultimately resulting in the selection of Howlett's MSF as the appropriate choice. Based on the sparse literature available within oral health policy analysis, analytical frameworks if used, were limited to either those developed by individual authors (Singh *et al.*, 2010), the HPT (Etiaba *et al.*, 2015) or Kingdon's MSF (Leck and Randall, 2017).

It was the opinion of this PhD candidate and supervisory team, that some of the inherent

weaknesses outlined above pertaining to both the HPT (Walt and Gilson, 1994) and Kingdon (1984) could be accounted for in selecting the broader framework proposed by Howlett (2019) Figure 3-1. This especially related to its comprehensive approach, the emphasis on the role of political actors and its consideration of policy implementation, which were all points of relevance to the research objective and the Irish oral health policy context in Study One. The starting point for Howlett's MSF is Kingdon's three streams (problems, policies, politics).

Howlett defines the streams as follows:

1. The Problem Stream - entails the recognition and definition of issues and policy problems.
2. The Policy Stream – is focused on various policy solutions or alternatives contributed by policy entrepreneurs, experts and various other stakeholders.
3. The Politics Stream - encompasses the broader political environment including public mood and external influences allowing for consideration of the role of political traction in influencing the position of policy issues on the government agenda.

Howlett further adapts the three-stream model to consider two further streams – the Process Stream and the Programme Stream.

4. The Process Stream accounts for the procedural aspects of policy development and includes the measures and pathways that guide how policies are proposed and developed.
5. The Programme Stream is focused on implementation, how policies are put into practice and if successful, how they are evaluated.

The confluence points and 'flow' of each stream, beginning with 'Kingdon's' three streams, and the 'policy windows' that emerge are illustrated in Figure 3-1.

The framework proposed by Howlett (2019) builds and expands on the earlier work by Kingdon and has the following key strengths:

1. It allows comprehensive analysis – by expanding the original model from three to five streams, Howlett's framework facilitates a more detailed examination of the policy process. This was an important consideration in PhD Study One as the objective was to generate a detailed understanding of the key factors impeding or promoting the development and implementation of oral health policy in Ireland spanning almost

three decades.

2. Inclusion of implementation – as mentioned the failure to consider policy implementation or outcomes is a key limitation of the HPT and Kingdon's framework which is accounted for in the programme stream by Howlett. This was of relevance to Study One as 'implementation' was explicitly mentioned as a research objective of Study One.
3. Dynamic analysis- Howlett's framework retains the key features of Kingdon's framework pertaining to capturing the non-linear and context dependent nature of policymaking which is not facilitated by the HPT. This is particularly relevant in oral health policy where policies are characterised by fragmentation and low priority.
4. Importance of actors - the role of policy entrepreneurs, actors and stakeholders was highlighted across each stream. Howlett accounts for political agents from policy makers to actors attempting and of critical importance within the Irish context in seeking to understand why certain policy decisions were made or not made.

Addressing the limitations of Howlett's MSF

As with any framework, there are inherent limitations to the MSF proposed by Howlett. Below those key weaknesses are outlined along with efforts made to address those by way of methodological approaches including triangulation of data, longevity, in-depth elite interviews and documentary analysis of literature derived from multiple sources.

Limitations of Howletts Multiple Streams Framework:

1. Complexity - the inclusion of the 'new' process and programme streams increased the comprehensive nature of the analysis but adds complexity owing to the number of streams.
2. Data intensive- the inclusion of five streams means significant volumes of data are required to comprehensively map all streams which is challenging in terms of resource demands and data availability.
3. Challenges in data integration – owing to the complexity of the framework, mapping heavy in textual data can require significant time particularly in terms of triangulation and interpretation.

4. Long-term trends and policy ‘windows’ - a limitation of the framework is the emphasis on more short-term policy dynamics and the opportunities for change which can neglect long-term sustained trends.
5. Institutional and governance factors – a further critique is that the role of formal institutions may be under-represented and their resultant impact on the policy process.

Steps taken to mitigate limitations:

1. Clearly defined research question – the scope of PhD Study One was explicitly defined i.e. an in-depth analysis of oral health policy, development and implementation in Ireland from 1994-2021. This clarity helped manage the complexities associated with the 5 streams in setting focused and specific boundaries for the research. Furthermore, ‘operational definitions’ within each stream were developed pertaining to each stream agreed by the supervisory team and which facilitated practical application of the framework.
2. Data triangulation – The combination of documents from both academic, health system and grey literature sources with interview data supported data validation and ensured that each stream was appropriately contextualised.
3. Data volume – The volume of data from 135 documents and 13 interviews with ‘elite’ participants generated depth and meant there was sufficient data to map across all 5 streams.
4. Long-term trends mapped – The longitudinal analysis spanning a 27-year-timeline as specified in the research question meant that any incremental changes or reforms if implemented outside of shorter focused ‘windows’ could be captured.
5. Integration of broader policy context - The documentary analysis incorporated general health policy documents in addition to health system reports and recommendations capturing key institutional influences. Furthermore, following stakeholder mapping, the interviews were conducted with representatives of institutions across the oral health policy landscape in Ireland including the health system, dental representative associations and academic institutions.
6. Framing of the policy window – A critique of the MSF is that there is an oversimplification of 'policy windows’ which doesn’t account for the complexities. In

Study One this phenomenon was appropriately contextualised within the documentary analysis and the depth provided with data from the interviews.

Therefore, although Howlett's framework has underlying limitations particularly around its complexity, short-term focus and emphasis on policy 'windows', it is still a valuable and appropriate choice for Study One (Howlett, 2019). 'Best practice' for policy analysis dictates that it is guided by an analytical framework and the steps taken outlined above sought to mitigate the potential limitations identified, leading to an overall comprehensive analysis generated in understanding those key influences impacting oral health policy in Ireland (Walt et al., 2008).

3.4.2 Health systems approaches within Health Policy and Systems Research

According to experts in the field of Health Systems and Policies Research (HPSR) policies and systems research should not be considered separate entities and active linkage between both domains produces better outcomes (Alliance for Health Policy and Systems Research, 2024). This approach was undertaken in this PhD overall as following the oral health policy analysis undertaken in Study One a systems approach was undertaken in Study Two specifically examining oral health coverage, a key component of health systems research (Alliance for Health Policy and Systems Research, 2024).

Some commonly used frameworks taking a health systems approach are outlined below along with their strengths and weaknesses.

3.4.2.1 Health Systems Performance Framework (Murray & Frenk, 2000)

This framework served as the basis for the 2000 World Health Report and identifies four key factors that outlines health system functions- (i) financing, (ii) provision of health services, (iii) stewardship (iv) and resource generation. Within each of the four functions, Murray & Frenk identified sub-functions and elements of strategic design, structural arrangements and implementation management that might contribute to a health system's ability to carry out these functions (Murray and Frenk, 2000).

Strengths:

1. Emphasises health system goals - this framework provided the first summary of the functions and actions of a health system towards the achievement of common goals (OECD, 2024)
2. Functional approach – It delineates four key functions as mentioned above which aids in clarifying different roles and perspectives within the health system (Murray and Frenk, 2000).
3. Emphasises fair financial contributions – highlights the importance of equity from the financial perspective (Murray and Frenk, 2000).

Limitations:

1. Data challenges – assessing abstract concepts such as fairness in financing and stewardship can be difficult (Smith and Busse, 2010)
2. Focus of measurements in healthcare - following the introduction of the framework there was extensive debate pertaining to the 'ranking' of healthcare systems (Klazinga *et al.*, 2009).
3. Contextual limitations - In addition to the absence of consideration of the social and educational determinants of health (Klazinga *et al.*, 2009).

3.4.2.2 World Health Organisation Building Blocks Framework, 2007

The aim of the framework is to promote a common understanding of what a health system is and what constitutes health systems strengthening. In the framework a health system is conceptualised as consisting of 6 building blocks: (i) service delivery; (ii) health workforce; (iii) information; (iv) medical products, vaccines and technologies; (v) financing; and (vi) leadership and governance well as process elements (access, coverage, quality and safety) and outcomes (improved health and health equity, responsiveness, social and financial risk protection and improved efficiency) (World Health Organisation, 2007).

It has been used to describe health systems and their performance and to evaluate the effects of reforms on systems (Obermann *et al.*, 2016; Marx *et al.*, 2018) in addition to the introduction of new technologies including vaccines (Mounier-Jack *et al.*, 2014).

Strengths:

1. Simplicity – Its structure facilitates discussion of key health system components across different systems and contexts (Mounier-Jack *et al.*, 2014).
2. Supports structuring of key research questions – the all-encompassing nature of the framework means no evidence gaps in analysis of health systems (Mounier-Jack *et al.*, 2014)
3. Comparative approaches- its extensive use internationally means it is suitable for generating inter-country comparison (Sacks *et al.*, 2019)

Limitations:

1. Suitability as an analytical tool – the framework was not originally intended to be used as an evaluative tool rather instead it was developed to guide the investment of resources. It is therefore organised around details of service delivery but limited in terms of service demand (Huff-Rousselle, 2013).
2. Static in design – there is limited evidence on the interaction between different building blocks and the links between the main components (inputs, outputs and outcomes) (Sacks *et al.*, 2019).
3. No weighting between the blocks – All parts of the system are assumed to have the same importance which is rarely the case. This can lead to a failure delve more comprehensively into significant system areas and expand on more complex issues (Mounier-Jack *et al.*, 2014).

3.4.2.3 *'Control Knobs Framework'* (Roberts et al., 2008)

This is a framework developed by the World Bank Institute in collaboration with the Harvard School of Public Health which describes adaptable 'control knobs' to describe discrete areas of health systems structure. They are – financing, payment, organisation, regulation and behaviour.

Strengths:

1. *Policy relevant* - This model particularly focuses on the needs of policymakers who want to know what policy instruments will allow them to measurably affect desired outcomes (Shakarishvili *et al.*, 2010)

2. *Role of behaviour* – It highlights the role of behaviour change at all levels, which is not accounted for in different frameworks (Shakarishvili *et al.*, 2010)
3. *Comprehensive* – By encompassing 5 domains as highlighted above it provides a wide overview of a health systems core functions (Roberts, 2008)

Limitations:

1. Limited adaptability – It may not account for cultural and political influences which can shape health system outcomes (Shakarishvili *et al.*, 2010)
2. Measurement challenges – Monitoring implementation of behaviour effectiveness can be challenging owing to data availability (World Health Organisation, 2010)

3.4.2.4 The World Health Organisation Universal Health Coverage Cube (WHO, 2008) (Figure 3-2)

According to the literature, health policy and systems research (HPSR) is not characterised by any particular methodology but more importantly, the approach should be dictated by the research question under study (Alliance for Health Policy and Systems Research, 2024).

Study Two of this PhD sought to: 'provide a detailed description and mapping of publicly funded oral health coverage for children across six European countries, each representative of a different oral health system model, and to report on that coverage in line with the World Health Organisation Coverage Cube'.

The research focus of Study Two was on oral health coverage for children (McAuliffe *et al.,* 2025). This was in response to, and building on the findings of Study One in the Irish context highlighting children as a vulnerable group excluded from coverage and the potential window of opportunity of reform emerging via universal oral health coverage (World Health Organisation, 2021; McAuliffe *et al.*, 2022).

A scoping of the literature highlighted the use of the universal health coverage cube by Professor Sara Allin in examining dental coverage for adults across seven jurisdictions globally. Professor Allin's research was published in a peer-reviewed journal (Allin *et al.*, 2020) and formed the basis for an evidence report published by the North American Observatory on Health Systems and Policies (Farmer *et al.*, 2019).

Following engagement and consultation with Prof Allin and her team, the cube adapted for public dental coverage utilised in their research was used for study 2 of this PhD Figure 3-2 (Allin *et al.*, 2020). Furthermore, a data collection template based on the cube used by Prof Allin was sourced and adapted to support data collection and use in the child population (Appendix F).

The Universal Health Coverage Cube (Cube) has three dimensions (Allin *et al.*, 2020):

1. Breadth of coverage – the population eligible for publicly funded oral healthcare.
2. Depth of coverage – the range of services covered under publicly funded oral healthcare.
3. Scope of coverage – the range of services covered.

Justification for the use of the WHO Universal Health Coverage Cube:

In addition to its use in high quality oral health research in the same domain as described above, the cube has the following strengths supporting its use in this research:

1. Simplicity and flexibility for comparison - this study sought to compare coverage across 6 different countries. The structure of the cube through providing a clear and common lens, enabled the organisation of significant volumes of data and facilitated inter-country comparison. The cube used notably in World Health Reports (2008 and 2010) and in the European Observatory's Health Systems in Transition reports and in recent times is 'used world-wide to illustrate UHC and supports related analyses' (Winkelmann *et al.*, 2018).
2. Comprehensive - The cube is recognised as being 'immensely helpful' in highlighting the key components required when making the transition toward expanded UHC (Ochalek *et al.*, 2020).
3. A focus on equity - The Cube shows the difference between the current national coverage situation in a country and the policy goal of universal health coverage, identifying where major gaps exist (Roberts *et al.*, 2015). This was a key consideration of PhD Study Two.

The weaknesses and potential limitations of the cube are outlined below before the steps taken to mitigate those concerns within the research are described.

Limitations:

1. Lack of specificity - A criticism levelled at the cube is that it too high-level. For example, it does not include disparities across the population groups, that instead national 'averages' are considered and thus do not highlight which groups should be identified for expanded coverage (Roberts *et al.,* 2015).
2. Conceptual tool only - Evidence points to the use of the cube as a conceptual device and not a practical tool for detailed design or implementation (Ochalek *et al.,* 2020)
3. Failure to incorporate contextual influences – The cube does do not account for the cultural, political or systemic contexts which can shape the implementation or expansion of universal health coverage (Rizvi *et al.*, 2020).

Mitigating actions adopted:

Steps taken to mitigate potential limitations of the WHO universal health coverage cube in PhD Study Two (McAuliffe *et al.,* 2025) are outlined as follows:

1. Increased specificity– this was secured using a version of the cube previously adapted for use in public dental systems and tailoring the research to focus on a defined population group in children. Furthermore, documents for analysis were sourced from academic, health system and other grey literature for each country without a language restriction. As such, the nuances of each system were captured including granular detail on organisational and governance regimes, regulation, service delivery models and financing mechanisms.
2. Incorporating implementation considerations – A section of the data collection template was developed to incorporate analysis of previous or planned coverage reform. This was applied to both documents analysed and in interviews with experts where questions about the practical challenges of implementing policies specific to their country and system.
3. Triangulation of data – by combining documentary analysis and interview data with local experts, the cube's lack of contextual detail pertaining to cultural, political and economic influences was accounted for.

3.5 Study One: Oral health policy analysis

3.5.1 PhD objective addressed in Study One

The overall aim of this PhD is to carry out a health systems and policy analysis that informs the delivery of oral health reform for children through the implementation of Ireland's national oral health policy, Smile agus Sláinte, in line with the global policy aim of universal oral health coverage (Department of Health, 2019a). The first research objective was to determine the key factors influencing Irish oral health policy development and implementation during the period 1994-2021.

To satisfy this objective, PhD Study One sought to:

1. Conduct a detailed mapping and timeline of Irish oral health policy developments from the period 1994 to 2021;
2. Develop a thorough understanding of the policy making process and the key actors, contexts and political influences impacting them;
3. Determine the critical factors influencing oral health policy implementation successes and failures during the period 1994-2021.

Health policy analysis is 'critical' to health system reform (Walt and Gilson, 1994). It has been used retrospectively and prospectively to examine past policy successes and failures and inform future policy implementation (Walt and Gilson, 1994). Thus, the objective of Study One was to conduct a detailed analysis of Irish oral health policy, which will be described in section 3.5.2. This analysis developed new knowledge with respect to oral health policy development and implementation and subsequently guided the inter-country comparative comparison in Study Two and analysis of indicators of oral healthcare for children in Study Three.

3.5.2 Approach to Study One

3.5.2.1 Oral health policy analysis

Health policy has been defined as 'courses of action (and inaction) that affect the set of institutions, organisations, services, and funding arrangements of the health and healthcare system. It includes policy made in the public sector (by government) as well as policies in the

private sector' (Buse *et al.*, 2012). Typically, health policies are 'formal written documents, rules and regulations that present policy makers' decisions about what actions are deemed legitimate and necessary to strengthen the health system and improve health' (Gilson and World Health Organization, 2012).

The aim of a health policy is to improve population health and reduce inequality. While national oral health policies have been shown to lead to improved oral health outcomes and reduced inequalities in accessing oral healthcare (Galvão and Roncalli, 2021).

Health policy analysis is a 'multi-disciplinary approach that aims to explain the interaction between institutions, interests, and ideas in the policy process' (Walt *et al.*, 2008). The rationale for carrying out policy analysis lies in the generation of rich knowledge of how and why policies were effective to plan for future policy implementation and health reform (Walt *et al.*, 2008).

However, policy analysis is 'complex' (Buse *et al.*, 2012). Simply put by Colins *et al.,* (2005) 'it is not an easy task'. Conducting health policy analysis is complex, because health policy is a complex, or so-called 'wicked' concept (Newman, 2007). Policy decisions are not necessarily evidence based nor the result of a rational process. The context and environment within which decisions are made can be influenced by a myriad of factors, most especially political influences (Walt and Gilson, 1994; Collins, 2005). As described by Buse et al., (2012), 'Understanding the politics of the policy process is arguably as important as understanding how medicine improves health' (Buse *et al.*, 2012).

Despite policy analysis being a well-established research and academic discipline (Walt and Gilson, 1994; Collins, 2005; Walt *et al.*, 2008; Buse *et al.*, 2012; Howlett, 2019), there is limited international research analysing oral health policy (Singh *et al.*, 2010; Etiaba *et al.*, 2015; Pucca *et al.*, 2015; Leck and Randall, 2017), and to the best of this PhD candidate's knowledge, none in the Irish context.

3.5.2.2 Case study approach

Study One sought to generate an in-depth analysis of Irish oral health policy, development and implementation over almost three decades. As such a 'case study approach' was adopted (Yin, 2014).

According to recent literature, to address the urgent challenges in health research demands 'methodological approaches that can attend to complexity' (Paparini *et al.*, 2020). Furthermore, that in conditions of complexity there 'is limited value in maintaining the current orientation to experimental trial designs in health sciences as providing 'gold standard evidence of effect'. Rather that in addition to such accepted approaches, policymakers also require 'credible evidence of relevance to their setting and populations' with case study research suggested to offer 'considerable potential for strengthening faith in both external and internal validity' (Paparini *et al.*, 2020).

Case studies are considered beneficial for 'in-depth, multi-faceted explorations of complex issues in their real-life settings' (Crowe *et al.*, 2011). They are an 'established research design… used extensively in a wide variety of disciplines' (Crowe *et al.*, 2011). However, case study research is 'frequently marginalised at the bottom of an evidence hierarchy' despite its 'essential' role within health sciences research with calls made to revisit this status (Paparini *et al.*, 2020).

A case study is defined as 'an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context especially when the boundaries between the phenomenon and context are not clearly evident' (Yin, 2014). Case studies enable researchers to obtain the meaningful characteristics of real-life events and complex social phenomena and cater for 'operational links needing to be traced over time' rather than simply denoting instances or frequencies of events (Yin, 2014). This research typology usually involves multi-methods where triangulation of evidence assists in making robust explanations of complex social phenomena, an approach applied to both PhD studies one and two (Yin, 2009).

Some applications of case studies cited within health systems and policies literature include:

1. Understanding pathways resulting from a new policy or service development (Yin, 2009);
2. Exploring under-researched and real-life phenomena (Meyer, 2001);
3. Providing 'invaluable' insights on intervention implementation including what gaps exists and why one strategy may be chosen over another (Crowe *et al.*, 2011);
4. Explaining causal links in real life interventions that are too complex for a survey or experimental design (Greenhalgh *et al.*, 2004; Yin, 2014).

Some key strengths, limitations and mitigation actions taken to account for potential weaknesses of the case study approach adopted in this PhD research are outlined below.

Strengths of case study research

1. Generates an in-depth understanding of 'how' and 'why' - According to the literature 'the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented' (Yin, 2009). This is critical in policy analysis research to determine why certain policy decisions were made or not made.

2. Allows consideration of actors and agencies - Health Systems and Policies Research often require consideration of 'the complex relationships among actors and agencies; and how those relationships influence change, including change over time' (Gilson and World Health Organization, 2012). This was a key lens of analysis in PhD Study One regarding the interactions and influences of actors in the oral health policy landscape in Ireland.

3. Can support and analyse policy development – The case study approach can both generate information *for* policy or be used to analyse past policy experiences in detail. PhD Study One encompasses an analysis of policy development in Ireland over almost three decades with the learnings generated intended to inform future policy implementation.

4. Flexible - case study approaches are very flexible in terms of overarching research purposes, it can:
    a. include a variety of evidence including documents, artifacts, interviews and observations beyond what would normally be available in a routine review or historical study (Yin, 2009).
    b. support explanatory inquiry to gain an understanding of situations and generate concepts for follow-up (Gilson and World Health Organization, 2012; Yin, 2014)
    c. allow detailed description of particular experiences (Walt *et al.*, 2008)
    d. can be used as a study approach in emancipatory work such as action research and participatory inquiry (Gilson and World Health Organization, 2012).

5. Comparative research – Case-study research can involve either single cases (the approach adopted in PhD Study One) or follow a 'multiple case study approach' (adopted in PhD Study Two) with this methodology used to in inter-country comparative research (Walt *et al.*, 2008; Yin, 2014).

Considering the above, and in the context of this research, case studies are considered 'the backbone of policy analysis research' (Pal, 2005). Typically, the most used methodology with respect to policy analyses, the case study approach has also been adopted internationally in a previous oral health policy analysis (Etiaba *et al.*, 2015).

Limitations of case-study research

However, the case study approach as with all research, is not without its limitations and these are outlined:

1. Lack of rigour: Critics of the design point to a lack of scientific rigour particularly regarding the absence of systematic procedures (Yin, 2009).
2. Poor generalisability – case-study approaches, particularly those adopting a single case, are suggest as having a limited potential for generalisation (Yin, 2009; Crowe *et al.*, 2011).
3. Time and resource intensive case studies rely on extensive data to facilitate the 'in-depth' analysis sought. Therefore, care needs to be undertaken to balance the volume of data with the time required for data analysis and interpretation of 'often highly complex data-sets' (Crowe *et al.*, 2011).
4. Ethical concerns – cases are often easily identifiable to 'insiders' posing a risk to participants engaged in research (Crowe *et al.*, 2011).
5. Poor definition of the 'case' – the risk of a failure to adequately and explicitly identify what is within the boundaries of the case, rationale for case selection and political influence (Walt *et al.,* 2008).

Mitigating actions adopted in this PhD research

Yin (2009), outlines procedures to ensure trustworthiness in case-study research while Crowe et al, (2011) outline 'mitigating actions' to avoid potential pitfalls when undertaking research.

Based on both of those criteria the following procedures were under-taken in the context of this PhD thesis:

1. Appropriate case(s) selection - To counter the risk of conceptualising the wrong case or having poor overall clarity on what constituted the 'case', careful consideration was given in the development of PhD Study One and two to accurately define the case(s) under analysis. This included defining by 'time' and /or 'space' (i.e. oral health policy development/implementation in Ireland between 1994-2021 in PhD Study One) and (public dental coverage for children across a specific named country in Study Two). This process was facilitated by conducting an initial in-depth scoping of the literature and transparency about what was beyond the scope of the case (for example in Study Two the case was limited to children under the age of 18 and coverage considerations in line with the WHO universal health coverage cube).

2. Lack of rigor – This was countered using triangulation (i.e. documentary analysis of different data sources grey, health system/service and academic literature along with the outcomes from semi-structured elite interviews). It was further countered by adopting a systematic approach (outlined in section 3.5.3) with data collection and analysis guided by two different theoretical frameworks (i.e. the Multiple Streams Framework in Study One and the WHO coverage cube in study 2). Finally, transparency was strongly emphasised throughout the research process in both studies 1 and 2 by detailing the steps involved in case selection, data collection, the rationale behind 'elite' participant selection, the lead researcher positionality. While this is further supported by a published protocol for study 2.

3. Potential for generalisability – this can be accentuated in a single study using theory (as evidenced in PhD Study One) or the use of replication logic by way of using multiple cases along with pattern matching of data across cases (as conducted in Study Two). Furthermore, findings from a single case can be 'telling' rather than 'typical' and offer insight into the wider issue if the context within which a case is viewed is considered as exemplifying wider social and political forces (Paparini *et al.*, 2020). This approach was adopted in Study One by way of discussion of the findings from oral health policy in Ireland within the broader international literature (McAuliffe *et al.,* 2022).

4. Ethical concerns - the importance of strict and appropriate anonymisation to mitigate the risk of revealing the identities of participants in addition to securing informed consent to participate on this basis is directed in the literature as key mitigating actions (Stake, 1995; Crowe *et al.*, 2011). Informed consent to participate was granted by all interviewees across both study 1 and 2 with data appropriately anonymised and no potentially revealing quotations were included.

5. Data and research resource management – careful planning and progress monitoring was undertaken throughout studies one and two to ensure there was sufficient opportunity to balance data depth with analysis. This was supported by ensuring data collection was focused in accordance with the stated research objectives and regular engagement with the wider research team (Crowe *et al.*, 2011).

Yin proposed a range of characteristics for creating rigorous explanatory case studies in health services research including identifying the case, operationalising the case study (identifying research priorities within a comprehensive framework) and the use of triangulation (collecting data from multiple sources) (Yin, 1999).

The methodology employed for PhD Study One outlined in Section 3.5.3 is presented in line with Yin's key criteria (Yin, 2009).

3.5.3 Study One: methodology

3.5.3.1 Defining the case

The first stage of conducting case study research is succinctly defining the case to be studied (Crowe *et al.*, 2011). This enables the researcher to identify a body of knowledge to which they will contribute, to identify why the case should be examined and whether the research will be useful. This definition is informed by an understanding of the literature and an appreciation of underlying theory and context.

These steps were followed in this thesis as previously explained in section 3.1 and in setting the scene for this research in chapters one and two, and the case was clearly defined as: the key factors influencing national oral health policy development and implementation in Ireland from 1994 to 2021.

3.5.3.2 Case boundaries

To guard against posing too broad a question, each case should have 'a pre-defined boundary' (Yin, 2009; Crowe *et al.*, 2011). Proposed methods to bind a case were by:

1. time and place (Creswell and Creswell, 2017);
2. time and activity or (Stake, 1995);
3. definition and context (Miles *et al.*, 1994).

This study was bounded by time and place. Study One retains a national focus, collating data pertinent to the oral health policy making and implementation in Ireland initially confined to a twenty-five-year period, from 1994-2019.

These dates were chosen as 1994 is the date of Ireland's first national health policy which included a 'Dental Health Action Plan' (Department of Health, 1994a) and Ireland's most recent and only national oral health policy which was published in 2019 (Department of Health, 2019a). However, the period of the study was expanded to include the impact of the COVID-19 pandemic, to July 2021.

3.5.3.3 Selection of an appropriate framework

According to the leading academics in this field, the best practice for health policy analysis is to root the analysis in an existing framework (Walt *et al.*, 2008). This ensures that the policy analysis is focused, approached in a systematic manner and based on clear propositions within existing frameworks (Walt *et al.*, 2008). It enables the research to not only answer 'what happened' but 'what explains what happened' (Walt *et al.*, 2008). It also may support the development of knowledge that is potentially transferrable (Crowe et al., 2011).

For Study One of this PhD, the 'Multiple Streams Framework' by Howlett (2019) was chosen for analysis due its comprehensive, wide raging coverage and ability to capture a multitude of elements in complex policy processes Figure 3-1. This framework seeks to capture some of the more nuanced features of policy, including policy strategies and styles, in addition to policy processes leading to different policy outcomes (Howlett, 2019).

The multiple streams Figure 3-1 are the problem, policy, process, politics, and programme streams and they are best surmised as follows:

1. *Problem* refers to the framing and articulation of policy problems.
2. *Policy* refers to the formulation of policies, policy alternatives and instruments.
3. *Process* refers to the main tasks and events which lead to policy outputs.
4. *Politics* refers to the politically active policy actors.
5. *Programme* refers to the management of implementation. (Howlett, 2019).

The choice of this framework was appropriate in this study and a detailed overview of its utility is provided in section 3.4.

The multiple streams provided an initial deductive framework; however, coding was also inductive by allowing other concepts and findings to occur beyond the five streams.

This was evident by way of the development of the 'operational definitions' pertinent to each stream which were guided by the researcher findings, similarly the selection of interview participants and the questions posed were guided by the streams but based on emerging findings.

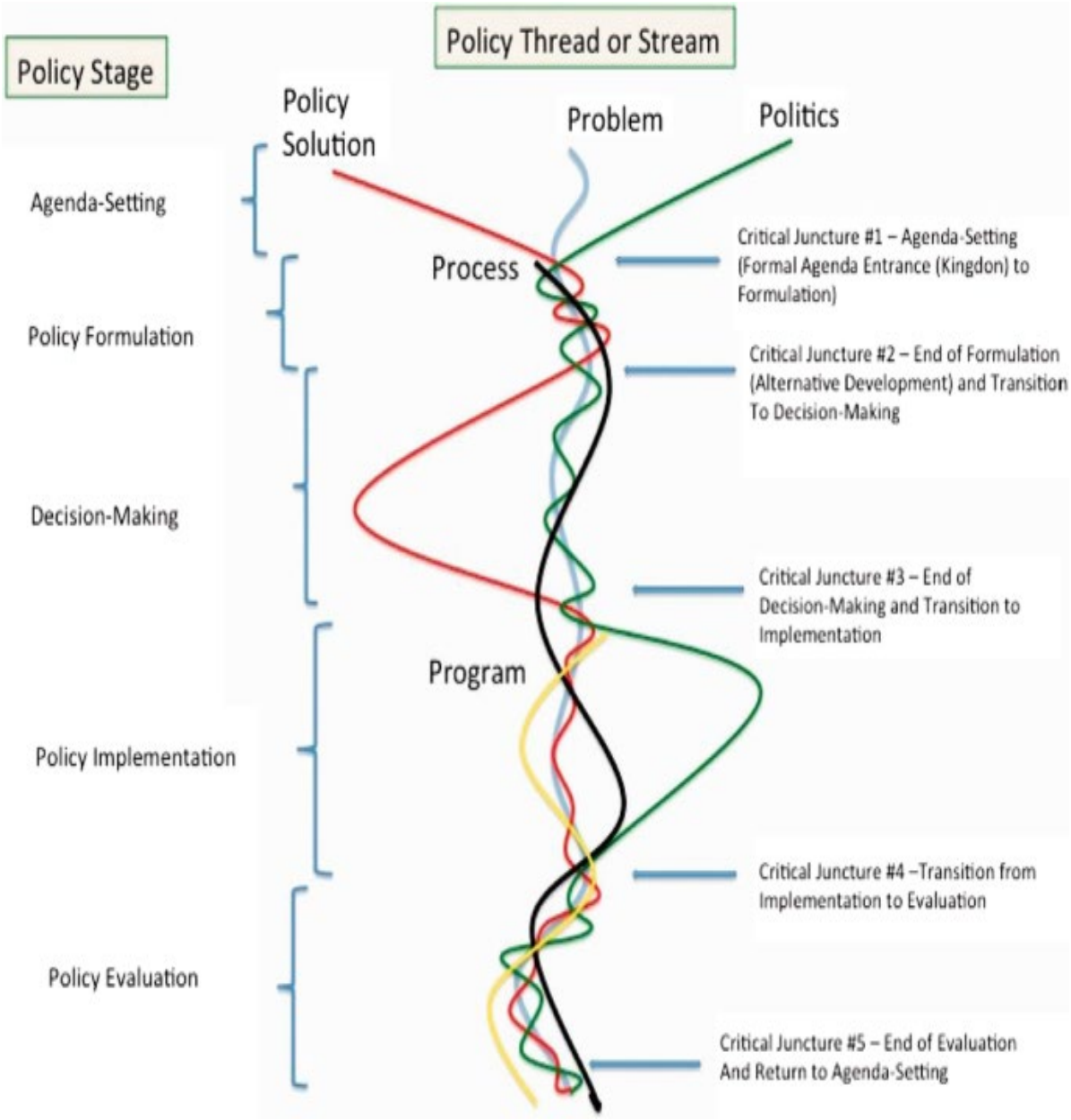


Figure 3-1 Howlett's multiple stream framework
Source: (Howlett, 2019)

3.5.3.4 Data collection

The first stage of the data collection and analysis process was to identify, source and analyse all the relevant documents with respect to Irish oral health policy as defined by the case study. This was followed by conducting in-depth, semi-structured interviews with 'elite' participants (Van Audenhove and Donders, 2019), who were considered experts across the oral health policy landscape in Ireland during the study period.

3.5.3.4.1 Documentary analysis

Documentary analysis is 'one of the most commonly used and powerful methods in health policy research' (Dalglish *et al.*, 2020). Documents have been broadly defined as 'physical or virtual artefacts designed by creators, for users to function within a particular setting' (Prior, 2002). However, they are not simply standalone objects of study but should be considered within the 'social web of meaning' within which they are produced (Dalglish *et al.*, 2020).

A range of documents including those within organisations and institutions have been considered a 'staple' of qualitative research and within policy analysis (Walt *et al.*, 2008; Bowen, 2009). They include peer reviewed and academic literature, strategies and plans, surveys and reports and grey literature including media publications (Bowen, 2009). Within health policy, research documents can be used in the data collection and analysis process to:

1. review existing policy problems (Etiaba *et al.*, 2015);
2. examine the implementation of policies in real-life settings; and
3. analyse policy processes and to inform new policies (Dalglish *et al.*, 2020).

Documents in this research

The documents analysed in this thesis were identified by:

1. Searching a variety of sources for documents pertaining to oral health policy including:
    a. Government websites particularly the website of the Department of Health, for policies, reports, and guidelines;
    b. The Lenus database, the Health Research Repository of the Irish health service (Health Service Executive Library, 2024); database, the Health Research Repository of the Irish health service (Health Service Executive Library, 2024);

c. Records of parliamentary debates, governmental committee meetings; and parliamentary questions on the 'Oireachtas' website (Houses of the Oireachtas, 2024a).

2. Contacting health service managers and administrators.

3. Accessing the additional information, documents and appendices found in bibliographies of secured documents.

The key words searched for were dental/oral health policy, with a scoping search of peer reviewed journal articles on oral health policy in Ireland also included.

Further documents were sourced through 'snowball' sampling which 'identifies cases of interest from people (or documents) who know people (or refer to documents) who know what cases are 'information rich' (Marshall and Rossman, 2014).

A deficiency of snowball sampling is the tendency to direct data collection toward documents of a supportive or similar position. However, for this study as the case under consideration is clearly defined (i.e. Irish national oral health policy) and the number of official government documents is limited, this is an appropriate means of sourcing other relevant documents. Two documents published outside the bounded time frame (Department of Health-Irish Dental Association-Health Board Working Party, 1979; Department of Health, 1988), prior to 1994 were included in the dataset as their contents were deemed critical to the analysis of the 'Dental Health Action Plan' of 1994.

Finally, documents which were unavailable in the public domain were directly sourced via interview participants and included an unpublished draft national oral health policy document.

A total of 125 documents were identified, reviewed, and mapped over a 27-year timeline. The documents analysed included health policy documents (n = 14), commissioned reports (n = 18) and health service documents (n = 19). A detailed overview of the dataset including the quantity and nature of included documents is presented in Table 3-1.

Table 3-1 An overview of documents incorporated in analysis

Document type	Number *(n)*
Policy documents[1]	14
Commissioned reports[2]	18
Health strategies[3]	9
Health service documents[4]	19
Non-governmental reports/strategies[5]	7
Legislation[6]	5
Reports of epidemiological surveys[7]	7
Parliamentary papers[8]	
Parliamentary questions	33
Presentations to parliamentary committees	4
Clinical guidelines[9]	4
Academic and grey literature[10]	5
Total	***n=125***

Notes:
1 **Policy document**: any publication with stated governmental policy positions including general and oral health policies, published and unpublished, along with associated policy frameworks, implementation, and action plans.
2 **Commissioned report**: any document commissioned by government including reports from external bodies and institutions along with inter departmental requests.
3 **Health strategy**: any document detailing steps and strategic intent by government, but not as actual government policy, for example health department statements of strategy.
4 **Health service documents**: any document outlining specific health and social service delivery, objectives, resources, actions, and outputs, primarily including HSE National Service plans.
5 **Non-governmental reports/strategies**: any relevant report/strategy published by a non-government affiliated organisation.
6 **Legislation:** relevant legal acts and regulations.
7 **Parliamentary question**: any relevant question raised by a member of parliament provided with an oral or written response.
8 **Presentation to parliamentary committee**: any evidence verbal or written presented to relevant governmental committees.
9 **Clinical guidelines**: a series of evidence-based guidelines for those planning and providing dental services for children in Ireland.
10 **Academic and grey literature**: relevant academic and grey literature used to enhance contextual nuance of included documents.

3.5.3.5 Analysis

Document analysis methods have been previously defined by Bowen (2009) as: 'finding, selecting, appraising (making sense of), and synthesising data contained in documents. Document analysis yields data – excerpts, quotations, or entire passages – that are then organised into major themes, categories, and case examples specifically through 'content analysis'. He further specified the steps required: 'skimming (superficial examination), reading (thorough examination), and interpretation. This iterative process combines elements of content analysis and thematic analysis. Content analysis is the process of organising information into categories related to the central questions of the research' (Bowen, 2009).

Coding

Qualitative data analysis software (NVivo 12) was used and followed a directed content analysis approach guided by the structured framework and incorporated deductive category application (Hsieh and Shannon, 2005). Initially, the contents of each document were mapped onto an MS Excel spreadsheet using a range of column headings. These headings included title, author, year, document type, source/location, political landscape, and document content. A range of key concepts were then identified as coding categories using the Multiple Stream Framework (Figure 3-1) as guidance, before operational definitions for each category were determined, and other themes or categories emerged. This was an emergent process that was refined as the data collection continued.

3.5.3.6 Triangulation

The limitations of using documents include: an absence of sufficient detail to satisfy a research question, difficulty in accessing important documents and 'biased selectivity' particularly within organisations where policies or documents continue to align with the agenda of that particular institution (Yin, 1994; Bowen, 2009). To counteract potential flaws and provide contextual, deeper insights, documents are considered particularly useful to combine with other qualitative methods by way of triangulation (Yin, 1994).

Triangulation has been defined as 'the combination of methodologies in the study of the same phenomenon' (Jick, 1979). In practice, it is where a researcher draws on at least two sources of evidence to corroborate findings and reduce potential biases that could exist (Yin, 1994;

Bowen, 2009). Potential data sources that work well in combination with documents have been suggested including interviews, participant observations and artifacts (Yin, 1994).

The use of semi-structured, in-depth interviews is said to 'greatly enrich' documents in health policy research (Dalglish *et al.*, 2020). However, to satisfy the aim of this research, those interviews required recruitment of individuals with high-level knowledge of, or insights with respect to policy decisions. In policy and health systems research such participants are referred to as 'elites' (Van Audenhove and Donders, 2019).

In both PhD Studies One and Two, in-depth interviews with powerful actors across the oral health systems and policies landscapes in Ireland (Study One), and across the six representative European countries, i.e. Ireland, Denmark, Germany, Hungary, Scotland and Spain (Study Two), were triangulated with the outcomes of analysis of multiple different documentary sources. The use of triangulation in this manner was a key strategy to enhance the validity and reliability of the research findings by cross-referencing data from multiple sources guided by two different analytical frameworks (Bowen, 2009).

An overview of the methods adopted pertaining to triangulation procedures which increased robustness across studies one and two is outlined below and in Table 3-2

3.5.3.6.1.1 Documentary analysis

Multiple document types were identified and analysed using documentary analysis methods across both studies (Bowen, 2009). The broad categories of documents included academic literature (peer reviewed research), health policies (e.g. oral and general health policies), health strategies, health services reports (e.g. commissioned reports, national health systems plans), governmental reports, parliamentary reports and questions, clinical guidelines and grey literature (e.g. media reports, public discourse, NGO reports)

The documentary analysis methods (Bowen, 2009), undertaken included an initial thematic analysis with coding guided by the Multiple Stream Framework (Howlett, 2019) (Study One) and the WHO Universal Coverage Cube (Study Two) (McAuliffe *et al.,* 2022, 2025). Triangulation of different sources of documents subsequently yielded insights by cross referencing to identify patterns of similarities and differences that emerged.

For example, triangulated sources included oral health policies, general health policy documents and commissioned reports (Department of Health, 1994a; Department of Health and Children, 2001a; PA Consulting Group, 2010; Houses of the Oireachtas, 2017). The purpose of this triangulation was to identify how oral health was featured and accounted for within general health policies and subsequently operationalised within the health system. This enabled deeper insights to be garnered regarding the priority of oral health and its integration within broader systems and policies.

A second example within the documents includes the triangulation of health service reports, health policies and parliamentary documents to compare service provision, policy objectives and political drivers (Department of Health, 1994a; Oral Care Consulting, 2009; Houses of the Oireachtas, 2021b). Triangulation in this manner can unveil discrepancies between policy intent and implementation, illustrating how different agendas hinder or support progress (Bowen, 2009; Howlett, 2019).

3.5.3.6.1.2 Semi-structured interview data triangulated with all sources of documents

'Elite' interviews were then conducted with powerful, informed actors who had unique perspectives and critical insights of specific oral health systems and policies (Van Audenhove and Donders, 2019). The broad aim of this component of the research was to validate and to fill any 'gaps' in documentary evidence and to explore the why of complex policy and systems processes. These factors were critical to Study Two for example which was conducted across six different countries and included documents in four different languages, with triangulation ensuring robustness (McAuliffe *et al.,* 2025).

Furthermore, the 'elites' provide unique knowledge which could not be secured from documents alone including perspectives on policy development processes, complex dynamics between differing stakeholder groups and events and actions influencing policy implementation and system reform (Mikecz, 2012).

3.5.3.6.1.3 Data analysis

Triangulating the data from all sources of documents with the elite interview data ensured that the findings generated were not purely academic or theoretical, it added depth to the narratives and confirmed or contested the overall findings. Sections 3.5.3 and 3.6.3 describe data analysis for both Studies One and Two, detailing how the insights of the documents are

compared and combined with the outcomes of the interviews identifying corroboration, contractions and overall patterns. In the 'Results' sections of both studies (Chapters 4, section 4.4 and Chapter 5, section 5.4), interview quotes are presented in line with explicit excerpts from the documentary analysis (McAuliffe *et al.,* 2022, 2025).

3.5.3.6.1.4 Conflicting data

In the event of conflicting accounts, for example when a policy documents stated intent was contradicted by an 'elite' participants account of its implementation in the real-world context, the following considerations were undertaken:

1. Is there further corroborating evidence available for example, a health system report that supports or refutes the policy by way of funding allocation, a parliamentary paper that identifies political intent or a comment from a second 'elite' that confirmed either the document or initial quote.
2. What is the interviewees positionality, and that of their institution and what was the risk of potential bias.
3. Equally what institution or author published the policy/document and critique of its content in view of the broader literature.

In all cases ensure efforts are made to report findings transparently, acknowledge and highlight discrepancies and present a balanced overview.

Table 3-2 Triangulation in this PhD Thesis

Data source	Purpose	Triangulation role	Knowledge
Academic literature	Peer-reviewed/empirical data on oral health, coverage and oral health systems globally	Compared with general and oral health policies, systems and grey literature before overall comparison with interview data	Facilitated peer-reviewed evidence base, global comparisons and situation of policy/interview data within the academic sphere.
Health policy literature	National and regional, oral and general health policies	Compared policy intent with other documents and elite interview data most especially pertaining to implementation	Overall holistic interpretation of the factors influencing oral health policy development and implementation generated
Health Systems literature	Analysis of broader health system structures affecting oral health.	Cross-checked with policies, parliamentary papers, grey literature and interview data	Identified system-level and operational facilitators and barriers (e.g. budget allocation and service plans)
Grey literature including parliamentary questions, media other non-governmental)	Political and public influences in oral health systems and policies	Findings validated against service and policy literature to highlight gaps or discrepancies	Illuminated contextual influences shaping policy implementation and system reform
Semi-Structured 'Elite' Interviews	Expert perspectives on policy development/ implementation, oral health coverage, system design along with various challenges and unintended effects.	Verified or challenged findings from documentary analysis, filling gaps and adding depth and contextual nuance.	Provided insights into political influences, why certain decisions were made or not, dynamics between stakeholders, real-world service delivery issues, and informal decision-making.

3.5.3.7 Semi-structured, in-depth interviews with 'Elites'

'Elite' participants are those who have a particular professional expertise or a close proximity to powerful roles within a system or process (Morris, 2009). Within health systems and policy research they are beneficial for verifying information, for providing access to narratives about events and sharing institutional knowledge that would be otherwise unavailable (Mikecz, 2012).

In-depth interviews are most effectively used where 'expert' opinions are of great interest and 'rich picture' is sought (Clark *et al.*, 2021; Coleman, 2022). While the semi-structured interview format serves as a 'flexible research tool' enabling probing, follow-up questioning and elaboration to fully support knowledge generation. This semi-structured style of interviewing therefore allows the researcher to address the overall research objectives however also permits 'elites' to discuss information which might not have been anticipated but nonetheless relevant to research questions (Rabionet, 2011).

Sampling technique

Purposive sampling is widely used in qualitative research for 'the identification and selection of information-rich cases' relating to the phenomenon of interest (Patton, 1990). In recruiting participants, it involves identifying and selecting individuals especially knowledgeable about, or experienced in, a particular area. Previous research directs that there must be a rationale for choosing study participants that is directly linked to the aim of the study and should encompass: why those individuals should be recruited and what qualifies them to address the aim of the research in question? (Palinkas *et al.*, 2015).

In the context of this PhD study, the initial outcomes from the documentary analysis enabled the categorisation of key stakeholder groups across the oral health policy landscape in Ireland namely: the Health Service Executive (HSE), private dental practitioners, academics, and policymakers including the Department of Health (DoH). As such the criteria for selecting elite informants were those individuals:

- Affiliated with or employed currently or formerly across the four stakeholder groups (i.e. HSE/Academia/Private practitioners or Department of Health);
- In a position of seniority or power within those institutions;

- Experienced in or having knowledge of oral health policy initiatives during the study period.

An overview of the categories of elites who participated in the study is detailed below.

This sampling method was further supplemented by snowball sampling where 'one interviewee gives the researcher the name of at least one more potential interviewee' (Bhattacherjee, 2012). Snowball sampling is most effective when members of the population of interest are not easily accessible including those in positions of power. As such this method is an effective means of conducting more thorough research by way of ensuring careful selection of study participants (Naderifar *et al.*, 2017). This iterative approach also satisfied the qualitative paradigm of reflective reviewing, whereby the list of participants was continually reviewed to ensure an appropriate sample was recruited.

Participants

Sample size determinants prior to data collection are not well aligned with an underlying qualitative methodology (Malterud *et al.*, 2016). However, within the literature a range of between 10 and 20 participants is recommended for conducting studies that are a component of a larger research project (Braun and Clarke, 2013). In all, fifteen participants (*n = 15*) were invited to interview, with thirteen (*n = 13*) consenting.

The sample consisted of:

- HSE (*n = 4*)
- Private dentists (*n = 2*)
- Academics (*n = 5*)
- Policy makers (*n = 2*)

Most respondents (*n = 11/13*) were dentists with additional post-graduate training in dental public health. Each of the those from the health system were in a position of management or leadership within the Irish Health Service Executive (HSE) organisation. Those interviewed who represented the 'academic' category were all employed as senior academics at university level working in dental public health and/or were engaged in oral health policy initiatives. The participants representing private practitioners also had direct knowledge of policy activities

during the study period. While those representing the Department of Health had worked at a high level within the institution, again with experience in oral health policy.

Recruitment

Potential participants identified as satisfying the inclusion criteria were initially contacted by the researcher using publicly available contact email addresses. During this introductory correspondence an overview of the proposed study was provided with assurances that should the participant express an interest in engaging with the research more extensive information would be provided. In those instances, a pack containing an invitation letter outlining the overall study (Appendix B), a participant information leaflet (Appendix C) and a blank consent form were provided (Appendix D). Recipients were asked to read the study materials and if they remained agreeable to participating, to return their signed consent form to the lead researcher.

Participants were guaranteed anonymity in agreeing to be interviewed, whereby their identities were known only to the research team, in line with the ethical permissions granted for this study.

Anonymity and absolute confidentiality in the context of qualitative research is complex particularly in highly sensitive, politicised environments (Saunders *et al.*, 2015; Lancaster, 2017). As previously mentioned, 'snowball sampling' was used in the identification and recruitment of some participants, due to the narrow landscape of oral health policy in Ireland the sampling frame was specialised and small. To maintain confidentiality and anonymity, the researcher consciously had vague responses to any questions or assumptions about the other participants potential or current involvement in the study.

Context-sensitive strategies are recommended to preserve the richness of the data while also protecting the participants (Saunders *et al.*, 2015). When choosing techniques to anonymise data it is recommended that 'identifying information that is not relevant from the perspective of theory and research questions should be excluded when describing the participants' (Vainio, 2013).

These practices were implemented in this research including anonymising data pertaining to identifiable features including individuals' names, places, cultural backgrounds, family

relationships and any other potentially identifiable information. This maintained an especially high priority when disseminating the findings from this research and no identifiable information was included in public records such as journal publication or presentations.

Data collection

Participants who agreed to take part were contacted and were invited to participate at a time and date that would be most convenient for them. In accordance with COVID-19 related public health guidelines all but one of the interviews (n=12) was conducted via tele-conferencing facilities (Microsoft Teams) between October 2020 and March 2021.

While the use of technological platforms were a necessary intervention due to advent of the pandemic, there are both methodological and ethical challenges associated with their use (Carter *et al.*, 2021). Issues requiring prior consideration include participant privacy, building a rapport and managing data. Interviewees in this study were contacted in advance to ensure they had access to and were familiar with Microsoft Teams.

An interview guide informed by the documentary analysis and guided by the 'multiple stream framework' was developed and following 'piloting' with one of the participants, was further refined (Appendix E). International evidence cites the risk of researchers posing questions that are too leading causing bias because of an overly specific interview protocol (Jiménez and Orozco, 2021). Instead, it is recommended that questions should be open-ended, that appropriate 'probes' are used and that questions should be 'flexible and allow for natural adaptation and extension with each respondent' (Weiss, 1995).

As such, in this PhD study a short interview guide was designed to stimulate discussion in relation to the research objectives, but it sought to retain flexibility. Open-ended questions were used for example: 'what influenced the policy making?' and 'why?'. While pauses in the conversation were not rushed and probes were used to query about documented events or claims made by 'other' unnamed interviewees (Marshall and Rossman, 2014) (Appendices E and K).

A key consideration during such interviews is the relationship between the 'elite' and the researcher. As described by Ostrander (1993), elites are 'used to being in charge and they are used to having others defer to them'. Additionally, this data collection was undertaken during

an environment of active policy discussion whereby oral health policy was of topical interest both in professional and public circles. In some instances, there were efforts to deviate from the discussion at hand. On those occasions, the PhD candidate gave some latitude to the participant before using the semi-structured interview protocol or prompts to guide the interview back to the answering the research questions (Stephens, 2007).

Most of the interviews lasted between 45 minutes to one hour, with two interviews lasting two hours. One interviewee requested a follow-up interview be recorded once they had sourced a document of interest, they believed to be pertinent to the interview and research aim. Each interview was audio-recorded before being transcribed verbatim using Otter.ai software. The transcripts generated from Otter.ai were reviewed in line with the audio, refined for accuracy and imported into NVivo12 database for management and organisation during data analysis.

3.5.3.8 Analysis of interviews and documents

As mentioned, a central methodological requirement of this study was the use of multiple data sources to build a comprehensive picture by way of triangulation (Adami and Kiger, 2005). Both the documentary analysis and analysis of interview data followed a directed content analysis approach (Hsieh and Shannon, 2005), guided by the Multiple Streams Framework, and employed a deductive category application (Howlett, 2019).

The 'basic coding process' in content analysis is to 'organise large quantities of text into fewer content categories' (Hsieh and Shannon, 2005). Categories are considered patterns of themes that are expressed directly in the text or through analysis. In a directed content analysis, a researcher uses existing framework to develop the initial coding scheme, and as the analysis proceeds the initial scheme is revised and refined (Hsieh and Shannon, 2005). In this study, the coding scheme was developed by the PhD candidate in discussion with the broad research team (HW, MH, SB), all of whom have extensive policy analysis or dental research experience.

Once transcription and review were completed the interview data were also managed in Nvivo12 and the following steps were taken:

1. Each interviewee was classified in accordance with their original participant category (i.e. HSE, DoH, academic or private practitioner);

2. Each interview was then coded in accordance with the pre-determined categories based on the five streams (i.e. problem, policy, politics, process, and programme stream);
3. Interview data was then merged with data from the documentary analysis under the same headings;
4. 'Sub-coding' of each stream was then conducted whereby additional codes for each stream were further broken-down;
5. Finally, codes were merged or distilled with other aligned themes.

Throughout the data analysis process, the findings from interviews were continually triangulated with the outcomes from the documentary analysis following best practice for policy analysis. This process continued until it was agreed there was sufficient 'information power' generated and no further data collection or analysis would yield evidence of value (Malterud *et al.*, 2016).

The data generated from the documentary analyses provided an adequate description of the technical content of key policies and literature (Bowen, 2009). While elite interviews were used to elaborate on the documents' findings in a more in-depth manner particularly to understand why specific policy choices were made or not made (Van Audenhove and Donders, 2019).

3.6 Study Two: Inter-country comparative analysis

3.6.1 PhD objective addressed in Study Two

While Study One generated in-depth findings with respect to oral health policy in the Irish context, to achieve the overall aim of the PhD which is to inform children's oral healthcare reform, learnings from effective oral health systems and reforms internationally were sought. Recent comparative oral health research found there is 'little known about the large variations between countries in terms of financing, access, coverage and delivery of oral healthcare' (Winkelmann *et al.*, 2022).

Thus, the PhD objective addressed in Study Two was, to provide a detailed description and mapping of publicly-funded oral health coverage for children across six European countries, and to report on that coverage in line with the World Health Organisation Coverage Cube (World Health Organisation, 2008) Figure 3-2.

To satisfy this objective, study two sought to:

1. describe and compare the child populations eligible for publicly funded dental care across representative European countries;
2. detail what oral health prevention and promotion programmes for children are in place across the different countries;
3. determine what proportion of oral healthcare is publicly financed and under what model of financing;
4. assess previous or planned child oral health system reforms.

3.6.2 Approach to Study Two

3.6.2.1 Inter-country comparative approach

This research set out to perform an inter-country comparison of publicly funded oral health systems for children. Inter-country comparative research has been defined as: 'an approach to knowing social reality through the examination for similarities and differences between data gathered from more than one [country]' (Elder, 1976).

Inter-country comparative research is 'a distinct method…which explicitly examines the differences and similarities between national sub systems and policies' (Cacace *et al.*, 2013).

Marmor (2012) outlined three purposes for engaging in inter-country research on health systems and policies:

1. Gaining insights into the structure and policies of national healthcare systems;
2. Understanding the rationale behind their configuration;
3. Deriving lessons from the experiences and practices of other countries.

Well conducted inter-country comparisons can provide a rich source of evidence and 'exert a powerful influence' on policymakers (Cacace *et al.*, 2013). There is increasing recognition from decision-makers that without measurement and comparison it is difficult to determine 'who or what works', to design health system reforms, to protect patients or to make a case for investing in healthcare (Papanicolas and Smith, 2013).

Health systems can be compared across a variety of domains including population health, health service outcomes, and equity (Papanicolas and Smith, 2013). On a large-scale comparisons are frequently conducted by institutions including the European Observatory on Health Systems and Policies (Kuszewski *et al.*, 2005) and the Organisation for Economic Cooperation and Development (OECD) (Häkkinen and Vohlonen, 1994). While recent academic literature (Allin *et al.*, 2020) and the first ever 'Health Systems in Transition' report (Winkelmann *et al.*, 2022), have illustrated the benefits of this approach within the context of oral health systems and policies research.

However, caution with respect to both the conduct and interpretation of comparative research is readily highlighted in the literature (Nolte and McKee, 2005; Marmor, 2012; Papanicolas and Smith, 2013; Cacace *et al.*, 2013). It is observed that comparisons can be problematic with a lack of appropriate theory guiding the identification of data, justification for country selection and analytical approach often identified as common shortcomings (Nolte and McKee, 2005).

Cacace et al., (2013) have proposed a range of criteria to strengthen the quality of inter-country comparative studies including: 1. appropriate use of theory; 2. explicit selection of

comparator countries; 3. rigor of design and methods; 4. attention to complexity and; 5. contribution to knowledge.

This PhD research adhered to each of these quality criteria.

3.6.2.2 Multiple case study methodology

Inter-country comparisons 'benefit greatly' from methodological triangulation to strengthen the quality of studies (Cacace *et al.*, 2013). There are several ways of classifying inter-country studies, one of which is 'case-orientated' which aims to understand the dynamics of a small number of cases and largely utilises qualitative methods of enquiry (Cacace *et al.*, 2013). The strengths and challenges with respect to case study design have previously been discussed in section 3.5.2.

This research followed Yin's multiple case study methodology (Yin, 2014) requiring the researcher to gather data from various sources to comprehensively capture the complexity of each system. Multiple case study methodology is defined as 'a qualitative methodology which allows researchers to contrast between individual cases, represent a diversity of qualities and extremes to create depth and to understand a broad phenomenon without losing the individuality of the single cases' (Baxter and Jack, 2008). It is the intentional analysis of two or more complete single cases (Stake, 1995). Multiple case studies enable an understanding of data both within and across different systems with the evidence generated considered 'strong and reliable' (Yin, 2014).

Each country in this study was represented as single case with six case studies in total analysed. The rationale for country selection is justified below.

3.6.3 Study Two: methodology

3.6.3.1 Conceptual framework

The 'starting point' of most international comparisons is the creation or use of a conceptual framework both to provide 'clarity…and to draw meaningful comparisons' (Papanicolas and Smith, 2013).

The World Health Organisation Universal Health Coverage Cube (World Health Organisation, 2008) Figure 3-2, adapted to describe publicly funded oral healthcare (Allin *et al.*, 2020) was used to guide both data collection and analysis in Study Two. The three central elements of the WHO cube are: (i) Breath: the extent of population coverage; (ii) Depth: the share of costs publicly funded and (iii) Scope: the range of treatment/services provided. An overview of the rationale for this framework selection is provided in section 3.4.

3.6.3.2 Country selection and target population

To ensure high quality comparative research there must be an explicit justification of country selection (Cacace *et al.*, 2013). This study sought to compare publicly funded oral healthcare coverage for children across different European countries to inform system reform in Ireland and generate transferable lessons.

A typological approach was used, drawing on Widström and Eaton's (2004) classification of European oral health systems. Six system models were identified: Nordic, Beveridgian, Bismarckian, Hybrid, Southern European, and Eastern European (see chapter 2, table 2.1) (Widström and Eaton, 2004). Countries were selected to represent these six system types, which vary in their financing arrangements, degree of public coverage, delivery structures, and reliance on private providers. In view of the overall PhD research question, the following criteria guided selection:

- Representation of one of the six European oral health system models;
- Evidence of effective oral health promotion and prevention regimes for children as evidenced by low d_3mft/D_3MFT (Broadbent and Thomson, 2005) and percentage with no obvious caries at age 12-years or ICDAS 0-3 (Pitts and Stamm, 2004)
- History of or planned oral health system reform;

- Relevance to Irish system reform (e.g. demographic comparability, structural alignment, or policy relevance);
- Access to local experts to support documentary analysis and elite interviews.

The study focused specifically on publicly funded oral healthcare for children (defined in most countries as under 18). The analysis did not extend to coverage for other vulnerable populations such as children with special healthcare needs. The six countries selected were: Ireland, Denmark, Germany, Hungary, Scotland, and Spain and justification for their inclusion is outlined below.

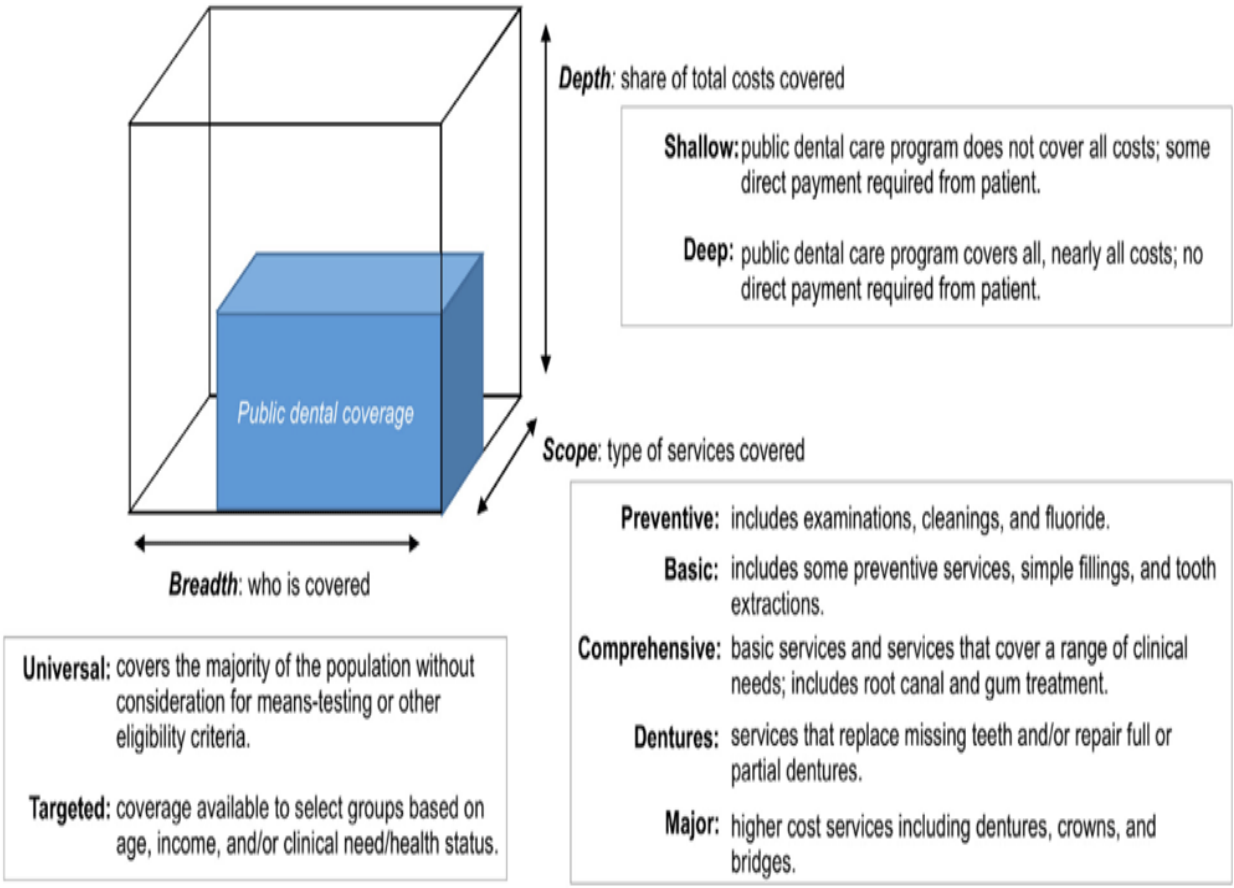


Figure 3-2 Dimensions of coverage for public oral healthcare models based on the World Health Organisation Coverage cube framework

Source: (Allin, 2020)

Ireland (Hybrid system)

Ireland was the core reference country, given the overarching aim of this PhD: to advise on oral healthcare reform for children in Ireland. Despite economic prosperity, Ireland lacks universal coverage for children's oral health, and its oral healthcare system is characterised by high out-of-pocket spending, a fragmented structure, and limited access for certain population groups (Johnston *et al.*, 2020). Ireland also represents a hybrid model of oral healthcare that draws from both public and private provision, making it distinct from most European comparators (Woods *et al.*, 2017).

Denmark (Nordic system)

Denmark was included as a representative of the Nordic model (Widström and Eaton, 2004). Oral healthcare for children is delivered through a publicly funded salaried dental service, aligning in structure with Ireland's Public Dental Service (PDS), but with broader and deeper coverage (Patel, 2012). Denmark also shares demographic similarities with Ireland (population size, education levels), and has consistently high access rates and positive child oral health outcomes, offering a meaningful point of comparison for reform (Kravitz *et al.*, 2015; Winkelmann *et al.*, 2022). Its system exemplifies the universal, prevention-focused approach associated with social democratic regimes (Esping-Andersen, 1990).

Scotland (Beveridgian system)

Scotland was selected to represent the Beveridgian model of healthcare, which is unique to the United Kingdom, where the entire population is eligible to obtain treatment through the tax-financed National Health Service (NHS). In 2006, the NHS dental payment system underwent reform in England, Wales, and Northern Ireland; however, it remained unchanged in Scotland. At the time of writing, oral healthcare treatment including orthodontics is provided free of charge to all patients under the age of 18 years (Sinclair *et al.*, 2019). Scotland also shares a similar population size and geographic profile with Ireland and is frequently used as a comparator in Irish health policy research. Its national Childsmile programme exemplifies a prevention-focused, integrated approach to child oral health, offering important insights for the advancement of universal oral health coverage (Macpherson *et al.*, 2015).

Germany (Bismarckian system)

Germany was included to represent the Bismarckian model of social health insurance (SHI),

where nearly all children are covered for oral healthcare via statutory health insurance (Ziller *et al.*, 2015). With 99% of dentists holding SHI contracts and strong utilisation rates, Germany exemplifies a high-performing conservative model (Ziller *et al.*, 2015). Its inclusion enabled comparison with systems where funding and access are structured through Social Health Insurance (SHI), offering contrast to both tax-based and hybrid systems (Winkelmann *et al.*, 2022).

Hungary (Eastern European system)

Hungary was selected to represent the Eastern European model of healthcare (Widström and Eaton, 2004). Historically, Hungary operated a system of free universal oral healthcare under state socialism. However, following economic transition and health system reform in the 1990s, the delivery and financing of oral healthcare have increasingly shifted toward the private sector (Widström and Eaton, 2004). Hungary's inclusion offers valuable insight into the legacies of system transition and the complexities of maintaining universal entitlements in practice (Gaál *et al.*, 2011).

Spain (Southern European system)

Spain was selected to represent the Southern European model (Widström and Eaton, 2004). Despite having a universal general healthcare system, coverage for children's oral health is both regionally fragmented and age-restricted, leading to significant variability in access and entitlements across its seventeen autonomous communities (Bravo *et al.*, 2015). Spain's inclusion enables examination of decentralised governance in oral health provision and also offers a useful comparator for Ireland in terms of the impact of the global economic crisis on public healthcare systems and subsequent austerity-related policy responses (Bravo *et al.*, 2015a).

3.6.3.3 Data collection

As previously mentioned, methodological triangulation is recommended as a key procedure to increase the strength of inter-country comparative research (Cacace *et al.*, 2013). Two strands of data collection were therefore undertaken in this study: (i) a documentary analysis (Bowen, 2009)– which sought to provide a detailed description of each coverage dimension as prescribed by the *Cube,* and (ii) semi-structured, in-depth interviews with elite participants (Van Audenhove and Donders, 2019) – which sought to verify and add depth to data sourced

from the documents and add country specific context. Both documents and interviews are regarded as examples of optimal data for comparative research (Cacace et al., 2013), with 'contextual description and understanding a basic condition for all successful cross-country comparison' (Landman, 2002).

An overview of both documentary analysis and elite interviewing methodologies was provided in Section 3.5.3.

3.6.3.4 Data collection template

Prior to commencing data collection, a 'data collection template' (Appendix F) previously developed by a research team investigating oral health coverage for older adults (Allin *et al.*, 2020) was accessed through the lead author on this study. This template was based on the criteria of the cube and was used to collect data on oral health for adults over the age of 65-years across eight different jurisdictions in Europe, Canada, the United States of America, and Australia. The template required in-depth information to be collated across a range of sectors pertaining to the oral health system including relevant laws, regulations, organisational structures, personnel and the three core features of The Cube: the breath, depth, and scope of oral healthcare coverage.

Permissions were granted from the international research team for the template to be adapted to the child population for use in this research.

3.6.3.5 Documents

Information sources:

The documents in this research were identified in the following ways:

1. A literature search of online databases including Medline (EBSCO), CINAHL (EBSCO), web of science (WoS) and google scholar. A search strategy (Appendix G) was developed with the assistance of a specialist medical librarian with the aim of identifying the relevant peer reviewed literature.
2. Searching publicly available sources including: (i) Government websites, particularly Ministries of Health and legislative databases, (ii) individual country health service platforms (iii) oral health professional associations and (iv) international organisations.

Documents reviewed included relevant publications by the European Observatory for Health Systems and Policies, the Council of European Dentists and the WHO, national government policies and strategies, clinical guidelines, and health service reports.

3. Documents provided by interview participants.

3.6.3.6 Sampling

Sampling methods in data collection 'must be consistent with the aims and assumptions inherent to the underlying research method' and 'qualitative methods are intended to achieve depth of understanding' (Morse, 2016).

As the aim of this research was to yield a thorough analysis and comparison of oral health coverage, purposively identifying documents prepared or published by institutions local to each country was necessary. Furthermore, due to the number of countries included in this analysis the majority of which do not have English has the native language, 'snowball' sampling (Naderifar *et al.*, 2017) to identify documents directly from respondents was of high importance to ensure no relevant documents were missed. Therefore, a combination of purposive and snowball sampling was an appropriate.

3.6.3.7 Translation

The countries included in this research who do not cite English as a national language were Denmark, Germany, Hungary, and Spain. National oral health policies along with other health services literature are generally published in a countries' native language. They are also the documents which can provide the most comprehensive detail around coverage considerations such as eligible populations and types of publicly funded treatments at a granular level. Additionally, such documents are not typically identified via peer reviewed literature searches.

This required careful methodological planning from the outset due to the additional time needed to source and translate such documents. Google translate was initially used to identify key words such as 'oral/dental health', 'dental care', 'dental system' and 'health ministry'.

Local 'elites' were also contacted and requested to provide any documents in their opinion that were critical to building an accurate description of their national oral healthcare system. The documents identified from both sources, if in a native language, were subsequently uploaded to google translate as a PDF and machine translated to English.

Google Translate is considered 'accurate in translating procedure and narrative text' with an accuracy rate of 79.57% and 86% respectively (Saputra, 2022). According to the 'Agency for Healthcare Research and Quality' in the United States, in the context of medical research the use of google translate is feasible, with care required in the extraction of results data for analyses such as systematic reviews (Balk *et al.*, 2013). To minimise the risk of incorporating errors in study data in this analysis, two local experts from each country were asked to verify the accuracy and interpretation of information obtained by the author for this study.

3.6.3.8 Documentary analysis

Documents were analysed using documentary analysis techniques. As mentioned, this analytic procedure aims to 'find, select appraise and synthesise' data contained in documents. The type of data generated are 'excerpts, quotations or entire passages' which are then organised into major themes through content analysis (Bowen, 2009). In this instance the content analysis was 'directed' by the *WHO Cube* (Hsieh and Shannon, 2005) and guided using the predetermined headings from the data collection template (Appendix F).

Documents were skimmed, then read in detail and relevant data captured in NVivo12. This data was then organised under the predetermined headings. This ultimately yielded a descriptive 'case' representing each individual country which was presented to two 'elites' in confidence in a word document for verification, prior to interview. The experts were asked to review the description of the oral health system provided and verify that it represented an accurate interpretation within the 'real world context'.

3.6.3.8.1 Semi-structured, in-depth interviews with 'Elites'

The rationale for conducting semi-structured interviews with 'elites' within this research has been previously discussed in section 3.4.3 pertaining to the insights and knowledge that can be provided such 'powerful actors' (Morris, 2009). In the context of Study Two, this rationale also held in terms of generating those insights, but with an added dimension of providing cultural context and verification of the findings from the documentary analysis

3.6.3.8.2 Sampling

To satisfy the above objective, purposive sampling was once again employed (Renjith *et al.*, 2021) and the following criteria were set:

- Two ‘elites’ (*n=2*) local to each of the six countries (*n=12*);
- Considered a ‘dental public health expert’ or a current or a former Chief Dental Officer;
- Along with two ‘elites’ (*n=2*) operating at the same professional level but not affiliated with any individual country to provide a ‘neutral’ overview of children’s oral healthcare.

In this research a ‘dental public health expert’ was defined as an individual at a senior position in an academic or health service setting, with additional post graduate training in dental public health. A ‘Chief Dental Officer’ was the senior civil servant providing oral health advice to a Health Ministry. Those individuals were identified via the documentary analysis often by way of acting as the leading author in national policy or service documents, they were sourced via public information or via ‘snowball’ sampling based on the recommendation of other participants or PhD supervisory team.

It is argued in the literature that ‘a priori’ estimation of sample sizes in qualitative research are incompatible with the conceptual and methodological notions underpinning it (Sim *et al.*, 2018). This is because the sample size included is often adaptive and emergent determined by data ‘saturation’ (Braun and Clarke, 2013). However, there is also a recognition that based on the underlying research question there can be ‘a need to make a decision on the number of participants in a study by one means or another’.

In the case of Study Two, a sample size of a minimum of two experts from each country was chosen to add local knowledge and ensure there was a potential for alternative viewpoints. However, the overall sample size remained under continuous review and the principals of ensuring adequate ‘information power’ from the data were followed (Malterud *et al.*, 2016).

During the preparatory and literature scoping phase of Study Two, one of the leading European experts in dental public health with knowledge across many systems (by way of specialist training, publications and positions held), Professor Kenneth Eaton, was approached for methodological advice. He subsequently became a PhD co-supervisor. He was of particular importance in identifying and providing access to individuals in position of power across Europe which could have otherwise posed methodological challenges (Lewis, 2006).

3.6.3.8.3 Recruitment

Interviewees were contacted either by way of publicly available contact email addresses or via an introductory email from the PhD co-supervisor, where they were provided with a brief overview of the study and an indication of what was required with respect to their participation. Once in agreement, they were subsequently sent an application pack containing a letter of invitation, participant information leaflet and consent form (Appendices H-J). At that point the individual case study for their representative country was provided with a request made to review its contents and an interview was arranged.

In some cases, participants reviewed contents via 'track review' while from others provided notes within the documents and for some, queries and clarifications were provided during the semi-structured interview.

3.6.3.8.4 Participants

A total of sixteen 'elites' (*n=16*) were invited to partake and fourteen (*n=14*) consented.

The sample consisted of two (*n=2*) participants from each country (i.e. Denmark, Germany, Hungary, Ireland, Scotland, and Spain) along with two experts (*n=2*) from non-participatory countries with significant expertise in this area (Belgium and Northern Ireland).

The sample consisted of eight *(n=8)* dental public health experts, six of whom were at a senior position in academia (*n=6*) and two of whom were in a management or leadership position within the public dental system *(n=2).*

A total of six participants, (*n=6*) one representative from each participating country, was a current or former Chief Dental Officer.

3.6.3.8.5 Semi-structured elite interview data collection

Due to logistical purposes, all interviews were conducted via teleconferencing facilities (Microsoft Teams*)* between May and September 2023. Participants were contacted in advance to arrange a convenient time, to ensure they were comfortable with the technological platform and to conduct the interview in English. A brief semi-structured interview guide was developed guided by the core features of the *WHO Cube* and the data collection template (Appendix K).

According to DiCicco-Bloom and Crabtree (2006), semi-structured interviews are 'organised around a set of predetermined open-ended questions, with other questions emerging from the dialogue between interviewer and interviewee/s'. Therefore, although an interview guide can include several predetermined questions, it is still within the scope of the format to 'probe in order to dig deeper into the interviewee's responses thorough follow-up questions' (McGrath *et al.*, 2019).

This was of importance in this study as interviewees were firstly asked to comment on the case study provided, before describing their role in the oral health system and their opinion of it. Retaining a semi-structured format enabled the use of probes to delve deeper into responses which was necessary due to the likelihood of participants having well prepared answers in advance of the interview. Interviews continued until the lead researcher and members of the research team were satisfied with the 'information power' generated within the data and in agreement that conducting further interviews would not sufficiently alter or enhance study findings (Malterud *et al.*, 2016).

All interviews were audio-recorded and transcribed verbatim using Otter.ai software. The transcripts generated by Otter.ai were cross checked with the original recording to check for misinterpretation or error before the final transcript was uploaded to an NVivo 12 database to organise the data during analysis.

3.6.3.8.6 Combined documentary and interview analysis

Data analysis of interviews followed a directed content analysis approach guided by the WHO Cube and employed a 'deductive category application' (Hsieh and Shannon, 2005).

Key initial concepts were identified as coding categories based on the WHO Cube and parameters of the data collection template before the interview data was merged with data from the expert validated documentary analysis under the same headings. Both datasets were organised by each individual country. This was followed by sub-coding and merging of codes while all the time following the principals of data triangulation whereby the data from documents and interviews were analysed together. Cross case analysis was then conducted to identify patterns of similarities and differences across different countries before all emerging findings were discussed in structured meetings within the research team.

Interview data can be ambiguous and subjective (Pannucci and Wilkins, 2010) while the potential limitations of documentary analyses include an absence of detail and biased selectivity (Yin, 2014). The use of a systematic approach to the literature search, a 'thick' description of the data and methodological triangulation can guard against such limitations.

However, it is important to highlight the weaknesses that prevailed within the study data, particularly in terms of enabling comparability across countries. To ensure maximum transparency throughout the presentation of the results strenuous efforts are made to ensure references, sources, year of reporting and methods behind data are presented to the reader with clarity. The results (chapter 5) of this study were presented in line with the headings of the *WHO Cube* and presented individually for each country with comparisons drawn where appropriate.

3.7 Study Three: Narrative review

3.7.1 PhD objective addressed in Study Three

A key finding from Study Two was the importance of good oral health data in effective systems particularly supporting reform. The 'prevalence' of the main oral diseases and conditions has been highlighted by the World Health Organisation as a 'core indicator' to track and monitor progress toward UHC. While also identifying oral health workforce as an area of key concern to support the implementation of the WHO Global Oral Health Action Plan (World Health Organisation, 2024a).

In view of the above, the objective of Study Three was to: describe and compare two key oral health 'indicators' of child universal oral health coverage, (i) oral disease, specifically dental caries prevalence at age 12 years and (ii) oral health workforce, across the same European countries.

As the population of interest in this PhD thesis are children, the most common oral disease of childhood, dental caries was chosen as the oral disease of relevance.

Previous research with respect to 'indicators' of oral health has highlighted the absence of a consensus on the standards and methods for measuring, collecting, and reporting oral health data. As such the study sought to:

1. describe the differences in the measurement and reporting of dental caries data across representative European countries.
2. examine the composition and distribution of the oral health workforce specifically dentists, hygienists, and dental assistants— assessing differences in workforce size, gender distribution, age demographics, and an estimate of the proportion of dentists providing publicly funded care for children.
3. critically assess discrepancies in the reporting and comparability of workforce and dental caries data across international databases, highlighting inconsistencies in data availability, collection methodologies, and reporting standards.
4. identify the key challenges in interpreting child oral health indicators globally and advocate for improved standardisation and harmonisation of data collection.

3.7.2 Approach to Study Three

Narrative review

A narrative review of the literature was chosen as the appropriate methodology. Narrative reviews allow researchers to 'describe what is known on a topic while conducting a subjective examination and a critique of a body of literature' and they are considered particularly useful for 'exploring topics that are under-researched' (Greenhalgh, 2018). The dearth of literature on oral healthcare measurement and the requirement to adopt a critical analysis of the methods behind their collation and use specified in the aim of this research, emphasise the rationale for conducting a narrative review.

The key strengths of a narrative review are their flexibility and practicality. They can provide a 'readable and relevant synthesis', offer an interpretation of existing evidence and critique research to date. They do not however offer an evidence-based synthesis, nor do they offer guideline statements (Sukhera, 2022).

To strengthen the methodological conduct of narrative reviews, previous research recommends the following are taken:

- A rationale is provided for choosing the narrative review methodology;
- Key terms, boundaries and definitions are clear with respect to the literature search;
- Justification is provided for inclusion and exclusion criteria;
- A reflexivity statement is provided;
- Details on analysis and interpretation are transparent (Sukera, 2022).

This study adhered to each of the above principles.

3.7.3 Study Three: methodology

3.7.3.1 Criteria for country selection

This research aims to critically analyse two oral health indicators across a range of European countries. The criteria for country selection were:

- Those countries who were representative of the variation of healthcare systems (i.e. tax funded, social health insurance, universal healthcare systems, 'targeted' systems, centralised and decentralised systems); and

- The different models of oral healthcare in Europe (Widström and Eaton, 2004).

As such, the representative countries included in this analysis were selected from one of each of the following types – Nordic, Bismarckian, Eastern, Hybrid, Beveridgian and Southern (Table 2.1).

3.7.3.2 Indices for assessing dental caries

The Decayed, Missing and Filled Teeth (DMFT) Index has been used for almost 80 years and remains the most used epidemiological index for assessing dental caries (Broadbent & Thomson, 2005). Obvious decay is when the disease appears to have penetrated dentine and is described as decay at the 'd_3 level' in deciduous teeth, the 'D_3 level' in permanent teeth, and also includes pulpal decay. This definition is in accordance with international epidemiological conventions, thus facilitating optimum comparison. It is recommended that countries conduct periodic national oral health surveys, with the 12-year-old age group considered particularly important as a target group for assessing the level of dental caries severity among children with permanent teeth (World Health Organization, 2013).

The International Caries Detection and Assessment System (ICDAS) was developed to provide a standardised caries detection and diagnosis system across a range of different environments (Pitts & Stamm, 2004). The ICDAS measures changes and potential lesion depth based on surface characteristics. The ICDAS scores range from zero to six for coronal caries, with zero representing a sound tooth and six an extensive distinct cavity with visible dentine (Shivakumar *et al.,* 2009).

The World Health Organisation has also published dental caries 'prevalence' information within its 'Global Oral Health Status report-country profiles' where it based data on 'Estimated prevalences from the Institute of Health Metrics and Evaluation (IHME) Global Burden of Disease Study 2019' (GBD, 2019), (World Health Organisation, 2022).

3.7.3.3 Data collection

A detailed search of both peer reviewed and other relevant literature such as publications from national and international databases (e.g. the World Health Organisation and the OECD) was required. The literature searches took place between June 2023 and February 2024. To

ensure accuracy in data reporting two experts from each country (*n=12*) were asked to verify findings.

3.7.3.4 Literature

3.7.3.4.1 Peer reviewed literature

Two individual search strategies (Appendices L and M), one focusing on each indicator, were developed by the lead researcher in collaboration with the assistance of a specialist medical librarian. The 'CoCoPop framework' (Condition, Context, Population) which has been shown to support effective literature searching for research questions focusing on aetiology was followed (Munn *et al.,* 2018). The 'condition' refers to the variable of interest and in this instance entailed dental caries and workforce.

No limitations were placed on the either the types of studies to be included nor study year due to the possibility of national oral health surveys having been previously conducted over a significant period. Titles and abstracts identified were downloaded to reference management software (*Zotero*) and screened using Rayaan, an online application supporting effective literature review screening efficiency.

3.7.3.4.2 Grey and other literature: dental caries

To ensure the most recent and representative figures with respect to dental caries were identified, national and international online databanks were directly searched. These included:

- Individual country databases such as those of health ministries and national oral health services (e.g. Sundhedsstyrelsens Centrale Odontologiske Register (SCOR) [Denmark], National Dental Inspection Programme, [Scotland].
- World Health Organisation: Oral Health Country/Area Profile Project (CAPP) Database
- World Health Organisation: Global Oral Health Status Report (GOHSR) - country profiles.
- The Council of European Chief Dental Officers (CECDO) database
- Organisation for Economic Cooperation and Development (OECD)

Other databases including The Global Health Observatory (World Health Organisation, 2024c), World Health Survey (World Health Organisation, 2003) and European Health for All (World Health Organisation, 2024d) databases were also searched.

Caries data in the GOHSR is derived from the Global Burden of Disease 2019 (GBD) and 'computed' the Institute of Health Metrics and Evaluation (IHME) (World Health Organisation, 2022). Therefore, the metadata informing this data was examined by way of the GBD 'data input sources tool' which was used to search for results for 'non-fatal outcomes' of caries of deciduous and permanent teeth for each study country.

3.7.3.4.3 Grey and other literature: workforce

To augment the data gathered from peer reviewed literature, national and international databanks by country were also interrogated, pertaining to oral health workforce. These included:

- Individual country databanks such as those of dental professional councils and associations, health ministries and national oral health services (e.g. The Dental Council of Ireland, National Health Service Scotland, Federal Association of Statutory Health Dentists [Germany]) (TURAS, 2022; BZÄK/KZBV, 2023; Dental Council of Ireland, 2024)
- World Health Organisation: Oral Health Country/Area Profile Project (CAPP) Database
- World Health Organisation: Global Oral Health Status Report (GOHSR) - country profiles.
- The Council of European Chief Dental Officers (CECDO) database
- Organisation for Economic Cooperation and Development (OECD)

3.7.3.5 Analysis

A range of information from each database was collected including the DMFT or other prevalence indicator score, and the citing evidence from which the information was sourced. These research reports were subsequently identified and analysed with numerous factors collated including: the year of study, source of information, year of results published, number of 12-year-olds, criteria for caries assessment and methods of calibration. This was in line with previous research evidence and followed best practice recommendations from the World

Health Organisation for oral health measurement (World Health Organisation, 2013; Patel *et al.*, 2016).

Regarding oral health workforce key factors were collected to generate a granular description of the oral health workforce across the representative countries including:

- Numbers of dentists, dental assistants/nurses, dental hygienists across the countries explicitly and per 100,000 population;
- Numbers of dentists providing publicly funded dental care for children;
- Distribution of dentists by age;
- Distribution of dentists by gender;
- Routine data nationally collected pertaining to dentists including qualification, location, area of working, working schedule i.e. if there is data available on part-time working and if dentists can be categorised as 'active' or not.

The international databases mentioned above were then accessed to garner figures for dentists' numbers across the countries with their source of reporting also derived.

Two data sheets were generated one each for workforce and caries prevalence based on the above parameters, before being presented to two country experts for verification.

3.8 Positionality and reflexivity

The PhD candidate engaged in reflective practice throughout all three studies being particularly cognisant the potential of introducing bias by way of my professional training as a dentist and my experiences as a clinician working in the Irish public dental system.

Reflexivity requires continual reflection on how the approach to the research may influence the conclusions drawn (Hardy et al., 2001). Being reflexive necessitates a commitment to practice, which requires time and space (Mauthner & Doucet, 2003). Dedicated reflexive practice was scheduled after conducting each interview, after coding each transcript, and while generating the themes that formed the results.

Specifically, this entailed writing field notes after each interview which were shared with a senior member of the research team during which the PhD candidate reflected both on my personal reactions and opinions to the participant and the information imparted. During the

analysis phase of each study, the PhD candidate maintained a folder of these memos in NVivo in a separate location to the one for data collection. She continued to review her role in the process, her position as the researcher and was conscious to be alert to any trends or patterns of behaviour that were becoming apparent.

Reflexive practice can be influenced by the researcher's own characteristics, highlighting the importance of positionality in qualitative research (Berger, 2015). At various stages of the PhD, the candidate was prompted to reflect on her own position as a researcher, as a dentist and ensure that particularly when interviewing 'elites' that the potential 'power' imbalance was not impacting her ability to conduct my research effectively. The potential 'power' imbalance was most especially tangible resulting from external pressures being placed by high-ranking members of the health system in an effort to restrict dissemination of the research.

The PhD candidate strove to use her clinical training and 'firsthand' knowledge of the underlying research subject to enhance the research approach and bridge the gap between being 'researcher' and 'expert' while maintaining confidence in the strength of the research findings and methods.

3.9 Ethics

Ethical approval for this PhD research was granted by the Clinical Research Ethics Committee of the Cork Teaching Hospitals at University College Cork (CREC) (Reference number: ECM 4 (J)12/11/2019) (Appendix A).

At the outset of this PhD ethical approval was also sought for two further studies:

- A multi-perspective qualitative study with caregivers and dentists by way of focus groups and semi-structured interviews to determine the patient and professional perspectives on paediatric oral healthcare care reform (***study four***); and
- A quantitative analysis of an anonymous Health Service Executive dataset to determine the prevalence of dental caries among a population of 5-year-old children accessing dental care in Ireland (***study five***)

These studies were not undertaken due to several factors. Firstly, the onset of the COVID-19 pandemic resulted in a nationwide lockdown in Ireland to various levels at different times

during this PhD resulting in difficulties conducting research such as that planned in study four. Secondly there were significant delays in securing permission from the Health Service Executive (HSE) to access data required for study five following a widespread and significant cyber-attack which had a serious impact on the organisation in 2021. Finally, the substantial volume of data generated from the first three studies was considered sufficient to answer the research question proposed and more than fulfil the requirements of a PhD.

The PhD candidate recognises the benefits that would ensue from generating insights from both patients and dentists on children's oral healthcare, while establishing a baseline of dental caries from a previously unreported population in Ireland would be highly informative in advance of any future system reform. She hopes to be able to revisit these studies in the future.

3.10 Chapter summary

This chapter provided a detailed account of the methodological design and methods employed across the three studies comprising this PhD research (Figure 3-3). It began by outlining the overarching qualitative and health systems and policy research orientation of the thesis (Alliance for Health Policy and Systems Research, 2024), with a justification for the overall design being a publication-based PhD comprised of three interlinked studies. The case study design was introduced as the most appropriate methodological approach given the complex, real-world nature of oral health system reform, particularly in the Irish context (Yin, 2014). The rationale for using both single-case (Study One) (McAuliffe *et al.,* 2022) and comparative multiple-case (Study Two) (McAuliffe *et al.,* 2025) designs was discussed, with reference to the aim and intended policy relevance of the research (Yin, 2014).

The chapter then detailed how each study adopted a unique but complementary design. Study One employed a single-country case study to examine the development and implementation of oral health policy in Ireland from 1994 to 2021 (McAuliffe *et al.,* 2022). It used documentary analysis and elite interviews, analysed through a directed content approach guided by Howlett's Multiple Streams Framework (Howlett, 2019). Study Two utilised a comparative case study design to map publicly funded oral health coverage for children across six European countries (McAuliffe *et al.,* 2025). Data were collected through documentary analysis and expert interviews, and analysis was guided by the WHO Universal Health Coverage Cube (World Health Organisation, 2008). Study Three was a narrative comparative review focusing on two key indicators, oral disease prevalence and workforce in the same six countries (Greenhalgh *et al.*, 2018). Given the lack of consistent, comparable data, this study relied on narrative synthesis and grey literature in multiple languages, with data accuracy verified by two local experts per country.

To ensure transparency and analytical rigour, the chapter critically engaged with common analytical frameworks in health policy and health systems research. It presented the strengths and limitations of both the Multiple Streams Framework (Howlett, 2019) and the WHO UHC Cube (World Health Organisation, 2008) and outlined mitigation strategies applied in this research. The use of triangulation (Yin, 2014), elite interviews (Van Audenhove and Donders, 2019), and careful reflexive practices (Agee, 2009) was discussed. Justification was provided

for the selection of countries in Study Two, based on typologies of oral healthcare models (Widström and Eaton, 2004), the presence of effective oral health promotion and prevention regimes for children, and experience of oral health system reform (McAuliffe et al., 2025).

Overall, this chapter aimed to clearly justify the methodological decisions taken and demonstrate how each method aligned with the overarching aim of the thesis: to appraise and inform the reform of the Irish publicly funded oral healthcare system for children.

The next three chapters (Chapters 4–6) present the findings of each individual study in the form of academic papers that have been published or accepted for publication. Chapter four presents Study One, analysing oral health policy development and implementation in Ireland over three decades, including the structural, political, and professional factors that facilitated or obstructed reform (McAuliffe *et al.,* 2022). Chapter five presents Study Two, a comparative analysis of oral health coverage for children across six European countries (McAuliffe et al., 2025) while chapter six details Study Three, a narrative review of oral health indicators across the same countries.

Chapter 7 will return to provide an overall synthesis of the findings from all three studies. It will draw out the cross-cutting themes, policy implications, and recommendations for reform, while also offering a reflective critique of the methodological approaches employed throughout the thesis.

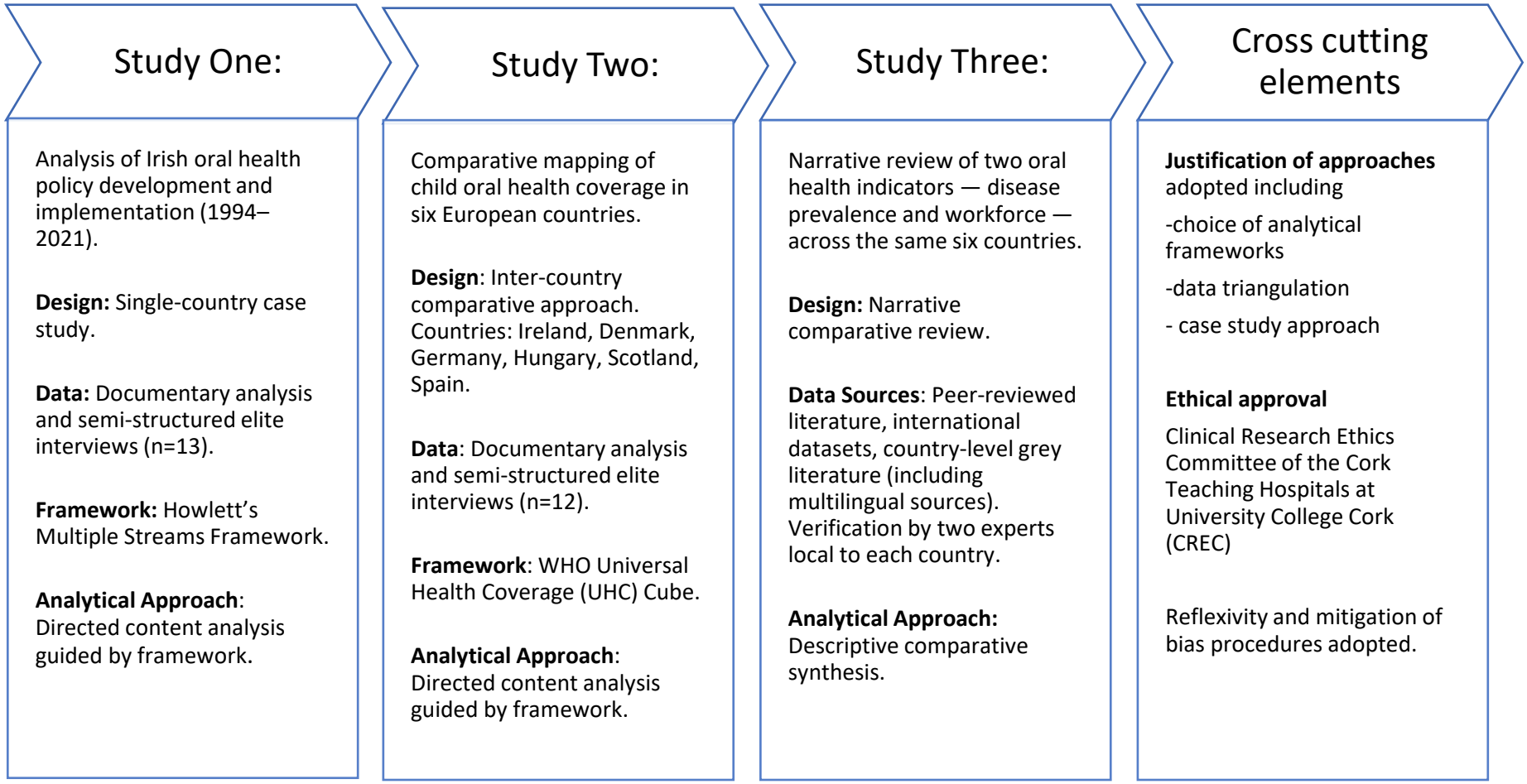


Figure 3-3 Summary - methodology and methods

Chapter 4 - Study 1

’Toothless’—the absence of political priority for oral health: a case study of Ireland 1994–2021

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4.1 Abstract

Background: Calls are emerging for oral health system reform under the Universal Healthcare (UHC) domain, while internationally there is an absence of political priority for oral health. In the Republic of Ireland there is very limited coverage of oral healthcare for the whole population. 'Smile agus Sláinte' Ireland's oral health policy published in 2019, represents the first change to national policy in over 25 years.

Methods: This research examined the key factors influencing oral health policy, development, and implementation in Ireland during the period 1994–2021. A case study approach was adopted with two strands of data collection: documentary analysis and semi-structured interviews with elite participants. Analysis was guided by Howlett's five stream framework.

Results: Ireland shares the international experience of oral health having very low political priority. This has perpetuated unequal access to public dental services for children and special needs populations while austerity measures applied to adult schemes resulted in increased unmet need with no universal coverage for dental care.
The only area where there is political interest in oral health is orthodontic care. This low political priority combined with a lack of actor power in national leadership positions in the Department of Health and Health Service Executive has contributed to successive non-implementation of oral health policy recommendations. This is most evident in the failure to publish the Draft National Oral Health Policy in 2009. The research finds a failure to adequately engage with key stakeholders, particularly the dental profession in the development of the 2019 policy. All these weaknesses have been exacerbated by the COVID-19 pandemic.

Conclusions: Ireland's new oral health policy, 'Smile agus Sláinte', presents an opportunity for the provision of much needed public dental services. However, successful reform will require strong political will and collaboration with dental leadership to provide advocacy at national level. Global calls to incorporate oral health into the UHC agenda and an agreed political consensus for UHC in Ireland may provide an opportunity for change. Genuine engagement

of all stakeholders to develop an implementation strategy is necessary to harness this potential window of opportunity for
oral health system reform.

Keywords: Oral health policy, Public dental systems, Universal healthcare, Oral health policy analysis, Reform

4.2 Background

Most oral health conditions are largely preventable (World Health Organisation, 2020). Yet oral diseases affect 3.5 billion people worldwide with untreated dental caries of permanent teeth the most prevalent condition (World Health Organisation, 2020a; Bernabe *et al.*, 2020). The burden of oral disease is hallmarked by significant inequality, disproportionately affecting marginalised populations and low socio-economic groups (Peres *et al.*, 2019). As such access to prevention, early diagnosis and treatment of oral diseases is 'unattainable for millions of people' (World Health Organisation, 2020a).

The main strategy for mitigating inequalities impacting access to oral health services is implementing oral health policies (Galvão and Roncalli, 2021). However, oral diseases are a neglected issue often failing to receive priority in broader health and public policies (Leake and Birch, 2008; Benzian *et al.*, 2011) 'isolated and marginalised' from health policy developments (Peres *et al.*, 2019). A lack of political commitment and resources along with the failure to prioritise disease prevention are contributory factors (World Health Organisation, 2020a). Responding to the global 'state of crisis' in oral health requires policy change from traditional clinical approaches particularly to align with the Universal Healthcare (UHC) agenda (Fisher *et al.*, 2018; Watt *et al.*, 2019; World Health Organisation, 2020a; Glick *et al.*, 2021).

The Republic of Ireland (Ireland) is a small country in Western Europe with a population of 5.01 million people (Central Statistics Office, 2021). The Irish general health system is 'complex' with access to care often based on the ability to pay rather than medical need (Johnston *et al.*, 2020). The latest available OECD data shows Government financing as a proportion of total health expenditure was 75% in 2019, a comparatively low figure compared to the EU average of 80% (OECD, 2021). For oral healthcare in Ireland, delivery is via a public/private mix of service provision (Woods *et al.*, 2017).

However, gaps in publicly funded oral healthcare for significant parts of the population mean high out of pocket payments that may cause financial hardship (Johnston *et al.*, 2020). In contrast to the general health system, it is estimated that almost two thirds of all dental expenditure in Ireland is privately financed, the majority of which relates to direct out of

pocket payments. Furthermore, while almost half the Irish population voluntarily purchase private health insurance (PHI), this is primarily to facilitate quicker access to planned hospital treatment or private medical care. PHI offers only 'limited coverage' of dental care (Woods *et al.*, 2017; Johnston *et al.*, 2020).

Leadership, governance and policy direction for the health system is provided by the Department of Health (DoH) (Department of Health, 2016). The Health Service Executive (HSE) established in 2005 is a national government agency under the aegis of the DoH responsible for the management and delivery of health and social care services (OECD/European Observatory on Health Systems and Policies, 2019). Following a decade of economic prosperity, Ireland experienced one of the most severe economic crises of any OECD country between 2008 and 2014 (Nolan *et al.*, 2014). During this time, austerity measures which had a lasting impact on the health system, including limiting access to dental services, were introduced (Williams and Thomas, 2017; Johnston *et al.*, 2020).

However, by 2017, Ireland was once again experiencing high levels of economic growth (Houses of the Oireachtas, 2017). Ireland is the only western European country without universal primary healthcare and despite many years of reform there is a consensus that the health system is inequitable and underperforming (OECD/European Observatory on Health Systems and Policies, 2019). Significant gaps in universal health coverage are a key consequence of Irelands complex system and as mentioned, access to publicly financed dental care is particularly poor, at just one third of all oral health expenditure (Johnston *et al.*, 2020; OECD, 2021). In 2017, the Irish Government committed to a 10-year plan developed by a cross-political party committee, toward the delivery of a universal single-tier health service where individuals are treated solely based on need, known as 'Sláintecare' (Houses of the Oireachtas, 2017).

In March 2019, Irelands national oral health policy known as 'Smile agus Sláinte', was published (Department of Health, 2019a). Its key goals are to support individuals to achieve their best oral health and reduce inequalities across the population, while the fluoridation of piped water supplies is supported as an oral health protection policy (Department of Health, 2019a). 'Smile agus Sláinte' aims to align with the 'same ideals' as the proposed universal health service, 'Sláintecare', however it describes the provision of 'preventive bundles' of care

delivered at various ages throughout the life course (Department of Health, 2019a). The planned large-scale reform of the public dental system outlined in this policy is considered 'challenging' by policymakers (Department of Health, 2019a).

Health policy analysis is crucial to health reform (Walt and Gilson, 1994). It is useful retrospectively and prospectively to understand past policy successes and failures and in planning for future policy implementation (Walt *et al.*, 2008). Previous research illustrates that with respect to oral health policy development, a better understanding of the complex interactions between context, policy processes and actors can enable the design of more responsive policies (Etiaba *et al.*, 2015). In particular the broader socio-political contexts in which actors develop oral health policies can facilitate and/or constrain actors' roles and policy processes (Etiaba *et al.*, 2015). There is limited international research analysing oral health policy and to the best of our knowledge, none in the Irish setting (Singh *et al.*, 2010; Etiaba *et al.*, 2015; Pucca *et al.*, 2015; Leck and Randall, 2017).

The aim of this research is to generate an in-depth understanding of the key factors that impeded or promoted the development and implementation of oral health policy in Ireland during the period 1994 to 2021.

4.3 Methods

To facilitate a comprehensive analysis, a case study approach was adopted (Yin, 2014). Case studies are considered beneficial for 'in-depth, multi-faceted explorations of complex issues in their real-life settings' (Crowe *et al.*, 2011). To strengthen study validity and generate a thorough understanding of the case, the use of multiple data sources is advised (Mays and Pope, 2000). Two strands of data collection and triangulation were thus undertaken—a documentary analysis and semi-structured in-depth interviews with 'elites' (Van Audenhove and Donders, 2019).

4.3.1 Documents

A documentary analysis examined the relevant reports, policies, service documents and other literature developed at local, regional, and national level from 1994 to 2021. These dates were chosen as 1994 is the date of Irelands' first national health policy which included a 'Dental

Health Action Plan' publication (Department of Health, 1994a) and Ireland's recent national oral health policy was published in 2019 (Department of Health, 2019a).

The study was expanded to include the impact of the COVID-19 pandemic to the time of writing in July 2021. Two documents published prior to 1994 were included in the dataset as their contents were deemed important to the analysis of the 'Dental Health Action Plan' (Department of Health-Irish Dental Association-Health Board Working Party, 1979; Department of Health, 1988).

Documents reviewed were identified by performing searches of:

1.Government websites particularly the website of the Department of Health, for policies, reports, and guidelines.

2.The Lenus database, the Health Research Repository of the Irish health service.

3. Records of parliamentary debates, governmental committee meetings and parliamentary questions on the 'Oireachtas' website.

A total of 125 documents were identified, reviewed, and mapped over a 27-year timeline. The documents analysed included health policy documents (n = 14), commissioned reports (n = 18) and health service documents (n = 19). A detailed overview of the dataset including the quantity and nature of included documents is presented in Table 4-1.

Table 4-1 An overview of documents incorporated in analysis

Document type	**Number *(n)***
Policy documents[1]	14
Commissioned reports[2]	18
Health strategies[3]	9
Health service documents[4]	19
Non-governmental reports/strategies[5]	7
Legislation[6]	5
Reports of epidemiological surveys[7]	7
Parliamentary papers[8]	
Parliamentary questions	33
Presentations to parliamentary committees	4
Clinical guidelines[9]	4
Academic and grey literature[10]	5
Total	***n=125***

Notes:

1. **Policy document**: any publication with stated governmental policy positions including general and oral health policies, published and unpublished, along with associated policy frameworks, implementation, and action plans.
2. **Commissioned report**: any document commissioned by government including reports from external bodies and institutions along with inter departmental requests.
3. **Health strategy**: any document detailing steps and strategic intent by government, but not as actual government policy, for example health department statements of strategy.
4. **Health service documents**: any document outlining specific health and social service delivery, objectives, resources, actions, and outputs, primarily including HSE National Service plans.
5. **Non-governmental reports/strategies**: any relevant report/strategy published by a non-government affiliated organisation. 6 Legislation: relevant legal acts and regulations.
6. **Parliamentary question**: any relevant question raised by a member of parliament provided with an oral or written response.
7. **Presentation to parliamentary committee**: any evidence verbal or written presented to relevant governmental committees.
8. **Clinical guidelines**: a series of evidence-based guidelines for those planning and providing dental services for children in Ireland.
9. **Academic and grey literature**: relevant academic and grey literature used to enhance contextual nuance of included documents.

4.3.2 Elite Interviews

The outcomes of the documentary analysis enabled the categorisation of key stakeholder groups across the oral health policy (OHP) landscape in Ireland: The Health Service Executive, private dental practitioners, academics, and policymakers including the Department of Health. In-depth elite interviews were then undertaken with actors purposely identified as representative of each stakeholder group. Participants were primarily identified via the documentary analysis, supplemented by purposive sampling based on the recommendation of participants and the researchers' knowledge of actors closely engaged in OHP and/or OHP development. A piloted interview guide informed by the documentary analysis was employed during interviews and the list of participants was continually reviewed throughout the data collection process.

In all fifteen participants *(n=15)* were invited to interview, with thirteen *(n=13)* consenting to participate: four representatives of the HSE *(n=4)*, two representatives from private dental practitioners (*n=2*), five academics *(n=5)* and two policymakers *(n=2)*. Most respondents *(n=11)* were trained dental practitioners, and all had a detailed knowledge of OHP and/or OHP development. All but one of the interviews were conducted via teleconferencing facilities between October 2020 and March 2021 in accordance with COVID-19 related public health guidelines.

4.3.3 Data analysis

This research followed best practice guidance for health policy analysis by rooting the analysis in an existing framework (Walt *et al.*, 2008). The 'Multiple Streams Framework by Howlett et al., (2019) was chosen for analysis due its comprehensive, wide raging coverage and ability to capture a multitude of elements in complex policy processes.

The five streams are the problem, policy, process, politics and programme streams Figure 4-1.

1. *Problem* refers to the framing and articulation of policy problems.
2. *Policy* refers to the formulation of policies and policy alternatives
3. *Process* refers to the main tasks and events which lead to policy outputs.
4. *Politics* refers to the politically active policy actors.
5. *Programme* refers to the management of implementation.

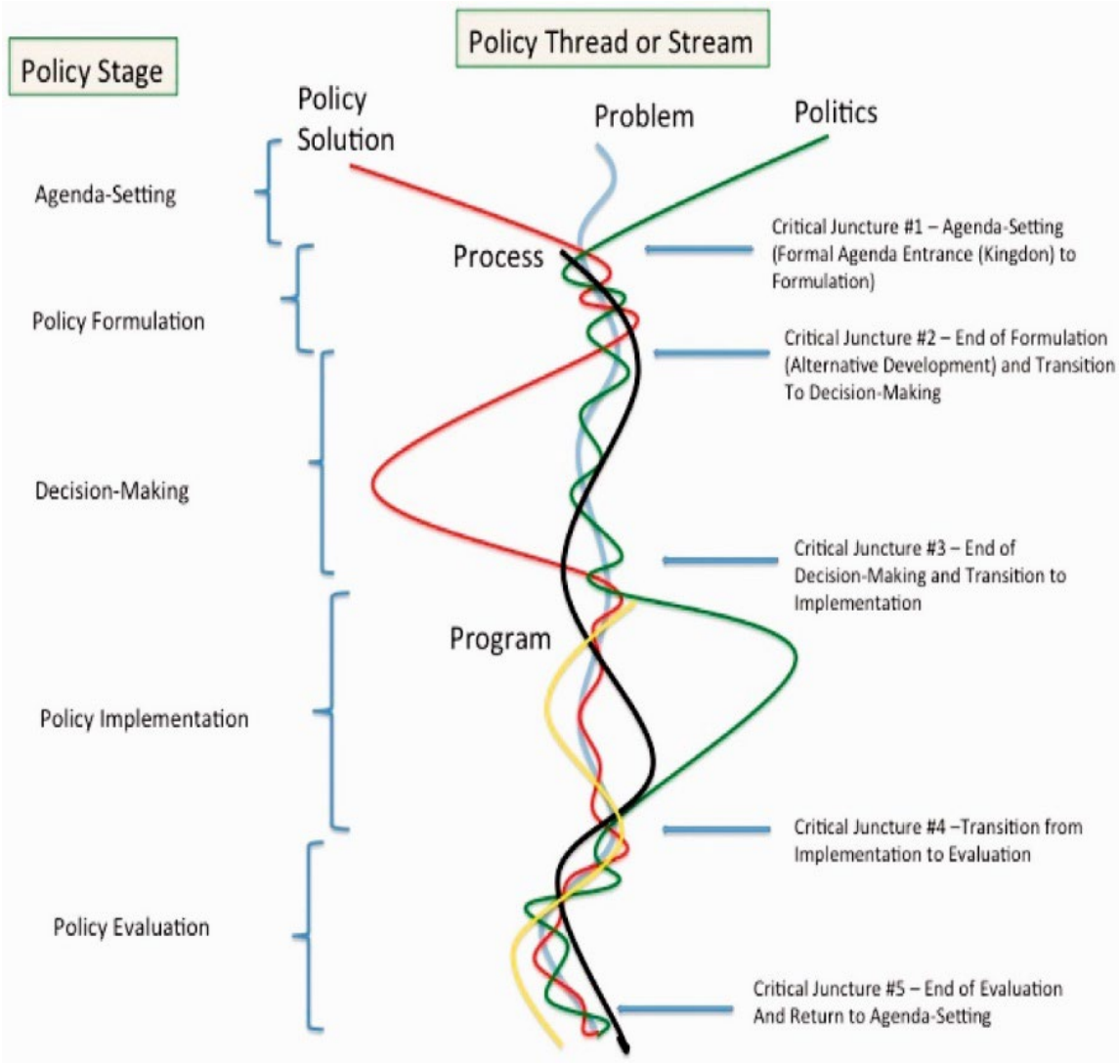


Figure 4-1 Figure Howlett's multiple streams model
Source: (Howlett, 2019)

Qualitative data analysis software (NVivo 12) was used and followed a directed content analysis approach (Mayring, 2014) guided by the structured framework. Initially, the contents of each document were mapped onto an MS Excel spreadsheet using a range of column headings. These headings included title, author, year, resource type, source/location, political landscape, and content. A range of key concepts were then identified as coding categories using the framework as guidance before operational definitions for each category were determined. The operational definitions derived from the framework in addition to the documents included in the dataset were agreed by all authors. Interviews were transcribed verbatim and coded.

All transcripts and outcomes from the documentary analysis were examined together and coded using NVivo. The predetermined categories derived from all five streams were applied across all documents and interviews where relevant and applicable, with any remaining text coded with another label and captured.

Throughout the data analysis process the findings from interviews were continually triangulated with the outcomes from the documentary analysis following best practice for policy analysis. The data generated from the documentary analyses provided an adequate description of the technical content of key policies and literature (Bowen, 2009). While elite interviews were used to elaborate on the document's findings in a more in-depth manner particularly to understand why specific policy choices were made or not made (Van Audenhove and Donders, 2019). Emerging findings were discussed in structured meetings with all authors who have extensive dental research or policy analysis experience.

4.3.4 Ethical considerations

Ethical approval for the study was obtained from the Clinical Research Ethics Committee of the Cork Teaching Hospitals at University College Cork (Reference number: ECM 4 (J)12/11/2019). At all times ethical considerations including ensuring confidentiality, obtaining informed consent, and preserving anonymity were adhered to. Informed consent to participate was granted by each participant.

4.4 Results

The findings are presented utilising Howlett's streams (Figure 4-1) and draw on findings from two datasets, a documentary analysis and interviews, triangulated to build an overall perspective.

4.4.1 The problem stream

The documentary analysis found that Ireland has very restricted dental coverage for the whole population (Johnston *et al.*, 2020). Publicly funded dental services are delivered via three schemes: (i) the Public Dental Service (PDS), (ii) the Dental Treatment Services Scheme (DTSS) and (iii) the Dental Treatment Benefit Scheme (DTBS) (Woods *et al.*, 2017) (Table 4-2). A significant proportion of the population (20% in 2016) are not eligible for any scheme and must either purchase private dental insurance or pay out of pocket for private dental care (Woods *et al.*, 2017; Johnston *et al.*, 2020). Those patients may claim back fees through tax relief up to a maximum of 20% of the treatment cost for certain non-routine procedures (Henry *et al.*, 2021).

The 'Public Dental Service' (PDS) is the only state-funded dental care for children and special needs populations, delivered by salaried dentists directly employed by the state (Department of Health, 2019a). The PDS aims to 'target' children for dental care in 'three designated classes in primary and secondary schools' (Department of Health, 1994a). According to documents analysed, the practice of targeting first emerged as a rationing mechanism in response to economic constraints in the 1980s by targeting two age ranges associated with the eruption of permanent teeth (i.e., ages 7–8 and 11–12) while emphasising the need for improved orthodontic services (Department of Health-Irish Dental Association-Health Board Working Party, 1979; Department of Health, 1988).

There is no further access to State supported dental services for any child under age 16, except in the event of an emergency (Department of Health, 2019a). The PDS has suffered significantly from austerity measures first introduced in 2009 with a 20% reduction in staffing levels (Government of Ireland, 2009; Houses of the Oireachtas, 2021c). It was further impacted by the COVID-19 pandemic with 23% of dental professionals redeployed to COVID-

19 related work (Houses of the Oireachtas, 2021a). Access to care is determined by age rather than need and despite recommendations to the contrary (Irish Oral Health Services Guideline Initiative, 2012) it remains the policy guidance under which dental services for children and special groups operate in 2021.

Inequalities with respect to dental care for children were highlighted in the documentary analysis. For example, a report commissioned by the Department of Health in 2002 described elements of the system as a 'disgrace' (Gelbier, 2002).
This remained an issue of common concern amongst interviewees when considering public dental services for children:

'Usually, it's one, maybe two (primary school) classes you're seeing properly...it's not kids from whatever zero to sixteen. They say every child under the age of sixteen. That's not true at all.' (P2)[1]

'[The Public Dental Service] just papers over the cracks…different regions have different resources…so if you live in one place two [primary school] classes might be seen, but drive down the road and you could have one, or none, same with special needs…' (P3) [2]

The Gelbier report also advocated for improved services for special needs groups: 'it is essential for this report to make the strongest of recommendations on behalf of special needs child and adult patients…a duty of care for those who cannot look after themselves' (Gelbier, 2002). It is estimated that 95% of the activity of the Public Dental System pertains to services provided to children, with just 5% of care going to patients in vulnerable groups (Henry *et al.*, 2021). While the reports of epidemiological studies that emerged from the documentary analysis found that permanent teeth were more frequently extracted in Irish children with a disability than the general population (Crowley *et al.*, 2005; Whelton *et al.*, 2009). The difficulties prevailing in special care dentistry also featured prominently in interviews:
'I feel extremely…very, very strongly about the…failure to invest in special care dentistry…'.

[1] P refers to 'Participant' with each interview participant assigned a code from P1-P13.
[2] In Ireland children attend their first-level education in primary schools (also called national schools) between the ages of 4 or 5 years and 12 years of age. Each year of education is referred to as a primary school class. The public dental services target children for assessment depending on which school class they attend.

(P4) and *'The problems for special needs groups...It's really upsetting…it's heart breaking…'(P6).*

An unpublished report identified during this research which was commissioned by the Department of Health in 2009 found a 'disinterest' in the public dental system by senior HSE management had a 'demoralising effect on service providers' (Oral Care Consulting, 2009). These sentiments were echoed by interviewees familiar with its operation:

'*We just do what we are told…stagger on' (*P2) and …'*it's like military rule'*… (P1)
'Insufficient attention is paid to any of the good outcomes…it's been next to impossible to get any attention from senior people in the HSE or the Department of Health'. (P4)

Dental services for adults are provided through the Dental Treatment Services Scheme (DTSS) and the Dental Treatment Benefit Scheme (DTBS) (Table 4-2) where dentists are contracted by the state to provide care in privately owned practices (Department of Health, 2019a). Both schemes were among the first health budgets to face cuts and suffered severely because of austerity measures introduced in 2010 (Johnston *et al.*, 2020). This described by an interviewee: '*The state basically ditched large swaths of the dental profession'.* (P8)

Funding of the DTSS scheme was reduced from €62 to €10 million between 2010 and 2015 (Houses of the Oireachtas, 2017). Dental benefits were limited to an examination and two emergency restorations with any other care subject to approval from the local HSE health manager. However, coverage was provided for unlimited dental extractions (Johnston *et al.*, 2020). The restrictions in preventive and restorative oral health care while funding remained uninhibited for dental extractions is described by an interviewee: '*Talk about equity and fairness…how could we do that? It's probably driven the level of extractions up…its almost medieval'* (P6).

The DTBS scheme was limited to examination only until provision for a scale and polished was reintroduced in 2017 (Johnston *et al.*, 2020). According to an interviewee: '*The darkest day in dentistry was when the budget for 2010 was announced…in dentistry it was treatment service to the patient that was curtailed, that didn't happen for other services like GPs or pharmacy'* (P4).

The documentary analysis concluded the changes introduced had a significant impact resulting in unmet need for dental care tripling between 2008 and 2012 (Johnston *et al.*, 2020). Despite calls to reverse the austerity measures, the funding cuts introduced in 2010 remain in place in 2021 (Houses of the Oireachtas, 2017; Johnston *et al.*, 2020).

The problems occurring in the DTSS Scheme were of concern for many interviewees: '*The DTSS has been decimated, the system is basically not functioning for…10 years, dentists are withdrawing because it's no longer lucrative, patients don't even know what's available to them…it is entirely dysfunctional…the Department [of Health] would prefer if everyone was edentulous' (P13).*

Table 4-2 An overview of publicly funded oral healthcare in Ireland in 2021

Dental Scheme	Patient Group Covered	Type of oral health care covered
Public Dental Service	• Children (0-16 years) ○ There are 1.07m children under age 16 in Ireland. ○ 22% of population • Some adult populations with special needs.	• 'Emergency' dental care only. • Comprehensive treatment entailing preventive and restorative care (including orthodontic treatment under strict qualification criteria). ○ Two age groups only (ages 7-8 and ages 11-12) • Eligibility does not equate to accessibility. • Service provision varies across the country. • Patients are targeted by age not clinical risk.
Dental Treatment Services Scheme (DTSS)	• Category I Medical Card holders ○ Eligibility for a Medical Card is generally based on an income means test. ○ Covers 32% of the population. • 24% of eligible persons utilised scheme in 2019	• One oral exam per annum, two fillings per annum and unlimited dental extractions. • Prior approval can be sought from a local HSE health manager for additional treatment including: ○ More than 2 fillings, full or partial dentures, anterior root canals and for certain high-risk groups, periodontal care.
Dental Treatment Benefit Scheme (DTBS)	• Social insurance contributors for three years (PRSI) • Up to 2.2m contributors insured in 2018 at a cost of €50m • In 2018 1.25 million claims were approved	• Oral examination and one scale and polish (to the value of €42) annually

Note: As of April 2021, there were 3,320 registered Dentists in Ireland of which an estimated 2,000 are actively practising with 316 salaried dentists directly employed by the HSE in the Public Dental Service.

4.4.2 The Policy Stream

1994 – the dental health action plan

The first Irish health policy 'Shaping a Healthier Future: A Strategy for Effective Healthcare in the 1990s' was published in 1994 (Department of Health, 1994a). It was a policy document which included a series of action plans including a Dental Health Action Plan' (DHAP). This was the 'first clear statement on the aims and health objectives of the dental services in Irish history' (Department of Health, 1994a) (Table 4-3).

The DHAP was viewed by most interviewees as generating improvements in public dental services: '*The dental health action plan did make progress, it put some adult services out there, some special care services…it did increase the number of teams*' (P4). While its dental public health approach was welcomed: '*It had a vision, a philosophy underpinning it…a recognition of inequalities…progress was made*' (P7). However, there was a failure to maintain progress: '*The platform was reached. And then very little was built on that platform'* (P4).

There were difficulties with workforce distribution: '*The poorer areas where it was difficult to recruit dentists were getting the minimum…*' (P11) and according to documents, concerns were raised regarding management and probity assurance in DTSS Scheme (Oral Care Consulting, 2009; PA Consulting Group, 2010).

Table 4-3 Irish National Oral Health Policies 1994-2019

Title		Year	Document	Key findings	Main recommendations
The Dental Health Action Plan		1994	An action plan published as part of the national health policy- Shaping a Healthier Future: A strategy for effective healthcare in the 1990s. The current policy guidance for all publicly operated dental schemes in Ireland in 2021.	1. No systematically organised care for pre-school children 2. Care for primary school children is uneven. 3. Poorer oral health in medical card holders 4. Increased demand for orthodontics. 5. Poor services for those with additional needs.	1. Goals for reduced dental decay across population by 2000. 2. Continue & increase fluoride use (water & toothpaste) with support from industry. 3. Consolidate & extend targeted school dental services. 4. Extend eligibility for care to age 17. 5. Care for adult medical holders through new scheme (DTSS).
Draft National Oral Health Policy		2009	Unpublished by the Department of Health.	1. Oral health has improved since the introduction of the Dental Health Action Plan for some groups. 2. However improved oral health not observed in medical card holders or children under-age-5.	1. Administration of DTSS and DTBS merged to enhance equity and reduce administration costs. 2. PDS: Refocus resources to address need, improve data management, monitoring of outcomes with a senior clinical manager to head service.

				3. Mismatch between peaks of childhood caries and age range the PDS focuses on. 4. Deficiencies in care for those with disabilities, special needs, and elderly in long stay institutions. 5. Overlaps between DTSS and DTBS schemes with co-ordination mechanisms lacking to ensure cost effectiveness and equity.	3. Identify people with special needs and social disadvantage for appropriate oral healthcare. 4. Enhance the regulatory regime governing oral healthcare. 5. Recognise specialty of Special Needs Dentistry immediately. Progress specialisation in Public Health Dentistry following new arrangements in PDS. 6. Allow dental hygienists operate independently. 7. Continue water fluoridation. 8. Integrate oral health promotion with general health promotion.
Smile agus Sláinte		2019	National Oral Health Policy. No implementation strategy published in 2021.	1. Inequalities in service provision for very young, vulnerable, those with disabilities and elderly. 2. Decline in dental decay since 1980s 3. 30% of 5-year-olds, 40% of 12-year-olds have dental decay. 4. Symptom led use of services for children under age 6. 5. Poor uptake of oral services by the elderly, rising incidence of head and neck cancer in older groups.	1. 41 actions, DoH leading transformation over 8-years 2. Primary oral healthcare approach with Sláintecare ideals 3. Reorient service into 3 streams: primary care (independent practitioners), community care (HSE salaried practitioners) and advanced oral healthcare centres. 4. Care delivered through packages, defined by age 5. Care for adults via medical card only 6. All access will begin at primary oral healthcare, referral to secondary and tertiary care for one off treatment.

				6. Three times more dental practices owned by private practitioners than HSE premises. 7. Current service not designed to deliver prevention and is not a comprehensive primary care service.	7. Upskilling of HSE practitioners required. 8. National oral health evaluation programme with WHO indicators 9. Oral health promotion programmes for disadvantaged and non-fluoridated areas 10. Topical fluoridation programmes for under-6's not supported

2001 – quality and fairness, a health system for you

In 2001, the national health policy 'Qualify and Fairness, A Health System for you' was published (Department of Health and Children, 2001b)**.** It defined 'Schools Dental Services' as free of charge for all and specified a series of actions including: (i) a review of the DHAP (ii) new goals for oral health (iii) the expansion of specialist training programmes and (iv) more use of private sector orthodontists. An accompanying 'Primary Care Strategy' assigned dentists to the 'Primary Care Network'. It recognised the 'particular implications' for dentists delivering public services in privately owned premises however no solution was proposed, nor was there any inclusion for dentists in human resource planning, education or training (Department of Health and Children, 2001a).

2002– the forum on fluoridation: a policy review

Community Water Fluoridation (CWF) was adopted as health policy in Ireland in 1964 (Government of Ireland, 1960). Responding to public concerns regarding patient safety a major policy review of CWF was undertaken in 2002. The review supported CWF as safe and effective while proposing a fluoride reduction in water supplies and toothbrushing recommendations in response to increasing levels of fluorosis (The Irish Expert Body on Fluorides and Health, 2002).

2009 – unpublished national oral health policy

During this research, a Draft National Oral Health Policy' first announced by the Minister for Health in 2007 and completed in 2009 was identified via both strands of data collected (Department of Health, 2009) (Table 4-3). The policy remains unpublished, with an unpublished copy obtained by the lead researcher.

This document acknowledged the 'apparent mismatch between peaks of childhood caries and the age range on which the PDS focuses' and the 'deficiencies in care' offered to special needs groups. The policy is referenced in the HSE National Service Plan 2008 (Health Service Executive, 2007) but according to one interviewee engaged in its development '*it never saw the light of day*' (P6). Another interviewee stated: '*There was a lot of buy in…a lot for everybody…but…it never went through…and then the economic collapse took it off the table*' (P12).

In a response to a parliamentary question in 2009, the then Minister for Health Mary Harney stated: 'The National Oral Health Policy has to be reconsidered in light of the current position of the public finances' (Houses of the Oireachtas, 2009b). By 2011, the HSE National Service Plan signalled the end of the unpublished draft policy stating that a 'new policy framework will be developed' (Health Service Executive, 2011).

2017 – Sláintecare

Oral health did not feature in any other national health policy document between 2001 and 2017 except for one mention of community water fluoridation (Department of Health, 2013). In 2017, the Sláintecare report, a 10-year plan for health reform was published by a cross-political party committee following a 2016 Programme for Government Commitment. It recommends dental care to fall under the remit of UHC and urges reinstatement of the pre-economic crisis DTSS budget as a 'short term' measure (Houses of the Oireachtas, 2017a). A "universal comprehensive package of care" following publication of a new oral health policy in 2017 is recommended.

In 2018, it was adopted as government policy when the 'Sláintecare Implementation Strategy' was published with dentists referenced as community-based care, but no further detail on oral healthcare was provided (Government of Ireland, 2018a). Following this, the first 'Sláintecare Action Plan' was published in 2019 with no mention of oral health (Department of Health, 2019b).

In 2018, 'First 5: A Whole-of-Government Strategy for Babies, Young Children and their Families 2019–2028' was released 'in line with Sláintecare' (Government of Ireland, 2018b). It recommends the introduction of 'a universal dental health package for children under six, supported by a screening/surveillance programme to target key ages and vulnerable groups.

2019 – Smile agus Sláinte

'Smile agus Sláinte' represents the first update to national oral health guidance since 1994. The need for a new policy is attributed to changing population demographics, technologies and treatment requirements (Department of Health, 2019a). It outlines a plan for dental coverage through bundles of care for those under-age-16, vulnerable groups and medical card

holders delivered at various stages throughout the life-course. Out of pocket charges are to continue for the remainder of the population (Table 4-3) (Department of Health, 2019a).

Its publication in 2019 was broadly welcomed by interviewees: '*It's a well-intentioned, well-researched, well-structured document*' (P1) with the emphasis on prevention and integration highlighted: '*…the positives of the policy are…more treatment for medical cardholders and more preventive treatment…those are huge positives* (P3)' and '*…that integrated system…everybody can endorse*' (P13).

'Smile agus Sláinte' proposes the reorientation of dental services for children from salaried services delivered in State owned premises to individual dentists contracted to provide treatment in "primary oral healthcare settings" (Department of Health, 2019a). This significant change was highlighted by interviewees: '*The pivoting of the profession is very ambitious…it's a seismic task*' (P4). While the 'primary care approach' was largely supported: "I*t's more sustainable long term… I think that the Public Dental Service* [Table 4-2] *needs to… become what the policy envisages, a high-risk service*' (P1).

The identification and management of vulnerable children was a concern raised by some: '*We need a very clear safety system for children who may need a little bit extra'* (P10). Along with the acceptability of the proposal to the dental profession: '*They have assumed that there will be no kickback from the community dentists but not everybody wants to see special care adult patients…if a person isn't good with children…they shouldn't be seeing children'* (P10). There were also significant concerns regarding the workforce skill mix available: '*The whole area of higher end training and specialization necessary…was deliberately underplayed*' (P4).

4.4.3 The politics stream

The strongest and most persistent finding emerging from both the interviews and documentary analysis is the low political interest in oral health in Ireland. This is surmised by an interviewee: '*Oh god there's absolutely no [political] interest, none, not at all, they've bigger fish to fry…dentistry isn't a priority*' (P2).

From the documentary analysis it is evidenced by the absence of oral health content in

national health policies (Department of Health and Children, 2001a, 2001b, 2003; Department of Health, 2012). Further reinforced by the failure to implement most recommendations from commissioned reports, research, guidelines, and policies over two decades (Gelbier, 2002; Crowley *et al.*, 2005; Department of Health, 2009; Irish Oral Health Services Guideline Initiative, 2009; Whelton *et al.*, 2009; Irish Oral Health Services Guideline Initiative, 2010, 2012).

Additionally, according to an analysis of reports commissioned by the Department of Health, the absence of dental leadership in the health Department and an advocate for oral health in national management in the HSE resulted in a failure to promote oral health and drive policy nationally (Oral Care Consulting, 2009; PA Consulting Group, 2010) (Table 4-4). An interviewee stated: *'There was a lot of messing, the role of the chief dental officer lay fallow for a while…in the department there was a lack of willingness, a lack of lobbying, a lack of leadership*' (P6). The political disinterest following the impact of austerity measures was also noted: *'[Public Dental] Clinics were closed, and nobody complained. Nobody missed them. That's frightening*.' (P1).

The exception is the high political priority attributed to orthodontics. In times of scarce resources orthodontics received precedence. This was criticised in a report commissioned by the DoH in 2002 (Gelbier, 2002): 'One wonders about the logic of providing orthodontics at a time when there appears to have been many other needs to be satisfied (e.g. tooth decay in young children)'. An analysis of documents found that in 2015, as austerity measures remained in place, additional public funds were allocated to orthodontic care (Health Service Executive, 2014). While in April 2021, politicians raised concerns regarding orthodontic waiting times during a governmental committee debate that was established to consider the difficulties faced by low-income adults accessing publicly funded dental care (Houses of the Oireachtas, 2021d).

This priority was reflected on by an interviewee: '*Orthodontics will always have a conversation because they're the articulate people…When you represent and advocate on behalf of the vulnerable adult, and the child, it falls on a political deaf ear. And that's the fact*' (P10). and another: '*Politically what we know is that the one important thing is orthodontics…the middle-class voter wants free orthodontics for their child and so that's what*

the politicians go for' (P6).

Table 4-4 details Irish health ministers, their political affiliation along with the presence of expert dental opinion advising government during the study period. This overview illustrates a predominance of centre right politicians responsible for health in Ireland. The exception is a centre-left minister in 1994 which coincided with political priority for oral health policy followed by policy implementation and subsequent public dental system reform.

Table 4-4 An overview of key political actors in Irish Oral Health Policy landscape: 1994-2021

Year	Health Minister Political parties in government with ministerial party in bold	Dental presence in Department of Health
1993-1994	Minister Brendan Howlin *Fianna Fáil/**Labour***	Assistant Chief Dental Officer
1994	Minister Michael Woods ***Fianna Fáil**/Labour*	Assistant Chief Dental Officer
1994-1997	Minister Michael Noonan ***Fine Gael**/Labour/Democratic Left*	Assistant Chief Dental Officer 1994-1995) Appointed 'Chief' Dental Officer (1996)
1997-2000	Minister Brian Cowen ***Fianna Fáil**/Progressive Democrats*	Chief Dental Officer
2000-2004	Minister Michael Martin ***Fianna Fáil**/Progressive Democrats*	Chief Dental Officer
2004-2011	Minister Mary Harney *Fianna Fáil/**Progressive Democrats***	No Chief Dental Officer
2011	Minister Mary Coughlan ***Fianna Fáil**/Progressive Democrats*	No Chief Dental Officer
2011-2014	Minister James Reilly ***Fine Gael**/Labour*	No Chief Dental Officer 2011-2013 HSE National Oral Health Lead seconded 2 days a week as Chief Dental Officer in 2013
2014-2016	Minister Leo Varadkar ***Fine Gael**/Labour*	Chief Dental Officer (Part-time)
2016-2020	Minister Simon Harris ***Fine Gael**/Fianna Fáil*	Chef Dental Officer
2020-Present	Minister Stephen Donnelly (incumbent) *Fine Gael/**Fianna Fáil***	Chief Dental Officer

- *Fianna Fáil (FF): Dominant from 1997-2007, nationalist and conservative, the largest and oldest political party in Ireland at that time.*
- *Fine Gael (FG): Traditional rival of Fianna Fáil a party of the centre right, liberal and conservative. Both FF and FG have seen their once broad popularity decline in recent years.*
- *Progressive Democrats (PDs): Formed by a group split from FF, pursued economically liberal policies with a strong low-tax, pro-business focus. Had considerable influence over government policies particularly economic and health policy.*
- *Labour: A party of the centre left described as a democratic socialist party.*

4.4.4 The process stream

The process stream is concerned with policy development (Howlett, 2019). For this research, the development of the 'Dental Health Action Plan' (DHAP) (Department of Health, 1994a), the unpublished Draft National Oral Health Policy in 2009 (Department of Health, 2009) and 'Smile agus Sláinte' (Department of Health, 2019a) are most relevant.
An overview of the key policy milestones for oral health in Ireland is illustrated in Figure 4-2

Development of the Dental Health Action Plan

A DoH report in 1988 found the public dental service was failing in its statutory duty to provide dental care for eligible adults (Department of Health, 1988). By 1990, public anger arising from media reporting of medical card holders with missing teeth drove oral health onto the political agenda (Gelbier, 2002).

According to an interviewee: '*What was appearing in the media was that the elderly were complaining they couldn't get dentures…and the big complaint about orthodontics, you couldn't get the kids teeth straight…so those two things were piling in on top of politicians*' (P11).
In the early 1990's the need for a new health policy for Ireland was emerging [67]: "…not only were the department [of health] devoting attention to teeth but an overall health strategy….so the plan for the dental services fitted" (P11).

At the same time, findings emerged from a national survey of adult oral health demonstrating that lower socioeconomic groups had poorer oral health, and greater treatment needs than the general population (Whelton *et al.*, 2007). This is described by an interviewee: *'Everyone knew medical card holders couldn't get a service, it was just…inequitable…the hard evidence really showed it'* (P6).

According to both strands of data in this research, the media spotlighting oral health inequalities at the same time a national health policy was under development combined with the outcomes from the national survey provided an opportunity for oral health to briefly garner political support. The 'Dental Health Action Plan' was subsequently published in 1994 (Department of Health, 1994a).

This is described by an interviewee*: "Talk about right party, right place, right time…The Secretary General, the Minister, everybody was on the same page. It was a transformative moment. It was presented as such, it was believed as such, this just wasn't a one-off kind of initiative*." (P11).

An outcome of the DHAP was the establishment of the DTSS scheme following negotiations with the dental professional representative group, the Irish Dental Association (IDA) (Department of Health, 1994a).

This success is attributed to shared leadership, collaboration, and effective communication by interviewees: '*The key thing was…leadership, enlightened leadership on all sides, totally committed people with very good communication skills…who saw they were doing something good*.'; (P11) and
'We had really good representation in the Department [of Health] at the time…and the civil servants were skilled' (P6).

Development of the unpublished Draft Oral Health Policy

According to an analysis of parliamentary documents, an investment in dental research of £1 m along with an expenditure of £2.34 m on commissioned reports between 1999 and 2007 brought oral health back onto the political radar (Houses of the Oireachtas, 2009c). On 18th October 2007, the Minister for Health launched the development of a new Oral Health Policy (Irish Dentistry, 2007).
According to an interviewee, a report advocating for reform of the Irish dental profession by the competition authority (The Competition Authority of Ireland, 2007) and investment in dental research instigated policy development: '*The drivers were The Competition Authority report…the Department [of Health] had spent a lot of money on research…and the legislation, anybody could see the dentist act needed to be updated'* (P12).

Documents identified during the course of this research reveal that a consultative and core policy development group was formed in the DoH in 2007 (Department of Health, 2009). Two studies were carried out, an analysis of the Public Dental System (Oral Care Consulting, 2009) and an economic analysis on the possible integration of the state dental schemes (the DTSS and DTBS) with the findings presented in March 2008. The draft National Oral Health Policy

was developed by 2009 but remains unpublished.

Development of Smile agus Sláinte

According to the documentary analysis, the development of 'Smile agus Sláinte' commenced in 2013 when the HSE National Oral Health Lead was released to the DoH for two days each week to undertake the functions of Chief Dental Officer. One of their primary responsibilities was the development of a new oral health policy (Houses of the Oireachtas, 2016). The policy document details the development process including a series of working groups with oral health professionals, an Academic Reference Group, an accompanying 'Practitioners Reference Group' along with an 'Independent Panel' (Department of Health, 2019a). According to an interviewee:

'*It started well…the policy was announced, feedback was encouraged…but as the years went on the amount of feedback and communication diminished*.' (P7)

Findings from both documents and interviews highlight that progress was slow – the policy development process started in 2013, and the policy was published in 2019 (Houses of the Oireachtas, 2016; Department of Health, 2019a). A key finding from most interviews carried out for this research is a perceived failure to engage with all relevant stakeholders particularly representatives of the HSE and private dental practitioners as the policy was being developed. This is described by an interviewee engaged in policy development: "You needed to bring the dental professional, along with you" (P5) and '*the most important people in the process weren't really considered at all*' (P13).

Interviewees also raised queries about the secrecy and time taken during the policy process: '*hush hush and top secret… It was going in the right direction but too secretive…we were waiting twenty years…'* (P2). While interviewees participating in policy development initiatives queried the extent to which their inputs were considered: '*…the final document, I can't see any evidence of…the group that is explicit…there's a sense the die was cast very early on*' (P4) and from another '*…the first time I saw what was in the thing was the day it came out*' (P13).

4.4.5 The programme stream

The programme stream is focused on implementation (Howlett, 2019). This section will examine oral health policy implementation successes and failures in Ireland during the study period in addition to considerations for the implementation of 'Smile agus Sláinte'.

Based on both sources of data in this study it can be concluded that the implementation of elements of the 'Dental Health Action Plan' and community water fluoridation were successful. As noted in interviews, political support for the DHAP combined with strong dental leadership, collaboration and communication supported implementation. While analysis of documents pertaining to community water fluoridation also illustrate political support, investment in research and proactive engagement by way of the Forum on Fluoridation in response to public concerns (The Irish Expert Body on Fluorides and Health, 2002).

However, a persistent finding emerging from the documentary analysis was the failure to implement a variety of recommendations, guidelines and a national oral health policy during the study period (Gelbier, 2002; Department of Health, 2009; Irish Oral Health Services Guideline Initiative, 2009, 2010; Irish Oral Health Services Guideline Initiative, 2012). This was especially evident with respect to the outcomes of national oral health surveys (Crowley *et al.*, 2005; Whelton *et al.*, 2006, 2009), clinical guidelines (Irish Oral Health Services Guideline Initiative, 2009, 2010, 2012), recommendations to expand dental specialist lists (Gelbier, 2002) and the failure to publish the draft national oral health policy in 2009 (Department of Health, 2009).

This was described by an interviewee: '*The failure to invest, particularly…from 2000 to 2010…is really important, it was possible…a number of initiatives were there but getting them over the line was next to impossible*'(P4) and another: '*So as the Irish economy went up, went down, went sideways… There were opportunities to do things*' (P8).

The absence of a Chief Dental Officer (CDO) in the Department of Health along with the formation of the HSE in 2005 were suggested by interviewees as contributing factors to non-implementation: '*It was a lost decade… from the time the CDO left*' (P4) and *'…the formation of the HSE. All of that was taking a lot of energy in the Department, dentistry wouldn't have*

been even on the radar' (P12).

An assessment of documents found that efforts to review the DTSS scheme failed in 2007 when legal concerns raised by the HSE and Department of Health with respect to negotiation with the Irish Dental Association triggered the Associations withdrawal from discussions (Houses of the Oireachtas, 2007).

Analysis also points to issues with respect to probity assurance within the DTSS scheme (Oral Care Consulting, 2009b) and resistance from the dental profession during negotiations. An interviewee familiar with events stated: '*It was just so slow…they were…trying to block anything' (*P12) and another: '*Between Department of Health, HSE and Dental Association. No party emerges from it with credit…it was a missed opportunity*' (P4).

'Smile agus Sláinte' commits to developing an implementation plan as a 'priority' (Department of Health, 2019a). The time frame for implementation is from 2019–2026 with agreement on an implementation plan with lead partners described as the 'initial focus' (Department of Health, 2019a). In 2021, this remains unpublished with the DoH stating the emergence of the COVID-19 pandemic had caused the policy roll out to be 'delayed' (Houses of the Oireachtas, 2021c). The impact of the pandemic was also of concern for interviewees: *'I'd be sceptical about anything happening… when this is all over…that's gona [going to] look like nothing compared to mental health, cancer, missed appointments…*' (P13).

While relationships between dental practitioners and the DoH were again challenged during the pandemic relating to the provision of PPE: '*They were promised PPE, and they're treating medical card patients, they were solidly promised PPE. And that promise was not delivered…where's the trust going to be now for the oral health policy*?' (P9).

A consistent finding from interviews was the need for better engagement between all stakeholders for implementation to progress: '*…the way forward is you start by talking but unfortunately talking just won't do it…they have to change the mood…buy goodwill… early wins…what's not contentious*' (P4).

The absence of public dental funding was also highlighted: *'The State is going to have to support dentistry in an unprecedented way.'(*P1) and '*…the biggest obstacle they are going to*

face is, is one of the biggest obstacles they always faced…it requires significant additional resources' (P10).

The importance of political support for policy implementation and support for senior officials deemed responsible for it was raised by one interviewee: '*The Chief Dental Officer needs support at the highest level in the Department of Health, including from the Minister, who must want the plan to succeed and state it publicly and not just lip service*' (P11). While the need for urgency was strongly advocated for: '*We're at a breaking point, both in terms of the children's and adults' services, now's the time to start the policy…if we mess this up, we lose one of the best opportunities we've ever had'* (P1)

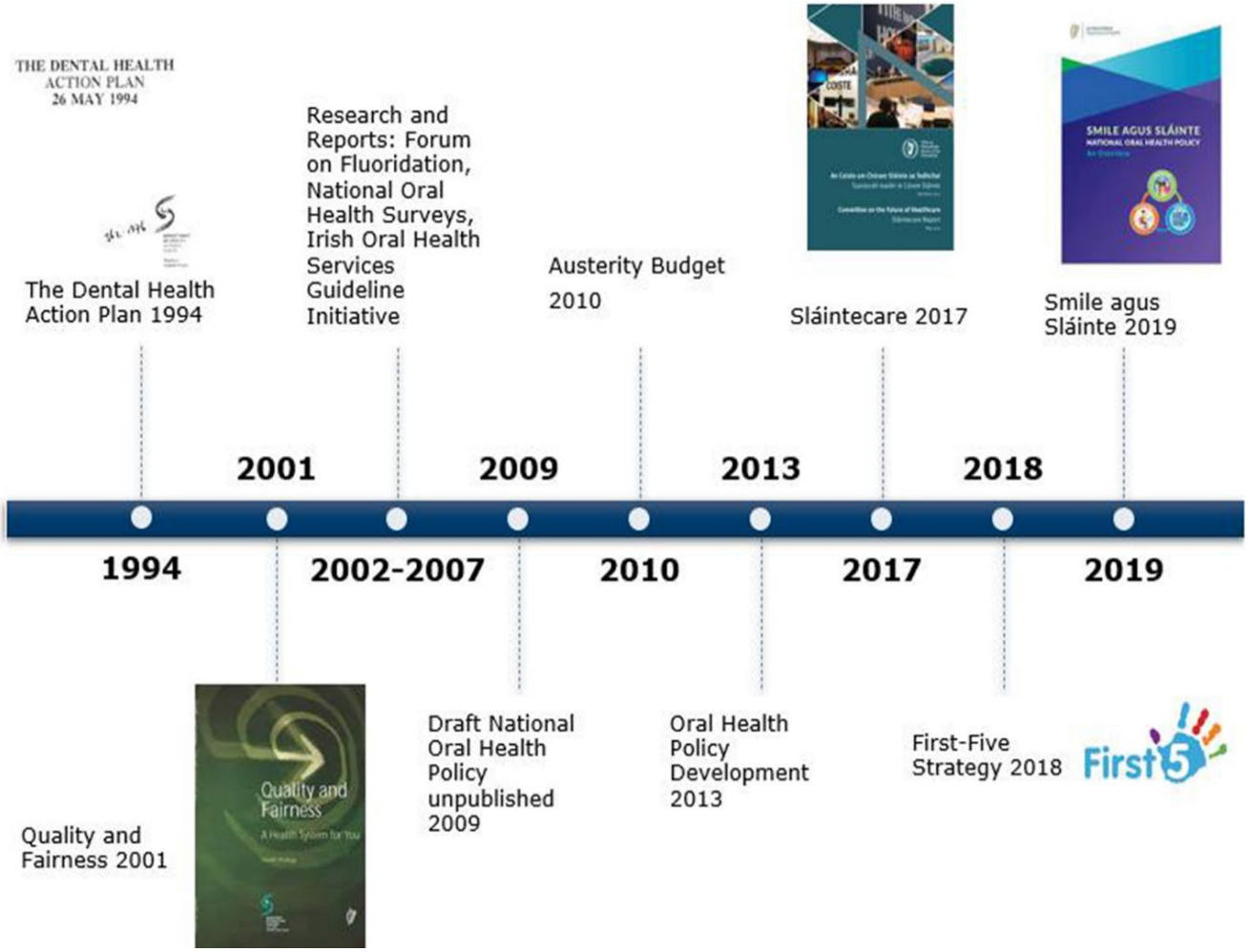


Figure 4-2 Timeline of key oral health policy milestones in Ireland 1994-2021

4.5 Discussion

The low political interest in oral health and the neglect of oral health policy as illustrated by this analysis of the Irish experience reinforces international literature in this area (Peres *et al.*, 2019; World Health Organisation, 2020a). Political power is one of the most important factors in determining the priority given to oral health policy (Benedetti *et al.*, 2015; Janakiram *et al.*, 2018). While the failure to incorporate oral health onto political agendas may exacerbate oral health inequalities, a key feature of the 'problem stream' in Ireland (Galvão and Roncalli, 2021).

Oral health has not featured prominently on the Irish political radar for the vast majority of the 27 years under scrutiny. Legislation governing the dental profession stems from 1985 (Government of Ireland, 1985) and the failure to update national oral health policy for over twenty-five years, both strongly reinforce this international finding (Department of Health, 2019a). The 'Dental Health Action Plan' published in 1994 was initially successful (Department of Health, 1994a). Its publication coincided with the tenure of a left-leaning health minister who, from analysis in this research, is given credit for providing political backing for policy implementation. This is reflective of more recent international literature showing that where left-wing parties are in power there is greater support and probability of delivering universal health coverage and more progressive health policies (McKee *et al.*, 2013).

Furthermore, the policy problem of poorer oral health among lower socioeconomic groups (Whelton *et al.*, 2007), along with demands for orthodontic care achieved prominence at the same time a national health policy was in development. In other words, there was an 'open window of opportunity' for policy change (Kingdon, 1984). Policy agenda setting theory proposes that 'multiple streams' must align for issues previously not high on the political radar to become visible (Kingdon, 1984). This was evident in 1994 and further supported by alignment between the Department of Health and the dental profession (Department of Health, 1994a).

However, there was a failure to build on the 'Dental Health Action Plan' and political attention diminished during the following decades despite the opportunity for action. When the Irish economy experienced exponential growth during the 'Celtic Tiger' years (2000–2007), the

health system benefited from increased spending (Burke *et al.*, 2016a). There was increased investment in dental research (Crowley *et al.*, 2005; Whelton *et al.*, 2006, 2009), in commissioned reports evaluating dental services (Gelbier, 2002; Oral Care Consulting, 2007, 2009; PA Consulting Group, 2010) and a Draft National Oral Health Policy (Department of Health, 2009).

However, there was a failure to increase coverage for dental care (Johnston *et al.*, 2020), to fulfil most of the conclusions and policy recommendations made (Oral Care Consulting, 2007; Irish Oral Health Services Guideline Initiative, 2009; Oral Care Consulting, 2009; Irish Oral Health Services Guideline Initiative, 2010; PA Consulting Group, 2010; Irish Oral Health Services Guideline Initiative, 2012) or to incorporate oral health into general health policies (Houses of the Oireachtas, 2017; Department of Health, 2019b). This mirrors findings internationally where a failure to fully implement stated commitments to oral health coupled with the fragmented integration of oral health into broader health systems is indicative the low importance attributed to it by decision makers (Singh *et al.*, 2010).

This lack of political priority is not unique to Ireland with global oral health suffering from limited political attention (Benzian *et al.*, 2011; World Health Organisation, 2020a). Oral diseases disproportionately impact marginalised groups, have low mortality, and are often considered inevitable which can influence their political importance (Benzian *et al.*, 2011; Benedetti *et al.*, 2015; Janakiram *et al.*, 2018). This persistent underestimation from a political perspective of the burden and impact of oral diseases and an unawareness of their harm creates a situation where high-level acknowledgements of oral health problems by political leadership are “toothless” (Janakiram *et al.*, 2018).

The exception in the Irish context is the political interest in orthodontic care. Evidence suggests that demand for orthodontic treatment is rising as the health and expectations of populations improve, along with increased concerns regarding dental aesthetics (Jawad *et al.*, 2015). In Ireland, access to publicly funded orthodontic care is determined by treatment need rather than income level, with research showing that children of lower socioeconomic status are less likely to have had orthodontic treatment than their better off counterparts (Whelton *et al.*, 2006).

When considering the prominence afforded to orthodontics, a DoH commissioned report pointed to the pressures placed on politicians by "middle class parents" seeking orthodontic care for children as a possible reason for the focus (Gelbier, 2002). In 2021, during a governmental committee meeting on the difficulties experienced by low-income adults accessing dental care, participating politicians discussed orthodontic waiting lists for children, with a dental professional representative cautioning the lack of access to basic oral healthcare as a 'much bigger impediment to child health' (Houses of the Oireachtas, 2021d).

The dominance of orthodontics across the political discourse in the absence of 'essential' primary oral health care services is particularly stark and poses the question, what constitutes essential oral healthcare? The categorisation of 'essential oral healthcare' is a topical issue in the global domain particularly in the aftermath of the COVID-19 pandemic (Benzian *et al.*, 2021). Defining essential oral health care is considered a 'formidable and highly pertinent challenge' (Benzian *et al.*, 2021). However, the engagement of all stakeholders in determining this definition is strongly advocated for, as is ensuring services are rooted in the 'immense unmet oral health needs' across populations with 'political decisions grounded in science and evidence' (Benzian *et al.*, 2021).

The importance of coalescence and a joint understanding between political stakeholders and oral health advocates is echoed throughout the literature (Benedetti *et al.*, 2015; Janakiram *et al.*, 2018). The role of those actors in oral health policymaking is crucial (Adeniyi *et al.*, 2012; Benedetti *et al.*, 2015; Etiaba *et al.*, 2015; Leck and Randall, 2017a) with respect to their use of evidence, in setting the agenda, emphasizing the importance of oral health, and mobilizing resources (Mozhdehifard *et al.*, 2019). An important finding of this study is the lack of policy champions across the oral health policy landscape in Ireland at critical intervals (Table 4-4).

The absence of a Chief Dental Officer in the Department of Health during key periods and an oral health advocate in a position of national authority in the HSE resulted in a lack visibility for oral health in decision making processes (Oral Care Consulting, 2009). This is highlighted in the DoH commissioned evaluation of the public dental service (PDS): 'The leadership deficit in both the Department of Health and the HSE is an impediment to developing and delivering the service' (PA Consulting Group, 2010). A consequence of insufficient leadership and a lack of oral health specialist expertise within policymaking bodies seen internationally is the failure

to publish national oral health policies (Janakiram *et al.*, 2018). This was also evident in the Irish context with the failure to publish the 'Draft National Oral Health Policy' in 2009 and recognise critical inequalities pertaining to the public dental system which still dominate in 2021.

Research examining the power of actors in the oral health policy context also finds the private sector strongly influences the policy making debate (Benedetti *et al.*, 2015). In the absence of skilled dental public health specialists, advocacy initiatives can fall to professional representative groups with a subsequent focus on curative interventions rather than prevention (Janakiram *et al.*, 2018). This is found in Ireland, where dental public health is not a recognised specialty, and the numbers of specialists are low (Gelbier, 2002).

The Irish Dental Association (IDA) represents the interests of private dental practitioners and salaried dentists working in the public system. The collapse of contract negotiations between the IDA, HSE and Department of Health in 2007 was considered a failure across all parties, however, the resistance of the profession was highlighted. This pursuit by the profession of their independent agenda is reflected in international research where efforts to prioritise oral health can be dominated by the private sector perspective (Benedetti *et al.*, 2015).

However, the influence of the dental profession has been significantly restricted since the introduction of austerity measures in 2010. A key component of oral health policymaking is the facilitation of conversations and dialogue between the different participants in the policy process (Singh *et al.*, 2010). This research finds that insufficient engagement has taken place with all dental professionals during the development of 'Smile agus Sláinte'. Stakeholder engagement is "critical" in delivering healthcare change and supporting implementation (Busse *et al.*, 2014). International evidence highlights that efforts to transform health systems are more successful when healthcare professionals are engaged, leading to improved clinical outcomes, patient safety, care quality and financial performance (Norris *et al.*, 2017).

To progress policy implementation and reform in Ireland, the agendas of the DoH and dental professionals require alignment and leadership to unite the policy community. International evidence emphasises the importance of developing a consensus among stakeholders on a shared vision and appropriate strategies (Benedetti *et al.*, 2015). While cautioning that

'simple document-based policy reforms' may not have the desired impact without widespread stakeholder support to carry it through to full funding and implementation (Singh *et al.*, 2010).

The emergence of the COVID-19 pandemic and likely future impacts on health spending has generated concerns amongst participants in this study regarding potential implementation. The pandemic also highlighted the position of oral health within the broader health system. Ireland, like many countries, limited dental services to 'emergency practice' in March 2020 (Government of Ireland, 2020a; Benzian *et al.*, 2021).

By May 2020 'routine dentistry' recommenced under new legal regulations with dental services classified as an 'essential service for Irish society' (Government of Ireland, 2020b). Historically oral health has often been assigned to individual responsibility (Wang *et al.*, 2020). However, moving forward, it must be an integral component of any health system. The emergence of "essential oral healthcare" as a consequence of the pandemic must be defined and further harnessed in supporting future health system reform, particularly in the realm of UHC (Benzian *et al.*, 2021).

This research finds that oral health policy in Ireland is 'path dependant' illustrated by its association to previous decisions and existing institutions (Wilsford, 1994). The Irish path has been one of providing minimal and emergency cover for some population groups, without universal coverage and a failure to focus on prevention and early intervention (Department of Health, 2019a; Johnston *et al.*, 2020). To avoid repeating historical mistakes, evidence suggests that 'strong conjunctural forces' are necessary to move policy away from its existing path onto a new trajectory (Wilsford, 1994). While 'windows of exceptional opportunity' that determine the ways a political system reacts to policy are required (Wilsford, 1994).

In May 2021, The World Health Assembly adopted a historic resolution on oral health (World Health Organisation, 2021). The central recommendation echoes calls internationally for the inclusion of oral health under the universal healthcare agenda (World Health Organisation, 2020a; Wang *et al.*, 2020; Glick *et al.*, 2021). At the time of writing in July 2021, Irish political attention appears focused on the adult medical card scheme (DTSS) (Table 4-2) where the numbers of dentists participating in the publicly funded scheme are rapidly declining and

patients are struggling to access dental care (Houses of the Oireachtas, 2021c). In April 2021, the DoH stated: 'the pandemic has caused…the roll-out of the policy to be delayed…and the proposed contract review (of the DTSS scheme) deferred' (Houses of the Oireachtas, 2021c).

The impetus for inclusion of oral health within UHC emerging worldwide, for which there is an agreed political consensus in Ireland (Houses of the Oireachtas, 2017a), could provide a platform for oral health policy in Ireland and the opening of a window of opportunity to bring about major oral health system reform.

4.6 Limitations/strengths/potential contributions

The key strengths of this paper include the use of a structural framework following best practice recommendations for policy analysis (Walt *et al.*, 2008; Howlett, 2019) and the use of multiple sources of data (Mays and Pope, 2000). Interviews are considered useful in policy analysis to provide rich information, particularly of a sensitive nature.

However, interview data can be ambiguous and subjective (Buse *et al.*, 2012). To overcome this potential limitation, interview data was continually triangulated with a detailed documentary analysis. Although the sample size for this study was relatively small (n = 13), with greater participation among policymakers sought, owing to the narrow oral health policy landscape in Ireland and the information power (Malterud *et al.*, 2016) generated from the interviews, we are confident of the strength of the findings.

Anonymity was granted to each interviewee with all transcripts anonymised and securely stored while the participants identities were known only to the research team. Furthermore, no identifiable quotations will be presented in this or any other publication arising from this analysis.

This research presents an original contribution to knowledge, an in-depth analysis of oral health policy in Ireland, the first study of its kind. This research highlighted the limited number of studies analysing oral health systems and policies along with the political and external influences which shape them. It is incumbent on the authors of this paper to urge for greater research in this area and echo organisations such as the International Association for Dental

Research in advocating for more implementation and oral health systems research (International Association for Dental Research, 2021).

4.7 Conclusion

This research clearly finds that oral health is not a political or policy priority in Ireland. The publication of 'Smile agus Sláinte' in 2019 provides an opportunity for much needed reform of the public dental system. However, to avoid repeating historical mistakes successful reform will require greater political interest than experienced to date, strong political will, and a major focus on implementation, including positive engagement with oral health professionals.

Internationally, calls have been made for the inclusion of oral health as part of the universal healthcare agenda. Ireland's national health policy 'Sláintecare' has agreed political consensus and an implementation plan in progress to deliver universal healthcare. In September 2021, the two most senior personnel responsible for Sláintecare resigned. In the aftermath of this, the Irish Government recommitted its promise of universal healthcare, however the extent that it will be implemented remains unclear. Incorporating oral health reform as an integral part of any future universal healthcare implementation may provide the opening of a window of opportunity.

Learning from this research, genuine engagement with all stakeholders in the development of a detailed implementation strategy for oral health system reform under the remit of universal healthcare is urgently required before the window closes yet again.

4.8 Chapter summary

This chapter presents a case study of oral health policy in Ireland between 1994 and 2021, exploring the key factors impacting policy development and implementation (McAuliffe *et al.,* 2022) (Figure 4.3). Using Howlett's Five Streams Framework, the study draws on documentary analysis (n=125 documents) and semi-structured interviews with 13 experts to examine the policy processes, actors, and contextual factors shaping oral health policy development and implementation. Findings demonstrate that oral health in Ireland has been persistently under-prioritised within national health policy, with limited publicly funded oral health coverage. Despite sporadic reform efforts, most notably the Dental Health Action Plan (Department of Health, 1994a) and Smile agus Sláinte (Department of Health, 2019a), policies and recommendations were poorly implemented.

Austerity measures during the economic crisis further restricted coverage, while political focus disproportionately favoured orthodontics over primary care. The study highlights systemic weaknesses including inadequate stakeholder engagement, fractured leadership, and the long-standing absence of a Chief Dental Officer, which collectively contributed to policy inertia.

While Smile agus Sláinte marks a policy opportunity, its delayed implementation and limited transparency during development signal ongoing barriers. The research underscores that meaningful oral health reform in Ireland requires political will, policy champions, and active engagement with all sectors of the dental profession. It also contributes to international understandings of how low political interest, even in high-income countries, can undermine efforts toward universal and equitable oral healthcare.

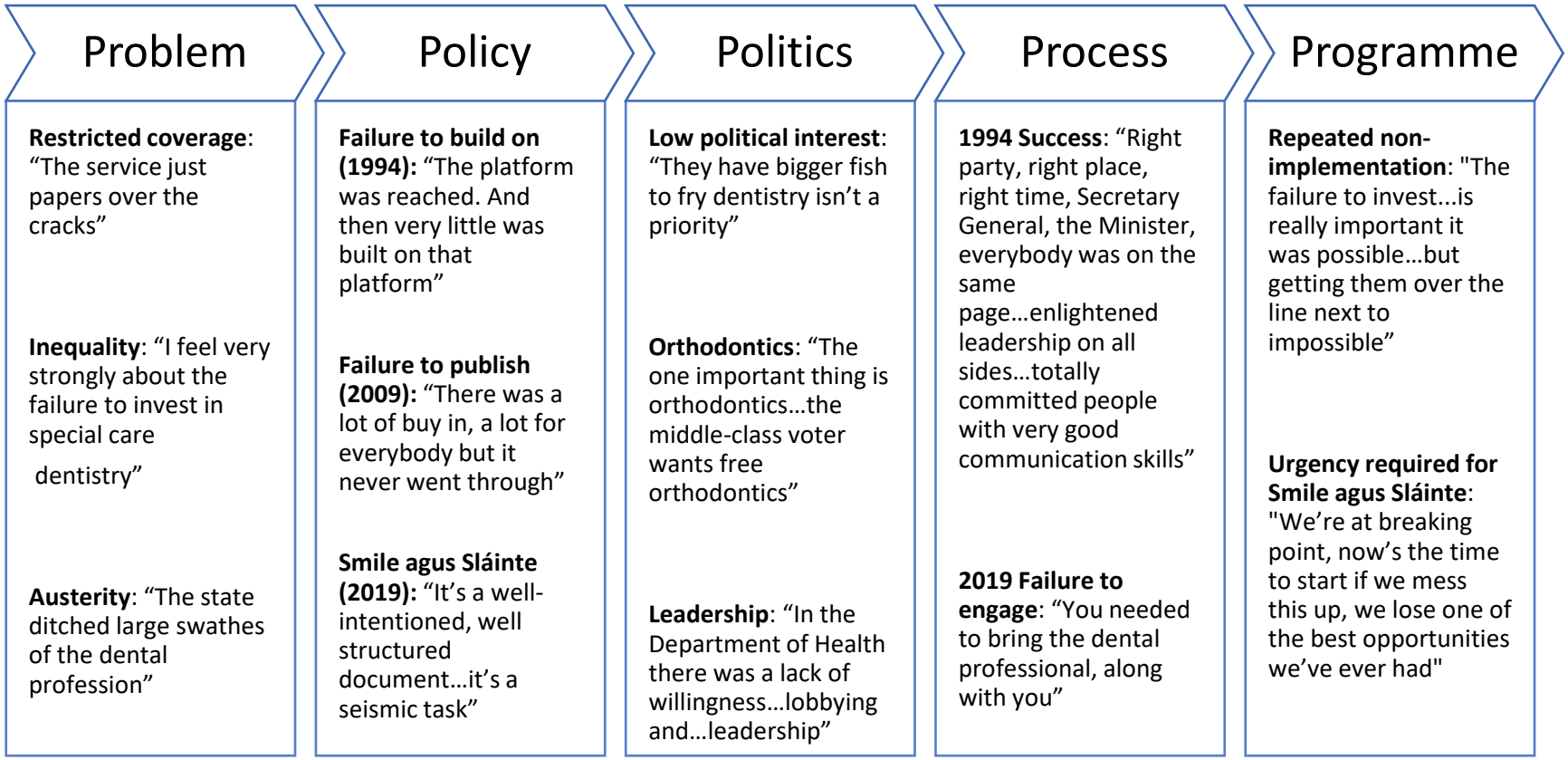


Figure 4-3 summary results Irish oral health policy analysis 1994-2021

Chapter 5 - Study 2

‘At a tipping point’: A comparative analysis of oral health coverage for children across six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain

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5.1 Abstract

Background

Dental caries remains a significant public health problem for children with continuing calls to incorporate oral health under the Universal Healthcare domain (UHC). However, there is little knowledge on the variations in the coverage, financing, and access to child oral healthcare across Europe.

Methods

This inter-country comparative analysis provides a detailed description and mapping of publicly funded oral health coverage across six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain. A multiple case study approach was adopted encompassing two strands of data collection: a documentary analysis and in-depth interviews with experts from each country. The WHO Universal Health Coverage Cube was used to guide data collection and analysis.

Results

Two broad models of child oral health coverage were found: those systems adopting 'universal' approaches (Denmark, Germany, Hungary, and Scotland) and those restricting coverage by 'targeting' children by age or where they live (Ireland and Spain). In countries without universal coverage (Ireland, and Spain), the private sector assumed a significant role, leading to substantial out-of-pocket expenses for families. This was also evident in Hungary owing to barriers in accessing its publicly funded oral healthcare system. Preventive oral healthcare was also attributed a lower priority in these countries, however a prominent observation across all countries was the necessity for a stronger focus on prevention. Each country with universal oral health coverage (Denmark, Germany, and Scotland) except for Hungary demonstrated a trend of expanded coverage and regulatory reform achieved using oral health data, political support and engaging the dental profession. While a failure to implement policy and system reform was evident in the remaining countries with the impact of the 2008 economic crisis particularly evident in Ireland and Spain.

Conclusions

This research finds that child oral health coverage in some European countries is 'at a tipping

point', with recognition of the need for reform evident in Hungary, Spain and Ireland while most 'universal' systems remain on alert to maintaining the broad coverage in place. To maintain and progress UHC for oral health there must be an emphasis on prevention, on addressing inequalities faced by children excluded from care and on advocacy using quality oral health data to engage both dental professionals and political will.

Keywords Universal health coverage, Oral health, Childhood dental caries, Oral health policy, Health service accessibility

5.2 Background

Oral health is increasingly positioned as a fundamental human right and 'integral to general health' (Watt *et al.*, 2019; World Health Organisation, 2022). While oral diseases are largely preventable, it is estimated that approximately half of the global population suffers from some form of oral disease (World Health Organisation, 2024a).

Dental caries is one such condition which has an impact across all ages but particularly in children (Fraihat *et al.*, 2019). It is the most common disease of childhood and is considered a 'major global public health challenge' (El Tantawi *et al.*, 2018; Goldfeld *et al.*, 2022). In addition to causing pain and infection, dental caries can lead to difficulties in eating and speaking along with reduced physical development, self-esteem and lower school performance (Guarnizo-Herreño *et al.*, 2019; Peres *et al.*, 2019). The high prevalence of dental caries also has a major societal cost with the global economic burden of the disease estimated at $245 billion (Vujicic and Listl, 2020).

Although the aetiology of dental caries is complex, influenced by biological factors and the social and commercial determinants of health, there is significant evidence supporting the impact of preventive approaches in improving oral health outcomes (Tinanoff *et al.*, 2019; Petersen *et al.*, 2020). Interventions including community water fluoridation (CWF) and the topical use of fluorides, oral health assessments in the early years, parental counselling and school-based initiatives have shown significant benefits (Petersen and Ogawa, 2016; Moraes *et al.*, 2021; Foote *et al.*, 2023). Furthermore, healthcare systems that offer regular access to oral healthcare services, in combination with preventive public health measures, may lead to improvements in the prevalence of dental caries (Goldfeld *et al.*, 2022). However, any 'downstream' interventions should be integrated with more radical up-, mid-stream and integrated approaches, delivered in a proportionate manner to guard against the risk of increasing rather than decreasing socio-economic inequalities (Watt *et al.*, 2019).

Despite this strong evidence base, national governments have demonstrated 'slow, limited and uneven adoption' of policies and strategies to improving children's oral healthcare, particularly for very young children and those most socially deprived (Crall and Vujicic, 2020). In many countries, oral health services are considered a non-essential component of health

systems and are consequently excluded from reform and progression towards Universal Health Coverage (UHC) (Winkelmann *et al.*, 2023). This is perpetuated by a lack of political priority for oral health, poor integration of oral healthcare within the broader healthcare system and the historical consignment of oral health to the realm of 'personal responsibility' (Benzian *et al.*, 2011; Wang *et al.*, 2020; Quiñonez, 2021; McAuliffe *et al.*, 2022).

Consequently, children, particularly the most vulnerable, face barriers in accessing oral healthcare. Global evidence indicates that these groups are inadequately served by primary oral healthcare (Hosseinpoor *et al.*, 2012; Petersen *et al.*, 2020). Furthermore, there are 'substantial' inequities both within and between countries with respect to coverage for primary oral healthcare for children (Petersen *et al.*, 2020).

Based on patterns of organisation and financing, researchers identify six defined 'models' of oral healthcare delivery in Europe (Table 5-1) (Widström and Eaton, 2004). These models are the Nordic, Bismarckian, Beveridgian, Hybrid, Southern European and Eastern European models. The Nordic model (e.g., Denmark) is typically characterised by a large public dental service for children which is operated by salaried personnel and financed by taxation (Kravitz *et al.*, 2015). There is also a private, non-salaried sector, that may be subsidised by public finance (Widström and Eaton, 2004). In Germany, the Bismarckian model is based on statutory health insurance split into public social insurance (SHI) and private health insurance (PHI) (Ziller *et al.*, 2015). Most oral healthcare costs are reimbursed, with services typically provided by independent (non-salaried) practice-based dentists (Ziller *et al.*, 2015). The Beveridgian model originated in the United Kingdom (e.g. Scotland) where publicly financed dental care is delivered by independent dentists contracted and financed via the tax funded National Health System (NHS) (Sinclair *et al.*, 2019).

A Hybrid model is seen in the Republic of Ireland (Ireland), which has adopted some features of the Beveridgian system. For children, emergency, and 'comprehensive' dental care at 'targeted ages' is provided by salaried dental practitioners directly employed by the state (Department of Health, 2019a). While publicly funded oral healthcare for adults is provided by independent dental practitioners contracted by the state. However, coverage limitations and access restrictions across the population mean the vast majority of dental expenditure in Ireland is privately financed (Johnston *et al.*, 2020; McAuliffe *et al.*, 2022). The Southern

European model (e.g. Spain) is predominately privately financed, with some publicly funded oral healthcare available particularly for children, but its provision is highly variable (Widström and Eaton, 2004; Bravo *et al.*, 2015). Finally, in most Eastern European countries (e.g. Hungary) public provision of care is reducing having previously been considered 'universally free', with 'the majority of care now provided in the private sector' (Widström and Eaton, 2004; Winkelmann *et al.*, 2022; Hajdu *et al.*, 2023).

The World Health Organisation (WHO) has led the recent global recognition of the 'neglect' suffered by oral health and the new emphasis placed on the inclusion of oral health under the UHC agenda (World Health Organisation, 2022). While the WHO Global Oral Health Action Plan 2023-2030 has the overarching aim of implementing UHC for oral health by 2030 (World Health Organisation, 2024a).

A recent report examining oral healthcare systems across Europe found there was 'little known about the large variations between countries in terms of financing, access, coverage and delivery of oral healthcare' (Winkelmann *et al.*, 2022). This echoes previous evidence highlighting the lack of international comparison and 'paucity of information on how oral healthcare systems are organised; how services are delivered, the healthcare professionals responsible for providing care and access to services' (Eaton *et al.*, 2019; Allin *et al.*, 2020).

Previous research demonstrates the advantages of inter-country comparisons in offering insights into the prevalence of child dental caries and the impact of health policies (Goldfeld *et al.*, 2022). While a detailed understanding of how different systems operate may provide greater knowledge for healthcare planning and policy-making within the UHC domain (Eaton *et al.*, 2019; Folayan *et al.*, 2021).

Thus, the objective of this research is to provide a detailed description and mapping of publicly funded oral health coverage for children across six European countries, each representative of a model for the provision of oral healthcare, and to report on that coverage in accordance with the World Health Organisation Coverage Cube.

Table 5-1 Models of oral healthcare delivery in six European countries

Country	Model	Main source of general healthcare financing	Children's oral health cover
Denmark	Nordic	Tax financed	Universal
Germany	Bismarckian	Social Health Insurance	Universal
Scotland	Beveridgian	Tax financed	Universal
Hungary[1]	Eastern European	Social Health Insurance	Universal
Ireland	Hybrid	Tax financed	Targeted*
Spain	Southern European	Tax financed	Targeted*

Note: *Targeted systems offer coverage for oral healthcare at specific ages and or in specific regions/locations.

1: In Hungary the formal eligibility is that of a universal model of oral health coverage for children. However, unlike the other universal models, there is evidence that owing to practical access barriers, universal eligibility does not equate to universal accessibility (Winkelmann et al., 2022)

5.3 Methods

5.3.1 Overview

This research set out to perform an inter-country comparison of publicly funded oral health systems for children. Marmor (2012) outlined three purposes for engaging in inter-country research on health systems and policies:

- Gaining insights into the structure and policies of national healthcare systems,
- Understanding the rationale behind their configuration,
- Deriving lessons from the experiences and practices of other countries.

Well conducted inter-country comparisons can provide a rich source of evidence and 'exert a powerful influence' on policymakers (Papanicolas and Smith, 2013). However, comparisons can be problematic with a lack of appropriate theory guiding the identification of data, justification for country selection and analytical approach which have been often identified as common shortcomings (Nolte and McKee, 2005).

Inter-country comparisons can 'benefit greatly' from methodological triangulation to strengthen the quality of studies (Cacace *et al.*, 2013). This research followed a multiple case study approach requiring the researcher to gather data from various sources to comprehensively capture the complexity of each system.

Multiple case studies enable an understanding of data both within and across different systems with the evidence generated considered 'strong and reliable' (Yin, 2014). As such there were two strands of data collection in this research (i) a documentary analysis and (ii) semi-structured 'elite' in-depth interviews with experts from each country (Van Audenhove and Donders, 2019). Findings from both strands of the data were analysed and triangulated together to generate the results. Despite the initial intent to provide inter-country comparison, due to the poor quality of data available, findings are presented individually for each country with comparisons drawn where appropriate.

5.3.2 Data collection

5.3.2.1 Country selection and target population

Cacace et al., (2013) highlighted the importance of explicit selection of comparator countries, ensuring their justification reflects the research objective. For the purpose of this analysis the following countries were chosen Denmark, Germany, Scotland, Hungary, Ireland, and Spain. To be selected, countries had to demonstrate the following characteristics:

1. be representative of the various health systems throughout Europe (i.e., social health insurance vs. tax-financed, multi- vs single-payee, centralised vs de centralised and the differing models of dental systems previously categorised across Europe (Sinclair *et al.*, 2019),
2. demonstrate effective oral health promotion and prevention regimes for children as evidenced by low d_3mft/D_3MFT (less than or equal to 1) and percentage with no obvious caries at age 12 (70% or greater)[1] (Broadbent and Thomson, 2005) or ICDAS 0-3 (Pitts and Stamm, 2004) and
3. have a history of or planned oral health system reform.

The study focused on publicly funded oral healthcare for children. In most countries, children are defined as those under the age of 18. Due to time constraints, it is beyond the scope of this research to consider oral health coverage for special needs populations and other vulnerable groups.

5.3.2.2 Conceptual Framework

Evidence indicates that due to the diverse nature of national health systems that whatever the purpose for inter-country comparison, a conceptual framework is needed to, 'provide clarity…and to draw meaningful comparisons' (Papanicolas and Smith, 2013). The World Health Organisation Universal Health Coverage Cube (*Cube*) (World Health Organisation, 2008) (Figure 3-2) adapted to describe publicly funded oral healthcare (Allin *et al.*, 2020) was used to guide both data collection and analysis in this research.

[1] Data for Ireland and Hungary did not meet these levels. However, in the case of Ireland, data comes from national survey which is more than 20 years old. While Hungary was considered a fair representation of the Eastern model as most other Eastern European countries reported similar levels.

The three central elements of the Cube are: (i) *Breath*: the extent of population coverage, (ii) *Depth*: the share of costs publicly funded and (iii) *Scope*: the range of treatment/services provided.

5.3.2.3 Documentary analysis

A documentary analysis examined documents derived from a range of sources including publicly available information, grey literature, peer reviewed academic literature and material provided by local experts. A pre-existing data collection template, based on the Cube, was accessed and refined to guide data collection (Appendix F) (Allin *et al.*, 2020). This template required in-depth information to be collated across a range of sectors in the oral health system including relevant laws, regulation, organisational structures, personnel and the three core features of the Cube: the breath, depth, and scope of oral healthcare coverage.

A search strategy (Appendix G) was developed with the assistance of a specialist medical librarian with the aim of identifying the relevant peer reviewed literature that described or compared publicly funded oral healthcare systems for children under the age of 18 years in the six representative countries. Other documents were identified by searching sources including (i) Government websites, particularly Ministries of Health and legislative databases, (ii) individual country health service platforms (iii) oral health professional associations and (iv) international organisations. Documents reviewed included relevant publications by the European Observatory for Health Systems and Policies, the Council of European Dentists and the WHO, national government policies and strategies, clinical guidelines, and health service reports.

The completed template incorporated data derived from both academic and other documents and was presented to two experts from each country for their review, following which these experts were invited to participate in interview. Each country's data was updated in the light of the 'local' expert feedback. The detailed templates for each country are available on request.

5.3.2.4 'Elite' interviews

Elite' interview participants are those who have a particular professional expertise or a close proximity to powerful roles within a system or process (Morris, 2009). Within health systems and policy research such interviews are beneficial for verifying information, providing access to narratives about events and sharing institutional knowledge that would be otherwise unavailable (Mikecz, 2012). In this study, an elite interviewee was someone possessing a high level of expertise in dental public health[2] or having served as a Chief Dental Officer[2], either currently or in the past. Those individuals were purposively identified from the national documentary analysis, the knowledge of the research team or based on the recommendation of other interviewees. A piloted interview guide informed by the literature was used during interviews and was continually updated throughout the interview process.

A total of sixteen elites (*n=16*) were invited to partake and fourteen (*n=14*) consented. The sample consisted of two (*n=2*) participants from each country involved in the analysis along with two experts (*n=2*) from non-participatory countries, recruited with the aim of providing an overarching view of children's oral healthcare in Europe. The sample consisted of eight (*n=8*) dental public health experts, six of whom were at a senior position in academia (*n=6*) and two were affiliated with the health service (*n=2*). While a total of six participants (*n=6*) were present or former country Chief Dental Officers. For logistical purposes all the interviews were conducted via teleconference (MS Teams) between May and September 2023.

5.3.3 Data analysis

Best practice for qualitative document analysis describes finding, selecting, appraising, and synthesising data which are then organised into major themes through content analysis (Bowen, 2009). This approach was followed, with analysis further directed by the WHO Coverage Cube (*Cube*). Qualitative data analysis software (NVivo 12) was used, with the data from the documents initially recorded into the data collection template under key headings

[2] In this research a 'dental public health expert' was defined as an individual at a senior position in an academic or health service setting, with additional post graduate training in dental public health. A 'Chief Dental Officer' was the senior civil servant providing oral health advice to a Health Ministry.

guided by the Cube. Interviews were transcribed verbatim. Operational definitions derived from the Cube, in line with the data collection template, were generated and the outcomes from the documentary analysis and the interviews were combined and coded together. To ensure triangulation, the findings from the documents were continually analysed together with those from the interviews.

The data from the document analysis enabled the generation of a rich description of the key features of each system (Bowen, 2009). However, document analysis is said to be 'powerfully' combined with other methods within qualitative research (Dalglish *et al.*, 2020) and the 'elite' interviews in this study provided critical contextual information along with country specific perspectives.

5.3.4 Ethics approval

Ethics approval for the study was granted by the Clinical Research Ethics Committee (CREC) of the Cork Teaching Hospitals at University College Cork (CREC) (Reference number: ECM 4 (J)12/11/2019). All research practices were carried out in accordance with the regulations determined by the CREC. At all times, ethical concerns including ensuring confidentiality, obtaining informed consent, and preserving anonymity were adhered to. Informed consent to participate was granted by each participant.

5.4 Results

The results are presented according to the dimensions of the WHO Coverage Cube (Figure 3-2) along with other key oral health system characteristics and include both documentary and interview findings triangulated.

5.4.1 Breadth of coverage: who is covered?

This analysis found two general categories with respect to the 'breadth' of oral healthcare coverage: those with 'universal' approaches and those 'targeting' specific age groups (Table 5-2). In all the included countries children are legally defined as those under the age of 18. A universal model was found in Denmark, Germany, Scotland, and Hungary where all children under the age of 18 are eligible for oral healthcare (Ziller *et al.*, 2015; Ministry of the Interior and Health, 2023; Anderson *et al.*, 2022; Hajdu *et al.*, 2023). While in Ireland and Spain, 'targeted' systems operate where children of specific ages are 'targeted' for emergency and routine oral healthcare, which is strongly dependant on resource availability and/or where a child lives (Bravo *et al.*, 2015a; McAuliffe *et al.*, 2022; Department of Health, 2019a).

Table 5-2 Overview of eligibility criteria for publicly funded dental care for children.

Country	Eligibility criteria
Denmark	**Universal population** **Age: All** children and young people under the age of 22 via the 'Public Dental System' automatically enrolled at birth
Germany	**Universal population** **Age: All** children under the age of 18, increasing to age 23 if they are not working and age 25 if a student. **Insurance status**: membership of 'sickness fund' enables access to SHI accredited dentists (99% of all dentists).
Scotland	**Universal population** **Age: All** children and young people under the age of 26 are eligible to receive oral healthcare **Insurance status**: Oral healthcare delivered via **'**NHS' dentists (86% of all dentists)
Hungary	**Universal population** **Age:** All children under the age of 18 **Insurance status:** Oral healthcare delivered via private practitioners in contract with NEAK only (31% of dentists opt into this scheme).
Ireland	**Targeted population** **Age:** Children under age 16 eligible for 'emergency' care only. 'Comprehensive' care targeted at children aged 5, 8, 12 via a 'Public Dental Service'. **Location:** Access varies due to resource and personnel shortages across different parts of the country.
Spain	**Targeted population** **Age:** Most programmes target children aged between 6-7 and 14 and 15 years old. **Location:** Eligibility is dependent on and varies according to the location in which a child lives and the target age category in operation in the individual region.

Note: In interpreting these data, it should be noted that there are a range of auxiliary oral healthcare professionals engaged in the delivery of oral healthcare for children varying in density, training and scope of practice. For example, in Spain there is no official registry of dental hygienists while in Germany there are low numbers of hygienists but instead dental assistants with additional training. Contrastingly there is mandatory professional registration of dental hygienists in the remaining four countries (Denmark, Scotland, Ireland and Hungary) who operate to varying degrees within the system.

There are a range of differences within and between the 'universal' and 'targeted' approaches. In Denmark, the tax-funded health system operates across three administrative and political levels: the state (holding overall regulatory supervisory responsibility), the regions (responsible for hospital and general practitioner-based care) and the 98 municipalities (responsible for primary care services including child and youth dental care) (Winkelmann *et al.*, 2022). Oral healthcare for children is the responsibility of each 'municipality' and access to free preventive and curative oral healthcare is a legal obligation (Ministry of the Interior and Health, 2023). A distinction is required in the case of adults in Denmark where there is no 'free' dental care, rather a system of subsidies operates prioritising prevention and basic oral healthcare (Winkelmann *et al.*, 2022).

The 'municipality population register' is a database from which 99% of children are automatically enrolled in the *Public Dental System*. This is used to monitor the regularity of dental visits, with repeated absences from dental care reported to social services (National Board of Health, 2020; Richard *et al.*, 2022; Danmarks Statistik, 2022). As described by an interviewee:

'You can say that 99% of children are actually born into the programme…it's not something that you have to seek, it is automatic…if the children don't show up, then municipalities are obligated by law to seek you'. (P3)

In Germany and Scotland, all children under the age of 18 and young adults up to the age of 25 and 26 respectively, are eligible to receive oral health care, free-of-charge, within their broad statutory health systems i.e., in Germany under Social Health Insurance (SHI) and under the National Health Service (NHS) in Scotland. In Germany, approximately 89% of the population belonged to 96 'sickness funds' under SHI in 2023, while those not entitled to sickness fund membership must join private health insurance companies (National Association of Statutory Health Insurance Funds, 2023). Membership of such a fund reimburses legally prescribed packages of care and most dentists (99%) opt in to have a contract with the SHI, resulting in 80% of 3- to 17-year-olds having at least one annual check-up (Krause *et al.*, 2018; Blümel *et al.*, 2020). In 2019, the Joint Federal Committee (G-BA) largely implemented the so-called *'ECC-concept of the dental profession for dental prevention'*

increasing the number of dental check-ups within SHI for very young children (Ziller *et al.*, 2021). This expansion in population coverage was described by an interviewee:

'We had a big problem with early childhood caries, this gap is now closed in the social insurance system, we can do early detections from 6 months old, and we are satisfied with the offers available' (P1).

Analysis of documents for Scotland, shows that 86% of independent dentists had a contract with the NHS in 2022, with over 65% of children receiving an examination from an NHS dentist in the last two years (TURAS, 2022; Public Health Scotland, 2023a). Furthermore, it is envisioned that every child under the age of 18 in Scotland will have access to the '*Childsmile*' programme (Macpherson *et al.*, 2015; University of Glasgow, 2023). 'Lifetime' registration with dentists has been in place in Scotland since 2010 (Public Health Scotland, 2023a) and was a key underlying aim in engaging all children as explained by an interviewee:

'*We wanted to make sure that every single child could be registered with a dentist, and they had a growing relationship with that dentist'* (P2).

In Hungary, according to the *National Health Insurance Fund Manager (NEAK)*, 'complete basic and specialist dental care' is available free of charge to all those under the age of 18 (National Health Insurance Fund Manager, 2023). Between 2016-2019, according to 'individual level care data' from the NEAK, 20% of 3-year-olds, 55-60% of 5-6-year-olds and 75-80% of 9-year-olds attend the dentist annually (Hajdu *et al.*, 2023). However, in contrast to the other 'universal' systems, most Hungarian dental practices are privately funded, and in 2022 almost 70% of dentists did not have a contract with the NEAK (Kivovics and Székelyhidi, 2022).

However, oral healthcare in Hungary is undergoing 'significant change'. The proportion of dental clinics operated by the state has fallen under 10% with almost 90% of oral healthcare provided by independent dental practitioners in private practice settings. Within this cohort there are dental practices that provide publicly funded oral healthcare whereby dental practitioners enter a contractual arrangement with the state (NEAK practices) and those practices which are fully private, and the patient pays wholly 'out-of-pocket' (Regional

European Association of the FDI, 2023). In contrast to the other 'universal' systems in this research, most Hungarian dental practices are privately funded, and in 2022 almost 70% of dentists did not have a contract with the NEAK (Kivovics and Székelyhidi, 2022).

As evidenced from the documentary analysis, 'it appears that, although by legal definition children under the age of 18 are universally entitled to dental care… in practice this is not implemented', with children aged 0-3 highlighted as a group for which care does 'not systematically exist' (Hajdu *et al.*, 2023). This finding was further emphasised during interviews with one interviewee stating:

'*All children under 18...it sounds great but…is it…real or not?'* (P14) and another: *'The dental care system for children is very simple…all children under 18 [are covered] but accessing it, that is the problem* (P11).'

As mentioned, Ireland and Spain are examples of 'targeted' models. In Ireland, all children under the age of 16 are eligible for emergency dental care, with 'comprehensive' care aimed at 'three designated classes in primary and secondary schools', generally corresponding to children aged 5, 8 and 12 years old (Department of Health, 1994a, 2019a). The basis of the current Irish system emerged from a rationing mechanism in the late 1980s implemented in response to economic constraints, where resources were directed at targeting the age ranges associated with the eruption of permanent teeth (Department of Health-Irish Dental Association-Health Board Working Party, 1979; Department of Health, 1988). This was elaborated on by an interviewee:

'*The targeted approach wasn't going to help every individual child, but you don't have the resources for spreading out to the whole population, so you were trying to…spend what resources you had…to improve the overall standard of oral health'* (P12) and another: *'It was based on the evidence of the time…if we were revisiting it today, we would do it differently'* (P10).

However, as seen in Hungary, there is also evidence in the Irish context that the intention to target children at three intervals was not fully implemented, with children struggling to access care (Duane *et al.*, 2017; Donovan, 2021; McAuliffe *et al.*, 2022). Documentary evidence

highlighted that due to resource limitations children's appointments are being delayed or deferred with 100,000 children awaiting an appointment with the public dental system in 2023 (Houses of the Oireachtas, 2023). While in some cases children are being targeted at one age only, typically around the age of 12 (Houses of the Oireachtas, 2022, 2023).

This finding was reinforced by an interviewee: '*The whole thing [system] got reduced to one class, two classes if you were lucky, depending on the amount of staff that were available…it can be different in every region'* (P12) with the exclusion of young children particularly emphasised by a different participant: *'I have felt for a long time that we should be seeing children at a much younger age'* (P10).

The documentary evidence also observed that 61% of Irish children do not access dental care before the age of 6, with fewer than one in ten children accessing care between the ages of one and three. In most instances the use of services is symptom led, where parents accessed care on an emergency basis (James *et al.*, 2021). This age-inequality was considered by the following comment from an interviewee: *'The Irish state is willing to pay for an annual examination for all adults but not for all children'* (P10).

In 2019, a new national oral health policy for Ireland called '*Smile agus Sláinte'* was published seeking to expand dental coverage for children (Department of Health, 2019a). At the time of writing a 'Strategic Reform Lead' for policy implementation and a 'Policy Implementation Unit' have been established with plans to develop an implementation strategy in 2024. However, the Health Service Executive (HSE) the national government agency tasked with that reform has warned of 'challenges to implementation' citing concerns such as the recruitment pause for healthcare staff (Health Service Executive, 2023a).

Similarly in Spain, children under-age-6 were identified as a 'vulnerable' group largely excluded from a publicly funded dental system which has been described as 'chaotic' and lacking in organised structure (Llena-Puy C *et al.*, 2018). In the Spanish system, for adults there is an 'absence of basic dental coverage' while coverage of dental care for children is dependent not only on the age of the child but the region of residence, resulting in notable disparities observed throughout Spain (Bravo *et al.*, 2015; Llena-Puy C *et al.*, 2018). This inequality was discussed by an interviewee:

'*There are a lot of differences between each region…some offer treatments some didn't... if your childhood was in somewhere like Valencia, you had different dental care than a child in Murcia' (P13).*

These disparities in coverage stem from the broader structure of the health system, wherein each of the 17 regions have their own regional health system and health ministry, thereby retaining primary jurisdiction over the delivery of services (Bravo *et al.*, 2015a). This was further expanded on by an interviewee:

'We are 17 regions, and each region can develop healthcare differently, there are a lot of similarities but also differences' (P9).

Most oral health programmes target children aged between 6-and-7 years up to 14- and-15-years-old. Only Valencia, Catalonia and the Canary Islands include provision for children under-age-6. While in Murcia, children remain eligible for the oral health program only until age-9. Similar to Ireland, evidence from the documentary analysis found that only 11.7% of children aged 0-4 had visited the dentist, increasing to over 69% for those aged between 5 and 14, which correlates to the availability of public dental services (Ministry of Health, 2017).

As observed in Germany and Ireland, there is an increasing recognition in Spain of the need to address inequalities concerning young children who are excluded from coverage. In 2022, the Spanish Government announced a plan to 'homogenise' oral health services nationally to guarantee equity in access regardless of place of residence (Official website of the President of the Government and the Council of Ministers, 2022). This initiative was referenced by a local expert familiar with the development of the policy:

'It is from the birth to 6…it comes from the National Government from Madrid, from the Ministry… and it is inside the regulation to expand primary care services' (P13).

5.4.2 Scope of coverage: which dental services are covered?

The second aspect of the WHO Coverage Cube, the 'scope', illustrates what dental services are provided within the publicly funded system and an overview of all countries included in this analysis is provided in Table 5-3.

Each country commits to a minimum scope of public dental services for children in terms of basic care including the provision of emergency treatment, fillings in permanent teeth and dental extractions. This research found a broad, comprehensive range of services is provided by each 'universal' system (i.e. Denmark, Germany, Scotland, and Hungary) where almost all treatments including referral for specialist care are included (Table 5-3). This coverage was described by a German interviewee:

In general, every normal care, prevention, restorative, endodontic, and so on, that's all covered by the insurances…there is very broad coverage' P4. Similarly, a Hungarian expert described the scope of services covered in Hungary: *'Prevention, emergency, fillings in primary and secondary dentition, fissure sealing, trauma…every treatment is free'* (P11).

Evidence from both the documents and interviews found that in the targeted systems (i.e. Ireland and Spain) there was a priority attributed to the management of permanent over deciduous teeth. In the Irish system, except for emergency dental care, there is no publicly funded dental care for children under the age of five, while the vast majority of 'comprehensive care' is concentrated in targeted groups (Department of Health, 1994a, 2019a). This system, based on policy guidance from 1994 (Department of Health, 1994a) was described by an interviewee: '*We had such an emphasis on permanent teeth over deciduous teeth and that became a mantra' (P10).* While in the Spanish system a *'portfolio of common services'* were specified by *'Royal Decree'* with certain treatments including 'restorative treatment of the temporary dentition' and orthodontic treatment, excluded from the basic package of care (Ministry of Health, 2006).

Access to publicly funded orthodontic care in the systems of the other included countries is restricted to those deemed of greatest clinical need. For example in Denmark those with 'moderate or major malocclusions' are referred for an assessment by an orthodontist

(Ministry of the Interior and Health, 2023) while in Germany the need for treatment is based on five orthodontic indication groups according to clinical severity (Kieferorthopädische Indikationsgruppen, KIG) (Glasl *et al.*, 2006) with similar systems of classification in practice in Scotland and Ireland (i.e. the Modified Index of Orthodontic Treatment Need-IOTN). In Hungary, patients are required to contribute to the cost of the orthodontic appliance, but the clinical work is provided free of charge (National Health Insurance Fund Manager, 2023).

A key difference across countries, was the scope of preventive care available and the importance attributed to preventive oral healthcare. In Denmark and Scotland, prevention occupies a central role in children's oral healthcare. Over half a century ago Denmark had some of the poorest levels of child oral health in Europe and in response the 'Danish Oral Healthcare Act' was enacted, legally mandating the provision of preventive care. This yielded significant increases in the availability of preventive services and a subsequent improvement in oral health (Patel, 2012). This was reflected upon by a Danish expert:

'*The whole culture of prevention has been very successful…we had pioneers in oral health research, we knew the importance of fluoride and non-operative treatment…we implemented this knowledge very early, and it became so much integrated in our system'* (P3).

Similarly in Scotland, Childsmile, a multi-faceted programme delivering prevention in dental practice, in community and in education settings was established in 2005 with the aim of improving children's oral health and reducing inequalities (Macpherson *et al.*, 2015). There was a 'major' improvement in oral health following the introduction of Childsmile, with a 2013 study finding a direct association between the introduction of supervised toothbrushing and a reduction in dental decay in 5-year-olds (Macpherson *et al.*, 2013). This component of the programme was strongly emphasised as the critical element of Childsmile success by local experts:

'*Childsmile getting out of dental practice and going into educational settings… that's the key message…a lot of people want to hear about fluoride varnish and it's like hold on a minute, the toothbrushing, that's where the action is'* (P8).

In contrast, evidence from the other countries highlighted concerns with respect to the

emphasis placed on treatment in comparison to prevention (Table 5-4). The recent expansion of coverage for preventive care for very young children in the German system was highlighted as an important step with respect to an increased emphasis on prevention (Ziller *et al.*, 2021). This was reinforced by an interviewee:

'*The German system is still very much focused on restorative dentistry and especially prosthetics, which has traditionally been very big in Germany. But there is now a focus on prevention, the numbers sealants, varnish etc placed go into the millions' (P4).* While similar changes were sought by a Hungarian expert: '*We have to change the complete system in Hungary instead of focusing on treatment we have to focus on prevention…we need to less paediatric dentistry but more effective' (*P11).

In targeted systems like Ireland and Spain, preventive interventions are primarily focused on specific age groups. These interventions are supplemented by community water fluoridation (CWF), serving as a population-wide preventive measure. In Ireland, CWF covers 71% of the population, while in Spain, it extends to only 10% (Bravo *et al.*, 2015; James *et al.*, 2021). Findings from both the documents and interviews observed disparities within the Irish system concerning the placement of fissure sealants, the cornerstone of preventive strategy with academics and policymakers highlighting the social and geographic inequalities involved (Irish Oral Health Services Guideline Initiative, 2010; Department of Health, 2019a).

This was echoed by an interviewee: '*It was a structure acceptable for its time but there was inequity…the inequity is now worse'* (P12). Similarly in Spain evidence points to a limited availability of preventive care and a social gradient evident in the use of those services which are covered (Ministry of Health, 2017). This was discussed by a Spanish expert: '*Service data show the percent of prevention is very low…it is coming from a philosophical perspective…prevention is still not in the mind of all dentists'* (P9).

Irrespective of the country or system in question a unanimous finding from all participants in this research was a need for broadening the scope of preventive care and reorientating systems to ensure prevention is central at a system level but also at a professional and patient level.

This was reflected on by an Irish expert: '*We need a system that explains things to parents…integral within the general health system…with an income for professionals that acknowledges that they must do prevention*' (P12). And a Danish expert: '*It's like the thinking of 'the end justifies the means'…we still scare the hell out of children having to get a filling at a young age…we need to help them in other ways and not focus on treatment at any cost'* (P5).

Table 5-3 Overview of the scope of public dental coverage for eligible children

Comprehensive services									Specialist care	
	Basic services									
Country	Preventive services			Emergency Care	Deciduous Tooth Tx[1]	Permanent Fillings	Extraction	Endo[2]	Ortho[3]	Other
	Scheduled Exam	Fluoride	Oral Health Promotion							
Denmark	✓	✓	✓	✓	✓	✓	✓	✓	✓ *	✓
Germany	✓	✓	✓	✓	✓	✓	✓	✓	✓ *	✓
Scotland	✓	✓	✓	✓	✓	✓	✓	✓	✓ *	✓
Hungary	✓	✓	✓	✓	✓	✓	✓	✓	✓ *	✓
Ireland	T	T*	T *	✓ [1]	T*	T*	T*	T *	T *	T *
Spain	T	T	T *	T *	-	T	T	T*	-	T *

✓ = Treatment covered, - = not covered, T * = covered but with restrictions or limitations. [1:] All children under the age of 16 are eligible for emergency care.

[1] Deciduous tooth treatment
[2] Endodontic treatment
[3] Orthodontic treatment

Table 5-4 Role of prevention in the child oral healthcare system.

Country	Approach	Legislation	Reform	Financing arrangement
Denmark[1]	• Individual prevention eligibility: Universal child population • General prevention programmes including oral health promotion activities	The Health Act and Dental Care Order (2023)[1]	• 1972: Child Oral Health Act introduced free prevention • 1989: Expanded to those aged 3-18 years • 1997: Included all children • 2022: Increased to age 22	• Publicly funded with most care provided by salaried dentists in state-owned clinics
Germany[2]	• Individual prevention eligibility: Universal child population • 'Group prophylaxis' (OHE, fluoride, screening in schools)	Social Code (SGB) Fifth Book (V) §22[2].	• 1989: IP for children in SHI (12-20 years) • 1991: IP expanded to those aged 6 • 1997-2000: All children • 2019: Increased package of care up to 33 months of age.	• Publicly funded service with most care provided by independent dental practitioners contracted by the state and reimbursed via a fee-for-service basis.
Scotland[3]	• Individual prevention eligibility: Universal child population • Childsmile: ○ Universal[3] ○ Targeted (high risk)	The National Health Service (General Dental Services) (Scotland) Regulations 2010.[3]	• 2005: Action plan for improving oral health • 2006-2008: Childsmile 'Demonstration phase' • 2011: Childsmile nationally available and incorporated into SDR • 2022: Childsmile expansion funding • 2023: New SDR (payment reform)	• Publicly funded service, most care provided by independent dental practitioners contracted by the state. Reimbursed via fee-for-service (FFS), capitation and via other grants/allowances.

Country	Approach	Legislation	Reform	Financing arrangement
Hungary[4]	• Individual prevention eligibility: Universal population • 'Group preventive counselling', school preventive services	CXXIII of 2015 law on primary health care	• Decline in dentists participating in public contracts from 1995 onwards.	Majority out-of-pocket • Prevention in theory provided by independent dentists under a predominantly performance-based FFS model • Owing to the decline in dentist participation this eligibility does not equate to accessibility
Ireland[5]	• Individual prevention eligibility: targeted ages • Community Water Fluoridation (CWF) (71% of the whole population)	S.I. No. 248/2000 - Health (Dental Services For Children) Regulations, 2000. The Health (Fluoridation of Water Supplies) Act, 1960	• 1994: national action plan targeting eruption of permanent teeth • 2010: economic crisis reduced service availability • 2019: national oral health policy proposing expanded preventive care	Majority out-of-pocket • publicly funded prevention provided by salaried dentists in state-owned facilities to targeted ages only • Community Water Fluoridation (CWF) is also state-funded. Outside of these state-funded services, individuals must cover the full cost of out-of-pocket payments provided by independent dentists

Country	Approach	Legislation	Reform	Financing arrangement
Spain[6]	Individual prevention eligibility: targeted population based on region. 'PADI' system in operation in 10 out of 17 ACs.	Royal Decree 1030/2006, of September 15 (national)	• 1989: PADI first introduced in Basque country • 2003-2005: PADI adopted in 6 other regions • 2008: Economic crisis halted reforms • 2018: PADI adopted in Madrid • 2022: Proposal for increased 'homogenised' preventive care across Spain for young children	• Publicly funded care varies according to region (AC) and restricted to target age • There is also variation in provider payment between contracted independent dentists largely remunerated by capitation, salaried models and so called 'mixed models'.

Notes:

1 Municipal dental care. Ministry of the Interior and Health, 2023 (Ministry of the Interior and Health, 2023).

2 Social Code (SGB) Fifth Book (V) (*Statutory Health Insurance. Section 28. Medical and dental treatment. (*German Federal Ministry of Justice ,2023)

3 It is anticipated that all children under the age of 18 in Scotland will have access to Childsmile. However, since the COVID-19 pandemic, there has been a reduction in Childsmile nursery availability and patient participation. NHS, GDS (Scotland) Regulations 2010 (Scottish Statutory Instruments, 2010). SDR: Statement of Dental Renumeration.

4 CXXIII of 2015 law on primary health care (National Legal Repository, 2023). Almost 70% of dental practices in Hungary are fully private practices and do not offer publicly funded preventive care. While with respect to the school screening programme there are geographic and social inequalities in its operation.

5 Houses of the Oireachtas, 2000(Houses of the Oireachtas, 2000). The primary component child preventive care is the application of fissure sealants at targeted ages which following the COVID-19 pandemic and economic crisis is suffering from limited resources nationally.

6 Royal Decree. Annual report on the development of Decree 118/90 on dental care for children in the Basque Country via the Programa de Asistencia Dental Infantil (PADI) programme (Departmento De Salud, 2022). The priority attributed to prevention varies extensively and is entirely dependent on where a child lives and their target age group.

5.4.3 Depth: How much of the costs are covered?

Across the six countries the depth of coverage for eligible children ranges from predominantly deep coverage (i.e. the public programme covers most costs) to shallow coverage (i.e. the public programme covers limited costs). In the event of the public programme not covering costs then the patient must pay for dental care 'privately' which mainly equates to direct out-of-pocket payments. An overview of general, public, and out-of-pocket spending across all included countries along with other financing information is provided in Table 5-5.

The universal systems (i.e. Denmark, Germany, Scotland, and Hungary) are generally characterised by deep coverage for children, almost all care is publicly funded and available 'free of charge' to the patient. As evident in previous comparisons there are distinctions required in the case of Hungary where there is a single health insurance fund that provides almost universal population health coverage (95%). The introduction of a new health insurance system in 1992 resulted in a reduction in the coverage for dental services and an increased emphasis on 'personal responsibility'. Dental services are not fully covered under statutory benefits and fees for services not covered must be reimbursed out-of-pocket (Winkelmann *et al.*, 2022; Sztrilich *et al.*, 2025). Although 'all care' is free of charge for those under the age of 18, the extent to which children have access to publicly funded oral healthcare is determined by the capacity of dentists who are prepared to provide it (Hajdu *et al.*, 2023).

This was emphasised by a local expert: *'The treatment is completely free, but the work is not popular, and we don't have enough paediatric dentists'* (P11). There are no data available on out-of-pocket spending for children's dental care in Hungary. However, evidence suggests that privately funded provision is dominant with 60% of dental care costs across the whole population privately funded (Winkelmann *et al.*, 2022).

In contrast, the other universal systems (i.e. Denmark, Scotland, and Germany) represent deep coverage with minimal out-of-pocket spending. In Denmark, 'child and youth' oral

healthcare is fully funded at the municipality level at a cost of €273m annually[5] [1] This includes all direct costs (including salary and pension contributions) along with indirect costs (including labour and equipment costs) funded by general taxation (Ministry of the Interior and Health, 2023). While most dentists delivering care for children are directly employed by the municipality on a salaried basis (Kravitz *et al.*, 2015).

Oral healthcare for children is offered at public clinics by salaried practitioners, by independent dentists who have entered an agreement with the municipality or by a combination of both approaches (Ministry of the Interior and Health, 2022). More than 91 out of the 98 municipalities employed their own dentists in state owned practices in 2015. Once young adults reach the age of 22, they are directed to the process of securing a private, independent dentist where they may receive subsidised care that can vary from 35-62% depending on the patients age and treatment (Winkelmann *et al.*, 2022). The impact of this salaried structure was discussed by a local expert: *'The subject of dentistry is the focus…not having to deal with who pays for what, but when the child gets to the clinic…it is the child who is in focus, and anyone can afford to get the treatment'* (P5).

In Germany (SHI) and Scotland (NHS), children are exempt from all user charges except for orthodontic treatment outside of qualification criteria and more advanced restorative care (Ziller *et al.*, 2015; Anderson *et al.*, 2022). Within the SHI, payment for services is on a fee-for-service basis while in Scotland in addition to submitting itemised treatment claims for payment, dentists can also receive a range of other payments, allowances and grants including capitation payments for continuity of care (Busse and Blümel, 2014; The Scottish Parliament, 2023). Many Scottish dental practitioners can provide a mixture of NHS and private (out-of-pocket) treatment. While treatment costs are free for some children and young adults under 26, other adults availing of 'NHS' services pay 80% of the cost of care which is capped at £384 for a course of treatment (The Scottish Parliament, 2023).

The significant public expenditure on dental care in Germany as seen in Table 5-5, was highlighted across both strands of this research. According to documents from the KZBV

[5] Data based on personal communication from 'Government Finances', Statistics Denmark

(National Association of SHI Dentists) in 2021 over €16.3b was spent on dental care across the population. This was discussed by a German expert: '*We have very high costs…and that is across all healthcare, dentistry is only a small part of the expenditure'*. In Scotland, the budget for oral healthcare for 2023/4 is just over £476 million (The Scottish Parliament, 2023). While findings from the Scottish Health Survey report indicated that with respect to dental expenditure across the population 75% of participants had NHS treatment with 20% of people paying out-of-pocket for dental care (Scottish Government, 2022).

When considering the depth of coverage, a finding common across all the universal systems were concerns about the financial sustainability of those systems into the future and maintaining political support to uphold the current depth of coverage. This was referenced by a German expert: *'I hope that we will hold what we have now'* (P1) and repeated by a Scottish expert: *'We need to hold the level that we have'* (P2) and another, emphasising a potential increase in private-only provision of dental care particularly with following the COVID-19 pandemic in Scotland: *'There has been anecdotal evidence of dentists ceasing to carry out NHS work'* (P8).

With respect to the targeted systems (i.e. Ireland and Spain), most oral healthcare is privately financed across the whole population. In Ireland, the 'Public Dental System' for children is entirely publicly funded and run by the HSE. This is the only state-funded dental care for children and due to its targeted structure, there are significant gaps in coverage resulting in hight out-of-pocket payments (Department of Health, 2019a; Johnston *et al.*, 2020). According to the Healthy Ireland Survey 2022, over 58% of dental visits by children were paid for by their parents own funds (Healthy Ireland, 2022). While national statistics figures show that 77% of dental care was privately funded across the population in 2018 with research finding that out-of-pocket dental costs in Ireland cause financial hardship (Central Statistics Office, 2020; Johnston *et al.*, 2020; Donovan, 2021).

Similarly in Spain according to the National Health Accounts System, total spending on dental care in 2020 was 3.7 billion Euros, of which 98.2% was private spending (Montero-Soler and Sánchez-Martínez, 2023). This is in direct contrast to universal general healthcare in Spain which is largely free at the point in delivery. This represents a key gap in healthcare coverage and originates from a long-standing tradition of purchasing dental care privately (Bravo *et al.*,

2015; Urbanos-Garrido *et al.*, 2021). This was discussed by a Spanish expert: '*Most of the dental treatments in Spain you have to pay from your own pocket, we just don't have public health dentistry…in the general population they don't even know that there is a public dental office*' *(*P13*).*

The inequalities that emerge due to large out-of-pocket expenditure were highlighted by participants from Ireland and Spain: *'The percentages might shift from decade to decade but broadly speaking the socio-economic gradient still applies to children's dental disease, poorer people have more disease than better-off people'*(P10). However, tackling inequalities was also a dominant theme across those representing universal systems with the model of oral healthcare system under consideration. This was referenced by a Danish participant: *'The ones who can navigate the system are the ones who don't need it, the socially disadvantaged are the ones who get forgotten in a more economically pressured system'* (P5).

While there were differing opinions with respect to the benefits of a salaried versus a fee-per-item model of payment, there was consensus that an optimal approach involves a combination of both elements. With respect to a salaried payment model a Spanish expert considered: '*There is a risk when you pay for treatment, of over treatment…the salaried system is better because there is no money between the patient and the professional…. especially if you are trying to get people to pay for prevention'* (P13).

The benefits of fee-for-item were considered by a German expert: *'There are pluses and minuses…it is very hard to make care profitable in paediatric practice you need to be very intense…that may drive incentives to do stuff you wouldn't have done otherwise...on the other hand in a salaried system you could end up with underperformance'* (P4). A neutral participant reflected on a combination of both models and highlighted the need for protection for vulnerable groups: *'There is a lot that you can do once it is monitored, and fee-for-service… it is more cost-effective however there is always going to be a group of society that need more time and a safety net…I think a mixture is the optimal'* (P7).

While common across most participants was the need for oral health to continue to strive for integration within the general health system: '*At the minute the only ones who care about teeth are the dentists, the general system needs to do more but dentists are so isolated and*

its partly their own fault…things are at a tipping point' (P7).

Table 5-5 Financing information relating to six European child oral healthcare systems

Financing information								
Country	**Funding model**	**Children's oral health cover**	**Public spending on general healthcare (WHOLE population) (OECD, 2023)**	**Public spending on oral healthcare (WHOLE population) (OECD, 2023)**	**O-O-P as % of total oral healthcare spending (WHOLE population)**	**Annual cost***	**Estimated* spend pp covered**	**Provider payment mechanism**
Denmark[1]	TF	Universal	85%	35%	72% (HiT,2019)	€273m[1] (Aged 0-22 years)	€196 [1]	Majority salaried dental practitioners employed in state owned facilities
Germany[2]	SHI	Universal	86%	67%	25% (HiT, 2019)	€16b[2] (Total population)	€183 [2]	Majority independent dental practitioners contracted by the state to provide care on a FFS basis
Scotland[3]	TF	Universal	83% (UK)	41% (UK)	20% ('Private' Scotland SHeS 2019/21)	€549m (Total population)	€89[3]	Majority independent dental practitioners contracted by the state through FFS, capitation and allowances
Hungary[4]	SHI	Universal	73%	34%	54% (HiT, 2019)	n/a	n/a	Majority independent practitioners via FFS
Ireland [5]	TF	Targeted	77%	23%[e]	77%[5] (National Statistics)	€70m[5] (Children only 2018)	€66[5]	Salaried dental practitioners directly employed by the state
Spain[6]	TF	Targeted	72%	2%	98% (National statistics)	€5m [6] (children one region)	€43[6] (children one region)	Majority independent practitioners but variation throughout with salaried and 'mixed' systems also in operation

Notes:

1 Sources: HiT: Oral health care in Europe. Financing, access, and provision. 2022. 1 'Government Finances', Statistics Denmark personal communication. 2022. Calculated based on total population under age 22. Population source: Statistic Denmark.

2 Sources HiT: Oral health care in Europe. Financing, access, and provision. 2022. Total figure for all SHI spending excl. dentures. Source: KZBV. Estimated spend over total population. Cost pp is total estimated across all SHI enrolees excluding dentures as best approximation to children (2022).

3 Source: Public Health Scotland. Based on population children under age 18 in 2019. Population source: National Records of Scotland. Note: Total budget for dental care in Scotland in 2023/24 is €549m. OOP estimate (e) based on Scottish Health Survey 'private treatment' response

4 In Hungary OOP as a % of total dental spending is 54% in 2019. Source: HiT: Oral health care in Europe. Financing, access, and provision. 2022

5* Source: Central Statistics Office Ireland (2020). Estimated cost based on total population under age 16 in Ireland. Population source: Central Statistics Office. Cost €70m in 2018. Source: Houses of the Oireachtas written statement 2018 (Houses of the Oireachtas, 2018) and ESRI 2019. Special needs populations not included in cost calculations but are estimated represent 5% of service activity (Nolan, 2019).

6 Figures based on PADI programme in The Basque Country. Source: Annual report on the development of the Decree 118/90 on dental care for children in the Basque Country. 2022 (Departmento De Salud, 2022).

TF Tax funded, SHI Social health insurance, Salaried Dentists directly employed delivering care

*Estimated cost based on rough calculation using total population figures

5.4.4 Reform

A significant finding from this research was the varying successes of different systems implementing reforms, particularly in expanding coverage for preventive measures. An overview of key milestones is presented in Figure 5-1.

In most universal systems (i.e. Denmark, Germany, and Scotland) the observed trend is one of expanded coverage with broader eligibility for children and an increased emphasis on preventive oral healthcare operating in well-regulated systems. Common factors that facilitated those successful reforms included: political will, engagement with the dental profession and academic collaboration supporting data and evidence.

In Scotland, the Childsmile programme has benefitted from 'strong and successive' government support across three different political administrations since 2005 with funding for Childsmile expansion again announced in 2022 (Macpherson *et al.*, 2019). This political engagement was considered by a local expert where the 'crisis' unfolding with respect to children's oral health was harnessed to engage politicians: '*It was almost by stealth…very slowly creeping oral health on the agenda…using crisis to our advantage and building up a critical mass of successful piloting that it became the norm and using skilled diplomacy'* (P2).

A critical element in the engagement of politicians was the ability of oral health advocates to lobby with high quality data to communicate the problem of oral disease in the child population. This was reflected on by a Scottish participant: *'People don't really understand dentistry or see the value of prevention and the programme could be threatened…one of the most valuable things in sustaining it was the academics showing both a beneficial health outcome and a cost benefit'* (P2).

This was echoed by a German participant reflecting on the successful expansion of care for young children in 2019: *'They [politicians] don't really have an interest, so we had a lot of data, facts, and evidence to convince the politicians'* (P1). While in Denmark participants referenced the importance of data in terms of the establishment of the SCOR monitoring system (Richard *et al.*, 2022) but also stemming from the collaboration between oral health research and dentists: *'The dental schools supported the municipalities the whole culture was*

shared knowledge' (P3).

A common finding across countries was the importance of engaging the dental profession in proposed system reform and appealing to the profession from both a financial perspective and in the interests of their patients. This was surmised by a non-aligned participant: *'You need to attract the dentists to work in the service...the only way we can get them...is to put on another layer of attractiveness-additional funding'* (P7) *and* a Scottish participant: '*You need buy in…you need to meet them…just keep focusing on the patient outcomes'* (P2).

In contrast, there is evidence of a failure to implement existing oral health policies and expand oral health care coverage in recent years, most notable in countries worst affected by the 2008 financial crisis (Bravo *et al.*, 2015; McAuliffe *et al.*, 2022). An absence of political priority and a failure to engage the dental profession were identified as impediments to implementing successful reform by an Irish expert: *'I haven't seen any politician in the last 30 years trying to make dentistry included…unfortunately I don't see the political interest…and engaging the dental profession has to be a core part of delivering on any policy'* (P10).

While the failure to update legislation and a regulatory basis for the dental profession were strongly highlighted by both Irish and by Hungarian interviewees who had concerns regarding probity assurance and adherence to guidelines*: 'We don't do anything about quality control and quality assurance…nobody checks is it true, is it good, is it real?* (P11)*'* and by an Irish expert referencing the failure to reform Irish legislation since 1985 stating*: 'The legislation should be there to protect the public and it is inadequate. (P10)'.*

An overview of each child oral healthcare system in the six representative European countries is provided in Table 5-6.

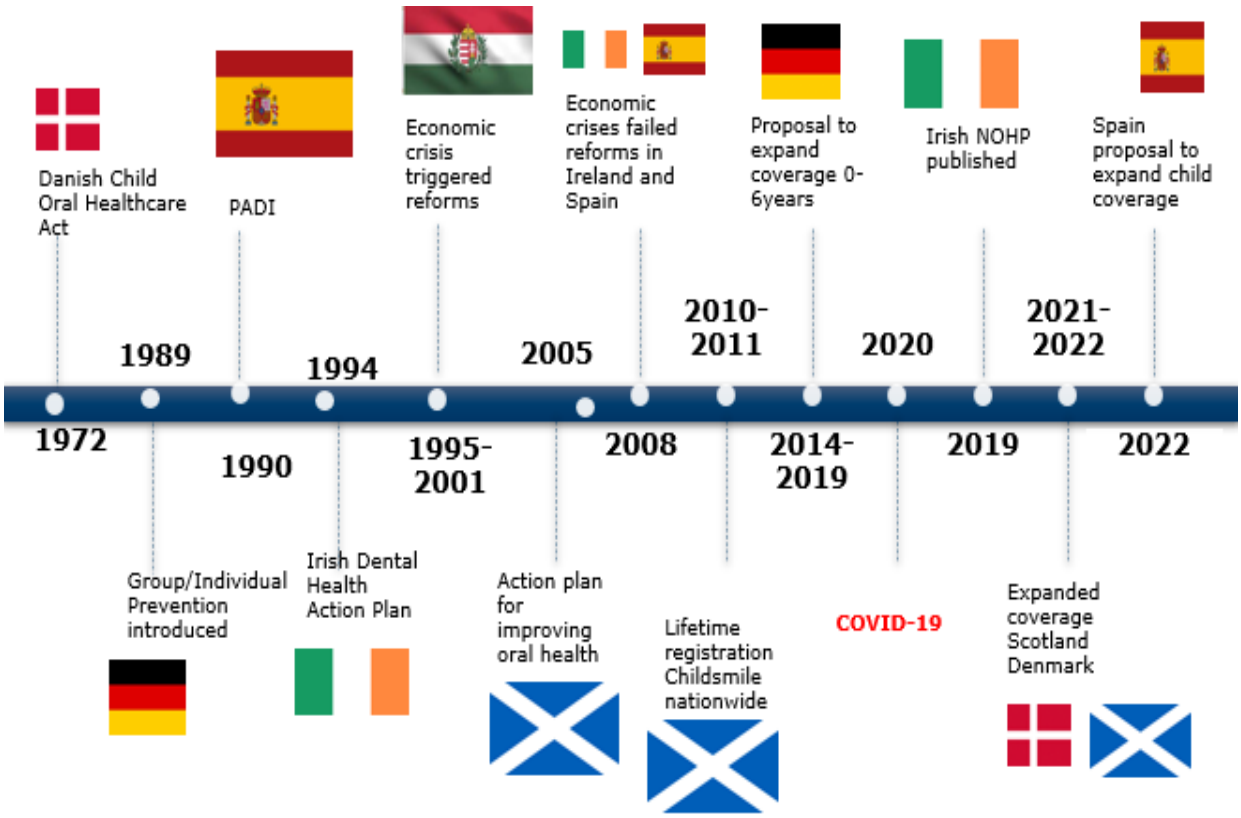


Figure 5-1 Milestones- Oral Health System Reforms in Europe

Table 5-6 An overview of child oral healthcare systems in six European countries

Child oral health system overview							
Country	**Dental Caries Prevalence (Most recent D_3MFT at age 12)**	**Coverage**	**Scope**	**Prevention**	**Proportion OOP dental care***	**Provider payment for children's care**	**Coverage trends**
Denmark[1]	0.38 (2023)[1]	Universal	Comprehensive	Publicly funded	Low	Majority salaried	Expanded
Germany[2]	0.50 (2025)[2]	Universal	Comprehensive	Publicly funded	Low	Majority PP	Expanded
Scotland[3]	0.36 (2023)[3]	Universal	Comprehensive	Publicly funded	Low	Majority PP	Expanded
Hungary[4]	2.32* (2017)[4]	Universal*	Comprehensive	Publicly funded-limited access	High	Majority PP	Reduced
Ireland [5]	1.4/1.8* (2002)[5]	Targeted	Basic	Majority private	High	Salaried	Reduced
Spain[6]	0.58* (2020)[6]	Targeted	Basic	Majority private	High	Majority PP	Reduced

Notes *Proportion out-of-pocket spending categorised as low (0-20%), medium (20-50%) or high (>60%).

1 Sundhedsstyrelsens Centrale Odontologiske Register (SCOR).
2 The Sixth German Oral Health Study (DMS V). Institute of German Dentists. Deutscher Zahnaerzteverlag DÄV. (Jordan *et al.,* 2025)
3 Public Health Scotland. National Dental Inspectorate Programme.
4 Szöke and Petersen 2020. *WHO pathfinder survey. Universal coverage but not equating to univeral accessibility.
5 North South Survey of Childrens Oral Health in Ireland. 2002. Mean $D_{3vc}MFT$ for 12- year-olds was 1.4 for those in receipt of CWF and 1.8 for those without. According to Irelands national oral health policy in 2019: It is estimated that one in 10 children in Ireland (or up to approximately one in five children, depending on their socioeconomic status and their access to water fluoridation) has a disproportionate level of dental decay compared to their peers'(Department of Health, 2019a).
6 Enucesta de salud oral en Espana 2020 (Bravo, 2020). *Diagnostic criteria used based on WHO 4th edition (1997) which considers caries to be an unmistakeable cavity (World Health Organisation, 1997).

5.5 Discussion

Two broad models of childhood oral health coverage are evident in this research: those systems adopting 'universal' approaches and those restricting coverage by 'targeting' children by age and/or location. Healthcare 'targeting' or rationing refers to the allocation of scarce resources to a patient population (Berezowski *et al.*, 2023). International literature suggests that rising costs and demands of healthcare systems place 'significant pressure' on decision-makers to identify the most appropriate policies for the allocation of increasingly scarce healthcare resources.

However, critical to that process is in addition to ensuring resources are distributed in a cost-effective manner, they must be done so equitably (Berezowski *et al.*, 2023). Equity concerns arise not only in the absence of oral healthcare coverage but also where 'one part of the population has greater dental coverage than another' (Manski *et al.*, 2015). This was seen in both 'targeted' models: where in Ireland, all adults are eligible for an annual examination, but children are not (Department of Health, 2019a) while in Spain the eligibility of children of the same age to care is dependent on geography (Bravo *et al.*, 2015).

In the absence of universal coverage, oral healthcare must be paid for via cost-sharing, private health insurance or via out-of-pocket payments, thus increasing the role of 'private' dentistry within the system (Johnston *et al.*, 2020; Winkelmann *et al.*, 2022). In Ireland, over two thirds of children's care was reported to be privately financed while in Spain 98% of all dental expenditure is funded via out-of-pocket payments (Healthy Ireland, 2022; Montero-Soler and Sánchez-Martínez, 2023). The Hungarian system despite offering broad coverage was also found to be dominated by private spending, emphasising that universal eligibility does not equate to universal accessibility (Winkelmann *et al.*, 2022; Hajdu *et al.*, 2023).

High out-of-pocket payments have been shown to lead to inequalities in accessing children's oral healthcare (Reda *et al.*, 2018; Watt *et al.*, 2019; Goldfeld *et al.*, 2022). This research also found access based on ability to pay rather than need (Ministry of Health, 2017; James *et al.*, 2021; Houses of the Oireachtas, 2023; Hajdu *et al.*, 2023). In contrast, broader oral health coverage has been shown to positively influence the use of services (Zhou *et al.*, 2017; Gnanamanickam *et al.*, 2018; Raittio and Suominen, 2023). More comprehensive coverage

was found via SHI in Germany, via the NHS in Scotland and the traditionally high level of subsidy common to Scandinavian welfare systems was also seen pertaining to Denmark (Widström and Eaton, 2004; Eaton *et al.*, 2019). In our findings, those systems demonstrated lower levels of out-of-pocket spending on oral healthcare in the child population and higher rates of access.

The consequences of poor access to care particularly burdens children from lower socioeconomic groups, with evidence citing that although those groups may benefit most from universal oral health coverage, they remain at a disproportionate risk of developing oral disease (Zhou *et al.*, 2017; Watt *et al.*, 2019). Therefore, a 'more radical preventive approach' and a shift in the dominance of treatment focused systems to an emphasis on prevention is required (Zhou *et al.*, 2017; Watt *et al.*, 2019; Goldfeld *et al.*, 2022; Winkelmann *et al.*, 2022). This is echoed in our analysis with the need for a greater importance attributed to preventive oral healthcare and consideration given to the model of payment for evidence-based preventive techniques, a strong and persistent finding throughout.

Preventive oral healthcare had varying levels of priority across the included countries. Except for Hungary, those countries offering 'universal' accessibility were also those countries offering the broadest coverage of preventive care. In Denmark and Scotland prevention occupies a central role in children's oral healthcare following the emergence of the Danish Child Oral Health Act and 'Childsmile' respectively, while Germany recently expanded preventive care for young children (Patel, 2012; Macpherson *et al.*, 2019; Ziller *et al.*, 2021). Payment models differed from salaried services in Denmark to predominantly 'fee-for-service' and capitation payments across the remaining 'universal' countries. A consensus from this research was that a hybrid model of payment incorporating elements of 'fee-for-service', capitation and pay for performance elements, with a 'safety net' component targeting those of high risk is preferable. This reinforces international findings suggesting a risk based, combination of payment methods, is effective in designing preventively focused payment systems (Pitts *et al.*, 2019).

This study highlights the role of dentists across the six representative countries, however further research is required in determining the impact of auxiliary oral healthcare professionals in the delivery of oral healthcare for children. Evidence from the international

literature and from the World Health Organisation highlights the need for 'creative workforce development' in improving population oral health and in the delivery of oral disease prevention (Gallagher *et al.*, 2024; World Health Organisation, 2024a).

In this research, the Childsmile programme was singled out across both strands of analysis, in terms of its clinical and cost effectiveness as an exemplar of success in oral health prevention. However, in this programme not only do auxiliary oral healthcare professionals (OHPs) but non-dental professionals, play a significant role. 'Extended Duty Dental Nurses' provide tailored oral health advice to individual patients and place regular fluoride varnish applications. 'Dental Health Support Workers' are employed by NHS boards to liaise with families, health visiting teams, nurseries, schools and dental practices. While 'Childsmile coordinators' support dental teams resolving difficulties and in maintaining standards (*Programme Manual for Childsmile Staff*, 2016). The impact of supervised toothbrushing delivered in nursery facilities led by these groups, was particularly singled out by 'elites' as critical to the overall success of 'Childsmile'. Contrastingly, within the 'targeted systems' concerns were raised by a Spanish 'elite' participant that prevention was not a focus within the 'dentist' centric model of care.

Our findings also suggest that an engrained culture of prevention within a system, political support, and funding, combined with good data to advocate for its importance and monitor its success, have supported the implementation of evidence based preventive policies. Furthermore, common to those countries has been the ability to proactively seek both regulatory and system reform with a focus on the expansion of prevention and achieving that success through engagement of dental professionals, oral health research and political interest.

In contrast, the countries where private provision of care is dominant offer little publicly funded preventive care, have also struggled to implement reform with limited political support and have been subject to significant funding reductions. Both Ireland and Spain faced severe impacts from the 2008 global financial crisis, leading to substantial cuts in oral healthcare budgets (Bravo *et al.*, 2015; Johnston *et al.*, 2020; Urbanos-Garrido, 2020; Nolan, 2019). Subsequent policy and reform efforts in both countries were unsuccessful, resulting in increased unmet oral healthcare needs and notable socioeconomic disparities, especially

among children who experienced a significant reduction in the availability of care (Bravo *et al.*, 2015; McAuliffe *et al.*, 2022; Johnston *et al.*, 2020; Urbanos-Garrido *et al.*, 2021).

Both the global financial crisis and the COVID-19 pandemic can each be classified as a health system 'shock', that is 'an unexpected occurrence…that has a large negative effect on the availability of health system resources or a large positive effect on the demand for health services' (Mladovsky *et al.*, 2012; Burke *et al.*, 2021; Thomas *et al.*, 2023). As evidenced in this research by experiences in Ireland and Spain, oral healthcare was particularly susceptible to coverage restrictions within the broader healthcare system post the economic crisis (Johnston *et al.*, 2020; Urbanos-Garrido, 2020).

While despite being classified as 'essential' healthcare during the COVID-19 pandemic, evidence shows that across many countries there was a 'widespread decline' in children's oral health status and access to oral healthcare (Lyu and Wehby, 2022; Karande *et al.*, 2023). The vulnerability of oral health within the broader health system as highlighted by the impact on oral healthcare during such 'shocks' must be recognised by oral health policy 'champions' in advocating for the wider integration of oral health within general healthcare (World Health Organisation, 2022; Eaton *et al.*, 2023).

This research finds that children's oral healthcare in Europe is currently at a 'tipping point'. Within 'universal' systems there is concern about the financial sustainability of broad baskets of coverage in the context of changing socioeconomic demographics. In Scotland, registration rates of children with the NHS have failed to recover following the COVID-19 pandemic with concerns that the substantial oral health improvements gained since the advent of *'Childsmile*' may have 'stalled' (The Scottish Parliament, 2023). While in Hungary there are concerns with respect to accountability and regulation, with calls to replace the 'out-dated' children's oral healthcare system (Hajdu *et al.*, 2023). In Ireland and Spain, new national oral health policies have been published, clearly recognising inequalities that are prevailing with respect to the targeted systems for children supported by proposals to expand the availability of preventive care in line with 'universal' general healthcare policy (Department of Health, 2019a; Official website of the President of the Government and the Council of Ministers, 2022).

The World Health Organisation has led the recent global recognition of the neglect of oral health from a policy and political perspective, and advocates for the integration of 'essential oral healthcare' in the 'Global strategy and action plan on oral health 2023–2030'(World Health Organisation, 2024a). However, the global literature highlights the challenge in defining what constitutes 'essential oral healthcare' (Eaton *et al.*, 2023). This was further reinforced in this study by highlighting the variation in the breadth, depth and scope of oral health coverage across representative European countries. The gap between those countries with very limited or no coverage of basic oral healthcare for children, compared with those providing broad and deep coverage, highlights the difficulties in achieving consensus on the definition. Participants from universal systems highlighted concerns of financial sustainability particularly from a 'fee-for-service' perspective while 'targeted' systems have struggled to expand coverage and implement reform. It is evident that defining 'essential oral healthcare' will require differing approaches at an individual country level requiring consultation with the oral healthcare profession, policymakers and evidence-based assessment of potential expanded or refined benefit baskets based on resource availability, workforce capacity and political and societal acceptability (Benzian *et al.*, 2021; Eaton *et al.*, 2023).

This renewed focus on the incorporation of oral health within UHC however must be harnessed by countries, most especially those operating in targeted systems, to expand coverage and implement necessary reform (Winkelmann *et al.*, 2022; Eaton *et al.*, 2023). While, across all countries, advocacy for oral health must be sustained by engaged oral health professionals, using high quality data and information while maintaining an emphasis on oral disease prevention and the inequalities burdening lower socio-economic groups.

5.6 Limitations/strengths/potential contributions

The authors wish to recognise several limitations inherent in this research. It is important to highlight the weaknesses prevailing in the study data, particularly in the comparability of data between countries. There was wide variability in data availability and reporting mechanisms across differing countries which posed challenges for direct comparison. While the lack of standardised oral health system indicators at the European level further constrained overall assessment of oral healthcare systems performance. To ensure maximum transparency, this

paper reports data with identified sources and the year reported. Beyond data weaknesses further challenges pertain to the applicability of study findings.

The range of differing policy contexts, government structures and financing mechanisms along with cultural influences between countries mean that while these findings offer valuable insights, direct policy transferability may be limited. While this study highlights key policy trends and oral healthcare system differences causal relationships cannot be inferred. Further longitudinal research and country-specific case studies are necessary to determine the long-term implications of different models of oral healthcare coverage. A final point of consideration is that to satisfy the research objective, 'elite' actors operating in positions of influence within the oral healthcare system were recruited for interview. As a result, almost all (n=13/14) 'elites' included were dentists which may have limited consideration of the roles of other oral health professionals within the wider oral healthcare system which should be a priority for future research.

Despite these limitations this study represents an important addition to the discourse on oral health coverage for children in Europe. The key strength of this paper is the use of multiple data sources and the triangulation of that data to strengthen the study findings. While the use of the WHO cube and a verified data collection template guided data collection and analysis. Inter-country comparisons have proven challenging with respect to language barriers and a failure to appropriately contextualise information. To ensure country specific data was both representative and accurate, two (n=2) local country experts were recruited from each country to verify the accuracy of the data and to add context.

There is limited knowledge on oral health coverage for children in Europe, an evidence gap which this in-depth multiple case study analysis serves to fill. In view of the data challenges highlighted, it is incumbent on the authors of this research to call for the development of comprehensive and systematic oral health system indicators. This information will be critical to monitor and compare oral health system performance into the future and in the identification of the most appropriate oral health system interventions and policies. While the variation in oral healthcare coverage across Europe highlighted points to the need for further research on what constitutes essential oral healthcare and where oral disease prevention, and upstream interventions feature in this domain.

5.7 Conclusion

Oral healthcare coverage for children varies across the European countries analysed from those adopting universal approaches to those 'targeting' specific groups, with the financial burden assumed by the individual in countries without universal coverage. Countries adopting universal approaches demonstrated greater access to services and a broader scope of preventive care. However, a key finding was the need to shift the focus from a treatment-dominated system to one entered on preventive care.

Most universal systems have successfully implemented system and policy reform through high-quality data, collaboration with dental research, political engagement, and the support of the dental profession. However, the vulnerability of oral health within the wider health system is an ongoing challenge and is most evident during times of pressurised resources such as the economic crisis or the aftermath of the COVID-19 pandemic. To progress the implementation of UHC for oral health, consideration will be needed with respect to reducing inequity from those excluded from care, the development of quality information to support advocacy, placing an emphasis on oral disease prevention and integrating oral health within the broader health system.

5.8 Chapter summary

This chapter presents an inter-country comparative analysis of publicly funded child oral healthcare coverage across six European countries—Denmark, Germany, Hungary, Ireland, Scotland, and Spain (McAuliffe *et al.,*2025) (Table 5-7). Guided by the WHO Universal Health Coverage (UHC) Cube, the study examines variations in population coverage (breadth), services provided (scope), and the proportion of costs covered (depth). Data were triangulated from documentary analysis and 14 semi-structured expert interviews.

Findings identify two broad coverage models: universal (Denmark, Germany, Scotland, and Hungary) and targeted (Ireland and Spain). Universal systems generally demonstrated broader access, stronger prevention policies, and deeper public funding—though Hungary's system is constrained by limited participation in public contracts, despite formal universality. Targeted systems were characterised by limited age-based eligibility, regional inequities, and

lower prioritisation of prevention, with substantial out-of-pocket costs.

The study concludes that several systems are at a tipping point: Ireland, Hungary, and Spain show growing recognition of the need for reform, while universal systems remain vigilant about preserving coverage. Strengthening preventive care, addressing inequalities, and leveraging high-quality oral health data for policy advocacy are critical to progressing UHC for children's oral health.

Table 5-7 Oral health coverage for children in six European countries

Model	Breadth	Scope	Depth	Reform
Universal Denmark (DK) Germany (GER) Scotland (SCO) Hungary* (HUN)	"You can say that 99% of children are actually born into the programme, if the children don't show up the municipalities are obliged by law to find you." (DK) "We wanted to make sure that every single child could be registered with a dentist and had a growing relationship with that dentist." (SCO)	"The culture of prevention has been successful, we had pioneers in research we knew the importance of fluoride, we implemented this knowledge very early, and it became integrated in our system." (DK) "Childsmile out of dental practice into educational settings was the key - the toothbrushing that's where the action is" (SCO)	"The subject of dentistry is the focus, not having to deal with who pays for what, the child is the focus, and anyone can afford to get the treatment (DK) "We have very high costs and that is across all healthcare, dentistry is only a small part of the expenditure (GER)	"It was almost by stealth very slowly creeping oral health on the agenda using crisis to our advantage and building up a critical mass of successful piloting" (SCO) "Politicians didn't have interest… so we had data, facts, and evidence." (GER)
Targeted **Ireland (IRE)** **Spain (ESP)**	"Totally inequitable." (IRE) "It can be different in each region, if your childhood was in in Valencia, you had different care than in Murcia." (ESP)	"Such an emphasis on permanent teeth over deciduous… became a mantra." (IRE) "Prevention is not in the mind of all dentists." (ESP)	"Most have to pay, and the socio-economic gradient applies, poorer children have more disease." (IRE) "The general population they don't even know that there is a public dental office." (ESP)	"I haven't seen a politician in the last 30 years trying to make dentistry included." (IRE) "The only ones who care about teeth are the dentists; the general system needs to do more but dentists are so isolated and it's partly their own fault…things are at 'a tipping point' (IRE).

Chapter 6 - Study 3

Assessing child oral health indicators of oral disease prevalence and workforce in six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain

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6.1 Abstract

Background

Oral diseases remain a significant public health problem, yet in many countries oral healthcare is isolated from general healthcare systems. In response, the adoption of oral health under the universal health coverage agenda is strongly advocated. A key obstacle in monitoring and evaluating the implementation of universal oral health coverage is the lack of standardised oral health indicators.

Methods

This study described and compared child oral health indicators of dental caries prevalence and oral health workforce across six representative European countries (Denmark, Hungary, Germany, Ireland, Scotland and Spain). A narrative review was conducted across each country, entailing a detailed analysis of both peer reviewed and grey literature for both indicators. Data collected for each individual country was verified by two experts local to each country (*n=12*).

Results

The DMFT index remained the most used measure for dental caries data for children across the study countries. However, national DMFT figures varied widely in terms of the method of estimating DMFT, the sample size on which the figure was based, criteria for caries diagnosis and the year of reporting. Equally there were extensive differences in the data collected pertaining to dentist workforce with some countries (such as Denmark and Germany) collating detailed information with others collecting very little data (e.g. Ireland). Broad workforce trends were observed including a higher proportion of dentist-to-population ratios in Germany and Spain compared to Scotland and Ireland with the fewest, a majority female dentist workforce, and a clear urban-rural divide, with rural and coastal areas reporting lower dentist densities.

Conclusion

Data on dental caries prevalence and the oral health workforce are not directly comparable across the six representative European countries analysed, due to substantial variation in the

methods used to generate and report them. The findings emphasise the need for improved workforce data to support effective planning and equitable distribution of oral health professionals to meet the objectives of universal oral health coverage. Inconsistencies were also identified across international databases, alongside a lack of transparency regarding the limitations of published data. Addressing these gaps through the explicit standardisation of methods and criteria, nationally and internationally, is essential to advancing universal oral health coverage.

Keywords: Universal health coverage, Oral health, Childhood dental caries, Oral health workforce

6.2 Background

Oral diseases, particularly dental caries, are among the most common diseases impacting children globally (Bernabe *et al.,* 2020). According to the WHO: 'No other disease group affects humanity across the life cycle and across all countries in the way that oral diseases do'. Yet oral health has been neglected, failing to achieve prominence in the global health agenda (World Health Organisation, 2022). As such oral healthcare is frequently excluded from state-funded population benefit packages and accessing oral healthcare can result in financial hardship particularly for children and vulnerable groups (Watt *et al.*, 2019; Wang *et al.*, 2020).

In response, a historic World Health Assembly resolution called for the integration of oral healthcare as an essential component of universal health coverage (UHC) (World Health Organisation, 2021). To advance this goal of universal coverage for oral healthcare, the WHO published the Global Oral Health Status Report which includes oral health country profiles 'based on key health and oral health indicators for monitoring and evaluation' (World Health Organisation, 2022). However, it also acknowledges the significant 'limitations' of existing oral health data, particularly in its ability to track progress towards UHC goals and compare health systems performance across countries (World Health Organisation, 2022).

The WHO defines UHC as ensuring that 'all individuals and communities have access to essential, quality health services that respond to their needs and that they can use without suffering financial hardship' (World Health Organisation, 2024a). The three core dimensions of UHC are (i) population coverage (ensuring that all individuals including vulnerable groups including children have access to essential health services), (ii) service coverage (guaranteeing a comprehensive range of health services is available including preventive, curative and rehabilitative care and (iii) financial coverage (reducing out-of-pocket expenses and preventing financial hardship due to healthcare costs (World Health Organisation, 2023c).

It is proposed such services should include oral health promotion and prevention as well as interventions pertaining to oral diseases across the life-course (World Health Organisation, 2024a). However, defining what constitutes 'essential' oral healthcare presents challenges that require consensus at the national level dependent on political, economic, resource

factors in addition to the system and cultural acceptability of proposals (Benzian *et al.*, 2021; Eaton *et al.*, 2023).

Comprehensive, consistent and effective health indicators are essential for assessing disease burden, monitoring service provision and informing health system planning and comparing systems (Bourgeois *et al.*, 2008; Tolonen *et al.*, 2021). However, the lack of global-level indicators for oral health monitoring are considered 'one of the major deficiencies in driving national and global universal health coverage agendas' (Agrasuta *et al.*, 2021). Existing research has shown that dental caries data reporting is often fragmented and inconsistent making it 'inadequate for planning the provision of oral healthcare across Europe on a scientific basis' (Patel *et al.*, 2016). While a detailed analysis of oral healthcare systems across Europe emphasised that data gaps limit meaningful comparisons of workforce capacity, service access, oral disease burden and overall oral health system performance (Winkelmann *et al.*, 2022). This report calls for an improved and strengthened evidence base to address such challenges (Winkelmann *et al.*, 2022).

The prevalence of the main oral diseases and conditions, including untreated dental caries of primary and permanent teeth, has been highlighted by the WHO in its Global strategy and action plan on oral health 2022-2030, as a 'core indicator' to track and monitor progress toward UHC (World Health Organisation, 2024a). The prevalence of dental caries in a population is influenced by multiple factors, beyond access to oral healthcare. These include socio-environmental determinants such as fluoride exposure, diet and socio-economic statuses and the availability and uptake of population prevention services such as community water fluoridation and oral health education initiatives (Watt *et al.*, 2019).

However, UHC remains essential for ensuring that access to diagnosis, prevention and intervention is equitable. Therefore, indicators of dental caries prevalence are crucial for assessing the burden of the disease among children and monitoring changes in that figure over time thereby determining the impact of oral health interventions and policies (World Health Organisation, 2024a).

Monitoring oral disease prevalence alone is insufficient, achieving universal oral health coverage also requires an adequate and well-distributed oral health workforce to deliver that

care (Birch *et al.*, 2015). Workforce and human resources are identified as a category of indicator to monitoring access to care by identifying barriers to access (Jashni *et al.*, 2023). Such indicators are essential for assessing the availability of oral healthcare professionals, their distribution and the sustainability of the workforce over time. Additionally, they have the potential to facilitate cross-country comparisons allowing policy makers to benchmark progress towards universal oral healthcare coverage (World Health Organisation, 2024a; Jashni *et al.*, 2023). Despite this, historically little interest has been given to oral healthcare services workforce and there is limited information available on relevant indicators (Ahern *et al.*, 2019).

The aim of this study is to assess the challenges in measuring child oral health indicators, namely oral disease prevalence and workforce, and to highlight the variations in data collection across six representative European countries (Widström and Eaton, 2004). As this study is focused on children, dental caries, the primary oral disease of childhood is the focus of analysis pertaining to oral diseases.

The objectives of this study are:

1. to describe the differences in the measurement and reporting of dental caries data across representative European countries.
2. to examine the composition and distribution of the oral health workforce specifically dentists, hygienists, and dental assistants— assessing differences in workforce size, gender distribution, age demographics, and an estimate of the proportion of dentists providing publicly funded care for children.
3. to critically assess discrepancies in the reporting and comparability of workforce and dental caries data across international databases, highlighting inconsistencies in data availability, collection methodologies, and reporting standards.
4. to identify the key challenges in interpreting child oral health indicators globally and advocate for improved standardisation and harmonisation of data collection.

6.3 Methods

A narrative literature review was conducted during the period June 2023 to February 2024, which entailed a detailed analysis of both peer reviewed and grey literature including oral health surveys, health service reports and policies. These were identified via online databases for the two indicators, dental caries (prevalence) and workforce. Data collected for each country was verified by two local experts per country[1].

6.3.1 Country selection

The criteria for country selection were those countries who were representative of the variation of healthcare systems (i.e. tax funded, social health insurance, universal healthcare systems, 'targeted' systems, centralised and decentralised systems) and the different models of oral healthcare in Europe (Widström and Eaton, 2004). As such, the representative countries included in this analysis were selected from one of each of the following types – Nordic, Bismarckian, Eastern, Hybrid, Beveridgian and Southern:

1. Nordic Model - This is a tax-funded model (e.g. Denmark) characterised by an extensive publicly funded oral healthcare service for children, delivered by salaried dental practitioners with municipal-led governance. Oral healthcare for adults is provided by private dental practitioners, some of which may be subsidised by public finance.
2. Bismarckian Model - This is a social health insurance (SHI) based system (e.g. Germany) funded through employer and employee contributions. Most of the population are members of state approved 'sick funds' which reimburse legally approved packages of oral healthcare.
3. Eastern European Model - A traditionally state funded model delivered via SHI (e.g. Hungary). However, public coverage for oral healthcare is often constrained leading to increasing involvement of the private sector.
4. Beveridgian Model - The entire population (e.g. Scotland) are eligible to access oral

[1] A country expert was considered a current or former Chief Dental Officer or someone working in a senior position within academic or oral health services with additional postgraduate training in dental public health.

healthcare via the tax funded National Health Service (NHS). All oral healthcare services are free of charge for children within the NHS, but adults require co-payments which are capped. Scotland was chosen as the representative country of the United Kingdom. Its national Childsmile programme exemplifies a prevention-focused, integrated approach to child oral health, offering important insights for the advancement of universal oral health coverage (Macpherson *et al.*, 2015) and is relevant to the overall focus of this research on child oral health.

5. Southern European Model - Publicly funded oral healthcare for children varies by age and/or geographic location with very limited coverage for oral healthcare for adults (e.g. Spain). As a result, privately financed and delivered oral healthcare is dominant.

6. Hybrid Model - A complex mix of different financing and delivery models incorporating elements of both Beveridgian (tax-funded) and Nordic (publicly funded oral healthcare for children delivered by salaried professionals) models (e.g. Ireland). Targeted coverage and restricted access to publicly funded oral healthcare mean a reliance on privately financed and delivered oral healthcare.

6.3.2 Peer reviewed literature

Two individual search strategies (Appendices L and M) one focusing on each indicator, were developed with the assistance of a specialist medical librarian in collaboration with the research team. The '*CoCoPop framework*' (Condition, Context, Population) which has been shown to support effective literature searching for research questions focusing on aetiology was followed (Munn *et al.*, 2018). The 'condition' refers to the variable of interest and in this instance entailed dental caries and workforce.

No limitations were placed on either the types of studies to be included or study year due to the possibility of national oral health surveys having been previously conducted over a significant period. Titles and abstracts identified were downloaded to an open-source reference management software programme (*Zotero*) and screened using an online research collaboration platform supporting effective literature review screening efficiency (*Rayyan*).

This study examines how dental caries data are collected and reported across six European

countries, indicating the healthcare system model, while focusing on the types of indicators used and variations in the data collection methods. Based on common international practice, discussion, deliberation and WHO guidance (World Health Organisation, 1997, 2013; Bourgeois *et al.*, 2008) the indices for dental caries chosen for identification in this analysis were (i) The Decayed, Missing and Filled Teeth (DMFT) Index at the WHO indicative age 12-years (Broadbent and Thomson, 2005; World Health Organisation, 2013), identified as the target group for assessing the level of dental caries severity among children with permanent teeth, and (ii) The International Caries Detection and Assessment System (ICDAS) (Pitts and Stamm, 2004). Both indicators were chosen due to their widespread adoption.

Prevalence data from the WHO 'Global Oral Health Status report-country profiles' was also captured (World Health Organisation, 2022). Dental caries prevalence refers to the proportion of individuals with at least one active caries lesion at the time of examination, typically reported as a percentage within a specified population at a specified time. The Global Burden of Disease (GBD) 2019 which informs WHO 'prevalence data' considers untreated dental caries as the presence of an unmistakable cavity in the crown or root of a tooth, regardless of the existence of a restoration (Vos *et al.*, 2020).

Dental enamel is a highly mineralised tissue which is subject to demineralisation and remineralisation, dental caries occurs when demineralisation exceeds remineralisation, and the lesion continues to progress (Featherstone *et al.*, 2021). The diagnosis of early enamel caries prior to cavitation can be prone to subjectivity. As a result, some caries indices limit the diagnosis to a stage of caries when it has reached a conclusive stage, for example at detectably softened enamel or at cavitation level. This can lead to variation in the use of an index depending on the definition of what is counted as caries in the measurement method (World Health Organisation, 2013).

The DMFT index measures the number of decayed (usually at the cavitation level or visibly extending into dentine), missing (due to caries) or filled (due to caries) teeth, it therefore seeks to capture the historically accumulated dental caries experience in permanent teeth at the tooth level in an individual at the time point of examination. Thus, reflecting the cumulative history of dental caries including treated and untreated lesions. DMFT does not measure prevalence but rather the overall burden of the disease at the individual level. All

individuals in a population with a DMFT value > 0 make up the population with dental caries (Broadbent and Thomson, 2005).

The ICDAS is a clinical dental caries classification tool that records the severity of carious lesions at different stages of progression, it can accommodate the recording of caries at the pre-cavitation level but can also be used to report caries at the dentinal level of involvement. ICDAS can be used to derive both dental caries prevalence and DMFT (Shivakumar *et al.*, 2009; ICCMS Caries Management, 2025).

In line with previous research, detailed information from each database was collected including the DMFT or other relevant measure, and the citing evidence from which the information was sourced (Patel *et al.*, 2016). Once information was identified a range of factors were collated including: the year of study, source of information, year of results published, sample size, criteria for dental caries assessment and methods of calibration.

6.3.2.1 Grey and other literature: dental caries

To ensure the most recent and representative figures with respect to dental caries were identified, national and international online databanks were also directly interrogated. These included:

- Individual country databases such as those of health ministries and national oral health services (e.g. Sundhedsstyrelsens Centrale Odontologiske Register (SCOR) (2022) [Denmark], National Dental Inspectorate Programme, [Scotland] (Danish Health Authority, 2023; Public Health Scotland, 2023b).
- World Health Organisation: Oral Health Country/Area Profile Project (CAPP) Database
- The Council of European Chief Dental Officers (CECDO) database
- Organisation for Economic Cooperation and Development (OECD)
- World Health Organisation: Global Oral Health Status Report (GOHSR) - country profiles. Due to the methods adopted by GBD (2019) there are differences evident in the data sources used to inform caries prevalence, in comparison to those employed by CAPP and CECDO. In this study the

GBD 'data input sources tool' was used to search for results for 'non-fatal outcomes' of caries of primary and permanent teeth for each study country.

Other databases including The Global Health Observatory, World Health Survey and European Health for All databases were also searched (World Health Organisation, 2003, 2024c, 2024d).

6.3.2.2 Grey and other literature: workforce

This study assessed multiple oral health workforce indicators, where data were available, including:

- Oral health workforce composition by professional category (i.e. dentists, dental hygienists, dental assistants)
- Total number of dentists
- Distribution of dental professionals by age/gender and location

These indicators were selected to analyse how different countries collect and report on oral health workforce data rather than evaluating workforce adequacy. Therefore, nationally collected data pertaining to dentists across each country were examined.

To augment the data gathered from peer reviewed literature, national and international databanks by country were also interrogated, pertaining to oral health workforce. These included:

- Individual country databanks such as those of dental professional councils and associations, health ministries and national oral health services (e.g. The Dental Council of Ireland, National Health Service Scotland, Federal Association of Statutory Health Dentists [Germany] (TURAS, 2022; BZÄK/KZBV, 2023; Dental Council of Ireland, 2024).
- World Health Organisation: Oral Health Country/Area Profile Project (CAPP) Database.
- World Health Organisation: Global Oral Health Status Report (GOHSR) - country profiles.
- The Council of European Chief Dental Officers (CECDO) database.
- Organisation for Economic Cooperation and Development (OECD).

6.3.3 Ethical approval

Ethical approval (Appendix A) to recruit country experts for the verification of study data was granted by the Clinical Research Ethics Committee (CREC) of the Cork Teaching Hospitals at University College Cork, Ireland (Reference number: ECM 4 (J)12/11/2019). At all times, ethical concerns including ensuring confidentiality and obtaining informed consent were adhered to.

6.4 Results

Study results will be presented separately for both dental caries and workforce for the countries selected based on the oral healthcare systems described for Europe (Widström and Eaton, 2004). National data presented for dental caries 'prevalence' and the methods used to inform them nationally and across international databases will be presented first. This is followed by an overview of dental workforce information under the same parameters.

6.4.1 Data pertaining to dental caries

The DMFT index remained the most used 'indicator' of dental caries across the representative countries, with more data collected in the 12-year-old age group across Europe than for any other child cohort or index of measurement.

National mean DMFT figures were available for all included countries and ranged from 0.32 and 0.38 in Scotland and Denmark, to 2.32 in Hungary (Table 6-1). However, there was wide variation in the diagnostic criteria adopted, methods used to collate the DMFT score, the nature of the sample of 12-year-olds included and the year for which data are reported.

In two out of the six countries (Denmark and Scotland), DMFT data for 12-year-olds are reported annually (Denmark) or every two years (Scotland) by national health services – the National Child Odontology Registry (SCOR) [Denmark] (Danish Health Authority, 2023) and the National Dental Inspection Programme (NDIP) [Scotland] (Public Health Scotland, 2023b). In the SCOR system, DMFT is calculated by consolidating data from clinical examinations conducted in the public dental system (Skeie and Klock, 2014; Nygaard *et al.*, 2023). In Scotland, the NDIP is conducted annually, where representative samples of 'P1' children (aged on average 5.5-years-old) and 'P7' children (aged on average 11.5-years-old) are examined on alternating years to determine the levels of 'obvious decay' nationally (Public Health Scotland, 2023b).

In three of the countries (Ireland, Germany and Spain), the national DMFT scores were derived from national oral health surveys (Whelton *et al.*, 2006; Bravo, 2020; Jordan *et al.*, 2025), while the DMFT for Hungary was based on a 'representative survey' using WHO

pathfinder methodology conducted in 2016/17 (Szöke and Petersen, 2020). National surveys in Spain and Germany were undertaken in 2020 and 2025 respectively, while the most recent nationally representative DMFT data for Ireland dated from 2002 (Whelton *et al.*, 2006) (Table 6-1).

Variations in the criteria for caries diagnosis were also observed across the included countries. Two of the national surveys (Germany and Hungary) followed WHO Oral Health Surveys Basic Methods, 5th Edition (2013) criteria (unmistakable cavity penetrating dentine), with Ireland like Scotland capturing both cavitated and non-cavitated dentinal lesions (Pine *et al.*, 1997; Whelton *et al.*, 2006). Spain followed WHO 4th edition criteria (1997), which also considers caries to be an unmistakeable cavity involving dentine (World Health Organisation, 1997). Scotland and thus the NDIP follow the British Association for the Study of Community Dentistry (BASCD) guidance (cavitated and non-cavitated lesions which have penetrated dentine) (Pine *et al.*, 1997). While diagnostic criteria within SCOR are based on guidelines laid down by the Danish Health Authority, where caries is recorded at the enamel only and enamel and dentine level (Danish Health Authority, 1999; Skeie and Klock, 2014).

Finally, substantial variation was observed in the number of 12-year-olds informing the national DMFT scores. For example, Denmark reported data based on over 40,000 public dental system records, and Scotland based its national estimate on a representative sample of more than 13,000 children (Danish Health Authority, 2023) (Public Health Scotland, 2023b). In contrast, smaller sample sizes were seen in Ireland (3,883), Germany (958), Hungary (473), and Spain (448). These figures, along with other methodological differences such as diagnostic criteria and survey type, are summarised in Table 6-1 (Whelton *et al.*, 2006; Szöke and Petersen, 2020; Bravo, 2020; Jordan *et al.*, 2025).

Table 6-1 Most recent national DMFT figure at age 12 across six European Countries

Country	National mean D_3MFT age 12	Source	Method	Year	Diagnostic criteria	Number of 12-year-olds
Denmark [1]	0.38	National Child Odontology Registry	National registry	2023	Danish Health Authority Criteria	40,264
Germany [2]	0.50	Sixth German Oral Health Study (DMS V)	National oral health survey	2025	WHO (5th Edition)	958
Hungary [3]	2.32	Representative survey: journal article (Szöke and Petersen)	Survey using WHO pathfinder methodology	2016/2017	WHO (5th Edition)*	473
Ireland [4]	1.4/1.8*	North South Survey of Children's Oral Health in Ireland 2002	National oral health survey	2002	Caries recorded at the dentinal level of involvement using WHO (1987) criteria. Figures include the expanded criteria to include visible non cavitated dentinal caries	3,883
Scotland [5]	0.36	National Dental Inspectorate Programme	National registry	2023	BASCD Guidelines	13,114
Spain [6]	0.58	Oral Health Survey in Spain 2020	National oral health survey	2020	WHO (4th edition)	448

Notes and sources:

1. Sundhedsstyrelsens Centrale Odontologiske Register. (SCOR). Danish Health Authority Criteria.
2. WHO 5th edition criteria: Oral health surveys: basic methods - 5th edition. The Sixth German Oral Health Study (DMS 6) recorded caries in 8-year-olds using ICDAS, results were converted DMF.
3. Changing Levels of Dental Caries over 30 Years among Children in a Country of Central and Eastern Europe - The Case of Hungary (Szöke and Petersen, 2020).
4. *Mean DMFT for 12-year-olds in receipt of community water fluoridation (CWF) was 1.4 for those not in receipt of CWF was 1.8. According to Irelands National Oral Health Policy (2019) 'one in 10 children in Ireland has a disproportionate level of dental decay compared to their peers'. This finding was based on a statistical analysis conducted by the Department of Health to support oral health policy development (Department of Health, 2019) based on data obtained from a study examining the impact of CWF (James *et al.*, 2021)
5. National Dental Inspectorate Programme (Public Health Scotland). British Association for the Study of Community Dentistry (BASCD) guidelines.
6. World Health Organisation Oral Health Surveys – Basic Methods, 4th Edition (1997)

6.4.1.1 Sources of variation in recorded caries levels

As summarised in Table 6-2, a wide range of methodological factors influence the reliability, comparability, and interpretation of caries data. These include differences in the type of survey used (e.g., national versus pathfinder), sampling methods, diagnostic criteria, and the physical conditions under which examinations take place (Patel *et al.*, 2016).

For instance, large-scale national surveys conducted in dental clinics with trained, calibrated examiners using artificial lighting and radiographs may identify more caries than school-based surveys reliant on ambient lighting and visual-only inspection (World Health Organisation, 2013). Similarly, surveys using broader diagnostic tools like ICDAS or reporting on non-cavitated lesions may yield higher prevalence estimates than those adhering strictly to the WHO definition of obvious decay (Shivakumar *et al.*, 2009). These discrepancies are further compounded by socioeconomic participation bias, children from lower-income families, who may have higher levels of untreated caries, may be less likely to participate in school-based surveys requiring parental consent. Collectively, these methodological inconsistencies undermine the reliability of direct cross-country comparisons and highlight the ongoing, pressing need for harmonisation in oral health surveillance methodologies (Bourgeois *et al.*, 2008).

Table 6-2 Sources of variation in recorded dental caries levels

Issue	Description of Variation
Type of Survey	National surveys use, representative samples, while pathfinder surveys have smaller, often non-representative samples in specific locations. As caries varies by region, pathfinder surveys may provide a misleading picture. Clinical data from dental attendance can be more detailed, especially if radiographs are used, which may lead to higher caries detection rates.
How the Survey Sample is Chosen	Different national surveys use different methods to divide the population into groups (stratification). Some may group by age, region, or socioeconomic background, affecting how representative the results are.
Response Rate to Surveys vs. Clinical Data	Survey participation can be low, making the data less representative. In contrast, data from dental services may be more complete, as most children visiting the dentist are included (depending on the system). However, clinical data may be biased towards those accessing care.
Ethical Considerations and Participation Bias	Surveys requiring parental consent may exclude children from lower socioeconomic backgrounds, who often have higher decay rates, leading to underestimation. Ethical approval processes may also restrict what data are collected.
Choice of Caries Measurement Index	The DMFT index (Decayed, Missing, Filled Teeth) and the ICDAS system (International Caries Detection and Assessment System) measure caries differently
Criteria for Identifying Caries	Caries is a continuous process, with early stages being reversible. If only obvious cavities are counted, early caries is missed. Different guidelines define when caries should be recorded—some allow use of a probe, while others focus on visible dentine involvement without probing. ICDAS records early caries, but results may be reported at different severity levels.
Inclusion of Radiographic Data	Some clinical datasets include radiographic findings, leading to higher detection rates, especially for hidden (proximal or early-stage) caries. Surveys typically rely on visual examination only, leading to underestimation.
How Caries Stages Are Reported	Some surveys group all stages of dental caries together, while others separate visible dentine caries from cavitated caries. This affects comparisons between different studies.

Issue	Description of Variation
Recording of Missing Teeth	Some surveys only count missing teeth due to caries, while others include teeth lost due to trauma, orthodontics, or natural exfoliation.
Examiner Training and Standardization	The way examiners are trained and tested for consistency varies. A standard statistical measure (Kappa Statistic) checks agreement among examiners, but different surveys set different standards. Some surveys check examiners' accuracy throughout the study, while others only train them at the start, which may affect consistency in recording caries.
Examination Location and Conditions	Clinical exams may lead to more caries being detected. In schools, poor lighting and child positioning may lead to underestimation. Unless a standard procedure (SoP) is followed, methods can vary. For example, whether teeth are cleaned or dried before examination can impact how much caries is seen.
Use of Artificial Light and Magnification	Some surveys use additional lighting (e.g., headlamps) and magnification, while others rely on ambient lighting. Better visibility increases detection rates.
Socioeconomic and Behavioural Factors	Some surveys adjust for diet, fluoride, sugar intake, and oral hygiene habits, while others do not. These factors strongly influence caries risk and can affect interpretation of results.
Definition of "Untreated Decay"	Some studies count only obvious cavities as untreated decay, while others include early-stage lesions that could be reversed. This affects decay prevalence estimates.
Treatment Access and Impact on Findings	In populations with good access to dental care, decay may be treated earlier, leading to higher recorded levels of treated disease. In contrast, disease may go unrecorded in surveys of populations with limited access as it is not visible outside the clinical setting without access to clinical radiography for example.

6.4.1.2 Reported dental caries data across international databases

Available data on dental caries for each study country across four different international databases is presented in Table 6-3.

This research finds there is very little agreement across international databases pertaining to the reporting of dental caries in terms of the data presented and the methods used to collate the information. Three out of four of the databases searched in this analysis (CAPP, CECDO, OECD) used the DMFT index for 12-year-olds as their measure for dental caries, with 'estimated prevalences' presented in the WHO country profiles (OECD, 2009; World Health Organisation, 2022; Council of European Chief Dental Officers, 2023; World Health Organisation, 2024b).

DMFT figures for the study countries provided by CAPP and CECDO are all presented with the year of reporting while each CAPP figure and half of those derived from the CECDO are also presented with explicit referencing to the original data source. Both databases identify DMFT at a country level by way of data derived from national oral health surveys (e.g. Germany and Spain) or aggregated data from the public dental system (e.g. SCOR in Denmark) with clarifications sought from national representatives as required (Council of European Chief Dental Officers, 2023; World Health Organisation, 2024b). However, despite adopting similar approaches, differences in reported DMFT for each country are evident (Table 6-3).

The only reported DMFT data from the OECD is based on 'A Health at a Glance' report on 'indicators' published in 2009 with DMFT data collected from 2006 or the closest available year for 12-year-olds. The source is 'OECD Health Data' and a range of years is provided in some instances for example data for Germany is reported as DMFT 0.7 (1980-2005) and Ireland as DMFT 0.8 (1980-2002) (OECD, 2009).

The only database not explicitly reporting DMFT is the WHO by way of its country profiles, published alongside the 'Global oral health status report' where dental caries prevalence of untreated caries data are used. These data are derived from the Global Burden of Disease 2019 (GBD) and 'computed' by the Institute of Health Metrics and Evaluation (IHME) (World Health Organisation, 2022).

The GBD (2019) considers untreated caries as the presence of an 'unmistakable cavity in the crown or root of a tooth, regardless of the existence of restoration' (Vos et al. 2020). The GBD methods for estimating caries burden are published and encompass an updated systematic review and a range of statistical analyses and estimates (Vos *et al.*, 2020). It demonstrated a wide variation in the included studies, for example for Ireland caries data were informed by four studies, including two from the 1990's (O'Mullane and Whelton, 1994; Bolin and Koch, 1996). However, data from the national oral health survey was not captured. With respect to Germany, results of the 2004 and 2009 national oral health surveys were included but the most recent survey conducted in 2014 was not (Pieper and Schulte, 2006; Pieper *et al.*, 2013).

Table 6-3 Reported data pertaining to dental caries for six European countries

	Databases			
Country	**CAPP (D_3MFT)**	**CECDO (D_3MFT)**	**OECD (D_3MFT)**	**WHO (OHCP) (Prevalence of untreated caries) ***
Denmark [1]	0.4 (2022) [SCOR[1]]	0.3 (2021) [SCOR]	0.8 (2006)	24.6% [GBD, 2019]
Germany [2]	0.4 (2016) [DAJ, 2017]	0.3 (2014) [DMS-V]	0.7 (1980-2005)	31.7% [GBD, 2019]
Hungary [3]	2.3 (2016) [Szöke and Petersen, 2020]	1.7 (2019) [-]	3.3 (1980-2001)	37.9% [GBD, 2019]
Ireland [4]	1.6 (2001) [National oral health survey][4]	0.8 (2015) [-]	1.1 (1980-2002)	31.6% [GBD, 2019]
Scotland [5]	0.5 (2017) [NDIP] [5]	0.5 (2018) [NDIP]	0.7 (1983-2005) (UK* only)	30.6% (UK) [GBD, 2019]
Spain [6]	0.58 (2020) [National oral health survey] [6]	2.0 (2020) [-]	1.3 (2005)	34% [GBD, 2019]

Notes and sources:

CECDO = Council of European Chief Dental Officers Database, CAPP = Oral Health Country/Area Profile Project, Health at a Glance (OECD) , WHO (GOHSR) = World Health Organisation: Global oral health status report - country profiles.

* Prevalence of untreated caries of permanent teeth in people 5+ years: 'Estimated prevalences from the Institute of Health Metrics and Evaluation (IHME) Global Burden of Disease Study 2019 (GBD, 2019) were computed by using population data from UN DESA World Population Prospects 2019 and applying them to disease relevant age groups. (Data source: Global Burden of Disease Collaborative Network. GBD 2019. Seattle: IHME; 2020.')

1 SCOR: Sundhedsstyrelsens Centrale Odontologiske Register. The national child odontology registry (SCOR).
2 DAJ, 2017 = (Deutche Arbeitsgeminschaft fur Jugendzhnpflege).
3 DMS-V: Fifth German Oral Health Survey , DAJ, 2017 = (Deutche Arbeitsgeminschaft fur Jugendzhnpflege)
4 North south survey of children's oral health in Ireland 2002.
5 NDIP= National Dental Inspectorate Programme (Public Health, Scotland).
6 Oral Health Survey in Spain 2020.

6.4.2 Oral health workforce

6.4.2.1 Oral health workforce composition

An overview of the oral health workforce specifically pertaining to dentists, dental assistants and dental hygienists collated across the representative countries is provided Table 6-4.

6.4.2.1.1 Dentists

Dentist-to-population ratios varied across countries, with Germany and Spain reporting the highest numbers of dentists per 100,000 people (121 and 84 respectively) (Gesundheits-Bericjterstattung Des Bundes (GBE), 2021; Instituto Nacionale de Estadistica, 2022a), while Ireland reported the fewest followed by Scotland (71 and 73 respectively) (General Dental Council (GDC), 2023, Dental Council of Ireland - Direct Communication).

As this research sought to examine indicators in the context of child oral healthcare, estimates of the proportion of dentists offering publicly funded oral healthcare for children were made. This is governed by the model of children's oral healthcare in place. For instance, in Germany and Scotland almost all dental care for children is provided free of charge under Social Health Insurance (SHI) and via the National Health Service (NHS) where 99% of all German dentists and 86% of Scottish dentists retain contracts (TURAS, 2022; National Association of Statutory Health Insurance Funds, 2023).

In Hungary, the proportion of clinics operated by the state and local government has fallen below 10% and over 90% of oral healthcare is provided in private (independent) dental practices. Some practices enter a contract with the National Health Insurance Fund of Hungary (NEAK) and the others which are purely private (69%) (Kivovics and Székelyhidi, 2023; Regional European Association of the FDI, 2023). The total proportion of publicly funded dental surgeries and private practices contracted by NEAK equates to 31% (Kivovics and Székelyhidi, 2022). In Spain, the estimated proportion of dentists offering publicly funded care for children is based on those engaged in the PADI Child Oral Health Programme (Bravo *et al.*, 2015a) projected to be 7,400[1] or 18%, however this data should be interpreted while

[1] Data provided via direct communication to lead author

recognising that PADI is not freely available throughout Spain.

In two out of the six countries (Denmark and Ireland), publicly-funded oral healthcare for children is typically delivered by salaried dentists directly employed by the State. In Scotland since 2014, there has also been a Public Dental Service (PDS), run by NHS boards employing 365 dentists in 2022 (TURAS, 2022). The PDS provides dental care for people with complex special care needs and seeks to provide dental care in some rural or remote areas where there are difficulties with access to NHS practices (The Scottish Parliament, 2023).

In Denmark approximately 18% (n=830) of the overall workforce are directly employed in municipal dental care (Danish Health Authority, 2024) and based on whole time equivalents (WTE) 9% (n=320) of the total dental workforce in Ireland are salaried dental practitioners (Health Service Executive, 2023b). According to data from the Health Service Executive in Ireland 51% of those worked part-time in 2023 (Health Service Executive, 2023b). In 50% of the included countries (Denmark, Ireland and Spain) paediatric dentistry is not a recognised speciality and specialist lists of paediatric dentists are not maintained.

6.4.2.1.2 Auxiliary oral healthcare professionals

Germany and Denmark have the highest number of dental assistants per 100,000 population (236 and 132 respectively) The number of dental hygienists in Germany is relatively low, at 29 per 100,000. However, Germany has a significant number of specialised dental chairside assistants (Zahnmedizinische Fachassistentin), with 24,000 professionals trained for additional duties, including supra-gingival scaling (The Council of European Chief Dental Officers, 2023). The total number of dental chairside assistants is estimated at 196,000, which equates to more than two per practicing dentist (Gesundheits-Bericjterstattung Des Bundes (GBE), 2021).

In Spain, there is no mandatory registration for dental hygienists (Martinez-Beneyto et al., 2021) leading to inconsistencies in data collection. However, the estimates suggest that Spain has 42 dental assistants and 32 dental hygienists per 100,000 population (The Council of European Chief Dental Officers, 2023). In contrast Denmark, Hungary, Ireland, and Scotland all require mandatory registration for dental hygienists (Kravitz *et al.*, 2015).

Hungary and Ireland report the lowest number of dental assistants per 100,000 population (Kivovics and Székelyhidi, 2023, Dental Council of Ireland, direct communication 2023). Similarly, Scotland and Ireland have the lowest number of registered dental hygienists with 12 per 100,000 population in each country (General Dental Council (GDC), 2023, Dental Council of Ireland, Direct communication 2023). However, in three out of six of the included countries mandatory registration of dental assistants (nurses) (Denmark, Ireland, and Spain) is not required (Kravitz *et al.*, 2015).

Across the six countries there are notable variations in both the number and type of auxiliary oral healthcare professionals (OHPs) per 100,000 population as well as differences in workforce classification and reporting practices. Although Germany and Denmark report the highest number of individuals classified as dental assistants per 100,000, workforce ratios per dentist and the scope of practice of auxiliary oral healthcare professionals vary significantly. For example, in Germany some dental assistants receive specialised training to perform extended duties whereas others do not. Inconsistencies in workforce data reporting are also evident, as some countries do not require mandatory registration for dental assistants, while others lack centralised workforce data for dental hygienists (e.g., Spain).

Finally, Scotland, stands out in its approach, as the only country in this study with registered dental therapists which is likely to explain the lower figure of dental hygienists in Scotland as some individuals may have multiple skills and qualifications. Dental hygienist-therapists are qualified to provide all direct restorations in the primary and secondary dentition and to extract primary teeth within their scope of practice (Turner *et al.*, 2020). There are also additional OHPs working within the Scottish Childsmile programme including ‘extended duty nurses’, ‘dental health support workers’ and ‘Childsmile coordinators’ (University of Glasgow, 2023).

Table 6-4 Dental workforce information across six European countries

Country	No of Dentists (year)	No of Dental Assistants per 100,000 population (year)	No of Dental Hygienists per 100,000 population (year)	Dentists per 100,000 population (year)	***Estimated*** proportion of dentists offering publicly funded care for children
Denmark [1]	4,535 *(2022)*	132 *(2020)*	44 *(2022)*	77 *(2022)*	18% *(n=830)* *(2022)*
Germany [2]	100,491 *(2021)*	236 (Dental assistant general) *(2021)*	29* *(2021)*	121 *(2021)*	99%* *(2023)*
Hungary [3]	7,198 *(Operational Register, 2022)*	62 *(Operational Register, 2022)*	36 *(Operational Register, 2022)*	74 *(2022)*	31%* *(2022)*
Ireland [4]	3,644* (2024)	15* (2024)	12 (2024)	71 *(2024)*	9% *(n=320*)* *(2023)*
Scotland [5]	3,988 *(2023)*	114 *(2023)*	12* *(2023)*	73 *(2021)*	86% (n=3,438*) (2022)
Spain [6]	40,968 (2022)	42 (e) *(2021)*	32 (e) *(2021)*	84 *(2022)*	18% (n=7,400*) (2023)

Notes and sources

1 Sources: www.sundhedsdata.dk. Dentists per 100,000 based on the total number of *practising* dentists. Population source (World bank 2021). Over 18% of dentists are employed in Kommunal tandpleje providing children and adolescent care.

2 Sources: KZBV and https://www.gbe-bund.de/. *The number of dental hygienists (Dentalhygieniker) is 1600 in total (CECDO, 2021). There are 24,000 specialised dental chairside assistants (Zahnmedizinische Fachassistentin) who have undergone extended training and perform additional duties including supra-gingival scaling. Population source: World bank, 2021. *Over 99% of dentists work in the SHI system (public system) where almost all children's care is covered.

3 NNK's annual data provision to the Supervisory Authority – 2022. National Professional Inspection for Dental and Oral Diseases. *There are 11,048 dentists, 15,173 dental assistants and 5,722 dental hygienists on the *basic* register in 2021. *In 2022, there are 227 full-time school dentists, 157 paediatric dentists and 1,764 *'mixed-practice'* dentists must supplement their work part-time (Hajdu et al. 2023).

4 Number of dentists represents the total number of registered dentists, the number of practising dentists is not available. Dental nurses' registration is voluntary. Population source based on Central Statistics Office 2021. *Publicly funded care for children is only delivered via salaried practitioners directly employed by the Health Service Executive. The total number of WTE employed was 320, of which 51% worked part time in 2023. Source: HSE. Health Service Personnel Census Report.

5 Total figures represent the number of professionals registered with the General Dental Council in Scotland in April, 2023. Population source: National Records of Scotland. A total of 3,438 dentists were registered with the National Health Service (NHS) in 2022 where all children can avail of free dental care at the point of access. Source: NHS Scotland Workforce Statistics.

6 Total number of dentists: Instituto Nacional de Estadistica. Total number of dental assistants and hygienists based on estimates from the CECDO database. Population estimate = World Bank, 2021.

6.4.2.1.3 Proportion of dentists by gender across representative European countries

In almost every country included in this analysis (i.e. Denmark, Hungary, Ireland, Scotland, and Spain), a greater proportion of dentists identified as female (Figure 6.1). The exception was in Germany where 47% identified as female (BZÄK/KZBV, 2023). There are no global workforce data available for Ireland. However, according to the Health Service Executive which delivers all publicly funded dental care for children 74.5% of all WTE dentists in 2023 identified as female (Health Service Executive, 2023b). The country with the next highest female to male ratio was found in Denmark as over 67% of all dentists are female. Based on Danish workforce projections by 2040 it is expected that approximately 26% of dentists will identify as male (Danish Health Authority, 2024). In Hungary 75% of those providing 'paediatric care' identify as female (Direct Communication, Chief Dental Officer Hungary, 2023).

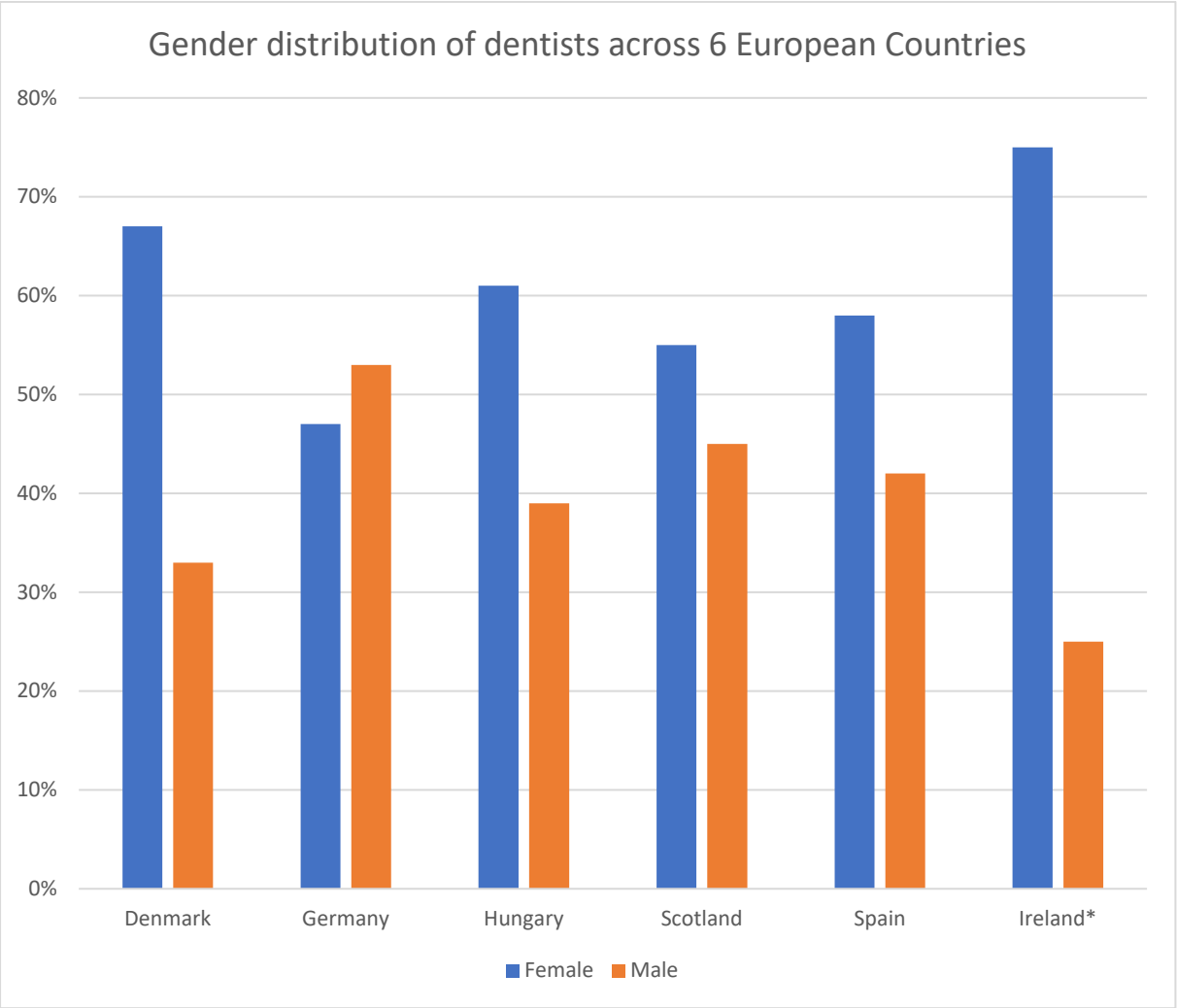


Figure 6-1 Gender distribution of dentists across six European countries

Sources:

1 Danish Health Authority (2021).

2 BZÄK (Federal Dental Association) (2022).

3 Operational registers, The National Public Health Centre (NKK) (Hungary) 2022

4 GDC, (2021).

5 INE, 2022

6* Ireland figure based on the % female WTE employed by the HSE in 2023 who are responsible for the delivery of all publicly funded dental care for children in Ireland.

6.4.2.1.4 Proportion of dentists by age group across representative European countries

There is variation in terms of dentist distribution by age across the countries in this analysis for which data is available (Figure 6-2).

Two of the countries (Germany and Denmark) have a greater proportion of dentists aged between 35-64 years, with over 72% of German dentists and 64% of Danish dentists falling within this category (BZÄK, 2022; Danish Health Authority, 2024). Most German dentists are aged between 55-64 years (BZÄK, 2022). While in Denmark, over 22% (n=689*)* of dentists are aged between 60-64 years (Danish Health Authority, 2024).

In Hungary, over 20% of dentists are aged 70 years and over, however, there is also a significant number of dentists in the younger age cohort (36%) of whom almost half are aged between 25-29 years (NKK, 2023).

In contrast, just *n=95* Scottish dentists are registered over the age of 65 years with 35% of dentists in the 18-34-years age category, which represents the age category with the highest proportion of dentists in Scotland (General Dental Council (GDC), 2023). Spain also demonstrated high numbers of dentists within younger age cohorts, with 29% of Spanish dentists (n=11,738) under the age of 35 years (Instituto Nacionale de Estadistica, 2022a).

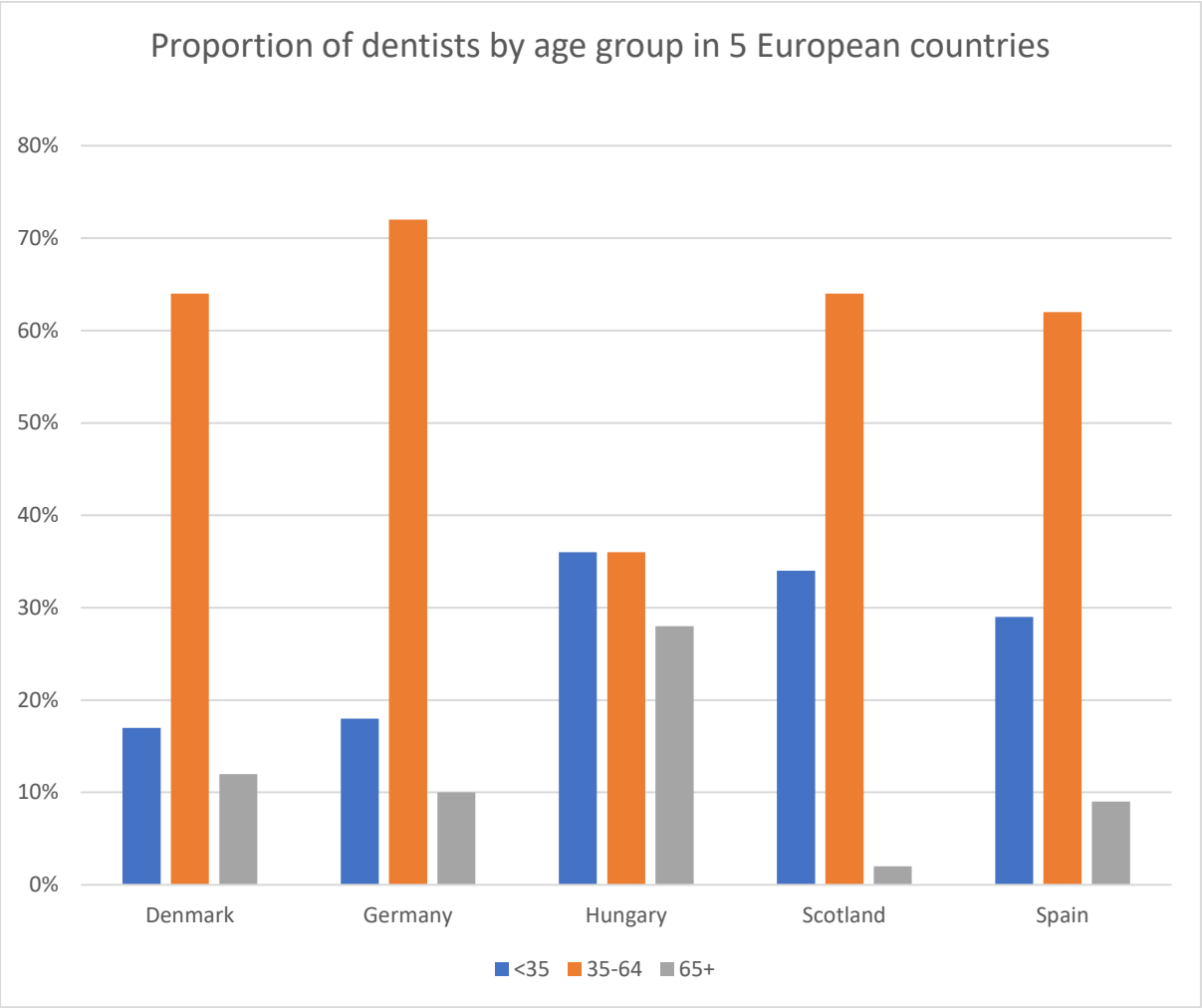


Figure 6-2 Proportion (%) of dentists by age group in five of the six* European representative countries

***Note:** There are no data available for Ireland

Sources:

1 Danish Health Authority (2021).

2 BZÄK (Federal Dental Association) (2022).

3 Operational registers, The National Public Health Centre (NKK) (Hungary) 2022

4 GDC, (2021).

5 INE, 2022.

6.4.2.1.5 Geographic distribution of dentists in six European countries

The geographic distribution of dentists across the six European countries reveals notable regional disparities, with urban centres generally hosting a higher concentration of dental practitioners than more peripheral or rural areas. Capital cities and major metropolitan regions tend to have the highest dentist densities, while remote and less densely populated areas often report significantly lower numbers of dentists per 100,000 population.

In Hungary and Spain, dentist workforce distribution have a similar pattern, with Budapest (136.2 per 100,000) and Madrid (134 per 100,000) recording the highest densities, whereas Nógrád (29.1 per 100,000) and Castile-La Mancha (46 per 100,000) report the lowest figures (Instituto Nacionale de Estadistica, 2022b; Chief Dental Officer Hungary, 2023). A comparable trend is observed in Germany, where Berlin (117 per 100,000) and Hamburg (113 per 100,000) lead in workforce concentration, while Saarland (71 per 100,000) and Brandenburg (76 per 100,000) have fewer dentists relative to their population sizes (Gesundheits-Berichterstattung Des Bundes, 2021).

In Denmark, workforce distribution appears to be influenced by proximity to educational institutions, with the Capital Region and Central Denmark Region showing the highest dentist densities (Danish Health Authority, 2024). There is limited data available in Ireland however there are suggestions of a divide in dentist workforce distribution. According to the Irish National Oral Health Policy 'in the most economically advantaged areas, the number of dentists available per 100,000 of the population is almost double that of less economically advantaged areas. Dublin has the most dentists per capita. In particular, along the western seaboard, from Mayo to West Cork, there are fewer dentists overall than the rest of Ireland (Department of Health, 2019a).

Scotland also demonstrates regional variations in access to NHS dental care, particularly for children. In NHS Borders, 77.4% of children accessed NHS dental services in the past two years, compared to just 41.9% in the Western Isles (Public Health Scotland, 2023a). The Western Isles and Shetland have the lowest numbers of NHS dentists, in contrast to Greater Glasgow and Clyde, which reports the highest workforce availability (TURAS, 2022). Similar

patterns emerge in Ireland's more remote regions, where access to dental services appears more limited outside of urban centres (Department of Health, 2019a).
Across all six countries, a pattern of greater workforce concentration in major cities and lower dentist availability in rural, coastal, or geographically isolated areas is evident.

6.4.2.1.6 Information pertaining to dentists collected nationally in six European countries.

The extent of nationally available data pertaining to dentists collated either by dental regulatory bodies or health services, vary markedly throughout the study countries. They range from extensive information in countries such as Denmark, Germany, and Hungary in comparison to very limited data in Ireland (Table 6-5).

All study countries require mandatory registration and collect information on the primary educational qualification attained by dentists. All countries except for Ireland collect data pertaining to dentists practising location, while in Scotland this information is provided relating to PDS dentists by the TURAS database (TURAS, 2022). Information on gender and age is accessible in all countries except Ireland.

The most granular data is collected by Denmark, Germany, and Hungary particularly collating information on dentists who are 'practising' or 'operational', what area of dentistry they are working in and if they are working outside of dentistry. Denmark and Germany also collect data regarding full or part-time working.

In Scotland, TURAS collects information on the area of dentistry within which NHS dentists work (i.e. vocational dentist, associate, general practitioner), however no information is available with respect to part-time working (TURAS, 2022). In Ireland, the Health Service Executive (HSE) provides data on part time working for salaried dentists (Health Service Executive, 2023b). Published reports and projections for oral healthcare workforce were found in three of the study countries (Denmark, Germany, and Scotland).

Table 6-5 Routinely collected information pertaining to dentists across six European counties

Country	Qualification	Geographical distribution	Gender	Age	Employment information*	Active Dentists	Part-time/fulltime working
Denmark [1]	✓	✓	✓	✓	✓	✓	✓
Germany [2]	✓	✓	✓	✓	✓	✓	✓
Hungary [3]	✓	✓	✓	✓	✓	✓	-
Ireland [4]	✓	-*	-	-	-	-	/
Scotland [5]	✓	✓*	✓	✓	/	/	-
Spain [6]	✓	✓	✓	✓	-	-	-

***** *Information available including whether a dentist works in private practice or public practice/public contract and within what area for example community or hospital dentistry*

✓ = data available, /= some data available, *data with limitations

Notes and sources

1 The Danish Health Authority

2 BZÄK/KZBV. Federal Dental Association and National Association of Statutory Health Insurance Dentists.

3 The National Public Health Centre (NKK) 2022. Source for professional contract: NEAK.

4 Dental Council of Ireland. *Individual address provided on registration not linked to dental practice.

5 TURAS. NHS Scotland workforce statistics and General Dental Council. 6 Instituto Nacional de Estadistica (INE).

6.4.2.1.7 Dentist workforce reporting across international databases

Data on the total number of dentists across the study countries varies considerably between international databases, reflecting differences in data sources, reporting years, and definitions of what constitutes a practicing dentist.
The most recent data tend to be available in the OECD and CECDO databases while figures in the CAPP database can date back up to ten years (OECD Health Statistics, 2022; The Council of European Chief Dental Officers, 2023; World Health Organisation, 2024b).

A key distinction between these databases lies in how they classify dentists. The OECD database differentiates between 'practising', 'professionally active' and 'licenced to practice' dentists, offering clear definitions for each category and specifying the data sources used for each country (OECD Health Statistics, 2020, 2022).

The CECDO database informed by direct communication from Chief Dental Officers, reports figures for 'active dentists' (The Council of European Chief Dental Officers, 2023). Meanwhile the WHO (GOHSR) data are based on the National Health Workforce Accounts (NHWA) platform (2020) and the CAPP database primarily relies on WHO Estimates of Health Personnel, except in the case of Denmark where data were provided by the Danish Health Authority. These inconsistencies in reporting definitions and data sources contribute to observed variations in workforce estimates.

For example, Ireland's dentist figures differ between databases, with the CECDO listing 2,828 dentists (2021), while the OECD reports 3,442 practicing dentists (2022). Similarly, Germany's workforce count ranges from 69,863 (CAPP, 2015) to 72,468 (CECDO, 2021), depending on the data source. In some cases, discrepancies are also linked to differences in reporting years, as seen in Spain, where CAPP reports 33,286 dentists (2014), whereas CECDO and OECD report 40,417 dentists (2021).

6.5 Discussion

This study found child oral health indicators of dental caries prevalence and oral health workforce are not comparable across the six representative European countries due to the wide variation in the data used to inform them (Patel *et al.*, 2016; Agrasuta *et al.*, 2021; Winkelmann *et al.*, 2022). Global frameworks such as that developed by the WHO and the World Bank provide mechanisms for monitoring UHC implementation (World Health Organisation and World Bank, 2014), however within this framework, 'there are no measures that involve or are specific to oral healthcare and/or dental care' (Jashni *et al.*, 2023). As such, it is not possible to progress on the integration of oral health within UHC without the establishment of 'clear, agreed-upon indicators' with oral health status including dental caries, and 'workforce' identified as potential indicators of use (Jashni *et al.*, 2023).

Health indicators are critical to identifying emerging health challenges, efficient resource allocation, policy and intervention evaluation. The WHO's Global Oral Health Status Report acknowledges the 'limitations' in oral health data (World Health Organisation, 2022) and the need for robust indicators to monitor progress toward universal oral health coverage (Winkelmann *et al.*, 2022; Jashni *et al.*, 2023). Similarly, the European Observatory on Health Systems and Policies identified the absence of 'comprehensive and systematic collection of information' necessary to assess and compare systems performance across European countries. In turn calling for the development of systematic oral health indicators to better inform-policy makers and support the design of appropriate oral health interventions (Winkelmann *et al.*, 2022). Health indicators should be specific, valid, reliable and well-defined to allow inter-country comparisons and benchmarking at the international level (Tolonen *et al.*, 2021). While an understanding of the 'data used to build health indicators' is important (Tolonen *et al.*, 2021; Winkelmann *et al.*, 2022).

The index most widely used to measure and report dental caries in this study was the DMFT, although it was not used in an identical manner in each country, leading to an absence of confidence in comparability across the six studied countries. The WHO proposes 'basic oral health surveys' as a useful means to identify 'important trends in oral health status amongst children' including reporting mean DMFT, and states oral health surveys should be conducted 'every five to six years' (World Health Organisation, 2013). Half of the countries in this study

had completed a national oral health survey, Germany most recently publishing reports after almost ten-year-interval (Jordan *et al.,* 2025) while data from Spain is within five years (Bravo, 2020). By contrast, the most recent survey conducted in Ireland was over twenty years ago (Whelton *et al.*, 2006).

However, national oral health surveys often encounter challenges in achieving high response rates, which can impact the representativeness and reliability of the collected data. The Sixth German Oral Health Study (DMS 6) exemplified these challenges. Conducted between 2021 and 2023, DMS 6 aimed to assess oral health across various age groups in Germany. The study reported an overall response rate of 26.5%, with notable variations among age cohorts and a response rate of 34% among 12-year-olds (Jordan *et al.*, 2025). This emphasises the importance of implementing strategies to enhance participation in national health surveys to ensure data accuracy and generalisability. Further arguments against using oral health surveys are high costs related to their planning, conduct and analyses along with difficulties in facilitating international comparisons (Broomhead *et al.*, 2024).

The alternative means of estimating national caries levels included conducting smaller scale surveys using pathfinder methodology (e.g. Hungary) (Szöke and Petersen, 2020) and using aggregated data consolidated from public dental systems (e.g. Denmark) (Danish Health Authority, 2023). Careful randomisation of a study sample using pathfinder approaches is required to ensure that a sample is representative of the population particularly pertaining to geographical variation. However, there is a risk that due to the small sample size (e.g. less than 500 children examined in Hungary) of an inaccurate estimate of dental caries and therefore insufficient understanding of disease levels or the impact of policy implementation, a problem that has occurred in other European countries (Patel *et al.*, 2016). Variations were also observed in the ratio of sample size to national population, particularly in Spain where a total of 448 children aged-12-years were examined out of a national population of over 47.5 million (Bravo, 2020).

The Danish SCOR system was established in 1972 for administrative and epidemiological purposes and is an example of using data derived from a public dental system to inform oral disease surveillance. Inputting data into SCOR by oral health personnel is obligatory with ‘mandatory registrations’ required at WHO indicative ages 5, 7, 12, and 15 years. Due to its

large sample size (e.g. over 40,000 twelve-year-old children in 2023) and long follow up, it is considered a 'comprehensive and continuously expanding registry of oral health' (Nygaard *et al.*, 2023).

The potential risk factors for reporting national caries levels based on aggregated data are that those with the highest levels of the disease may not be included. A failure to accurately capture the oral health status of vulnerable groups and their under representation in sample sizes may lead to a lower estimation of dental caries (Patel *et al.*, 2016). This is less likely to occur within the Danish setting specifically due its model of data collection and service delivery i.e. free of charge at the point of delivery, automatic child enrolment and dentists obliged to ensure all children assigned to their clinics are examined, with social services contacted in the event of non-attendance (Danish Health Authority, 2023).

The final method of collating national dental caries values seen in this study was seen in Scotland via its National Dental Inspection Programme (NDIP) (Public Health Scotland, 2023b). The NDIP, coordinated by Public Health Scotland (PHS) and supported by Scottish Dental Epidemiology Co-ordinating Committee (SDECC) was established in 2002 in line with the introduction of Childsmile (Macpherson *et al.*, 2010). A central aim of NDIP is to determine the 'level of obvious decay' (at the D_3 level into dentine) and in contrast to the SCOR system it operates in conjunction with clinical care.

Annual reports are published by PHS in detailing the methods, examiner calibration and sample size used (over 13,000 children aged c. 12-years-old in 2023) in addition to biannual collection of data pertaining to children in younger cohorts, aged c. 5-years-old. It is said to generate 'reliable oral health information' for all stakeholders concerned with 'oral disease prevalence' including the Scottish government (Public Health Scotland, 2023b). Data provided by NDIP and analysed by the University of Glasgow has been highlighted as integral to the long-term evaluation and sustainability of the Childsmile programme (Ross *et al.*, 2023).

This study found the DMFT index remained the most used indicator pertaining to dental caries across the study countries included in this analysis, with the 12-year-old WHO indicative age being the most common age. In Germany, the recording of caries in 8-year-old children was done using the International Caries Detection and Assessment System (Pitts and Stamm,

2004), with results then converted into the DMFT index (Jordan *et al.,* 2025). For other age groups in Germany, only 'clear, clinically observable caries lesions were recorded' (Jordan *et al.,* 2025). The ICDAS had been used in other national oral health surveys previously such as in Iceland (Agustsdottir *et al.*, 2010). Should oral health systems succeed in placing a greater emphasis on prevention, the ICDAS owing to its ability to give an accurate assessment of all stages of caries, not just established disease requiring restorative care, may be beneficial particularly in the evaluation of the impact of preventive interventions. However, this will be dependent on sufficient collaboration, training and reliable examiner calibration (Patel *et al.*, 2016).

For indicators to be reliable and comparable the 'definition of the indicator' is considered a 'main component' that affects the quality of information (Tolonen *et al.*, 2021). In this analysis along with variation in the sample sizes and methods of determining national caries data, there was also wide variation regarding the criteria for recording caries. Two of the countries (Germany and Hungary) followed WHO (2013) criteria (World Health Organisation, 2013), with the SCOR system following guidance laid down by the Danish Health Authority (Danish Health Authority, 2023) and NDIP followed BASCD guidance (Pine *et al.*, 1997). Ireland follows a combined BASCD and WHO criteria identifying both cavitated and non cavitated lesions (Whelton *et al.*, 2006). Spain continues to follow WHO guidance from 1997, despite conducting regular surveys since the updated guidelines were published in 2013 (World Health Organisation, 1997). The rationale proposed for this was 'to facilitate comparability and not break the time series of analysis of epidemiological trends' by maintaining 'the same methodology used in previous national health surveys' (Bravo, 2020).

The variation across the study countries pertaining to dental caries data were replicated across oral health workforce data, particularly with respect to the varying depth and granularity of accessible information. This reinforces existing research on oral health highlighting that there remains an absence of 'standardised and reliable methodologies to gather information for successful workforce planning (Yamalik *et al.*, 2013). There is 'incomplete and uneven information on workforce which is challenging and problematic (Yamalik *et al.*, 2013).

Detailed workforce data are regularly collated by the Danish Health Authority, SHI Dentists in

Germany, and the National Public Health Centre in Hungary, while Ireland remains an outlier in terms of limited data availability. Previous research on the Irish oral healthcare workforce has identified the paucity of workforce data as a major barrier to planning, with the national dental professional register deemed insufficient for workforce estimates (Haase and Batchelor, 2014).

Several broad trends were observed across workforce domains that warrant discussion. Firstly, the number of dentists per capita varies widely. Germany and Spain report substantially higher dentist-to-population ratios, with Spain experiencing a 745% increase in dentists per capita since the 1980s due to the expansion of private dental education and lack of workforce regulation (Hernández-Ruiz *et al.*, 2022). This has led to under employment and oversupply of dentists, (Bravo *et al.*, 2015; Hernández-Ruiz *et al.*, 2022) in contrast with Ireland and Scotland where dentist shortages have been identified as a crucial issue (The Scottish Parliament, 2023).

This study echoes research conducted in 2024 which found that Ireland has the lowest ratio of dentists to total population in Europe (Fernández-Serrano *et al.*, 2024). This appears to be especially problematic in the delivery of publicly funded children's care with less than 10% of registered dentists employed to deliver that care (Health Service Executive, 2023b) in contrast with almost 20% of the Danish workforce providing care to a similar cohort (Danish Health Authority, 2024).

Secondly this study supports the global trends indicating a female majority of the dentist workforce, particularly in paediatric and publicly funded dental services (Ivanoff *et al.*, 2018; Fleming *et al.*, 2023). Studies indicate that female dentists are more likely to work part-time which may impact service provision and workforce capacity (Ayers *et al.*, 2008; Oshima *et al.*, 2021). This research found that in Denmark almost 40% salaried dentists work part-time while in Ireland this figure exceeds 50% (Health Service Executive, 2023b; Danish Health Authority, 2024). It should be noted the recruitment and retention of dentists is impacted by a host of factors including contractual arrangements, the range of care provided and working conditions (Holloway and Chestnutt, 2024). However, in addition to those structural determinants, the implications of the female majority must also be accounted for in workforce design, the economic challenges of workforce patterns for patient care and

potential flexible working practices (Gallagher and Scambler, 2021).

The oral health workforce, particularly pertaining to children is not solely dependent on the availability of dentists but is also influenced by auxiliary dental professionals including dental hygienists and assistants. However, their availability, training, scope of practice and requirement for registration vary widely across the six study countries (Kravitz *et al.*, 2015; Winkelmann *et al.*, 2022). Auxiliary OHPs play a significant role in Denmark and Scotland, two systems highlighted for their strong preventive focus and effective oral healthcare systems for children (Kravitz *et al.*, 2015). Scotland is the only study country to formally integrate dental therapists into its publicly funded oral healthcare system. In the Scottish Childsmile programme a range of auxiliary and non-dental professionals play a central role (Kravitz *et al.*, 2015; *Programme Manual for Childsmile Staff*, 2016).

While in Denmark, dental hygienists play a 'major role' in the delivery of oral healthcare for children (Richard *et al.*, 2022). Denmark reported over 44 dental hygienists per 100,000 population which was almost four times more than the figure reported in Ireland of 12 per 100,000. These variations highlight the potential for expanding the role of auxiliary professionals and creative workforce solutions, in the delivery of children's oral healthcare particularly in regions experiencing workforce shortages (Gallagher *et al.*, 2024).

A clear urban-rural divide in the distribution of dentists emerged across all study countries. Major metropolitan areas and capital cities reported higher dentist workforce densities, while rural and coastal regions had fewer dentists. For example, in Hungary and Spain, there were over four and three times as many dentists per 100,000 population in Budapest and Madrid in comparison to rural areas. This was replicated in findings pertaining to Ireland and Scotland, with fewer dentists found in rural and coastal regions. This geographic imbalance in dentist workforce distribution echoes the international literature where population urbanisation is a strong predictor of not only the density of dentists but the overall oral health workforce (Northridge *et al.*, 2020; Gallagher *et al.*, 2024). It is suggested that financial prosperity, infrastructure and amenities facilitate the attractiveness of urban areas for professionals (Gallagher *et al.*, 2024).

Finally, there are contrasting findings regarding the age profile of dentists with Germany,

Demark and Hungary demonstrating greater numbers in older aged cohorts compared to a high proportion of Spanish dentists who are younger. The proportion of older dentists among all working dentists in Germany in particular has risen continuously in recent years with the number of dentists under the age of 45 unable to compensate for the numbers approaching retirement (BZÄK, 2022).

The broader implications of potential workforce shortages mean policies aimed at developing universal oral health coverage and reducing the barriers to oral healthcare will have limited chance of success if the capacity to provide that care is not there to satisfy demand (Ahern *et al.*, 2019). Therefore, careful oral health workforce planning where currently 'little attention is given' and which are 'isolated from planning of services' must be of critical importance to health system and policy leaders (Birch *et al.*, 2015).

Universal health coverage (UHC) is widely recognised as a crucial pathway to achieving improved health outcomes for all (United Nations General Assembly, 2019b). Since 2019, oral health has been included in the United Nations Political Declaration on UHC underscoring the need for accessible and affordable oral healthcare services globally (United Nations General Assembly, 2019). To 'better understand' how actions and investments can deliver on the goal of UHC, the ability to document trends in effective health service provision and population health gains is essential (Lozano *et al.*, 2020). As such meaningful indicators are indelible to the construction of health systems world-wide (Marques dos Santos *et al.*, 2024).

The inconsistencies in how dental caries and oral workforce data are presented and reported across international databases such as the OECD and the WHO, underscore a fundamental gap as a foundation for the evidence base essential to oral health policy (Agrasuta *et al.*, 2021; Winkelmann *et al.*, 2022). Without standardised, transparent and regularly updated data, policymakers will continue to face substantial challenges in assessing progress toward universal oral health coverage and in designing and evaluating evidence based-interventions to improve equitable access to oral healthcare (Winkelmann *et al.*, 2022).

6.6 Limitations/strengths/potential contributions

Although the research set out to explicitly compare countries, due to the variation in the available data, countries were analysed individually with comparisons drawn if and where appropriate. For instance, data on dental caries, numbers of dentists and other aspects of workforce were often found to be inaccurate or incomplete. As such extensive efforts were made to ensure the accuracy of the data presented. This was achieved by verifying the data collected by two country experts, identifying and translating local information and making explicit the source from which all figures were sourced. The depth and granularity of data presented in this research represents a key strength of this study.

Beyond workforce availability and disease burden, multiple systemic factors influence children's access to oral healthcare. These include the capacity of professional dental education and training programmes, which shape workforce supply, engagement of oral healthcare professionals, geographic distribution, and the inclusion and prioritisation of preventive services in national oral health benefit packages. Financial barriers, such as out-of-pocket costs and the structure of public or private insurance schemes, also determine the extent to which children can access timely dental care. While this study primarily examines workforce and disease burden indicators, these broader structural factors must be considered in future research and policy discussions to ensure that children's oral health needs are met comprehensively.

It is incumbent on the authors of this research to highlight the difficulty and time-consuming interrogation of databases, largely non-academic, that was necessary to source data contained in this study. There must be an onus at an individual country level to maintain, review and monitor national oral health data and trends. This needs to be supported at an international level through a consensus on the quality, standards and methods for informing oral health indicators, if universal oral health coverage is to be more than an aspiration.

6.7 Conclusion

This study demonstrates that data on indicators for dental caries and the oral health workforce are not directly comparable across the six representative European countries analysed, owing to significant variation in methods of measurement, data collection methods, reporting standards, and workforce classifications.

By systematically mapping these discrepancies, the study offers updated figures and identifies specific methodological limitations that contribute to the persistent lack of standardisation in oral health surveillance. Notably, workforce data revealed marked differences in dentist-to-population ratios, gender distribution, and the availability of auxiliary professionals, with many countries lacking disaggregated data on those providing or available to provide publicly funded care for children.

These findings highlight the urgent need for greater transparency in international oral health reporting and a critical reassessment of the indicators currently used to monitor progress. Addressing these limitations through standardisation, agreed consistent diagnostic criteria, and improved workforce data will be essential to inform evidence-based policymaking and to support meaningful progress toward universal oral health coverage.

6.8 Chapter summary

This chapter presents a comparative analysis of child oral health indicators, a study accepted for publication —specifically dental caries prevalence and oral health workforce capacity— across six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain (Figures 6-3 and 6-4). Drawing on a narrative literature review of peer-reviewed and grey literature, the study highlights significant challenges in the comparability and interpretation of oral health data.

The Decayed, Missing and Filled Teeth (DMFT) index remains the most widely reported 'indicator' of dental caries in children, yet the study identifies extensive variation in how DMFT is measured and reported. Differences include diagnostic criteria, survey design, sample size, and data sources—limiting meaningful cross-country comparison. Similarly, the quality and availability of workforce data vary, with discrepancies in the number of dentists per capita, the proportion providing publicly funded care for children, and the presence of auxiliary dental professionals.

The findings emphasise the urgent need for greater standardisation in both caries and workforce reporting. Addressing these inconsistencies is essential to monitoring progress toward universal oral health coverage for children. The chapter calls for improved national data systems, harmonised methodologies, and stronger integration of oral health into health policy planning.

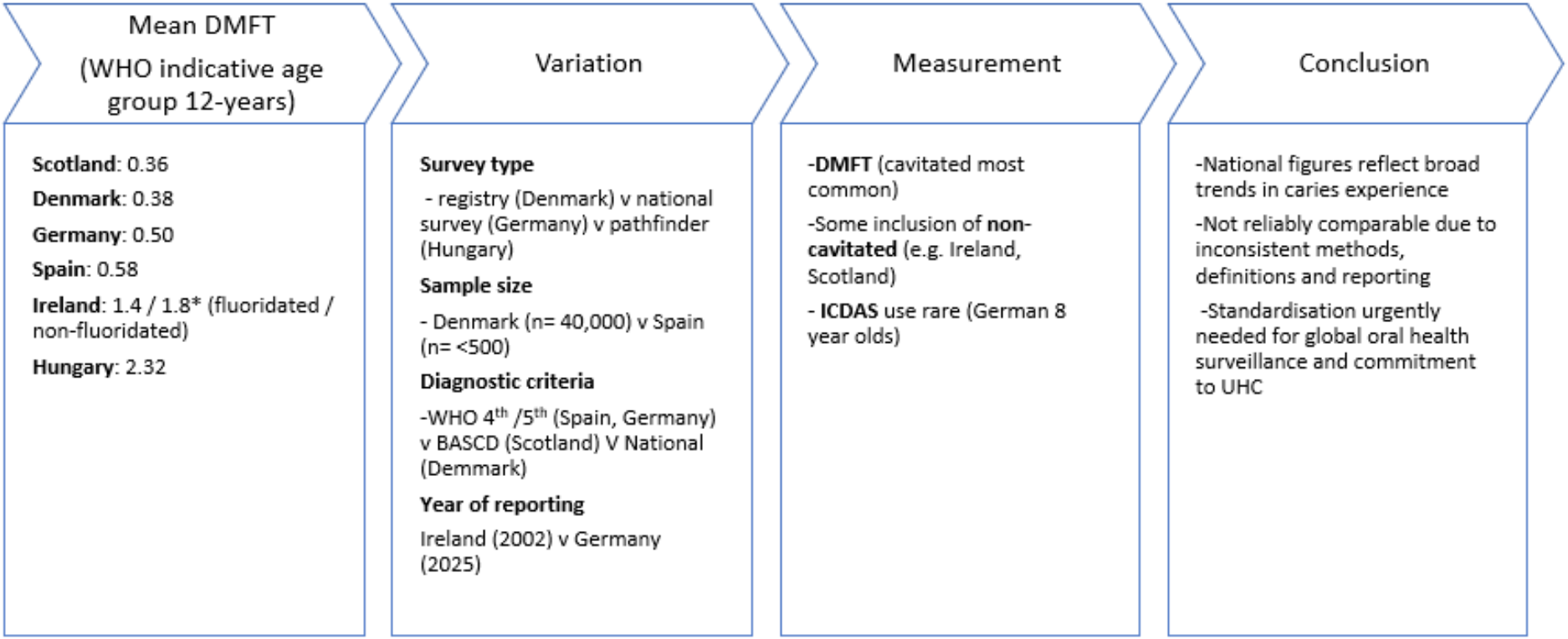


Figure 6-3 Summary - child dental caries data

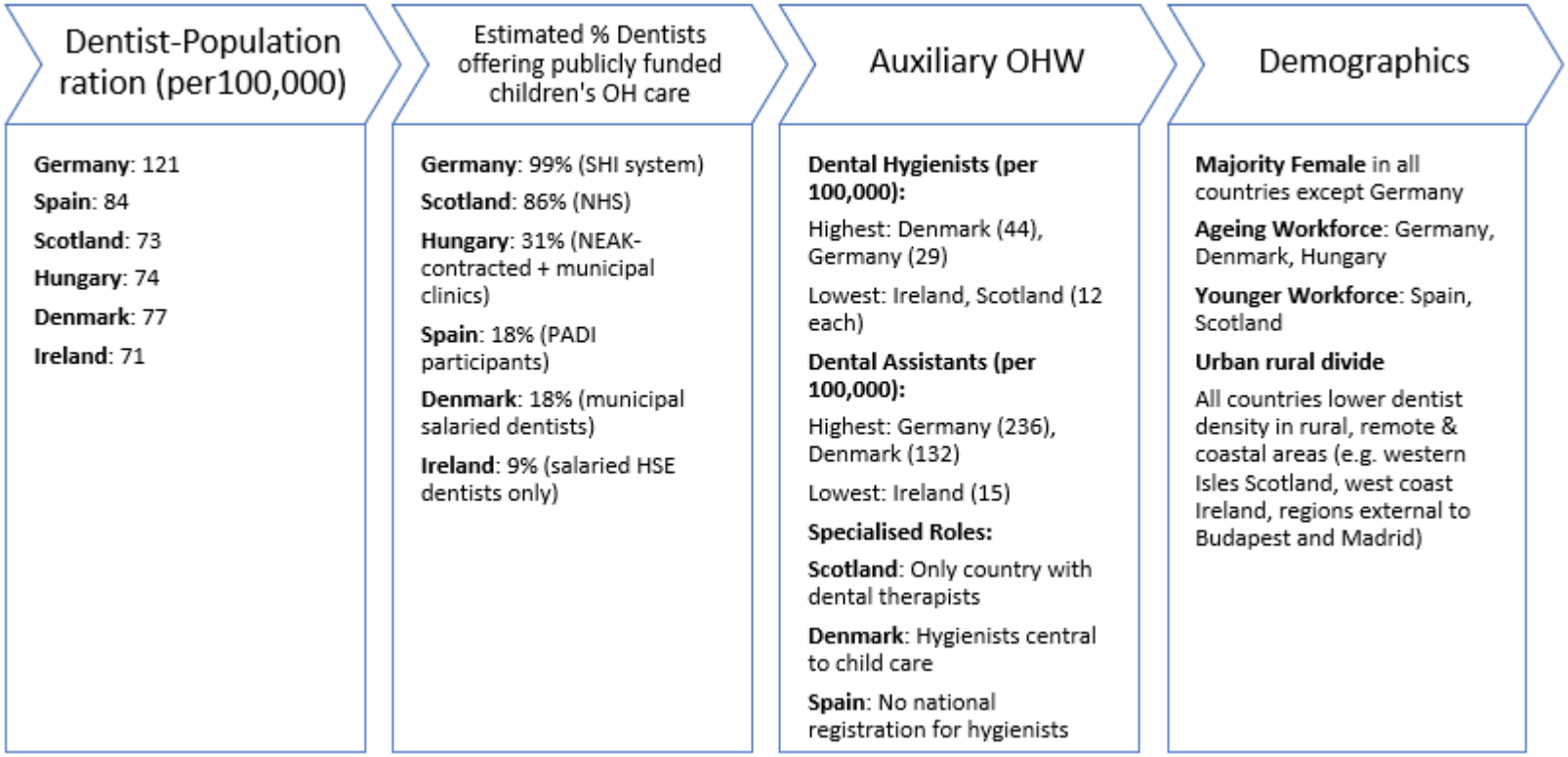


Figure 6-4 Summary - child oral health workforce data

Chapter 7 Discussion and Conclusions

7.1 Chapter overview

Chapter seven presents an overview of the main findings from the three research studies that were conducted in the programme of research for this PhD. This is followed by a discussion of oral health policy in Ireland and the context of influences and barriers to implementation. A synthesis of how the thesis findings contribute to the existing literature on oral health systems and policies is then provided. This is followed by an outline of the strengths and limitations of the thesis before recommendations for oral health policy implementation in Ireland are made. Suggestions for future research and a final conclusion to the PhD thesis are provided.

7.2 Overview of findings

Despite being almost entirely preventable, oral diseases are among the most prevalent of all diseases globally, while dental caries is the single, most common, chronic disease of childhood (Bernabe *et al.*, 2020; World Health Organisation, 2024a). Oral diseases disproportionately impact the most vulnerable and marginalised in society. Their exclusion from general healthcare systems in many countries exacerbates existing health inequalities and contributes to the barriers in accessing oral healthcare (Peres *et al.*, 2019).

It is proposed that the global drive for universal oral health coverage can serve as a potential opportunity for the integration of oral health within the broader healthcare system and improved access to primary oral healthcare (Watt *et al.*, 2019).

Ireland is an example of a country where there is restricted oral health coverage for large sectors of the population including children, and historically, limited oral health system reform (Johnston *et al.*, 2020). Ireland's first national oral health policy in over one quarter of a century, Smile agus Sláinte, was published in 2019 (Department of Health, 2019a). The aim of this PhD was to appraise and inform the reform of the Irish publicly funded oral health system for children, proposed by the policy, in line with the global policy aim of universal oral health coverage (World Health Organisation, 2024a).

This first objective of this PhD was to generate an in-depth understanding of the key factors that impeded or promoted the development and implementation of oral health policy in Ireland during the period 1994 to 2021.

The second objective was to provide a detailed description and mapping of publicly funded oral health coverage for children across six European countries, each representative of a different oral health system model, and, to report on that coverage in line with the WHO Universal Health Coverage Cube (World Health Organisation, 2008).

The third objective was to describe and compare two key oral health 'indicators' of child universal oral health coverage, (i) oral disease, specifically dental caries prevalence at age 12 years and (ii) oral health workforce, across the same European countries.

To meet these objectives, three distinct but interconnected studies, with data collected from multiple sources across different domains, were conducted. The study findings are briefly re-stated below.

7.2.1 Policy analysis findings

Study One- (McAuliffe et al., 2022)

The strongest and most persistent finding from the Irish oral health policy analysis was the low political interest in oral health. This was the dominant finding from the triangulation of both primary (i.e. 'elite' interviews conducted with 13 experts across the Irish oral health policy landscape) and secondary data sources (i.e. analysis of 125 documents developed at local, regional, and national level, mapped over a 27-year period).

The low political priority was illustrated by a failure to incorporate oral health into national health policies or to reform dental legislation. It was further evidenced by the non-implementation of clinical guidelines, recommendations from commissioned reports and a national oral health policy, during the study period.

The political disinterest also contributed to the absence of oral health professionals or advocates, in positions of influence and power within the key decision-making institutions of

the health system namely the Department of Health (DoH) and the Health Service Executive (HSE).

Overall, this perpetuated a system hallmarked by unequal access to publicly funded oral healthcare particularly for children and special needs groups, while services for adults were subject to long-lasting austerity measures which resulted in a tripling of unmet needs for dental care.

The exception to the political malaise was a keen interest amongst politicians in orthodontics. Findings from both the documents and interviews suggested that even during times of scarcity, orthodontics received political priority. Evidence pointed to the pressures placed on politicians by predominantly middle-class voters seeking publicly funded orthodontic care for their children as the motivation for this political interest.

Finally, the policy analysis found limited engagement took place with central stakeholders, particularly the dental profession, in the development of *Smile agus Sláinte.* In view of Ireland's poor history of oral health system reform, this prompted significant concerns for future oral health policy implementation.

The publication of the World Health Assembly resolution on advancing universal oral healthcare, along with Ireland's political commitment to universal general healthcare was suggested as a potential lever to institute long awaited oral healthcare reform (Houses of the Oireachtas, 2017; World Health Organisation, 2021, 2024a).

7.2.2 Inter-country comparative analysis findings

Study Two - (McAuliffe et al., 2025)

To build on the in-depth knowledge generated within a single country in Study One, Study Two sought to compare oral healthcare for children across multiple, representative European countries. This study sought to determine the key lessons that could be learned with respect to effective oral healthcare systems for children, through the lens of universal oral health coverage.

The results highlighted two broad 'models' of oral health coverage for children across the European countries in the analysis: those systems adopting 'universal' approaches whereby all children were eligible for almost all care without cost (found in Denmark, Germany, Scotland, and Hungary) and those restricting coverage by way of 'targeting' children by their age and/or the location in which they live (i.e. Ireland and Spain).

In those countries without universal coverage (i.e. Ireland and Spain), and in Hungary due to the difficulties in accessing it's 'universal system', the private sector assumes a very significant role in the delivery and financing of children's oral healthcare. This results in high out-of-pocket payments, placing a financial burden on families.

Additionally, those countries with more restricted coverage were also those where preventive oral healthcare was afforded lower priority within the oral healthcare system. Although the need for a greater emphasis on prevention was a dominant outcome across all systems and countries, Scotland and Denmark were notable for embedding prevention systemically, particularly through initiatives like Childsmile, where the use of auxiliary professionals played a key role in delivering preventive care in schools and nursery facilities.

A significant finding from Study Two was the varying successes of different systems in implementing oral healthcare reforms. Most 'universal' systems demonstrated a trend of effective reform, including expanded oral healthcare coverage with a particular focus on prevention. Those reforms were achieved in different systems and countries by similar means: using high quality data, collaboration with a range of stakeholders including dental professionals and academics, and by securing sustained political interest.

In contrast, a failure to update legislation, implement policy and expand coverage was most evident in the two 'targeted' systems (i.e. Ireland and Spain) with those oral healthcare systems demonstrating vulnerabilities to significant health system 'shocks', especially in the form of a global financial crisis.

7.2.3 Narrative review of indicators findings

Study Three- (Accepted at BMC Oral Health, citation forthcoming)

A consistent finding from Study Two was a notable scarcity of oral health data across Europe and ongoing concerns regarding the reliability and comparability of available data, despite strong evidence supporting its critical role in effective oral healthcare reform. In addressing this gap, Study Three critically assessed two primary indicators proposed by the WHO in its Global Oral Health Status Report (2022), to track progress toward universal oral health coverage: the prevalence of oral diseases and the oral health workforce.

Given the study's specific focus on child oral health, dental caries, being the predominant oral disease in childhood, was selected for analysis. The WHO's report uses 'estimated prevalences' for untreated caries, typically represented by DMFT (Decayed, Missing, Filled Teeth) scores; thus, this study examined various indices, including DMFT, to evaluate the robustness and reliability of available dental caries data (World Health Organisation, 2022, 2024a).

The central finding from Study Three reaffirmed that indicators of dental caries prevalence and oral health workforce are not directly comparable across representative European countries (Denmark, Germany, Hungary, Ireland, Scotland, and Spain). This incomparability results from variations in data collection methods, diagnostic criteria, sample sizes, frequency of reporting among others. The DMFT index remained the most commonly used measure, but significant inconsistencies were identified, such as differing criteria for caries diagnosis (WHO Basic Methods editions ranging from 1987 to 2013, BASCD guidelines in Scotland, and specific national guidelines in Denmark), variations in sample sizes (ranging from over 40,000 children in Denmark to just 448 children in Spain), and significant differences in reporting frequencies and data sources.

Regarding the oral health workforce, substantial disparities in data quality and detail were similarly evident. Countries like Denmark and Germany provided extensive workforce data, including dentists' practice location, gender, age demographics, and working patterns. Conversely, countries such as Ireland provided minimal workforce data, limiting comparative

analysis. Broader workforce trends identified included higher dentist-to-population ratios in Germany and Spain compared to notably lower ratios in Scotland and Ireland, a pronounced trend of dentists identifying as female within paediatric dentistry across nearly all studied countries, and noteworthy age-related workforce variations, with older dentists predominant in Germany and Denmark and notably younger dentists in Spain.

This study also highlighted significant urban-rural divides, with dentist workforce densities markedly higher in major urban centres across all studied countries. These variations underline critical gaps in equitable workforce distribution, potentially impacting children's access to oral healthcare services, especially in rural and coastal areas.

Overall, Study Three underscores the urgent need for standardised data collection and reporting mechanisms across Europe. Addressing these disparities will be crucial for accurately evaluating oral healthcare systems, guiding evidence-based policy-making, and ultimately advancing the goal of universal oral health coverage for children.

7.3 Oral health policy in Ireland: context, influences and barriers

The findings from the three studies highlight the significant gaps in oral healthcare coverage, workforce and available oral health data in Ireland, all of which contribute to persistent challenges for children accessing oral healthcare (Department of Health, 2019a). In order to understand why these challenges, persist, in-line with the overall aim of this PhD – to inform oral health system reform for children in Ireland, it is pertinent to consider the broader influences on Irish oral health policy. These include historical, political and economic impacts on oral health policy development and implementation.

The following section explores how key oral health policies emerged, the structural barriers that have hindered their implementation, and the systemic factors that continue to deprioritise oral health within the Irish general healthcare system (Table 7-1).

7.3.1 Evolution of oral health policy in Ireland

7.3.1.1 The Dental Health Action Plan (DHAP) (Department of Health, 1994a)

In the mid 1990's Ireland was experiencing a period of rapid economic growth, the beginning of the so-called 'Celtic Tiger' era, transforming Ireland from one of Western Europe's poorest countries into one of its wealthiest (Burke *et al.*, 2016). The political context was also favourable to the development of oral health policy with a 'left-leaning' Minister for Health, Brendan Howlin of the Labour Party, given significant credit for putting oral health on the political agenda, along with an Assistant Chief Dental Officer employed in the Department of Health (McAuliffe *et al.*, 2022).

Ireland's first general health policy 'Shaping a Healthier Future: a strategy for effective healthcare in the 1990's' was published in 1994 (Department of Health, 1994b) and included a series of 'action plans' one of which was the Dental Health Action Plan (DHAP). This was the 'first clear statement on the aims and health objectives of the dental services in Irish history' (Department of Health, 1994a). The publication of the DHAP led to critical successful policy outputs most especially establishing publicly funded oral healthcare for low-income adults (The Dental Treatment Services Scheme) and the expansion of the targeted system for children, along with a recognition of oral health inequalities impacting very young children and special needs groups (Table 4-2).

A 'problem stream' successfully framing oral health issues was also very prominent facilitated by media spotlighting of dental issues which was further informed by data from a national oral health survey (Gelbier, 2002; Whelton *et al.*, 2007), all of which were well communicated and led by skilled 'policy entrepreneurs'. This evolution is described by a senior expert familiar with policy events:

'*You had to use the political force that was behind the things the politicians were interested in, what was in the news, dentures and braces...use the momentum to get dental onto the agenda…we had the hard data…and the brilliant thing was the Minister for Health was actually interested…talk about right party, right place, right time…it was a transformative moment*' – (P 11, Study One, extended dataset).

Genuine engagement and collaboration with the dental profession was also highlighted as critical to the success of the policy initiatives:

'*Leadership, good people on all sides who were clever in negotiations… who saw they were doing something good for everyone, the profession and the community, and just decided to start…everyone didn't have everything they wanted but…come back next year…let's just start*' – (P11, Study One, extended dataset).

Following the publication of the DHAP there were several years of phased expansion and policy implementation. However, the policy ultimately stagnated within five years (McAuliffe *et al.*, 2022). Concerns regarding probity within the fee-per-service scheme for adults were raised within the Department of Health and there was a failure to further integrate oral health within the general healthcare system (Gelbier, 2002; PA Consulting Group, 2010; McAuliffe *et al.*, 2022). By 2001, when Ireland's next general health policy was published, oral health was not included to any significant level with a 'review' of the DHAP instead proposed (Department of Health and Children, 2001b). Despite this, the DHAP of 1994 remains the policy direction for all publicly funded oral healthcare in Ireland in 2025.

In summary, the DHAP was an ambitious and well supported policy initiative initially, but it lacked long-term implementation planning, dedicated funding and failed to sustain political support following a change in government (McAuliffe *et al.*, 2022). Oral health in this instance appears to have been framed as a 'one time' policy 'action plan' rather than a system requiring ongoing and continued reform.

7.3.1.2 The 2009 Draft National Oral Health Policy (Unpublished, Department of Health, 2009)

From 2001 to 2008, Ireland's 'Celtic Tiger' economy experienced unprecedented economic growth, and the health budget quadrupled, reflecting rising national income and making up for decades of under-spending in health (Burke *et al.*, 2014). This coincided with the most significant change to the organisation of the health system since the foundation of the state by way of the establishment of a centralised, national Health Service Executive (HSE) in 2005 (Burke *et al.*, 2018a).

Two national political parties, Fianna Fáil (FF), and the Progressive Democrats (PDs), were in power continually from 1997 to 2007. Fianna Fáil, conservative and nationalist, were the largest and oldest political party in Ireland at the time. While the 'PDs' were a group split from FF that perused economically liberal policies, with a strong low tax and pro-business ethos (Burke *et al.*, 2018b). Although the minority party in government for ten years from 1997, they had considerable influence over government policy, especially economic policy (Leahy, 2009). Furthermore, their leader, Mary Harney, was Tánaiste (deputy prime minister) and from 2004 until 2010 she was the Minister for Health. In government, the PDs held considerable influence over health policy even before occupying the health ministry (Wren, 2003).

Within oral healthcare, this was a period characterised by investment in oral health research (Crowley *et al.*, 2005; Whelton *et al.*, 2006; Irish Oral Health Services Guideline Initiative 2009, 2010, 2012) and in commissioning reports on dental services (Gelbier, 2002; The Irish Expert Body on Fluorides and Health, 2002; Oral Care Consulting, 2007; PA Consulting Group, 2010). However, there was no expansion in oral health coverage nor oral health policy or system reform. During the course of this PhD research an unpublished national oral health policy (2009) was identified via both strands of analysis (Health Service Executive, 2007; Irish Dentistry, 2007) with a copy secured by the PhD candidate (Table 4-3).

In this unpublished policy, key recommendations included the merger of the two publicly funded adult schemes (DTBS and DTSS) (Table 4-2), a reorientation of the public dental service for children under-age-5 and special needs groups, and the appointment of a senior clinical manager within the HSE who should be provided with sufficient authority to lead the service.

According to experts engaged in the process, the drivers for policy development stemmed from the investment in research, a recognition of the need to update dental legislation and a report from the Competition Authority of Ireland advocating for reform of the dental profession (Government of Ireland, 1985; The Competition Authority of Ireland, 2007; Houses of the Oireachtas, 2009c).

However, according to a senior health service manager this era represents:

'*A lost decade, from the time the CDO left the Department…there were opportunities to do things but getting them over the line was next to impossible'* – (P4, Study One).

While economic prosperity did not translate to actionable improvements for the oral health system, as described by an academic expert:

'I mean the Irish economy was booming…money everywhere…and still they couldn't get things right' – (P8, Study One, extended dataset).

Furthermore, poor relationships between the Department of Health, HSE and the Irish Dental Association hindered the development process, with the profession identified by one participant engaged in the policy process as *'blocking everything*' – (P12, Study One), while a high-ranking health service manager reflected that between all stakeholders – '*No party emerges from it with credit'* – (P4, Study One).

These difficult relationships were further evidenced by the collapse of negotiations to review the dental treatment services scheme in 2007 (Houses of the Oireachtas, 2007). This 'whirlpool' of turbulence (Howlett, 2019) was ongoing against the background of the most significant reorganisation of the health system in history, signalling a significant loss in political momentum due to competing priorities and according to an expert familiar with events - *'dentistry was not even on the radar'* – (P12, Study One).

In summary, despite economic prosperity and research investment, the 2009 Draft Policy was derailed by political shifts, a change in government which lost political backing for the policy, further exacerbated by the absence of a CDO in the Department of Health for ten years. This was compounded by professional conflicts, and the competing demands of wider health system reform. Its failure represents a major lost opportunity in Irish oral health policy.

By 2008, Ireland experienced one of the most severe economic crises of any OECD country and in 2010 austerity measures were introduced under the so-called 'troika bailout' (Burke et al., 2016). Oral healthcare was deeply impacted by budget reduction measures with public funding for the DTSS scheme (publicly funded oral healthcare scheme for low-income adults) reduced from €62m to €10m between 2010 and 2015 (Houses of the Oireachtas, 2017). While the DTBS (a dental scheme for adults who have sufficient social insurance contributions) was restricted to an annual dental examination only, having previously offered broad and deep coverage (Nolan, 2019). Subsequently between 2008 and 2012 unmet need for dental care in

Ireland tripled with the rise explained by 'the significant cuts in dental benefits' (Johnston *et al.*, 2020).

7.3.1.3 Smile agus Sláinte (Department of Health, 2019a)

In Ireland, the predominant influence on public health policy choices from 2009 to 2014 was prolonged austerity leading to continuous cuts to staff and budgets alongside an increasing demand for care (Burke *et al.*, 2014; Johnston *et al.*, 2020). Austerity measures, including the majority of those introduced in oral healthcare, still prevail in 2025. However, by 2017, Ireland was once again experiencing high economic growth (Burke *et al.*, 2018).

Ireland is unusual as the 'only Western European country that does not offer universal coverage of primary care' (OECD and European Observatory on Health Systems and Policies, 2021). Following a general election in Ireland in 2016, Fine Gael a centre-right party emerged as the largest political party and went on to form a new minority government with the support of 'Independents'. During the election campaign health was deemed the number one issue of concern for Irish citizens and almost all political parties committed to the implementation of universal healthcare (Burke *et al.*, 2018a).

Subsequently in 2017, an Irish cross-party parliamentary committee published a report, known as 'Sláintecare' (Sláinte is the Irish word for 'health') (Houses of the Oireachtas, 2017). Considered unique and historic it is the first time there has been a cross-party political consensus on major health reform in Ireland, and seeks to establish a universal, single tier health service (Houses of the Oireachtas, 2017; Burke *et al.*, 2018b). Sláintecare recommends that dental care should fall under the remit of universal health coverage (UHC) in Ireland. However, dental care received no mention in either the subsequent implementation or action plan associated with this policy (Government of Ireland, 2018a; Department of Health, 2019b).

Prior to Sláintecare, oral health was almost entirely neglected in general health policy between 2001 and 2017 and did not feature in any national health policy document except for one mention of community water fluoridation (Department of Health, 2013).

In 2009, the Minister for Health signalled the end of the unpublished national oral health policy (2009) when stating that, *'The national oral health policy has to be reconsidered in light*

of the public finances' (Houses of the Oireachtas, 2009b). As mentioned, the budget of 2010 signalled catastrophic cuts in dental care. As such it was not until 2011 that the HSE next identified oral health policy as a priority because of the 2009 policy remining incomplete, stating in a National Service Plan, that a 'new policy framework will be developed' (Health Service Executive, 2011).

Subsequently following a ten-year vacancy, in 2013 the 'National Oral Health Lead' of the HSE was released to undertake the functions of Chief Dental Officer for two days each week. They were specifically tasked with policy development, a process independent of the development of the general health policy development, Sláintecare (Houses of the Oireachtas, 2016). Based on this research it would be reasonable to conclude that the drivers to initiate the development of the 2019 policy ultimately stemmed from the failure of the 2009 policy, consequently it's recognition within the HSE service plan framework and predominantly the restoration of the Chief Dental Officer position, albeit on a part-time basis, tasked with policy development.

Findings from this research highlight how policy development was welcomed and began positively. The policy document states that a practitioner and an 'academic reference group' were established (Department of Health, 2019a) and this was further described by a senior health service manager:

'It started very well, they looked for everyone to get involved…things were positive, promising…hopeful of something new' – (P7, Study One, extended data set).

However, progress was slow, development began in 2013, and the policy was ultimately published in 2019. Unlike the DHAP, which had significant stakeholder agreement, Smile agus Sláinte was criticised for lack of meaningful consultation with dentists, leading to resistance. Despite early engagement of academic and practitioner reference groups seeking their collaboration and contribution, ultimately a key finding of this research was a failure to maintain consultation with the dental profession. There was almost unanimous agreement from experts of a failure to genuinely engage with oral health professionals, both private (independent) practitioners and salaried practitioners within the HSE, in addition to incorporating feedback from the academic and practitioners' groups. There was a consensus among interviewees that this posed a significant threat to policy implementation.

This was best summarised by a HSE aligned participant as follows:

'They should have brought everyone along with them…that is the single biggest failing of it, they did a bit at the start, but it wasn't enough. The secrecy around everything…you can't do that; it's just not going to wash. By taking so long they nearly made a mess out of it anyways, the profession can be bolshy, but you can't exclude them and then turn around and expect them to deliver on it' – (P2, Study One, extended dataset).

Smile agus Sláinte represented the first update to national policy in Ireland in over one-quarter of a century (Department of Health, 2019a). It aims to reduce oral health inequalities and expand access to oral healthcare across much of the population with a strong emphasis on prevention across the life-course (Table 4-3). It outlines a plan for dental coverage for children delivered via bundles of care by independent dental practitioners in private practice settings, a significant 'reorientation' from the salaried services which dominated since the inception of publicly funded oral healthcare for Irish children (Department of Health, 1988).

Based on these foundations, the policy proposals were broadly supported by experts recognising the strength of the policy document. While there was an overarching consensus that for children's care, delivery within private settings would gain efficiencies but would need to be supported by a 'safety net' salaried service-albeit with the recognised challenge of appealing to a disengaged profession. This was reflected upon by a senior manager within the health service:

'*The policy itself is well structured, and most countries would love to have a document like it. For children, I agree with the approach, private practice is efficient… but special needs groups, very young kids, those needing GA, they will need to be housed in the HSE. And the million-dollar question… how do you get everybody on board?'* (P1, Study One, extended dataset).

The policy was published in 2019. However, it lacked detailed costings and a clear implementation plan, delaying progress (Nolan, 2019). The COVID-19 pandemic paused many health initiatives, and oral health once again was de-prioritised. Between 2020 and 2022 there was evidence of further deterioration in stakeholder relationships pertaining to issues including the provision of personal protective equipment (PPE) during the pandemic (McAuliffe *et al.*, 2022).

Against a background of increasing prosperity, growing population and limited dental workforce operating under constrained administrative regulations, there was more than a 50% reduction in the number of private dentists contracted by the state to provide publicly funded oral healthcare for adults during the decade up to 2024. The very same group of professionals on which there is a reliance to deliver the 2019 oral health policy (Houses of the Oireachtas, 2024b).

A general election was held in Ireland in 2024. During the election campaign all parties pledged to increase the number of doctors and to reduce hospital waiting lists along with increasing coverage offered by general medical practitioners (Gerba, 2025). Although most parties committed to oral healthcare reform (Irish Dental Association, 2024), it did not appear as an issue of major voter concern. Rather the most important issues identified by the Irish electorate, were housing and homelessness, followed by the cost of living and health (Gerba, 2025). Ultimately the 2024 general election demonstrated the resilience of the Irish 'political centre'. Despite a challenging term in office, the two incumbent parties – Fianna Fáil and Fine Gael – successfully retained their position. Irelands political landscape is therefore unusual compared to other western democracies such as the United States and the United Kingdom where voters turned against incumbent parties, Irelands electorate instead chose stability over change, during a time of global uncertainty (Gerba, 2025).

The new Programme for Government has made provisions for oral healthcare with a stated intention to 'implement Smile agus Sláinte' (Government of Ireland, 2025). According to the new Minister for Health in Spring 2025: '*The National Oral Health Policy was approved by Government in 2019. Implementation, delayed by the pandemic, is now proceeding…. a key focus will be…to support the establishment of packages of care for 0–7-year-olds and commence a review of the DTSS scheme* (Department of Health, 2025).

It is evident from this PhD thesis that Smile agus Sláinte (Department of Health, 2019a) represents Ireland's most comprehensive oral health policy reform attempt in decades, but there are significant risks to its implementation including weak planning and delivery, resistance from key stakeholders, and lack of clear political leadership to push forward necessary reforms

Table 7-1 An overview of oral health policies in Ireland 1994-2021

Policy	Key Features	Political/ Economic Context	Implementation Successes & Failures	Why It Stalled?
1994 Dental Health Action Plan (DHAP)	- Expanded children's public dental services. - Introduced publicly funded oral healthcare for low-income adults (DTSS).	- Economic growth ('Celtic Tiger'). - Strong political support (Minister for Health + Assistant CDO in Dept. of Health).	- Successfully launched DTSS and expanded care. - Established clear policy goals.	- No sustained funding - Oral health deprioritised in wider health policy (2001). - Lost momentum after change in political leadership.
2009 Draft National Oral Health Policy (Unpublished)	- Proposed major reforms: merging adult dental schemes, restructuring services for children.	- Economic prosperity but overshadowed by 2008 financial crisis. - Major health system restructuring (HSE formation).	- Identified critical needs for reform but never implemented.	- No strong political leadership. - Shift in government focus due to financial crisis. - Poor relationships between stakeholders (HSE, Dept. of Health, IDA).
2019 Smile agus Sláinte	- Emphasis on preventive care & UHC for oral health. - Shift from salaried public services to private sector provision.	- Post-austerity economic recovery. - Political focus on Sláintecare (UHC) but oral health not fully integrated.	- Comprehensive policy document published. - Initial support from policymakers.	- Stakeholder resistance (dentist contracts). - No clear sustained funding strategy. - COVID-19 stalled implementation.

7.3.2 Why oral health lacks political priority in Ireland: Structural and policy failures

Ireland's general healthcare system has been subject to decades of public and political dissatisfaction, particularly pertaining to poor and unequal access, quality and outcomes (Burke *et al.*, 2018a). However, oral health is particularly neglected (Johnston *et al.*, 2020) and oral healthcare reform has failed to gain sustained political traction despite 'policy windows' and Ireland's economic capacity (McAuliffe *et al.*, 2022). This section explores the underlying reasons for this persistent disinterest including the dominance of private financing, weak political and institutional leadership and absence of oral healthcare data.

7.3.2.1 Oral health as a 'private responsibility'

Historically, the financing of oral healthcare in Ireland has been largely treated as an individual responsibility rather than a public health need, and unlike GP or hospital care, oral healthcare services have failed to fully integrate into the broader healthcare system. The latest available data from the Organisation for Economic Co-operation and Development (OECD) shows Government financing of general healthcare as a proportion of total health expenditure for Ireland was 77.4% in 2021, a lower share than the EU average of 81.1% (OECD and European Observatory on Health Systems and Policies, 2021).

Despite being ranked among the top five wealthiest countries globally, by per capita Gross National Product (GNP) (World Bank Group, 2022), Ireland continues to underfund oral healthcare. Unlike general healthcare, the converse funding model is evident is oral healthcare. Most oral healthcare in Ireland is privately financed, with out-of-pocket payments accounting for over 77% of total dental costs (Central Statistics Office, 2020). Furthermore, research has identified that out-of-pocket dental costs in Ireland cause financial hardship (Johnston *et al.*, 2020).

Findings from Study Two of this PhD research highlight that international systems with greater public financing of oral healthcare services for children have stronger government prioritisation, mirroring previous research conducted pertaining to oral healthcare for adults

(Allin *et al.*, 2020; McAuliffe *et al.*, 2025). The consignment of oral health to that of personal reasonability is well versed in the international literature (Wang *et al.*, 2020; World Health Organisation, 2024a). The implications of private financing suggested in the literature and seen in the Irish context in this research, is that advocacy for prioritising for oral health among political leaders is based on the private sector perspective. Not only does this mean a failure to adopt a dental public health approach, which has implications particularly on access to oral healthcare for the most vulnerable, but it also means less responsibility is assumed by government to provide comprehensive oral healthcare services (Benedetti *et al.*, 2015).

7.3.2.2 Weak political leadership and institutional gaps

The framing of oral healthcare as an issue of the private sector and individual responsibility means little political accountability and, as such, it suffers a lack of political champions. In Ireland over almost three decades, oral health policies and initiatives pertaining to oral health have failed to translate into long-term systemic reform and remain isolated (McAuliffe *et al.*, 2022). The success of the 1994 policy was largely dependent on an engaged Minister for Health supported by clinical leadership and guidance from the Chief Dental Officer. However, following a change in government, oral health was rapidly deprioritised, culminating in its exclusion from the 2001 general health policy, and neglect has since persisted (McAuliffe *et al.*, 2022). This is in direct contrast to evidence from Scotland (Study Two) highlighting how the Childsmile initiative was supported and uninterrupted by successive political administrations (Macpherson *et al.*, 2019; McAuliffe *et al.*, 2025).

In Ireland, this was further exacerbated owing to the absence of a Chief Dental Officer in the Department of Health from 2004 to 2014, along with the absence of dental professional expertise in positions of authority within the Health Service Executive (Oral Care Consulting, 2009; PA Consulting Group, 2010). Evidence confirms the absence of these crucial actors means a lack of visibility for oral health in decision-making processes, a failure to emphasise the importance of oral health to decision makers and limited ability to secure resources for oral health (Mozhdehifard *et al.*, 2019). This leadership deficit was explicitly highlighted in the Irish context in a review commissioned by the Department of Health identifying it as an 'impediment to delivering' oral healthcare for children (PA Consulting Group, 2010). It was further emphasised by a senior academic in PhD Study One citing, '*in the department there*

was a lack of willingness, a lack of lobbying, a lack of leadership' (McAuliffe *et al.*, 2022).

7.3.2.3 Unawareness of the harm of oral disease burden

Most oral health conditions are largely preventable, which contributes to policy neglect. When a condition is seen as both non-life-threatening and avoidable by individual behaviour, policymakers may assume it doesn't require aggressive public intervention (Janakiram *et al.*, 2018). This is especially challenging during times of crisis or health system shocks, where there is increased competition for scarce resources (Mladovsky *et al.*, 2012). Furthermore, oral diseases disproportionately impact marginalised groups and are often considered inevitable which can influence their political importance (Benedetti *et al.*, 2015; Janakiram *et al.*, 2018).

This was evident in the Irish setting as surmised by an high-ranking official in the HSE in Study One as follows: '*they just have bigger fish to fry, dentistry isn't a priority'* and another expert familiar with processes within the Department of Health following the onset of the COVID19 pandemic; '*this is going to look like nothing compared to mental health, cancer, missed appointments'* (McAuliffe *et al.*, 2022).

Broadly speaking, policymakers appear to be unaware of the internation between oral health and general health (Janakiram *et al.*, 2018). Notably the impact that poor oral health has on a range of systemic diseases including diabetes (Stöhr *et al.*, 2021), ventilator-associated pneumonia (Zhao *et al.*, 2020), dementia (Beydoun *et al.*, 2020), along with shared risk factors and inflammatory processes in cardio-vascular disease (Gianos *et al.*, 2021), amongst others. This leads to unnecessary suffering and higher healthcare costs. The question arises, why have advisors not communicated this interaction and stressed the shared risk-factor approach (Sheiham and Watt, 2000) and potential savings to be accrued?

The only facet of oral healthcare in Ireland which has drawn constant and unwavering political attention is orthodontics. It was suggested both by documents and interviewees that this was driven by pressure placed on politicians by 'middle-class' parents advocating for publicly funded orthodontic care, even during times where basic oral healthcare for children was absent (Gelbier, 2002). This reinforces evidence that politicians often prioritise high-impact, short term health initiatives that deliver clear electoral gains (Hoffman *et al.*, 2019).

7.3.2.4 Lack of data and targets

Robust data and surveillance raise the visibility of health problems to decision-makers. Conversely, a lack of epidemiological data can lead to policy inaction – if a problem isn't measured or reported, the true oral disease burden can remain unknown and 'cannot be addressed adequately' (Benedetti *et al.*, 2015). For oral health, many countries have sparse or incomplete data on disease prevalence, unmet need, or outcomes of dental services (Winkelmann *et al.*, 2022).

Study Two highlighted Scotland and Germany as examples where timely, relevant oral health data (including cost-effectiveness analyses) were key in securing sustained political support (McAuliffe *et al.*, 2025). Study Three of this PhD clearly identifies the inadequacy of oral health data currently available in Ireland. The most recent national oral health surveys for children and adults were conducted over twenty-five years ago while most data pertaining to oral health workforce is inadequate or incomplete (Whelton *et al.*, 2006, 2007; Haase and Batchelor, 2014).

In summary, oral health in Ireland has suffered from a classic 'policy inertia' (Howlett, 2019) hallmarked by political disinterest, where multiple factors reinforced each other: policymakers underestimated the problem's importance, in part due to low mortality and lack of data; no authoritative champions pushed back against this complacency; and the public accepted their own oral health problems as their own shortcomings and generally did not demand action, except in niche areas such as orthodontics.

7.3.3 Overall lessons from periods of action and inaction on oral health policy

Oral health policy, particularly in Ireland, follows episodic cycles of development, with brief moments of policy action emerging when political, economic, and institutional conditions align. However, these windows of opportunity are often short-lived, leading to prolonged periods of neglect and non-implementation (Howlett, 2019).

While key policy milestones such as the Dental Health Action Plan (DHAP) (Department of Health, 1994a) and Smile agus Sláinte (Department of Health, 2019a) publication provided temporary momentum, they failed to translate into sustained oral health system reform.
This pattern is not unique to Ireland and reflects broader theoretical understandings of how policy change occurs, why certain issues fail to gain sustained traction, and why health policy reform can stagnate for decades (Howlett, 2019). It is important to note that 'Strategic Objective 1 and Action 1' of the Global Oral Health Action Plan is to develop and implement a national oral health policy, strategy, or action plan, emphasising the priority placed on policy, with a periodic review of the policy undertaken within five years of its onset (World Health Organisation, 2024a).

Kingdon's Multiple Streams Framework, which underpinned the analytical foundation of this research, posits that for policy change to occur, three streams must align: (1) the problem stream, where an issue is recognised as a pressing societal concern; (2) the policy stream, where viable solutions exist; and (3) the politics stream, where there is political will to act (Kingdon, 1984; Howlett, 2019).

Policy windows often close due to shifts in political leadership, competing policy priorities, or economic downturns that redirect resources elsewhere. In Ireland, oral health has consistently failed to progress onto the political agenda because these streams have rarely aligned. While the problem of poor access and inequalities has been long acknowledged (McAuliffe et al., 2022), viable solutions have prompted disagreements amongst policy 'entrepreneurs' about the preferred policy solutions (Howlett, 2019). Even when policy proposals emerged, such as the 2009 unpublished National Oral Health Policy, they failed to gain momentum due to professional dissent, weak political conditions and feeble institutional leadership.

This framework also helps explain why oral health remains in a cycle of policy dormancy, only to resurface sporadically. Policy windows are often short-lived and dependent on external events, such as political transitions, economic shifts, or public health crises (Kingdon, 1995). For instance, the DHAP (1994) became possible due to a unique convergence of a Minister for Health supportive of reform, strong epidemiological data and public awareness about oral health inequalities. This was fully supported by very strong collaborative engagement with and among the dental profession.

However, once these conditions changed with a new government, the window of opportunity closed, leading to stagnation for over a decade. Similarly, Smile agus Sláinte, (Department of Health, 2019a) emerged in a moment where health system reform was under discussion, yet without a clear implementation roadmap or sustained leadership and advocacy, its progress stalled. This demonstrates that without long-term policy integration, oral health remains vulnerable to external disruptions and changing political climates.

7.3.3.1 Periods of action: what enables oral health policy successes

While policy change in oral health has been sporadic, certain factors clearly created windows of opportunity for reform. In 1994, a committed Minister for Health played an individual role in bringing oral health onto the political agenda. This reflects a wider pattern in health policy, where reform efforts often depend on political leaders and or policy entrepreneurs willing to push for change (Kingdon, 1995; Howlett, 2019). However, the reliance on individual political figures rather than structural commitments means that when these leaders leave office, momentum often dissipates, as was the case with oral health policy in Ireland following the late 1990s (McAuliffe *et al.*, 2022).

In addition to political leadership, public advocacy and crisis moments have played a role in catalysing action. Policy literature suggests that reform is often accelerated by public pressure or external crises that force governments to act (Howlett, 2019). However, unlike other areas of healthcare, oral health in Ireland has not widely benefited from significant public outcry or media scrutiny, aside from orthodontic concerns, meaning that crises in oral health have largely remained invisible in political discourse.

By contrast, in Scotland, the Childsmile programme was successfully integrated into mainstream NHS delivery and maintained across multiple political administrations, due to clear public support and its framing as a preventive cost-saving measure by academics and advocates (Macpherson *et al.*, 2019; McAuliffe *et al.*, 2025).

Another critical enabler of policy action is the integration of oral health into wider health system reforms. Findings from Study Two highlight that countries such as Germany and Denmark successfully sustained oral health policies because they were embedded within existing statutory health insurance structures or universal healthcare models. This ensured that oral health was not treated as a separate issue requiring independent political action but rather as an integral component of broader health system planning (McAuliffe *et al.*, 2025). Similarly, Germany's expansion of dental coverage for young children reflects a long-term commitment to integrating oral health within the broader health insurance scheme (SHI), preventing the start-stop pattern seen in Ireland (German Federal Ministry of Justice, 2023). These cases underscore that policy endurance is strongest where oral health is framed as an integral part of mainstream healthcare, rather than a standalone sector competing for attention (McAuliffe *et al.*, 2025).

This comparative evidence highlights a key learning from this thesis: oral health policy reforms are more durable when embedded within national health reform frameworks and backed by sustained political commitment. This reinforces the global movement toward integrating oral health within Universal Health Coverage (UHC), as advocated by the World Health Organisation (World Health Organisation, 2024a).

7.3.3.2 Periods of inaction: Why does oral health reform stagnate?

Despite moments of progress, oral health reform in Ireland has consistently failed to sustain momentum, resulting in long periods of policy stagnation. Policy analysis literature refers to 'path dependency' where existing institutional structures and past policy decisions create inertia that makes significant change difficult (Wilsford, 1994). In the case of oral health, the separation of oral healthcare from mainstream healthcare financing and governance has become self-reinforcing, making systemic reform more challenging. As a result, policy changes

have stagnated. The low political salience of oral health relative to other healthcare issues has been previously discussed in detail (chapter 4) and later in, chapter 7 section 7.4.2. This has contributed to the recurrent neglect of oral health policy, which is reinforced by Ireland's reliance on private financing and delivery for dental care which further distances the state from accountability and reform (Benedetti *et al.*, 2015; Janakiram *et al.*, 2018).

The lack of comprehensive and up-to-date oral health data has further reinforced this inertia. Countries that have successfully maintained oral health as a policy priority, such as Scotland, Germany and Denmark, have done so by implementing robust surveillance mechanisms that provide regular updates on oral health needs and service outcomes (Danish Health Authority, 2023; Public Health Scotland, 2023b). Resistance from key stakeholders, including divisions within the dental profession over proposed reforms and the lack of consensus on financing mechanisms, further contributed to stagnation. In contrast, successful oral health reforms in Germany and Scotland were facilitated by stronger professional engagement and agreement on policy direction (McAuliffe *et al.*, 2025).

As mentioned, institutional weaknesses principally leadership deficits in the Department of Health and the HSE resulted in limited advocacy meaning reform efforts failed in Ireland. This contrasts with countries where strong institutional structures, such as national oral health committees (e.g. Danish Health Authority) (National Board of Health, 2020; Ministry of the Interior and Health, 2023) and statutory health boards incorporating oral health professionals (e.g. The Federal Joint Committee (G-BA) in Germany) ensured policy continuity and prevented stagnation (Gemeinsamer Bundesausschuss, 2022).

In summary this PhD findings align with the broader health policy literature which suggests that without political champions, sustained advocacy, dental leadership and structured institutional frameworks, policy issues can remain in prolonged dormancy until external catalyst forces change (Kingdon, 1995; Howlett, 2019). Lessons from this thesis suggest that to break this 'path dependency' (Wilsford, 1994) and to move policy away from its existing path onto a new trajectory, exceptional windows of opportunity are required (Wilsford, 1994; Howlett, 2019).

Ultimately, the Irish experience underscores a critical lesson: oral health policy will continue

to be subject to cycles of inaction unless it is fully integrated into national health system reform, supported by dedicated institutional, political and dental leadership, and reinforced by sustained advocacy and data-driven decision-making. Without these structural changes, oral health will remain a peripheral issue, vulnerable to policy neglect and stagnation.

7.4 Contribution of the research

The overarching aim of this thesis was to appraise and inform the reform of the Irish publicly funded oral healthcare system for children proposed by Ireland's National Oral Health Policy, Smile agus Sláinte (Department of Health, 2019a), in line with the global policy aim of universal oral health coverage.

This was fulfilled by adopting an oral health policy and systems analysis, which represent a novel contribution to knowledge by expanding the limited body of health policies and systems research within oral health.

7.4.1 Oral health policy and systems research

According to the WHO, health policy and systems research 'seeks to understand and improve how societies organise themselves in achieving collective health goals, and how different actors interact in the policy and implementation processes to contribute to policy outcomes' (Alliance for Health Policy and Systems Research, 2024).

Policy research examines how a range of factors including different actors and contexts contribute to policy. While health systems research addresses questions including 'coverage, quality and efficiency of health systems' (Alliance for Health Policy and Systems Research, 2024).

To the best of this PhD candidate's knowledge, there is currently no established tradition of ongoing oral health policy analysis at any academic centre globally. Health policy analysis is a well-established research method recognised as integral to health system reform (Walt *et al.*, 2008). However, there has been far less attention given to oral health policy analysis while the 'interface between research and policy remains understudied in oral health' (Verdugo-

Paiva *et al.*, 2023).

This was reinforced in the literature review conducted for this PhD thesis which found previous examples of oral health policy analysis were conducted in only a handful of countries (Singh and Combrinck, 2011; Etiaba *et al.*, 2015; Pucca *et al.*, 2015; Leck and Randall, 2017).

Organisations such as the International Association for Dental, Oral, and Craniofacial Research (IADR) have called for more implementation, health systems and policies research (International Association for Dental Research, 2021). While the Lancet Oral Health Series, the FDI Vision for 2023 report, the 2021 World Health Assembly Resolution along with the 2023 WHO Strategy and Action Plan have all called for urgent oral health system transformation and policy implementation, but also research to support those efforts (Peres *et al.*, 2019; Watt *et al.*, 2019; Glick *et al.*, 2021; World Health Organisation, 2021, 2022, 2023a, 2024a).

However, evidence points to the slow progress historically in achieving such oral health systems transformation (Watt *et al.*, 2019; Listl *et al.*, 2022). It is suggested that to build toward oral health system improvement, and to 'truly approach evidence-informed oral health policy making substantial "know-how" and ''know do'' gaps still need to be overcome' (Listl *et al.*, 2023).

Study One extended this literature by conducting a detailed oral health policy analysis, the first of its kind in Ireland, and as mentioned, one of only a few national oral health policy analyses available globally (McAuliffe *et al.*, 2022). Although, this case study is centred on a single country, it supplements the literature pertaining to the methodological approach adopted in conducting an oral health policy analysis (Howlett, 2019). For example, Howlett's Multiple Streams Framework was an appropriate analytical framework for utilisation in Study One and introduces this policy framework to the oral health research community.

The existing literature also points to the fact that health policies and health systems 'are not separate entities' and that an understanding of 'the processes and dynamics of health systems can directly inform policy and decision-making' (Alliance for Health Policy and Systems Research, 2024). Study Two (McAuliffe *et al.*, 2025) adopted an oral health systems

approach and sought to fill the evidence gap described as the 'paucity of information' on oral healthcare systems in Europe (Eaton *et al.*, 2019).

In addition to the contribution of the empirical findings of this study to the literature, it also demonstrated the benefits of adopting an oral health systems approach including the use of the WHO Coverage Cube as a conceptual framework (World Health Organisation, 2008). The framework was previously adapted by Allin et al., (2020) and used in a comparative analysis of oral healthcare coverage for older adults across eight different jurisdictions. Study Two further demonstrated its use but in the child population and across different systems in European countries (McAuliffe *et al.*, 2025).

An oral health systems approach was also followed in Study Three, this time adopting an analytical lens in examining the outcomes of oral health systems. Earlier research highlighted the variations in the DMFT index across European countries (Patel *et al.*, 2016), this PhD updates but also built on this knowledge by examining current data pertaining to dental caries for child populations and the methodology underpinning it, nationally and internationally.

While previous research conducted on oral health workforce considered areas including skill mix, planning, estimates and other aspects of dental careers. Study Three provided an update on both the supply of oral health professionals available, and methodology adopted by six European countries and international organisations, to generate key elements of dental workforce information.

7.4.2 Themes for discussion

In the following section, the results of each study (chapters 4, 5 and 6) are brought together, where relevant and appropriate, to generate a coherent discussion, where findings from each of the specific studies interact with each other. To synthesise the results of each study a thematic approach was adopted, following the guidance of Braun and Clarke (2013), which resulted in the development of five themes which are presented and discussed below.

These themes are:

1. Political priority for oral health
2. 'Siloed' oral health
3. Oral health inequality
4. Oral health promotion and disease prevention
5. Oral health workforce and skill mix
6. Deficiencies in oral health data

7.4.2.1 Theme 1: Political priority for oral health

Across all three studies in this thesis, a consistent finding was the limited political interest in oral health and its weak positioning within broader health policy and system agendas. Study One presented Ireland as a case study of this pattern over a 30-year-period (McAuliffe *et al.*, 2022), while Study Two illustrated how political priority contributed to incomplete or stalled reforms in targeted systems such as Ireland and Spain (McAuliffe *et al.*, 2025). Study Three revealed the absence of up-to-date, standardised oral health data, an essential tool for policy advocacy across multiple countries (Benedetti *et al.*, 2015).

These findings align with a growing body of global literature. The WHO Global Strategy and Action Plan on Oral Health 2023-2030 has identified weak political and resource commitments as core structural challenges, echoed in recent calls for greater political advocacy and leadership in oral health (Watt *et al.*, 2019; Eaton *et al.*, 2023; World Health Organisation, 2024a). Evidence also suggests that low political salience is shaped by the perception of oral health as a private responsibility, the invisibility of its burden and lack of accessible data to inform non-dental stakeholders (Benzian *et al.*, 2011; Benedetti *et al.*, 2015).

In contrast, Study Two highlighted how sustained political commitment contributed to successful reforms in countries like Scotland and Germany, where high-quality data and cross-sector collaboration enabled the development, expansion and integration of programmes such as Childsmile and preventive services for young children (Macpherson *et al.*, 2019; Ziller *et al.*, 2021; McAuliffe *et al.*, 2025). These examples, further explored in Section 7.5, illustrate the value of aligning public health and political priorities.

Both of those examples, along with the one successful policy implementation in Ireland in 1994, which was part of Shaping a Healthier Future, a strategy for effective healthcare in the 1990s, highlighted that appealing to politicians required opportune moments often stemming from crises along. This is further supported by strong leadership and communication, using high-quality information. However, research repeatedly reinforces that a lack of comprehensive and up-to-date data on the status of oral health hampers efforts to advocate to policy-makers and politicians (Patel *et al.*, 2016; Agrasuta *et al.*, 2021; Winkelmann *et al.*, 2022).

Study Three of this PhD corroborated these findings by highlighting the poor comparability and reliability of two aspects of oral health data currently available in Europe. This extends the evidence base available and renews calls for the development of national and international indicators for oral healthcare (Winkelmann *et al.*, 2022; World Health Organisation, 2022).

A novel insight from the Irish case (Study One) was the political attention given to orthodontics — despite the lack of system-wide prevention and access to essential oral healthcare. This reinforces the gap between public health priorities and political incentives, with oral health reform often shaped by electoral considerations and short-term gains (Hoffman et al., 2019). This tension presents challenges for defining and advocating for essential oral healthcare grounded in public health evidence (Benzian et al., 2021).

Overall, political leadership supported by reliable data, clear communication, and stakeholder engagement remains a fundamental enabler of oral health reform, and its absence a persistent barrier.

7.4.2.2 Theme 2: 'Siloed' oral health

The Lancet Commission on Oral Health described the 'key features of an ideal oral healthcare system', as having 'no divide between dental and general healthcare' (Watt *et al.*, 2019). However, a substantial body of international evidence points to the prevailing 'silo-based approach' where oral healthcare remains marginalised from broader health systems (World Health Organisation, 2021; Glick *et al.*, 2021; Winkelmann *et al.*, 2022; World Health

Organisation, 2024a). Watt et al., (2019) argue that existing policies, systems, and delivery models are responsible for this segregation. This PhD substantiates these claims and directly responds to calls for better information on the provision and utilisation of oral healthcare services within general healthcare systems, a gap identified in the recent literature (Winkelmann *et al.*, 2022).

In Ireland, Study One revealed that oral health was virtually absent from general health policies over a 27-year period, even during moments of proposed system-wide reform toward universal healthcare (McAuliffe et al., 2022). This lack of visibility reinforces existing literature noting that oral health is routinely excluded from national health policy narratives without explanation (Jean *et al.*, 2021).

Study Two further illustrated how oral health is structurally separated from general healthcare systems (McAuliffe *et al.*, 2025). In countries like Scotland, Germany and Denmark, children's oral healthcare is integrated into statutory entitlements and broader healthcare structures (Ziller *et al.*, 2015; The Scottish Parliament, 2023; Ministry of the Interior and Health, 2023). In these systems, children's oral healthcare is a well-established, universal component of overall healthcare and consequently of the 'benefit basket' (Winkelmann *et al.*, 2022). This contrasts with countries like Ireland and Spain, where oral health is excluded from primary care resulting in greater reliance on private providers (McAuliffe *et al.*, 2025) and higher vulnerability to health system shocks (Mladovsky *et al.*, 2012; Burke *et al.*, 2021; Thomas *et al.*, 2023).

Study Three reinforced this theme through the lens of data and monitoring. The lack of comprehensive oral health data, combined with its limited recognition by public health bodies, reflects a continued disconnect. Oral health indicators remain poorly aligned with broader frameworks — such as Disability Adjusted Life Years (DALYs), the Sustainable Development Goals, or the NCD Global Monitoring Framework (Benedetti *et al.*, 2015; Jean *et al.*, 2021). Study Three also documented inconsistencies in the reporting of caries and workforce data across international databases such as the OECD and WHO. Without these data, the extent of the oral disease burden remains poorly defined relative to other general health conditions, contributing to the continued marginalisation of oral health and likely underestimating associated inequalities (Benedetti *et al.*, 2015).

7.4.2.3 Theme 3: Oral health inequality

Inequality in access and eligibility to oral healthcare for children was a strong thread spanning studies one and two (McAuliffe *et al.*, 2022, 2025). Oral health inequalities refer to differences in outcomes or service access between groups that are 'avoidable and unjust' (Public Health England, 2021). A substantial body of evidence shows that dental caries disproportionately affects disadvantaged children and functions as a marker of socio-economic inequality (Peres *et al.*, 2019; Goldfeld *et al.*, 2022; World Health Organisation, 2023a).

While this PhD did not explicitly set out to investigate inequality, it became a consistent and important cross-cutting theme. In Ireland, Study One found that children are not eligible for publicly funded oral healthcare on the same basis as adults, a reflection of longstanding policy decisions that de-prioritise children and other vulnerable population groups (Department of Health, 2019a). The current system targets only three specific age groups and access varies by region depending on resources, resulting in de facto inequality (Duane *et al.*, 2017; Department of Health, 2019a; Houses of the Oireachtas, 2023).

Study Two reinforced this picture by contrasting countries with universal eligibility for children (e.g. Germany, Scotland, Denmark) and those with targeted or constrained models (Ireland and Spain) (McAuliffe *et al.*, 2025). Targeting was often introduced as a response to budgetary constraints, for example, the current Irish model originated as a rationing measure in the late 1980s (Department of Health, 1988) but such systems now reproduce inequality in access and cost burden.

These targeted systems tend to rely more heavily on private dentistry and out-of-pocket payments, which are known to contribute to poorer health outcomes and reduced access among disadvantaged groups (Reda *et al.*, 2018; Watt *et al.*, 2019; Goldfeld *et al.*, 2022). Study Two also found that systems with universal coverage were associated with lower levels of out-of-pocket spending and higher access rates for children (McAuliffe *et al.*, 2025).

Recent literature calls for greater integration of policy analysis into oral health inequality research, recognising that political economy and system design play central roles in shaping who is covered and how (Guarnizo-Herreño *et al.*, 2013; Tsakos *et al.*, 2023). This PhD adds to that evidence by highlighting how policy decisions on eligibility, made under economic

pressure or without equity-based frameworks, can entrench inequalities in oral healthcare for children (McAuliffe *et al.*, 2022, 2025).

7.4.2.4 Theme 4: Oral health promotion and disease prevention

A key theme emerging from studies one and two was the variation in how oral health promotion and disease prevention were conceptualised, prioritised, and funded across oral health systems. While the effectiveness of preventive interventions such as community water fluoridation (Iheozor-Ejiofor *et al.*, 2024), fluoride-based applications such as toothpaste (Walsh *et al.*, 2019), interventions in the early years (Khairuddin *et al.*, 2024) and school-based oral health programmes (Bramantoro *et al.*, 2021) is well-established, this research reinforces evidence highlighting the persistent gap between that evidence-base and its translation into oral health policy system design (Goldfeld *et al.*, 2022).

The literature distinguishes between clinical prevention which operates at the individual level and oral health promotion, which requires action across policy, education, and community settings to address upstream social and behavioural determinants of oral health (Watt *et al.*, 2019). As outlined in chapter two, effective oral health promotion involves a range of up, mid, and down-stream approaches along with intersectoral collaboration, community engagement, and behavioural change at scale (Macpherson *et al.*, 2010, 2019). However, this broader need remains inconsistently embedded in national oral health polices, particularly in targeted systems (McAuliffe *et al.*, 2025).

In Ireland, while community water fluoridation is a long-standing effective caries prevention population-level intervention, only 71% of the population receives fluoridated water (James *et al.*, 2021) and there is no national oral health promotion framework, beyond fissure sealant application at targeted ages (Department of Health, 1994a, 2019a). From a systems perspective, there is little political or health system attention to oral disease prevention, for example, preventive care for low-income adults was removed during austerity, and children's access to publicly funded preventive interventions remains limited to specific age groups and subject to regional capacity (Department of Health, 1994a, 2019a; Johnston *et al.*, 2020).

Study Two further illustrated how targeted systems (Ireland and Spain) and access-

constrained universal systems (e.g. Hungary) have struggled to embed prevention or promotion effectively (McAuliffe *et al.*, 2025). In Hungary, although children are formally eligible for preventive care, private practitioners who deliver most services, often do not offer it, even when families are paying out-of-pocket (Regional European Association of the FDI, 2023). Similarly, in Spain and Ireland, the prevailing professional culture remains treatment-oriented, with little incentive or structure to support community-level oral health promotion (McAuliffe *et al.*, 2025). These patterns are reinforced by payment models that reward restorative procedures, limited political understanding of oral disease as preventable, and the historical positioning of dentistry outside broader public health frameworks (Watt *et al.*, 2019; Winkelmann *et al.*, 2022).

Importantly, this trend is not unique to oral health systems alone. Across OECD countries, investment in prevention remains low, typically under 6% of total health spending and is especially vulnerable to cuts during times of fiscal constraint (Gmeinder *et al.*, 2017). These patterns were reflected in Ireland and Spain, following the 2008 global financial crisis (McAuliffe, 2025).

In contrast, universal systems such as Scotland, Germany, and Denmark embedded both prevention and promotion at multiple levels (McAuliffe *et al.*, 2025). In Denmark, legislation mandates preventive oral healthcare for children, delivered by salaried municipal dentists, and a culture of prevention has been cultivated through long-standing partnerships between universities and dental services (Kravitz *et al.*, 2015; Ministry of the Interior and Health, 2023; McAuliffe *et al.*, 2025). In both Denmark and Scotland, academics and clinicians worked collaboratively to develop an evidence base for prevention, influencing both policy design and professional priorities.

In Scotland, the Childsmile programme exemplifies this integration: oral health promotion is embedded within nursery and school settings, including daily supervised toothbrushing, with extensive parental engagement (Macpherson et al., 2010; The Scottish Government, 2019). These programmes are supported by extended-duty dental nurses and health visitors, demonstrating the role of a multidisciplinary team in sustaining health promotion at scale (*Programme Manual for Childsmile Staff*, 2016).

These findings reflect a broader lesson: where oral health promotion and prevention are prioritised through clear governance, legislation, dedicated funding, and cross-sectoral implementation, health systems achieve stronger population outcomes and improved efficiency. Furthermore, these systems also tend to communicate their successes using high-quality data underpinned by research and evaluation, enabling further political and financial support (Anopa *et al.*, 2015).

While Ireland has made some progress through community water fluoridation and individual preventive care at targeted ages, a coordinated, system-wide oral health promotion strategy is lacking. Smile agus Sláinte proposes a significant step forward in this regard, outlining a model of care that integrates preventive oral healthcare throughout the life course, including the provision of eight structured oral healthcare packages for children and prevention-focused services for high-risk groups, along with the inclusion of oral health evaluation and research development (Department of Health, 2019a). The policy document also commits to delivering oral health promotion programmes aligned with the Healthy Ireland framework, including maintaining community water fluoridation and calls for broader regulation including the sugar sweetened drinks tax and tobacco control). It aims to develop community-level initiatives (e.g. fluoride mouth-rinsing programmes for children over six-years of age, oral health promotion programmes for vulnerable groups and socio-economically disadvantaged areas, and to support oral healthcare professionals to work with other healthcare professionals to improve health and oral health). However, it also excludes topical fluoride programmes (e.g. fluoride toothpaste schemes) for children under six, citing concerns about fluorosis and swallowing (Department of Health, 2019a).

As of 2025, implementation of these components has been slow, with uneven workforce engagement and no formal national oral health promotion campaign in operation. As discussed in chapter two, addressing this requires not only policy ambition, but governance structures, workforce development, system capacity to embed health promotion meaningfully across settings and a sense of collaboration and ownership. A public health approach that integrates promotion and prevention into primary care, community outreach, and intersectoral policy is central to achieving universal oral health coverage, as envisioned in the WHO Global Oral Health Action Plan (2023–2030).

7.4.2.5 Theme 5: Oral health workforce and skill mix

A well-planned, adequately resourced, and equitably distributed workforce is essential for the functioning and reform of oral health systems (Gallagher *et al.*, 2024; World Health Organisation, 2024a). Across all three studies in this thesis, the availability, configuration, and engagement of the workforce emerged as key determinants of access, prevention, and reform capacity (McAuliffe *et al.*, 2022, 2025). The findings from Study Three emphasised the structural nature of these challenges, while studies one and two highlighted how system design and professional culture shape workforce engagement and performance (McAuliffe *et al.*, 2022, 2025).

In Study One, the disengagement of both salaried and independent dental practitioners in Ireland is a barrier to reform. Dentists reported low morale, limited influence over service planning, and a sense of being excluded from decision-making. Participants described reforms as being announced without consultation and expressed scepticism regarding the feasibility of implementing policy objectives without structural change, leadership, and investment (McAuliffe *et al.*, 2022). This reflects a broader systems issue, where workforce planning has been decoupled from policy development, and where the perspectives of frontline professionals are not systematically included in reform processes (Birch *et al.*, 2015; Norris *et al.*, 2017).

Study Two extended these findings by illustrating how successful oral health systems mobilise a broader range of workforce roles to deliver preventive care. In Scotland, the Childsmile programme depends on extended-duty dental nurses, health visitors, and therapists who provide school-based oral health education, supervised toothbrushing, and fluoride varnish (*Programme Manual for Childsmile Staff*, 2016). Denmark similarly employs a wide range of salaried staff at the municipal level, including dental hygienists, to deliver legally mandated preventive care to children (Kravitz *et al.*, 2015; Richard *et al.*, 2022). These models contrast sharply with systems such as Ireland, Spain, and Hungary, where the oral health workforce remains dominated by general dental practitioners and where auxiliary roles are underutilised or absent (Kravitz *et al.*, 2015; Martinez-Beneyto *et al.*, 2021; Winkelmann *et al.*, 2022; Dental Council of Ireland, 2024).

Study Three further illustrated that workforce density and distribution vary substantially across the countries studied, with implications for service capacity and equity. Ireland had the lowest ratio of dentists per 100,000 population among the six countries analysed, and a particularly low number of dental hygienists (12 per 100,000), compared with Denmark (44 per 100,000) (Danish Health Authority, 2024; Dental Council of Ireland, 2024). Furthermore, Ireland also does not have standardised registration or reporting for dental nurses, in addition to collecting limited data pertaining to the overall workforce including, nature of practice or working schedule (Haase and Batchelor, 2014; Kravitz *et al.*, 2015). This restricts insight into the true size and structure of the workforce. These data limitations severely constrain workforce planning and policy evaluation, reinforcing the WHO's observation that oral health workforce data is often fragmented and overlooked in health systems (World Health Organisation, 2024a).

A further concern raised in Study Three was geographical inequality. Urban–rural disparities in dentist density were observed in all studied countries, for example in Hungary and Spain, rural areas had fewer than half the workforce density of capital cities (Instituto Nacionale de Estadistica, 2022a; Chief Dental Officer Hungary, 2023). While in Ireland, according to the national oral health policy there are major regional disparities in dentist density, particularly along the western seaboard and in rural areas (Department of Health, 2019a). These patterns reflect broader trends in the international literature, where professional location choices can be shaped by a range of factors including financial prosperity, better infrastructure and amenities (Gallagher *et al.*, 2024).

Changing workforce demographics also have implications for policy. Study Three found a greater proportion of the dentist workforce identified as female. In both Ireland and Denmark, female dentists make up the majority of salaried dental practitioners and are more likely to work part-time (Health Service Executive, 2023b; Danish Health Authority, 2024). While this shift does not inherently reduce capacity, it requires workforce planning to account for changing work patterns, flexible service models, and retention strategies that respond to evolving professional expectations (Gallagher and Scambler, 2021).

Finally, across all countries, Study Three identified critical data and measurement challenges.

There is no standardised international reporting framework for oral health workforce indicators. Key gaps exist in data disaggregation (e.g. by age, gender, full-time equivalent status), and in several countries, auxiliary staff are not officially tracked or regulated. These limitations mirror wider critiques of oral health governance, where planning is often reactive, uncoordinated, and disconnected from broader health system strategies (Winkelmann *et al.*, 2022).

Together, the results of this PhD support the findings that oral health workforce and skill mix are important levers of oral health system performance. Where workforce roles are diversified, supported by regulation and investment, and embedded in broader public health systems, preventive and reform initiatives were supported. Conversely, systems with narrow delivery models, disengaged professionals, and poor data infrastructure remain vulnerable to stagnation. Addressing these issues is not solely a matter of workforce supply, but of structural reform, workforce engagement, and system-wide planning.

7.4.2.6 Theme 6: Deficiencies in oral health data

The importance of good oral health data has been illustrated across each of the previous themes and throughout the thesis. However, the absence of indicators for oral health monitoring has been described as 'one of the major deficiencies in driving national and global universal health coverage agendas' (Agrasuta *et al.*, 2021). Aligned with the discussion presented, the trajectory of this PhD research pointed to an evidence gap pertaining to the methods and sources of information currently in use to inform oral health data.

The publication of the Global Oral Health Status Report provided an impetus for the consideration of oral health 'indicators', with two indicators relevant for children chosen for analysis: dental caries prevalence and oral health workforce (World Health Organisation, 2022). According to the literature health indicators should be specific, valid, reliable, and well-defined to allow inter-country comparisons (Tolonen *et al.*, 2021). Study Three illustrated the broad variation in the methods used to inform the two indicators analysed across six representative European countries and the resultant difficulties in their use for comparison.

There was disagreement in the data pertaining to the decayed, missing and filled tooth index

(DMFT). This included variation in the source of DMFT score ranging from national oral health surveys, aggregation of clinical data and pathfinder surveys (Whelton *et al.*, 2006; Bravo, 2020; Szöke and Petersen, 2020; Danish Health Authority, 2023; Jordan *et al.*, 2025). There was further variability in the year of reporting with a difference of over twenty years between national reporting in different countries (Whelton *et al.*, 2006; Public Health Scotland, 2023b).

Furthermore, the sample sizes used ranged from 448 in a Spanish 'national health survey' to consolidated data from over 40,000 12-year-olds in Denmark (Bravo, 2020; Danish Health Authority, 2023). While there was also no common agreement found in the criteria used for caries diagnosis (ranging from individual country guidelines to BASCD criteria to WHO recommendations) (Pine *et al.*, 1997; World Health Organisation, 1997, 2013; Danish Health Authority, 2023).

In addition, there was extensive disagreement across every international database searched. Different figures for DMFT were reported from Oral Health Country/Area Profile Project (CAPP) Database, the Council of European Chief Dental Officers (CECDO) and Organisation for Economic Cooperation and Development (OECD) (OECD, 2009; Council of European Chief Dental Officers, 2023; World Health Organisation, 2024b).

While the WHO GOHSR differed in not presenting DMFT but rather more correctly a percentage for 'caries prevalence' based on the global burden of disease data (2019) (Vos *et al.*, 2020; World Health Organisation, 2022).

Study Three further extended and corroborated the evidence for the absence of 'standardised and reliable methodologies to gather information for indicators relevant to a successful workforce planning process' (Nash, 2012). This PhD study highlighted at a granular level, the oral health workforce shortages faced by some countries (i.e. Scotland and Ireland) in addition to the contrasting information collated by health service and regulatory bodies.

It also signalled potential concerns regarding an ageing dental workforce and a pattern of feminisation of paediatric dentistry in the European countries under study. The implications for the dental profession from the continued feminisation of dentistry include an increase in part-time working, recruitment challenges in rural areas and that women are less likely to

hold positions of seniority or leadership within the health system (McKay and Quiñonez, 2012; Fleming *et al.*, 2023).

This further speaks to implications of potential workforce shortages overall, meaning planned policies aimed at developing universal oral health coverage and reducing the barriers to oral healthcare will have limited chance of success if the capacity to provide that care is not there to satisfy demand (Ahern *et al.*, 2019).

In the GOHSR, the WHO clearly state that the 'limitations of oral health data and information must be acknowledged and emphasised'. They also call for the use of data to align with global health metrics rather than specific oral health indicators which 'oral health specialists may miss' (World Health Organisation, 2022).

This disagrees with previous oral health literature which found that oral health indicators are not well aligned with disability-adjusted life years which do not accurately capture the intricacies of oral diseases (Benedetti *et al.*, 2015). Winkelmann et al., (2023) subsequently suggested in the Lancet that 'monitoring UHC for oral health across countries is challenging and requires a standardised set of UHC indicators for oral health which so far is not available'.

Studies one and two of this PhD contributed to the rationale for the importance of oral health indicators (McAuliffe *et al.*, 2022, 2025), before Study Three extended the evidence available in six European countries pertaining to the methodology behind the information used to inform the two relevant measures of universal child oral health coverage.

This research clearly illustrates a lack of organisation and agreement nationally and internationally with respect to oral health data. As the drive for universal oral health coverage continues this PhD builds on the evidence base calling for all countries to maintain, review and monitor national oral health data and trends. This needs to be supported at an international level through a consensus on the quality, standards, and methods with leaders from national and international organisations required to support such efforts.

7.5 The challenge of moving from policy to action

Policy implementation, the process of translating political decisions and formal health policy strategies into functioning programmes and services, remains one of the most difficult and least predictable phases of health system reform (Hudson *et al.*, 2019). Even in well-resourced and well-organised health systems, the transition from policy inception to implementation is shaped not only by technical capacity, but by complex political, institutional and relational dynamics (Lipsitz, 2012), with research in the health sciences in both change management and implementation science growing (Burgette *et al.*, 2023; Health Service Executive, 2023c).

The 'implementation gap' identified, i.e. the divergence between policy formulation and on-the-ground delivery, is a persistent feature of health systems globally (Hudson *et al.*, 2019). This is a challenge across all health systems. However arguably, it is particularly relevant in neglected policy areas, such as oral health, where institutional mandates are often weak and service delivery is split across public and private sectors (Benzian *et al.*, 2011; Benedetti *et al.*, 2015).

Hudson et al., (2019) argued that policy implementation is deeply political requiring the navigation of multiple actors, incentives and institutional constraints. The assumption that evidence-based policy will simply translate into evidence-based practice underestimates the role of power, negotiation and politics, both at the macro and micro level. Rather health policy implementation occurs instead in complex systems shaped by historical legacies, actor interests and competing priorities (Walt and Gilson, 1994). The influence of power, or a lack thereof, by oral health advocates, is a particular feature of implementation challenges in the Irish context evidenced in this research (McAuliffe, 2022). Topp et al.'s (2021) framework for understanding power in health policy and systems research thus offers a useful lens for examining the so called 'implementation gap' in the broader literature (Hudson *et al.*, 2019).

This framework identifies three interrelated dimensions of power that operate across all stages of the policy process: (1) actor relationships and networks, (2) sources and forms of power, and (3) societal flows and expressions of power (Topp *et al.*, 2021). When applied to health policy implementation these considerations illuminate why certain reforms stall despite strong policy 'streams' (Howlett, 2019).

7.5.1 Actor relationships and networks

Policy implementation is rarely successful following a 'top-down' approach. Ultimately it is carried out by people and organisations-frontline healthcare providers, managers, communities, professional groups, bureaucrats and political leaders (Howlett, 2019). Their relationships and networks form a central 'site' where power is exercised in the implementation process (Topp *et al.*, 2021). However, research shows that the values, interests and interactions of such actors can profoundly impact how a policy is implemented, sometimes leading them to resist or reinterpret policies according to local realities (Gilson and Raphaely, 2008).

This results in Lipsky's classic theory of 'street level bureaucracy' being borne out; front-line actors engaged in implementation, for example oral healthcare professionals, can exercise discretion in how policy is enacted, influenced by their own incentives, interests and values (Lipsky, 1980). Such discretionary power can have contrasting implications, it may help adapt policies to local contexts and conditions or undermine fidelity if those bureaucrats disagree with, or feel disempowered by, policy (Rossi *et al.*, 2025).

Barriers: Stakeholder engagement is critical throughout the policy development cycle (problem identification, agenda setting, policy formulation, adoption, implementation and evaluation) 'is essential' (Gilson *et al.*, 2012; Busse *et al.*, 2014; Masefield *et al.*, 2021). It can give additional legitimacy by providing evidence to support and shape policies and increase accountability of the government to stakeholders, thus achieving greater policy implementation (Leviton and Melichar, 2016). Conversely if actors are excluded or mistrustful, policy implementation can be negatively impacted owing to 'inadequate collaborative policy making' (Hudson *et al.*, 2019), a finding observed in the Irish oral health policy domain in this research (McAuliffe, 2022).

This is reinforced in the broader literature with evidence demonstrating that trust between stakeholders is fundamental while a lack of trust can promote resistance and disengagement, leading to fragmentated efforts in policy implementation (Gilson, 2003; Erasmus and Gilson, 2008; Topp *et al.*, 2021). While perceived power imbalances between actors can lead to a perception of policies imposed 'from above' contributing to covert opposition or apathetic

compliance (Gilson and Raphaely, 2008).

Strategies: Building strong, collaborative actor relationships is widely seen as a successful factor in policy implementation (Hudson *et al.*, 2019). A useful strategy observed in the literature is to cultivate 'policy champions' that can generate strong coalitions and create networks, serving as focal points between different groups and drive reform past bureaucratic inertia (Gilson and Raphaely, 2008; Bullock and Lavis, 2019). While inclusive policy design and participatory implementation planning are considered critical (Cairney and Toomey, 2024). While support for change must be created within the system.

A recent systematic review seeking to generate advice for policymakers on 'collaborative policy making' identifies five main features of importance:

1. most effective action involves detailed planning and preparation,
2. a well-understood sense of collective purpose a common vision with partners must be generated,
3. use creative methods to visualise collaboration,
4. create new informal forums to support formal collaboration and
5. ensure that enough people have the specialist skills and resources to fulfil each essential task (Cairney and Toomey, 2024).

7.5.2 Sources of power

The second dimension of Topp's framework is 'power resources and institutions' (Topp *et al.*, 2021). The framework postulates that various sources of power are relevant: material resources (funding, infrastructure), technical expertise and information, bureaucratic or political authority (position in the hierarchy), and forms of social or cultural capital (status, education, credibility) (Topp *et al.*, 2021). Implementation tends to succeed when these sources of power are mobilised in support of the policy; failure often occurs when they are lacking or countervailing forces dominate. This domain is referred to as 'the drivers of the drivers' surfacing the institutions, organisations and attributes that provide a 'fountainhead of power' (Topp *et al.*, 2021).

Barriers: Several power-related barriers emerge repeatedly in the literature. A foremost issue as evidenced in this PhD research and within the global evidence base is weak political

commitment and leadership in oral health policy implementation (McAuliffe *et al.*, 2022, 2025).

Without strong political will, i.e. leaders willing to invest political capital, policies often falter at implementation (Benzian *et al.*, 2011; Watt *et al.*, 2019; McAuliffe *et al.*, 2022; Parker *et al.*, 2025). Opposition from powerful stakeholders is another common barrier: when policies redistribute resources or authority, those who stand to lose may use their power to obstruct implementation (Topp *et al.*, 2021). While a chronic barrier in many low- and middle-income countries (and some high-income contexts) is resource insufficiency. Policies are launched without adequate budgets, staffing, or infrastructure, leading to partial or poor implementation (Mahmoodi *et al.*, 2023).

Strategies: Overcoming these barriers involves leveraging and reallocating power in support of change. As illustrated by Buse et al. (2012), successful implementation often depends on aligning these sources in ways that facilitate reform. For example, policies with secure funding streams and clear legal mandates are more likely to be delivered than those based on ad hoc or aspirational commitments (Roberts, 2008). Adequate and sustained financing is equally critical and ensuring funds are protected for implementation activities (Roberts, 2008). This might entail enshrining the policy in legislation or integrating it into national development agendas to protect it from political cycles of change (Hudson *et al.*, 2019). Strong leadership and governance mechanisms (e.g. an intersectoral implementation task force or appointing a dedicated programme director or clinical leader responsible for clinical programme and care pathways) may also concentrate authority and accountability for implementation (World Health Organisation, 2024a). While a key strategy is building institutional capacity: investing in research, evidence informed practices (guidelines and audit), training programmes, information systems, and workforce to sustain implementation (Ahmat *et al.*, 2022).

7.5.3 Broader societal flows and expressions of power

The third site of power in implementation encompasses the broader societal context – the cultural, political, and historical currents that shape how policies are perceived and acted upon (Topp *et al.*, 2021). Implementation does not happen in a vacuum and formal and informal institutions, prevailing ideologies, and public sentiments impact policy uptake

(Howlett, 2019).

For example, within oral healthcare in many high-income Western countries a treatment and technology-focused model of oral healthcare dominates. This model has its roots in the surgical origins of the dental profession and represents a belief that treatment and high-technology intervention will ultimately restore so-called 'dental fitness'. As a result, dentist dominated models of care have made it challenging to implement reforms that are orientated toward prevention and equity (Watt *et al.*, 2019).

Barriers: Key societal barriers include unfavourable public attitudes, social norms and political cultures that impede change. From the oral health perspective this is exacerbated by the delivery of oral healthcare in many high-income countries by dentists operating in private practice settings (Watt *et al.*, 2019). This further reinforces the cultural norm of purchasing dental care and the 'personal responsibility' to maintain oral health (Wang *et al.*, 2020).

Cultural norms and perceptions also have an impact on the actions of decision-makers (Benedetti *et al.*, 2015). Typically, health issues that predominantly affect disenfranchised groups or that lack an immediate dramatic impact struggle to galvanise either political or public attention needed to harness robust implementation (Janakiram *et al.*, 2018). Both sectors are 'too easily attracted to the prospect of short-term results' rather than the 'messy' and protracted drive to long term policy implementation (Hudson *et al.*, 2019).

Finally, global and external influences represent another facet of societal power. International policy priorities can either support or hinder national implementation. If global initiatives focus on specific diseases domestic policymakers may allocate resources accordingly. Conversely, a lack of international attention (as with oral health historically) can reinforce domestic policy inertia (Benzian *et al.*, 2011; Watt *et al.*, 2019; Eaton *et al.*, 2023).

Strategies: Addressing societal power dynamics requires engaging with the broader context and shaping the narrative around the policy. One crucial strategy is public communication and advocacy to build support and shared understanding of the policy's value (Watt *et al.*, 2019; United Nations Population Fund, 2022; Eaton *et al.*, 2023). While social accountability mechanisms can also empower communities and service users to drive implementation. By

enabling citizens to voice feedback (through health committees, citizens assemblies or civil society oversight), policymakers can be held to account for delivering on paper commitments, and services can become more responsive (Nejatian *et al.*, 2024). This helps invert power hierarchies, giving traditionally weaker stakeholders a say in the process. In contexts where marginalised groups have been excluded, deliberate strategies like community participation in planning or targeting interventions to high-need areas help counteract societal inequities (Nejatian *et al.*, 2024).

Finally, a useful tool in advocacy is the astute framing of a policy problem and utilising 'windows of opportunity'. As mentioned, global norms and pressures can be leveraged such as governmental commitments to UHC or the WHO Global Oral Health Strategy and Action Plan (McAuliffe *et al.*, 2022; World Health Organisation, 2024a). While 'timing' and 'windows of opportunity' are also part of the societal dimension (Kingdon, 1995; Howlett, 2019).

Policy 'champions' who succeed often utilise or create a conducive moment, for example, after an election, during a public health crisis, or alongside a broader reform wave to launch reform plans, when the public mood and political conditions favour change. Recognising these moments and acting decisively (i.e. coupling problems, solutions, and politics) is a well evidenced strategy from political analyses of health reforms highlighted in this PhD research (Howlett, 2019).

Closing the gap between policy formulation and implementation thus requires more than technical plans (Hudson *et al.*, 2019; Topp *et al.*, 2021). The literature across health system reforms, from primary care to oral health, underscores that implementation is a social and political process as much as a managerial one (Howlett, 2019; Rechel *et al.*, 2020). Effective implementation strategies tackle barriers on all three fronts outlined above: they foster inclusive actor relationships, mobilise adequate authority and resources, and integrate the policy with the broader sociopolitical environment (Rechel *et al.*, 2020). In practice, this means engaging stakeholders at all levels, securing committed leadership and funding, and cultivating public and institutional support for change (Rechel *et al.*, 2020; World Health Organisation, 2024a).

The following section explores examples from specific case studies within this PhD research which demonstrate how the theoretical challenges and strategies for success outlined have emerged in 'real-world' oral healthcare systems.

7.6 Lessons from international and comparative experience

While health systems literature has long emphasised the challenges of translating policy into practice (Howlett, 2019; Hudson *et al.*, 2019; Allen *et al.*, 2020; Rechel *et al.*, 2020), the case studies analysed in this PhD provide rich empirical evidence of both success and stagnation in oral health policy implementation (McAuliffe *et al.*, 2022, 2025). Drawing on a six-country comparative study of children's oral healthcare coverage, as well as elite interviews, a detailed national oral health policy analysis and a review of key indicators, key themes emerge (McAuliffe *et al.*, 2022, 2025). This PhD thesis highlights how institutional design, actor engagement, and societal framing contribute to the realisation of oral healthcare reform (McAuliffe *et al.*, 2022, 2025).

In Denmark, oral health policy for children has been implemented with consistency and equity, largely due to its statutory grounding and decentralised but coordinated governance model (Winkelmann *et al.*, 2022). Children's and youth dental care comprises 'municipal dental care' (National Board of Health, 2020). The legal framework for municipal dental care is laid down in accordance with the Health Act (2019) and the Dental Order (2022). As specified in the Dental Order, the Danish Health Authority sets detailed clinical and administrative guidelines for municipal dental services, supported by the work of the Dental Health Committee — a standing advisory forum with representatives from key actors in oral healthcare including professional organisations, researchers, and health authorities. The committee provides broad professional advice to the 'National Board of Health' and has a stated aim of supporting improved population oral health and high-quality dental care (National Board of Health, 2020; Ministry of the Interior and Health, 2022).

This integration within the wider welfare state ensures that oral health is treated not as a separate or marginal concern, but as a routine part of preventive care. This structure is embedded for almost 50 years and according to one Danish expert, part of this success was engraining dental services into society through legal measures and changing the public

perception of oral diseases in children as being unacceptable:

'In 1972 when they organised things…it was very closely connected to public schools and the reason for this is because the culture of going to school is mandatory by the law…they wanted that mandatory culture transferred into child oral healthcare…you must go to school and you must go to the dentist…even now we have a parent responsibility law that says you must take care of your child's health and if you do not take your child to the dentist you are not fulfilling your parent responsibilities, you are breaking the law.' – (P3, Study Two, extended dataset).

Other key features of the Danish system are its protected funding at the municipality level and keen emphasis on prevention which according to a local expert, emerged from an engrained culture fuelled by research and shared learning with dental schools (McAuliffe *et al.*, 2025). Overall, this reflects a durable configuration of visible power (legal mandates), relational power (professional inclusion), and societal legitimacy (norms of universality and prevention).

Germany similarly provides a strong institutional model, although organised and delivered through a different system. Oral health services are fully integrated into the Statutory Health Insurance (SHI) system. The Federal Joint Committee (G-BA) is the highest decision-making body in the German healthcare system and oversees SHI benefits. It consists of representatives from healthcare service providers and the statutory health insurance funds working together. Its core decision-making body is 'the plenum', which has 13 voting members (Gemeinsamer Bundesausschuss, 2022) and includes dental representation via the Federal Association of Statutory Health Insurance Dentists (KZBV). Additional representatives including the German Dental Association (Bundeszahnärztekammer, BZÄK) take part in discussions on directives and resolutions regarding quality assurance (Geminsamer Bundesausschuss, 2023).

This ensures that dental perspectives are directly considered in decisions about service scope and reimbursement. This integration reflects strong institutional commitment to oral health: insurers and provider associations negotiate dental care fees and standards within the same framework as other health services. This corporatist arrangement ensures implementation is negotiated, not imposed, and policies benefit from both financial protection and technical

oversight. One German participant summarised the strengths of the system:

'*We have a very strong system, oral health is in the SHI [Social Health Insurances], the same as everything else, coverage is nearly 100%, children are obliged to be covered by the insurances and because there is very broad and deep coverage, people expect to receive very good care. With any change that is introduced, in comparison with many other countries, the processes in Germany are very specific…the insurances and the dental bodies are all sitting at the table together…and of course in Germany things work out because we have enough dentists*' – (P4, Study Two, extended dataset).

The German case underscores that when oral health is treated as an integral, non-optional part of healthcare, policies gain the institutional backing and financing needed to succeed (McAuliffe *et al.*, 2025).

Scotland's Childsmile programme provides a compelling example of how oral health policy can be implemented successfully through a multi-sectoral, equity-focused approach supported by high quality oral health research. Developed in response to child oral health inequalities, Childsmile built cross-sector support by engaging education, public health, and dental services from its inception (Scottish Executive, 2005; Macpherson *et al.*, 2010). The programme embedded supervised toothbrushing into early years settings, supported fluoride varnish application by dental nurses, and has benefitted from public funding supported across multiple political administrations (Anopa *et al.*, 2015; Macpherson *et al.*, 2015).

According to an expert, key to Childsmile success was engagement of the auxiliary dental workforce:

'*A lot of people come to us wanting to hear how it happened…Childsmile getting out of dental practice and going into educational settings… that's the key…a lot of people want to hear about fluoride varnish and it's like hold on a minute, the toothbrushing, that's where the action is'* (Study 2, P8).

Its initial success is attributed to harnessing existing pilot initiatives and slowly increasing visibility on the political agenda:

'*It was almost by stealth…very slowly creeping oral health on the agenda…using crisis to our*

advantage and building up a critical mass of successful piloting that it became the norm and…using skilled diplomacy'- (P2, Study Two).

Participants engaged in the programme describe patient engagement and engagement of the dental profession, using local leadership and communicating the benefits of the programme via data:

'*So much of it was done informally, lunches, dinners…it was path of least resistance, get someone well known locally who had a bit of drive who knew those who would be friendly [practitioners and nurseries] and willing….it wasn't an overnight success, we met resistance from some practitioners who said, look it won't work, but we got enough to start, kept plugging away and then the evidence from the academics…we could show the value of it financially as well as the health gains…and any time of any hint of a cut we were banging away about the money we were saving'* –(P2, Study Two, extended dataset).

The success of Childsmile illustrates how high-level political support, evidence-based planning, and stakeholder engagement (even in the face of initial resistance to fluoridation) translated policy into action (McAuliffe *et al.*, 2025).

In contrast, the case of Hungary highlights the consequences of institutional disconnection and professional disengagement. The country's single-payer National Health Insurance Fund includes dental services in its benefits package, and nearly the entire population (95%) is insured (Sztrilich *et al.*, 2025). In theory, this should guarantee basic oral health services to all citizens. However, coverage is not comprehensive, and implementation gaps have led to high out-of-pocket expenses and uneven access (Hajdu *et al.*, 2023).

Although Hungary formally offers universal oral healthcare coverage for children, only about one-third of dentists participate in the public contract scheme (Kivovics and Székelyhidi, 2022; Regional European Association of the FDI, 2023). The remainder work in 'fully' private practice, often citing low reimbursement rates, bureaucratic burden, and deteriorating infrastructure (Regional European Association of the FDI, 2023).
As reported in interviews: '*The work is not popular, and we don't have enough paediatric dentists'* – (P11, Study Two).

According to experts this has particularly impacted the provision of preventive oral healthcare along with concerns regarding professional regulation owing to private sector dominance (Regional European Association of the FDI, 2023):

'*We can't do anything about quality control and quality assurance…nobody checks is it true, is it good is it real'* – (P10, Study Two).

This has resulted in restricted access, especially in rural and lower-income areas (Hajdu *et al.*, 2023). The formal policy commitment is therefore undercut by structural disincentives and fractured state–professional relations with increased dominance of private sector delivery and funding. This represents a clear example of how the absence of aligned financial, institutional, and relational power can undermine even 'universal' policy (McAuliffe *et al.*, 2025).

Spain offers a cautionary tale of how decentralised authority without national guarantees can lead to uneven policy implementation. The Spanish National Health System provides comprehensive medical coverage for the population, but oral health benefits are minimal (Bravo *et al.*, 2015). In the absence of national coordination there is inconsistent implementation of oral health policy (Bravo *et al.*, 2015; Llena-Puy C *et al.*, 2018).

While some autonomous regions such as the Basque Country have developed oral health programmes for children, others provide only minimal emergency coverage (Departmento de Salud, 2022). The national government has set few binding standards, leaving implementation to the discretion of regional health authorities.

Politically, oral health has not been a priority at the central level in Spain, and thus little pressure was put on regions to expand services uniformly. Moreover, budget constraints during economic crises led some regions to scale back dental programs (Bravo *et al.*, 2015). The outcome is reflected in utilisation and health indicators: Spain reports higher levels of unmet dental needs compared to many EU peers, and catastrophic out-of-pocket dental spending affects poorer households (López-López *et al.*, 2023).

This is discussed by a Spanish expert in Study Two:

'*Most of the dental treatments in Spain you have to pay from your own pocket, we just don't have public health dentistry…in the general population they don't even know that there is a public dental office'* (P13, Study Two).

The result is wide territorial inequity in access and coverage. As one Spanish respondent noted:

'*There are a lot of differences between each region…some offer treatments some didn't... if your childhood was in somewhere like Valencia, you had different dental care than a child in Murcia'* – (P13, Study Two).

This fragmentation reflects a lack of both structural power (institutional mandate and funding) and relational alignment (between national and regional authorities) (McAuliffe *et al.*, 2025).

Taken together, these comparative examples affirm that successful implementation in oral health is not incidental. Where governance structures provide clear mandates, where providers are engaged and resourced, and where oral health is framed as a core social good, policies are more likely to endure. Conversely, where financial incentives are misaligned, professional actors are excluded, or oral health is treated as marginal, or an individual responsibility implementation falters. These lessons from both success and failure offer direct relevance for the Irish context.

In the following section, these findings are used to generate suggested recommendations to inform the implementation of Smile agus Sláinte and embed oral health more securely within Ireland's health system. These recommendations are grounded in the triangulated findings from interview data, policy documents, and comparative country analysis (McAuliffe *et al.*, 2022, 2025). They reflect both barriers to reform and potential enablers, and are intended to assist the Department of Health, the HSE, and broader stakeholders in implementing Smile agus Sláinte effectively (Department of Health, 2019a).

7.7 Recommendations for advancing oral health policy implementation in Ireland

The implementation of Smile agus Sláinte offers a pivotal opportunity to realise a coherent, prevention-focused oral health system in Ireland (Department of Health, 2019a; McAuliffe *et al.*, 2022). Ireland's political commitment to universal healthcare and the global momentum towards universal oral healthcare coverage led by the WHO should provide a window of opportunity of much needed oral healthcare reform in Ireland (Houses of the Oireachtas, 2017; McAuliffe *et al.*, 2022; World Health Organisation, 2024a).

Yet, as this thesis and broader international evidence have shown, policy documents alone are insufficient to achieve transformative outcomes without the institutional, financial and professional foundations to deliver reform (Singh *et al.*, 2010; Benedetti *et al.*, 2015; Howlett, 2019; World Health Organisation, 2024a).

Accordingly, the following recommendations are grounded in:
1. International principles such as WHO's vision for Universal Oral Health Coverage, which emphasises integration, financial protection, workforce capacity, and data systems (World Health Organisation, 2024a);

2. Alignment with Ireland's general health policy, Sláintecare and its strategic aim to strengthen primary and community care and reduce inequities (Government of Ireland, 2021); and

3. The empirical findings from this PhD which include documentary analysis and expert interviews that illuminate both the obstacles and opportunities facing Irish oral health reform (McAuliffe *et al.*, 2022, McAuliffe et al., 2025)

The structure of these recommendations mirrors key levers of implementation: governance, financing, workforce, service design, and stakeholder engagement (Rechel *et al.*, 2020). They reflect not only the failures of past reform efforts but also the conditions that enabled success, particularly the collaborative momentum that underpinned the 1994 DHAP (Department of Health, 1994a).

Importantly, the below proposals recognise that while many elements can be actioned, others require further research, piloting, and adaptive learning. A summary of the recommendations for oral health policy implementation in Ireland is provided in Table 7-2.

7.7.1.1 Build and sustain political commitment for oral health reform

Smile agus Sláinte has lacked political visibility since its publication limiting its implementation 'power' (Topp *et al.*, 2021). Despite its alignment with Sláintecare principles, prevention, equity, and community-based care; oral health has remained excluded from subsequent implementation plans and budget processes (Houses of the Oireachtas, 2017, McAuliffe, 2022).

As the WHO Global Oral Health Strategy and Action Plan (2024) underscores, political priority is essential to overcome systemic neglect and embed oral health within UHC. Previous success in Ireland (Department of Health, 1994a) was largely due to political alignment and strategic timing with action while policy 'windows of opportunity' remained open (McAuliffe *et al.*, 2022). By contrast, the 2019 policy has lacked sustained political advocacy, this is described by a senior manager in the health service referencing the volume of parliamentary questions posed to the health service:

'It [Smile agus Sláinte] has a complete lack of interest politically, and actually, it is specifically in the children's service... It's ortho [orthodontics], ortho, ortho…it just does not make sense'- (P1, Study One, extended dataset).

This contrasts markedly to the political support observed internationally in Childsmile implementation and sustainability. In addition to the positioning of dentistry with a 'seat at the table' within the broader health system structure in countries such as Denmark and Germany (McAuliffe *et al.*, 2025).

An Irish expert calls for:
'*Support at the highest level in the Department of Health, including from the Minister, who must want the plan to succeed and state it publicly and not just lip service'*- (P11, Study One).

Policy recommendations for building sustained political support*:*

1. *Appoint a named Ministerial lead with accountability for oral health reform.*

   Assign formal political responsibility for Smile agus Sláinte implementation to a designated Minister or Junior Minister. This will signal senior-level commitment and provide a focal point for progress reporting and advocacy.

2. *Embed Smile agus Sláinte within annual Sláintecare implementation reports.*

   Oral health reform should be integrated into the Sláintecare delivery framework and made visible in annual reporting, implementation updates - including quarterly updates to the Health Oireachtas Committee, and multi-annual budgeting, ensuring that it is treated as a core component of UHC reforms, not a parallel or marginal issue.

3. *Develop political understanding of oral health as children's rights, equity and cost-effectiveness issue.* Evidence on inequalities, return on investment in prevention, and long-term system savings should be determined and used to strengthen advocacy.

4. *Mobilise cross-party and civil society support to create political incentives for reform*.

   Build public and professional demand for equitable oral healthcare through professional associations and patient groups. Cross-party political engagement though the Oireachtas Health Committee will help to depoliticise oral health and secure longer-term reform commitments that extend beyond electoral cycles.

7.7.1.2 Repair stakeholder relationships through structured engagement and trust building

This research highlighted the deep mistrust between the dental profession, the Department of Health, and the HSE, thus creating a significant barrier to implementation. The 1994 Dental Health Action Plan succeeded in part because it was led by a collaborative team with strong relationships and skilled negotiators. By contrast, Smile agus Sláinte, was perceived by many as 'top-down' and poorly communicated (McAuliffe *et al.*, 2022)**.**

Findings from Study Two highlight how some countries institutionalise stakeholder contributions through formal bodies for example, the G-BA in Germany and the dental health

committee in Denmark, ensuring dentistry is fully represented in service delivery and decision-making. Interviewed experts In Ireland suggested crucial to the policy implementation effort is rebuilding trust and creating a shared consensus:

'*If I had all the parties in front of me now what I would say, is, that there are sufficient areas of agreement in this policy that could allow a way forward… updating legislation is not contentious… expanding auxiliaries is not contentious, increasing special care coverage… but because the policy took such a long time and then the government delayed the publication… what happened was there was a gap between policy makers who were mostly from an academic side of dentistry, and practising clinicians… so I think a clinical forum to figure out and agree the best way to treat children, the best way to treat special care, the best way to treat adults in our system as possibly the way forward and to agree the clinical arrangements first'* – (P4, Study One, extended dataset).

Another expert considering the views of general (independent) practitioners explained:

*'Relationship building must be a priority. There needs to be honesty. Can we all be honest and say right now, what is doable. In a situation like this you have to say well are there any easy wins? And can we stop causing greater damage. It's on both sides; the department and the dentists need to play ball too… An increased and well-funded school service [salaried service for children], that's doable, let's sit down and see what people have to say. Maybe that might require a third party to hold hands' – (*P13, Study One, extended dataset).

Policy recommendations for rebuilding stakeholder trust:

1. Establish a National Oral Health Stakeholder Forum with formal advisory status.

Appointed by the Minister for Health, this forum should include representatives from general practice, salaried practitioners, auxiliary professionals, academia, patient groups, and HSE leadership. Its remit should include regular structured dialogue, co-design of implementation pathways, and consensus on clinical and service delivery models. It should report publicly at set intervals and be fully resourced.

2. Identify and act on shared priorities as 'early wins'.

Focus dialogue on areas of broad agreement such as expanding the salaried child oral health services, updating dental legislation, and strengthening coverage for vulnerable groups. Visible progress in these areas will help build momentum and trust.

3. Ensure transparent and inclusive implementation processes.

Smile agus Sláinte must be implemented collaboratively. All relevant professional stakeholders should be involved not just in consultation, but in co-design and local-level planning. This includes salaried and independent providers and HSE leadership.

4. Use independent facilitation to rebuild trust.

Consider the appointment of a neutral, third-party facilitator or implementation lead to mediate between the Department, the HSE, and professional groups. This may help resolve tensions, manage expectations, and establish a culture of constructive engagement for the longer term.

7.7.1.3 Establish a dedicated oral health implementation unit and strengthen governance

Strategic objective one of the WHO Action Plan includes an action to strengthen national oral health leadership, specifically: 'Institute or reinforce an oral health unit at the Ministry of Health or another appropriate national governmental health agency to oversee national policy, technical, surveillance, management, coordination and advocacy functions' (World Health Organisation, 2024a). A key lesson from the 1994 DHAP was the value of a coordinated leadership team to drive implementation. In contrast, Smile agus Sláinte lacks an implementation office, performance monitoring system or clear governance plan.

The impact of a disempowered unit within the Department of Health in Ireland for significant periods was summarised by an expert:

'*There was a lot of messing, the role of the chief dental officer lay fallow for a while… [as a result] in the department there was a lack of willingness, a lack of lobbying, a lack of leadership*' - (P6, Study One).

This is in contrast to other international systems studied whereas, in Germany and Denmark,

institutionalised leadership ensures dentistry is embedded in wider health reform planning.

Policy recommendations for strengthened governance:

1. Establish a dedicated Oral Health Policy Implementation Unit within the Department of Health.

This unit should be responsible for the day-to-day coordination, delivery, and evaluation of Smile agus Sláinte, with a clear mandate, reporting structure, and sufficient resourcing. Its establishment should align with WHO Action Plan recommendations for national oral health leadership (WHO, 2024a).

2. Ensure cross-sectoral representation and authority within the unit.

Membership should include oral health professionals, policy officials, academics and senior HSE representatives. This group must hold formal decision-making authority and be accountable to the Minister for Health.

3. Develop national clinical and service pathways.

The unit should lead the co-design of agreed oral healthcare pathways for children, adults, and people with special healthcare needs. These pathways should define roles, service entitlements, referral systems, and performance benchmarks.

4. Implement public performance monitoring aligned with Sláintecare and WHO indicators.

Introduce regular, transparent reporting of oral health system performance including access, workforce, prevention, and outcomes aligned with universal health coverage (UHC) and Sláintecare frameworks. Public reporting can enhance accountability and demonstrate progress to stakeholders.

7.7.1.4 Secure sustainable and predictable investment in oral health

The WHO recognises that oral healthcare systems are currently 'inadequately funded' in many countries (World Health Organisation, 2024a). Ireland is one such example where oral health has suffered sustained underinvestment despite economic recovery. Ireland is recognised as the fifth wealthiest country in the world in terms of per capita GDP, according to the World Bank (World Bank Group, 2022), yet budgets for public dental services remain well below pre-austerity levels (2008) and far below comparator countries.

Interviewees repeatedly identified funding reductions as a core issue of concern from a senior HSE manager: '*There has been erosion of funding for years and it is cumulative, cut, cut, cut…they just cut everything in dental first, and you never get it back'*- (P2, Study One, extended dataset).

In contrast, sustained public funding underpinned the success of Childsmile and Denmark's municipal models, and as part of Germany's significant investment in its broader healthcare system (McAuliffe *et al.*, 2025). In this research 77% of dental care in Ireland is privately financed (Central Statistics Office, 2020; Johnston *et al.*, 2020). The reorientation of historical trends of under-investment required to implement the policy was suggested by a senior health service manager as a potential impediment:

I think the scale of investment that's required is multiples of what's being spent on the [current] salaried service in order for the policy to achieve the uptake it requires...before the department go much further with this, there has to be a realisation that the type of funding that's required is in the hundreds of millions of Euro'- (P4, Study One, extended dataset).

Policy recommendations for sustained financing:

1. Develop a multi-annual investment strategy for Smile agus Sláinte, linked to measurable milestones.

The strategy should be aligned with Sláintecare reform timelines and WHO universal health coverage (UHC) oral health indicators, enabling phased implementation and performance tracking over time.

*2. Introduce ring-fenced budgets for core reform priorities***.**

Allocate protected funding for prevention programmes, contract reform, workforce expansion, service infrastructure, data systems, and evaluation. This should fall under the oversight of the Ministerial lead for Smile agus Sláinte and be reviewed annually.

3. Integrate oral health into Integrate oral health into core Sláintecare budgeting frameworks.

Oral health investment should be embedded within the national healthcare budget and

reported as a distinct entity in annual Sláintecare spending reviews to ensure visibility, accountability, and long-term commitment.

7.7.1.5 Reorient service delivery with a phased rollout for older children

The first population cohort identified by policy-makers for policy implementation initiatives are children aged 0-7 years old (Department of Health, 2019a, 2025). As evidenced in this PhD thesis, these are a group for which there is no systematic oral healthcare in Ireland beyond emergency care. This rationale for expanding care to a vulnerable and moving towards universal coverage for all children, is crucial, and in line with broader Irish general health policy nationally and the WHO-led policy internationally (Houses of the Oireachtas, 2017; Government of Ireland, 2018a; World Health Organisation, 2024a).

However, there are concerns from experts that the proposed model of service delivery i.e. by independent practitioners in private practice settings, a significant reorientation from the current salaried model, would create resistance from the profession and hinder long-term policy implementation. This is summarised by an expert affiliated with the HSE:

'*In a way things are so broken we could be very strategic in starting off the policy, privatise a 6th class [children aged 12-years-old] take the pressure off the salaried system, on a pilot basis. Older children are more likely to get on better in the private practice setting and appeal more to the practitioners. Keep the younger kids in the HSE who are more likely to need more support with staff who are good at managing them.'* – (P1, Study One, extended dataset).

A different senior health service manager proposed:
'*It should all be part of a clinical forum to discuss our options, but the reality is the private guys are just not lining up to take on the very young kids, but we need to get it started* – (P4, Study One, extended dataset).

Scotland's phased implementation of Childsmile, Germanys phased expansion of care to younger children and the gradual roll out of the 1994 dental health action plan (McAuliffe *et al.*, 2022, 2025) suggest the value of sequencing and measured nature of policy implementation (Rechel *et al.*, 2020).

Policy recommendations for phased implementation of service delivery

1. Initiate phased implementation with older children (ages 7–12) through pilot programmes in independent practice settings.

Begin service rollout with this age group where care can be more feasibly delivered by private providers, as part of a measured transition. Pilot schemes should be closely monitored for access, quality, and workforce participation, building momentum while easing pressure on existing salaried services.

2. *Maintain HSE responsibility for children under 7 years and high-risk groups until capacity is strengthened.*

Given the greater complexity of care for younger children and vulnerable populations, responsibility should remain within HSE-led salaried services until sufficient workforce training, infrastructure, and referral pathways are in place.

3. Establish clear clinical referral pathways between public and private providers.

Develop formal systems to ensure continuity of care between independent practitioners and HSE services, particularly for children requiring complex treatment, behaviour management, or access to hospital-based services.

4. *Link phased implementation to broader system readiness and governance reforms.*

Rollout should be contingent on parallel progress in workforce planning, stakeholder engagement, governance, and funding (see recommendations 1–3). A whole-system readiness approach will minimise disruption and build trust during the transition.

7.7.1.6 Expand the oral health workforce

One of the six strategic objectives of the WHO Global Strategy on Oral Health is to 'develop innovative workforce models and expand competency-based education to respond to population oral health needs' (World Health Organisation, 2024a). Ireland has one of the lowest dentist-to-population ratios in Europe, and auxiliary roles (e.g. dental hygienists) are severely underdeveloped while dental therapists are not recognised.

Participants emphasised that Smile agus Sláinte is unachievable without strategic workforce investment, while recognising that such a depleted workforce affords opportunity for reform. An expert familiar with policy development reflected:

'I am very conscious of the effect of the tight workforce situation at present…However, I think this is also an opportunity to emphasise a much greater role for flexible auxiliary workers of hygienist plus type, much like orthodontic therapist, but specialising in Paediatric Dental Care/ Special Needs/ Public Health/ Health Promotion in addition to clinical skills' – (P11, Study One, extended dataset).

Evidence throughout studies two and three demonstrate the strengths of the expanded workforce in countries such as Denmark and Scotland, particularly where auxiliary professionals have been successfully deployed to deliver preventive and child-focused care at scale (McAuliffe *et al.*, 2025).

Policy recommendations for expanding the oral health workforce

1. *Modernise professional regulation and recognition.*

Update the Dentist Act (1985) to reflect current workforce needs and international best practice. This may include formal recognition of dental therapists, expansion of defined roles for dental hygienists and oral health promoters, and establishment of career frameworks for auxiliary roles in public and special care dentistry.

2. Scale up education and training for an expanded skill-mix

Invest in training pathways for dental hygienists, and dental nurses along with oral health promoters, in partnership with higher education institutions. Programmes should be aligned with national service needs, particularly in prevention, special care, and community-based child services.

3. *Upskill general dental practitioners (GDPs) in prevention and paediatric care*.

Introduce funded, competency-based continuing professional development (CPD) for GDPs focused on prevention, child and adolescent oral health, and behavioural management. This should be preceded by a national audit of current skillsets and accompanied by structured referral networks for complex cases.

4. Address workforce inequalities through national planning.

Commission a comprehensive national workforce needs assessment, with geographic, demographic, and service-level mapping. Prioritise underserved areas for targeted recruitment, incentive schemes, and integration of auxiliary staff within community-based models.

7.7.1.7 Merge and reform public dental contracts to enable policy alignment

Fragmentation between the publicly funded dental schemes for adults in Ireland i.e. the dental treatment benefit scheme (DTBS – based on social insurance contributions) and the publicly funded dental scheme for low-income adults (DTSS – dental treatment services scheme), was a key source of concern in the draft national oral health policy of 2009 (unpublished).

It was cited as causing duplication, confusion and inefficiency. Calls for contract consolidation date back to 2009, and experts in this research were unequivocal in their request that consideration be made not only to ease those burdens, but to also re-engage the dental profession in terms of their participation in the DTSS scheme which is rapidly declining:

'*There needs be consolidation of public dental contracts with private dentists under a single entity to maximize leverage towards achieving policy goals of Smile & Slainte'* - (P11, Study One, extended dataset).

This was also evident in the international comparisons with Germany's corporatist contracting system and Denmark's public-private mix demonstrating that integrated contracts can align incentives with policy goals (McAuliffe *et al.*, 2025).

Policy recommendations for alignment of public contracts:

1. *Consolidate DTBS and DTSS into a single, unified national oral health contract.*

Develop a new contract model that replaces current fragmented schemes, aligned with the service bundles and objectives of *Smile agus Sláinte*. This should follow a comprehensive review of both schemes, assessing opportunities to reduce duplication, improve access, and embed prevention-focused incentives.

2. *Establish a central contracting unit within the HSE*.

Create a dedicated unit responsible for contract administration, provider engagement, and performance management. This will ensure consistent standards, transparency, and oversight across public-private arrangements.

3. *Embed quality, prevention, and equity indicators into contract design*.

Include outcome-based metrics and process indicators that reward providers for prevention, continuity of care, and delivery to underserved populations. Structured incentives and tiered payment mechanisms should reflect these goals.

7.7.1.8 Develop a national oral health surveillance strategy for Ireland

As of 2025, Ireland lacks a functioning national oral health information infrastructure, and the most recent national child oral health survey was conducted over two decades ago (Whelton et al., 2006). This longstanding absence of up-to-date, nationally representative data has made it difficult to quantify needs, track inequalities, or demonstrate the value of interventions (Winkelmann *et al.*, 2022). Consequently, oral health has struggled to maintain political visibility or attract sustained investment. In contrast, in the early 1990s Ireland undertook both adult and child oral health surveys, and the stark findings particularly on socioeconomic inequalities, helped to bring oral health onto the policy agenda (McAuliffe *et al.*, 2022).

The lack of data today has the opposite effect: emerging problems remain invisible, and successful programmes are difficult to evaluate. As global literature confirms, weak surveillance systems are among the key reasons oral health remains under-prioritised in health reform planning (Benedetti *et al.*, 2015; Winkelmann *et al.*, 2022).

This data vacuum reflects not only a technical or financial shortfall but also deeper political and institutional challenges. Ireland's historical approach to data collection has been project-based and ad hoc, often dependent on short-term collaboration between academic institutions, health boards, and international partners—as exemplified by the 2002 North-South survey coordinated through the WHO Collaborating Centre at UCC (Whelton *et al.*, 2006). That kind of structured partnership has not been sustained.

Within the HSE data on over 800,000 patients is collected through a national dental record system, however, according to Donovan et al., (2021), 'this system does not have permission to enable analysis outside of secondary use for business planning'. Plans to introduce a new electronic dental record system within the HSE may offer future opportunities, but structural, professional, and political tensions remain unresolved.

As one senior expert within the HSE cautioned:
'Theres a huge, huge deficit [of data] in Ireland. The experience of the cyber-attack has put the HSE on guard regarding data and things are slow…there is a new system planned, and the shift would mean to create better reports and have a better, more informed analysis of oral disease distribution and progression…but data is always only as good as the input…rubbish in means rubbish out. I do think epidemiological oversight should reside with the HSE via a strengthened dental public health unit, but I think there will be some opposition to that from the Department and the dental schools will need to be involved' – (P4, Study Two, extended dataset).

There is no national agreement on which dental caries indices to use (e.g., DMFT vs ICDAS), how to stratify sampling, or how to ensure representative coverage of underserved groups. Participation bias is a known risk: lower-income households, which are most affected by oral disease, may be less likely to participate in voluntary surveys, as highlighted in recent concerns about equity in national surveillance (Patel *et al.*, 2016). In such contexts, there is a risk that the populations Smile agus Sláinte aims to reach are rendered invisible in the data.

The WHO directs member states to 'enhance surveillance and health information systems to provide timely and relevant feedback on oral health to decision-makers for evidenced-based policy-making' (World Health Organisation, 2024a). Yet as Study Three in this thesis revealed, even global monitoring systems suffer from data gaps and methodological inconsistencies.

One German participant recounted:
'*We have criticised the WHO reports, they are based on the Global Burden of Disease Study, this complex extrapolation of data, it was a little bit strange to use…the WHO said the databases internationally were so bad, with their own indicators including DMFT that they*

had to use the GBD data…the Council of European Dentists and the Chief Dental Officers have all criticised it, so the WHO knows about this problem and they've promised to try to solve it in the future, but it's difficult with 193 countries' – (P1, Study Two, extended dataset).

Meanwhile, countries that have achieved stronger alignment with UHC principles such as Denmark, Germany, and Scotland have built structured, recurrent, and often legislatively supported oral health surveillance systems. Denmark's SCOR system consolidates data from municipal services annually. While Scotland's National Dental Inspection Programme (NDIP) provides nationally representative caries prevalence data through regular school inspections (Danish Health Authority, 2023; Public Health Scotland, 2023). Germany favours national oral health surveys and recently published the results of the 'Sixth German Oral Health Study (DMS 6)', aligned with WHO reference age groups (Jordan *et al.*, 2025).

Ireland's ability to monitor population needs, evaluate Smile agus Sláinte, and achieve universal oral health coverage will remain constrained until an integrated national surveillance system is developed. Based on WHO guidance, international best practice (World Health Organisation, 2013, 2024a; Patel *et al.*, 2016), and this research's findings, the following strategy is recommended.

Recommendations for national oral health surveillance in Ireland

1. *Establish a national oral health surveillance governance framework.*

Convene a structured partnership between the Department of Health, HSE, universities, dental associations, and patient groups. This body should agree national surveillance methodology, ownership, data sharing protocols, and lead agencies. Responsibility for oversight should be assigned jointly to the HSE via a strengthened 'Dental Public Health Unit' and university-based research centres.

2. Formalise collaboration between HSE and academic dental schools.

Follow an Academic Health Sciences model by developing joint appointments, with a focus on oral epidemiology and dental public health, between the HSE and university dental schools. Integrate Smile agus Sláinte's 'Advanced Care Centres' within dental hospitals and link them to national surveillance and referral systems.

3. Conduct a national baseline oral health survey aligned with WHO indicators.

Commission a full-scale, nationally representative oral health survey utilising standardised diagnostic criteria (e.g., ICDAS/DMFT), WHO reference age groups, and stratified sampling that ensures the inclusion of underserved populations. While some critics have questioned the relevance of periodic national surveys in the context of advancing health information technologies, this thesis contends that in the Irish context, such a survey remains not only appropriate but essential. Ireland has not conducted a national oral health survey since 2002, resulting in a substantial evidence gap that impedes effective planning, evaluation, and policy development.

Although integrated digital systems hold promise for future surveillance, Ireland's current IT infrastructure does not yet support secondary use of routine oral health data, and no comprehensive national dataset exists. Given the country's relatively small population and high-income status, the cost and feasibility of conducting a national survey are proportionate to the potential policy and system benefits. Furthermore, international best practice affirms the value of such surveys. Countries such as Germany continue to undertake epidemiological studies (typically every 7–10 years) to track disease trends, assess equity, and guide system performance. In this context, a national oral health survey in Ireland would establish a long-overdue baseline, enabling retrospective comparability, informing service design, and supporting ongoing monitoring of Smile agus Sláinte.

4. Embed real-time data capture into service delivery through electronic dental records.

Ensure that the forthcoming HSE Electronic Dental Record (EDR) system enables secure, standardised reporting of clinical and epidemiological data including of dental caries, treatment types, service uptake, and patient demographics for secondary use in planning and evaluation.

5. Publish annual national oral health reports.

Develop and disseminate yearly reports on oral health status, inequalities, service access, and performance aligned with WHO UHC monitoring frameworks and Sláintecare progress indicators. Reports should be publicly available and used to guide planning and resource

allocation. Without timely, reliable, and actionable oral health data, Ireland cannot plan, deliver, or evaluate its reform agenda. A surveillance strategy is not simply technical, it is political. It represents a commitment to visibility, equity, and evidence-based delivery in line with both national goals and international expectations.

Smile agus Sláinte aligns well with Sláintecare's commitment to equity, prevention and community-based care (Houses of the Oireachtas, 2017; Department of Health, 2019a). It also supports Ireland's obligations under WHO's vision for Universal Oral Health Coverage (World Health Organisation, 2024a). However, as evidenced in this research, translating policy into practice requires leadership, structure, and investment. The 1994 DHAP succeeded initially because it combined political sponsorship, collaborative implementation, and timely delivery (McAuliffe *et al.*, 2022). Smile agus Sláinte has the potential to follow the same path, however this is dependent on governance, funding, and professional trust being restored.

While it is important to highlight that some recommendations emanating from this thesis may require further research or piloting, they offer a potential evidence-based roadmap for actions.

Table 7-2 Summary recommendations for oral health policy implementation in Ireland

Recommendation	Responsible Lead (Dept/HSE)	Barrier	Supporting quote
1. Political Commitment and Leadership	Department of Health (Ministerial Lead)	Lack of political ownership and visibility	*'The Chief Dental Officer needs support at the highest level in the Department of Health, including from the Minister, who must want the plan to succeed and state it publicly and not just lip service'.*
2 Strengthen governance	Department of Health/HSE	Absence of leadership and policy governance	*'There must be accountability, ownership and leadership to guide this'*
3. Stakeholder Engagement and Collaboration	Department of Health / HSE / IDA	Fractured relationships and absence of co-design	*'Relationships are broken they have to change the mood, buy goodwill - early wins and what's not contentious'.*
4. Sustainable Financing and Investment	Department of Health / Dept of Public Expenditure	Chronic underinvestment and lack of ring-fenced funding	*'The State is going to have to support dentistry in an unprecedented way'.*
5. Phased Rollout of Children's Services	HSE Oral Health Services / Department of Health	Provider resistance and feasibility issues	*'Privatise a 6th class [children aged 12-years-old] take the pressure off the salaried system, on a pilot basis. Older children are more likely to get on better in the private practice setting and appeal more to the practitioners. Keep the younger kids in the HSE who are more likely to need more support with staff who are good at managing them'.*
6. Workforce Expansion and Skill-Mix	Dept of Health / HSE / Training Bodies	Severe workforce shortages and lack of auxiliaries	*'I am very conscious of the effect of the tight workforce situation at present. However, I think this is also an opportunity to emphasise a much greater role for flexible auxiliary workers'.*
7. Contract Reform (DTSS/DTBS Merger)	Department of Health / Dept of Public Expenditure	Fragmentation of service delivery and inefficiency	*'There needs be consolidation of public dental contracts with private dentists under a single entity to maximize leverage towards achieving policy goals'*
8. Oral Health Surveillance and Data Strategy	Dept of Health / HSE / Academic Institutions	Absence of national data, weak monitoring	*'Theres a huge, huge deficit [of data] in Ireland… I do think epidemiological oversight should reside with the HSE in combination with the dental schools via a shared and strengthened dental public health unit'.*

7.8 Strengths and limitations

Both the thesis overall and the individual studies within the thesis have several strengths and limitations that warrant consideration. These issues have been previously highlighted within the individual studies (chapters 4-6) and in the justification of the research approach adopted (chapter 3). In the following section the overarching strengths and limitations of thesis are discussed, including methodological considerations and mitigating actions adopted in response to potential weaknesses. Finally, a reflection from the experiences of this PhD candidate in the application of these methods in the oral health systems and policies is provided.

7.8.1 Thesis strengths

7.8.1.1 Contribution to novel research

Of the overarching strengths identified, the first one is the novel contribution to original research provided by this thesis. As outlined in section 7.3.1 it expands the limited body of research pertaining to oral health policy and systems research globally.

To the best of this PhD candidate's knowledge, Study One is the first ever oral health policy analysis conducted in Ireland and one of the few examples of this type of study within the oral health policy research domain (McAuliffe *et al.*, 2022).

Study Two also represents an addition to knowledge by generating an in-depth analysis of an under-researched topic, i.e. publicly funded oral health coverage for children, and updates previous research by Widström et al., (2004) (McAuliffe *et al.,* 2025).

Finally, the dearth of information pertaining to oral health data has been highlighted throughout this chapter, with Study Three corroborating and building on previous work (Patel *et al.*, 2016) by adopting a critical and comparative approach. The inter-country comparative approach adopted in both studies two and three allowed for the identification of variation within and across systems, along with potential areas for policy and system learning thus building a broader evidence base (Marmor, 2012; Cacace *et al.*, 2013).

7.8.1.2 Methodological strengths

The second strength of this PhD pertains to key aspects of methodological approach applied. For example, best practice recommendations for conducting policy analysis have been suggested (Walt *et al.*, 2008), and the extent to which these criteria were adhered to in Study One is an important strength of the work.

Walt et al., (2008) stated that researchers should approach policy analysis 'systematically, developing clear and testable propositions about the issue they are studying'. Additionally, they advocated for the use of case study research methods emphasising the need for methodological rigour and 'clearly identifying the type of 'case' and unit of analysis' (Walt *et al.*, 2008a). Each of these recommendations are adopted in Study One (McAuliffe *et al.,* 2022).

Yin (2001) further expanded on the methodological rigour required by advocating for 'boundaries' to generate a focused research question. In Study One, a case study approach was adopted as suggested, with the phenomenon of interest explicitly stated as Irish oral health policy with its analysis bounded, in addition to place, by time with the period of analysis specified between 1994 and 2021. As such, one of the primary strengths of this study is its long view encompassing almost three decades, which helped to explore the genesis of Irish oral health policy to present day.

Walt et al., (2008) also argued for the critical application of existing frameworks to guide and inform health policy analysis. The use of conceptual frameworks in studies one and two are key methodological strengths of the thesis and the justification for their use is outlined in detail in Chapter 3.

The multiple streams framework (MSF) (Howlett, 2019) facilitated a nuanced and in-depth approach to the oral health policy analysis conducted in Study One. Howlett's streams have their roots in 'Kingdon's' seminal work which considered why policy issues rise and fall on government agendas (Kingdon, 1995). The MSF caters for analysis beyond the 'what' of the policy-making process to exploring how an issue appears on the agenda and the 'who', 'why', ' when' and ' how' behind policy choices being made or not made (Howlett, 2019). As such the policy analysis in Study One illuminated policies, problems, processes and the complex political actors and cultural forces that shaped the development and implementation (or lack

thereof) of Irish oral health policy.

Furthermore, the use of the World Organisation Universal Health Coverage Cube previously adapted for public dental coverage analysis, was similarly effective in guiding and directing the organisation and analysis of extensive volumes of data across six countries in Study Two (World Health Organisation, 2008; Allin *et al.*, 2020). While the use of a proven data collection template based on the Cube was an additional strength of the study.

The approach adopted in Study Three was that of a narrative review. This type of review is defined as 'a scholarly summary along with interpretation and critique' (Greenhalgh *et al.*, 2018). Such reviews are considered beneficial to offer rich, meaningful summaries of a topic while describing and interpretating literature in the field of interest (Sukhera, 2022). However, a criticism of their application is a lack of systematic rigour. To help reduce the impact of this potential limitation in Study Three care was taken to ensure a systematic approach to the literature search was executed.

7.8.1.3 Depth of literature

This represents the third strength of the thesis overall which was the breadth and depth of literature analysed. In Study One a detailed documentary analysis was conducted analysing documents identified from peer reviewed literature, health policies, health service reports and strategies, guidelines, and additional grey literature including parliamentary reports, questions, and media reports over 27-years.

Similarly, in Study Two a search strategy was developed with the assistance of a medical librarian (SB) to ensure a detailed search of peer reviewed publications with all abstracts reviewed with a second reviewer (JC). Additional documents were subsequently identified by individual country searching across a variety of domains including government websites, health service platforms and professional organisations. Furthermore, documents were sourced directly from interview participants local to each country.

Equally in Study Three there were two separate literature search strategies developed, again with the assistance of a specialist medical librarian, with no limits or restrictions placed. In the absence of desired depth from the peer reviewed literature, data were sought from national

and international sources without language restriction, including health ministries and national oral health services complimented by searches of international organisations including World Health Organisation: Oral Health Country/Area Profile Project (CAPP) and The Council of European Chief Dental Officers (CECDO) databases. Across the thesis the interrogation of literature to this extent generated rich, detailed information informing the documents analysed for this research.

Documents are considered one of the 'most powerful methods' in health policy research (Bowen, 2009). Furthermore, as health systems research considers detailed facets of healthcare including coverage and access, documents are also beneficial in providing comprehensive content analysis in this domain (Dalglish *et al.*, 2020). However, analysis of the literature is only as good as the literature which is available and the concerns underlying available data will be acknowledged in the limitations section.

Therefore, it is suggested that to further inform documents and to support the strength of qualitative research overall, the triangulation of data from multiple sources is necessary. This represents the fourth overarching strength of the PhD, the triangulation of different data sources and the use of 'elite' interviews (Mays and Pope, 2000; Yin, 2001).

7.8.1.4 Elite participants and data triangulation

'Elite' participants are those who have specific expertise, knowledge or operate close to positions of power within health systems (Morris, 2009). A total of twenty-seven 'elites' from nine different countries were recruited for this research, representing a key strength of this thesis.

Across studies 1 and 2, semi-structured interviews were conducted with 'elites' identified from the document analysis. These interviews elaborated on the data generated from several different sources of documents. This triangulation meant the outcomes from multiple data sources were continually informing each other, and the overall findings (McAuliffe *et al.*, 2022, 2025).

'Elite' participants provide 'crucial' information in policy research (Vaagland, 2024) and in this PhD thesis their participation yielded two particular strengths. Firstly, they provided detailed

narratives adding depth and context to the high-level information found in the documents (Mikecz, 2012). 'Elite interviews' are recognised as beneficial in tracking the processes that lead to key political decisions for example (Ntienjom Mbohou and Tomkinson, 2022), which was of crucial use in Study One.

Secondly, as studies two and three spanned six different countries, the 'elite' participants ensured both accuracy in verifying data collected, along with the addition of country specific context particularly with respect to cultural norms, which enriched oral health coverage descriptions.

The challenges to interviewing 'elites' which can impact the quality of findings include access to the elite, the risk of the elite presenting biased information and the power asymmetry between the researcher and elite, each of which is exacerbated when considering highly politicised topics (Vaagland, 2024).

In this PhD, triangulation of evidence generated from documents, along with the relatively large number of interview participants, sought to guard against the risk of the bias, subjectivity and ambiguity that can emerge from interviews (Buse *et al.*, 2012).

An additional factor which supported 'accessing' and the management of positionality within interviews reported in this PhD was conducting interviews 'online' due to the outbreak of the COVID-19 pandemic.

It is necessary to acknowledge that much of this PhD was conducted in an unanticipated context i.e. the introduction of emergency public health measures in response to the COVID-19 pandemic. This impacted the overall PhD study protocol, the limitations of which will be dealt with below.

On a practical level, the public health measures required all bar one interview to be conducted remotely via teleconferencing facilities (i.e. Microsoft Teams). Previous literature has outlined the debate on the quality of remote versus in-person interviewing. For instance, Johnston et al., (2021) compared methods across 300 interviews, reporting that face-to-face approaches produced richer data, despite being of similar in length to remote interviews.

Others pointed to the benefits of remote interviewing including reduced resource consumption, improved representativeness due to broader geographic accessibility and greater convenience for participants (Musselwhite *et al.*, 2007; Wray and Barrett, 2022).

In addition to the essential advantages of better resource management in conducting almost thirty interviews across nine different countries, it was the experience of this PhD candidate that 'going online' significantly both enhanced access to elites and the 'positionality' in conducting to elite interviews. This further corroborates recent research on the topic (Vaagland, 2024).

Restrictions on international travel and 'stay at home' mandates appeared to increase the appeal of participating in this PhD research. While the sudden change in schedule also offered greater flexibility in terms of the availability of such 'in demand' actors.

Furthermore, previous literature argues that the interview environment can often reinforce the unbalanced power relationship between elites and interviewees. Again, in this PhD candidate's experience the 'home-office' context in which these online interviews took place generated a personal atmosphere. It considerably relaxed both the researcher and interviewee, which rapidly built trust and facilitated dialogue that appeared to greatly strengthen the data generated from interview.

7.8.2 Thesis limitations

7.8.2.1.1 Public, parent and broad professional engagement

While the impact of the COVID-19 pandemic facilitated the recruitment and participation of 'elites', it conversely impacted an intention to seek the insights of patients, parents, educators, and oral health professionals.

At the outset of this PhD ethical approval was sought to conduct a qualitative research project comprising interviews and focus groups with oral health professionals and care-givers. Following further scoping, a multi-disciplinary stakeholder group comprising allied health professionals and educators including teachers was also planned. The overall aim was to seek

the insights of all relevant stakeholders with respect to planned oral health system reform in Ireland. However, following the onset of the pandemic, this project was not initiated.

Ultimately, all of those interviewed for this PhD thesis either were or are in positions of power or influence within their respective oral healthcare system or within the broader oral health policy sphere.

While the benefits of elite interviewing in health systems and policy research have been espoused above, the resultant limitation is that the insights garnered are solely from those most 'powerful' in a top-down hierarchy (Lancaster, 2017). This requires acknowledgement considering the strong thread pertaining to oral health inequalities emphasised in this research, and the fact that oral diseases disproportionately impact those most vulnerable, whose perspectives are not accounted for in this research.

Previous research has highlighted that to address oral health inequalities in children more insights into parents' experiences, especially those in lower socio-economic groups, is needed. While it is 'imperative to collaborate with families and prioritise their perspectives' (Ramji *et al.*, 2020; Arora *et al.*, 2021). Most particularly in the context of intervention development and implementation the importance of a 'bottom-up' approach should be recognised. While the voices of those families living in vulnerable circumstances who are 'often unheard during intervention design processes' must be prioritised (Balasooriyan *et al.*, 2024).

Furthermore, the perspectives of the oral healthcare team have previously shown to be of significant importance in understanding the barriers and facilitators to the adoption and promotion of preventative oral healthcare and in the delivery of care for very young children (Clark *et al.*, 2014; Leggett *et al.*, 2024). In the Irish context, the focus of this PhD, oral health professionals most especially dentists are identified by policymakers as key stakeholders owing to the significant 'reorientation in their way of working' proposed by the Ireland's national oral health policy (Department of Health, 2019a).

The completion of the planned qualitative project would have provided those perspectives and ensured accurate representation of the differing stakeholders in terms of planned oral

health system reform. Furthermore, an intended component of the project was to incorporate a structured Public and Patient Involvement element (PPI) following the standards mandate by INVOLVE, comprising the caregivers of young children (Gray-Burrows *et al.*, 2018).

Additionally, while this thesis includes a dedicated background discussion of the oral health workforce and skill mix, this theme was not a core component of the empirical research studies. Due to the specific research objectives and sampling strategy, all interview participants were high-ranking experts almost all of whom were dentists with strategic or policy-level roles. As a result, the perspectives of auxiliary oral healthcare professionals, such as dental hygienists, therapists, and dental nurses, were not captured. This is a limitation particularly given the emphasis placed on workforce reform, team-based care, and expanded skill mix in both international policy (World Health Organisation, 2024a; Gallagher et al., 2024) and Ireland's own national oral health policy (Department of Health, 2019a). Their views may have provided further valuable insights into the feasibility and delivery of planned oral health reforms. The focus on dentists as participants and the absence of broader perspectives are recognised in the limitations of both published papers (McAuliffe *et al.,* 2022, 2025). Nonetheless, this thesis contributes valuable insights into policy-level dynamics and system design, and future research could build on this foundation by incorporating the perspectives of the wider oral health workforce.

Ultimately this PhD thesis did not utilise public and patient involvement (PPI). According to the literature a crucial component of PPI is that it is not a 'tick box' exercise and should be done so in a genuine integrated manner (Andrews *et al.*, 2015). As this PhD research centred on a health systems and policy level approach it was felt the use of potential participants' time and resources was not warranted. However, engagement with patient and professional groups could have added to the initial scoping phases of the study and to sense-check the findings.

7.8.2.2 Data availability

This PhD thesis used analysis of secondary data as a key basis for its findings. As such like any analysis irrespective of the comprehensive approach adopted, the outcomes are dependent on the quality of information available.

The weaknesses prevailing in oral health data have been widely recognised by the WHO along with academics including those leading the Lancet oral health series (Peres *et al.*, 2019; Watt *et al.*, 2019; World Health Organisation, 2022; Eaton *et al.*, 2023). This especially pertains to the lack of up-to-date data on the burden of oral diseases, oral health risk factors, outcome measures and oral healthcare utilisation data (Winkelmann *et al.*, 2022).

In terms of this PhD, this posed a particular limitation in terms of the comparative approach adopted in studies 2 and 3. The benefits of inter-country comparative analysis are well versed in the health systems literature in terms of deriving lessons from the experiences of other countries and insights into the composition of national systems and policies (Marmor, 2012). While previous research pointed to the specific advantages of such comparisons in offering insights into the prevalence of dental caries in children and the impact of health policies (Goldfeld *et al.*, 2022).

However, despite setting out to explicitly compare countries, the limitations of available data meant that countries were required to be considered individually and comparisons drawn where feasible and appropriate.

Literature warns of the issues pertaining to the comparability of the DMFT index as an outcome measure, information on outpatient dental expenditure, unmet needs for dental care and numbers of dentists, all data indicators which are often inaccurate or incomplete (Patel *et al.*, 2016; Winkelmann *et al.*, 2022).

As these data are used throughout studies two and three, extensive efforts were made to verify their accuracy with local experts, to seek additional local literature and when these data were used and to make explicit to the reader the source of data along with the limitations pertaining to it.

7.8.2.3 Absence of a 'mixed methods' approach

The data issues speak to a third potential limitation of the thesis – the absence of a mixed method approach. Ethical approval was also sought at the outset of the PhD to conduct a quantitative descriptive analysis using an anonymised, aggregated dataset to determine the prevalence of dental caries among a population of Irish children under-age-5 utilising the public dental system in the period prior to oral health policy publication.

There are no nationally published data for this group who had been identified as the first cohort to be targeted for system reform (Department of Health, 2019a). It was anticipated that this quantitative study would 'extend the breadth and range of inquiry' provided by qualitative data in this PhD and generate an understanding of service need, forming a central component of recommendations for implementation (Greene, 2007). However, data delays following a severe cyber-attack suffered by the Irish Health Service Executive in the midst of the pandemic resulted in this study not being undertaken.

According to the literature, well tested quantitative measures of implementation are under-utilised in policy research (Allen *et al.*, 2020). Yet it has been argued that given the complexities of health systems, policies and interventions mixed methods approaches are particularly important and powerful in this domain (De Allegri *et al.*, 2018; Fisher and Hamer, 2020). While the Alliance for Health Policy and Systems Research strongly advocate for their increased use (Gilson and World Health Organisation, 2012).

Study Three of this PhD went some way to providing key quantitative information in the context of health systems for children. However, the overall qualitative approach adopted restricts the generalisability of study findings. The context within which the implications of this body of research is presented could be more nuanced with the addition of quantitative data. Thus, the resources and constraints determined by this PhD programme limited progression of this aspect of analysis. Furthermore, the methods of case study, documentary analysis and semi-structured interviews were suitable for the overarching research question under analysis (Walt *et al.*, 2008; Bowen, 2009; Gilson and World Health Organization, 2012).

7.8.2.4 Methodological limitations

Qualitative methodologies are considered critical to Health Systems and Policy Research. They have been used for a diverse range of purposes ranging from policy and program evaluation to studying complex health care organisations and systems (Fisher and Hamer, 2020). While the findings of qualitative studies have been shown to improve healthcare planning, organisation and delivery by way of the in-depth description and insights into social processes and contexts generated (Murphy, 2017).

However, such approaches have inherent limitations particularly pertaining to generalisability, reliability, researcher bias and cross-country comparability (Hardy *et al.*, 2001; Mauthner and Doucet, 2003; Nolte and McKee, 2005; Walt *et al.*, 2008; Hammarberg *et al.*, 2016). These issues were previously identified within the individual studies (Chapters 4-6) (McAuliffe *et al.*, 2022, 2025). The limitations will be briefly restated below along with the high-level mitigating steps taken to account for them.

7.8.2.4.1 Limited generalisability of qualitative research

Unlike quantitative methodologies, qualitative methodologies do not allow for statistical generalisation (Polit and Beck, 2010). This is rooted in the overall goal of qualitative research, which is to generate rich, contextual understandings of phenomena (Bower and Scambler, 2007; Yin, 2014). Findings from the policy analysis in the Irish context in Study One for example sought this rich context however, owing to this approach the findings may not be applicable to different health systems or settings. This is acknowledged in the published research (McAuliffe *et al.*, 2022).

That said, a mitigating factor pertaining to this research is the potential for policy 'transferability'. This is directed by the model of generalisability proposed by Firestone (1993) which refers to the use of findings from an inquiry applied to a different group of people or setting. To support transferability, there is a requirement for a 'thick description' (Polit and Beck, 2010).

A '*thick description*' refers to a rich, thorough descriptive set of information about the research setting, study participants, and observed transactions and processes (Polit and Beck,

2010). Study One included 125 documents, 13 interviews and is over 11,000 words in length, going some length to satisfy this criterion (McAuliffe *et al.*, 2022).

A second strategy to enhance generalised inferences is by increasing the number of cases under consideration. This was applied in Study Two (McAuliffe *et al.,* 2025) by selecting diverse but representative countries to allow insights into differing and alternative oral health systems (Walt *et al.*, 2008; Yin, 2014; Safari *et al.*, 2023).

7.8.2.4.2 Data availability for documentary analysis

Documentary analysis is contingent on existing sources of information additional to academic literature including government reports, policy documents, unpublished documents, commissioned reports and media publications (Bowen, 2009). The quality, accessibility and completeness of these sources however may be inconsistent (Bowen, 2009).

In Study Two there is the additional challenge of comparing across different health systems (Winkelmann *et al.*, 2022). Some countries may have comprehensive policy documents while others may lack transparency, which was further compounded by the complications of researching documents across four languages.

The mitigation strategies adopted in this research in response included the use of triangulation across multiple document sources along with elite interviews to validate findings in addition to providing critical context (McAuliffe *et al.,* 2022, 2025). A further consideration was the application of reflexive document selection in ensuring balanced and diverse perspectives were captured (Bowen, 2009; Yin, 2014).

7.8.2.4.3 Researcher bias

In qualitative research, the researcher plays a central role in data collection and interpretation (Galdas, 2017). Their theoretical lens, background and personal experiences can shape how findings are analysed, interpreted and presented (Anderson, 2010; Berger, 2015). In this research policy the researcher's own policy preferences or perspectives on specific health systems could influence how findings are framed.

This was mitigated against though several specific steps in this PhD thesis (Mays and Pope, 2000; Creswell and Creswell, 2017); (i) through the use of two different analytical frameworks which ensured consistency and transparency in theme identification, (ii) by engaging in reliability checks – the PhD candidate as the lead researcher was responsible for all analysis, however the emerging findings were discussed in regular, structured meetings with the broad research team to identify any subjective bias, (iii) critical reflexivity – the PhD candidate engaged in regular reflexivity actively reflecting on how their assumptions may influence interpretation including maintaining a reflexive journal which was shared with a member of the supervisory team.

7.8.2.4.4 Respondent bias

While HPSA relies on 'elites' for their first-hand knowledge of decision-making processes (Buse *et al.*, 2012), this can introduce bias where the findings disproportionately reflect those powerful perspectives (Morris, 2009; Mikecz, 2012).This pertains to the risk that respondents may provide information that serves their own interests and that due to the power dynamics in effect (between a researcher and an elite) these individuals may control the discussion to present narratives that justify their perspective during interview (Van Audenhove and Donders, 2019).

In addition to data triangulation and researcher reflexivity previously discussed, other strategies that were employed to strengthen validity and reliability pertaining to 'elite' interviews included:

1. ensuring diverse sampling – a range of participants from different organisations were recruited to obtain as balanced perspective as possible (Murphy, 2017);
2. probing – using follow-up questions to delve deeper into responses and seeking clarification to uncover more nuanced information (Mikecz, 2012);
3. Maintaining anonymity and confidentiality – according to the literature, some elites can be viewed as 'a vulnerable group when they disclose information about sensitive policy processes' (Lancaster, 2017). Therefore, assuring participants that their contributions would remain confidential encouraged honestly, supported building a rapport and reduced the likelihood of self-censorship with securing such trust considered 'critical for effective elite interviews'.

4. ‘Going online’ in the context of this highly politicised topic in the Irish context, greatly facilitated unique insights being secured from powerful elites, replicating and extending the evidence base developed by Vaagland (2024).

7.8.3 Reflections on the methodological approach adopted

Study One represents a significant contribution to the oral health systems and policy analysis field as it was the first study to use the expanded Multiple Streams Framework (Howlett, 2019) applied to oral health in the global literature (McAuliffe *et al.,* 2022).

This PhD research demonstrated the framework’s utility in facilitating a systematic and comprehensive approach to a complex issue. However, the rigidity of the streams when applied to an area such as oral health, where policy change may be particularly incremental and not necessarily align with all open windows of opportunity. This reflection is not unique to this study, often the ‘hard’ delineations in frameworks are more difficult to find and/or interpret in the real world. Indeed, it is often the interaction between different components of a framework that is the interesting finding (Schulmann *et al.*, 2024).

In this research the political stream dominated but in its obstruction of the flow of the process and programme streams, with a poorly recognised problem stream, again contrary to existing literature in this space (Howlett, 2019). Furthermore, politically active actors were present across multiple streams, however those with oral health knowledge had limited power to push the streams in a positive direction. While the policy stream was significantly weakened owing to the failure of those actors to align with an overall solution.

Therefore, it is the perspective of this PhD candidate that potential refinements of the MSF should investigate the opportunity for a dominant stream which could consider historical policy and structural inertia. Furthermore, policy stagnation could be recognised within the programme stream by facilitating an interruption in the ‘flow’ to illustrate non-implementation. These are considerations within a low policy priority area such as oral health but also may be relevant in other neglected health areas within general health policy analysis.

The second study of the PhD further refined the use of the WHO Universal Health Coverage

cube applied to the child population (McAuliffe *et al.,* 2025). It was highly effective in mapping significant volumes of data across the different countries with the demands of the data collection template sourced ensuring granular data was collected. However, a critical limitation of the Cube when applied to oral health is that it does not account for key contextual influences that shape its application, particularly in the context of poor quantitative oral health data.

It is the view of this researcher that without supplementary qualitative data from the elite interviews the Cube alone would have oversimplified the complexities of the systems under analysis in addition to lacking in robustness due to data weakness. This highlights a key methodological contribution of this study, that within oral health research, while structured health systems frameworks offer comparability, they may require qualitative supplementation to ensure accuracy and contextual depth.

This study also highlights the need for further refinement of a specific and reliable oral health coverage framework in the Cube building on the work of Allin et al., (2020) and this research. It could integrate not only the components of the cube but also consider workforce capacity and skill, cultural and political influences, professional education and specific considerations for oral disease prevention.

Study Three of this PhD adopted a different methodological approach by way of a narrative review which is frequently considered lower in the research hierarchy. However, in this instance a narrative review was essential due to the absence of standardised, quality oral health data from peer reviewed sources.

A critical finding from this study was that major global oral health monitoring frameworks are fundamentally flawed with significant discrepancies between reported data and actual country-level realities. The Global Burden of Disease (GBD, 2019) dataset extrapolated by the IHME in providing dental caries 'prevalence' levels for example were insufficient owing to their systematic methodologies where peer reviewed literature were only captured.
Equally the WHO oral health profiles fail to publish readily available dentist workforce data at national level (World Health Organisation, 2024a).

To obtain accurate information, extensive country-specific searches were required, including across non-English sources, demonstrating the hidden complexity of comparative research within oral health. Study Three underscores the need for greater methodological flexibility in oral health research and builds on the evidence base for the utility of a narrative review approach. While narrative reviews are often dismissed in favour of systematic reviews this study illustrates that in an under researched area such oral health with an absence of reliable data, flexible approaches can deliver meaningful insights.

7.9 Directions for further research

Oral health research continues to receive limited attention from major funders, with a noticeable lack of research focused on health systems and policy (Benzian *et al.*, 2011; Eaton *et al.*, 2023). This thesis contributes to a growing but still underdeveloped field (McAuliffe *et al.,* 2022, 2025). As such, further research is essential to support oral health system strengthening, both in Ireland and globally. The suggestions below are organised into two categories: national research priorities relevant to the Irish context, and internationally relevant themes aligned with global oral health agendas.

7.9.1 Research to support oral health reform in Ireland

In the immediate term in Ireland, evidence to inform oral health policy implementation is a priority for further research. This PhD outlined two potential studies in support of this endeavour which could be further refined and built upon.

7.9.1.1 Baseline population oral health data

A key barrier to implementation and monitoring in Ireland is the lack of recent, representative data on oral disease. Study Three revealed that no national data exists on caries prevalence in children within the last 15 years, and none at all for adult populations since 2000 (Whelton *et al.*, 2006). Research is urgently needed to determine an efficient and sustainable mechanism for oral disease surveillance, with agreement across academic, policy and service stakeholders.

7.9.1.2 Barriers and facilitators to implementation

This thesis highlights the value of qualitative, multi-perspective research in health systems analysis. Further work is required to understand the views of key stakeholders identified in Smile agus Sláinte (Department of Health, 2019a) including caregivers, oral health professionals, and those tasked with implementation to better anticipate and address the implementation challenges associated with oral healthcare reform (Rosing *et al.*, 2019).

7.9.1.3 Oral health workforce and access

A third national priority relates to the availability and distribution of the workforce. This thesis identified two critical barriers to access: geographic shortages of oral health professionals, and limited willingness among some practitioners to care for high-risk and marginalised populations. Research should explore factors affecting workforce supply, skill mix, and recruitment, as well as the impact of incentives, contractual arrangements, and training models on engagement with prevention and public service delivery. Further work could also engage auxiliary professionals, whose perspectives were not included in this thesis but are critical to understanding the feasibility of proposed workforce reforms.

7.9.2 Global research priorities in oral health systems

7.9.2.1 Defining universal oral health coverage

A challenge to implementing the World Health Organisation Global Oral Health Action Plan, is defining what universal oral health coverage means. As outlined by Eaton *et al*., (2023), this definition will represent different implications in different countries influenced by political and cultural factors along with the resources available. This requires further research on what constitutes 'essential oral healthcare' and where oral disease prevention, and upstream interventions feature in this domain. It should also include engagement with all relevant stakeholders including auxiliary professionals, governments and patient representatives at local and national levels (Benzian *et al.*, 2021).

7.9.2.2 Development of harmonised oral health indicators

The unreliable and inconsistent information both on oral health status and systems should be a research priority globally. This is an issue recognised by a host of international organisations and academics alike and is likely one of the most significant obstacles to expanding universal oral health coverage (Winkelmann *et al.*, 2022; World Health Organisation, 2021, 2024a). This present research highlights the variation and incomplete data currently prevailing in Europe. Further research should investigate potential strategies for the development of more systematic, harmonised data and the strategies to achieve broader integration of quality indicators for oral health within general healthcare.

7.9.2.3 Understanding structural determinants of oral health inequalities

This study highlighted persistent inequalities pertaining to access to oral healthcare for children (McAuliffe *et al.,* 2022, 2025). Further research should move away from simply documenting oral health inequalities towards explaining them. This could include inter-disciplinary research on better understanding the role of the broader structural determinants (particularly political and economic factors) on creating and influencing inequalities in oral health.

7.9.2.4 Comparative research on global progress toward universal oral health coverage

This research contributes to understanding oral health system models in Europe, but further work is required to situate these systems within a broader global context. While countries such as Denmark, Germany, and Scotland offer relatively strong public coverage for children, the European region overall exhibits considerable variation in coverage, system integration, and workforce planning (Winkelmann *et al.*, 2022; McAuliffe *et al.*, 2025).

Globally, some upper-middle-income countries have made notable efforts to embed oral health within universal coverage frameworks. For example, Thailand offers comprehensive publicly funded oral health services for children under 12. However, despite the breadth of service provision, the country continues to report high rates of dental caries in young children, suggesting that service coverage alone is insufficient without concurrent attention to social determinants, behaviour change, and quality of care (Sitthisettapong et al., 2021).

Similarly, Brazil's '*Programa Brasil Sorridente'* is often cited as a benchmark for integrating oral health into primary care through family health teams. Yet the success of the programme has varied significantly by region, and questions remain regarding long-term sustainability and equitable implementation (Galvão and Roncalli, 2021).

In contrast, high-income countries such as the United States and Australia continue to rely heavily on private financing, with fragmented and often means-tested public programmes. Even where coverage is formally available, utilisation remains low, as seen in Australia's Child Dental Benefits Schedule (Trinh *et al.*, 2022) or subject to complex eligibility criteria, as with Medicaid in the United States (Fellows *et al.*, 2022). Low- and middle-income countries face distinct barriers to achieving UHC in oral health, including limited public health infrastructure, insufficient workforce capacity, and underinvestment in oral health promotion. Without robust national financing strategies, many of these systems struggle to deliver even a basic package of preventive and essential services (World Health Organisation, 2024a).

Further research is needed to compare how different health systems, across income levels and region, define and implement oral health coverage within the UHC agenda. This includes assessing the degree of service integration, monitoring and data capacity, financing models, and workforce distribution. Such comparative work is crucial to identifying realistic, context-specific pathways toward strengthening public oral health systems and achieving universal coverage.

7.10 Conclusions

For the Irish population as a whole, publicly funded oral health coverage remains limited, with vulnerable groups, particularly children and special needs groups, disproportionately affected. The 2008 global financial crisis had a lasting impact on the Irish oral healthcare system, and the consequences of austerity-era budget cuts remain evident in 2024. In the absence of universal coverage, the private sector continues to play a dominant role, with over 70% of oral healthcare in Ireland privately financed.

In April 2019, Ireland's national oral health policy 'Smile agus Sláinte' was published representing the first update in policy in over one quarter of a century. Framed around the same ideals as *Sláintecare*, it aspires to improve oral health and reduce inequalities by fundamentally reorienting public services, particularly for children. However, policymakers have acknowledged the implementation of this reform as particularly challenging.

This PhD thesis has examined the landscape of national oral health policy and systems for children through the lens of universal oral health coverage. It employed a combination of policy analysis, inter-country comparison, elite stakeholder interviews, and a critical review of key oral health indicators, providing a comprehensive and multi-level perspective.

A persistent finding was the low political priority afforded to oral health in Ireland, alongside its exclusion from broader health policy frameworks. This has contributed to a fragmented, unequal oral healthcare system with little meaningful reform over several decades. In contrast, international comparison across representative European countries revealed two distinct models of children's oral health coverage: universal systems and targeted systems. Universal models, such as those in Denmark, Germany, and Scotland demonstrated greater progress in reform, a stronger preventive ethos, and more sustained political commitment.

A recurring enabler of such success was the availability of high-quality oral health data. Yet, this research found that two key indicators of oral health coverage for children, workforce capacity and dental caries prevalence, remain methodologically inconsistent and difficult to compare across countries. This weakens system accountability and impedes shared learning. Notably, Ireland was found to have the lowest ratio of oral health professionals, including

dentists and hygienists, among the countries studied. This is a structural constraint that poses a significant challenge to policy implementation and equitable service delivery.

As of 2025, oral healthcare for children in Europe appears to be at a tipping point. Targeted systems are under increasing pressure to expand coverage, while universal systems remain vigilant in protecting the gains they have achieved. In Ireland, progress on the implementation of Smile agus Sláinte remains limited.

Nonetheless, the global momentum toward universal oral health coverage, alongside Ireland's broader political commitment to universalism, offers renewed opportunity for reform. To progress oral health coverage for children, both in Ireland and internationally, there must be a renewed emphasis on prevention, on addressing structural inequalities, and on strengthening advocacy through high-quality data. Achieving these goals will require coordinated leadership, engaged oral health professionals, and sustained political will.

Chapter 8 References

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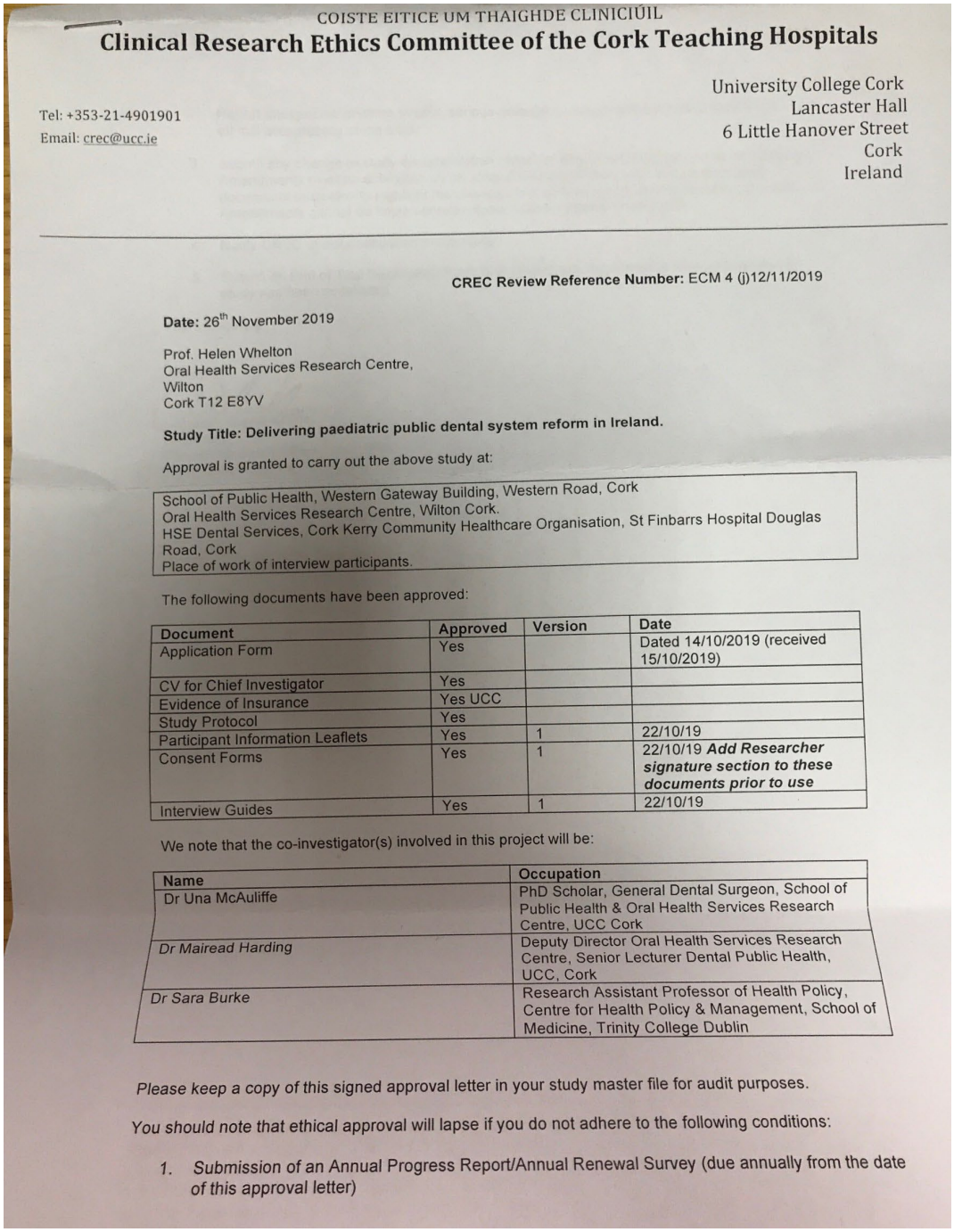
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Chapter 9 Appendices

9.1 Appendix A: Ethical approval (Studies 1-3)



COISTE EITICE UM THAIGHDE CLINICIÚIL

Clinical Research Ethics Committee of the Cork Teaching Hospitals

Tel: +353-21-4901901
Email: crec@ucc.ie

University College Cork
Lancaster Hall
6 Little Hanover Street
Cork
Ireland

CREC Review Reference Number: ECM 4 (j)12/11/2019

Date: 26th November 2019

Prof. Helen Whelton
Oral Health Services Research Centre,
Wilton
Cork T12 E8YV

Study Title: Delivering paediatric public dental system reform in Ireland.

Approval is granted to carry out the above study at:

School of Public Health, Western Gateway Building, Western Road, Cork
Oral Health Services Research Centre, Wilton Cork.
HSE Dental Services, Cork Kerry Community Healthcare Organisation, St Finbarrs Hospital Douglas Road, Cork
Place of work of interview participants.

The following documents have been approved:

Document	Approved	Version	Date
Application Form	Yes		Dated 14/10/2019 (received 15/10/2019)
CV for Chief Investigator	Yes		
Evidence of Insurance	Yes UCC		
Study Protocol	Yes		
Participant Information Leaflets	Yes	1	22/10/19
Consent Forms	Yes	1	22/10/19 ***Add Researcher signature section to these documents prior to use***
Interview Guides	Yes	1	22/10/19

We note that the co-investigator(s) involved in this project will be:

Name	Occupation
Dr Una McAuliffe	PhD Scholar, General Dental Surgeon, School of Public Health & Oral Health Services Research Centre, UCC Cork
Dr Mairead Harding	Deputy Director Oral Health Services Research Centre, Senior Lecturer Dental Public Health, UCC, Cork
Dr Sara Burke	Research Assistant Professor of Health Policy, Centre for Health Policy & Management, School of Medicine, Trinity College Dublin

Please keep a copy of this signed approval letter in your study master file for audit purposes.

You should note that ethical approval will lapse if you do not adhere to the following conditions:

1. *Submission of an Annual Progress Report/Annual Renewal Survey (due annually from the date of this approval letter)*

2. Report unexpected adverse events, serious adverse events or any event that may affect ethical acceptability of the study

3. Submit any change to study documentation (minor or major) to CREC for review and approval. Amendments must be submitted on an amendment application form and revised study documents must clearly highlight the changes and contain a new version number and date. Amendments cannot be implemented without written approval from CREC.

4. Notify CREC of discontinuation of the study

5. Submit an End of Trial Declaration Form and Final Study Report/Study Synopsis when the study has been completed.

Yours sincerely

Professor David Kerins
Chairman
Clinical Research Ethics Committee
of the Cork Teaching Hospitals

The Clinical Research Ethics Committee of the Cork Teaching Hospitals, UCC, is a recognised Ethics Committee under Regulation 7 of the European Communities (Clinical Trials on Medicinal Products for Human Use) Regulations 2004, and is authorised by the Department of Health and Children to carry out the ethical review of clinical trials of investigational medicinal products. The Committee is fully compliant with the Regulations as they relate to Ethics Committees and the conditions and principles of Good Clinical Practice.

9.2 Appendix B: Study One - letter of invitation



ucc
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland



SPHeRE
Structured Population and Health-services Research Education

LETTER OF INVITATION

Delivering paediatric public dental system reform in Ireland

Date:

Dear X

We are conducting research on the delivery of paediatric dental system reform in Ireland, the first component of which involves an analysis of Irish oral health policy during the period 1994-2020.

The key objective of this study is to generate an in-depth understanding of policy and the key actors, context and processes influencing policymaking during the past 25 years in Ireland. The impact of the pandemic on oral health and reforming the paediatric dental system in the months and years following the emergence of COVID-19 will also be discussed.

We hope to conduct interviews with the central stakeholders involved in the dental system and the policymaking process. The findings from interviews will then be combined with a documentary analysis of the key policy relevant publications from the same time.

Participation is voluntary and all information will be used in a confidential manner with anonymity strongly emphasised. All participants will be requested to give their written consent to participate.

Should you be amenable to partaking, you will be provided with a Participant Information Leaflet and an interview will be conducted via teleconference facilities (MS Teams) as appropriate, at a time of your convenience.
I would very much welcome your valuable contribution to this work considering your role and experience.

Further information may be obtained from h.whelton@ucc.ie.

Best wishes,

Professor Helen Whelton
Head of College Medicine and Health, University College Cork
Chief Academic Advisor, South-South West Hospitals Group

9.3 Appendix C: Study One - participant information leaflet

PARTICIPANT INFORMATION LEAFLET





Title of study: Delivering paediatric public dental system reform in Ireland.

Ireland's newly published National Oral Health Policy[1] , *Smile agus Sláinte*, represents the first change in oral health policy in Ireland for 25-years. A key action is reforming the paediatric public dental system from a targeted based approach led by the Schools Dental Services, to the delivery of preventative bundles of treatment in primary care.

The aim of our research is: to analyse oral health policy in Ireland during the period 1994-2021.

Who should partake? The key actors, as evidenced from documentary analysis and following recommendations from interviewees, prominent across the oral health policy landscape during this period will be invited to partake.

What does this entail for you? This study involves interviews. You will be invited to participate in one interview, which will last between 45 minutes to 1 hour at a time convenient for you. The interview will be recorded and conducted by a researcher who is also a dentist. The interview will seek your opinion on the dental system and oral health of Irish children, Irish oral health policy, the impact of COVID-19, the policymaking process and future system reform.
What about confidentiality? The information you will give will be kept entirely confidential. No personal details that might identify you will appear in the study report or associated publications.
What about withdrawing? You have the right to withdraw from the interview discussions at any time, even if you initially agree to participate.
What are the benefits of participating? The results of this research will be reported back to the Department of Health and the Health Service Executive to help inform future changes to dental care and oral health policy in Ireland. So, your opinions and perspectives are really important.
What risks are there to taking part? The risks (if any) are considered minimal and ethical approval has been granted from the Clinical Research Ethics Committee of the Cork Teaching Hospitals. All information will be treated in the strictest confidence. Participation is voluntary. The research findings will be presented in the report of the study, presentations, and publications, but your anonymity will be strictly upheld. Interviews will be conducted in person or via teleconference facilities (MS Teams) as appropriate. All public health measures will be strictly adhered to in the conduct of this research.
What about your privacy? The data controller for this study is University College Cork and the Data Protection Officer at UCC is Catriona O'Sullivan. Her contact details are:
Address: Information Compliance Manager, University College Cork, 4 Carrigside, College Road, Cork.
Phone: +353 (0)21 4903949; Email: gdpr@ucc.ie
There is a valid legal reason to process this data under GDPR falling under Articles 6(1)(e) and 9(2)(j) 2018, which means this research serves the public good, that data is used for scientific research purposes only, that safeguards are in place to protect you and your consent has been sought. Your

[1] Department of Health. Smile agus Sláinte: National Oral Health Policy. Dublin; 2019.

data will not be shared with anyone.

What are your rights around your data? You have a right to access your data; rectify your data; erase data; restrict or object to data processing; or lodge a complaint with the Data Protection Commissioner; should you wish.

Contact details:

Further information relating to any of the above can be obtained from Professor Helen Whelton, Oral Health Services Research Centre, Cork University Dental School and Hospital, Wilton, Cork. T: +353 (0)21 4901210. E: h.whelton@ucc.ie

Thank you for taking the time to read this information leaflet.

9.4 Appendix D: Study One - consent form

WRITTEN CONSENT FORM FOR SEMI STRUCTURED INTERVIEW PARTICIPANTS

Title of study: Delivering public paediatric dental system reform in Ireland.

- ◊ This is to confirm that I have been informed about this study. I have received a copy of the information leaflet for my records

- ◊ I understand that there are minimal risks to me taking part. I understand the interview will take place in person or using teleconference facilities (MS Teams) as appropriate.

- ◊ I understand that my taking part in interviews is voluntary and I may withdraw at any time I choose.

- ◊ I understand that the sponsors and investigators have such insurance as is required by law in the event of injury resulting from this research.

- ◊ I understand that all the information given will be highly confidential and anonymous. My name or personal details will not be reported at any stage.

- ◊ Confidentiality of records concerning my involvement in this project will be maintained. When required by law, the records of this research may be reviewed by government agencies and sponsors of the research (Health Research Board Ireland). All anonymised transcripts of data will be retained in the Oral Health Services Research Centre, Cork University Dental School and Hospital, on file for a period of ten years.

- ◊ I understand that results of the study will be published in the study report, scientific journals and shared at relevant conferences.

- ◊ I have had the opportunity to ask questions concerning any and all aspects of the project.

PARTICIPANTS AGREEMENT:

I, the undersigned, hereby consent to participate in the above described project. I have received a copy of this consent form for my records. I understand that if I have any questions concerning this research, I can contact the researchers listed above.

After reading the entire consent form, if you have no further questions about giving consent, please sign where indicated.

_____	_____	_____
Participants Name (Print Name)	Participants Signature	Date
_____	_____	_____
Researcher Name (Print Name)	Research Signature	Date

9.5 Appendix E: Study One – interview questions

SEMI STRUCTURED INTERVIEW QUESTIONS

Title of study: Delivering paediatric public dental system reform in Ireland
Possible Questions however semi-structured approach will be maintained

1. **Personal context:**
    - What is your role/background/organisation?
    - Can you tell me about the process involved in developing smile agus Sláinte, from your perspective?
        - **i.** What was your specific role?
        - **ii.** Can you give me an example of actions you completed?
        - **iii.** Have you any reflections on the role you played?
    - When Smile agus Sláinte is implemented, how will this impact your role?

2. **Smile agus Sláinte: Development**
    - What is your opinion on the oral health of Irish children currently?
    - Do you have any thoughts on the present dental system?
    - What do you believe are the priorities in this policy?
        - **i.** Why do you think such priorities were chosen?
        - **ii.** Are there any other areas you believe should be prioritised?
        - **iii.** What would be your proposed policy? Can you give me examples?
    - Overall, in your opinion, what were the key factors influencing the development of the national oral health policy?
        - **i.** What were the challenges?
        - **ii.** What facilitated policymaking?

3. **Stakeholders**
    - Can you identify the key stakeholders in the oral health policy landscape in Ireland?
        - **i.** What are their roles?
    - Do you have any thoughts on the dynamics between stakeholder groups during Smile agus Sláinte development?
        - **i.** Did this impact you? How/Why?
    - Who do you believe had the most power in setting the agenda for the policy?
        - **i.** Can you give me any examples?
    - Do you have anything further you would like to add?

4. **Smile agus Sláinte: Implementation**
    - What will be the key challenges in implementing this policy?
    - In your opinion, what strategies should be used in the implementation process?
    - Who do you see as the crucial actors involved in implementation?
    - Do you have any thoughts on the proposed financing of the new policy?
    - Do you have anything further you would like to add?

5. **Political context**
    - Do you have any thoughts on how the issue of oral health has been dealt with by the government?
    - What do you believe are the barriers to establishing greater political support and investment for oral health?
    - Are you aware of any consultation and decision-making processes related to the development of the oral health policy from a political perspective?
    - Do you have any understanding of how the responsibility for oral health was allocated across government departments?
    - Do you have any thoughts on the engagement between government officials and policy developers?

6. **Conclusion:**
    - Looking back now, do you have any overall reflections about the policy making process?
    - Would you do anything different with respect to future policy development?
    - What are your next immediate concerns with respect to the policy?
    - Do you have anything else you would like to add? Is there anyone else I should talk to?

Probes

Probes will be used to gain a deeper understanding of specific themes which emerge during the interviews. Examples of probes include:

- Tell me more about that issue...
- You mentioned that (XXX) is a particular problem. Can you elaborate on that?
- What do you think could be done to address that particular issue?

9.6 Appendix F: Study Two – data collection template

[Template sourced from Professor Sara Allin and her research team (Allin et al., 2020)]

Areas for compilation for each country:

1. ***Laws and regulations***
    a. Summarize the laws and regulations pertaining to the publicly funded dental care programme
        i. Do they include a definition of oral health, and is this consistent with the WHO definition?
    b. What is the governing legislation for coverage of dental care?
    c. How are decisions made with regard to eligibility for coverage, and the basket of services covered?
    d. Is there any role of health technology assessment (HTA) to determine the services to include in the program?

2. Organisation

    a. Describe the main organisations involved in [A] determining eligibility for publicly funded dental care, and [B] purchasing dental care (paying dentists)
    b. Where are dental services delivered? (e.g., private practice, community health centre, government funded clinics, mobile dental care, other-prison dental services and military)

3. Personnel

a. What dental professionals provide care under the program?
b. Describe the provision of dental care in the publicly funded system?
c. Consider ratio of dentists to hygienists; public or private ownership; solo or team-based practice; integrated with other health services or only dental;
d. Is there a role for dental assistants, or other categories of personnel?
e. What conditions or restrictions are placed on providers?

4. Financing

    a. What proportion of total spending on dental care is publicly funded?
    b. How is the publicly funded dental care funded? (taxes- central or local, general or earmarked, social insurance)
    c. How are providers paid?
    d. Who funds the program?
    e. Who administers the funds?
    f. Are claims adjudicated?

5*. What is the depth of coverage, in other words, role of private finance in the publicly funded system?*

a. Describe the role of cost sharing (e.g., premiums, co-payments, co-insurance, deductible)
b. Describe the exemptions or protection mechanisms in place. Is there a maximum financial limit of coverage?
c. Describe the exemptions or protection mechanisms in place. Is there a maximum financial limit of coverage?
d. Describe the role of private, voluntary, insurance (e.g., to cover co-payments, to top up the public coverage)

5. Programme outputs-what is the scope of coverage:

a. What services are covered publicly?
b. Are recipients referred to specialists for treatment?

6. Programme recipients – who is covered?

a. Describe the target population for the program
b. Describe eligibility criteria for dental care coverage (e.g., based on residency status, age, income, SES, dental need etc.)
c. How do recipients get to know about the program?
d. How long are individuals enrolled in the program? E.g,. for life? Time-bound? Treatment-bound?
e. Provide information on who actually uses public dental services (e.g., drawing on audits, patient surveys, etc)

7. Goal

a. What outcome is the publicly funded dental program intending to achieve?
b. Is there any evidence to suggest it is achieving the intended goal, or any mechanism for collecting data that enables evaluations?

8. Reforms

a. Note recent reforms related to dental care programs (e.g., in coverage, financing, regulation)
b. Is there a discernible trend in levels of eligibility, included services and/or financial coverage of dental care?
c. Are there any recent/relevant political debates or policy documents/strategies?
d. Note any recent oral health strategy documents, and whether they are informed by WHO oral health guidelines

9.7 Appendix G: Study Two – search string

MEDLINE

Medical Subject Headings (MeSH):

[+ = EXPLODED TERM]

Adolescent
Child, Preschool+
Child+
Cost-Benefit Analysis
Delivery of Health Care+
Denmark+
Dental Care for Children
Dental Care+
Dental Caries+
DMF Index
Europe, Eastern+
Europe+
European Union
Fluoridation
Germany+
Global Health
Health Care Costs+
Health Expenditures+
Hungary
Infant, Newborn+
Infant+
Insurance, Dental
Ireland
Mouth Diseases+
National Health Programs+
Pediatric Dentistry
Preventive Dentistry+
Quality Indicators, Health Care+
School Dentistry
Scotland+
Socioeconomic Factors+
Spain
State Dentistry
Tooth Diseases+
Tooth, Deciduous+
Universal Health Care
Universal Health Insurance
Young Adult

S1	(MH "Quality Indicators, Health Care+")
S2	health indicator*
S3	care OR care quality OR system OR system quality
S4	S2 AND S3
S5	quality OR standard* OR outcome* OR key performance indicator* OR KPIs OR marker* OR evaluat* OR effect* OR effic* OR assessment*
S6	S1 OR S4 OR S5
S7	(MH "Child+")
S8	(MH "Child, Preschool")
S9	(MH "Infant+")
S10	(MH "Infant, Newborn+")
S11	(MH "Adolescent")
S12	(MH "Young Adult")
S13	S7 OR S8 OR S9 OR S10 OR S11 OR S12
S14	baby OR babies OR infant* OR newborn* OR child* OR toddler* OR preschool* OR "pre school*" OR "pre-school*" OR teen* OR youth* OR adolescen*
S15	primary school OR secondary school OR high school OR "school-age*" OR "school age*"
S16	S14 OR S15
S17	S13 OR S16
S18	(MH "Universal Health Insurance")
S19	(MH "Universal Health Care")
S20	(MH "Delivery of Health Care+")
S21	(MH "National Health Programs+")
S22	(MH "Insurance, Dental")
S23	(MH "Global Health")
S24	S18 OR S19 OR S20 OR S21 OR S22 OR S23
S25	universal health insurance OR universal healthcare OR universal health care OR universal health provision OR universal healthcare system OR care system OR UHC OR cover* OR universal health service cover* OR universal health service*
S26	(MH "Socioeconomic Factors+")
S27	(MH "Health Expenditures+")
S28	(MH "Cost-Benefit Analysis")
S29	(MH "Health Care Costs+")
S30	S26 OR S27 OR S28 OR S29
S31	socioeconomic* OR health expenditure* OR cost-benefi* OR cost effic* OR health care cost* OR health care reform* OR global health OR public health OR social determinant* OR health expen* OR cost effect*
S32	S24 OR S25 OR S30 OR S31
S33	(MH "Dental Caries+")
S34	(MH "DMF Index")
S35	(MH "Dental Care+")
S36	(MH "Dental Care for Children")
S37	(MH "Preventive Dentistry+")
S38	(MH "School Dentistry")
S39	(MH "State Dentistry")
S40	(MH "Pediatric Dentistry")

S41	(MH "Tooth Diseases+")
S42	(MH "Mouth Diseases+")
S43	(MH "Tooth, Deciduous+")
S44	(MH "Fluoridation")
S45	high sugar* OR oral disease* OR oral care OR dental disease* OR dental care OR oral health* OR dental health* OR dental quality of life OR DMFT OR decayed missing filled tooth OR fluoridation OR dental caries
S46	tooth OR teeth OR deciduous teeth OR permanent teeth OR school dentistry OR pediatric dentistry OR state dentistry OR tooth disease* OR mouth disease* OR preventive dentistry
S47	S45 OR S46
S48	(MH "Ireland")
S49	ireland OR irish OR republic of ireland
S50	S48 OR S49
S51	(MH "Spain")
S52	spain OR spanish
S53	S51 OR S52
S54	(MH "Germany+")
S55	germany OR german
S56	S54 OR S55
S57	(MH "Denmark+")
S58	denmark OR danish
S59	S57 OR S58
S60	(MH "Hungary")
S61	hungary OR hungarian
S62	S60 OR S61
S63	(MH "Scotland+")
S64	scotland OR scottish
S65	S63 OR S64
S66	(MH "Europe+") OR (MH "Europe, Eastern+")
S67	(MH "European Union")
S68	europe OR european OR european union OR eastern europe OR eastern european
S69	S66 OR S67 OR S68
S70	S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44
S71	S47 OR S70
S72	S50 OR S53 OR S56 OR S59 OR S62 OR S65 OR S69
S73	S6 AND S17 AND S32 AND S71 AND S72

Search string EBMASE

1 exp health care quality/2 exp outcome assessment/ 3exp quality control/ 4 ("clinical indicators"

or "health status indicators" or "quality control" or "outcome assessment").ti. or ("clinical indicators" or "health status indicators" or "quality control" or "outcome assessment").ab 5 1 or 2 or 3 or 4 6 exp school child/ or exp child/ or exp preschool child/ or exp child day care/ 7 exp infant disease/ or exp infant/ 8 exp prematurity/ 9 exp postmaturity/ 10 exp newborn/ 11 exp young adult/ 12 exp adolescent/ 13 (baby or babies or infant* or newborn* or child* or toddler* or preschool* or "pre school" or pre-school* or school-going or "school age" or school-age or teen* or youth* or adolescen* or "primary school" or "secondary school" or "high school" or creche or nursery or "junior infants" or "senior infants").ti. or (baby or babies or infant* or newborn* or child* or toddler* or preschool* or "pre school" or pre-school* or school-going or "school age" or school-age or teen* or youth* or adolescen* or "primary school" or "secondary school" or "high school" or creche or nursery or "junior infants" or "senior infants").ab. 14 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 15 exp universal health care/ 16 exp universal health insurance/ 17 exp health care delivery 18 / exp health care 19 exp public health 20 exp health care policy/ or exp global health/ 21 exp insurance/ or exp health insurance/ or exp national health insurance/ or exp public health insurance/ or exp dental insurance/22 exp socioeconomics/23 exp sociodemographics/ 24exp "health care cost"/25exp "cost benefit analysis"/ 26exp "cost effectiveness analysis" 27 exp "cost"/("health services needs" or "health service demands" or "health care delivery" or "health care demands" or "universal health-care" or "universal healthcare" or "universal health care" or "universal health insurance" or "health insurance" or "dental insurance" or "medical insurance" or "national health programs" or "national health programmes" or "national healthcare delivery" or "national healthcare demands" or "national health-care delivery" or "national health-care demands" or "universal health provision" or "universal healthcare system" or UHC or cover* or "universal health service cover*" or "universal health service*" or socioeconomic* or cost-benefi* or "cost effic*" or "health care cost*" or "health care reform" or "global health" or "public health" or "social determinant" or "health expen*" or "cost effect*" or "national health").ti. or ("health services needs" or "health service demands" or "health care delivery" or "health care demands" or "universal health-care" or "universal healthcare" or "universal health care" or "universal health insurance" or "health insurance" or "dental insurance" or "medical insurance" or "national health programs" or "national health programmes" or "national healthcare delivery" or "national healthcare demands" or "national health-care delivery" or "national health-care demands" or "universal health provision" or "universal healthcare system" or UHC or cover* or "universal health service cover*" or "universal health service*" or socioeconomic* or cost-benefi* or "cost effic*" or "health care cost*" or "health care reform" or "global health" or "public health" or "social determinant" or "health expen*" or "cost effect*" or "national health").ab. 29 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 30 exp dental caries/31exp dental health 32 exp pediatric dentistry/ 33exp school dentistry 34exp preventive dentistry 35exp dental procedure/ 36 exp DMF index 37exp fluoridation/ 38exp mouth disease/ 39exp dentistry/40exp tooth disease/ 41exp deciduous tooth/ 42exp mouth hygiene/ 43exp permanent tooth/44 (teeth or tooth or DMFT or decayed missing filled tooth or DMF or dental caries).ti. or (teeth or tooth or DMFT or decayed missing filled tooth or DMF or dental caries).ab. 45 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 46exp Ireland/ 47 exp Spain/48 exp Germany/ 49exp Denmark/ 50 exp Hungary 51exp Scotland/ 52 (Ireland or Irish or Spain or Spanish or Germany or German or Denmark or Danish or Hungary or Hungarian or Scotland or Scottish or Europe or European or European Union).ti. or (Ireland or Irish or Spain or Spanish or Germany or German or Denmark or Danish or Hungary or Hungarian or Scotland or Scottish or Europe or European or European Union).ab. 53 exp European Union/54 exp Europe/ or exp Eastern Europe/ or exp Western Europe/ or exp Southern Europe/ 55 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 56 5 and 14 and 29 and 45 and 55

9.8 Appendix H: Study Two – letter of invitation

LETTER OF INVITATION

Delivering paediatric public dental system reform in Ireland

Date:

Dear

We are conducting research around reforming the public dental system for children in Ireland following the publication of Ireland's first national oral health policy in 25 years. One part of this research will be to determine what can be learnt from other countries public dental services for children.

The objective of this study is to conduct a comparative analysis across multiple countries to determine the lessons learnt from successful dental systems for children internationally that could be applied to Ireland**.** We hope to conduct interviews with key stakeholders and complete a documentary analysis of policy related publications.

Participation is voluntary, and all information will be used in a confidential manner with anonymity strongly emphasised. All participants will be requested to give their written consent to partake.

Should you be happy to participate you will be provided with a Participant Information Leaflet and an interview via teleconferencing (MS Teams) will be arranged at a time that would be most convenient for you.

I would very much welcome your valuable contribution to this work considering your role and experience.

Further information may be obtained from h.whelton@ucc.ie.

Best wishes,

Professor Helen Whelton
Head of College Medicine and Health, University College Cork
Chief Academic Advisor, South-South West Hospitals Group

9.9 Appendix I: Study Two – participant information leaflet

PARTICIPANT INFORMATION LEAFLET





Title of study: Delivering paediatric public dental system reform in Ireland.

Ireland's new National Oral Health Policy[2] , *Smile agus Sláinte*, represents the first change in oral health policy in Ireland for 25-years. A key recommendation is changing the paediatric public dental system. At present, children are seen at "targeted ages" usually aged 7-8 and aged 11-12, by salaried dentists directly employed by the state. Treatment for any other child under the age of 16 is only in the event of an emergency. The new policy proposes that preventative packages of dental care will be delivered to children of many ages by general practitioners independently contracted by the state to provide treatment in primary care.

Aim of this study is: To conduct a cross-national comparative analysis of paediatric dental system reform internationally.

Who should partake? Key actors, as evidenced from documentary analysis and on recommendation from interviewees, in a leadership role within the paediatric public dental system in each country, will be invited to partake.

What does this mean for you? This study involves interviews. You will be invited to participate in one interview, in English, which will last between 45 minutes to 1 hour, at a time of your convenience via tele conferencing **(MS Teams).** The interview will be recorded and conducted by a researcher who is also a Dentist experienced in treating children. The interview will focus on topics including the dental system in your country, the impact of COVID-19 on dental care, how changes were made to that system over time and your thoughts on how the system has impacted the oral health of children. The aim of this study is to determine lessons that could be learned for Ireland to reform the paediatric public dental system.

What about confidentiality? The information you will give will be kept confidential. No personal details that might identify you will appear in the study report or associated publications.

What about withdrawing? You have the right to withdraw from the interview discussions at any time, even if you initially agree to participate.

What are the benefits of participating? The results of this unique scoping exercise will be reported back to the Department of Health of the Irish Government and the Health Service Executive (responsible for the delivery of public health and social care services) in Ireland to help provide information around future changes to dental care and implementing dental system reform. So, your

[2] Department of Health. Smile agus Sláinte: National Oral Health Policy. Dublin; 2019. https://health.gov.ie/wp-content/uploads/2019/04/NOHP-Main-FINAL.pdf

opinions and perspectives are very important.

What risks are there to taking part? The risks (if any) are considered minimal and ethical approval has been granted from the Clinical Research Ethics Committee of the Cork Teaching Hospitals, Cork, Ireland. All information will be treated in the strictest confidence. Participation is voluntary. The research findings will be presented in the report of the study, presentations, and publications, but your anonymity will be upheld.

What about your privacy? The data controller for this study is University College Cork and the Data Protection Officer at UCC is Catriona O'Sullivan. Her contact details are:
Address: Information Compliance Manager, University College Cork, 4 Carrigside, College Road, Cork. Ireland.
Phone: +353 (0)21 4903949; Email: gdpr@ucc.ie
There is a valid legal reason to process this data under GDPR falling under Articles 6(1)(e) and 9(2)(j) 2018, which means this research serves the public good, that data is used for scientific research purposes only, that safeguards are in place to protect you and your consent has been sought. Your data will not be shared with anyone.

What are your rights around your data? You have a right to access your data; rectify your data; erase data; restrict or object to data processing; or lodge a complaint with the Data Protection Commissioner in Ireland; should you wish.

Contact details:
Further information relating to any of the above can be obtained from Professor Helen Whelton, Oral Health Services Research Centre, Cork University Dental School and Hospital, Wilton, Cork. T: +353 (0)21 4901210. E: h.whelton@ucc.ie

9.10Appendix J: Study Two – consent form

WRITTEN CONSENT FORM FOR SEMI STRUCTURED INTERVIEW PARTICIPANTS

Title of study: Delivering public paediatric dental system reform in Ireland.

- ◊ This is to confirm that I have been informed about this study. I have received a copy of the information leaflet for my records

- ◊ I understand that there are minimal risks to me taking part. I understand the interview will take place in person or using teleconference facilities (MS Teams) as appropiate.

- ◊ I understand that my taking part in interviews is voluntary and I may withdraw at any time I choose.

- ◊ I understand that the sponsors and investigators have such insurance as is required by law in the event of injury resulting from this research.

- ◊ I understand that all the information given will be highly confidential and anonymous. My name or personal details will not be reported at any stage.

- ◊ Confidentiality of records concerning my involvement in this project will be maintained. When required by law, the records of this research may be reviewed by government agencies and sponsors of the research (Health Research Board Ireland). All anonymised transcripts of data will be retained in the Oral Health Services Research Centre, Cork University Dental School and Hospital, on file for a period of ten years.

- ◊ I understand that results of the study will be published in the study report, scientific journals and shared at relevant conferences.

- ◊ I have had the opportunity to ask questions concerning all aspects of the project.

PARTICIPANTS AGREEMENT:

I, the undersigned, hereby consent to participate in the above described project. I have received a copy of this consent form for my records. I understand that if I have any questions concerning this research, I can contact the researchers listed above.

After reading the entire consent form, if you have no further questions about giving consent, please sign where indicated.

_____	_____	_____
Participants Name (Print Name)	Participants Signature	Date
_____	_____	_____
Researcher Name (Print Name)	Research Signature	Date

9.11Appendix K: Study Two - semi-structured interview questions

SEMI STRUCTURED INTERVIEW QUESTIONS

Title of study: Delivering paediatric public dental system reform in Ireland

Questions for semi structured interviews:

*Background on the study and on Irish paediatric dental system will be given to participants prior to commencing the interview along with the data collected pertaining to their own country. This will be first discussed before proceeding to interview.

1. Can you tell me about your background and role in your organisation?

2. What is the public dental system for children like in your country?
    - What services are covered? And for whom?
    - Who pays?
    - What about prevention?

3. Did the system change?
    - Who decided? What strategies were used to implement change?
    - What do you think worked?

4. How did the public dental system in your country operate during the peak of the COVID-19 pandemic?
    - How do you feel this has impacted the oral health of children in your country?
    - How do you think services should evolve in response to COVID-19?

5. What are the performance measures used to evaluate the dental system in your country?

6. In your opinion, if you could recommend to Ireland, the key features of a public dental system for children, what would they be?

7. What would be the key strategies you would recommend for implementing reform of a public dental system for children following the emergence of COVID-19?

Probes

Probes will be used to gain a deeper understanding of specific themes which emerge during the interviews. Examples of probes include:

- Tell me more about that issue...
- You mentioned that (XXX) is a particular problem. Can you elaborate on that?
- What do you think could be done to address that particular issue?
- Is there anything else you would like to add?

9.12 Appendix L: Study Three narrative review - search string oral health workforce

Agreed Question: To describe and analyse child oral health indicators of oral health workforce in European countries: Denmark, Hungary, Ireland, Germany, Scotland and Spain

Limits: None

Key Concepts: (((Dental OR oral) AND (health)) AND (workforce or human resources or staff))) OR dentist OR dental nurse OR dental assistant OR dental hygienist OR paediatric dentist OR paediatric specialist dentist; Key indicators OR Measure* OR Metric* OR indicator*; (Child OR Children) AND (Denmark OR Hungary OR Ireland OR Germany OR Scotland OR Spain)

Sources: OVID Embase; EBSCO Medline; EBSCO Cinahl Complete; TRIP

Search Strategy (Embase): 1 exp dentist/ 2 exp dental assistant/ 3 "dental nurs*".ab,ti. 4 exp dental hygienist/ 5 exp pediatric dentist/ 6 "paediatric dent*".ab,ti. 7 (p?ediatric* adj5 dent*).ab,ti. 8 ((dental or oral) adj5 health).ab,ti. 9 health care personnel/ 10 exp workforce/ or exp health workforce/ 11 dental staff/ 12 health care manpower/ or personnel management/ 13 9 or 10 or 12 14 8 and 13 15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 11 16 clinical indicator/ or indicator/ or health status indicator/ 17 measurement/ 18 metric*.ab,ti. 19 16 or 17 or 18 20 child/ 21 child*.ab,ti. 22 pediatrics/ 23 paediatric*.ab,ti. 24 20 or 21 or 22 or 23 25 Denmark/ 26 Hungary/ 27Ireland/ 28 Germany/ 29 Scotland/ 30 Spain/ 31 (Danish or Hungar* or Irish or German* or Scottish or Spanish).ab,ti. 32 25 or 26 or 27 or 28 or 29 or 30 or 31 33 24 and 32 34 15 and 33

Search Strategy (Medline): S1 (MH "Dentists+") OR (MH "Dentist's Role") S2 AB dentist* OR TI dentist* S3 (MH "Dental Assistants") S4 AB "dental nurs*" OR TI "dental nurs*" S5 (MH "Dental Hygienists") S6 (MH "Pediatric Dentistry") S7 AB "p?ediatric dent*" OR TI "p?ediatric dent*" S8 AB ((dental OR oral) N5 health) OR TI ((dental OR oral) N5 health) S9 AB "health care personnel" OR TI "health care personnel" S10 (MH "Health Personnel+") OR (MH "Allied Health Personnel+") OR (MH "Dental Health Services+") S11 (MH "Health Workforce") S12 S9 OR S10 OR S11 S13 S8 AND S12 S14 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S13 S15 AB indicator* OR TI indicator* S16 AB (measure* OR metric*) OR TI (measure* OR metric*) S17 S15 OR S16 S18 (MH "Child+") OR (MH "Child Health") S19 (MH "Child Health Services+") S20 (MH "Pediatric Dentistry") S21 AB ((p?ediatr* OR child*) N5 (dent* OR oral)) OR TI ((pediatr* OR child*) N5 (dent* OR oral)) S22 S18 OR S19 OR S20 OR S21 S23 (MH "Denmark+") OR (MH "Germany+") S24 (MH "Hungary") S25 (MH "Ireland") S26 (MH "Scotland+") S27 (MH "Spain") S28 AB (spanish OR scottish OR irish OR hungar* OR german* OR danish)) OR TI (spanish OR scottish OR irish OR hungar* OR german* OR danish)) S29 S23 OR S24 OR S25 OR S26 OR S27 OR S28 S30 S22 AND S29 S31 S14 AND S30 S32 S17 AND S31

9.13 Appendix M: Study Three narrative review - search string dental caries prevalence

Agreed Question: Describe and analyse child oral health indicators of dental caries prevalence in European countries: Denmark, Hungary, Ireland, Germany, Scotland and Spain.

Limits: None

Key Concepts: Dental Caries; (DMFT OR Decayed, missing, filled tooth index OR ICDAS OR "International Caries Detection and Assessment System" OR Measure* OR Metric* OR Indicator*); (Child OR Children) AND (Denmark OR Hungary OR Ireland Or Germany OR Scotland OR Spain)

Sources: OVID Embase; EBSCO Medline; EBSCO Cinahl Complete; TRIP

Search Strategy (Embase): 1exp dental caries/ 2 ("dental decay" or "tooth decay").ab,ti. 3 1 or 2 4 exp DMFT index/ 5 ("DMFT Index" or "Decayed, missing, filled tooth index").ab,ti. 6 ("International Caries Detection and Assessment System" or ICDAS).ab,ti. 7 measurement/ 8 metric*.ab,ti. 9 indicator/ or health status indicator/ 10 indicator*.ab,ti. 11 exp child/ 12 child*.ab,ti. 13 pediatrics/ 14 paediat*.ab,ti. 15 11 or 12 or 13 or 14 16 Denmark/ 17 danish.ab,ti. 18 Hungary/ 19 hungar*.ab,ti. 20Ireland/ 21 irish.ab,ti. 22 Germany/ 23 german*.ab,ti. 24 Scotland/ 25 scottish.ab,ti. 26 Spain/ 27 spanish.ab,ti. 28 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 29 15 and 28 30 4 or 5 or 6 or 7 or 8 or 9 or 10 31 3 and 29 and 30

Search Strategy (Medline): S1 (MH "Dental Caries+") S2 AB ("dental decay" OR "tooth decay") OR TI ("dental decay" OR "tooth decay") S3 S1 OR S2 S4 AB (DMFT OR "Decayed, missing, filled tooth index") OR TI (DMFT OR "Decayed, missing, filled tooth index") S5 AB (ICDAS OR "International Caries Detection and Assessment System") OR TI (ICDAS OR "International Caries Detection and Assessment System") S6 AB measure* OR TI measure* S7 (MH "Metric System") S8 AB metric* OR TI metric* S9 AB indicator* OR TI indicator* S10 S4 OR S5 OR S6 OR S7 OR S8 OR S9 S11 (MH "Child+") OR (MH "Child Health") S12 (MH "Pediatrics+") S13 AB paediatr* OR TI paediatr* S14 S11 OR S12 OR S13 S15 (MH "Denmark+") S16 (MH "Hungary") S17 (MH "Ireland") S18 (MH "Germany+") S19 (MH "Scotland+") S20 (MH "Spain") S21 AB (danish OR hungar* OR irish OR german* OR scottish OR spanish) OR TI (danish OR hungar* OR irish OR german* OR scottish OR spanish) S22 S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 S23 S14 AND S22 S24 S3 AND S10 AND S23

9.14 Appendix N: PDF paper one

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RESEARCH Open Access

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'Toothless'—the absence of political priority for oral health: a case study of Ireland 1994–2021

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Background: Calls are emerging for oral health system reform under the Universal Healthcare (UHC) domain, while internationally there is an absence of political priority for oral health. In the Republic of Ireland there is very limited coverage of oral healthcare for the whole population. 'Smile agus Sláinte' Ireland's oral health policy published in 2019, represents the first change to national policy in over 25 years.

Methods: This research examined the key factors influencing oral health policy, development, and implementation in Ireland during the period 1994–2021. A case study approach was adopted with two strands of data collection: documentary analysis and semi-structured interviews with elite participants. Analysis was guided by Howlett's five stream framework.

Results: Ireland shares the international experience of oral health having very low political priority. This has perpetuated unequal access to public dental services for children and special needs populations while austerity measures applied to adult schemes resulted in increased unmet need with no universal coverage for dental care. The only area where there is political interest in oral health is orthodontic care. This low political priority combined with a lack of actor power in national leadership positions in the Department of Health and Health Service Executive has contributed to successive non-implementation of oral health policy recommendations. This is most evident in the failure to publish the Draft National Oral Health Policy in 2009. The research finds a failure to adequately engage with key stakeholders, particularly the dental profession in the development of the 2019 policy. All these weaknesses have been exacerbated by the COVID-19 pandemic.

Conclusions: Ireland's new oral health policy, 'Smile agus Sláinte', presents an opportunity for the provision of much needed public dental services. However, successful reform will require strong political will and collaboration with dental leadership to provide advocacy at national level. Global calls to incorporate oral health into the UHC agenda and an agreed political consensus for UHC in Ireland may provide opportunity.

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Keywords: Oral health policy, Public dental systems, Universal healthcare, Oral health policy analysis, Reform

Background

Most oral health conditions are largely preventable [1]. Yet oral diseases affect 3.5 billion people worldwide with untreated dental caries of permanent teeth the most prevalent condition [2, 3]. The burden of oral disease is hallmarked by significant inequality, disproportionately affecting marginalised populations and low socio-economic groups [4]. As such access to prevention, early diagnosis and treatment of oral diseases is "unattainable for millions of people"[2].

The main strategy for mitigating inequalities impacting access to oral health services is implementing oral health policies [5]. However, oral diseases are a neglected issue often failing to receive priority in broader health and public policies [6, 7], "isolated and marginalised" from health policy developments [4]. A lack of political commitment and resources along with the failure to prioritise disease prevention are contributory factors [2]. Responding to the global "state of crisis" in oral health requires policy change from traditional clinical approaches particularly to align with the Universal Healthcare (UHC) agenda [2, 8–10].

The Republic of Ireland (Ireland) is a small country in Western Europe with a population of 5.01 million people. The Irish general health system is "complex" with access to care often based on the ability to pay rather than medical need [12].The latest available data from the Organisation for Economic Co-operation and Development (OECD) shows Government financing as a proportion of total health expenditure was 75% in 2019, a comparatively low figure compared to the EU average of 80% [13]. For oral healthcare in Ireland, delivery is via a public/private mix of service provision [14]. However, gaps in publicly funded oral healthcare for significant parts of the population mean high out of pocket payments that may cause financial hardship [12]. In contrast to the general health system, it is estimated that almost two thirds of all dental expenditure in Ireland is privately financed, the majority of which relates to direct out of pocket payments. Furthermore, while almost half the Irish population voluntarily purchase private health insurance (PHI), this is primarily to facilitate quicker access to planned hospital treatment or private medical care. PHI offers only "limited coverage" of dental care [12, 14].

Leadership, governance and policy direction for the health system is provided by the Department of Health (DoH)[16]. The Health Service Executive (HSE) established in 2005 is a national government agency under the aegis of the DoH responsible for the management and delivery of health and social care services [17]. Following a decade of economic prosperity, Ireland experienced one of the most severe economic crises of any OECD country between 2008 and 2014 [18]. During this time, austerity measures which had a lasting impact on the health system, including limiting access to dental services, were introduced [12, 19]. However, by 2017, Ireland was once again experiencing high levels of economic growth [20].

Ireland is the only western European country without universal primary healthcare and despite many years of reform there is a consensus that the health system is inequitable and underperforming [17]. Significant gaps in universal health coverage are a key consequence of Irelands complex system and as mentioned, access to publicly financed dental care is particularly poor, at just one third of all oral health expenditure [12, 13]. In 2017, the Irish Government committed to a 10-year plan developed by a cross-political party committee, toward the delivery of a universal single-tier health service where individuals are treated solely based on need, known as 'Sláintecare' [20].

In March 2019, Irelands national oral health policy known as 'Smile agus Sláinte', was published [21]. Its key goals are to support individuals to achieve their best oral health and reduce inequalities across the population, while the fluoridation of piped water supplies is supported as an oral health protection policy [21]. 'Smile agus Sláinte' aims to align with the "same ideals" as the proposed universal health service, 'Sláintecare', however it describes the provision of 'preventive bundles' of care delivered at various ages throughout the life course [21]. The planned large scale reform of the public dental system outlined in this policy is considered

"challenging" by policymakers [21].
Health policy analysis is crucial to health reform [22]. It is useful retrospectively and prospectively to understand past policy successes and failures and in planning for future policy implementation [23]. Previous research illustrates that with respect to oral health policy development, a better understanding of the complex interactions between context, policy processes and actors can enable the design of more responsive policies [24]. In particular the broader socio-political contexts in which actors develop oral health policies can facilitate and/or constrain actors roles and policy processes [24]. There is limited international research analysing oral health policy [24–27] and to the best of our knowledge, none in the Irish setting.
The aim of this research is to generate an in-depth understanding of the key factors that impeded or promoted the development and implementation of oral health policy in Ireland during the period 1994 to 2021.

Methods

To facilitate a comprehensive analysis, a case study approach was adopted [28]. Case studies are considered beneficial for "in-depth, multi-faceted explorations of complex issues in their real-life settings"[29]. To strengthen study validity and generate a thorough understanding of the case, the use of multiple data sources is advised [30]. Two strands of data collection and triangulation were thus undertaken—a documentary analysis and semi-structured in-depth interviews with 'elites' [31].

Documents

A documentary analysis examined the relevant reports, policies, service documents and other literature developed at local, regional, and national level from 1994 to 2021. These dates were chosen as 1994 is the date of Irelands' first national health policy which included a 'Dental Health Action Plan' publication [32] and Ireland's recent national oral health policy was published in 2019 [21]. The study was expanded to include the impact of the COVID-19 pandemic to the time of writing in July 2021. Two documents published prior to 1994 were included in the dataset as their contents were deemed important to the analysis of the 'Dental Health Action Plan' [33, 34].
Documents reviewed were identified by performing searches of:

1. Government websites particularly the website of the Department of Health, for policies, reports, and guidelines.
2. The Lenus database, the Health Research Repository of the Irish health service.
3. Records of parliamentary debates, governmental committee meetings and parliamentary questions on the 'Oireachtas' website.

A total of 125 documents were identified, reviewed, and mapped over a 27-year timeline. The documents analysed included health policy documents (n = 14), commissioned reports (n = 18) and health service documents (n = 19). A detailed overview of the dataset including the quantity and nature of included documents is presented in Table 1.

Elite interviews

The outcomes of the documentary analysis enabled the categorisation of key stakeholder groups across the oral health policy (OHP) landscape in Ireland: The Health Service Executive, private dental practitioners, academics, and policymakers including the Department of Health. In-depth elite interviews were then undertaken with actors purposely identified as representative of each stakeholder group. Participants were primarily identified via the documentary analysis, supplemented by purposive sampling based on the recommendation of participants and the researchers' knowledge of actors closely engaged in OHP and/or OHP development. A

Table 1 An overview of documents incorporated in analysis

Document type	Number (n)
Policy documents[1]	14
Commissioned reports[2]	18
Health strategies[3]	9
Health service documents[4]	19

Non-governmental reports/strategies[5]	7
Legislation[6]	5
Reports of epidemiological surveys[7]	7
Parliamentary papers[8]	
Parliamentary questions	33
Presentations to parliamentary committees	4
Clinical guidelines[9]	4
Academic and grey literature[10]	5
Total	*n* = 125

[1] Policy document: any publication with stated governmental policy positions including general and oral health policies, published and unpublished, along with associated policy frameworks, implementation, and action plans [2] Commissioned report: any document commissioned by government including reports from external bodies and institutions along with inter departmental requests

[3] Health strategy: any document detailing steps and strategic intent by government, but not as actual government policy, for example health department statements of strategy

[4] Health service documents: any document outlining specific health and social service delivery, objectives, resources, actions, and outputs, primarily including HSE National Service plans

[5] Non-governmental reports/strategies: any relevant report/strategy published by a non-government affiliated organisation [6] Legislation: relevant legal acts and regulations

[7] Parliamentary question: any relevant question raised by a member of parliament provided with an oral or written response

[8] Presentation to parliamentary committee: any evidence verbal or written presented to relevant governmental committees

[9] Clinical guidelines: a series of evidence-based guidelines for those planning and providing dental services for children in Ireland

[10] Academic and grey literature: relevant academic and grey literature used to enhance contextual nuance of included documents

piloted interview guide informed by the documentary analysis was employed during interviews and the list of participants was continually reviewed throughout the data collection process.

In all fifteen participants (n = 15) were invited to interview, with thirteen (n = 13) consenting to participate: four representatives of the HSE (n = 4), two representatives from private dental practitioners (n = 2), five academics (n = 5) and two policymakers (n = 2). Most respondents (n = 11) were trained dental practitioners, and all had a detailed knowledge of OHP and/or OHP development. All but one of the interviews were conducted via teleconferencing facilities between October 2020 and March 2021 in accordance with COVID-19 related public health guidelines.

Data analysis

This research followed best practice guidance for health policy analysis by rooting the analysis in an existing framework [23]. The 'Five stream framework' by Howlett et al. [35] was chosen for analysis due its comprehensive, wide raging coverage and ability to capture a multitude of elements in complex policy processes. The five streams (Fig. 1) are the problem, policy, process, politics and programme streams [35]:

1. *Problem* to the framing and articulation of policy problems.
2. *Policy* refers to the formulation of policies, policy alternatives and instruments.
3. *Process* refers to the main tasks and events which lead to policy outputs.
4. *Politics* refers to the politically active policy actors.
5. *Programme* refers to the management of implementation [35].

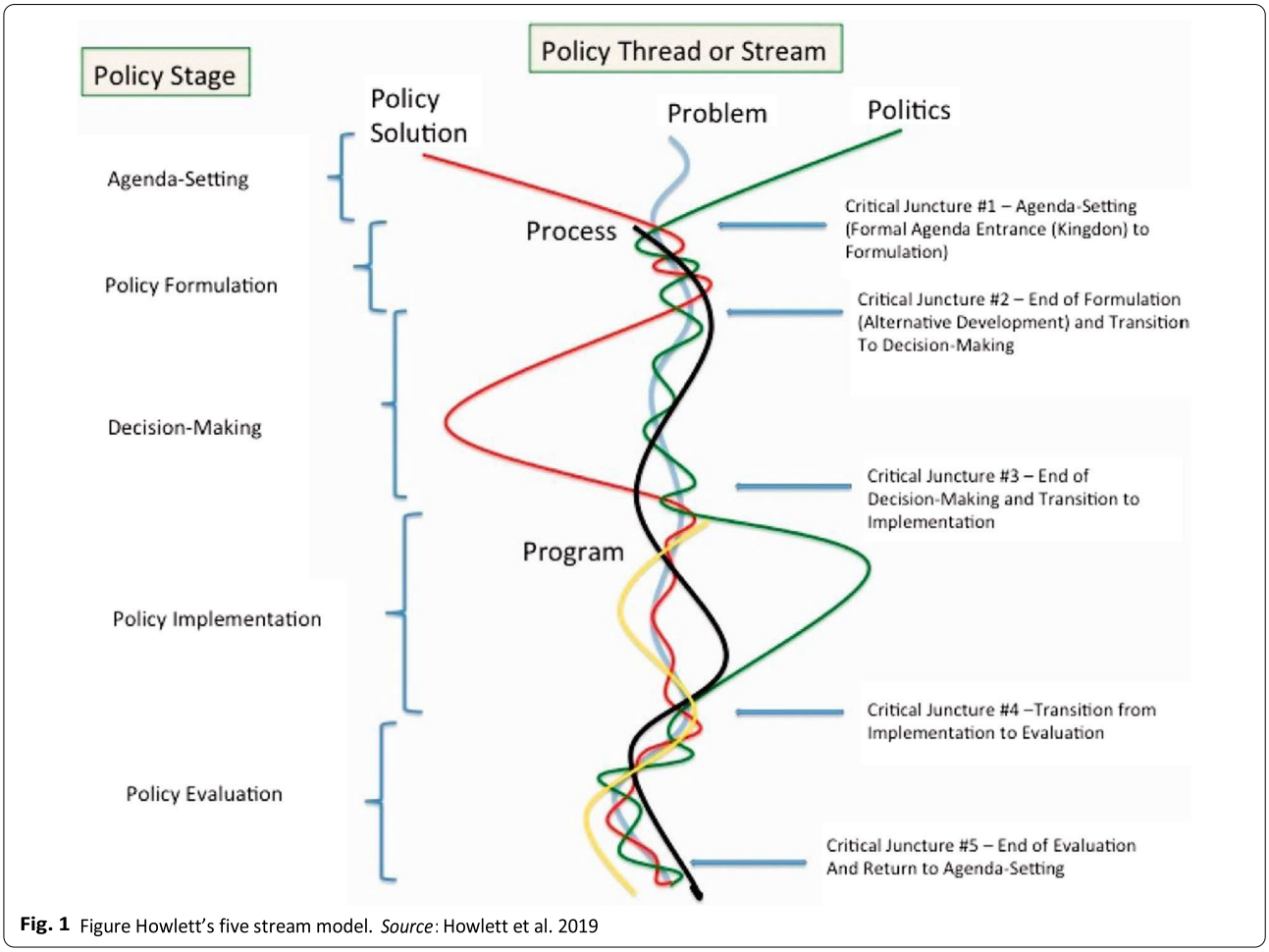


Fig. 1 Figure Howlett's five stream model. *Source*: Howlett et al. 2019

Qualitative data analysis software (NVivo 12) was used and followed a directed content analysis approach [36] guided by the structured framework. Initially, the contents of each document were mapped onto an MS Excel spreadsheet using a range of column headings. These headings included title, author, year, resource type, source/location, political landscape, and content. A range of key concepts were then identified as coding categories using the framework as guidance before operational definitions for each category were determined. The operational definitions derived from the framework in addition to the documents included in the dataset were agreed by all authors. Interviews were transcribed verbatim and coded.

All transcripts and outcomes from the documentary analysis were examined together and coded using NVivo. The predetermined categories derived from all five streams were applied across all documents and interviews where relevant and applicable, with any remaining text coded with another label and captured.

Throughout the data analysis process, the findings from interviews were continually triangulated with the outcomes from the documentary analysis following best practice for policy analysis. The data generated from the documentary analyses provided an adequate description of the technical content of key policies and literature [37]. While elite interviews were used to elaborate on the documents' findings in a more in-depth manner particularly to understand why specific policy choices were made or not made [31]. Emerging findings were discussed in structured meetings with all authors who have extensive dental research or policy analysis experience.

Ethical considerations

Ethical approval for the study was obtained from the

Clinical Research Ethics Committee of the Cork Teaching Hospitals at University College Cork (CREC) (Reference number: ECM 4 (J)12/11/2019). All methods were carried out in accordance with the guidelines and regulations determined by the CREC. At all times, ethical considerations including ensuring confidentiality, obtaining informed consent, and preserving anonymity were adhered to. Informed consent to participate was granted by each participant.

Results

The findings are presented utilising Howlett's streams (Fig. 1) and draw on findings from two datasets, a documentary analysis and interviews, triangulated to build an overall perspective. **The problem stream**

The documentary analysis found that Ireland has very restricted dental coverage for the whole population [12]. Publicly funded dental services are delivered via three schemes: (i) the Public Dental Service (PDS), (ii) the Dental Treatment Services Scheme (DTSS) and (iii) the Dental Treatment Benefit Scheme (DTBS) (Table 3) [14]. A significant proportion of the population (20% in 2016) are not eligible for any scheme and must either purchase private dental insurance or pay out of pocket for private dental care [12, 14]. Those patients may claim back fees through tax relief up to a maximum of 20% of the treatment cost for certain non-routine procedures [15].

The 'Public Dental Service' (PDS) is the only state funded dental care for children and special needs populations, delivered by salaried dentists directly employed by the state [21]. The PDS aims to "target" children for dental care in "three designated classes in primary and secondary schools"[32]. According to documents analysed, the practice of targeting first emerged as a rationing mechanism in response to economic constraints in the 1980s [33] by targeting two age ranges associated with the eruption of permanent teeth (i.e., ages 7–8 and 11–12) while emphasising the need for improved orthodontic services[33, 34].

There is no further access to State supported dental services for any child under age 16, except in the event of an emergency [21]. The PDS has suffered significantly from austerity measures first introduced in 2009 with a 20% reduction in staffing levels [38, 39]. It was further impacted by the COVID-19 pandemic with 23% of dental professionals redeployed to COVID-19 related work [40]. Access to care is determined by age rather than need and despite recommendations to the contrary [41] it remains the policy guidance under which dental services for children and special needs groups operate in 2021.

Inequalities with respect to dental care for children were highlighted in the documentary analysis. For example a report commissioned by the DoH in 2002 described elements of the system as a "disgrace" [42]. This remained an issue of common concern amongst interviewees when considering public dental services for children:

> *Usually, it's one, maybe two (primary school) classes you're seeing properly…it's not kids from whatever zero to sixteen. They say every child under the age of sixteen. That's not true at all. (P2).*[1]
>
> *([The Public Dental Service]) just papers over the cracks…different regions have different resources…so if you live in one place two (primary school) classes might be seen, but drive down the road and you could have one, or none, same with special needs…*[2]
> *(P3)*

The Gelbier report [42] also advocated for improved services for special needs groups: "it is essential for this report to make the strongest of recommendations on behalf of special needs child and adult patients…a duty of care for those who cannot look after themselves" [42]. It is estimated

[1] P refers to 'Participant' with each interview participant assigned a code from P1-P13.

[2] In Ireland children attend their first-level education in primary schools (also called national schools) between the ages of 4 or 5 years and 12 years of age. Each year of education is referred to as a primary school class. The public dental services target children for assessment depending on which school class they attend.

that 95% of the activity of the Public Dental System pertains to services provided to children, with just 5% of care going to patients in vulnerable groups [15]. While the reports of epidemiological studies that emerged from the documentary analysis found that permanent teeth were more frequently extracted in Irish children with a disability than the general population [43, 44]. The difficulties prevailing in special care dentistry also featured prominently in interviews:

> *I feel extremely…very, very strongly about the…failure to invest in special care dentistry…. (P4) The problems for special needs groups…It's really upsetting…it's heart breaking…. (P6)*

An unpublished report identified during this research which was commissioned by the Department of Health in 2009 found a "disinterest' in the public dental system by senior HSE management had a "demoralising effect on service providers" [45]. These sentiments were echoed by interviewees familiar with its operation: *We just do what we are told…stagger on…(P2) and*

> *…it's like military rule… (P1)*
> *Insufficient attention is paid to any of the good outcomes…it's been next to impossible to get any attention from senior people in the HSE or the Department of Health…. (P4)*

Dental services for adults are provided through the Dental Treatment Services Scheme (DTSS) and the Dental Treatment Benefit Scheme (DTBS) (Table 3) where dentists are contracted by the state to provide care in privately owned practices [21]. Both schemes were among the first health budgets to face cuts and suffered severely because of austerity measures introduced in 2010 [12]. This described by an interviewee: "The state basically ditched large swaths of the dental profession…" (P8).

Funding of the DTSS scheme was reduced from €62 to €10 million between 2010 and 2015 [20]. Dental benefits were limited to an examination and two emergency restorations with any other care subject to approval from the local HSE health manager. However, coverage was provided for unlimited dental extractions [12]. The restrictions in preventive and restorative oral health care while funding remained uninhibited for dental extractions is described by an interviewee: "…Talk about equity and fairness…how could we do that? It's probably driven the level of extractions up…its almost medieval…" (P6)

The DTBS scheme was limited to examination only until provision for a scale and polished was reintroduced in 2017 [12]. According to an interviewee: "The darkest day in dentistry was when the budget for 2010 was announced…in dentistry it was treatment service to the patient that was curtailed, that didn't happen for other services like GPs or pharmacy…" (P4).

The documentary analysis concluded the changes introduced had a significant impact resulting in unmet need for dental care tripling between 2008 and 2012 [12]. Despite calls to reverse the austerity measures, the funding cuts introduced in 2010 still remain in place in 2021 [12, 20]. The problems occurring in the DTSS Scheme were of concern for many interviewees: "The DTSS has been decimated, the system is basically not functioning for…10 years, dentists are withdrawing because it's no longer lucrative, patients don't even know what's available to them…it is entirely dysfunctional…the Department [of Health] would prefer if everyone was edentulous…" (P13).

The policy stream

1994—the dental health action plan

The first Irish health policy 'Shaping a Healthier Future: A Strategy for Effective Healthcare in the 1990s' was published in 1994 [46]. It was a policy document which included a series of action plans including a Dental Health Action Plan' (DHAP). This was the 'first clear statement on the aims and health objectives of the dental services in Irish history' [32] (Table 2).

The DHAP was viewed by most interviewees as generating improvements in public dental services: "The dental health action plan did make progress, it put some adult services out there, some special care services…it did increase the number of teams." (P4) While its dental public health approach was welcomed: "It had a vision, a philosophy underpinning it…a recognition of inequalities… progress was made" (P7). However, there was a

failure to maintain progress: “The platform was reached. And then very little was built on that platform (P4)”. There were difficulties with workforce distribution: “The poorer areas where it was difficult to recruit dentists were getting the minimum…” (P11) and according to documents, concerns were raised regarding management and probity assurance in DTSS Scheme [45, 47].

2001—quality and fairness, a health system for you In 2001, the national health policy ‘Qualify and Fairness, A Health System for you’ was published [48]. It defined ‘Schools Dental Services’ as free of charge for all and specified a series of actions including: (i) a review of the DHAP (ii) new goals for oral health (iii) the expansion of specialist training programmes and (iv) more use of private sector orthodontists. An accompanying ‘Primary Care Strategy’ [49] assigned dentists to the ‘Primary Care Network’. It recognised the ‘particular implications’ for dentists delivering public services in privately owned premises however no solution was proposed, nor was there any inclusion for dentists in human resource planning, education or training [49].

2002—the forum on fluoridation: a policy review
Community Water Fluoridation (CWF) was adopted as health policy in Ireland in 1964 [50]. Responding to public concerns regarding patient safety a major policy review of CWF was undertaken in 2002 [51]. The review supported CWF as safe and effective while proposing a

Table 2 IrishNationalOralHealthPolicies1994–2019

Title	Year	Document	Keyfindings	Mainrecommendations
TheDentalHealthActionPlan	1994	Anactionplanpublishedaspartofthenational healthpolicy-ShapingaHealthierFuture:Astrat - egyforeffectivehealthcareinthe1990s Thecurrentpolicyguidanceforallpubliclyoper - ateddentalschemesinIrelandin2021	Nosystematicallyorganisedcareforpre-school children Careforprimaryschoolchildrenisuneven Poorероralhealthinmedicalcardholders Increaseddemandfororthodontics Poorservicesforthosewithadditionalneeds	Goalsforreduceddentaldecayacrosspopulation by2000 Continue&increasefluorideuse(water&tooth - paste)withsupportfromindustry Consolidate&extendtargetedschooldental services Extendeligibilityforcaretoage17 Careforadultmedicalholdersthroughnewscheme DTSS
DraftNationalOralHealthPolicy	2009	UnpublishedbytheDepartmentofHealth	Oralhealthhasimprovedsincetheintroductionof theDentalHealthActionPlanforsomegroups Howeverimprovedoralhealthnotobservedin medicalcardholdersorchildrenunder-age-5 Mismatchbetweenpeaksofchildhoodcariesand agerangethePDSfocuseson Deficienciesincareforthosewithdisabilities,spe - cialneedsandelderlyinlongstayinstitutions OverlapsbetweenDTSSandDTBSschemeswith co-ordinationmechanismslackingtoensurecost effectivenessandequity	AdministrationofDTSSandDTBSmergedto enhanceequityandreduceadministrationcosts PDS:Refocusresourcestoaddressneed,improve datamanagement andmonitoringofoutcomes withaseniorclinicalmanagertoheadservice Identifypeoplewithspecialneedsandsocialdisad - vantageforappropriateoralhealthcare Enhancetheregulatoryregimegoverningoral healthcare RecognisespecialtyofSpecialNeedsDentistry immediately.ProgressspecialisationinPublicHealth Dentistryfollowingnewarrangementsin PDS Allowdentalhygienistsoperateindependently Continuewaterfluoridation Integrateoralhealthpromotionwithgeneralhealth promotion actions,DoHleadingtransformationover8-years
SmileagusSláinte	2019	NationalOralHealthPolicy Noimplementationstrategypublishedbytheend of2021	Inequalitiesinserviceprovisionforveryyoung, vulnerable,thosewithdisabilitiesandelderly Declineindentaldecaysince1980s %of5-year-olds,40%of12-year-oldshave dentaldecay Symptomleduseofservicesforchildrenunder age6 Pooruptakeoforalservicesbytheelderly,rising incidenceofheadandneckcancerinoldergroups Threetimesmoredentalpracticesownedby privatepractitionersthanHSEpremises Currentservicenotdesignedtodeliverprevention andisnotacomprehensiveprimarycareservice	Primaryoralhealthcareapproachwith Sláintecare ideals Reorientserviceinto3streams:primarycare independentpractitioners),communitycare(HSE salariedpractitioners)andadvancedoralhealthcare centres Caredeliveredthroughpackages,definedbyage Careforadultsviamedicalcardonly Allaccesswillbeginatprimaryoralhealthcare, referraltosecondaryandtertiarycareforoneoff treatment UpskillingofHSEpractitionersrequired Nationaloralhealthevaluationprogrammewith WHOindicators Oralhealthpromotionprogrammesfordisadvan - tagedandnon-fluoridatedareas Topicalfluoridationprogrammesforunder-6’snot supported

fluoride reduction in water supplies and toothbrushing recommendations in response to increasing levels of fluorosis [51].

2009—unpublished national oral health policy During this research, a Draft National Oral Health Policy' first announced by the Minister for Health in 2007 and completed in 2009 was identified via both strands of data collected [52] (Table 2). The policy remains unpublished, with an unpublished copy obtained by the lead researcher.

This document acknowledged the "apparent mismatch between peaks of childhood caries and the age range on which the PDS focuses" and the "deficiencies in care" offered to special needs groups [52]. The policy is referenced in the HSE National Service Plan 2008 [53] but according to one interviewee engaged in its development "it never saw the light of day" (P6). Another interviewee stated: "There was a lot of buy in…a lot for everybody… but…it never went through…and then the economic collapse took it off the table" (P12).

In a response to a parliamentary question in 2009, the then Minister for Health Mary Harney stated: "The National Oral Health Policy has to be reconsidered in light of the current position of the public finances" [54]. By 2011, the HSE National Service Plan signalled the end of the unpublished draft policy stating that a "new policy framework will be developed" [55]. ***2017—Sláintecare***

Oral health did not feature in any other national health policy document between 2001 and 2017 except for one mention of community water fluoridation [56]. In 2017, the Sláintecare report, a 10-year plan for health reform was published by a cross-political party committee following a 2016 Programme for Government Commitment. It recommends dental care to fall under the remit of UHC and urges reinstatement of the pre-economic crisis DTSS budget as a "short term" measure [20]. A "universal comprehensive package of care" following publication of a new oral health policy in 2017 is recommended. In 2018, it was adopted as government policy when the 'Sláintecare Implementation Strategy' was published with dentists referenced as community-based care, but no further detail on oral healthcare was provided [57]. Following this, the first 'Sláintecare Action Plan' was published in 2019 with no mention of oral health [58].

In 2018, 'First 5: A Whole-of-Government Strategy for Babies, Young Children and their Families 2019–2028' was released "in line with Sláintecare" [59]. It recommends the introduction of "a universal dental health package for children under six, supported by a screening/ surveillance programme to target key ages and vulnerable groups" [59]. ***2019—Smile agus Sláinte***

'Smile agus Sláinte' represents the first update to national oral health guidance since 1994. The need for a new policy is attributed to changing population demographics, technologies and treatment requirements [21]. It outlines a plan for dental coverage through bundles of care for those under-age-16, vulnerable groups and medical card holders delivered at various stages throughout the life-course. Out of pocket charges are to continue for the remainder of the population (Table 2) [21].

Its publication in 2019 was broadly welcomed by interviewees: "It's a well-intentioned, well-researched, well-structured document" (P1) with the emphasis on prevention and integration highlighted: "…the positives of the policy are…more treatment for medical cardholders and more preventive treatment…those are huge positives (P3)" and "…that integrated system…everybody can endorse (P13)".

'Smile agus Sláinte' proposes the reorientation of dental services for children from salaried services delivered in State owned premises to individual dentists contracted to provide treatment in "primary oral healthcare settings" [21]. This significant change was highlighted by interviewees: "The pivoting of the profession is very ambitious…it's a seismic task" (P4). While the "primary care approach" was largely supported: "Its more sustainable long term… I think that the Public Dental Service (Table 3) needs to… become what the policy envisages, a high-risk service" (P1).

The identification and management of vulnerable children was a concern raised by some: "We need a very clear safety system for children who may need a little bit extra"(P10). Along with the acceptability of the proposal to the dental profession: "They have assumed that there will be no kickback from the community dentists but not everybody wants to see special care adult patients…if a person isn't good with children…they shouldn't be seeing children" (P10). There were also significant

concerns regarding the workforce skill mix available: "The whole area of higher end training and specialization necessary… was deliberately underplayed." (P4). **The politics stream**

The strongest and most persistent finding emerging from both the interviews and documentary analysis is the low political interest in oral health in Ireland. This is surmised by an interviewee: "Oh god there's absolutely no [political] interest, none, not at all, they've bigger fish to fry…dentistry isn't a priority". (P2).

Table 3 An overview of publicly funded oral healthcare in Ireland in 2021

Dental scheme	Patient group covered	Type of oral health care covered
Public Dental Service	Children (0–16 years) There are 1.07 m children under age 16 in Ireland 22% of population Some adult populations with special needs	'Emergency' dental care only Comprehensive treatment entailing preventive and restorative care (including orthodontic treatment under strict qualification criteria) Two age groups only (ages 7–8 and ages 11–12) Eligibility does not equate to accessibility Service provision varies across the country Patients are targeted by age not clinical risk
Dental Treatment Services Scheme (DTSS)	Category I Medical Card holders Eligibility for a Medical Card is generally based on an income means test Covers 32% of the population 24% of eligible persons utilised scheme in 2019	One oral exam per annum, two fillings per annum and unlimited dental extractions Prior approval can be sought from a local HSE health manager for additional treatment including: More than 2 fillings, full or partial dentures, anterior root canals and for certain high risk groups, periodontal care
Dental Treatment Benefit Scheme (DTBS)	Social insurance contributors for three years (PRSI) Up to 2.2 m contributors insured in 2018 at a cost of €50 m In 2018 1.25 million claims were approved	Oral examination and one scale and polish (to the value of €42) annually

As of April 2021, there were 3320 registered Dentists in Ireland of which an estimated 2000 are actively practising with 316 salaried dentists directly employed by the HSE in the Public Dental Service

From the documentary analysis it is evidenced by the absence of oral health content in national health policies [48, 49, 56, 60, 61]. Further reinforced by the failure to implement most recommendations from commissioned reports, research, guidelines, and policies over two decades [41–44, 52, 62–64]. Additionally, according to an analysis of reports commissioned by the Department of Health, the absence of dental leadership in the health Department and an advocate for oral health in national management in the HSE resulted in a failure to promote oral health and drive policy nationally [45, 47] (Table 4). An interviewee stated: "There was a lot of messing, the role of the chief dental officer lay fallow for a while…in the department there was a lack of willingness, a lack of lobbying, a lack of leadership" (P6). The political disinterest following the impact of austerity measures was also noted: "[Public Dental] Clinics were closed, and nobody complained. Nobody missed them. That's frightening." (P1).

The exception is the high political priority attributed to orthodontics. In times of scarce resources orthodontics received precedence. This was criticised in a report commissioned by the DoH in 2002 [42]: "One wonders about the logic of providing orthodontics at a time when there appears to have been many other needs to be satisfied (e.g. tooth decay in young children)"[42]. An analysis of documents found that in 2015, as austerity measures remained in place, additional public funds were allocated to orthodontic care [65].While in April 2021, politicians raised concerns regarding orthodontic waiting times during a governmental committee debate that was established to consider the difficulties faced by low income adults accessing publicly funded dental care. [66].

This priority was reflected on by an interviewee: "Orthodontics will always have a conversation because they're the articulate people…When you represent and advocate on behalf of the vulnerable adult, and the child, it falls on a political deaf ear. And that's the fact" (P10). and another: "Politically what we know is that the one important thing is orthodontics…the middle-class voter wants free orthodontics for their child and so that's what the politicians go for" (P6).

Table 4 details Irish health ministers, their political affiliation along with the presence of expert dental

opinion advising government during the study period. This overview illustrates a predominance of centre right politicians responsible for health in Ireland. The exception is a centre-left minister in 1994 which coincided with political priority for oral health policy followed by policy implementation and subsequent public dental system reform. **The process stream**

The process stream is concerned with policy development [35]. For this research, the development of the 'Dental Health Action Plan' (DHAP) [32], the unpublished Draft National Oral Health Policy in 2009 and 'Smile agus Sláinte' [21] are most relevant. An overview of the key policy milestones for oral health in Ireland is illustrated in Fig. 2.

Table 4 An overview of key political actors in Irish Oral Health Policy landscape: 1994–2021

Year	Health Minister Political parties in government with ministerial party in bold	Dental presence in Department of Health
1993–1994	Minister Brendan Howlin *Fianna Fáil/**Labour***	Assistant Chief Dental Officer
1994	Minister Michael Woods ***Fianna Fáil**/Labour*	Assistant Chief Dental Officer
1994–1997	Minister Michael Noonan ***Fine Gael**/Labour/Democratic Left*	Assistant Chief Dental Officer 1994–1995) Appointed 'Chief' Dental Officer (1996)
1997–2000	Minister Brian Cowen ***Fianna Fáil**/Progressive Democrats*	Chief Dental Officer
2000–2004	Minister Michael Martin ***Fianna Fáil**/Progressive Democrats*	Chief Dental Officer
2004–2011	Minister Mary Harney *Fianna Fáil/**Progressive Democrats***	No Chief Dental Officer
2011	Minister Mary Coughlan ***Fianna Fáil**/Progressive Democrats*	No Chief Dental Officer
2011–2014	Minister James Reilly ***Fine Gael**/Labour*	No Chief Dental Officer 2011–2013 HSE National Oral Health Lead seconded 2 days a week as Chief Dental Officer in 2013
2014–2016	Minister Leo Varadkar ***Fine Gael**/Labour*	Chief Dental Officer (Part-time)
2016–2020	Minister Simon Harris ***Fine Gael**/Fianna Fáil*	Chef Dental Officer
2020-Present	Minister Stephen Donnelly (incumbent) *Fine Gael/**Fianna Fáil***	Chief Dental Officer

Fianna Fáil (FF): Dominant from 1997–2007, nationalist and conservative, the largest and oldest political party in Ireland at that time

Fine Gael (FG): Traditional rival of Fianna Fáil, a party of the centre right, liberal and conservative. Both FF and FG have seen their once broad popularity decline in recent years

Progressive Democrats (PDs): Formed by a group split from FF, pursued economically liberal policies with a strong low-tax, pro-business focus. Had considerable influence over government policies particularly economic and health policy

Labour: A party of the centre left described as a democratic socialist party

Development of the DHAP

A DoH report in 1988 found the public dental service was failing in its statutory duty to provide dental care for eligible adults [33]. By 1990, public anger arising from media reporting of medical card holders with missing teeth drove oral health onto the political agenda [42]. According to an interviewee: "What was…appearing in the media was that the elderly were complaining they couldn't get dentures…And…the big complaint about orthodontics, you couldn't get the kids teeth straight…So those two things were piling in on top of politicians." (P11).

In the early 1990's the need for a new health policy for Ireland was emerging [67]: "…not only were the department [of health] devoting attention to teeth but an overall health strategy….so the plan for the dental services fitted" (P11).

At the same time, findings emerged from a national survey of adult oral health demonstrating that lower socioeconomic groups had poorer oral health and greater treatment needs than the general population [68]. This is described by an interviewee:

Everyone knew medical card holders couldn't get a service…it was just…inequitable…the hard evidence really showed it… (P6)

According to both strands of data in this research, the media spotlighting oral health inequalities at the same time a national health policy was under development combined with the outcomes from the national adults survey provided an opportunity for oral health to briefly garner political support. The 'Dental Health Action Plan' was subsequently published in 1994 [32].

This is described by an interviewee: "Talk about right party, right place, right time…The Secretary General, the Minister, everybody was on the same page. It was a transformative moment. It was presented as such, it was believed as such, this just wasn't a one-off kind of initiative." (P11).

An outcome of the DHAP was the establishment of the DTSS scheme following negotiations with the dental professional representative group, the Irish Dental Association (IDA) [32]. This success is attributed to shared leadership, collaboration, and effective communication by interviewees:

The key thing was…leadership, enlightened leadership on all sides, totally committed people with very good communication skills…who saw they were doing something good. (P11)

We had really good representation in the Department [of Health] at the time…and the civil servants were skilled. (P6)

Development of the unpublished Draft Oral Health Policy According to an analysis of parliamentary documents, an investment in dental research of £1 m along with an expenditure of £2.34 m on commissioned reports between 1999 and 2007 brought oral health back onto the political radar [69]. On 18th October 2007, the Minister for Health launched the development of a new Oral Health Policy [70]. According to an interviewee, a report advocating for reform of the Irish dental profession by the competition authority [71] and investment in dental research instigated policy development: "The drivers were…the Competition Authority report…the Department [of Health] had spent a lot of money on research… and the legislation, anybody could see the dentist act needed to be updated" (P12).

Documents identified during the course of this research reveal that a consultative and core policy



Fig. 2 Timeline of key oral health policy milestones in Ireland 1994–2021

development group was formed in the DoH in 2007 [52]. Two studies were carried out, an analysis of the Public Dental System [45] and an economic analysis on the possible integration of the state dental schemes (the DTSS and DTBS) with the findings presented in March 2008. The draft National Oral Health Policy was developed by 2009 but remains unpublished.

Development of Smile agus Sláinte

According to the documentary analysis, the development of 'Smile agus Sláinte' commenced in 2013 when the HSE National Oral Health Lead was released to the DoH for two days each week to undertake the functions of Chief Dental Officer. One of their primary responsibilities was the development of a new oral health policy [72]. The policy document details the development process including a series of working groups with oral health professionals, an Academic Reference Group, an accompanying 'Practitioners Reference Group' along with an 'Independent Panel' [21]. According to an interviewee:

> *It started well…the policy was announced, feedback was encouraged…but as the years went on the amount of feedback and communication diminished. (P7)*

Findings from both documents and interviews highlight that progress was slow – the policy development process started in 2013 and the policy was published in 2019 [21, 72]. A key finding from most interviews carried out for this research is a perceived failure to engage with all relevant stakeholders particularly representatives of the HSE and private dental practitioners as the policy was being developed. This is described by an interviewee engaged in policy development: "You needed to bring the dental professional, along with you" (P5). *…the most important people in the process weren't really considered at all. (P13)*

Interviewees also raised queries about the secrecy and time taken during the policy process: "…hush hush and top secret… It was going in the right direction but too secretive…we were waiting twenty years…" (P2). While interviewees participating in policy development initiatives queried the extent to which their inputs were considered: "…the final document, I can't see any evidence of…the group that is explicit…there's a sense the die was cast very early on" (P4) and from another "…the first time I saw what was in the thing was the day it came out". (P13)

The programme stream

The programme stream is focused on implementation [35]. This section will examine oral health policy implementation successes and failures in Ireland during the study period in addition to considerations for the implementation of 'Smile agus Sláinte'.

Based on both sources of data in this study it can be concluded that the implementation of elements of the 'Dental Health Action Plan' and community water fluoridation were successful. As noted in interviews, political support for the DHAP combined with strong dental leadership, collaboration and communication supported implementation. While analysis of documents pertaining to community water fluoridation also illustrate political support, investment in research and proactive engagement by way of the Forum on Fluoridation in response to public concerns [51].

However, a persistent finding emerging from the documentary analysis was the failure to implement a variety of recommendations, guidelines and a national oral health policy during the study period [41, 42, 52, 62–64]. This was especially evident with respect to the outcomes of national oral health surveys [43, 44, 73], clinical guidelines [41, 62–64], recommendations to expand dental specialist lists [42] and the failure to publish the draft national oral health policy in 2009 [52].

This was described by an interviewee: "The failure to invest, particularly…from 2000 to 2010…is really important, it was possible…a number of initiatives were there but getting them over the line was next to impossible" (P4) and another: "So as the Irish economy went up, went down, went sideways… There were opportunities to do things" (P8).

The absence of a Chief Dental Officer (CDO) in the Department of Health along with the formation of

the HSE in 2005 were suggested by interviewees as contributing factors to non-implementation: "It was a lost decade… from the time the CDO left"(P4) and "…the formation of the HSE. All of that was taking a lot of energy in the Department, dentistry wouldn't have been even on the radar" (P12).
An assessment of documents found that efforts to review the DTSS scheme failed in 2007 when legal concerns raised by the HSE and Department of Health with respect to negotiation with the Irish Dental Association triggered the Associations withdrawal from discussions [74]. Analysis also points to issues with respect to probity assurance within the DTSS scheme [75] and resistance from the dental profession during negotiations. An interviewee familiar with events stated: "It was just so slow… they were…trying to block anything…"(P12) and another: "Between Department of Health, HSE and Dental Association. No party emerges from it with credit…it was a missed opportunity". (P4).
'Smile agus Sláinte' commits to developing an implementation plan as a "priority" [21]. The time frame for implementation is from 2019–2026 with agreement on an implementation plan with lead partners described as the "initial focus" [21]. In 2021, this remains unpublished with the DoH stating the emergence of the COVID-19 pandemic had caused the policy roll out to be "delayed" [39].
The impact of the pandemic was also of concern for interviewees: "I'd be sceptical about anything happening… when this is all over…that's gona [going to] look like nothing compared to mental health, cancer, missed appointments…" (P13).
While relationships between dental practitioners and the DoH were again challenged during the pandemic relating to the provision of PPE: "They were promised PPE, and they're treating medical card patients, they were solidly promised PPE. And that promise was not delivered…where's the trust going to be now for the oral health policy?" (P9).
A consistent finding from interviews was the need for better engagement between all stakeholders for implementation to progress: "…the way forward is you start by talking but unfortunately talking just won't do it…they have to change the mood…buy goodwill… early wins… what's not contentious" (P4). The absence of public dental funding was also highlighted: "The State is going to have to support dentistry in an unprecedented way…"(P1) and "…the biggest obstacle they are going to face is, is one of the biggest obstacles they always faced…it requires significant additional resources". (P10).
The importance of political support for policy implementation and support for senior officials deemed responsible for it was raised by one interviewee: "The Chief Dental Officer needs support at the highest level in the Department of Health, including from the Minister, who must want the plan to succeed and state it publicly and not just lip service" (P11). While the need for urgency was strongly advocated for: "We're at a breaking point, both in terms of the children's and adults' services, now's the time to start the policy…if we mess this up, we lose one of the best opportunities we've ever had" (P1).

Discussion

The low political interest in oral health and the neglect of oral health policy as illustrated by this analysis of the Irish experience reinforces international literature in this area [2, 4]. Political power is one of the most important factors in determining the priority given to oral health policy [76, 77]. While the failure to incorporate oral health onto political agendas may exacerbate oral health inequalities, a key feature of the 'problem stream' in Ireland [5].
Oral health has not featured prominently on the Irish political radar for the vast majority of the 27 years under scrutiny. Legislation governing the dental profession stems from 1985 [78] and the failure to update national oral health policy for over twenty five years, both strongly reinforce this international finding [21]. The 'Dental Health Action Plan' published in 1994 was initially successful [32]. Its publication coincided with the tenure of a left-leaning health minister who, from analysis in this research, is given credit for providing political backing for policy implementation. This is reflective of more recent international literature showing that where leftwing parties are in power there is greater support and probability of delivering universal health coverage and more progressive health policies [79]. Furthermore, the policy problem of poorer oral health among lower socioeconomic groups [68], along with demands for orthodontic care achieved prominence at the same time a

national health policy was in development. In other words, there was an "open window of opportunity" for policy change [80]. Policy agenda setting theory proposes that "multiple streams" must align for issues previously not high on the political radar to become visible [80]. This was evident in 1994 and further supported by alignment between the Department of Health and the dental profession [32].

However, there was a failure to build on the 'Dental Health Action Plan' and political attention diminished during the following decades despite the opportunity for action. When the Irish economy experienced exponential growth during the 'Celtic Tiger' years (2000–2007), the health system benefited from increased spending [81]. There was increased investment in dental research [43, 44, 73], in commissioned reports evaluating dental services [42, 45, 47, 75] and a Draft National Oral Health Policy [52]. However, there was a failure to increase coverage for dental care [12], to fulfil most of the conclusions and policy recommendations made [41, 45, 62–64, 75] or to incorporate oral health into general health policies [20, 58]. This mirrors findings internationally where a failure to fully implement stated commitments to oral health coupled with the fragmented integration of oral health into broader health systems is indicative the low importance attributed to it by decision makers [25]. This lack of political priority is not unique to Ireland with global oral health suffering from limited political attention [2, 6]. Oral diseases disproportionately impact marginalised groups, have low mortality, and are often considered inevitable which can influence their political importance [6, 76, 77]. This persistent underestimation from a political perspective of the burden and impact of oral diseases and an unawareness of their harm creates a situation where high level acknowledgements of oral health problems by political leadership are "toothless" [77]. The exception in the Irish context is the political interest in orthodontic care. Evidence suggests that demand for orthodontic treatment is rising as the health and expectations of populations improve, along with increased concerns regarding dental aesthetics [82]. In Ireland, access to publicly funded orthodontic care is determined by treatment need rather than income level, with research showing that children of lower socioeconomic status are less likely to have had orthodontic treatment than their better off counterparts [73]. When considering the prominence afforded to orthodontics, a DoH commissioned report pointed to the pressures placed on politicians by "middle class parents" seeking orthodontic care for children as a possible reason for the focus [42]. In 2021 during a governmental committee meeting on the difficulties experienced by low-income adults accessing dental care, participating politicians discussed orthodontic waiting lists for children, with a dental professional representative cautioning the lack of access to basic oral healthcare as a "much bigger impediment to child health"[66].

The dominance of orthodontics across the political discourse in the absence of 'essential' primary oral health care services is particularly stark and poses the question, what constitutes essential oral healthcare? The categorisation of 'essential oral healthcare' is a topical issue in the global domain particularly in the aftermath of the COVID-19 pandemic [83]. Defining essential oral health care is considered a "formidable and highly pertinent challenge" [83]. However, the engagement of all stakeholders in determining this definition is strongly advocated for, as is ensuring services are rooted in the "immense unmet oral health needs" across populations with "political decisions grounded in science and evidence" [83].

The importance of coalescence and a joint understanding between political stakeholders and oral health advocates is echoed throughout the literature [76, 77]. The role of those actors in oral health policymaking is crucial [24, 26, 76, 84] with respect to their use of evidence, in setting the agenda, emphasizing the importance of oral health, and mobilizing resources [85].

An important finding of this study is the lack of policy champions across the oral health policy landscape in Ireland at critical intervals (Table 4). The absence of a Chief Dental Officer in the Department of Health during key periods and an oral health advocate in a position of national authority in the HSE resulted in a lack visibility for oral health in decision making processes [45]. This is highlighted in the DoH commissioned evaluation of the public dental service (PDS): "The leadership deficit in both the Department of Health and the HSE is an impediment to developing and delivering

the service" [47]. A consequence of insufficient leadership and a lack of oral health specialist expertise within policymaking bodies seen internationally is the failure to publish national oral health policies [77]. This was also evident in the Irish context with the failure to publish the 'Draft National Oral Health Policy' in 2009 and recognise critical inequalities pertaining to the public dental system which still dominate in 2021.

Research examining the power of actors in the oral health policy context also finds the private sector strongly influences the policy making debate [76]. In the absence of skilled dental public health specialists, advocacy initiatives can fall to professional representative groups with a subsequent focus on curative interventions rather than prevention [77]. This is found in Ireland, where dental public health is not a recognised specialty and the numbers of specialists are low [42]. The Irish Dental Association (IDA) represents the interests of private dental practitioners and salaried dentists working in the public system. The collapse of contract negotiations between the IDA, HSE and Department of Health in 2007 was considered a failure across all parties, however, the resistance of the profession was highlighted. This pursuit by the profession of their independent agenda is reflected in international research where efforts to prioritise oral health can be dominated by the private sector perspective [76].

However, the influence of the dental profession has been significantly restricted since the introduction of austerity measures in 2010. A key component of oral health policymaking is the facilitation of conversations and dialogue between the different participants in the policy process [25]. This research finds that insufficient engagement has taken place with all dental professionals during the development of 'Smile agus Sláinte'. Stakeholder engagement is "critical" in delivering healthcare change and supporting implementation [86]. International evidence highlights that efforts to transform health systems are more successful when healthcare professionals are engaged, leading to improved clinical outcomes, patient safety, care quality and financial performance [87].

To progress policy implementation and reform in Ireland, the agendas of the DoH and dental professionals require alignment and leadership to unite the policy community. International evidence emphasises the importance of developing a consensus among stakeholders on a shared vision and appropriate strategies [76]. While cautioning that "simple document-based policy reforms" may not have the desired impact without widespread stakeholder support to carry it through to full funding and implementation [25].

The emergence of the COVID-19 pandemic and likely future impacts on health spending has generated concerns amongst participants in this study regarding potential implementation. The pandemic also highlighted the position of oral health within the broader health system. Ireland, like many countries, limited dental services to "emergency practice" in March 2020 [83, 88]. By May 2020 "routine dentistry" recommenced under new legal regulations with dental services classified as an "essential service for Irish society" [89]. Historically oral health has often been assigned to individual responsibility [90]. However moving forward, it must be an integral component of any health system. The emergence of "essential oral healthcare" as a consequence of the pandemic must be defined and further harnessed in supporting future health system reform, particularly in the realm of UHC [83].

This research finds that oral health policy in Ireland is "path dependant" illustrated by its association to previous decisions and existing institutions [91]. The Irish path has been one of providing minimal and emergency cover for some population groups, without universal coverage and a failure to focus on prevention and early intervention [12, 21]. To avoid repeating historical mistakes, evidence suggests that "strong conjunctural forces"are necessary to move policy away from its existing path onto a new trajectory [91]. While "windows of exceptional opportunity" that determine the ways a political system reacts to policy are required [91]. In May 2021, The World Health Assembly adopted a historic resolution on oral health [92]. The central recommendation echoes calls internationally for the inclusion of oral health under the universal healthcare agenda [2, 10, 90]. A the time of writing in July 2021, Irish political attention appears focused on the adult medical card scheme (DTSS) (Table 3) where the numbers of dentists participating in the publicly funded scheme are rapidly declining and patients are struggling to access dental care [39]. In April 2021, the DoH stated: "the pandemic has

caused…the roll-out of the policy to be delayed…and the proposed contract review (of the DTSS scheme) deferred" [39].
The impetus for inclusion of oral health within UHC emerging worldwide, for which there is an agreed political consensus in Ireland [20], could provide a platform for oral health policy in Ireland and the opening of a window of opportunity to bring about major oral health system reform.

Limitations/strengths/potential contributions

The key strengths of this paper include the use of a structural framework following best practice recommendations for policy analysis [23, 35] and the use of multiple sources of data [30]. Interviews are considered useful in policy analysis to provide rich information, particularly of a sensitive nature. However, interview data can be ambiguous and subjective [93]. To overcome this potential limitation, interview data was continually triangulated with a detailed documentary analysis. Although the sample size for this study was relatively small (n = 13), with greater participation among policymakers sought, owing to the narrow oral health policy landscape in Ireland and the information power [94] generated from the interviews, we are confident of the strength of the findings. Anonymity was granted to each interviewee with all transcripts anonymised and securely stored while the participants identities were known only to the research team. Furthermore, no identifiable quotations will be presented in this or any other publication arising from this analysis. This research presents an original contribution to knowledge, an in-depth analysis of oral health policy in Ireland, the first study of its kind. This research highlighted the limited number of studies analysing oral health systems and policies along with the political and external influences which shape them. It is incumbent on the authors of this paper to urge for greater research in this area and echo organisations such as the International Association for Dental Research in advocating for more implementation and oral health systems research [95].

Conclusion

This research clearly finds that oral health is not a political or policy priority in Ireland. The publication of 'Smile agus Sláinte' in 2019 provides an opportunity for much needed reform of the public dental system. However, to avoid repeating historical mistakes successful reform will require greater political interest than experienced to date, strong political will, and a major focus on implementation, including positive engagement with oral health professionals. Internationally, calls have been made for the inclusion of oral health as part of the universal healthcare agenda. Ireland's national health policy 'Sláintecare' has agreed political consensus and an implementation plan in progress to deliver universal healthcare. In September 2021, the two most senior personnel responsible for Sláintecare resigned. In the aftermath of this, the Irish Government recommitted its promise of universal healthcare, however the extent that it will be implemented remains unclear. Incorporating oral health reform as an integral part of any future universal healthcare implementation may provide the opening of a window of opportunity. Learning from this research, genuine engagement with all stakeholders in the development of a detailed implementation strategy for oral health system reform under the remit of universal healthcare is urgently required before the window closes yet again.

Abbreviations

UHC: Universal Healthcare;
DoH: Department of Health; **HSE**: Health Service Executive; **OHP**: Oral Health Policy**; CWF**: Community Water Fluoridation; **PDS**: Public Dental Service; **DTSS**: Dental Treatment Services Scheme; **DTBS**: Dental Treatment Benefit Scheme.

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Authors' contributions

All authors, UMA, SB, MH and HW contributed actively to this paper. The design of this study was developed by UMA and SB. UMA was responsible for data collection and analysis. Feedback on the analysis and the interpretation was received from UMA, SB, MH and HW. UMA drafted the paper for submission and all authors approved the final version.

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Availability of data and materials

The datasets generated and analysed during the current study are not publicly available to maintain the anonymity guaranteed to study participants but may be available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval for the study was obtained from the Clinical Research
Ethics Committee of the Cork Teaching Hospitals at University College Cork (Reference number: ECM 4 (J)12/11/2019). At all times ethical considerations including ensuring confidentiality, obtaining informed consent, and preserving anonymity were adhered to. Informed consent to participate was granted by each participant.

Consent for publication Not applicable.

Competing interests

The authors declare they have no competing interests.

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9.15 Appendix O: PDF paper two

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'At a tipping point': a comparative analysis of oral health coverage for children across six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain

Úna McAuliffe[1*], Kenneth Eaton[2], Máiréad Harding[3], Helen Whelton[4], Jodi Cronin[5] and Sara Burke[6]

Abstract

Background Dental caries remains a significant public health problem for children with continuing calls to incorporate oral health under the Universal Healthcare domain (UHC). However, there is little knowledge on the variations in the coverage, financing, and access to child oral healthcare across Europe.

Methods This inter-country comparative analysis provides a detailed description and mapping of publicly funded child oral health coverage across six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain. A multiple case study approach was adopted encompassing two strands of data collection: a documentary analysis and in-depth interviews with experts from each country. The WHO Universal Health Coverage Cube was used to guide data collection and analysis.

Results Two broad models of child oral health coverage were found: those systems adopting 'universal' approaches (Denmark, Germany, Hungary, and Scotland) and those restricting coverage by 'targeting' children by age or where they live (Ireland and Spain). In countries without universal coverage (Ireland and Spain), the private sector assumed a significant role, leading to substantial out-of-pocket expenses for families. This was also evident in Hungary owing to barriers in accessing its publicly funded oral healthcare system. Preventive oral healthcare was also attributed a lower priority in these countries, however a prominent observation across all countries was the necessity for a stronger focus on prevention. Each country with universal oral health coverage (Denmark, Germany, and Scotland) except for Hungary, demonstrated a trend of expanded coverage and regulatory reform achieved using oral health data, political support and engaging the dental profession. While a failure to implement policy and system reform was evident in the remaining countries with the impact of the 2008 economic crisis particularly evident in Ireland and Spain.

Conclusions This research finds that child oral health coverage in some European countries is 'at a tipping point', with recognition of the need for reform evident in Hungary, Spain and Ireland while most 'universal' systems remain on alert to maintaining the broad coverage in place. To maintain and progress UHC for oral health there must be an emphasis on prevention, on addressing inequalities faced by children excluded from care and on advocacy using quality oral health data to engage both dental professionals and political will.

Keywords Universal health coverage, Oral health, Childhood dental caries, Oral health policy, Health service accessibility

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Background

Oral health is increasingly positioned as a fundamental human right and 'integral to general health' [1, 2]. While oral diseases are largely preventable, it is estimated that approximately half of the global population suffers from some form of oral disease [3].

Dental caries is one such condition which has an impact across all ages but particularly in children [4]. It is the most common disease of childhood and is considered a 'major global public health challenge' [5, 6]. In addition to causing pain and infection, dental caries can lead to difficulties in eating and speaking along with compromised physical development, self-esteem and lower school performance [7, 8]. The high prevalence of dental caries also has a major societal cost with the global economic burden of the disease estimated at US $245 billion [9].

Although the aetiology of dental caries is complex, influenced by biological factors and the social and commercial determinants of health, there is significant evidence supporting the impact of preventive approaches in improving oral health outcomes [10, 11]. Interventions including community water fluoridation (CWF) and the topical use of fluorides, oral health assessments in the early years, parental counselling and school-based initiatives have shown significant benefits [12–14]. Furthermore, healthcare systems that offer regular access to oral healthcare services, in combination with preventive public health measures, may lead to improvements in the prevalence of dental caries [6]. However, any 'downstream' interventions should be integrated with more radical up-, mid-stream and integrated approaches, delivered in a proportionate manner to guard against the risk of increasing rather than decreasing socio-economic inequalities [1].

Despite this strong evidence base, national governments have demonstrated 'slow, limited and uneven adoption' of policies and strategies to improve children's oral healthcare, particularly for very young children and those most socially deprived [15]. In many countries, oral healthcare services are considered a non-essential component of health systems and are consequently excluded from reform and progression towards Universal Health Coverage (UHC) [16]. This is perpetuated by a lack of political priority for oral health, poor integration of oral healthcare within the broader healthcare system and the historical consignment of oral health to the realm of 'personal responsibility' [17–20]. Consequently, children, particularly the most vulnerable, face barriers in accessing oral healthcare. Global evidence indicates that these groups are inadequately served by primary oral healthcare [11, 21]. Furthermore, there are 'substantial' inequities both within and between countries with respect to coverage for primary oral healthcare for children [11].

Based on patterns of organisation and financing, researchers identify six defined 'models' of oral healthcare delivery in Europe (Table 1) [22]. These models are the Nordic, Bismarckian, Beveridgian, Hybrid, Southern European and Eastern European models. The Nordic model (e.g., Denmark) is typically characterised by a large public dental service for children which is operated by salaried personnel and financed by taxation [23]. There is also a private, non-salaried sector, that may be subsidised by public finance [22]. In Germany, the Bismarckian model is based on statutory health insurance split into public social insurance (SHI) and private health insurance (PHI) [24]. Most oral healthcare costs are reimbursed, with services typically provided by independent (non-salaried) practice-based dentists [24]. The Beveridgian model originated in the United Kingdom (e.g. Scotland) where publicly financed dental care is delivered by independent dentists contracted and financed via the tax funded National Health System (NHS) [25].

A Hybrid model is seen in the Republic of Ireland (Ireland), which has adopted some features of the Beveridgian system. For children, emergency, and 'comprehensive' dental care at 'targeted ages' is provided by salaried dental practitioners directly employed by the state [27]. While publicly funded oral healthcare for adults is provided by independent dental practitioners contracted by the state. However, coverage limitations and access restrictions across the population mean most dental expenditure in Ireland is privately financed [19, 28]. The Southern European model (e.g. Spain) is predominately privately financed, with some publicly funded oral healthcare available particularly for children, but its provision

Table 1 Models of oral healthcare delivery in six European countries

Country	Model	Main source of general healthcare financing	Children's oral health cover
Denmark	Nordic	Tax financed	Universal
Germany	Bismarckian	Social Health Insurance	Universal
Scotland	Beveridgian	Tax financed	Universal
Hungary[1]	Eastern European	Social Health Insurance	Universal
Ireland	Hybrid	Tax financed	Targeted*
Spain	Southern European	Tax financed	Targeted*

* Targeted systems offer coverage for oral healthcare at specific ages and or in specific regions/locations

1: In Hungary the formal eligibility is that of a universal model of oral health coverage for children. However, unlike the other universal models, there is evidence that owing to practical access barriers, universal eligibility does not equate to universal accessibility [26].

is highly variable [22, 29]. Finally, in most Eastern European countries (e.g. Hungary) public provision of care is reducing having previously been considered 'universally free', with 'the majority of care now provided in the private sector' [22, 26, 30].

The World Health Organisation (WHO) has led the recent global recognition of the 'neglect' suffered by oral health and the new emphasis placed on the inclusion of oral health under the UHC agenda [2]. While the WHO Global strategy and action plan on oral health 2023–2030 has the overarching aim of implementing UHC for oral health by 2030 [31]. A 2022 report examining oral healthcare systems across Europe found there was 'little known about the large variations between countries in terms of financing, access, coverage and delivery of oral healthcare' [26]. This echoes previous evidence highlighting the lack of international comparison and 'paucity of information on how oral healthcare systems are organised, how services are delivered, the healthcare professionals responsible for providing care and access to services' [32, 33].

Previous research demonstrates the advantages of inter-country comparisons in offering insights into the prevalence of child dental caries and the impact of health policies [6]. While a detailed understanding of how different systems operate may provide greater knowledge for healthcare planning and policy-making within the UHC domain [32, 34].

Thus, the aim of this research is to provide a detailed description and mapping of publicly funded oral healthcare coverage for children across six European countries, each representative of a model for the provision of oral healthcare, and to report on that coverage in accordance with the World Health Organisation Coverage Cube [33, 35].

Methods

Overview

This research set out to perform an inter-country comparison of publicly funded oral healthcare systems for children. Marmor (2012) [36] outlined three purposes for engaging in inter-country research on health systems and policies:

- Gaining insights into the structure and policies of national healthcare systems,
- Understanding the rationale behind their configuration,
- Deriving lessons from the experiences and practices of other countries.

Effectively conducted inter-country comparisons can provide a rich source of evidence and 'exert a powerful influence' on policymakers [37]. However, comparisons can be problematic with a lack of appropriate theory guiding the identification of data, justification for country selection and analytical approach which have been identified as common shortcomings [38].

Inter-country comparisons can 'benefit greatly' from methodological triangulation to strengthen the quality of studies [39]. This research followed a multiple case study approach requiring the researcher to gather data from various sources to comprehensively capture the complexity of each system. Multiple case studies enable an understanding of data both within and across different systems with the evidence generated considered 'strong and reliable' [40]. As such there were two strands of data collection in this research (i) a documentary analysis and (ii) semi-structured 'elite' in-depth interviews with experts from each country [41]. Findings from both strands of the data were analysed and triangulated together to generate the results. Despite the initial intent to provide inter-country comparison, due to the poor quality of data available, findings are presented individually for each country with comparisons drawn where appropriate.

Data Collection

Country selection and target population

Cacace et al. (2013) [39] highlighted the importance of explicit selection of comparator countries, ensuring their justification reflects the research aim. For this analysis the following countries were chosen, Denmark, Germany, Hungary, Ireland, Scotland and Spain. To be selected, countries had to demonstrate the following characteristics:

i. be representative of the various health systems throughout Europe (i.e., social health insurance vs. tax-financed, multi- vs single-payee, centralised vs de centralised and the differing models of dental systems previously categorised across Europe [25],
ii. demonstrate effective oral health promotion and prevention regimes for children as evidenced by low d_3mft/D_3MFT (less than or equal to 1) and percentage with no obvious caries at age 12 (70% or greater)[1] [42] or ICDAS 0–3 [43] and
iii. have a history of or planned oral health system reform.

The study focused on publicly funded oral healthcare for children. In most countries, children are defined as

[1] Data for Ireland and Hungary did not meet these levels. However, in the case of Ireland, data comes from national survey which is more than 20 years old. While Hungary was considered a fair representation of the Eastern model as most other Eastern European countries reported similar levels.

those under the age of 18. Due to time constraints, it is beyond the scope of this research to consider oral healthcare coverage for special needs populations and other vulnerable groups.

Conceptual framework

Evidence indicates that due to the diverse nature of national health systems that whatever the purpose for inter-country comparison, a conceptual framework is needed to, 'provide clarity…and to draw meaningful comparisons' [37]. The World Health Organisation Universal Health Coverage Cube (Cube) [35] (Fig. 1) adapted to describe publicly funded oral healthcare [33] was used to guide both data collection and analysis in this research.

The three central elements of the Cube are: (i) Breath: the extent of population coverage, (ii) Depth: the share of costs publicly funded and (iii) Scope: the range of treatment/services provided.

Document analysis

A documentary analysis examined documents derived from a range of sources including publicly available information, grey literature, peer reviewed academic literature and material provided by local experts. A pre-existing data collection template, based on the Cube, was accessed and refined to guide data collection [33]. This template required in-depth information to be collated across a range of sectors in the oral healthcare system including relevant laws, regulation, organisational structures, personnel and the three core features of the Cube: the breath, depth, and scope of oral healthcare coverage.

A search strategy (Appendix A) was developed with the assistance of a specialist medical librarian with the aim of identifying the relevant peer reviewed literature that described or compared publicly funded oral healthcare systems for children under the age of 18 years in the six representative countries. Other documents were identified by searching sources including (i) Government websites, particularly Ministries of Health and legislative databases, (ii) individual country health service platforms (iii) oral health professional associations and (iv) international organisations. Documents reviewed included relevant publications by the European Observatory for Health Systems and Policies, the Council of European Dentists and the WHO, national government policies and strategies, clinical guidelines, and health service reports with no language restriction.

The completed template incorporated data derived from both academic and other documents and was presented to two experts from each country for their review, following which these experts were invited to participate in interview. Each country's data was updated in the light of the 'local' expert feedback. The detailed templates for each country are available on request.

'Elite' Interviews

'Elite' interview participants are those who have a particular professional expertise or a close proximity to roles with authority within a system or process [44]. Within health systems and policy research such interviews are beneficial for verifying information, providing access to narratives about events and sharing institutional knowledge that would be otherwise unavailable [45]. In this study, an elite interviewee was someone possessing a high level of expertise in dental public health[2] or having served as a Chief Dental Officer[3], either currently or in the past. Those individuals were purposively identified from the national documentary analysis, the knowledge of the research team or based on the recommendation of other interviewees. A piloted interview guide informed by the literature was used during interviews and was continually updated throughout the interview process.

A total of sixteen elites ($n=16$) were invited to partake and fourteen ($n=14$) consented. The sample consisted of two ($n=2$) participants from each country involved in the analysis along with two experts ($n=2$) from non-participatory countries, recruited with the aim of providing an overarching view of children's oral healthcare in Europe. The sample consisted of eight ($n=8$) dental public health experts, six of whom were at a senior position in academia ($n=6$) and two were affiliated with the health service ($n=2$). While a total of six participants ($n=6$) were present or former country Chief Dental Officers. For logistical purposes all the interviews were conducted via teleconference (MS Teams) between May and September 2023.

Data analysis

Best practice for qualitative document analysis describes finding, selecting, appraising, and synthesising data which are then organised into major themes through content analysis [46]. This approach was followed, with analysis further directed by the WHO Coverage Cube (Cube). Qualitative data analysis software (NVivo 12) was used, with the data from the documents initially recorded into the data collection template under key headings guided by the Cube. Interviews were transcribed verbatim. Operational definitions derived from the Cube, in line with the data collection template, were generated and the outcomes from the documentary analysis and the

[2] In this research a 'dental public health expert' was defined as an individual at a senior position in an academic or health service setting, with additional post graduate training in dental public health.

[3] A 'Chief Dental Officer' was the senior civil servant providing oral health advice to a Health Ministry.

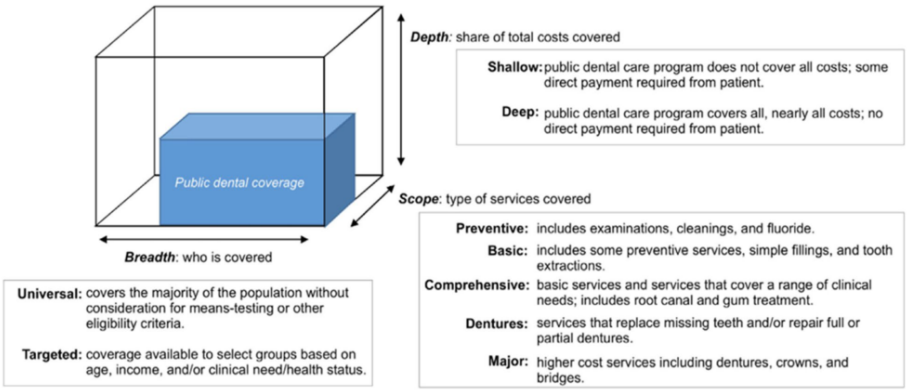


Fig. 1 Dimensions of coverage for public oral healthcare models based on the World Health Organization Coverage cube framework [33]

interviews were combined and coded together. To ensure triangulation, the findings from the documents were continually analysed together with those from the interviews.

The data from the document analysis enabled the generation of a rich description of the key features of each system [46]. However, document analysis is said to be 'powerfully' combined with other methods within qualitative research [47] and the 'elite' interviews in this study provided critical contextual information along with country specific perspectives.

Ethics approval

Ethics approval for the study was granted by the Clinical Research Ethics Committee (CREC) of the Cork Teaching Hospitals at University College Cork (CREC) (Reference number: ECM 4 (J)12/11/2019). All research practices were carried out in accordance with the regulations determined by the CREC. At all times, ethical concerns including ensuring confidentiality, obtaining informed consent, and preserving anonymity were adhered to. Informed consent to participate was granted by each participant.

Results

The results are presented according to the dimensions of the WHO Coverage Cube (Fig. 1) along with other key oral health system characteristics and include both documentary and interview findings triangulated.

Breadth of coverage: who is covered?

This analysis found two general categories with respect to the 'breadth' of oral healthcare coverage: those with 'universal' approaches and those 'targeting' specific age groups (Table 2). In all the included countries children are legally defined as those under the age of 18. A universal model was found in Denmark, Germany, Scotland, and Hungary where all children under the age of 18 are eligible for oral healthcare [24, 30, 48, 49]. While in Ireland and Spain, 'targeted' systems operate where children of specific ages are 'targeted' for emergency and routine oral healthcare, which is strongly dependant on resource availability and/or where a child lives [19, 27, 29].

There are a range of differences within and between the 'universal' and 'targeted' approaches. In Denmark, the tax-funded health system operates across three administrative and political levels: the state (holding overall regulatory supervisory responsibility), the regions (responsible for hospital and general practitioner-based care) and the 98 municipalities (responsible for primary care services including child and youth dental care) [26]. Oral healthcare for children is the responsibility of each 'municipality' and access to free preventive and curative oral healthcare is a legal obligation [48]. A distinction is required in the case of adults in Denmark where there is no 'free' dental care, rather a system of subsidies operates prioritising prevention and basic oral healthcare [26].

The 'municipality population register' is a database from which 99% of children are automatically enrolled in the Public Dental System. This is used to monitor the regularity of dental visits, with repeated absences from dental care reported to social services [50–52]. As described by an interviewee:

> *'You can say that 99% of children are actually born into the programme…it's not something that you have to seek, it is automatic…if the children don't show up, then municipalities are obligated by law to seek you.' (P3)*

Table 2 Overview of eligibility criteria for publicly funded dental care for children

Country	Eligibility criteria
Denmark	Universal population Age: All children and young people under the age of 22 via the 'Public Dental System' automatically enrolled at birth
Germany	Universal population Age: All children under the age of 18, increasing to age 23 if they are not working and age 25 if a student Insurance status: membership of 'sickness fund' enables access to SHI accredited dentists (99% of all dentists)
Scotland	Universal population Age: All children and young people under the age of 26 are eligible to receive oral healthcare Insurance status: Oral healthcare delivered via 'NHS' dentists (86% of all dentists)
Hungary	Universal population Age: All children under the age of 18 Insurance status: Oral healthcare delivered via private practitioners in contract with NEAK (31% of dentists opt into this scheme)
Ireland	Targeted population Age: Children under age 16 eligible for 'emergency' care only. 'Comprehensive' care targeted at children aged 5, 8, and 12 via a 'Public Dental Service' Location: Access varies due to resource and personnel shortages across different parts of the country
Spain	Targeted population Age: Most programmes target children aged between 6–7 and 14 and 15 years old Location: Eligibility is dependent on, and varies according to, the location in which a child lives and the target age category in operation in the individual region

In interpreting these data, it should be noted that there are a range of auxiliary oral healthcare professionals engaged in the delivery of oral healthcare for children varying in density, training and scope of practice. For example, in Spain there is no official registry of dental hygienists while in Germany there are low numbers of hygienists but instead dental assistants with additional training. Contrastingly there is mandatory professional registration of dental hygienists in the remaining four countries (Denmark, Scotland, Ireland and Hungary) who operate to varying degrees within the system

In Germany and Scotland, all children under the age of 18 and young adults up to the age of 25 and 26-years-old respectively, are eligible to receive oral health care, free-of-charge, within their broad statutory health systems i.e., in Germany under Social Health Insurance (SHI) and under the National Health Service (NHS) in Scotland. In Germany, approximately 89% of the total population belonged to 96 state-approved 'sickness funds' under SHI in 2023, while those not entitled to sickness fund membership must join private health insurance companies [53]. Membership of such a fund reimburses legally prescribed packages of care and most dentists (99%) opt in to have a contract with the SHI, resulting in 80% of 3- to 17-year-olds having at least one annual check-up [54, 55]. In 2019, the Joint Federal Committee (G-BA) largely implemented the so-called *'ECC-concept of the dental profession for dental prevention'* increasing the number of dental check-ups within SHI for very young children [56]. This expansion in population coverage was described by an interviewee:

> *'We had a big problem with early childhood caries, this gap is now closed in the social insurance system, we can do early detections from 6 months old, and we are satisfied with the offers available' (P1)*

Analysis of documents for Scotland, shows that in 2022, 86% of independent dentists had a contract with the NHS with over 65% of children receiving an examination from an NHS dentist in the last two years [57, 58]. Furthermore, it is envisioned that every child under the age of 18 in Scotland will have access to the *'Childsmile'* programme [59, 60]. 'Lifetime' registration with dentists has been in place in Scotland since 2010 [58] and was a key underlying aim in engaging all children as explained by an interviewee:

> *'We wanted to make sure that every single child could be registered with a dentist, and they had a growing relationship with that dentist' (P2).*

In Hungary, according to the *National Health Insurance Fund Manager (NEAK)*, 'complete basic and specialist dental care' is available free of charge to all those under the age of 18 [61]. Between 2016–2019, according to 'individual level care data' from the NEAK, 20% of 3-year-olds, 55–60% of 5–6-year-olds and 75–80% of 9-year-olds attend the dentist annually [30]. However, oral healthcare in Hungary is undergoing 'significant change'. The proportion of dental clinics operated by the state has fallen under 10% with almost 90% of oral healthcare provided by independent dental practitioners in private practice settings. Within this cohort there are dental practices that provide publicly funded oral healthcare whereby dental practitioners enter a contractual arrangement with the state (NEAK practices) and those practices which are fully private, where the patient pays 'out-of-pocket' [62]. In contrast to the other 'universal' systems in this research, most Hungarian dental practices are privately funded, and in 2022 almost 70% of dentists did not

have a contract with the NEAK [63]. As evidenced from the documentary analysis, 'it appears that, although by legal definition children under the age of 18 are universally entitled to dental care… in practice this is not implemented', with children aged 0–3 highlighted as a group for which care does 'not systematically exist' [30]. This finding was further emphasised during interviews with one interviewee stating: *'All children under 18…it sounds great but…is it…real or not?' (P14)* and another: *'The dental care system for children is very simple…all children under 18 [are covered] but accessing it, that is the problem (P11)'.*

As mentioned, Ireland and Spain are examples of 'targeted' models. In Ireland, all children under the age of 16 are eligible for emergency dental care, with 'comprehensive' care aimed at 'three designated classes in primary and secondary schools', generally corresponding to children aged 5, 8 and 12 years old [27, 64]. The basis of the current Irish system emerged from a rationing mechanism in the late 1980s implemented in response to economic constraints, where resources were directed at targeting the age ranges associated with the eruption of permanent teeth [65, 66]. This was elaborated on by an interviewee:

> *'The targeted approach wasn't going to help every individual child, but you don't have the resources for spreading out to the whole population, so you were trying to…spend what resources you had…to improve the overall standard of oral health' (P12) and another: 'It was based on the evidence of the time…if we were revisiting it today, we would do it differently' (P10).*

However, as seen in Hungary, there is also evidence in the Irish context that the intention to target children at three intervals was not fully implemented, with children struggling to access care [19, 67, 68]. Documentary evidence highlighted that due to resource limitations children's appointments are delayed or deferred with 100,000 children awaiting an appointment with the public dental system in 2023 [69]. While in some cases children are being targeted at one age only, typically around the age of 12 [69, 70]. This finding was reinforced by an interviewee: *'The whole thing [system] got reduced to one class, two classes if you were lucky, depending on the amount of staff that were available…it can be different in every region' (P12)* with the exclusion of young children particularly emphasised by a different participant: *'I have felt for a long time that we should be seeing children at a much younger age' (P10).*

For Irish adults, publicly funded oral healthcare is delivered by independent dental practitioners who have entered a contract with the state, via two publicly funded dental schemes, a dental treatment services scheme (DTSS scheme) wherein adults, mainly of lower incomes, are eligible for basic and emergency dental care annually. While the other (a Dental Treatment Benefit Scheme) entitles those with sufficient social insurance contributions to an annual dental examination and scale and polish [19, 71]. The documentary evidence found that 61% of Irish children do not access dental care before six years of age, with fewer than one in ten children accessing care between the ages of one and three. In most instances the use of services is symptom led, where parents accessed care on an emergency basis [27, 72]. This age-inequality was considered by the following comment from an interviewee: *'The Irish state is willing to pay for an annual examination for all adults [eligible for publicly funded dental care] but not for all children' (P10).*

In 2019, a new national oral health policy for Ireland called 'Smile agus Sláinte' was published seeking to expand dental coverage for children [27]. At the time of writing a 'Strategic Reform Lead' for policy implementation and a 'Policy Implementation Unit' have been established with plans to develop an implementation strategy in 2024. However, the Health Service Executive (HSE) the national government agency tasked with that reform has warned of 'challenges to implementation' citing concerns such as the recruitment pause for healthcare staff [73].

Similarly in Spain, children aged less than six years old were identified as a 'vulnerable' group largely excluded from a publicly funded dental system which has been described as 'chaotic' and lacking in organised structure [74]. In the Spanish system, for adults there is an 'absence of basic dental coverage' while coverage of dental care for children is dependent not only on the age of the child but the region of residence, resulting in notable disparities observed throughout Spain [29, 74]. This inequality was discussed by an interviewee: *'There are a lot of differences between each region…some offer treatments some didn't… if your childhood was in somewhere like Valencia, you had different dental care than a child in Murcia' (P13).*

These disparities in coverage stem from the broader structure of the health system, wherein each of the 17 regions have their own regional health system and health ministry, thereby retaining primary jurisdiction over the delivery of services [29]. This was further expanded on by an interviewee: *'We are 17 regions, and each region can develop healthcare differently, there are a lot of similarities but also differences' (P9).* Most oral health programmes target children aged between 6-and-7 years up to 14- and-15-years-old. Only Valencia, Catalonia and the Canary Islands include provision for children aged less than six years old. While in Murcia, children remain eligible for the oral health program only until age-9. Similar to Ireland, evidence from the documentary

analysis found that only 11.7% of children aged 0–4 had visited the dentist, increasing to over 69% for those aged between 5 and 14, which correlates to the availability of public dental services [75].

As observed in Germany and Ireland, there is an increasing recognition in Spain of the need to address inequalities concerning young children who are excluded from coverage. In 2022, the Spanish Government announced a plan to 'homogenise' oral healthcare services nationally to guarantee equity in access regardless of place of residence [76]. This initiative was referenced by a local expert familiar with the development of the policy:

> *'It is from the birth to 6…it comes from the National Government from Madrid, from the Ministry… and it is inside the regulation to expand primary care services' (P13).*

Scope of coverage: which dental services are covered?

The second aspect of the WHO Coverage Cube, the 'scope', illustrates what dental services are provided within the publicly funded system and an overview of all countries included in this analysis is provided in Table 3.

Each country commits to a minimum scope of public dental services for children in terms of basic care including the provision of emergency treatment, fillings in permanent teeth and dental extractions. This research found a broad, comprehensive range of services is provided by each 'universal' system (i.e. Denmark, Germany, Scotland, and Hungary) where almost all treatments including referral for specialist care are included (Table 3). This coverage was described by a German interviewee:

> *'In general, every normal care, prevention, restorative, endodontic, and so on, that's all covered by the insurances…there is very broad coverage'P4.* Similarly, a Hungarian expert described the scope of services covered in Hungary: 'Prevention, emergency, fillings in primary and secondary dentition, fissure sealing, trauma…every treatment is free' P11.

Evidence from both the documents and interviews found that in the targeted systems (i.e. Ireland and Spain) there was a priority attributed to the management of permanent over deciduous teeth. In the Irish system, except for emergency dental care, there is no publicly funded dental care for children under the age of five, while the vast majority of 'comprehensive care' is concentrated in targeted groups [27, 64]. This system, based on policy guidance from 1994 [64] was described by an interviewee: *'We had such an emphasis on permanent teeth over deciduous teeth and that became a mantra' (P10).* While in the Spanish system a 'portfolio of common services' were specified by 'Royal Decree' with certain treatments including 'restorative treatment of the temporary dentition' and orthodontic treatment, excluded from the basic package of care [77].

Access to publicly funded orthodontic care in the systems of the other included countries is restricted to those deemed of greatest clinical need. For example, in Denmark those with 'moderate or major malocclusions' are referred for an assessment by an orthodontist [48]

Table 3 Overview of the scope of public dental coverage for eligible children

Comprehensive services										Specialist care	
Country	Basic services										
	Preventive services			Emergency Care	Deciduous Tooth Tx[2]	Permanent Fillings	Extraction	Endo[3]		Ortho[4]	Other
	Scheduled Exam	Fluoride	Oral Health Promotion								
Denmark	✓	✓	✓	✓	✓	✓	✓	✓		✓ *	✓
Germany	✓	✓	✓	✓	✓	✓	✓	✓		✓ *	✓
Scotland	✓	✓	✓	✓	✓	✓	✓	✓		✓ *	✓
Hungary	✓	✓	✓	✓	✓	✓	✓	✓		✓ *	✓
Ireland	T	T*	T *	✓ [1]	T*	T*	T*	T *		T *	T *
Spain	T	T	T *	T *	-	T	T	T*		-	T *

Overview of eligibility criteria for publicly funded dental care for children

✓ = Treatment covered,— = not covered, * = covered but with restrictions or limitations, T = targeted population

[1] All children under the age of 16 are eligible for emergency care in Ireland not just the targeted population

[2] Deciduous tooth treatment

[3] Endodontic treatment

[4] Orthodontic treatment

while in Germany the need for treatment is based on five orthodontic indication groups according to clinical severity (Kieferorthopädische Indikationsgruppen, KIG) [78] with similar systems of classification in practice in Scotland and Ireland (i.e. the Modified Index of Orthodontic Treatment Need-IOTN). In Hungary, patients are required to contribute to the cost of the orthodontic appliance, but the clinical work is provided free of charge [61].

A key difference across countries, was the scope of preventive care available and the importance attributed to preventive oral healthcare. In Denmark and Scotland, prevention occupies a central role in children's oral healthcare. Over half a century ago Denmark had some of the poorest levels of child oral health in Europe and in response the 'Danish Oral Healthcare Act' was enacted, legally mandating the provision of preventive care. This yielded significant increases in the availability of preventive services and a subsequent improvement in oral health [79]. This was reflected upon by a Danish expert: *'The whole culture of prevention has been very successful…we had pioneers in oral health research, we knew the importance of fluoride and non-operative treatment…we implemented this knowledge very early, and it became so much integrated in our system' (P3).*

Similarly in Scotland, Childsmile, a multi-faceted programme delivering prevention in dental practice, in community and in education settings was established in 2005 with the aim of improving children's oral health and reducing inequalities [59]. There was a 'major' improvement in oral health following the introduction of Childsmile, with a 2013 study finding a direct association between the introduction of supervised toothbrushing and a reduction in dental decay in 5-year-olds [80]. This component of the programme was strongly emphasised as the critical element of Childsmile success by local experts: *'Childsmile getting out of dental practice and going into educational settings… that's the key message…a lot of people want to hear about fluoride varnish and it's like hold on a minute, the toothbrushing, that's where the action is.' (P8).*

In contrast, evidence from the other countries highlighted concerns with respect to the emphasis placed on treatment in comparison to prevention (Table 4). The recent expansion of coverage for preventive care for very young children in the German system was highlighted as an important step with respect to an increased emphasis on prevention [56]. This was reinforced by an interviewee: *'The German system is still very much focused on restorative dentistry and especially prosthetics, which has traditionally been very big in Germany. But there is now a focus on prevention, the numbers sealants, varnish etc. placed go into the millions' (P4).* While similar changes were sought by a Hungarian expert: *'We have to change the complete system in Hungary instead of focusing on treatment we have to focus on prevention…we need less paediatric dentistry [coverage] but more effective' P11.*

In targeted systems like Ireland and Spain, preventive interventions are primarily focused on specific age groups. These interventions are supplemented by community water fluoridation (CWF), serving as a population-wide preventive measure. In Ireland, CWF covers 71% of the population, while in Spain, it extends to only 10% [29, 72]. Findings from both the documents and interviews observed disparities within the Irish system concerning the placement of fissure sealants, the cornerstone of preventive strategy with academics and policymakers highlighting the social and geographic inequalities involved [27, 86]. This was echoed by an interviewee: *'It was a structure acceptable for its time but there was inequity…the inequity is now worse' (P12).* Similarly in Spain evidence points to a limited availability of preventive care and a social gradient evident in the use of those services which are covered [75]. This was discussed by a Spanish expert: *'Service data show the percent of prevention is very low…it is coming from a philosophical perspective…prevention is still not in the mind of all dentists' (P9).*

Irrespective of the country or system in question a unanimous finding from all participants in this research was a need for broadening the scope of preventive care and reorientating systems to ensure prevention is central at a system level but also at a professional and patient level. This was reflected on by an Irish expert: *'We need a system that explains things to parents…integral within the general health system…with an income for professionals that acknowledges that they must do prevention' (P12).* And a Danish expert: *'It's like the thinking of 'the end justifies the means'…we still scare the hell out of children having to get a filling at a young age…we need to help them in other ways and not focus on treatment at any cost' (P5).*

Depth: How much of the costs are covered?

Across the six countries the depth of coverage for eligible children ranges from predominantly deep coverage (i.e. the public programme covers most costs) to shallow coverage (i.e. the public programme covers limited costs). In the event of the public programme not covering costs then the patient must pay for dental care 'privately' which mainly equates to direct out-of-pocket payments or seeking reimbursement through dental health insurance for those who are privately insured. An overview of general, public, and out-of-pocket spending across all included countries along with other financing information is provided in Table 5.

Table 4 Role of prevention in the child oral healthcare system

Country	Approach	Legislation	Reform	Financing arrangement
Denmark[1]	-Individual prevention eligibility: Universal child population. -General prevention programmes including oral health promotion activities.	The Health Act and Dental Care Order (2023)[1]	1972: Child Oral Health Act introduced free prevention 1989: Expanded to those aged 3–18 years 1997: Included all children 2022: Increased to age 22	Publicly funded service with most care provided by salaried dentists in state-owned clinics.
Germany[2]	-Individual prevention (IP) eligibility: Universal child population. -'Group prophylaxis' (oral health promotion, fluoride applicaton, screening in schools).	Social Code (SGB) Fifth Book (V) §22[2]	1989: IP for children in SHI (12–20 years) 1991: IP expanded to those aged 6 1997–2000: IP for all children 2019: Increased package of care up to 33 months of age	Publicly funded service with most care provided by independent dental practitioners contracted by the state and reimbursed via a fee-for-service (FFS) basis.
Scotland[3]	-Individual prevention eligibility: Universal child population -Childsmile: Universal[3] Targeted (high risk population receive additional resources).	The National Health Service (General Dental Services) (Scotland) Regulations 2010[3]	2005: Action plan for improving oral health 2006–2008: Childsmile 'Demonstration phase' 2011: Childsmile nationally available and incorporated into SDR 2022: Childsmile expansion funding 2023: New SDR (payment reform)	Publicly funded service, with most care provided by independent dental practitioners contracted by the state. Dentists are reimbursed via FFS, capitation and via other grants/allowances.
Hungary[4]	-Individual prevention eligibility: Universal population -'Group preventive counselling' and school preventive services.	CXXIII of 2015 law on primary health care	Decline in the number of dentists participating in public contracts from 1995 onwards.	Prevention in theory is provided by independent dentists under a predominantly performance-based FFS model. Owing to the decline in dentist participation this eligibility does not equate to accessibility.
Ireland[5]	-Individual prevention eligibility: targeted ages. -Community Water Fluoridation (CWF) (71% of the whole population).	S.I. No. 248/2000—Health (Dental Services For Children) Regulations, 2000. The Health (Fluoridation of Water Supplies) Act, 1960.	1994: national action plan targeting eruption of permanent teeth 2010: economic crisis reduced service availability 2019: national oral health policy proposing expanded preventive care	Publicly funded prevention provided by salaried dentists in state-owned facilities to targeted ages only Community Water Fluoridation (CWF) is also state-funded. Outside of these state-funded services, individuals must cover the full cost of preventive services provided by independent dentists.
Spain[6]	-Individual prevention eligibility: targeted population based on age and/or region. -'PADI' system in operation in 10 out of 17 ACs.	Royal Decree of 15 September 2006 (1030/2006)	1989: PADI first introduced in Basque country 2003–2005: PADI adopted in 6 other regions 2008: Economic crisis halted reforms 2018: PADI adopted in Madrid 2022: Proposal for increased 'homogenised' preventive care across Spain for young children	Publicly funded care varies according to region (AC) and restricted to targeted ages. There is also variation in provider payment between contracted independent dentists largely remunerated by capitation, salaried models and so called 'mixed models'.

1 Municipal dental care. Ministry of the Interior and Health, 2023 [48]

2 Social Code (SGB) Fifth Book (V) [81]

3 It is anticipated that all children under the age of 18 in Scotland will have access to Childsmile. However, since the COVID-19 pandemic, there has been a reduction in Childsmile nursery availability and patient participation. NHS, GDS (Scotland) Regulations 2010 [82]. SDR: Statement of Dental Renumeration

4 CXXIII of 2015 law on primary health care [83]. Almost 70% of dental practices in Hungary are fully private practices and do not offer publicly funded preventive care. While with respect to the school screening programme there are geographic and social inequalities in its operation [30]

5 Houses of the Oireachtas, 2000 [84]. The primary component child preventive care is the application of fissure sealants at targeted ages which following the COVID-19 pandemic and economic crisis is suffering from limited resources nationally

6 Royal Decree. Annual report on the development of Decree 118/90 on dental care for children in the Basque Country. 2022 [85]. The priority attributed to prevention varies extensively and is entirely dependent on where a child lives and their target age group

Table 5 Financing details of six European publicly funded oral healthcare systems for children

Financing information								
Country	**Funding model**	**Children's oral health cover**	**Public spending on general healthcare (WHOLE population) (OECD, 2023 or nearest year)**	**Public spending on oral healthcare (WHOLE population) (OECD, 2023 or nearest year)**	**O–O-P as % of total oral healthcare spending (WHOLE population)**	**Annual cost***	**Estimated* spend pp covered**	**Provider payment mechanism**
Denmark[1]	TF	Universal	85%	35%	72% (HiT,2019)	€273m[1] (Aged 0–22 years)	€196[1]	Majority salaried dental practitioners employed in state owned facilities
Germany[2]	SHI	Universal	86%	67%	25% (HiT, 2019)	€16b[2] (Total population)	€183[2]	Majority independent dental practitioners contracted by the state to provide care on a FFS basis
Scotland[3]	TF	Universal	83% (UK)	41% (UK)	20%[e] ('Private' Scotland SHeS 2019/21)	€549 m (Total population)	€89[3]	Majority independent dental practitioners contracted by the state through FFS, capitation and allowances
Hungary[4]	SHI	Universal	73%	34%	54% (HiT, 2019)	n/a	n/a	Majority independent practitioners via performance-based FFS
Ireland[5]	TF	Targeted	77%	23%[e]	77%[5] (National Statistics)	€70m[5] (Children only 2018)	€66[5]	Salaried dental practitioners directly employed by the state
Spain[6]	TF	Targeted	72%	2%	98% (National statistics)	€5 m[6] (children one region,)	€43[6] (children one region)	Majority independent practitioners but variation throughoutwithsalaried and 'mixed' systems also in operation

1 Sources: HiT: Oral health care in Europe. Financing, access, and provision. 2022 [26]. 1 'Government Finances', Statistics Denmark personal communication. 2022. Calculated based on total population under age 22. Population source: Statistic Denmark. 2 Sources HiT: Oral health care in Europe. Financing, access, and provision. 2022 [26]. Total figure for all SHI spending excl. dentures. Source: KZBV. Estimated spend over total population. Cost pp is total estimated across all SHI enrolees excluding dentures as best approximation to children (2023). 3 Source: Public Health Scotland. Based on population children under age 18 in 2019. Population source: National Records of Scotland. Note: Total budget for dental care in Scotland in 2023/24 is €549 m.OOP estimate (e) based on Scottish Health Survey 'private treatment' response. 4 In Hungary OOP as a % of total dental spending is 54% in 2019. Source: HiT: Oral health care in Europe. Financing, access, and provision. 2022 [26]. 5 *Source: Central Statistics Office Ireland (2020). Estimated cost based on total population under age 16 in Ireland. Population source: Central Statistics Office. Cost €70 m in 2018. Source: Houses of the Oireachtas written statement 2018 [87] and ESRI 2019. Special needs populations not included in cost calculations but are estimated represent 5% of service activity [71]. 6 Figures based on PADI programme in The Basque Country. Source: Annual report on the development of the Decree 118/90 on dental care for children in the Basque Country. 2022 [85]

TF Tax funded, SHI Social health insurance, Salaried Dentists directly employed delivering care

* Estimated cost based on rough calculation using total population figures

The universal systems (i.e. Denmark, Germany, Scotland, and Hungary) are generally characterised by deep coverage for children, almost all care is publicly funded and available "free of charge" to the patient. As evident in previous comparisons there are distinctions required in the case of Hungary where there is a single health

insurance fund that provides almost universal population health coverage (95%) [88]. The introduction of a new health insurance system in 1992 resulted in a reduction in the coverage for dental services and an increased emphasis on 'personal responsibility'. Dental services are not fully covered under statutory benefits and fees for services not covered must be reimbursed out-of-pocket [26, 88]. Although 'all care' is free of charge for those under the age of 18, the extent to which children have access to publicly funded oral healthcare is determined by the capacity of dentists who are prepared to provide it [30]. This was emphasised by a local expert: *'The treatment is completely free, but the work is not popular, and we don't have enough paediatric dentists' p11.* There are no data available on out-of-pocket spending for children's dental care in Hungary. However, evidence suggests that privately funded provision is dominant with over 60% of dental care costs across the whole population privately funded [26].

In contrast, the other universal systems (i.e. Denmark, Scotland, and Germany) represent deep coverage with minimal out-of-pocket spending. In Denmark, 'child and youth' oral healthcare is fully funded at the municipality level at a cost of €273 m annually.[4] This includes all direct costs (including salary and pension contributions) along with indirect costs (including labour and equipment costs) funded by general taxation [48]. Oral healthcare for children is offered at public clinics by salaried practitioners, by independent dentists who have entered an agreement with the municipality or by a combination of both approaches [89]. More than 91 out of the 98 municipalities employed their own dentists in state owned practices in 2015. Once young adults reach the age of 22, they are directed to the process of securing a private, independent dentist where they may receive subsidised care that can vary from 35–62% depending on the patients age and treatment [26]. The impact of the salaried structure on the provision of child oral healthcare was discussed by a local expert: *'The subject of dentistry is the focus…not having to deal with who pays for what, but when the child gets to the clinic…it is the child who is in focus, and anyone can afford to get the treatment' P5.*

In Germany (SHI) and Scotland (NHS), children are exempt from all user charges except for orthodontic treatment outside of qualification criteria and more advanced restorative care [24, 49]. Within the SHI, payment for services is on a fee-for-service basis while in Scotland in addition to submitting itemised treatment claims for payment, dentists can also receive a range of other payments, allowances and grants including capitation payments for continuity of care [90, 91]. Many Scottish dental practitioners can provide a mixture of NHS and private (out-of-pocket) treatment. While treatment costs are free for some children and young adults under 26, other adults availing of 'NHS' services pay 80% of the cost of care which is capped at £384 for a course of treatment [91].

The significant public expenditure on dental care in Germany as seen in Table 5, was highlighted across both strands of this research. According to documents from the KZBV (National Association of SHI Dentists) in 2021 over €16.3b was spent on dental care across the population. This was discussed by a German expert: *'We have very high costs…and that is across all healthcare, dentistry is only a small part of the expenditure.'* In Scotland, the budget for oral healthcare for 2023/4 is just over £476 million [91]. While findings from the Scottish Health Survey report indicated that with respect to dental expenditure across the population, 75% of participants had NHS treatment, with 20% of people paying out-of-pocket for dental care [92].

When considering the depth of coverage, a finding common across all the universal systems were concerns about the financial sustainability of those systems into the future and maintaining political support to uphold the current depth of coverage. This was referenced by a German expert: *'I hope that we will hold what we have now' (p1)* and repeated by a Scottish expert: *'We need to hold the level that we have' (p2)* and another, emphasising a potential increase in private-only provision of dental care particularly following the COVID-19 pandemic in Scotland: *'There has been anecdotal evidence of dentists ceasing to carry out NHS work' (p8).*

With respect to the targeted systems (i.e. Ireland and Spain), most oral healthcare services are not covered by the public system and are instead primarily financed through private means across the population. In Ireland, the Public Dental System for children is entirely publicly funded and run by the HSE. This is the only state funded dental care for children and due to its targeted structure, there are significant gaps in coverage resulting in high out-of-pocket payments [27, 28]. According to the Healthy Ireland Survey 2022, over 58% of dental visits by children were paid for by their parents own funds [93]. While national statistics figures show that 77% of dental care was privately funded across the population in 2018 with research finding that out-of-pocket dental costs in Ireland cause financial hardship [28, 68, 94].

Similarly in Spain according to the National Health Accounts System, total spending on dental care in 2020 was 3.7 billion Euros, of which 98.2% was private spending [95]. This is in direct contrast to universal general healthcare in Spain which is largely free at the point of delivery. This represents a key gap in healthcare coverage

[4] Data based on personal communication from 'Government Finances', Statistics Denmark.

and originates from a long-standing tradition of purchasing dental care privately [29, 96]. This was discussed by a Spanish expert: *'Most of the dental treatments in Spain you have to pay from your own pocket, we just don't have public health dentistry…in the general population they don't even know that there is a public dental office' (P13).*

The inequalities that emerge due to large out-of-pocket expenditures were highlighted by participants from Ireland and Spain: *'The percentages might shift from decade to decade but broadly speaking the socio-economic gradient still applies to children's dental disease, poorer people have more disease than better-off people'(P10).* However, tackling inequalities was also a dominant theme across those representing universal systems with the model of oral healthcare system under consideration. This was referenced by a Danish participant: *'The ones who can navigate the system are the ones who don't need it, the socially disadvantaged are the ones who get forgotten in a more economically pressured system' (P5).*

While there were differing opinions with respect to the benefits of a salaried versus a fee-for-service model of payment, there was consensus that an optimal approach involves a combination of both elements. With respect to a salaried payment model a Spanish expert considered: *'There is a risk when you pay for treatment, of over treatment…the salaried system is better because there is no money between the patient and the professional…. especially if you are trying to get people to pay for prevention' (P13).*

The benefits of fee-for-service were considered by a German expert: *'There are pluses and minuses…it is very hard to make care profitable in paediatric practice you need to be very intense…that may drive incentives to do stuff you wouldn't have done otherwise…on the other hand in a salaried system you could end up with underperformance' (P4).* A neutral participant reflected on a combination of both models and highlighted the need for protection for vulnerable groups: *'There is a lot that you can do once it is monitored, and fee-for-service… it is more cost-effective however there is always going to be a group of society that need more time and a safety net…I think a mixture is the optimal'(P7).* While common across most participants was the need for oral health to continue to strive for integration within the general health system: *'At the minute the only ones who care about teeth are the dentists, the general system needs to do more, but dentists are so isolated and its partly their own fault…things are at a tipping point' (P7).*

Reform

A significant finding from this research was the varying successes of different systems in implementing reforms, particularly in expanding coverage for preventive measures. An overview of key milestones is presented in Fig. 2.

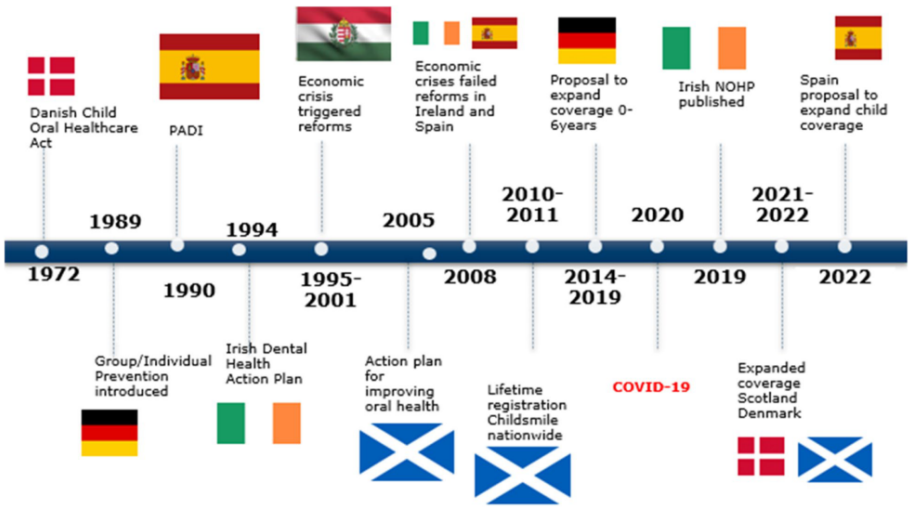


Fig. 2 Milestones- Oral Health System Reforms in Europe

In most universal systems (i.e. Denmark, Germany, and Scotland) the observed trend is one of expanded coverage with broader eligibility for children and an increased emphasis on preventive oral healthcare operating in well-regulated systems. Common factors that facilitated those successful reforms included: political will, engagement with the dental profession and academic collaboration supporting data and evidence.

In Scotland, the Childsmile programme has benefitted from 'strong and successive' government support across three different political administrations since 2005 with funding for Childsmile expansion again announced in 2022 [97]. This political engagement was considered by a local expert where the 'crisis' unfolding with respect to children's oral health was harnessed to engage politicians: *'It was almost by stealth…very slowly creeping oral health on the agenda…using crisis to our advantage and building up a critical mass of successful piloting that it became the norm and using skilled diplomacy' (P2).*

A critical element in the engagement of politicians was the ability of oral health advocates to lobby with high quality data to communicate the problem of oral disease in the child population. This was reflected on by a Scottish participant: *'People don't really understand dentistry or see the value of prevention and the programme could be threatened…one of the most valuable things in sustaining it was the academics showing both a beneficial health outcome and a cost benefit' (P2).* This was echoed by a German participant reflecting on the successful expansion of care for young children in 2019: *'They [politicians] don't really have an interest, so we had a lot of data, facts, and evidence to convince the politicians' (P1).* While in Denmark participants referenced the importance of data in terms of the establishment of the SCOR monitoring system [51] but also stemming from the collaboration between oral health research and dentists: *'The dental schools supported the municipalities the whole culture was shared knowledge' (P3).*

A common finding across countries was the importance of engaging the dental profession in proposed system reform and appealing to the profession from both a financial perspective and in the interests of their patients. This was surmised by a non-aligned participant: *'You need to attract the dentists to work in the service…the only way we can get them…is to put on another layer of attractiveness-additional funding' (P7)* and a Scottish participant: *'You need buy in…you need to meet them…just keep focusing on the patient outcomes' (P2).*

In contrast, there is evidence of a failure to implement existing oral health policies and expand oral health care coverage in recent years, most notable in countries worst affected by the 2008 financial crisis [19, 29]. An absence of political priority and a failure to engage the dental profession were identified as impediments to implementing successful reform by an Irish expert: *'I haven't seen any politician in the last 30 years trying to make dentistry included…unfortunately I don't see the political interest…and engaging the dental profession has to be a core part of delivering on any policy' (P10).* While the failure to update legislation and a regulatory basis for the dental profession were strongly highlighted by both Irish and Hungarian interviewees: *'We don't do anything about quality control and quality assurance…nobody checks is it true, is it good, is it real? (P11)'* and by an Irish expert referencing the failure to reform Irish legislation since 1985 stating: *'The legislation should be there to protect the public and it is inadequate. (P10)'.*

An overview of each child oral healthcare system in the six representative European countries is provided in Table 6.

Discussion

Two broad models of childhood oral health coverage are evident in this research: those systems adopting 'universal' approaches and those restricting coverage by 'targeting' children by age and/or location. However, there are significant nuances within and between these types with Hungary proving the exception in all types of categorisations. Healthcare 'targeting', or rationing refers to the allocation of scarce resources among a patient population [100]. International literature suggests that rising costs and demands on healthcare systems place 'significant pressure' on decision-makers to identify the most appropriate policies for allocating increasingly scarce healthcare resources.

However, critical to that process is in addition to ensuring resources are distributed in a cost-effective manner, they must be done so equitably [100]. Equity concerns arise not only in the absence of oral healthcare coverage but also where 'one part of the population has greater dental coverage than another' [101]. This was seen in both 'targeted' models: where in Ireland, all eligible adults are entitled to an annual dental examination, but children are not [27]; while in Spain the eligibility of children of the same age to care is dependent on their geographical location [29].

In the absence of universal coverage, oral healthcare must be paid for via cost-sharing, private health insurance or via out-of-pocket payments, thus increasing the role of 'private' dentistry within the system [26, 28]. In Ireland, over two thirds of children's care was reported to be privately financed, while in Spain 98% of all dental expenditures is funded via private means [93, 95]. The Hungarian system, despite offering broad coverage, was also found to be dominated by private spending,

Table 6 An overview of child oral healthcare systems in six European countries

Child oral health system overview							
Country	**Dental Caries Prevalence (Most recent D_3MFT at age 12)**	**Coverage**	**Scope**	**Prevention**	**Proportion OOP oral health care***	**Provider payment mechanism**	**Coverage trends**
Denmark[1]	0.38 (2023)[1]	Universal	Comprehensive	Publicly funded	Low	Majority salaried	Expanded
Germany[2]	0.50 (2025)[2]	Universal	Comprehensive	Publicly funded	Low	Majority PP	Expanded
Scotland[3]	0.36 (2023)[3]	Universal	Comprehensive	Publicly funded	Low	Majority PP	Expanded
Hungary[4]	2.32* (2017)[4]	Universal*	Comprehensive	Majority private- (publicly funded, limited access)	High	Majority PP	Reduced
Ireland[5]	1.4/1.8* (2002)[5]	Targeted	Basic	Majority private	High	Salaried	Reduced
Spain[6]	0.58* (2020)[6]	Targeted	Basic	Majority private	High	Majority PP	Reduced

Sources: 1 Sundhedsstyrelsens Centrale Odontologiske Register (SCOR). 2 The Sixth German Oral Health Study (DMS6). Institute of German Dentists. Institut der Deutschen Zahnarzte. Rainer et al., 2025. 3 Public Health Scotland. National Dental Inspectorate Programme. 4 Szöke and Petersen 2020. *WHO pathfinder survey. *Universal coverage but not equating to univeral accessibility. 5 North South Survey of Childrens Oral Health in Ireland. 2002. Mean $D_{3vc}MFT$ for 12- year-olds was 1.4 for those in receipt of CWF and 1.8 for those without. This is the most recently available information with respect to DMFT in Ireland. According to Irelands national oral health policy in 2019: It is estimated that one in 10 children in Ireland (or up to approximately one in five children, depending on their socioeconomic status and their access to water fluoridation) has a disproportionate level of dental decay compared to their peers' [27]. 6 Enucesta de salud oral en Espana 2020 [98]. *Diagnostic criteria used based on WHO 4th edition (1997) which considers caries to be an unmistakeable cavity [99]

* Proportion out-of-pocket spending categorised as low (0–20%), medium (20–50%) or high (> 50%)

Salaried = salaried dental practitioners directly employed by the state, PP = independent (non-salaried) dental practitioners contracted by the state to provide care via fee-for-service, capitation or other means

emphasising that universal eligibility does not equate to universal accessibility [26, 30].

High out-of-pocket payments have been shown to lead to inequalities in children's access to oral healthcare [1, 6, 102]. This research also found access based on ability to pay rather than need [28, 30, 75]. In contrast, broader oral health coverage has been shown to positively influence the use of services [103–105]. More comprehensive coverage was found via SHI in Germany and the NHS in Scotland, while the traditionally high level of subsidies common to Scandinavian welfare systems, was also seen pertaining to Denmark [48, 54–58]. In our findings, these systems had lower levels of out-of-pocket spending on oral healthcare for children and higher rates of access.

The consequences of poor access to care particularly burdens children from lower socioeconomic groups, with evidence citing that although those groups may benefit most from universal oral healthcare coverage, they remain at a disproportionate risk of developing oral disease [1, 103]. Therefore, a 'more radical preventive approach' and a shift in the dominance of treatment focused systems to an emphasis on prevention is required [1, 6, 103, 106]. This is echoed in our analysis which emphasises the need to prioritise preventive oral healthcare and careful consideration of provider payment models for evidence-based preventive techniques, a strong and persistent finding throughout this research.

Preventive oral healthcare had varying levels of priority across the included countries. Except for Hungary, countries offering 'universal' accessibility were also the countries offering the broadest coverage of preventive care. In Denmark and Scotland prevention occupies a central role in children's oral healthcare following the emergence of the Danish Child Oral Health Act and 'Childsmile' respectively, while Germany recently expanded preventive care for young children [56, 79, 97].

Provider payment models for prevention varied across countries, ranging from salaried dental practitioners providing services in Denmark to predominantly independent private dental practitioners contracted by the state and reimbursement on a 'fee-for-service' or capitation basis across the remaining 'universal' countries. A consensus from this research was that a hybrid model of payment incorporating elements of 'fee-for-service', capitation and pay for performance elements, with a 'safety net' salaried component targeting those of high risk is preferable. This reinforces international findings suggesting a risk based, combination of payment methods, is effective in designing preventively focused payment systems [107].

This study highlights the role of dentists across the six representative countries, however further research is required in determining the impact of auxiliary oral healthcare professionals in the delivery of oral healthcare for children. Evidence from the international literature and from the World Health Organisation highlights the need for 'creative workforce development' in improving population oral health and in the delivery of oral disease prevention [31, 108]. In this research, the Childsmile programme was singled out across both strands of analysis,

in terms of its clinical and cost effectiveness as an exemplar of success in oral health prevention. However, in this programme not only do auxiliary oral healthcare professionals (OHPs) but non-dental professionals also play a significant role. 'Extended Duty Dental Nurses' provide tailored oral health advice to individual patients and place regular fluoride varnish applications. 'Dental Health Support Workers' are employed by NHS boards to liaise with families, health visiting teams, nurseries, schools and dental practices. While 'Childsmile coordinators' support dental teams resolving difficulties and in maintaining standards [109]. The impact of supervised toothbrushing delivered in nursery facilities led by these groups, was particularly singled out by 'elites' as critical to the overall success of 'Childsmile'. Contrastingly, within the 'targeted systems' concerns were raised by a Spanish 'elite' participant that prevention was not a central focus within the 'dentist' centric model of care.

Our findings also suggest that an engrained culture of prevention within a system, political support, and funding, combined with good data to advocate for its importance and monitor its success, have supported the implementation of evidence based preventive policies. Furthermore, common to those countries has been the ability to proactively seek both regulatory and system reform with a focus on the expansion of prevention and achieving that success through engagement of dental professionals, oral health research and political interest.

In contrast, countries where private provision of care is dominant offer little publicly funded preventive care, have also struggled to implement reform with limited political support and have been subject to significant funding reductions. Both Ireland and Spain faced severe impacts from the 2008 global financial crisis, leading to substantial cuts in oral healthcare budgets [28, 29, 71, 110]. Subsequent policy and reform efforts in both countries were unsuccessful, resulting in increased unmet oral healthcare needs and notable socioeconomic disparities, especially among children who experienced a significant reduction in the availability of care [19, 28, 29, 96].

Both the global financial crisis and the COVID-19 pandemic can each be classified as a health system 'shock', that is 'an unexpected occurrence…that has a large negative effect on the availability of health system resources or a large positive effect on the demand for health services' [111–113]. As evidenced in this research by experiences in Ireland and Spain, oral healthcare was particularly susceptible to coverage restrictions within the broader healthcare system post the economic crisis [28, 110]. While despite being classified as 'essential' healthcare during the COVID-19 pandemic, evidence shows that across many countries there was a 'widespread decline' in children's oral health status and access to oral healthcare [114, 115]. The vulnerability of oral health within the broader health system as highlighted by the impact on oral healthcare during such 'shocks' must be recognised by oral health policy 'champions' in advocating for the wider integration of oral health within general healthcare [2, 116].

This research finds that children's oral healthcare in Europe is currently at a 'tipping point'. Within 'universal' systems there is concern about the financial sustainability of broad baskets of coverage in the context of changing socioeconomic demographics. In Scotland, registration rates of children with the NHS have failed to recover following the COVID-19 pandemic with concerns that the substantial oral health improvements gained since the advent of 'Childsmile' may have 'stalled' [91]. While in Hungary there are concerns with respect to accountability and regulation, with calls to replace the 'out-dated' children's oral healthcare system [30]. In Ireland and Spain, new national oral health policies have been published, clearly recognising inequalities that are prevailing with respect to the targeted systems for children supported by proposals to expand the availability of preventive care in line with 'universal' general healthcare policy [27, 76].

The World Health Organisation has led the recent global recognition of the neglect of oral health from a policy and political perspective, and advocates for the integration of 'essential oral healthcare' in the 'Global strategy and action plan on oral health 2023–2030' [31]. However, the global literature highlights the challenge in defining what constitutes 'essential oral healthcare' [116]. This was further reinforced in this study by highlighting the variation in the breadth, depth and scope of oral health coverage across representative European countries. The gap between those countries with very limited or any coverage of basic oral healthcare for children, compared with those providing broad and deep coverage, highlights the difficulties in achieving consensus on the definition. Participants from universal systems highlighted concerns of financial sustainability particularly from a 'fee-for-service' perspective while 'targeted' systems have struggled to expand coverage and implement reform. It is evident that defining 'essential oral healthcare' will require differing approaches at an individual country level requiring consultation with the oral healthcare profession, policymakers and evidence-based assessment of potential expanded or refined benefit baskets based on resource availability, workforce capacity and political and societal acceptability [116, 117].

This renewed focus on the incorporation of oral health within UHC however must be harnessed by countries, most especially those operating in targeted systems, to

expand coverage and implement necessary reform [26, 116]. While, across all countries, advocacy for oral health must be sustained by engaged oral health professionals, using high quality data and information while maintaining an emphasis on oral disease prevention and the inequalities burdening lower socio-economic groups.

Limitations/strengths/potential contributions

The authors wish to recognise several limitations inherent in this research. It is important to highlight the weaknesses prevailing in the study data, particularly in the comparability of data between countries. There was wide variability in data availability and reporting mechanisms across differing countries which posed challenges for direct comparison. While the lack of standardised oral health system indicators at the European level further constrained overall assessment of oral healthcare systems performance. To ensure maximum transparency, this paper reports data with identified sources and the year reported. Beyond data weaknesses further challenges pertain to the applicability of study findings. The range of differing policy contexts, government structures and financing mechanisms along with cultural influences between countries mean that while these findings offer valuable insights, direct policy transferability may be limited. While this study highlights key policy trends and oral healthcare system differences causal relationships cannot be inferred. Further longitudinal research and country-specific case studies are necessary to determine the long-term implications of different models of oral healthcare coverage. A final point of consideration is that to satisfy the research aim, 'elite' actors operating in positions of influence within the oral healthcare system were recruited for interview. As a result, almost all ($n=13/14$) 'elites' included were dentists which may have limited consideration of the roles of other oral health professionals within the wider oral healthcare system which should be a priority for future research.

Despite these limitations this study represents an important addition to the discourse on oral health coverage for children in Europe. The key strength of this paper is the use of multiple data sources and the triangulation of that data to strengthen the study findings. While the use of the WHO cube and a verified data collection template guided data collection and analysis. Inter-country comparisons have proven challenging with respect to language barriers and a failure to appropriately contextualise information. To ensure country specific data was both representative and accurate, two ($n=2$) local country experts were recruited from each country to verify the accuracy of the data and to add context. There is limited knowledge on oral health coverage for children in Europe, an evidence gap which this in-depth multiple case study analysis serves to fill. In view of the data challenges highlighted, it is incumbent on the authors of this research to call for the development of comprehensive and systematic oral health system indicators. This information will be critical to monitor and compare oral health system performance into the future and in the identification of the most appropriate oral health system interventions and policies. While the variation in oral healthcare coverage across Europe highlighted points to the need for further research on what constitutes essential oral healthcare and where oral disease prevention, and upstream interventions feature in this domain.

Conclusion

Oral healthcare coverage for children varies across the European countries analysed from those adopting universal approaches to those 'targeting' specific groups, with the financial burden assumed by the individual in countries without universal coverage. Countries adopting universal approaches demonstrated greater access to services and a broader scope of preventive care. However, a key finding was the need to shift the focus from a treatment-dominated system to one centered on preventive care. Most universal systems have successfully implemented system and policy reform through high-quality data, collaboration with dental research, political engagement, and the support of the dental profession. However, the vulnerability of oral health within the wider health system is an ongoing challenge and is most evident during times of pressurised resources such as the economic crisis or the aftermath of the COVID-19 pandemic. To progress the implementation of UHC for oral health, consideration will be needed with respect to reducing inequity from those excluded from care, the development of quality information to support advocacy, placing an emphasis on oral disease prevention and integrating oral health within the broader health system.

Abbreviations

UHC	Universal Health Coverage
SHI	Social Health Insurance
NHS	National Health System
TF	Tax Funded
WHO	World Health Organisation
HSE	Health Service Executive
CWF	Community Water Fluoridation
OOP	Out of Pocket
SDR	Statement of Dental Renumeration
CSO	Central Statistics Office

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
All authors, UMA, SB, KE, MH, HW and JC contributed actively to this paper. The design of this study was developed by UMA, SB, and KE. UMA was responsible for data collection and analysis. Feedback on the analysis and the interpretation was received from all authors. UMA drafted the paper for submission and all authors approved the final version.

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Data availability
The final datasets generated and analysed are not publicly available to maintain the anonymity guaranteed to individual study participants, but individual country case studies based on the documentary analysis may be available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical approval for the study was granted from the Clinical Research Ethics Committee of the Cork Teaching Hospitals at University College Cork (Reference number: ECM 4 (J)12/11/2019). Ethical considerations including ensuring confidentiality, obtaining informed consent, and preserving anonymity were always adhered to. Informed consent to participate was granted by each participant.

Competing interests
The authors declare no competing interests.

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9.16Appendix P: Draft paper three

Assessing child oral health indicators of dental caries and workforce in six European countries: Denmark, Germany, Hungary, Ireland, Scotland, and Spain

[Accepted for publication- BMC Oral Health]

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Abstract

Background

Oral diseases remain a significant public health problem, yet in many countries oral healthcare is isolated from general healthcare systems. In response, the adoption of oral health under the universal health coverage agenda is strongly advocated. A key obstacle in monitoring and evaluating the implementation of universal oral health coverage is the lack of standardised oral health indicators.

Methods

This study described and compared child oral health indicators of dental caries prevalence and oral health workforce across six representative European countries (Denmark, Hungary, Germany, Ireland, Scotland and Spain). A narrative review was conducted across each country, entailing a detailed analysis of both peer reviewed and grey literature for both indicators. Data collected for each individual country was verified by two experts local to each country (*n=12*).

Results

The DMFT index remained the most used measure for dental caries data for children across the study countries. However, national DMFT figures varied widely in terms of the method of estimating DMFT, the sample size on which the figure was based, criteria for caries diagnosis and the year of reporting. Equally there were extensive differences in the data collected

pertaining to dentist workforce with some countries (such as Denmark and Germany) collating detailed information with others collecting very little data (e.g. Ireland). Broad workforce trends were observed including a higher proportion of dentist-to-population ratios in Germany and Spain compared to Scotland and Ireland with the fewest, a majority female dentist workforce, and a clear urban-rural divide, with rural and coastal areas reporting lower dentist densities.

Conclusion

Data on dental caries prevalence and the oral health workforce are not directly comparable across the six representative European countries analysed, due to substantial variation in the methods used to generate and report them. The findings emphasise the need for improved workforce data to support effective planning and equitable distribution of oral health professionals to meet the objectives of universal oral health coverage. Inconsistencies were also identified across international databases, alongside a lack of transparency regarding the limitations of published data. Addressing these gaps through the explicit standardisation of methods and criteria, nationally and internationally, is essential to advancing universal oral health coverage.

2 Background

Oral diseases, particularly dental caries, are among the most common diseases impacting children globally (Bernabe *et al.,* 2020). According to the WHO: 'No other disease group affects humanity across the life cycle and across all countries in the way that oral diseases do'. Yet oral health has been neglected, failing to achieve prominence in the global health agenda [1]. As such oral healthcare is frequently excluded from state-funded population benefit packages and accessing oral healthcare can result in financial hardship particularly for children and vulnerable groups [2,3].

In response, a historic World Health Assembly resolution called for the integration of oral healthcare as an essential component of universal health coverage (UHC) [4]. To advance this goal of universal coverage for oral healthcare, the WHO published the Global Oral Health Status Report which includes oral health country profiles 'based on key health and oral health indicators for monitoring and evaluation' (World Health Organisation, 2022). However, it also

acknowledges the significant ‘limitations’ of existing oral health data, particularly in its ability to track progress towards UHC goals and compare health systems performance across countries [1].

The WHO defines UHC as ensuring that ‘all individuals and communities have access to essential, quality health services that respond to their needs and that they can use without suffering financial hardship’ [5] . The three core dimensions of UHC are (i) population coverage (ensuring that all individuals including vulnerable groups including children have access to essential health services), (ii) service coverage (guaranteeing a comprehensive range of health services is available including preventive, curative and rehabilitative care and (iii) financial coverage (reducing out-of-pocket expenses and preventing financial hardship due to healthcare costs [6].

While it is proposed such services should include oral health promotion and prevention as well as interventions pertaining to oral diseases across the life-course [5]. However, defining what constitutes 'essential' oral healthcare presents challenges that require consensus at the national level dependent on political, economic, resource factors in addition to the system and cultural acceptability of proposals [7,8].

Comprehensive, consistent and effective health indicators are essential for assessing disease burden, monitoring service provision and informing health system planning and comparing systems [9,10]. However, the lack of global-level indicators for oral health monitoring are considered ‘one of the major deficiencies in driving national and global universal health coverage agendas’ [11]. Existing research has shown that dental caries data reporting is often fragmented and inconsistent making it ‘inadequate for planning the provision of oral healthcare across Europe on a scientific basis’ [12]. While a detailed analysis of oral healthcare systems across Europe emphasised that data gaps limit meaningful comparisons of workforce capacity, service access, oral disease burden and overall oral health system performance [13]. This report calls for an improved and strengthened evidence base to address such challenges [13].

The prevalence of the main oral diseases and conditions, including untreated dental caries of primary and permanent teeth, has been highlighted by the WHO in its Global strategy and

action plan on oral health 2022-2030, as a 'core indicator' to track and monitor progress toward UHC [5]. The prevalence of dental caries in a population is influenced by multiple factors, beyond access to oral healthcare. These include socio-environmental determinants such as fluoride exposure, diet and socio-economic statuses and the availability and uptake of population prevention services such as community water fluoridation and oral health education initiatives [2].

However, UHC remains essential for ensuring that access to diagnosis, prevention and intervention is equitable. Therefore indicators of dental caries prevalence are crucial for assessing the burden of the disease among children and monitoring changes in that figure over time thereby determining the impact of particular oral health interventions and policies [5].

Monitoring oral disease prevalence alone is insufficient, achieving universal oral health coverage also requires an adequate and well-distributed oral health workforce to deliver that care [14]. Workforce and human resources are identified as a category of indicator to monitoring access to care by identifying barriers to access (Jashni *et al.*, 2023). Such indicators are essential for assessing the availability of oral healthcare professionals, their distribution and the sustainability of the workforce over time. Additionally, they have the potential to facilitate cross-country comparisons allowing policy makers to benchmark progress towards universal oral healthcare coverage [5,15] . Despite this, historically little interest has been given to oral healthcare services workforce and there is limited information available on relevant indicators [16].

The aim of this research is to assess the challenges in measuring child oral health indicators, namely oral disease prevalence and workforce capacity, and to highlight the variations in data collection across six representative European countries [17,18]. As this study is focused on children, dental caries, the primary oral disease of childhood is the focus of analysis pertaining to oral diseases.

The objectives are:

5. to describe the differences in the measurement and reporting of dental caries data

across representative European countries.

6. to examine the composition and distribution of the oral health workforce specifically dentists, hygienists, and dental assistants— assessing differences in workforce size, gender distribution, age demographics, and an estimate of the proportion of dentists providing publicly funded care for children
7. to critically assess discrepancies in the reporting and comparability of workforce and dental caries data across international databases, highlighting inconsistencies in data availability, collection methodologies, and reporting standards
8. to identify the key challenges in interpreting child oral health indicators globally and advocate for improved standardisation and harmonisation of data collection.

3 Methods

A narrative literature review was conducted during the period June 2023 to February 2024, which entailed a detailed analysis of both peer reviewed and grey literature including oral health surveys, health service reports and policies. These were identified via online databases for the two indicators, dental caries (prevalence) and workforce. Data collected for each country was verified by two local experts per country.[16]

Country selection

The criteria for country selection were those countries who were representative of the variation of healthcare systems (i.e. tax funded, social health insurance, universal healthcare systems, 'targeted' systems, centralised and decentralised systems) and the different models of oral healthcare in Europe [17]. As such, the representative countries included in this analysis were selected from one of each of the following types – Nordic, Bismarkian, Eastern, Hybrid, Beveridgian and Southern:

7. Nordic Model - This is a tax-funded model (e.g. Denmark) characterised by an extensive publicly funded oral healthcare service for children, delivered by salaried dental practitioners with municipal-led governance. Oral healthcare for adults is

[16] A country expert was considered a current or former Chief Dental Officer or someone working in a senior position within academic or oral health services with additional postgraduate training in dental public health.

provided by private dental practitioners, some of which may be subsidised by public finance.

8. Bismarkian Model- This is a social health insurance (SHI) based system (e.g. Germany) funded through employer and employee contributions. Most of the population are members of state approved 'sick funds' which reimburse legally approved packages of oral healthcare.
9. Eastern European Model- A traditionally state funded model delivered via SHI (e.g. Hungary). However, public coverage for oral healthcare is often constrained leading to increasing involvement of the private sector.
10. Beveridgian Model - The entire population (e.g. Scotland) are eligible access oral healthcare via the tax funded National Health Service (NHS). All oral healthcare services are free of charge for children within the NHS, but adults require co-payments which are capped. Scotland was chosen as the representative country of the United Kingdom. Its national Childsmile programme exemplifies a prevention-focused, integrated approach to child oral health, offering important insights for the advancement of universal oral health coverage [19] and is relevant to the overall focus of this research on child oral health.
11. Southern European Model: Publicly funded oral healthcare for children varies by age and/or geographic location with very limited coverage for oral healthcare for adults (e.g. Spain). As a result, privately financed and delivered oral healthcare is dominant.
12. Hybrid Model - A complex mix of different financing and delivery models incorporating elements of both Beveridgian (tax-funded) and Nordic (publicly funded oral healthcare for children delivered by salaried professionals) models (e.g. Ireland). Targeted coverage and restricted access to publicly funded oral healthcare mean a reliance on privately financed and delivered oral healthcare.

Peer reviewed literature

Two individual search strategies (Appendices L and M) one focusing on each indicator, were developed with the assistance of a specialist medical librarian in collaboration with the research team. The '*CoCoPop framework*' (Condition, Context, Population) which has been shown to support effective literature searching for research questions focusing on aetiology was followed [20]. The 'condition' refers to the variable of interest and in this instance

entailed dental caries and workforce.

No limitations were placed on either the types of studies to be included or study year due to the possibility of national oral health surveys having been previously conducted over a significant period. Titles and abstracts identified were downloaded to an open-source reference management software programme (*Zotero*) and screened using Rayyan, an online research collaboration platform supporting effective literature review screening efficiency.

This study examines how dental caries data is collected and reported across six European countries, indicating the healthcare system model, while focusing on the types of indicators used and variations in the data collection methods. Based on common international practice, discussion, deliberation and WHO guidance [21,22,9] the indices for dental caries chosen for identification in this analysis were (i) The Decayed, Missing and Filled Teeth (DMFT) Index at the WHO indicative age 12-years [22,23], identified as the target group for assessing the level of dental caries severity among children with permanent teeth, and (ii) The International Caries Detection and Assessment System (ICDAS) [24]. Both indicators were chosen due to their widespread adoption.

Prevalence data from the WHO 'Global Oral Health Status report-country profiles' was also captured [1]. Dental caries prevalence refers to the proportion of individuals with at least one active caries lesion at the time of examination, typically reported as a percentage within a specified population at a specified time. The Global Burden of Disease 2019 (GBD 2019) which informs WHO 'prevalence data' considers untreated dental caries as the presence of an unmistakable cavity in the crown or root of a tooth, regardless of the existence of a restoration [25].

Dental enamel is a highly mineralised tissue which is subject to demineralisation and remineralisation, dental caries occurs when demineralisation exceeds remineralisation, and the lesion continues to progress [26]. The diagnosis of early enamel caries prior to cavitation can be prone to subjectivity. As a result, some caries indices limit the diagnosis to a stage of caries when it has reached a conclusive stage, for example at detectably softened enamel or at cavitation level. This can lead to variation in the use of an index depending on the definition of what is counted as caries in the measurement method [22].

The DMFT index measures the number of decayed (usually at the cavitation level or visibly extending into dentine), missing (due to caries) or filled (due to caries) teeth, it therefore seeks to capture the historically accumulated dental caries experience in permanent teeth at the tooth level in an individual at the time point of examination. Thus, reflecting the cumulative history of dental caries including treated and untreated lesions. DMFT does not measure prevalence but rather the overall burden of the disease at the individual level. All individuals in a population with a DMFT value > 0 make up the population with dental caries [23].

The ICDAS is a clinical dental caries classification tool that records the severity of carious lesions at different stages of progression, it can accommodate the recording of caries at the pre-cavitation level but can also be used to report caries at the dentinal level of involvement. ICDAS can be used to derive both dental caries prevalence and DMFT [27].

In line with previous research, detailed information from each database was collected including the DMFT or other relevant measure, and the citing evidence from which the information was sourced [12]. These research reports were subsequently identified, and a range of factors were collated including: the year of study, source of information, year of results published, sample size, criteria for dental caries assessment and methods of calibration.

Grey and other literature: dental caries

To ensure the most recent and representative figures with respect to dental caries were identified, national and international online databanks were also directly interrogated. These included:

- Individual country databases such as those of health ministries and national oral health services (e.g. Sundhedsstyrelsens Centrale Odontologiske Register (SCOR) (2022) [Denmark], National Dental Inspectorate Programme, [Scotland] [28,29].

- World Health Organisation: Oral Health Country/Area Profile Project (CAPP) Database
- The Council of European Chief Dental Officers (CECDO) database
- Organisation for Economic Cooperation and Development (OECD)
- World Health Organisation: Global Oral Health Status Report (GOHSR) - country profiles. Due to the methods adopted by GBD (2019) there are differences evident in the data sources used to inform caries prevalence, in comparison to those employed by CAPP and CECDO. In this study the GBD 'data input sources tool' was used to search for results for 'non-fatal outcomes' of caries of deciduous and permanent teeth for each study country.

Other databases including The Global Health Observatory, World Health Survey and European Health for All databases were also searched [30–32].

Grey and other literature: workforce

This study assessed multiple oral health workforce indicators, where data were available, including:

- Oral health workforce composition by professional category (i.e. dentists, dental hygienists, dental assistants)
- Total number of dentists
- Distribution of dental professionals by age/gender and location where data were available.

These indicators were selected to analyse how different countries collect and report on oral health workforce data rather than evaluating workforce adequacy. Therefore, nationally collected data pertaining to dentists across each country was examined.

To augment the data gathered from peer reviewed literature, national and international databanks by country were also interrogated, pertaining to oral health workforce. These included:

- Individual country databanks such as those of dental professional councils and associations, health ministries and national oral health services (e.g. The Dental

Council of Ireland, National Health Service Scotland, Federal Association of Statutory Health Dentists [Germany] [33–35].

- World Health Organisation: Oral Health Country/Area Profile Project (CAPP) Database.
- World Health Organisation: Global Oral Health Status Report (GOHSR) - country profiles.
- The Council of European Chief Dental Officers (CECDO) database.
- Organisation for Economic Cooperation and Development (OECD).

Ethical approval

Ethical approval (Appendix A) to recruit country experts for the verification of study data was granted by the Clinical Research Ethics Committee (CREC) of the Cork Teaching Hospitals at University College Cork, Ireland (Reference number: ECM 4 (J)12/11/2019). At all times, ethical concerns including ensuring confidentiality and obtaining informed consent were adhered to.

Results

Study results will be presented separately for both dental caries and workforce for the countries selected based on the oral healthcare systems described for Europe [17]. National data presented for dental caries 'prevalence' and the methods used to inform them nationally and across international databases will be presented first. This is followed by an overview of dental workforce information under the same parameters.

Data pertaining to dental caries

This study finds that the DMFT index remains the most used 'indicator' of dental caries across the representative countries, with more data collected in the 12-year-old age group across Europe than for any other child cohort.

National mean DMFT figures were available for all included countries and ranged from 0.32 and 0.38 in Scotland and Denmark, to 2.32 in Hungary (Table 1). However, there was wide variation in, the diagnostic criteria adopted, methods used to collate the DMFT score, the nature of the sample of 12-year-olds included and the year for which data are reported.

In two out of the six countries (Denmark and Scotland), DMFT data for 12-year-olds are reported annually (Denmark) or every two years (Scotland) by national health services – the National Child Odontology Registry (SCOR) [Denmark] [28] and the National Dental Inspection Programme (NDIP) [Scotland] [29]. In the SCOR system, DMFT is calculated by consolidating data from clinical examinations conducted in the public dental system [36,37]. In Scotland, the NDIP is conducted annually, where representative samples of 'P1' children (aged on average 5.5-years-old) and 'P7' children (aged on average 11.5-years-old) are examined on alternating years to determine the levels of 'obvious decay' nationally [29].

In three of the countries (Germany, Ireland, and Spain), the mean national DMFT scores were derived from national oral health surveys [38–40], while the DMFT for Hungary was based on a 'representative survey' using WHO pathfinder methodology conducted in 2016/17 [41]. National surveys in Spain and Germany were undertaken in 2020 and 2025 respectively, while the most recent nationally representative DMFT data for Ireland dated from 2002 [39] (Table 1).

Variations in the criteria for caries diagnosis were also observed across the included countries. Two of the national surveys (Germany and Hungary) followed WHO Oral Health Surveys Basic Methods, 5th Edition (2013) criteria (unmistakable cavity penetrating dentine), with Ireland similar to Scotland capturing both cavitated and non-cavitated dentinal lesions [39]. Spain followed WHO 4th edition criteria (1997), which also considers caries to be an unmistakeable cavity involving dentine [21]. Scotland and thus the NDIP follow the British Association for the Study of Community Dentistry (BASCD) guidance (cavitated and non-cavitated lesions which have penetrated dentine) [42]. While diagnostic criteria within SCOR are based on guidelines laid down by the Danish Health Authority, where caries is recorded at the enamel only and enamel and dentine level [36,43].

Finally, substantial variation was observed in the number of 12-year-olds informing the national DMFT scores. For example, Denmark reported data based on over 40,000 public dental system records, and Scotland based its national estimate on a representative sample of more than 13,000 children [28] [29]. In contrast, smaller sample sizes were seen in Ireland (3,883), Germany (958), Hungary (473), and Spain (448). These figures, along with other methodological differences such as diagnostic criteria and survey type, are summarised in Table 1 [39,38,41,40].

Table 1: Most recent national DMFT figure at age 12 across six European Countries

Country	National mean D_3MFT age 12	Source	Method	Year	Diagnostic criteria	Number of 12-year-olds
Denmark [1]	0.38	National Child Odontology Registry	National registry	2023	Danish Health Authority Criteria	40,264
Germany [2]	0.50	Sixth German Oral Health Study (DMS V)	National oral health survey	2025	WHO (5th Edition)	958
Hungary [3]	2.32	Representative survey: journal article (Szöke and Petersen)	Survey using WHO pathfinder methodology	2016/2017	WHO (5th Edition)*	473
Ireland [4]	1.4/1.8*	North South Survey of Children's Oral Health in Ireland 2002	National oral health survey	2002	Caries recorded at the dentinal level of involvement using WHO (1987) criteria. Figures include the expanded criteria to include visible non cavitated dentinal caries	3,883
Scotland [5]	0.36	National Dental Inspectorate Programme	National registry	2023	BASCD Guidelines	13,114
Spain [6]	0.58	Oral Health Survey in Spain 2020	National oral health survey	2020	WHO (4th edition)	448

Notes and sources

1 Sundhedsstyrelsens Centrale Odontologiske Register. (SCOR). Danish Health Authority Criteria. 2. WHO 5th edition criteria: Oral health surveys: basic methods - 5th edition. 2.The Sixth German Oral Health Study (DMS 6) recorded caries in 8-year-olds using ICDAS, results were converted DMF.3 Changing Levels of Dental Caries over 30 Years among Children in a Country of Central and Eastern Europe - The Case of Hungary (Szöke and Petersen, 2020). 4 *Mean DMFT for 12-year-olds in receipt of community water fluoridation (CWF) was 1.4 for those not in receipt of CWF was 1.8. According to Irelands National Oral Health Policy (2019) 'one in 10 children in Ireland has a disproportionate level of dental decay compared to their peers'. This finding was based on a statistical analysis conducted by the Department of Health to support oral health policy development (Department of Health, 2019) based on data obtained from a study examining the impact of CWF [44] 5 National Dental Inspectorate Programme (Public Health Scotland). British Association for the Study of Community Dentistry (BASCD) guidelines. 6 World Health Organisation Oral Health Surveys – Basic Methods, 4th Edition

Sources of variation in recorded caries levels

As summarised in Table 2, a wide range of methodological factors influence the reliability, comparability, and interpretation of caries data. These include differences in the type of survey used (e.g., national versus pathfinder), sampling methods, diagnostic criteria, and the physical conditions under which examinations take place [12].

For instance, large-scale national surveys conducted in dental clinics with trained, calibrated examiners using artificial lighting and radiographs may identify more caries than school-based surveys reliant on ambient lighting and visual-only inspection [22]. Similarly, surveys using broader diagnostic tools like ICDAS or reporting on non-cavitated lesions may yield higher prevalence estimates than those adhering strictly to the WHO definition of obvious decay [27]. These discrepancies are further compounded by socioeconomic participation bias, children from lower-income families, who may have higher levels of untreated decay, may be less likely to participate in school-based surveys requiring parental consent. Collectively, these methodological inconsistencies undermine the reliability of direct cross-country comparisons and highlight the pressing need for harmonisation in oral health surveillance methodologies.

Table 2 : Sources of variation in recorded dental caries levels

Issue	Description of Variation
Type of Survey	National surveys use, representative samples, while pathfinder surveys have smaller, often non-representative samples in specific locations. As caries varies by region, pathfinder surveys may give a misleading picture. Clinical data from dental attendance can be more detailed, especially if X-rays are used, which may lead to higher caries detection rates.
How the Survey Sample is Chosen	Different national surveys use different methods to divide the population into groups (stratification). Some may group by age, region, or socioeconomic background, affecting how representative the results are.
Response Rate to Surveys vs. Clinical Data	Survey participation can be low, making the data less representative. In contrast, data from dental services may be more complete, as most children visiting the dentist are included (depending on the system). However, clinical data may be biased towards those accessing care.
Ethical Considerations and Participation Bias	Surveys requiring parental consent may exclude children from lower socioeconomic backgrounds, who often have higher decay rates, leading to underestimation. Ethical approval processes may also restrict what data can be collected.
Choice of Caries Measurement Index	The DMFT index (Decayed, Missing, Filled Teeth) and the ICDAS system (International Caries Detection and Assessment System) measure decay differently
Criteria for Identifying Caries	Decay is a continuous process, with early stages being reversible. If only obvious cavities are counted, early decay is missed. Different guidelines define when decay should be recorded—some allow use of a probe, while others focus on visible dentine involvement without probing. ICDAS records early decay, but results may be reported at different severity levels.
Inclusion of Radiographic Data	Some clinical datasets include X-ray findings, leading to higher detection rates, especially for hidden (proximal or early-stage) decay. Surveys typically rely on visual examination only, leading to underestimation.
How Caries Stages Are Reported	Some surveys group all stages of decay together, while others separate visible dentine caries from cavitated caries. This affects comparisons between different studies.
Recording of Missing Teeth	Some surveys only count missing teeth due to decay, while others include teeth lost due to trauma, orthodontics, or natural exfoliation,

Examiner Training and Standardization	The way examiners are trained and tested for consistency varies. A standard statistical measure (Kappa Statistic) checks agreement among examiners, but different surveys set different standards. Some surveys check examiners' accuracy throughout the study, while others only train them at the start, which may affect consistency in recording caries.
Examination Location and Conditions	Clinical exams may lead to more decay being detected. In schools, poor lighting and child positioning may lead to underestimation. Unless a standard procedure (SoP) is followed, methods can vary. For example, whether teeth are cleaned or dried before examination can impact how much decay is seen.
Use of Artificial Light and Magnification	Some surveys use additional lighting (e.g., headlamps) and magnification, while others rely on ambient lighting. Better visibility increases detection rates.
Socioeconomic and Behavioural Factors	Some surveys adjust for diet, fluoride, sugar intake, and oral hygiene habits, while others do not. These factors strongly influence caries risk and can affect interpretation of results.
Definition of "Untreated Decay"	Some studies count only obvious cavities as untreated decay, while others include early-stage lesions that could be reversed. This affects decay prevalence estimates.
Treatment Access and Impact on Findings	In populations with good access to dental care, decay may be treated earlier, leading to higher recorded levels of treated disease. In contrast, disease may go unrecorded in surveys of populations with limited access as it is not visible outside the clinical setting without access to clinical radiography for example.

Reported dental caries data across international databases

Available data on dental caries for each study country across four different international databases is presented in Table.3.

This research finds there is very little agreement across international databases pertaining to the reporting of dental caries in terms of the data presented and the methods used to collate the information. Three out of four of the databases searched in this analysis (CAPP, CECDO, OECD) used the DMFT index for 12-year-olds as their measure for dental caries, with 'estimated prevalences' presented in the WHO country profiles [45,1,46,47].

DMFT figures for the study countries provided by CAPP and CECDO are all presented with the year of reporting while each CAPP figure and half of those derived from the CECDO are also presented with explicit referencing to the original data source. Both databases identify DMFT at a country level by way of data derived from national oral health surveys (e.g. Germany and Spain) or aggregated data from the public dental system (e.g. SCOR in Denmark) with clarifications sought from national representatives as required [46,47]. However, despite adopting similar approaches, differences in reported DMFT for each country are evident (Table.3).

The only reported DMFT data from the OECD is based on 'A Health at a Glance' report on 'indicators' published in 2009 with DMFT data collected from 2006 or the closest available year for 12-year-olds. The source is 'OECD Health Data' and a range of years is provided in some instances for example data for Germany is reported as DMFT 0.7 (1980-2005) and Ireland as DMFT 0.8 (1980-2002) [45].

The only database not explicitly reporting DMFT is the WHO by way of its country profiles, published alongside the 'Global oral health status report' where 'dental caries prevalence' data is used. This data is derived from the Global Burden of Disease 2019 (GBD) and 'computed' by the Institute of Health Metrics and Evaluation (IHME) [1].

The GBD (2019) considers untreated caries as the presence of an 'unmistakable cavity in the crown or root of a tooth, regardless of the existence of restoration' (Vos et al. 2020). The GBD methods for estimating caries burden are published and encompass an updated systematic

review and a range of statistical analyses and estimates [25]. It demonstrated a wide variation in the included studies, for example for Ireland caries data were informed by four studies, including two from the 1990's [48,49]. However, data from the national oral health survey was not captured. With respect to Germany, results of the 2004 and 2009 national oral health surveys were included but the most recent survey conducted in 2014 was not [50,51].

Table 3 Reported data pertaining to dental caries for six European countries.

	Databases			
Country	**CAPP (D_3MFT)**	**CECDO (D_3MFT)**	**OECD (D_3MFT)**	**WHO (OHCP) (Prevalence of untreated caries) ***
Denmark [1]	0.4 (2022)	0.3 (2021)	0.8 (2006)	24.6%

	[SCOR[1]]	[SCOR]		[GBD, 2019]
Germany [2]	0.4 (2016) [DAJ, 2017]	0.3 (2014) [DMS-V]	0.7 (1980-2005)	31.7% [GBD, 2019]
Hungary [3]	2.3 (2016) [Szöke and Petersen, 2020]	1.7 (2019) [-]	3.3 (1980-2001)	37.9% [GBD, 2019]
Ireland [4]	1.6 (2001) [National oral health survey][4]	0.8 (2015) [-]	1.1 (1980-2002)	31.6% [GBD, 2019]
Scotland [5]	0.5 (2017) [NDIP] [5]	0.5 (2018) [NDIP]	0.7 (1983-2005) (UK* only)	30.6% (UK) [GBD, 2019]
Spain [6]	0.58 (2020) [National oral health survey] [6]	2.0 (2020) [-]	1.3 (2005)	34% [GBD, 2019]

Notes and sources:

CECDO = Council of European Chief Dental Officers Database, CAPP = Oral Health Country/Area Profile Project, Health at a Glance (OECD) , WHO (GOHSR) = World Health Organisation: Global oral health status report - country profiles.

** Prevalence of untreated caries of permanent teeth in people 5+ years: 'Estimated prevalences from the Institute of Health Metrics and Evaluation (IHME) Global Burden of Disease Study 2019 (GBD, 2019) were computed by using population data from UN DESA World Population Prospects 2019 and applying them to disease relevant age groups. (Data source: Global Burden of Disease Collaborative Network. GBD 2019. Seattle: IHME; 2020.')*

1 SCOR: Sundhedsstyrelsens Centrale Odontologiske Register. The national child odontology registry (SCOR). 2 DAJ, 2017 = (Deutche Arbeitsgeminschaft fur Jugendzhnpflege). 3 DMS-V: Fifth German Oral Health Survey , DAJ, 2017 = (Deutche Arbeitsgeminschaft fur Jugendzhnpflege) 4 North south survey of children's oral health in Ireland 2002. 5 NDIP= National Dental Inspectorate Programme (Public Health, Scotland). 6 Oral Health Survey in Spain 2020.

Oral health workforce

Oral health workforce composition

An overview of the oral health workforce specifically pertaining to dentists, dental assistants and dental hygienists collated across the representative countries is provided Table 4.

Dentists

Dentist-to-population ratios varied across countries, with Germany and Spain reporting the

highest numbers of dentists per 100,000 people (121 and 84 respectively) [52,53], while Ireland reported the fewest followed by Scotland (71 and 73 respectively) (General Dental Council (GDC), 2023, Dental Council of Ireland - Direct Communication).

As this research sought to examine indicators in the context of child oral healthcare, estimates of the proportion of dentists offering publicly funded oral healthcare for children were made. This is governed by the model of children's oral healthcare in place. For instance, in Germany and Scotland almost all dental care for children is provided free of charge under Social Health Insurance (SHI) and via the National Health Service (NHS) where 99% of all German dentists and 86% of Scottish dentists retain contracts [33,55].

In Hungary, the proportion of clinics operated by the state and local government has fallen below 10% and over 90% of oral healthcare is provided in private (independent) dental practices. Some practices enter a contract with the National Health Insurance Fund of Hungary (NEAK) and the others which are purely private (69%) [56,57]. The total proportion of publicly funded dental surgeries and private practices contracted by NEAK equates to 31% [58,58]. In Spain, the estimated proportion of dentists offering publicly funded care for children is based on those engaged in the PADI Child Oral Health Programme [59] projected to be 7,400[17] or 18%, however this data should be interpreted while recognising that PADI is not freely available throughout Spain.

In two out of the six countries (Denmark and Ireland), publicly-funded oral healthcare for children is typically delivered by salaried dentists directly employed by the State. In Scotland since 2014, there has also been a Public Dental Service (PDS), run by NHS boards employing 365 dentists in 2022 [33]. The PDS provides dental care for people with complex special care needs and seeks to provide dental care in some rural or remote areas where there are difficulties with access to NHS practices [60].

In Denmark approximately 18% (*n=830*) of the overall workforce are directly employed in municipal dental care [61] and based on whole time equivalents (WTE) 9% (*n=320*) of the total dental workforce in Ireland are salaried dental practitioners [62]. According to data from the

[17] Data provided via direct communication to lead author.

Health Service Executive in Ireland 51% of those worked part-time in 2023 [62]. In 50% of the included countries (Denmark, Ireland and Spain) paediatric dentistry is not a recognised speciality and specialist paediatric lists are not maintained.

Auxiliary oral healthcare professionals

Germany and Denmark have the highest number of dental assistants per 100,000 population (236 and 132 respectively) The number of dental hygienists in Germany is relatively low, at 29 per 100,000. However, Germany has a significant number of specialised dental chairside assistants (Zahnmedizinische Fachassistentin), with 24,000 professionals trained for additional duties, including supra-gingival scaling.[63]. The total number of dental chairside assistants is estimated at 196,000, which equates to more than two per practicing dentist [52].

In Spain, there is no mandatory registration for dental hygienists (Martinez-Beneyto et al., 2021) leading to inconsistencies in data collection. However the estimates suggest that Spain has 42 dental assistants and 32 dental hygienists per 100,000 population [63]. In contrast Denmark, Hungary, Ireland, and Scotland all require mandatory registration for dental hygienists [64].

Hungary and Ireland report the lowest number of dental assistants per 100,000 population(Kivovics and Székelyhidi, 2023, Dental Council of Ireland, direct communication 2023).Similarly, Scotland and Ireland have the lowest number of registered dental hygieniests with 12 per 100,000 population in each country have the lowest number of (General Dental Council (GDC), 2023, Dental Council of Ireland, Direct communication 2023).However, in three out of six of the included countries mandatory registration of dental assistants (nurses) (Denmark, Ireland, and Spain) is not required [64].

Across the six countries there are notable variations in both the number and type of auxiliary oral healthcare professionals (OHPs) per 100,000 population as well as differences in workforce classification and reporting practices. Although Germany and Denmark report the highest number of individuals classified as dental assistants per 100,000, workforce ratios per dentist and the scope of practice of auxiliary oral healthcare professionals vary significantly. For example, in Germany some dental assistants receive specialised training to perform

extended duties whereas others do not. Inconsistencies in workforce data reporting are also evident, as some countries do not require mandatory registration for dental assistants, while others lack centralised workforce data for dental hygienists (e.g., Spain).

Finally, Scotland, stands out in its approach, as the only country in this study with registered dental therapists which is likely to explain the lower figure of dental hygienists in Scotland as some individuals may have multiple skills and qualifications. Dental hygienist-therapists are qualified to provide all direct restorations in the primary and secondary dentition and to extract primary teeth within their scope of practice [65]. There are also additional OHPs working within the Scottish Childsmile programme including 'extended duty nurses', 'dental health support workers' and 'Childsmile coordinators' [66].

Table 4 Dental workforce information across six European countries

Country	**No of Dentists (year)**	**No of Dental Assistants per 100,000 population (year)**	**No of Dental Hygienists per 100,000 population (year)**	**Dentists per 100,000 population (year)**	***Estimated*** **proportion of dentists offering publicly funded care for children**
Denmark [1]	4,535 *(2022)*	132 *(2020)*	44 *(2022)*	77 *(2022)*	18% *(n=830)* *(2022)*
Germany [2]	100,491 *(2021)*	236 (Dental assistant general) *(2021)*	29* *(2021)*	121 *(2021)*	99%* *(2023)*
Hungary [3]	7,198 *(Operational Register, 2022)*	62 *(Operational Register, 2022)*	36 *(Operational Register, 2022)*	74 *(2022)*	31%* *(2022)*
Ireland [4]	,3644* (2024)	15* (2024)	12 628 (2024)	71 *(2024)*	9% *(n=320*)* *(2023)*
Scotland [5]	3,988 *(2023)*	114 *(2023)*	12* *(2023)*	73 *(2021)*	86% (n=3,438*) (2022)

Spain [6]	40,968 (2022)	42 (e) *(2021)*	32 (e) *(2021)*	84 *(2022)*	18% (n=7,400*) (2023)

Notes and sources

1 Sources: www.sundhedsdata.dk. Dentists per 100,000 based on the total number of *practising* dentists. Population source (World bank 2021). Over 18% of dentists are employed in Kommunal tandpleje providing children and adolescent care.

2 Sources: KZBV and https://www.gbe-bund.de/. *The number of dental hygienists (Dentalhygieniker) is 1600 in total (CECDO, 2021). There are 24,000 specialised dental chairside assistants (Zahnmedizinische Fachassistentin) who have undergone extended training and perform additional duties including supra-gingival scaling. Population source: World bank, 2021. *Over 99% of dentists work in the SHI system (public system) where almost all children's care is covered.

3 NNK's annual data provision to the Supervisory Authority – 2022. National Professional Inspection for Dental and Oral Diseases. *There are 11,048 dentists, 15,173 dental assistants and 5,722 dental hygienists on the *basic* register in 2021. *In 2022, there are 227 full-time school dentists, 157 paediatric dentists and 1,764 *'mixed-practice'* dentists must supplement their work part-time (Hajdu et al. 2023).

4 Number of dentists represents the total number of registered dentists, the number of practising dentists is not available. Dental nurses' registration is voluntary. Population source based on Central Statistics Office 2021. *Publicly funded care for children is only delivered via salaried practitioners directly employed by the Health Service Executive. The total number of WTE employed was 320, of which 51% worked part time in 2023. Source: HSE. Health Service Personnel Census Report.

5 Total figures represent the number of professionals registered with the General Dental Council in Scotland in April, 2023. Population source: National Records of Scotland. A total of 3,438 dentists were registered with the National Health Service (NHS) in 2022 where all children can avail of free dental care at the point of access. Source: NHS Scotland Workforce Statistics.

6 Total number of dentists: Instituto Nacional de Estadistica. Total number of dental assistants and hygienists based on estimates from the CECDO database. Population estimate = World Bank, 2021.

Proportion of dentists by gender across representative European countries

In almost every country included in this analysis (i.e. Denmark, Hungary, Ireland, Scotland, and Spain), a greater proportion of dentists identified as female. The exception was in Germany where 47% identified as female [34]. There are no global workforce data available for Ireland. However, according to the Health Service Executive which delivers all publicly funded dental care for children 74.5% of all WTE dentists in 2023 identified as [62]. The country with the next highest female to male ratio was found in Denmark as over 67% of all dentists are female. Based on Danish workforce projections by 2040 it is expected that approximately 26% of dentists will identify as male [61]. In Hungary 75% of those providing 'paediatric care' are women [67]).

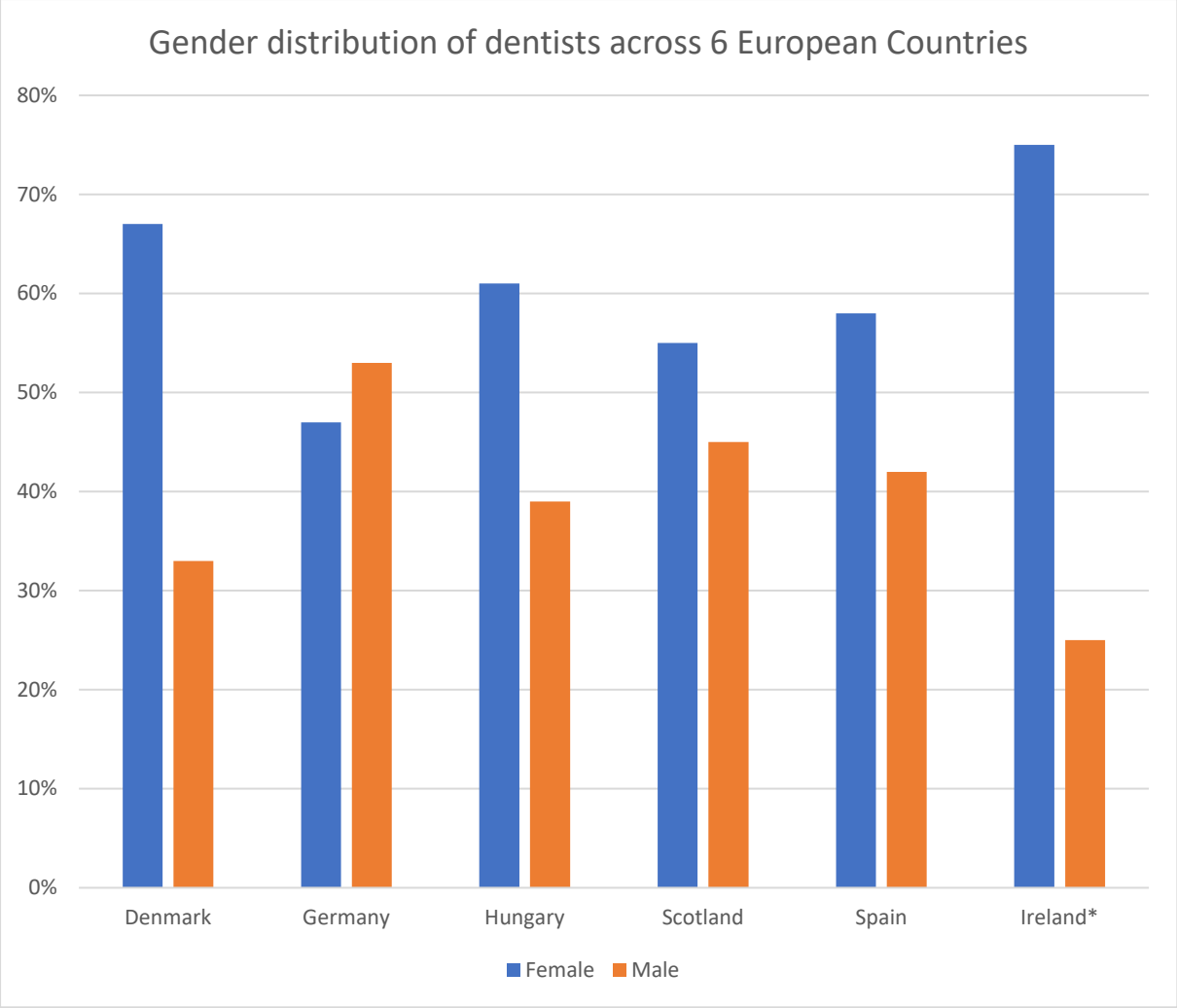


Figure 1 Gender distribution of dentists across six European Countries

Sources:
1 Danish Health Authority (2021).
2 BZÄK (Federal Dental Association) (2022).
3 Operational registers, The National Public Health Centre (NKK) (Hungary) 2022
4 GDC, (2021).
5 INE, 2022
6* Ireland figure based on the % female WTE employed by the HSE in 2023 who are responsible for the delivery of all publicly funded dental care for children in Ireland.

Proportion of dentists by age group across representative European countries

There is variation in terms of dentist distribution by age across the countries in this analysis for which data is available (Figure.2).

Two of the countries (Germany and Denmark) have a greater proportion of dentists aged between 35-64 years, with over 72% of German dentists and 64% of Danish dentists falling within this category [61,68]. Most German dentists are aged between 55-64 years [68]. While in Denmark, over 22% (*n=689)* of dentists are aged between 60-64 years [61].

In Hungary, over 20% of dentists are aged 70 years and over, however, there is also a significant number of dentists in the younger age cohort (36%) of whom almost half are aged between 25-29 years (NKK, 2023[18]).

In contrast, just *n=95* Scottish dentists are registered over the age of 65 years with 35% of dentists in the 18-34-years age category, which represents the age category with the highest proportion of dentists in Scotland [54]. Spain also demonstrated high numbers of dentists within younger age cohorts, with 29% of Spanish dentists (*n=11,738*) under the age of 35 years [53].

[18] Data provided to lead author.

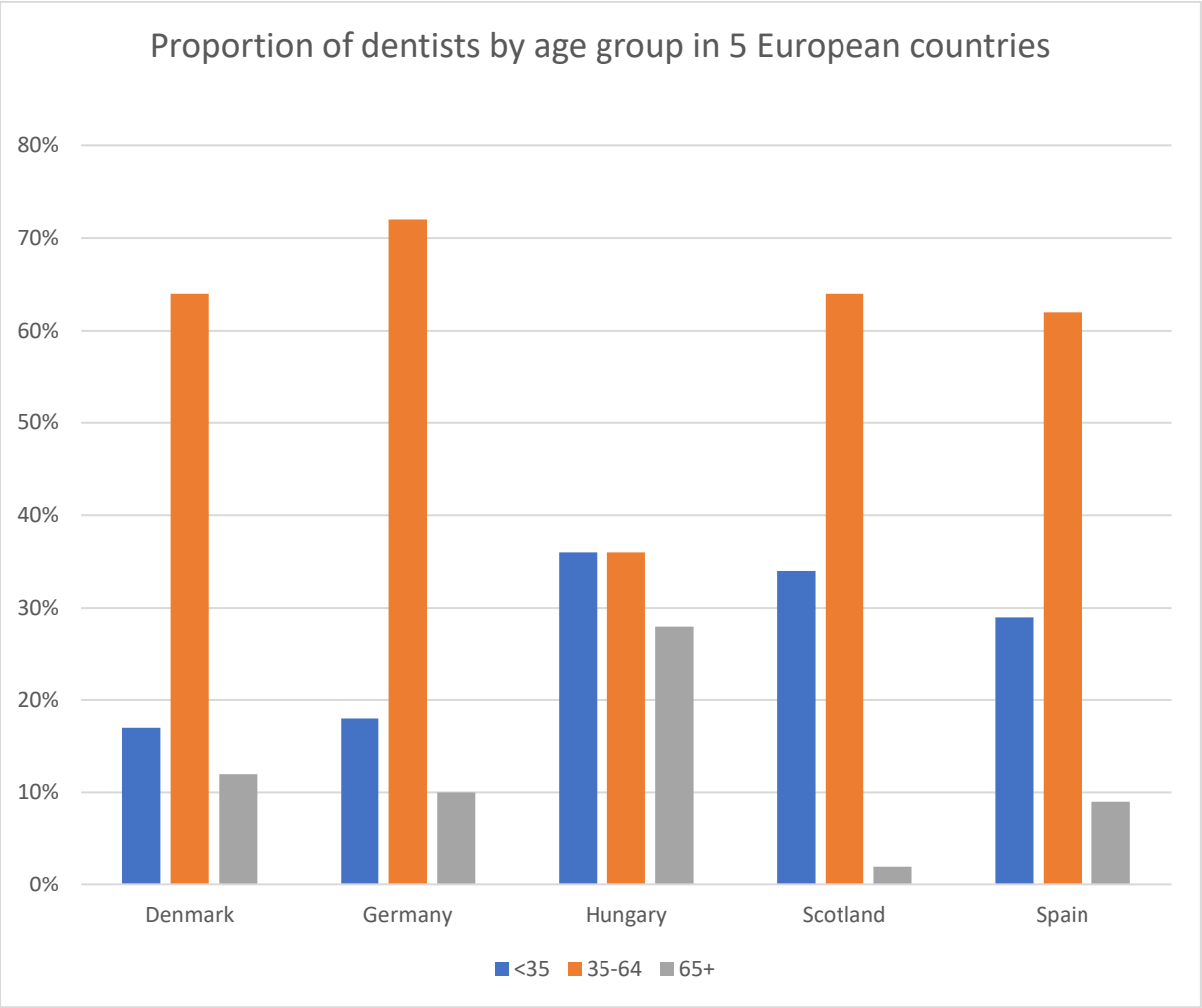


Figure 2 Proportion (%) of dentists by age group in five of the six* European representative countries

***Note:** There are no data available for Ireland

Sources:

1 Danish Health Authority (2021).

2 BZÄK (Federal Dental Association) (2022).

3 Operational registers, The National Public Health Centre (NKK) (Hungary) 2022

4 GDC, (2021).

5 INE, 2022.

Geographic distribution of dentists in six European countries

The geographic distribution of dentists across the six European countries reveals notable regional disparities, with urban centres generally hosting a higher concentration of dental practitioners than more peripheral or rural areas. Capital cities and major metropolitan regions tend to have the highest dentist densities, while remote and less densely populated areas often report significantly lower numbers of dentists per 100,000 population.

In Hungary and Spain, dentist workforce distribution have a similar pattern, with Budapest (136.2 per 100,000) and Madrid (134 per 100,000) recording the highest densities, whereas Nógrád (29.1 per 100,000) and Castile-La Mancha (46 per 100,000) report the lowest figures [67,69]. A comparable trend is observed in Germany, where Berlin (117 per 100,000) and Hamburg (113 per 100,000) lead in workforce concentration, while Saarland (71 per 100,000) and Brandenburg (76 per 100,000) have fewer dentists relative to their population sizes [70].

In Denmark, workforce distribution appears to be influenced by proximity to educational institutions, with the Capital Region and Central Denmark Region showing the highest dentist densities [61]. There is limited data available in Ireland however there are suggestions of a divide in dentist workforce distribution. According to the Irish National Oral Health Policy 'in the most economically advantaged areas, the number of dentists available per 100,000 of the population is almost double that of less economically advantaged areas. Dublin has the most dentists per capita. In particular, along the western seaboard, from Mayo to West Cork, there are fewer dentists overall than the rest of Ireland [71].

Scotland also demonstrates regional variations in access to NHS dental care, particularly for children. In NHS Borders, 77.4% of children accessed NHS dental services in the past two years, compared to just 41.9% in the Western Isles [72]. The Western Isles and Shetland have the lowest numbers of NHS dentists, in contrast to Greater Glasgow and Clyde, which reports the highest workforce availability [33]. Similar patterns emerge in Ireland's more remote regions, where access to dental services appears more limited outside of urban centres [71]**.** Across all six countries, a pattern of greater workforce concentration in major cities and lower dentist availability in rural, coastal, or geographically isolated areas is evident.

Information pertaining to dentists collected nationally in six European countries.

The extent of nationally available data pertaining to dentists collated either by dental regulatory bodies or health services, vary markedly throughout the study countries. They range from extensive information in countries such as Denmark, Germany, and Hungary in comparison to very limited data in Ireland (Table.5).

All study countries require mandatory registration and collect information on the primary educational qualification attained by dentists. All countries except for Ireland collect data pertaining to dentists practising location, while in Scotland this information is provided relating to PDS dentists by the TURAS database [33]. Information on gender and age is accessible in all countries bar Ireland.

The most granular data is collected by Denmark, Germany, and Hungary particularly collating information on dentists who are 'practising' or 'operational', what area of dentistry they are working in and if they are working outside of dentistry. Denmark and Germany also collect data regarding full or part-time working.

In Scotland, TURAS collects information on the area of dentistry within which NHS dentists work (i.e. vocational dentist, associate, general practitioner), however no information is available with respect to part-time working [33]. In Ireland, the Health Service Executive (HSE) provides data on part time working for salaried dentists [62]. Published reports and projections for oral healthcare workforce were found in three of the study countries (Denmark, Germany, and Scotland).

Table 5 Routinely collected information pertaining to dentists across six European counties

Country	Qualification	Geographical distribution	Gender	Age	Employment information*	Active Dentists	Part-time/fulltime working
Denmark [1]	✓	✓	✓	✓	✓	✓	✓
Germany [2]	✓	✓	✓	✓	✓	✓	✓
Hungary [3]	✓	✓	✓	✓	✓	✓	-
Ireland [4]	✓	-*	-	-	-	-	/
Scotland [5]	✓	✓*	✓	✓	/	/	-
Spain [6]	✓	✓	✓	✓	-	-	-

***** *Information available including whether a dentist works in private practice or public practice/public contract and within what area for example community or hospital dentistry*

✓ = data available, /= some data available, *data with limitations

Notes and sources

1 The Danish Health Authority 2 BZÄK/KZBV. Federal Dental Association and National Association of Statutory Health Insurance Dentists. 3 The National Public Health Centre (NKK) 2022. Source for professional contract: NEAK. 4 Dental Council of Ireland. *Individual address provided on registration not linked to dental practice. 5 TURAS. NHS Scotland workforce statistics and General Dental Council. 6 Instituto Nacional de Estadistica (INE).

Dentist workforce reporting across international databases

Data on the total number of dentists across the study countries varies considerably between international databases, reflecting differences in data sources, reporting years, and definitions of what constitutes a practicing dentist.
The most recent data tend to be available in the OECD and CECDO databases while figures in the CAPP database can date back up to ten years [47,63,73].

A key distinction between these databases lies in how they classify dentists. The OECD database differentiates between 'practising', 'professionally active' and 'licenced to practice' dentists, offering clear definitions for each category and specifying the data sources used for each country [74,73].

The CECDO database informed by direct communication from Chief Dental Officers, reports figures for 'active dentists' [63]. Meanwhile the WHO (GOHSR) data are based on the National Health Workforce Accounts (NHWA) platform (2020) and the CAPP database primarily relies on WHO Estimates of Health Personnel, except in the case of Denmark where data were provided by the Danish Health Authority. These inconsistencies in reporting definitions and data sources contribute to the observed variations in workforce estimates.

For example, Ireland's dentist figures differ between databases, with the CECDO listing 2,828 dentists (2021), while the OECD reports 3,442 practicing dentists (2022). Similarly, Germany's workforce count ranges from 69,863 (CAPP, 2015) to 72,468 (CECDO, 2021), depending on the data source. In some cases, discrepancies are also linked to differences in reporting years, as seen in Spain, where CAPP reports 33,286 dentists (2014), whereas CECDO and OECD report 40,417 dentists (2021).

Discussion

Universal health coverage (UHC) is widely recognised as a crucial pathway to achieving improved health outcomes for all [75]. Since 2019, oral health has been included in the United Nations Political Declaration on UHC underscoring the need for accessible and affordable oral healthcare services globally [75]. To 'better understand' how actions and investments can

deliver on the goal of UHC, the ability to document trends in effective health service provision and population health gains is essential [76]. As such meaningful indicators are indelible to the construction of health systems world-wide [77].

Global frameworks such as that developed by the WHO and the World Bank provide mechanisms for monitoring UHC implementation [78], however within this framework, 'there are no measures that involve or are specific to oral healthcare and/or dental care'[15]. As such, it is not possible to progress on the integration of oral health within UHC without the establishment of 'clear, agreed-upon indicators' with oral health status including DMFT, and 'workforce' identified as potential indicators of use [15].

Health indicators are critical to identifying emerging health challenges, efficient resources allocation, policy and intervention evaluation. The WHO's Global Oral Health Status Report acknowledges the 'limitations' in oral health data and[1] the need for robust indicators to monitor progress toward universal oral health coverage [13,15].Similarly the European Observatory on Health Systems and Policies identified the absence of 'comprehensive and systematic collection of information' necessary to assess and compare systems performance across European countries. In turn calling for the development of systematic oral health indicators to better inform-policy makers and support the design of appropriate oral health interventions [13]. Health indicators should be specific, valid, reliable and well-defined to allow inter-country comparisons and benchmarking at the international level [10]. While an understanding of the 'data used to build health indicators' is of significant importance [10]. [13] This study finds child oral health indicators of dental caries prevalence and oral health workforce are not comparable across six representative European countries due to the wide variation in the data used to inform them [12,11,13].

The DMFT index was the most widely reported data pertaining to dental caries, although not used in an identical way in each country. The WHO proposes 'basic oral health surveys' as a useful means to identify 'important trends in oral health status amongst children' including DMFT, and states they should be conducted 'every five to six years' [22]. Half of the countries in this study had completed a national oral health survey, Germany most recently publishing reports after almost ten-year-interval (Jordan *et al.,* 2025) while data from Spain is within five

years [40]. By contrast, the most recent survey conducted in Ireland was over twenty years ago [39].

However, national oral health surveys often encounter challenges in achieving high response rates, which can impact the representativeness and reliability of the collected data. The Sixth German Oral Health Study (DMS 6) exemplifies these challenges. Conducted between 2021 and 2023, DMS 6 aimed to assess oral health across various age groups in Germany. The study reported an overall response rate of 26.5%, with notable variations among age cohorts and a response rate of 34% among 12-year-olds [38]. This emphasises the importance of implementing strategies to enhance participation in national health surveys to ensure data accuracy and generalisability. Further arguments against using oral health surveys are high costs related to their planning, conduct and analyses along with difficulties in facilitating international comparisons [79].

The alternative means of estimating national DMFT included conducting smaller scale surveys using pathfinder methodology (e.g. Hungary) [41] and using aggregated data consolidated from public dental systems (e.g. Denmark) [28]. Careful randomisation of a study sample via pathfinder approaches is required to ensure that a sample is representative of the population particularly pertaining to geographical variation. However, there is a risk that due to the small sample size (e.g. less than 500 children examined in Hungary) of an inaccurate estimate DMFT and therefore insufficient understanding of disease prevalence or the impact of policy implementation, a problem that has occurred in other European countries [12]. Variations were also observed in the ratio of sample size to national population, particularly in Spain where a total of 448 children aged-12 were examined out of a national population of over 47.5 million [40].

The Danish SCOR system was established in 1972 for administrative and epidemiological purposes and is an example of using data derived from a public dental system to inform oral disease surveillance. Inputting data into SCOR by oral health personnel is obligatory with ‘mandatory registrations’ required at WHO indicative ages 5, 7, 12, and 15 years. Due to its large sample size (e.g. over 40,000 twelve-year-old children in 2023) and long follow up, it is considered a ‘comprehensive and continuously expanding registry of oral health’ [37].

The potential risk factors for reporting national DMFT based on aggregated data are that those with the highest levels of oral disease may not routinely access oral healthcare. A failure to accurately capture the oral health status of vulnerable groups and their under representation in sample sizes may lead to a lower estimation of caries prevalence [12]. This is less likely to occur within the Danish setting specifically due its model of service delivery i.e. free of charge at the point of delivery, automatic child enrolment and dentists obliged to ensure all children assigned to their clinics are examined, with social services contacted in the event of non-attendance [28].

The final method of collating national mean DMFT seen in this study was seen in Scotland via its National Dental Inspection Programme (NDIP) [29]. The NDIP, coordinated by Public Health Scotland (PHS) and supported by Scottish Dental Epidemiology Co-ordinating Committee (SDECC) was established in 2002 in line with the introduction of Childsmile [80]. A central aim of NDIP is to determine the 'level of obvious decay' (at the D_3 level into dentine) and in contrast to the SCOR system it operates in conjunction with clinical care.

Annual reports are published by PHS in detailing the methods, examiner calibration and sample size used (over 13,000 children aged c. 12-years-old in 2023) in addition to biannual collection of data pertaining to children in younger cohorts. It is said to generate 'reliable oral health information' for all stakeholders concerned with 'oral disease prevalence' including the Scottish government [29]. While data provided by NDIP and analysed by the University of Glasgow has been highlighted as integral to the long-term evaluation and sustainability of Childsmile [81].

This study found the DMFT index remained the most used indicator pertaining to dental caries across the study countries included in this analysis, with the 12-year-old WHO indicative age being the most common age. In Germany, the recording of caries in 8-year-old children was done using the International Caries Detection and Assessment System [24], with results then converted into the DMFT index (Jordan *et al.,* 2025). For other age groups only 'clear, clinically observable caries lesions were recorded' (Jordan *et al.,* 2025). The ICDAS has been used in national oral health surveys previously such as in Iceland [82] . Should oral health systems succeed in placing a greater emphasis on prevention, the ICDAS owing to its ability to give an

accurate assessment of all stages of caries, not just established disease requiring restorative care, may be beneficial particularly in the evaluation of the impact of preventive interventions. However, this will be dependent on sufficient training and reliable examiner calibration [12]

For indicators to be reliable and comparable the 'definition of the indicator' is considered a 'main component' that affects the quality of information [10]. In this analysis along with variation in the sample sizes and methods of determining national caries data, there was also wide variation regarding the criteria for recording caries. Two of the countries (Germany and Hungary) followed WHO (2013) criteria [22], with the SCOR system following guidance laid down by the Danish Health Authority [28] and NDIP followed BASCD guidance [42]. Ireland follows a combined BASCD and WHO criteria identifying both cavitated and non cavitated lesions [39]. Spain continues to follow WHO guidance from 1997, despite conducting regular surveys since the updated guidelines were published in 2013 [21]. The rationale proposed for this was 'to facilitate comparability and not break the time series of analysis of epidemiological trends' by maintaining 'the same methodology used in previous national health surveys' [40].

The variation across the study countries pertaining to dental caries data were replicated across oral health workforce data, particularly with respect to the varying depth and granularity of accessible information. This reinforces existing research on oral health highlighting that there remains an absence of 'standardised and reliable methodologies to gather information for successful workforce planning [83]. There is 'incomplete and uneven information on workforce which is challenging and problematic [83].

Detailed workforce data are regularly collated by the Danish Health Authority, SHI Dentists in Germany, and the National Public Health Centre in Hungary, while Ireland remains an outlier in terms of limited data availability. Previous research on the Irish oral healthcare workforce has identified the paucity of workforce data as a major barrier to planning, with the national dental professional register deemed insufficient for workforce estimates [84].

Several broad trends were observed across workforce domains that warrant discussion.

Firstly, the number of dentists per capita varies widely. Germany and Spain report substantially higher dentist-to-population ratios, with Spain experiencing a 745% increase in dentists per capita since the 1980s due to the expansion of private dental education and lack of workforce regulation [85]. This has lead to under employment and oversupply of dentists, [59,85] in contrast with Ireland and Scotland where dentist shortages have been identified as a crucial issue [60].

This study echoes research conducted in 2024 which found that Ireland has the lowest ratio of dentists to total population in Europe [86]. This appears to be especially problematic in the delivery of publicly funded children's care with less than 10% of registered dentists employed to deliver that care [62] in contrast with almost 20% of the Danish workforce providing care to a similar cohort [61].

Secondly this study supports the global trends indicating a female majority of the dentist workforce, particularly in paediatric and publicly funded dental services[87,88]. Studies indicate that female dentists are more likely to work part-time which may impact service provision and workforce capacity [89,90]. This research found that in Denmark almost 40% salaried dentists work part-time while in Ireland this figure exceeds 50% [62,61]. It should be noted the recruitment and retention of dentists is impacted by a host of factors including contractual arrangements, the range of care provided and working conditions [91]. However, in addition to those structural determinants, the implications of the female majority must also be accounted for in workforce design, the economic challenges of workforce patterns for patient care and potential flexible working practices [92].

The oral health workforce, particularly pertaining to children is not solely dependent on the availability of dentists but is also influenced by auxiliary dental professionals including dental hygienists and assistants. However, their availability, training, scope of practice and requirement for registration vary widely across the six study countries[13,64]. Auxiliary OHPs play a significant role in Denmark and Scotland, two systems highlighted for their strong preventive focused and effective oral healthcare systems for children [64]. Scotland is the only study country to formally integrate dental therapists into its publicly funded oral healthcare system. while With the planned establishment of the Childsmile programme a

range of additional auxiliary and non-dental professionals play a central role [64,93].

While in Denmark, dental hygienists play a ‘major role’ in the delivery of oral healthcare for children [94]. Denmark reported over 44 dental hygienists per 100,000 population which was almost four times more than the figure reported in Ireland of 12 per 100,000. These variations highlight the potential for expanding the role of auxiliary professionals and creative workforce solutions, in the delivery of children’s oral healthcare particularly in regions experiencing workforce shortages [95].

A clear urban-rural divide in the distribution of dentists emerged across all study countries. Major metropolitan areas and capital cities reported higher dentist workforce densities, while rural and coastal regions had fewer dentists. For example, in Hungary and Spain, there were over four and three times as many dentists per 100,000 population in Budapest and Madrid in comparison to rural areas. This was replicated in findings pertaining to Ireland and Scotland, with fewer dentists found in rural and coastal regions. This geographic imbalance in dentist workforce distribution echoes the international literature where population urbanisation is a strong predictor of not only the density of dentists but the overall oral health workforce [95,96] . It is suggested that financial prosperity, infrastructure and amenities facilitate the attractiveness of urban areas for professionals [95].

Finally, there are contrasting findings regarding the age profile of dentists with Germany, Demark and Hungary demonstrating greater numbers in older aged cohorts compared to a high proportion of Spanish dentists who are younger. The proportion of older dentists among all working dentists in Germany in particular has risen continuously in recent years with the number of dentists under the age of 45 unable to compensate for the numbers approaching retirement [68].

The broader implications of potential workforce shortages mean policies aimed at developing universal oral health coverage and reducing the barriers to oral healthcare will have limited chance of success if the capacity to provide that care is not there to satisfy demand [16]. Therefore, careful oral health workforce planning where currently ‘little attention is given’ and which are ‘isolated from planning of services’ must be of critical importance to health system and policy leaders [14].

The inconsistencies in how dental caries and oral workforce data are presented and reported across international databases such as the OECD and the WHO, underscore a fundamental gap as a foundation for the evidence base essential to oral health policy [11,13]. Without standardised, transparent and regularly updated data, policymakers will continue to face substantial challenges in assessing progress toward universal oral health coverage and in designing and evaluating evidence based-interventions to improve equitable access to oral healthcare [13].

Limitations/strengths/potential contributions

Although the research set out to explicitly compare countries, due to the variation in the available data, countries were analysed individually with comparisons drawn if and where appropriate. For instance, data on DMFT, numbers of dentists and other aspects of workforce were often found to be inaccurate or incomplete. As such extensive efforts were made to ensure the accuracy of the data presented. This was achieved by verifying the data collected by two country experts, identifying and translating local information and making explicit the source from which all figures were sourced. The depth and granularity of data presented in this research represents a key strength of this study.

Beyond workforce availability and disease burden, multiple systemic factors influence children's access to oral healthcare. These include the capacity of professional dental education and training programs, which shape workforce supply, engagement of oral healthcare professionals, geographic distribution, and the inclusion of preventive services in national oral health benefit packages. Financial barriers, such as out-of-pocket costs and the structure of public or private insurance schemes, also determine the extent to which children can access timely dental care. While this study primarily examines workforce and disease burden indicators, these broader structural factors must be considered in future research and policy discussions to ensure that children's oral health needs are met comprehensively.

It is incumbent on the authors of this research to highlight the difficulty and time-consuming interrogation of databases, largely non-academic, that was necessary to source data

contained in this study. There must be an onus at an individual country level to maintain, review and monitor national oral health data and trends. This needs to be supported at an international level through a consensus on the quality, standards and methods for informing oral health indicators.

Conclusion

This study demonstrates that data on dental caries prevalence and the oral health workforce are not directly comparable across the six representative European countries analysed, owing to significant variation in data collection methods, reporting standards, and workforce classifications.

By systematically mapping these discrepancies, the study offers updated figures and identifies specific methodological limitations that contribute to the persistent lack of standardisation in oral health surveillance. Notably, workforce data revealed marked differences in dentist-to-population ratios, gender distribution, and the availability of auxiliary professionals, with many countries lacking disaggregated data on those providing publicly funded care for children.

These findings highlight the urgent need for greater transparency in international oral health reporting and a critical reassessment of the indicators currently used to monitor progress. Addressing these limitations through standardisation, using consistent diagnostic criteria, and improved workforce data will be essential to inform evidence-based policymaking and to support meaningful progress toward universal oral health coverage.

Availability of data and materials

The final datasets generated and analysed are not publicly available to maintain the anonymity guaranteed to individual study participants, but individual country case studies based on the documentary analysis may be available from the corresponding author on reasonable request.

Abbreviations

BASCD: British Association for the Study of Community Dentistry

BZÄK: Bundeszahnärztekammer

CAPP: Oral Health Country/Area Profile Project

CECDO: Council of European Chief Dental Officers

DMFT: Decayed, Missing and Filled Teeth Index

DMS-V: Fünfte Deutsche Mundgesundheitsstudie

EHFA: European Health for All

GBD: Global Burden of Disease

GBE: Gesundheits-Bericjterstattung Des Bundes

GDC: General Dental Council

GHO: Global Health Observatory

GOHSR: Global Oral Health Status Report (GOHSR)

HSE: Health Service Executive

ICADS: The International Caries Detection and Assessment System

IHME: Institute of Health Metrics and Evaluation

INE: Instituto Nacionale de Estadistica

KZBV: Kassenzahnärztliche Bundesvereinigung

NHS: National Health Service

NKK: The National Public Health Centre

OECD: Organisation for Economic Cooperation and Development (OECD)

OHP: Oral Health Professional

OOP: Out of Pocket Payments

PADI: Programa de Asistencia Dental Infantil

PDS: Public Dental Service

SCOR: Sundhedsstryrelsens Centrale Odontologiske Register

SHI: Social Health Insurance

UHC: Universal Healthcare

WHO: World Health Organisation

WHO (OHCP): World Health Organisation: Global oral health status report - country profiles.

WHS: World Health Survey

WTE: Whole Time Equivalent

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Contributions

All authors, UMA, KE, MH, SB, HW and EC contributed actively to this paper. The design of this study was developed by UMA, KE, SB and MH. UMA was responsible for data collection and analysis. Feedback on the analysis and the interpretation was received from all authors. UMA drafted the paper for submission and all authors approved the final version.

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Ethics declarations

Ethics approval and consent to participate.

Ethical approval for the study was granted from the Clinical Research Ethics Committee of the Cork Teaching Hospitals at University College Cork (Reference number: ECM 4 (J)12/11/2019). Ethical considerations including ensuring confidentiality, obtaining informed consent, and preserving anonymity were always adhered to. Informed consent to participate was granted by each participant.

Competing interests

The authors declare they have no financial or non-financial competing interests.

9.17 Appendix Q: Original protocol guiding studies two and three

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STUDY PROTOCOL

Comparing oral health systems for children in six European countries to identify lessons learned for universal oral health coverage: A study protocol. [version 1; peer review: 2 approved, 1 approved with reservations]

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Abstract

Background: Oral diseases have the highest global prevalence rate among all diseases, with dental caries being one of the most common conditions in childhood. A low political priority coupled with a failure to incorporate oral health within broader health systems has contributed to its neglect in previous decades. In response, calls are emerging for the inclusion of oral health within the universal healthcare domain (UHC). This protocol outlines the methodology for a cross-country comparative analysis of publicly funded oral health systems for children across six European countries, reporting on oral health status in line with the indicators for UHC.

Methods: This study will follow Yin's multiple case study approach and employ two strands of data collection, analysis, and triangulation: a systematic documentary analysis and semi-structured interviews with elite participants local to each country. The countries chosen for comparison and providing a representative sample of European dental systems are Denmark, Hungary, the Republic of Ireland, Germany, Scotland, and Spain. A systematic search of five electronic databases and four additional electronic resources will be undertaken, in addition to grey literature and other publicly available sources, with the outcomes verified and further informed by local experts. The WHO Universal Health Coverage Cube will be used to guide data collection and analysis.

Conclusions: This research will provide policy makers with an in-depth analysis and comparison of publicly funded oral health systems for children in Europe, including consideration of effective preventive strategies, oral health system reform, and indicators of universal oral health coverage. It is anticipated that the outcomes may help in positioning oral health on governmental health agendas and support its integration into wider health systems' reform in an accessible and affordable manner.

Keywords

Oral health systems, universal health coverage, childhood dental caries, oral health policy, health system financing, protocol, reform.

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Author roles: McAuliffe Ú: Conceptualization, Data Curation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Project Administration, Resources, Software, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Woods N**: Formal Analysis, Methodology, Supervision, Validation, Writing – Review & Editing; **Barrett S**: Data Curation, Methodology, Resources, Software, Writing – Review & Editing; **Cronin J**: Formal Analysis, Methodology, Software, Writing – Review & Editing; **Whelton H**: Conceptualization, Formal Analysis, Methodology, Supervision, Validation, Writing – Review & Editing; **Harding M**: Conceptualization, Formal Analysis, Methodology, Supervision, Validation, Writing – Review & Editing; **Eaton K**: Conceptualization, Formal Analysis, Methodology, Supervision, Validation, Writing – Review & Editing; **Burke S**: Conceptualization, Formal Analysis, Methodology, Supervision, Validation, Writing – Review & Editing

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Open Peer Review

Approval Status ? ✓ ✓

	1	2	3
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Any reports and responses or comments on the article can be found at the end of the article.

Introduction

Oral diseases, despite being largely preventable, are among the most prevalent non-communicable diseases globally (World Health Organization, 2020). People are impacted from childhood to adolescence, adulthood and into later life with little improvement of the situation over the past two decades (World Health Organization, 2020). Furthermore, the burden of oral disease is hallmarked by significant inequality, disproportionately affecting marginalised populations and those in low socio-economic groups (Peres *et al.*, 2019).

Dental caries (tooth decay) is an especially serious public health problem for children, affecting 60–90% of schoolchildren worldwide (Petersen & Lennon, 2004; Slade *et al.*, 2018). In addition to causing pain and infection, caries significantly impact children's social and psychological wellbeing, along with their quality of life (BaniHani *et al.*, 2018; Peres *et al.*, 2019). It is associated with reduced school attendance, impaired speech development and can result in lower body weight and height (Jackson *et al.*, 2011; Sheiham, 2006).

Dental caries not only impacts the affected child, but also the broader family, resulting in lost workdays with the added financial burden that may be associated with accessing dental services (Casamassimo *et al.*, 2009). Furthermore, the management of dental caries in younger children may require hospitalisation for treatment under general anaesthesia with associated health, financial and health system implications (McAuliffe *et al.*, 2017; Peres *et al.*, 2019). This is a problem of global concern, with the management of oral diseases and extraction of carious (decayed) teeth previously cited as the number one reason for hospital admission of young children in Australia and England (Chrisopoulos, 2016; Levine, 2021).

Important risk factors for disease development in children have been identified, most notably high-sugar dietary habits (Watt *et al.*, 2019) with parental behaviour being a 'significant predictor' (Östberg *et al.*, 2017), while fluoride exposure is an important protective factor (Petersen & Lennon, 2004). Early availability and access to preventive oral healthcare has been proposed as fundamental to improving children's oral health, reducing costs, and establishing life-long practices (Irish Oral Health Services Guideline Initiative, 2012; World Health Organization, 2020).

In May 2021, the World Health Assembly adopted a historic resolution on oral health, strongly advocating for its inclusion under the Universal Healthcare (UHC) agenda (World Health Organization, 2021a). The WHO defines UHC as ensuring 'all people have access to services and do not suffer financial hardship for paying for them' (World Health Organization, 2021b). Evidence has suggested that UHC may be a global risk indicator for early childhood caries (ECC), i.e., dental caries diagnosed in children under age six (Anil & Anand, 2017) with a lower prevalence of ECC seen in countries with good UHC (El Tantawi *et al.*, 2018). However, not all countries with UHC include entitlements to oral healthcare, particularly preventative oral healthcare, which is often considered a non-essential health service (Wang *et al.*, 2020).

Historically, oral healthcare was relegated to the realm of personal responsibility (Wang *et al.*, 2020) and currently remains a low priority across governments globally. This has led to a lack of political commitment, coverage, and a failure to resource disease prevention (World Health Organization, 2020). Responding to the 'global state of crisis' in oral health requires a shift in focus from the traditionally curative models of care to a more inclusive approach, where oral health services are fully integrated in universal health systems worldwide (Glick *et al.*, 2021; Watt *et al.*, 2019).

However, dental caries is a complex, multifactorial disease influenced by biological factors and the social determinants of health (Meyer & Enax, 2018; Watt *et al.*, 2019). There have been conflicting results demonstrating the influence of access to oral healthcare on the prevalence of dental caries in very young children, with a reduction in disease severity evident in Nordic countries with universal oral health cover (Virtanen *et al.*, 2007), yet a high disease prevalence remaining, or no impact seen, in countries with free access like Peru and Brazil (Azañedo *et al.*, 2017; Pucca Jr *et al.*, 2015). Recent research by Folayan *et al.* (2021), found that higher governmental health expenditure may be associated with a reduction in ECC and called for further research across individual countries to assess the impact of UHC on disease prevalence, and how UHC could be optimised to reduce the risk of dental caries.

In Europe, healthcare systems are publicly financed via general taxation or compulsory social health insurance

and complemented by private contributions from either voluntary insurance and/or direct out of pocket payments (OPP) by individuals (Sinclair *et al.*, 2019). Based on the method of administration and financing, six oral healthcare systems have been described, namely the Nordic, Bismarkian, Beveridgian, Southern European, Eastern European and Hybrid models (Widström & Eaton, 2004). However, the extent of public financing, universal coverage and the density and distribution of dentists working at the primary healthcare level varies within each system (Glick *et al.*, 2021; Patel, 2012; The Platform for Better Oral Health in Europe, 2015).

In terms of publicly funded oral healthcare for children, the child population covered and the extent of cover also varies within and across systems (Table 1). For example, Denmark and Germany, representative of the Nordic and Bismarkian systems respectively, provide free basic oral healthcare services to pre-school and school children where even the youngest children are included in the system (Widström & Eaton, 2004). The Danish system is largely tax-financed, while Germany has a statutory health insurance system split into public social insurance (SHI) and private health insurance (Ziller *et al.*, 2015). In the Beveridgian system, unique to the United Kingdom, the entire population is eligible to obtain treatment through the tax-financed National Health Service (NHS). In 2006, the NHS payment system changed in England, Wales, and Northern Ireland. However, it remained the same in Scotland, and oral healthcare treatment including orthodontics is free of charge to all patients under the age of 18 years as at time of writing (Sinclair *et al.*, 2019).

In contrast, the Spanish health system, an example of a South European system, is primarily tax-financed and organised nationally and regionally, with health competencies transferred to the 17 Autonomous Communities (ACs) (Bravo *et al.*, 2015). The level of oral health coverage for Spanish children strongly depends on regional location, with some oral healthcare available to children aged from seven to 15 years of age in certain areas yet little coverage in other regions (Sinclair *et al.*, 2019). In most Eastern European countries, the provision of care has shifted from largely free public provision to the majority of care being delivered in the private sector (Widström & Eaton, 2004). Hungary, an example of an Eastern European system, is financed by contributions from employed persons and employers with children receiving free oral healthcare until the age of 18 (Kivovics & Csado, 2010).

In the Republic of Ireland (Ireland), representative of a hybrid system, children are targeted for comprehensive care at specific age groups, with restricted access other than emergency treatment for all other cohorts (Department of Health, 2019). Ireland's general health system is complex and predominantly funded through general taxation. However, more than half of the Irish population purchase private health insurance, predominantly to facilitate quicker access to hospital care and private healthcare (Johnston *et al.*, 2020). In contrast to the general health system, two thirds of all dental expenditure in Ireland is privately financed with some,

Table 1. An overview of oral health systems coverage for children in six European countries.

Country	Main source of general healthcare financing, model and percentage of current expenditure financed in 2019. TF = Tax financed, SHI= Social health insurance.	Oral healthcare model	Children's oral health cover
Denmark	TF (83.3%)	Nordic	Universal
Hungary	SHI (59.8%)	Eastern European	Universal
Ireland	TF (74%)	Hybrid	At specific ages with restrictions
Germany	SHI (78.1%)	Bismarkian	Universal
UK	TF (78.5%)*	Beveridgian	Universal
Spain	TF (66.6%)	Southern European	At specific ages with restrictions

*The figure for the UK is for England, Scotland and Wales. The table saying the focus of this analysis is Scotland. *Source: Sinclair et al. (2019) and Eurostat (2021).*
*Office for National Statistics, 2021, UK Health Accounts 2019, UK https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthcaresystem/bulletins/ukhealthaccounts/2019#total-current-healthcare-expenditure-in-the-uk

but little, publicly funded coverage for oral healthcare (Henry *et al.,* 2021; Johnston *et al.,* 2020). In any system when costs are high, children of limited means, who are also at increased risk, may not be able to afford care (Watt *et al.,* 2019). This can result in inequalities in access to services and ultimately poorer oral health (Wang *et al.,* 2020).

In addition to the range of differences between systems, including funding, there is a paucity of information on how the system is organised; for example, how services are delivered, the healthcare professionals responsible for providing care and access to services (Allin *et al.,* 2020; Eaton *et al.,* 2019; Glick *et al.,* 2021). An in-depth understanding and comparison of how different oral care systems operate and their position within the UHC domain could provide a greater knowledge for healthcare planning and policy decision making (Eaton *et al.,* 2019; Folayan *et al.,* 2021). Aim of this research

The primary aim of this research is to compare publicly funded oral health coverage for children under the age of eighteen years across six European countries, each of which is representative of a model for the provision of oral healthcare, and to report on oral health status in line with the indicators for universal oral healthcare. This protocol outlines the methodology for the collection, management, and analysis of data from a systematic documentary analysis and semi-structured interviews with local experts, pertaining to Denmark, Hungary, Ireland, Germany, Scotland, and Spain, to meet the primary study aim. Objectives of this research

To describe and compare models of publicly funded oral health systems for children across the chosen six European countries including the financing arrangements associated with each system.

To collect and compare available and relevant indicators of universal coverage for oral health in the chosen countries.

To identify those national oral healthcare systems with effective oral health prevention and promotion programmes for children, as evidenced by low d_3mft/D_3MFT or ICDAS 0-3 and the percentage (%) with no obvious dental caries at age 12.

To learn from successful examples of oral health systems for children internationally, in terms of outcomes and costs, that can be applied to other countries.

Protocol

Study design

This is a cross-national comparative analysis of publicly funded oral health systems for children under the age of eighteen across six European countries. The study will follow Yin's multiple-case study approach (Yin, 2014). To strengthen study validity, two strands of data collection, analysis and triangulation will be undertaken:

A systematic documentary analysis.

Semi-structured interviews with 'elite' participants from each country (Van Audenhove & Donders, 2019). Ethical approval

Ethical approval for the study was obtained from the Clinical Research Ethics Committee of the Cork Teaching Hospitals at University College Cork (Reference number: ECM 4 (J)12/11/2019). Written informed consent to participate will be sought from each participant prior to interview.

Country selection

Countries proposed for comparison are:

Nordic system: Denmark

Eastern European system: Hungary

Hybrid system: Ireland

Bismarkian system: Germany

Beveridgian system: Scotland[1]

Southern European system: Spain

Criteria for country selection

The criteria for country selection are those:

Which are representative of the variation of health systems throughout Europe (i.e., social health insurance vs. tax-financed, multi- vs single-payer, centralised versus decentralized) and the different models of dental systems in Europe (Sinclair *et al.,* 2019).

Demonstrate effective oral health prevention and promotion strategies evidenced by low d_3mft/D_3MFT and percentage with no obvious caries at age 12 or ICDAS 0-3.

With a history of, or planned oral health system reform.

[1] Scotland is chosen for comparison due to the improvements in the oral health of children and the reduction in associated inequalities that have transpired following the successful implementation of the Childsmile programme.

Indices for assessing dental caries. The Decayed, Missing and Filled Teeth (DMFT) Index has been used for almost 80 years and remains the most commonly used epidemiological index for assessing dental caries (Broadbent & Thomson, 2005). Obvious decay is when the disease appears to have penetrated dentine and is described as decay at the 'd_3 level' in deciduous teeth, the 'D_3 level' in permanent teeth, and includes pulpal decay. This definition is in accordance with international epidemiological conventions, thus facilitating optimum comparison. It is recommended that countries conduct periodic national oral health surveys, with the 12-year-old age group considered particularly important as a target group for assessing the level of dental caries severity among children with permanent teeth (World Health Organization, 2013).

The International Caries Detection and Assessment System (ICDAS) was developed to provide a standardized caries detection and diagnosis system across a range of different environments (Pitts & Stamm, 2004). The ICDAS measures changes and potential lesion depth based on surface characteristics. The ICDAS scores range from zero to six for coronal caries, with zero representing a sound tooth and six an extensive distinct cavity with visible dentin (Shivakumar *et al.*, 2009).

There are limitations associated with the DMFT, particularly the range of diagnostic criteria, sampling techniques and methods used to train and calibrate examiners across different countries. Nationally reported DMFT varies across countries, with some reports stemming from data generated almost 20 years apart (Patel *et al.*, 2016). This will be recognised in the findings of this study by highlighting the year of reporting to facilitate appropriate interpretation of each country's D_3MFT. Participants

In-depth interviews will be undertaken with individuals selected as representatives of, and with expert knowledge local to, each country. Participants will be identified via (i) the outcomes of the documentary analysis, (ii) using purposive sampling based on the recommendations of participants and (iii) the researchers' understanding of individuals with expert knowledge of the oral health system in question. It is anticipated that two experts from each country, i.e., a total of twelve experts *(n=12)*, will participate. Data collection

Conceptual framework. To describe and compare publicly funded oral health systems for children under age 18 across the six chosen countries, each model will be described according to the three core features of the WHO Coverage Cube Framework (World Health Organization, 2010): (i) breadth, i.e., child populations (0–18 years) eligible for publicly funded oral health programs; (ii) depth, i.e., the share of the total costs that are borne by the government/public payer; and (iii) scope, i.e., the range of services covered under publicly funded oral healthcare programs (Figure 1).

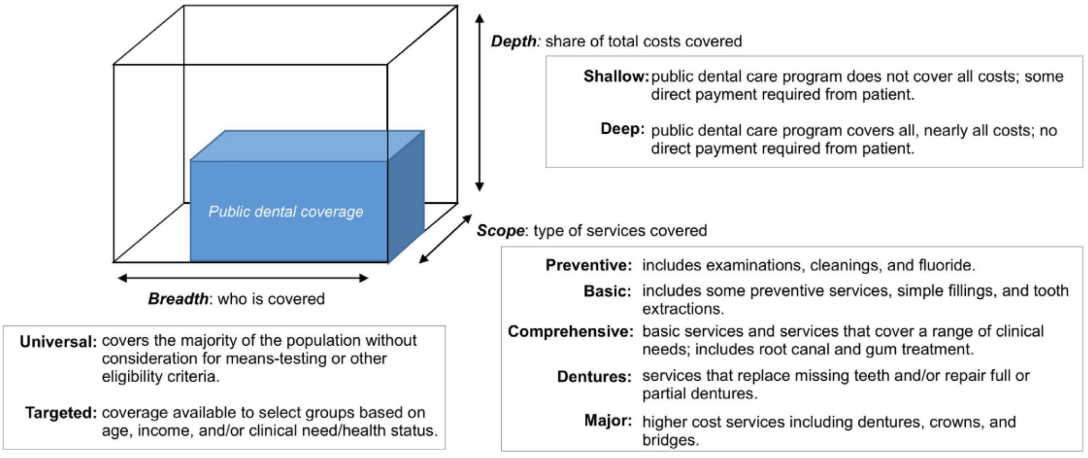


Figure 1. Dimensions of coverage for public oral healthcare models based on the World Health Organization Coverage cube framework. Adapted from Allin *et al.*, 2020.

Documentary analysis

A documentary analysis is a systematic procedure for reviewing documents, requiring data be examined and interpreted to elicit meaning and gain empirical understanding of a given topic (Bowen, 2009). This systematic documentary analysis will aim to examine the relevant reports, policies, service documents, academic

publications and other literature developed at local, regional, and national level for each country.

Information sources

The relevant documents will be identified in the following ways:

A literature search of the following databases: Medline (EBSCO), CINAHL (EBSCO), EMBASE,

ProQuest and the Cochrane Library. The TRIP database will be searched for grey literature along with medRxiv (for health sciences preprints), while Google Scholar and Web of Science will also be utilised.

Manual reference checks of identified documents and studies.

Publicly available resources and documents will be searched to identify existing reviews, oral health policies and position papers regarding oral health coverage by national and international stakeholders e.g., governmental health departments of each country and international organisations including the World Health Organization, FDI World Dental Federation and the Council for European Chief Dental Officers.

Search strategy. The search strategy for this research will be developed with the assistance of a specialist medical librarian (SKB) based at Cork University Hospital, Cork, Ireland, in collaboration with the lead author, an academic dental researcher (UM). The search strategy will entail using a combination of keywords and subject headings, incorporating MeSH (PubMed/Medline), CINAHL Headings (CINAHL) and EMTREE headings (EMBASE). Search results will be filtered for items published in English since 2001 and will then be screened by title and abstract. If key documents are only available in the country's native language, these will be translated with verification of their critical elements sought from local experts. The search strategy presented in extended data (McAuliffe, 2021) is based on Medline and will be tested and adapted for all other databases and resources. An overview of the MeSH terms is presented in Table 2.

Inclusion criteria

Types of study to be included

No limitations will be placed on the study or document included if the study design and document address the research aim. Government documents such as national oral health policies along with clinical guidelines academic literature, oral health service reports, and other grey literature, in addition to international recommendations pertaining to evidence for improved oral health, will be eligible for inclusion.

Population, concept, and context

This research seeks to compare oral health systems for children across countries. To ensure most systems are eligible for consideration, an age range up to 18 years is proposed. It is beyond the scope of this research to consider oral health service reviews for special needs and other vulnerable populations. Policies, guidance, and other literature that pertain to public oral healthcare systems, strategies for oral health promotion and prevention, universal oral health coverage, dental system reform and improved oral health status for children $\leq$ 18 years will be included. All included studies/documents must include two or more of the following outcomes: (1) publicly funded dental systems seeking to, or who have successfully, implemented universal oral health coverage in the last twenty years, (2) reduced oral health inequalities, (3) improved oral health system accessibility (4) reduced oral health system costs (5) caries rates as determined by d_3mft/D_3MFT and percentage with no obvious caries at 12 years, or (6) the International Caries Detection and Assessment System (ICDAS) and other indicators of oral health status including periodontal diseases and oral health-related quality of life measures (OHRQoL). Please see Table 3 for full inclusion criteria.

Table 2. Specific MeSH terms employed.

Area of interest	MeSH terms
"Health Indicators"	(MH "Quality Indicators, Health Care+")
"Population under age 18"	(MH "Child+") OR (MH "Child, Preschool") OR (MH "Infant+") OR (MH "Infant, Newborn+") OR (MH "Adolescent") OR (MH "Young Adult")
"Universal Health Care"	(MH "Universal Health Insurance") OR (MH "Universal Health Care") OR (MH "Delivery of Health Care+") OR (MH "National Health Programs+") OR (MH "Insurance, Dental") OR (MH "Global Health")
"Healthcare Costs"	(MH "Socioeconomic Factors+") OR (MH "Health Expenditures+") OR (MH "Cost-Benefit Analysis") OR (MH "Health Care Costs+")
"Oral Health"	(MH "Dental Caries+") OR (MH "DMF Index") OR (MH "Dental Care+") OR (MH "Dental Care for Children") OR (MH "Preventive Dentistry+") OR (MH "School Dentistry") OR (MH "State Dentistry") OR (MH "Pediatric Dentistry") OR (MH "Tooth Diseases+") OR (MH "Mouth Diseases+") OR (MH "Tooth, Deciduous+") OR (MH "Fluoridation")
"Country"	(MH "Ireland") OR (MH "Spain") OR (MH "Germany+") OR (MH "Denmark+") OR (MH "Hungary") OR (MH "Scotland+") OR (MH "Europe+") OR (MH "Europe, Eastern+") OR (MH "European Union")

Table 3. Documentary analysis related inclusion criteria.

Criterion	Inclusion
Population	Community dwelling children aged less than 18 years of age.
Document/study type	No limitations on document type provided research aim is addressed. Grey literature including national oral health policies, health service reports and recommendations will also be included
Setting	Publicly funded oral healthcare systems including primary and secondary care. *Excluded: residential oral healthcare facilities*
Outcome(s)	Included documents must have two or more: Publicly funded oral health systems successfully implemented UHC Reduced oral health inequalities Reduced oral health system costs Improved oral health system accessibility Dental caries rates via dmft/D3MFT and % with no obvious caries at age 12 or ICDAS (0–3) Other indicators of oral health status including periodontal diseases/Oral Health Related Quality of Life measures
Time period	2001–2021
Language	English

Study selection and data extraction

Download of title and abstract records

Titles and abstracts identified will be downloaded in file formats usable with our chosen reference management software (Zotero) with any additional information stored in Microsoft Excel. They will then be uploaded to Zotero and Rayaan, an online application supporting systematic review screening efficiency (Ouzzani *et al.*, 2016), with any duplicate entries removed.

Reviewer calibration

A data charting form will be developed, guided by the inclusion criteria. The data selection process and form will be pilottested in 10% of randomly selected and included articles to assess reviewer calibration. Any discrepancies between reviewers will be discussed with amendments made to the data extraction form and further calibration as required to ensure near perfect (>80%) agreement.

Title and abstract reviews

Title and abstract reviewing will be performed by one reviewer (UM) and verified by another (JC). The verification process will entail an assessment of the original screening of the title and abstract to confirm whether the second reviewer agrees with the decision made. Any discrepancies will be discussed with a third researcher engaged (SB or KE) if a consensus fails to be reached. Titles and abstracts that fail to meet the

eligibility criteria will be excluded from the next stage of assessment, while those that conform to the eligibility criteria will be included for full-text review.

Full-text review

Full-text material will be sourced using the resources provided by University College Cork. If the full text cannot be accessed, the team will investigate if they can be retrieved via any other library to which the broad team has access, via international experts local to each country or by contacting the relevant authors.

Data extraction

A data extraction form will be developed, guided by the WHO Coverage Cube, based on previous work by Allin *et al*., 2020, and further refined for this research. Full-text reviews will be completed by one reviewer (UM) with verification by another (JC). Any discrepancies will be resolved by discussion, and failure to reach consensus will require consultation with a third member of the research team (SB or KE). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses

(PRISMA-S) will be applied in illustrating this approach (Rethlefsen *et al.*, 2021).

Risk of bias (quality) assessment. Risk of bias will be assessed by one researcher and verified by another with any discrepancies resolved in discussion with a third member of the research team (SB or KE). Each study will be assessed by a tool appropriate for its study design, particularly using the Critical Appraisal Skills Programme (CASP) checklists pertaining to the individual study type. However, considering the nature of the research question, not all items are applicable to every type of included document in this analysis and quality ratings will be determined in this instance. Semi-structured interviews with elite participants

Following the outcomes of the documentary analysis and guided by the WHO Coverage Cube, a semi-structured interview guide will be developed for use with all participants (World Health Organization, 2010). This will be piloted and further reviewed in structured meetings with the research team. The full list of participants will be regularly updated throughout the research process. In view of the wide geographic spread of participants, it is expected that all interviews will take place via tele-conferencing tools. Strategy for data analysis

This research will follow Yin's multiple-case study methodology in employing two strands of data collection and analysis (Yin, 2014).

Document analysis requires superficial examination, thorough examination, and interpretation of documents combining content analysis and thematic analysis (Bowen, 2009). This analysis will follow a directed content analysis approach guided by the WHO framework and employ a deductive category application (Graneheim & Lundman, 2004). This research will follow the checklist to improve trustworthiness in content analysis developed by Elo *et al*. (2014).

Key initial concepts will be identified as coding categories using the WHO framework as guidance before operational definitions for each category are defined. Interviews will be transcribed verbatim and coded. All data will be managed and coded using qualitative data analysis software (NVivo 12 qualitative data analysis software).

The data from the documentary analysis will be analysed together with the data from interviews to ensure themes are triangulated across both datasets. A dedicated case study will then be drafted for each country individually before cross case analysis will be conducted to identify patterns of similarities and differences across the cases. All sub-themes and main themes will be tabulated and discussed among the research team, with a particular emphasis on the possible implications for policymakers.

The potential limitations of documentary analyses include: an absence of detail, low retrievability or biased selectivity (Yin, 1994). Additionally, interview data may be subjective and ambiguous (Pannucci & Wilkins, 2010). It is expected the data triangulation employed in this research will guard against the possible limitations of trustworthiness, researcher bias and respondent bias. Additional techniques including a documented systematic search, a 'thick' description of outcomes and an audit trail will further serve to ensure verification.

Dissemination

The findings will be presented to policymakers and governmental health departments in each country, in addition to professional networking conferences both nationally and internationally, such as the European Association of Dental Public Health congress. Study status

The search strategy is under development with the support of a specialist medical librarian (SKB) at Cork

University Hospital with initial searches of the MEDLINE database underway. **Conclusion**

The challenges to meeting oral health needs of populations, and particularly vulnerable groups, is now receiving global attention, with policy makers being urged to appropriately position oral health within the emerging universal healthcare (UHC) agenda (Glick *et al.*, 2021; Watt *et al.*, 2019; World Health Organization, 2021a). However, there is conflicting support for the impact of improved access to oral health systems and the prevalence of dental caries in children (Pucca Jr *et al.*, 2015; Virtanen *et al.*, 2007). Recent evidence has confirmed that higher governmental health expenditure may be associated with lower prevalence of the disease among very young children; however, calls have been made for country-specific studies to determine how UHC may reduce the risk of dental caries (Folayan *et al.*, 2021). This proposed research aims to compare publicly funded oral health systems for children throughout Europe and to report on oral health status in line with the indicators for UHC. By providing this evidence for oral health advocates internationally, this research may support the positioning of oral health on governmental agendas and ensure that essential oral health systems are integrated into broader healthcare in an accessible and affordable manner.

Data availability Underlying data

No data are associated with this article.

Extended data

Open Science Framework: Comparing oral health systems for children in six European countries to identify lessons learned for universal oral health coverage: A study protocol: Extended data., https://osf.io/347vw

This project contains the following extended data:

- Medline (EBSCO) Search strategy.docx (The mix of key words and mesh terms that will be used to search Medline and that will be transferred to other databases for searchers).

Data are available under the terms of the Creative Commons Zero "No rights reserved" data waiver (CC0 1.0 Public domain dedication).

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Current Peer Review Status: ? ✓ ✓

Version 1

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✓ **Xiaojuan Zeng**
Dental pubic Health, College & Hospital of Stomatology, Guangxi Medical University, Guangxi, China

This study will follow Yin's multiple case study approach and employ two strands of data collection, analysis, and triangulation with elite participants local to each country. This study proposal is interesting and good. The background was sufficient writing. The study clearly described the aims and objectives. The study design was suitable for the study questions. The methods were good enough to guide other to do similar study. In addition, the datasets were clearly presented in a useable and accessible format.

This study may provide policy makers with effective preventive strategies, oral health system reform, and indicators of universal oral health coverage. It may help in positioning oral health on governmental health agendas and support its integration into wider health systems' reform in an accessible and affordable manner. However, it will be great if more countries such as China can be involved in the future.

Is the rationale for, and objectives of, the study clearly described? Yes

Is the study design appropriate for the research question? Yes

Are sufficient details of the methods provided to allow replication by others?
Yes

Are the datasets clearly presented in a useable and accessible format? Yes

Competing Interests: No competing interests were disclosed.
Reviewer Expertise: Oral epidemiology, Oral health promotion, Oral health related quality of life, Common risk factor on Oral disease and ChronicNon-communicable Diseases (NCD), Oral health policy, Diet and Oral health, Oral heath inequality

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 25 September 2023

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Paulo Frazão
University of São Paulo, São Paulo, Brazil

The authors present a study protocol that aims to compare publicly funded oral health coverage for children under the age of eighteen years across six European countries. The countries will be selected according to diversity of oral healthcare model that they deliver. Based on the management and financing strategy, six oral healthcare systems will be described, namely the Nordic, Bismarkian, Beveridgian, Southern European, Eastern European and Hybrid models. The rationale of the study is well formulated but some points deserve consideration. The literature shows that the magnitude of dental caries prevalence is strongly associated to sugar and fluoride exposures.

Then it is important to clarify that the focus is untreated dental caries prevalence. This point is clearer in the Methods (use of ‘d3 level’ in deciduous teeth and the ‘D3 level’ in permanent teeth) than in the Introduction. This is particularly relevant because previous studies that sought to explore relationship between Universal Health Coverage (see that the manuscript reports incorrectly UHC as Universal Healthcare in the fifth paragraph, in the conclusion and in the abstract) and early childhood caries (ECC) have some major limitations. For example, the supporting studies (El Tantawi et al., 2018; Folayan et al. 2021) of the justification did not included indicators related to sugar and fluoride exposure. ECC’s definition requires the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth. The conflicting results cited by the authors in the 7th paragraph can be related to methodological characteristics of the studies as the observed outcome and included variables. The presented study protocol will investigate dental caries determined by ‘d3 and D3 levels’ indicators.

The study design will be based on multiple-case study approach in which a cross-national comparative analysis will be undertaken using documentary research and semi-structured interviews with local experts. Forward the authors stated that they will undertake in-depth interviews. So they will undertake semi-structured in-depth interviews. Each delivery model of oral healthcare will be described according WHO Coverage Cube Framework. Systematic documentary analysis will be performed examining scientific documents and technical reports. It was not justified why the authors will select local and regional reports.

For the purpose of the protocol I think that national-level documents would be more appropriated. The procedures for searching and selecting of the documents were well described. The researchers will assess risk of bias using a tool appropriate for each study design. The presented protocol is well designed for producing evidence on publicly funded oral health systems for children throughout Europe and on oral health status in line with the indicators for Universal Health Coverage. It is important to highlight that UHC means Universal Health Coverage instead of Universal Health Care. The UHC strategy sponsored by WHO is not necessarily the same strategy implemented by some countries where the access to health services does not depend on the user's ability to pay. I agree with the authors that the current protocol may support the positioning of oral health on governmental agendas and ensure that essential oral health systems are integrated into broader healthcare in an accessible and affordable manner.

Is the rationale for, and objectives of, the study clearly described? Yes

Is the study design appropriate for the research question? Yes

Are sufficient details of the methods provided to allow replication by others? Yes

Are the datasets clearly presented in a useable and accessible format? Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Oral health policy and epidemiology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 19 September 2023

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Kaung Myat Thwin
Niigata University, Niigata, Japan

Abstract:

Background: It would have been better if the types of oral health systems were mentioned (taxfinanced and social health insurance).

Methodology: Instead of stating that the study will follow Yin's multiple case study approach, it would be better to state what information will be extracted from the literature (main source of general healthcare financing, the level of coverage (age), range of services), how it will be graded (risk of bias) or analyzed.

Introduction:

The Introduction is quite long. It would have been better if the introduction of oral diseases and dental caries was brief. Since the title is about oral health systems, it would be more interesting to discuss why it was necessary to compare oral health systems for children in six European countries (research gap). Instead of discussing each country's oral health systems, it would have been more organized to read which country utilizes tax financing and social health insurance as the main source of general healthcare financing, the level of coverage (age), range of services (included treatments), and so on.

Aims

1. Objectives: The statement "to learn from successful examples" limits the learning to only the success of implementing the oral health

system. In my opinion, we can also learn even from not-successful examples. It is better to revise this sentence.

2. Please add the study's hypothesis. **Protocol:**
    1. Study design: The statement "oral health systems for children under the age of eighteen" is vague. It is better to put the age range of the target population of this study.

    2. What do "elite" participants mean? It would be easier to understand it if it was defined in item #2.

    3. Indices for assessing dental caries: Please also mention why you will use two indices: DMFT and ICDAS.

    4. In data collection, you mentioned that the children under age 18, while in Population, concept and context of Inclusion criteria, the children ≤18. Which one is correct? Please amend it.

Inclusion criteria:

1. What is the included literature? Does "No limitations on document types" mean you will include even study protocol or unpublished study?

2. Why do you limit 2001, is there any reason?

3. It would be better if you clarify whether you will include documents only in English or not since you described "If key documents are only available in the country's native language, these will be translated with verification of their critical elements sought from local experts" in search strategy section.

Data extraction: It would be better if you provided what data will you extract from the articles.

Risk of bias: Since you include all types of articles, the CASP checklist cannot be performed in all included documents. In that case, what tools or checklist will you use?

It would be better to state the research questions you want to answer in this review because study selection and data extraction will depend on it. The risk of bias assessment will be unclear without considering each research question.

Conclusion: Since there were four objectives mentioned in this study, it would have been better if each objective was addressed in the conclusion. Future study recommendations could also be mentioned (e.g., can be used for reform).

Beside the above mentioned comments, I may suggest you to add the sections such as "Expected results", "Study period and study protocol".

In addition, when you described the outcomes, it is better to specify which is primary outcome, then which are the secondary outcomes.

Is the rationale for, and objectives of, the study clearly described? Partly

Is the study design appropriate for the research question? Yes

Are sufficient details of the methods provided to allow replication by others?
Partly

Are the datasets clearly presented in a useable and accessible format?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Oral health and general health, oral health promotion, dental public health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.