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Deprescribing for frail older adults residing in long-term care facilities: a mixed-methods evaluation.

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

University College Cork

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September 2023

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List of Abbreviations

ADeN - Australian Deprescribing Network

ADE – Adverse Drug Event

APEASE - Acceptability, practicability, effectiveness, affordability, safety and equity

B - Barrier

BCT – Behavioural Change Techniques

BCTTv1 – Behavioural Change Technique Taxonomy Version 1

BCW – Behavioural change wheel

BP – Blood Pressure

CaDeN - Canadian Deprescribing Network

CASP - Critical Appraisal Skills Programme

CENTRAL - The Cochrane Central Register of Controlled Trials

CFS – Clinical Frailty Scale

CI – Confidence Interval

CNM - Clinical Nurse Manager

COM-B – Capability, Opportunity, Motivation, Behvaiour

COREQ - consolidated criteria for reporting qualitative research

COS – Core outcome set

CREDES - Conducting and REporting of DElphi Studies

DEFERAL - DEprescribing review for Frail oldER Adults in Long-term care

E – Enabler

EU – European Union

ENTREQ - Enhancing transparency in reporting the synthesis of qualitative research

GP – General Practitioner

GRADE-CERQual - Grading of Recommendations Assessment – Development and Evaluation and Confidence in Evidence from Reviews of Qualitative Research

HbA1C – Haemoglobin A1C

HCP – Healthcare Professional

HIQA - Health Information Quality Authority

HSE – Health Service Executive

IQR – Interquartile range

IT – Information Technology

LTC – Long-term care

LTCF – Long-term care facility

MAI – Medication Appropriateness Index

MDT – Multidisciplinary team

MRC – Medical Research Council

NC – Nurse Champion

NERD - Network of European Researchers in Deprescribing

PE – Potential enabler

PIM – potentially inappropriate medication

PIP – potentially inappropriate prescribing

PPI – Proton Pump Inhibitor

PRISMA - Preferred Reporting Items for Systematic reviews and Meta-Analyses

PRN – *pro ra nata*

PROSPERO - The International Prospective Register of Systematic Reviews

QES – Qualitative evidence synthesis

RETREAT - Review question, Epistemology, Time, Resources, Expertise, Audience and purpose, Type of data

RCT – Randomised Controlled Trial

RR – Relative Ratio

SBP – Systolic Blood Pressure

SD – Standard deviation

SPICE – Setting, Perspective, Interest, Phenomenon of, Comparison, Evaluation

StaRI - Standard for Reporting Implementation Studies

STOPP - Screening Tool of Older Persons' Prescriptions

STOPP/START - Screening Tool of Older Persons' Prescriptions (STOPP) and Screening Tool to Alert to Right Treatment (START)

STOPP/START v2 - Screening Tool of Older Persons' Prescriptions (STOPP) and Screening Tool to Alert to Right Treatment (START) version 2

STOPPFall - Screening Tool of Older Persons Prescriptions in older adults with high fall risk

STOPPFrail - Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy

STOPPFrail v2 - Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy version 2

TDF – Theoretical Domains Framework

UK – United Kingdom

UN – United Nations

USDeN - US Deprescribing Research Network

WHO – World Health Organisation

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: Date:

_____ _____

Clara H. Heinrich September 2023

Publications, presentations and awards

Thesis related peer-reviewed full paper publications

- **Heinrich CH**, Hurley E, McCarthy S, McHugh S, Donovan MD. Barriers and enablers to deprescribing in long-term care facilities: A 'best-fit' framework synthesis of the qualitative evidence. Age and Ageing 2022; 51: 1–19, DOI:10.1093/ageing/afab250. IF 12.782.
- **Heinrich CH**, McHugh S, McCarthy S, Donovan MD. Barriers and enablers to deprescribing in long-term care: a qualitative investigation into the opinions of healthcare professionals in Ireland. PLOS One (2022). https://doi.org/10.1371/journal.pone.0274552. IF 3.752.
- **Heinrich, CH**, McCarthy, S., McHugh, S. et al. Identification of Potentially Inappropriate Medications in Frail Older Adults Residing in Long-Term Care: A Retrospective Chart Review Study. Drugs - Real World Outcomes (2022). https://doi.org/10.1007/s40801-022-00342-2 IF 1.837 IF 1.89.
- **Heinrich, CH**, McHugh S, McCarthy S, Curran GM, Donovan MD. Multidisciplinary DEprescribing review for Frail oldER Adults in Long-term care (DEFERAL): Implementation strategy design using behaviour science tools and stakeholder engagement. Research in Social and Administrative Pharmacy (2023). https://doi.org/10.1016/j.sapharm.2023.05.002 IF 3.348.

Non-thesis related peer-reviewed full paper publications

- **Heinrich CH**, Donovan MD. Assessing Community Pharmacists' Attitudes Towards Identifying Opportunities for Deprescribing in Clinical Practice in Ireland. International Journal of Pharmacy Practice, Vol 30, 28–35, DOI:10.1093/ijpp/riab079 IF 1.8.
- Hurley H, Walsh E, Foley T, **Heinrich CH**, Byrne S, Dalton K. General practitioners' perceptions of pharmacists working in general practice: a qualitative interview study. Family Practice, 2022; cmac115, https://doi.org/10.1093/fampra/cmac115 IF 2.2.

- Morel T, **Heinrich CH**, Zerah L, Hurley E, Christiaens A, Fournier JP. Use of deprescribing search filters in systematic review search strategies: A case study. Basic Clin Pharmacol Toxicol. 2023 Jun 2. doi: 10.1111/bcpt.13908. IF 3.1

Peer-reviewed published abstracts

- **Heinrich CH**, Hurley E, McCarthy S, McHugh S, Donovan MD. Barriers and enablers to deprescribing in long-term care facilities: a 'best-fit' framework synthesis of the qualitative evidence. International Journal of Clinical Practice 43, pages1736–1801 (2021). DOI: 10.1007/s11096-021-01352-w
- **Heinrich CH**, McHugh S, McCarthy S, Donovan MD. Barriers and enablers to deprescribing in long-term care: a qualitative investigation into the opinions of healthcare professionals in Ireland. Pharmacoepidemiology and Drug Safety 2022;31(Suppl. 1):3–26. DOI: 10.1002/pds.5499.
- **Heinrich CH**, McCarthy S, McHugh S, Donovan MD. Identification of potentially inappropriate medications in frail older adults residing in long-term care: a retrospective chart review study. Pharmacoepidemiology and Drug Safety 2022;31(Suppl. 1):3–26. DOI: 10.1002/pds.5499.
- **Heinrich CH**, McCarthy S, McHugh S, Donovan MD. Identification of Potentially Inappropriate Medications In Frail Older Adults Residing in Long-Term Care: A Retrospective Chart Review Study. Age and Ageing IF 12.782. Volume 51, Issue Supplement 3, November 2022, afac218.030
  https://doi.org/10.1093/ageing/afac218.030
- **Heinrich CH,** McCarthy S, McHugh S, Curran GM, Donovan MD. Multidisciplinary deprescribing review for frail older adults in long-term care: Development of a theory informed implementation strategy using a Delphi survey and Roundtable discussion with stakeholders. International Journal of Pharmacy Practice.

Non-thesis related peer-reviewed published abstracts

- Hurley E, Foley T, Walsh E, Byrne S, **Heinrich CH**, Dalton K. General practitioners' perceptions of pharmacists working in general practice: a qualitative interview study. Rural and Remote Health 2023; 23: 8105. https://doi.org/10.22605/RRH8105
- **Heinrich CH**, Donovan MD. Role of the Community Pharmacist in Deprescribing Potentially Inappropriate Medications (PIMs) in Older Adults. Pharmacoepidemiology and Drug Safety 2022;31(Suppl. 1):3–26. DOI: 10.1002/pds.5499

Posters and Oral Presentations

- Heinrich CH, Hurley E, McCarthy S, McHugh S, Donovan MD. Barriers and enablers to deprescribing in long-term care facilities: a 'best-fit' framework synthesis of the qualitative evidence.
    1. 18th Annual Psychology Health and Medicine Conference, 12th-14th May 2021, virtual. Poster presentation and oral discussion.
    2. European Society of Clinical Pharmacy Symposium, 19th-21st October 2021, virtual. Oral PowerPoint presentation and poster presentation.
- Heinrich CH, McCarthy S, McHugh S, Donovan MD. Barriers and enablers to deprescribing in long-term care facilities: a qualitative investigation into the opinions of healthcare professionals in Ireland.
    1. 2nd European Conference on Ageing and Gerontology, University College London, 14th-17th July 2022, virtual. Oral PowerPoint presentation.
    2. 22nd World Congress of gerontology and geriatrics, 12th – 16th June 2022, virtual. Oral PowerPoint presentation.
    3. 1st Annual International Conference on Deprescribing, Kolding Denmark, 5th-8th September, 2022. Poster presentation.
- Heinrich CH, McCarthy S, McHugh S, Donovan MD. Identification of potentially inappropriate medications in frail older adults residing in long-term care: a retrospective chart review study.

1. Prescribing and Research in Medicines Management (PRIMM) (United Kingdom & Ireland) 33rd Annual Scientific Meeting, 10th June 2022. Oral and poster presentation.
2. 1st Annual International Conference on Deprescribing, Kolding Denmark, 5th-8th September, 2022. Poster presentation.
3. Irish Gerontological Society 69th Annual Scientific Meeting, Co. Cavan, Ireland. 3rd-4th November 2022. Poster presentation.

- Heinrich CH**,** McCarthy S, McHugh S, Curran GM, Donovan MD. Multidisciplinary DEprescribing Review for Frail oldER Adults in Long-term care (DEFERAL): Implementation strategy design using behaviour science tools and stakeholder engagement.
    1. Health Services Research in Pharmacy Practice Conference, University of Bradford, United Kingdom, 16th-17th April 2023. Oral PowerPoint presentation.
    2. CARU Webinar; Irish Hospice Foundation, All Ireland Institute of Hospice and Palliative Care and the HSE July 20th 2023, online presentation.

Awards

- Successful applicant of University College Cork's College of Medicine and Health Travel Bursary to attend the 1st Annual Conference on Deprescribing in Denmark, September 2022.
- Dr John Fleetwood award for best oral poster presentation in the student category at the Irish Gerontological Society 69th Annual Scientific Meeting 2022.

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Thesis Abstract

Introduction

Globally, the population is ageing and the demand for long-term care (LTC) is increasing. Older adults residing in LTC have a higher degree of physical frailty compared to their community-dwelling counterparts. The physiological changes associated with ageing and frailty can increase the risk of experiencing an adverse event from a medication. Polypharmacy and potentially inappropriate medications (PIMs) are even more of a concern in frail older adults as frailty increases the risk of adverse outcomes. Deprescribing has been shown to reduce PIMs for older adults residing in LTC however, deprescribing is not universally implemented.

The aim of this thesis is to develop and test an evidence- and theory-based implementation strategy to support HCPs engage with deprescribing in routine practice for frail older adults residing in LTC.

Methods

A mixed-methods approach was utilised for this thesis, informed by the Medical Research Council's framework for designing and evaluating complex interventions. Firstly, the 'best-fit' framework method was used to synthesise the qualitative evidence, using the Theoretical Domains Framework. The resulting 'best-fit' framework was used to inform a semi-structured interview study of HCPs working in LTC to identify context-specific deprescribing barriers/enablers. A retrospective chart review was conducted in two long-term care facilities (LTCFs) using Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy version 2 (STOPPFrail v2) to identify PIMs. Results supported the design of a deprescribing implementation strategy. The implementation strategy design consisted of 3 phases; a mapping process to identify behaviour change techniques (BCTs) which could form a strategy, a modified online Delphi survey to select feasible BCTs and a roundtable discussion to prioritise barriers/enablers and tailor the proposed strategies for deprescribing in LTC. A feasibility study of the resulting strategy was conducted in two public LTCFs focusing on implementation outcomes whilst collecting intervention data.

Results

The qualitative evidence synthesis and interview study summarised the deprescribing barriers/enablers in LTC. Barriers included insufficient resources, lack of co-ordination between healthcare settings and negative social influences. Deprescribing enablers included interprofessional support and patient social influence. The retrospective chart review study identified that lack of a documented indication for prescribed medications was the most prevalent PIM criterion, with antihypertensives the largest drug class potentially inappropriately prescribed. The final deprescribing implementation strategy consisted of an education-enhanced 3-monthly multidisciplinary team deprescribing review, led by a nurse, conducted at the LTC site targeting antihypertensives, named the DEFERAL strategy. Of HCPs involved in the feasibility study, the DEFERAL strategy was unanimously considered acceptable and appropriate, with 90% agreeing that it was feasible. Qualitative feedback outlined site-specific modifications for future consideration.

Conclusion

This thesis has designed and feasibility tested a theory- and stakeholder-informed implementation strategy to support HCPs to engage with deprescribing PIMs prescribed to frail older adults residing in public LTCFs in Ireland. The DEFERAL strategy helped to address a gap reported in the deprescribing literature by incorporating concepts from behavioural and implementation science to target barriers and enablers inherent with the LTC setting and translate deprescribing into routine practice. The strategy was considered acceptable, appropriate and majorly feasible, with modifications reported for consideration in future piloting and effectiveness research.

Chapter 1: Introduction

1.1 Ageing population

1.1.1 Prevalence

Globally the population is ageing, with both the number and proportion of older adults increasing. It is predicted that by 2050, the number of adults aged 60 years or more will reach 2.1 billion, increasing from 1 billion in 2019 (1). This shift in demographic will have a subsequent effect on societal and political decision-making, as demand for age-related services will change accordingly. The United States National Institute on Ageing recognise the significance of this change, and as a part of their Strategic Directions for Research 2020-2025, they aim to increase the understanding of the consequences of an ageing society on intervention development and policy decisions (2). The impact of ageing is also of interest to the United Nations (UN) and World Health Organisation (WHO), as they declared 2021-2030 the Decade of Healthy Ageing. One of the four aims of this global collaboration includes providing older people with access to quality long-term care, if it is required (3).

Considering the Irish context, the population is ageing at a similar rate as the global expansion. The number of older adults, aged 65 years or more, is projected to increase from one eight to one sixth of the total population, with the number of adults aged 85 years or more expected to almost double by 2030 (4). Ageing and the associated senescence is a well-documented risk factor for chronic disease, increasing morbidity and mortality (5). The process of ageing is considered the primary risk factor for diseases and conditions that can impair an individual's health and overall well-being (6). Therefore, this demographic shift will place an increased pressure on the Irish health and social care services, with particular demand placed on older persons services, as multimorbidity will become more common (4,7).

1.1.2 Long-term care (LTC)

With an expanding population over the age of 65, there is an increased demand for long-term care (LTC) for older adults (1,4,8). In Ireland, the number of older adults who reside in LTCFs rose by 9.4% in 2016, with requirements projected to increase by 40-54% from 2015 to 2030 (4,9). This increase in

demand for LTC is reflected across Europe, with a sharp increase in the number of LTC beds observed in most European Union (EU) member states over the past decade (10).

The regulation of all LTCFs in Ireland is co-ordinated by the Health Information and Quality Authority (HIQA), an independent authority which strives to advance top quality and safe care for older people in Ireland (11). HIQA regularly inspect and audit LTC sites and are responsible for setting standards for health and social services, based on best available evidence and practice. HIQA developed the National Standards for Residential Care Settings for Older People in Ireland underpinned by The Health Act (2007), which is the state legislation for the monitoring, inspecting and registration of LTCFs. Under The Health Act (2007), all LTCFs must register with HIQA and follow their regulations for registration and standards, which aim to ensure quality (4). These standards focus on outcomes which aim to improve quality of life and include monitoring the safe and rational use of medications for older adults residing in these settings (12).

Long-term care for older adults in Ireland is divided into three main categories (13).

(i) Public sites, managed by the state's Health Service Executive (HSE). In these state-funded facilities, services are supplied by publicly-employed HSE staff. Nurses and nursing staff are government employees. Pharmaceutical care is provided by a pharmacy who successfully secured the tendered state contract to supply medicines and pharmaceutical care for the LTCF. Medicines are funded by the state. Upon admission to the LTCF, the responsibility for medical care of patients is transferred to the facility's Medical Officer. A HSE Medical Officer is a General Practitioner (GP) who has a HSE contract with the setting and is now responsible for the care and wellbeing of all LTCF residents.

(ii) Private sites which are voluntary sites and 'not-for-profit'. These are often run by charities or religious orders.

(iii) Private site which are 'for-profit' owned by private operators. Private sites are owned by groups or individuals independently managing the facility. Nurses and nursing staff are

directly employed by the organisation owning or running the LTCF. Similar to public LTCFs, pharmaceutical care is generally provided by a contracted pharmacy. Medication costs are incurred by each individual resident. Residents generally stay under the care of their admitting GP. The GP will visit the site to review their patients on a routine/as required basis, at the discretion of the GP. The private model of LTC has no formal clinical governance associations with the HSE (14).

The landscape of LTCF has undergone significant change over the past thirty years. In the 1990s, 80% of LTC was publicly funded, now approximately 80% of the LTC beds in Ireland are managed by private sites (both 'for-profit' and 'not-for-profit' organisations) (14–17). The demand for LTC is increasing, meaning this is an important sector to focus research which aims to increase medication safety and appropriateness.

1.1.3 Frailty

Recent studies into the Irish LTC sector report that over 50% of all residents in LTC are over 85 years of age, with projections showing that this cohort will grow by a factor of four in the coming 30 years (17). While not directly associated, ageing is a factor which can increase the risk of frailty (18). Frailty can be defined as a particular vulnerable health state with poor return to homeostasis. It defines the process where the body's physiological state gradually declines due to age-related degeneration and is characterised by a loss of physical and cognitive abilities (19). Frailty is dynamic, with the ability to transition between degrees of frailty. Despite this, there exists a greater possibility of frailty progression rather than reversal (19). Physical frailty is highly prevalent among older adults, particularly residents of LTCFs (20). A European study identified frailty rates to be highest among LTCF patients compared to acute hospitals and primary care (21). The pooled prevalence estimate of frailty in LTC settings is 52.3%, with a further 40.2% of LTC residents described as being pre-frail (22). Frailty is associated with an increased susceptibility to unfavourable health outcomes, such as falls and hospitalisations, and is correlated with increased morbidity and mortality (6,23,24).

There is a wide array of tools available for measuring frailty. A recent review identified 51 instruments specifically designed to assess frailty, with seven of them validated for use in community, clinical, and LTC settings (25). Those validated in the LTC setting included the widely used Rockwood's Clinical Frailty Scale (CFS), published in 2005 and revised in 2008. This tool is used in addition to clinical judgement to measure frailty and assist clinical decision-making (26). The CFS is a 9-point scale which considers multiple criteria such as:

(i) medical presentation,

(ii) exercise level,

(iii) activities of daily living,

(iv) requirement for assistance with personal care,

(v) life expectancy.

In 2016, the most widely cited frailty assessment tool was Fried's phenotype method (27,28). This method established a standardised phenotype of frailty for older adults with the tool having predictive validity for unwanted outcomes such as falls, hospitalisations and death. It proposed five criteria to define frailty (28):

(i) weakness,

(ii) slow walking speed,

(iii) low physical activity,

(iv) self-reported exhaustion/exhaustion/poor endurance,

(v) unintentional weight loss and sarcopenia.

Cullinan and colleagues explain that these tools should not be seen as alternatives to one another, but rather distinct tools with different functions and therefore should be identified as complementary (29).

The physiological changes associated with ageing and frailty can increase the risk of experiencing an adverse event associated with a medication, which may once have been indicated and appropriate (30–32). New tools which target appropriate prescribing for older adults with limited life expectancy incorporate their own assessment of frailty. In 2017, the Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy (STOPPFrail) was published which aimed to create and validate a list of explicit criteria for PIM use in older adults with limited life expectancy (33). This guideline was updated by Curtin and colleagues in 2020 creating the revised STOPPFrail version 2 (STOPPFrail v2). The updated tool helps to identity older adults who may be appropriate for the STOPPFrail-guided deprescribing. Those who would meet the criteria as listed in STOPPFrail v2 include older adults (≥65 years) with limited life expectancy and for whom the focus of care is to enhance quality of life and reduce drug burden. Eligible older adults typically met all of the below criteria (34):

(i) Activities of daily living dependency (i.e., assistance with dressing, washing, transferring, walking) and/or severe chronic disease and/or terminal illness.

(ii) Severe irreversible frailty, i.e., high risk of acute medical complications and clinical deterioration (as determined by the physician overseeing the patient's care, based on a clinical judgement and medical assessment).

(iii) Physician overseeing care of patient would not be surprised if the patient died in the next 12 months.

Very old frail people or those living in LTC are often excluded from randomised controlled trials (RCTs) due to their limited autonomy, multiple co-morbidities and cognitive issues. Evidence generated and best practice guidelines are often not inclusive of this population (35,36) and may not always be appropriate to guide the medical management of this cohort. The assessment of frailty is important to consider when determining the appropriateness of prescribed medications in this patient cohort and thus STOPPFrail v2 is a very useful guideline to apply in LTC.

1.2 Polypharmacy, Potentially Inappropriate Prescribing (PIP) and Potentially Inappropriate Medications (PIMs)

1.2.1 Definitions

1.2.1.1 Polypharmacy

Increasing age and the associated multimorbidity contributes to the medication burden often experienced by older adults (31). Polypharmacy has been described as a geriatric syndrome (37), and is generally considered the use of five or more medications, with excessive polypharmacy considered the use of ten or more medications (38). Polypharmacy and excessive polypharmacy can sometimes be necessary to treat the multiple chronic conditions seen in the older adult patient cohort (39–41). Therefore, it is considered important to distinguish between appropriate polypharmacy, where all medicines are indicated and prescribed at the right dose for the correct duration and inappropriate polypharmacy, consisting of many medicines including those which may not be safe or appropriate (40). Polypharmacy remains prevalent throughout the ageing process and towards end of life (42,43).

1.2.1.2 PIP

Potentially inappropriate prescribing (PIP) describes the prescribing of medications for which the risk outweighs the potential clinical benefit (44). PIP encompasses prescribing medications which lack a clear indication, have a higher risk of adverse effects in the patient population or are not cost-effective. PIP does not account for life expectancy, consider treatment time to benefit or benefit-to-risk ratio analysis (45).

PIP can be present in various ways:

(i) Mis-prescribing: prescribing a medication that significantly increases the risk of an adverse drug event.

(ii) Overprescribing: prescribing medications for which no clear indication exists.

(iii) Under-prescribing: omitting potentially beneficial medications which are clearly indicated for the treatment or prevention of disease (46).

In the frail older adult cohort, mis-prescribing and overprescribing occur to a greater extent than under-prescribing (47).

1.2.1.3 PIMs

Mis-prescribing and overprescribing are inherently linked with potentially inappropriate medications (PIMs), medications which carry a greater risk than benefit for patients (48). Considering that age-related pharmacokinetic and pharmacodynamic changes are inevitable, some medications may become unsuitable as time progresses. This means that medications which were once safe and appropriate can become PIMs. Both PIP and PIMs are prevalent across all healthcare settings for older adults (49). PIMs are associated with an increased risk of drug-drug interactions and contributes to inappropriate polypharmacy (50–52).

1.2.2 Prevalence in the LTC setting

1.2.2.1 Polypharmacy

A systematic review investigating polypharmacy in LTCFs concluded that the prevalence of polypharmacy is high. While rates varied across studies, up to 91% (range 38.1-91.2%) of residents were prescribed five or more medications and 65% (range 10.6-65%) prescribed ten or more medications, indicating in some studies over half of all residents were experiencing excessive polypharmacy (53). This compares to the general population of Ireland, where 31% of adults over the age of 65 are taking five or more medications, rising to 37% in those over 75 years (54).

1.2.2.2 PIP

Considering the prevalence of polypharmacy increases with age and the connection between polypharmacy and inappropriate medications (55), PIP and PIMs remain a cause of concern in LTC. Two studies investigated the prevalence of PIP for older adults residing in Irish LTCFs. In 2008, PIP was identified for 59.8% of 313 patients from seven public LTCFs included in the study (56). In 2010, a review of 14 Irish LTCFs with a total population of 732 patients identified that almost 70% experienced at least one instance of PIP (44). A similar chart review study was conducted in 29 Canadian LTCFs which identified slightly lower rate, where 54.7% of patients had at least one instance of PIP (57).

1.2.2.3 PIMs

A systematic review of international studies identified the weighted point prevalence of PIM use in LTCFs to be 43.2% (95% CI 37.1-49.1%) (58). This issue seems to be of global significance as evidenced

in Norway where 43.8% of patients from 30 LTCFs were prescribed at least one PIM, with 9.9% prescribed three or more PIMs (59) and in Brazil, with 82.6% of LTC patients taking at least one PIM (60). A Korean study of nearly nine thousand LTC patients identified that 81.6% received at least one PIM (61). In the US, a retrospective study of over one million older adults residing in LTCFs reported that 76.9% of patients were prescribed at least one PIM (62). Lee *et al.* conducted a matched cohort study to compare PIM use between older adults in LTC and in the community. Older adults residing in LTC were prescribed more medications and had a higher prevalence of PIMs compared to their community-dwelling counterparts (86.8% in LTC and 75.4% in community). In LTC, 46.3% of prescriptions included a PIM compared to 36.1% in the community (63). This illustrates the need to focus efforts to increase the appropriateness of prescribing for older adults residing in LTC.

1.2.3 Consequence of polypharmacy, PIP and PIMs

Adverse events or symptoms caused by polypharmacy are sometimes under-recognised in older adults as they can present as non-specific symptoms of the normal ageing process, such as tiredness, confusion, falls, constipation, and incontinence (31,64). The negative consequences associated with polypharmacy in older adults can include an increased risk of adverse drug events (ADEs), drug-drug-interactions, medication non-adherence, falls, decline in functional status, cognitive impairment, hospitalisations and all-cause mortality (65–68). A population-based longitudinal study of adults aged 85 years or older exposed to polypharmacy reported that each additional medication was associated with a 3% increased risk of mortality (69). For this study, polypharmacy was defined as between five and nine prescribed medications without differentiation between inappropriate polypharmacy and appropriate polypharmacy (40,70,71). Similar to polypharmacy, PIP is associated with ADEs and increased hospitalisations (72). PIM use is linked with adverse health outcomes for older adults including an increased risk of hospitalisations and mortality (73–77).

Toh *et al.* conducted a systematic review and meta-analysis investigating the prevalence and health outcomes associated with polypharmacy for frail older adults. Results identified that this cohort were less likely to experience an improvement in their frailty status, have a higher risk of mortality, require

assistance with activities of daily living and were more likely to suffer adverse outcomes associated with hospital visits (78). All these ADEs places stress on the healthcare systems resources, both primary and secondary, including time, staff, finance, in addition to environmental factors such as hospital beds and transfers.

Given the individual and healthcare system consequences associated with polypharmacy, PIP and PIMs, addressing these issues could benefit both patient wellbeing and the healthcare system. In addition to improving health outcomes, it has been reported that managing inappropriate polypharmacy could potentially reduce global health expenditure by 0.3% (79). Routine medication reviews should be considered in clinical practice for older adults, to address PIP and PIMs. This is to ensure that the safety and wellbeing of older adults is maintained, optimising health outcomes (80).

1.2.4 Frailty and polypharmacy, PIP and PIMs

Frailty and polypharmacy are commonly associated; however, the causal link remains unclear. Factors which are hypothesised to impact both frailty and polypharmacy include physiological changes of ageing, multimorbidity, having a chronic condition, life expectancy and cognitive status (81). Interventions, such as pharmacist-led medication reviews targeting PIMs prescribed to frail older adults have shown positive effects, however they have not been shown to affect frailty scores in older adults and evidence was moderate to critically low (24).

Polypharmacy, PIP and PIMs are even more of a concern in frail older adults as frailty significantly increases the risk of adverse outcomes including mortality, hospitalisation and falls or fractures (82). In addition, PIP can lead to a deterioration in the health of frail older adults, such as a deterioration in cognition and an increase in the risk of falls (83). As frailty is identified to be a greater predictor of medicines-related harm than chronological age (84), interventions targeting polypharmacy, PIP and PIMs should focus on the frail population. Such interventions should also include a frailty assessment which would allow the identification of patients at the greatest risk of adverse events and most likely to benefit from deprescribing (85), addressing the healthcare issues identified in the older adult cohort.

1.3 Deprescribing

1.3.1 Definition

Deprescribing, a term first published in 2003, is gaining popularity in modern day healthcare. Deprescribing describes the systematic process of discontinuing a medication, where the drug benefit is outweighed by the potential harm. It includes withdrawal, tapering or switching to a more appropriate drug class, supervised by a healthcare professional (HCP), and is considered a part of good prescribing (86–89). As described by Turner *et al.*, deprescribing considers the balance of therapeutic goals, benefits, unwanted effects and medical ethics, with its main priority being patient care and safety (90). Page and colleagues also describe deprescribing as a "patient-centred process", with a focus on improving health outcomes for patients through discontinuing medications which are no longer necessary or could cause harm (91). Deprescribing can be described as reactive, to address unwanted side-effects or lack of medical benefit or proactive to initiate changes to medications before a potential adverse event occurs (92,93). Considering the rise in multimorbidity and associated polypharmacy, the United Kingdom's (UK) National Institute for Health and Care Excellence have updated their guidance to include consideration of deprescribing when reviewing and optimising treatments in the management of multimorbidity (94). Deprescribing is an activity which addresses healthcare issues such as polypharmacy, inappropriate medication use and medication-related harms (95). Scott and colleagues propose that deprescribing should be considered as an integral feature of good prescribing and should be carried out routinely. However, this is not currently the case and proactive deprescribing is not routine practice (93,96).

1.3.2 Deprescribing benefits

Deprescribing benefits are widely reported. Reducing inappropriate polypharmacy through deprescribing offers the potential benefits of improved adherence, reduced ADEs, reduced drug-drug interactions, reduced morbidity and mortality (97). Systematic reviews of deprescribing trials have documented positive outcomes such as a reduced medication burden and cost for patients, reduced PIMs prescribed and increased medication adherence (98,99). A systematic review of deprescribing for frail older adults identified positive clinical outcomes such as improved mental health status, daily

function and frailty status (100). Kua *et al.* identified that deprescribing in LTCFs has the potential to reduce PIMS by 59%, improving patient safety and medication appropriateness (101). In addition to the above benefits, other positive outcomes reported from deprescribing in LTC are improved quality of life and reduced nurse time spent on medication administration (102,103). This suggests that proactive deprescribing could be a valuable intervention to tackle inappropriate polypharmacy and PIMs in this setting.

1.3.3 Deprescribing networks and available tools

To facilitate HCPs' engagement with deprescribing, different supportive resources have been created (104). Similarly, deprescribing networks have been established, such as the Australian Deprescribing Network (ADeN), Canadian Deprescribing Network (CaDeN), Network of European Researchers in Deprescribing (NERD) and US Deprescribing Research Network (USDeN), to support clinicians, academics, researchers, policymakers and patients in their understanding of deprescribing and to facilitate the translation of research and knowledge into evidence-based routine practice.

In 2020, Reeve comprehensively reviewed the tools which are available to support deprescribing irrespective of patient populations and grouped them according to their function (105):

(i) General deprescribing guidance: resources which provide non-specific advice about deprescribing, not focusing on a particular drug class. Examples of such guidance include publications in peer-reviewed academic journals describing the deprescribing process (86) and national guidance describing best practice (106,107).

(ii) Generic deprescribing frameworks: resources which provide generic advice on the process of deprescribing. Examples include the 'deprescribing rainbow', a patient-centred framework to support deprescribing (108).

(iii) Drug-specific deprescribing guidelines/guides: resources which provide specific advice on deprescribing a medication or class of medications. Research groups such as Bruyère Deprescribing Research Team, University of Sydney and Primary Health Tasmania have produced deprescribing guidelines, to support HCP engagement (102,109), creating

deprescribing algorithms for individual drug classes (110–116). Similarly, the Scottish National Health Service have published guidance for deprescribing benzodiazepines and z-drugs and antipsychotics in patients with dementia (117,118).

(iv) Electronic Clinical Decision Support Systems: software or web-based systems to support deprescribing by providing information on the benefit-to-risk ratio of medications and recommending which drugs to deprescribe on a trial basis. Examples include MedStopper (available at www.medstopper.com). Some tools incorporate published PIM lists into their software e.g., MedSafer incorporates the American Geriatrics Society Beers Criteria, the Screening Tool of Older Persons Prescriptions (STOPP) and Canadian Choosing Wisely (42,119–121).

(v) Tools for identifying PIMs: in addition to individual guidelines, lists of medications which may not be safe or appropriate for a specific population are available. PIM lists exist internationally for different patient cohorts, helping HCPs to identify deprescribing targets. Examples of explicit (criteria-based) tools tailored to older adults include STOPP, first introduced in 2008, updated in 2015 and 2023 (121–123), PRISCUS (Latin for “old and venerable) (124), European Union (EU) (7) (125) and Beers Criteria (120,126,127). PIM lists also exist for specific population cohorts such as the List of Evidence-Based Deprescribing for Chronic Patients criteria (LESS-CHRON) criteria for patients with multimorbidity (128), Screening Tool of Older Persons Prescriptions in older adults with high fall risk (STOPPFall) (129) specifically for those at risk of falls and STOPPFrail, introduced in 2017 and updated in 2021 (33,34) for frail older adults with limited life expectancy. The Good Palliative-Geriatric Practice algorithm is an implicit (judgement-based) tool which incorporates clinical reasoning. It is used to inform HCP decision-making to improve drug therapy in frail older adults by making deprescribing recommendations to increase medication safety and appropriateness where relevant (130).

(vi) Tools for engaging patients: these mainly take the form of educational material e.g., EMPOWER brochures (131,132) or questionnaires such as the Patients' Attitude Towards Deprescribing questionnaire (133,134), to inform and engage patients about deprescribing and include them in decision-making.

As identified by Reeve, tools exist to support deprescribing for specific patient cohorts (105). Shrestha *et al.* conducted a systematic review, investigating tools suitable to support deprescribing for older adults with limited life expectancy. The review concluded that a limited number of tools exist to support HCPs deprescribing for this patient cohort, with material either targeting disease specific medication or a list of medication classes, irrespective of disease e.g., STOPPFrail (33,34,135). For older adults residing in LTC, in addition to limited life expectancy, levels of frailty are high (20,136). For this cohort prescribing patterns should switch from primary or secondary prevention toward symptomatic treatment and end-of-life care (135,137). Thompson *et al.* reviewed deprescribing tools specific for frail older adults with limited life expectancy. Reflective of Reeve's classifications, results identified three main categories: overarching frameworks to support a "deprescribing mindset", lists of PIMs and medication-specific tools (138).

Shrestha and colleagues recently developed and validated a decision-aid tool to support HCPs deprescribing for older adults with limited life expectancy, named De-TOPPLE. The tool is not a prescriptive list of PIMs, rather a tool designed to categorise medications and support HCPs to identify potential deprescribing targets for older adults with limited life expectancy, including palliative, end-of-life and frail patients (139). The tool was designed based on existing evidence and validated by expert opinion (86,135,139). It is intended for clinical use and includes an assessment to classify medication as preventative, dual purpose or for symptom control. The tool considers a medication's time-to-benefit, in addition to the need for symptom relief and the inclusion of patient opinion. The De-TOPPLE tool was not developed using behavioural theory or implementation science. Additionally,

the tool is not adjusted for a specific context e.g., the LTC setting, where unique barriers/enablers could exist influencing HCP engagement.

To date, no deprescribing resource exists which offers a combination of strategies to support HCPs to proactively engage with deprescribing for frail older adults with limited life expectancy residing in LTC. Current tools have been classified into distinct categories as outlined by Reeve, Thompson and Shreshta, however no single tool exists which has amalgamated different elements from these categories, to create a resource suitable to support HCPs proactively deprescribing for frail older adults residing in LTC. Considering the LTC population and importance of measured frailty for structuring medication reviews (83), a resource designed to support HCP decision-making in this setting should include a frailty assessment to help identify deprescribing targets. Considering the gap between existing deprescribing evidence and clinical practice (140,141), a deprescribing intervention should be accompanied by an implementation strategy to encourage HCP buy-in, outlining the role, responsibilities and mechanisms for multidisciplinary collaboration. The designed strategy should consider social, environmental, and contextual factors related to the population of interest, which may influence HCP engagement. Finally, a deprescribing strategy should include a summative list of PIMs prescribed to frail older adults, to identify deprescribing targets and the option to include tailored drug class specific guidelines, to support clinical decision-making.

1.3.3.1 Deprescribing networks and guidelines in Ireland

Support for deprescribing at a national level in Ireland is only beginning, with the incorporation of deprescribing guidance as part of appropriate prescribing guidelines introduced by the HSE in 2018. This guidance is indicated for the general population and not specific for the LTC setting. These currently only exist for a select few PIP scenarios: urinary tract infection prophylaxis (142), proton pump inhibitors (PPIs) for the treatment of gastro-oesophageal reflux disease (143), benzodiazepines and z-drugs for the treatment of anxiety and insomnia (144), azithromycin prophylaxis in severe chronic obstructive pulmonary disease, bronchiectasis or asthma (145) and finally inhaled

corticosteroids for the treatment of chronic obstructive pulmonary disease (146). Through EU funded projects such as iSimpathy, education for HCPs has begun on how to structure medication reviews and introducing deprescribing in primary care (147).

1.3.4 Deprescribing interventions

Deprescribing studies have been conducted internationally, targeting the older adult population (148,149). Deprescribing trials have been conducted in various healthcare settings including primary care (150), secondary (119) and LTC (101). Deprescribing trials have also been investigated for various conditions, for example, chronic kidney disease (151), hypertension (152), cardiovascular disease (153), and diabetes (154). Different HCPs have led deprescribing interventions, including GPs (155), pharmacists (156) and geriatricians (157). Similarly, deprescribing trials have been conducted in multiple patient cohorts, such as for frail older adults (158), patients at end of life (159) or those with multimorbidity (150).

RCTs have been conducted, focusing on deprescribing specific drug classes e.g., antihypertensives (152) or antihyperglycemics (154). Trials have also investigated the various implementation strategies which can be utilised to increase HCPs engagement with deprescribing. Examples of strategies used in deprescribing trials conducted in various healthcare settings include:

(i) Patient-centred programmes: Zechmann and colleagues investigated the effect of a deprescribing intervention which incorporated physician training, a validated deprescribing algorithm and shared decision-making. The shared decision-making consisted of a practice-nurse or GP reviewing a patient's medication list, identifying the four main diagnoses and complaints, in agreement with the patient. Each individual drug was then reviewed by the GP using an algorithm to determine appropriateness. The GP made deprescribing recommendations with decisions regarding which to implement shared with the patient. Results showed a reduction in the total number of medications for the intervention group immediately after the trial, however the number of medicines increased again 6 and 12 months (150).

(ii) Educational interventions: Pharmacists involved in the intervention sent deprescribing educational material to selected patients, in addition to sending their physicians an evidence-based pharmaceutical opinion to recommend deprescribing. This resulted in a 43% reduction in dispensing of the targeted PIM (160).

(iii) Electronic decision support tools: The MedSafer study consisted of an electronic decision support tool which generated personalised reports of deprescribing opportunities for each patient. Deprescribing rates increased by 25.6% for the intervention group (119).

(iv) Medication review interventions conducted by one healthcare profession: Balsom *et al.* conducted a pharmacist-led deprescribing medication review for residents of a LTCF in Canada. Results showed a reduction in the average number of medications taken, with the effect sustained at 3 and 6 months (161).

(v) Multifaceted interventions: Anderson and colleagues conducted a multi-strategic intervention incorporating education, medication review and information technology (IT) infrastructure. At study completion, this resulted in 6.8% of regular medicines being deprescribed (155).

As can be seen from the above, deprescribing interventions have led to positive medication-related outcomes. In 2021, Ibrahim *et al.* conducted a systematic review investigating all deprescribing interventions including frail older adults. Six articles were deemed eligible for inclusion in the review. The review identified that at least half of all deprescribing trials incorporated medication review as either the entire deprescribing strategy or part of the strategy. Studies also frequently incorporated tools and algorithms to guide the identification and deprescribing of PIMs, including the STOPP criteria, STOPPFrail tool, the Good Palliative-Geriatric Practice algorithm or drug class specific guidelines. Half of the studies were pharmacist-led trials while the other half incorporated an MDT approach. Of these interventions, there was great variation in outcomes measured. The primary outcome was generally safety of deprescribing, ADEs and hospitalisations. Secondary outcomes included:

(i) Clinical outcomes: frailty and function, falls, cognition, depression and mental health, quality of life.

(ii) Medication related outcomes: number of medications, number of PIMs.

(iii) Feasibility of deprescribing: assessing uptake of deprescribing recommendations.

(iv) Acceptability of deprescribing: investigating patients' and HCPs' perceptions of deprescribing.

(v) Cost-related outcomes: the cost implications associated (100).

Of the six studies, three reported on safety outcomes and showed no significant change in adverse events, hospitalisations or mortality (159,162,163). All six studies reported a reduction in the total number of medications and the number of PIMs (159,162–166). Four studies documented feasibility of deprescribing recommendations suggested by the pharmacist/multidisciplinary team (MDT). Recommendations had a 72-91% acceptance and implementation rate (159,162,163,165). Two studies reported on patient and HCP acceptability of deprescribing interventions with both studies showing stakeholders were happy to stop unnecessary medications (163,165).

Shrestha *et al.* conducted a systematic review looking at interventions aimed at deprescribing for older adults with limited life expectancy (life expectancy of up to two years in those with life limiting illness in advanced or end stage/palliative care/end of life/terminally ill/frail) or those with a life-limiting illness (advanced or end-stage condition of cancer, dementia, heart failure, chronic obstructive pulmonary disease, and kidney disease) (167). Nine studies were identified and deprescribing interventions consisted of:

(i) Individualised patient medication review by a GP and geriatrician/clinical pharmacologist (158).

(ii) Drug class-specific deprescribing e.g., statins led by a GP (168).

(iii) Deprescribing review using the Good Practice-Geriatric-Palliative approach algorithm, led by a GP (130).

(iv) MDT medication review using PIM identification tools such as Beers criteria, STOPP and Medication Appropriateness Index (MAI) involving patient discussion (169).

(v) MDT geriatric palliative care team assessment using MAI (170).

(vi) Pharmacist medication review using STOPP and Screening Tool to Alert to Right Treatment (START) criteria, with deprescribing decisions confirmed by the GP (171).

(vii) Comprehensive geriatric assessment conducted by senior nurse, followed by geriatrician video conferencing (172).

(viii) Three-tiered medication review structure starting with patient-centred assessment, then diagnosis-centred assessment and finally medication-centred assessment by an MDT of two geriatricians and pharmacist (173).

(ix) Medication chart review by geriatric consultant (174).

Of the nine studies, four reported on the primary outcome of medication appropriateness, defined as reduction in PIMs/PIP or unnecessary medications. All four studies showed a reduction of inappropriate or unnecessary medications (169–172).

Secondary outcomes were divided into medication-related outcomes, clinical outcomes or cost-related outcomes. Of the seven studies which reported on medication-related outcomes including polypharmacy, all showed a reduction in the mean number of medications. Clinical outcomes measured included mortality, quality of life and falls, with inconsistent results reported. Mortality was measured in three studies, with one quasi-experimental trial showed a statistically significant reduction in mortality at 12 months (130), not significant in the two RCTs (158,168). Quality of life was measured in two RCTs, one showed a statistically significant improvement for cancer patients when statins were deprescribed (168). Similarly, falls were measured in two RCTs, with one showing a significant reduction at 12 months (171). A proposed hypothesis to explain the mixed evidence on such clinical outcomes is the variation in the implementation of such deprescribing interventions (80). Limited evidence was reported on cost-savings. Considering the inherent complexity of deprescribing,

careful consideration is required when developing the supportive strategy, to increase the chance of the intervention being effective and routinely implemented in clinical practice (175).

Despite deprescribing being a broadly researched area associated with positive clinical outcomes, there exists a lack of continued implementation of deprescribing interventions, possibly due to lack of consideration of determinants of behaviour, including barriers and enablers inherent with the setting, existing at a personal, organisational and health system level (176). To date, interventions often only target one determinant, which Scott and colleagues suggest, may explain the limited efficacy of deprescribing interventions to date, considering proactive deprescribing is a heterogenous behaviour (177). Significant research has been conducted, investigating various strategies to support deprescribing, in multiple settings and for diverse patient cohorts. Despite the vast volume of research and documented deprescribing benefits, deprescribing is still not routine practice (178,179), even in frail older adults residing in LTC who are the cohort with the greatest risk for PIP and all its associated negative sequelae.

1.3.5 Deprescribing in LTCFs

It is well documented that there is a high incidence of polypharmacy, PIP and PIMs in LTC (180); thus, LTC is an important setting to focus deprescribing research, especially frail older adults.

1.3.5.1 Deprescribing research in LTCFs

Internationally, numerous deprescribing trials have been conducted in LTC, utilising different implementation strategies to achieve the common goal of increasing medication safety and appropriateness by reducing the number of PIMs prescribed (101,181–189). Additional outcomes measured include:

(i) Quality of life and safety outcomes (186).

(ii) Anticholinergic burden, drug burden index and sedative burden (188).

(iii) Medication costs (188).

(iv) Cognitive function, falls, care dependency and daily function (190).

(v) Patient symptom assessment (191).

(vi) Clinical parameters associated with the drug class of interest, e.g., systolic blood pressure (SBP) associated with deprescribing antihypertensives (184).

Studies conducted in the LTC setting showing success based on their established outcomes, have used a variety of different strategies, or combinations of strategies, to achieve the predefined goals. Types of implementation strategies used in this setting include:

(i) Medication review using an implicit deprescribing algorithm targeting a particular drug class (181).

(ii) Educational interventions combined with social support from the wider MDT (182).

(iii) Medication review combined with social support from the wider MDT (186).

(iv) Medication review combined with social support from the wider MDT and utilising evidence-based toolkit for identifying PIMs (188).

(v) Medication review combined with the evidenced-based electronic deprescribing decision support tool MedSafer to identify PIMs (192).

Reflecting on the extensive research conducted to date in this field, deprescribing has been shown to be feasible, safe, and effective to implement, in a multitude of healthcare settings, including LTC. A variety of implementation strategies have been investigated, with evidence generated of what is effective to support HCPs' engagement with deprescribing (193), and the associated health outcomes and patient benefits (194).

1.3.6 Deprescribing in LTC - where are we now?

As outlined above, various strategies have been implemented to support deprescribing in LTC internationally. Despite the research conducted in primary and secondary care in Ireland (159,195–197), there exists a paucity of research describing effective interventions to support proactive deprescribing to increase medication safety and appropriateness for frail older adults who reside in Irish LTCFs. PIP is reported to be an issue in Irish LTCFs (44). Despite awareness of the extensive

deprescribing evidence, HCPs do not routinely engage with proactive deprescribing when caring for older adults in this setting (198), a population at a greater risk of PIP. Implementation strategies designed and trialled in LTC thus far have not considered stakeholder reported barriers/enablers to deprescribing, or additional contextual influences associated with the healthcare setting. Existing strategies have been designed by researchers rather than HCPs, who have experience of working with frail older in LTC. These HCPs have an awareness of the opportunities and limitations associated with the LTC setting and possibly have the knowledge of what would be considered feasible and sustainable to support deprescribing. This reticence to deprescribe may be to do with the design of existing interventions and implementation strategies to increase engagement with deprescribing behaviour. Campbell postulates that "deprescribing is not likely to occur without change in the delivery system" (199); therefore, the focus of research now needs to shift towards implementation science.

1.3.7 Research opportunities for deprescribing

Researchers have noted the diversity in deprescribing evidence and have called for better description, definition and categorisation of deprescribing trials (140,200,201), as published studies vary distinctly in either design, the deprescribing implementation strategy used or primary outcomes measured (100). Consequences of this heterogeneity are that the evidence generated has little real-world impact (202). Opportunities exist for future research to focus on clear reporting of strategy design methods, and measure a set of core outcomes, universal to deprescribing research.

Hughes explains that an intervention targeting HCP behaviour change requires a systematic development approach, considering; what needs to change, barriers and facilitators of that change, implementation strategies to support the change and evaluating associated outcomes (70). Academics have called for a shift in deprescribing research, moving past knowledge generation, or investigation into deprescribing barriers or enablers and increase research into the development, feasibility, implementation, evaluation and sustainability of deprescribing trials, increasing their utilisation into routine practice (200,203). This focus on design, implementation and sustainability should incorporate

the thoughts and opinions of targeted end users from the context where the deprescribing intervention is intended to be implemented, in this instance the HCPs working in LTC. This change in perspective; including stakeholders in the design phases and consideration of acceptability, feasibility and appropriateness of implementation strategies could help to support behaviour change and increase HCPs' engagement with proactive deprescribing.

1.4 Behavioural science

Behaviour affects health and contributes to morbidity and mortality, as evidenced by many risk factors associated with noncommunicable diseases being behaviourally driven (204,205). Behavioural science is the evidence-based study of how humans behave and can be used to predict, explain or change behaviour (204,206). Behavioural theory summarises the knowledge, mediators and moderators of behaviour change (207). Any change in the provision of healthcare requires various stakeholders to change their behaviour (208). Therefore, such strategies should consider the inclusion of behavioural science during intervention design.

Deprescribing is an evidence-based clinical practice (140), also described as a behaviour (209), thus increasing deprescribing engagement requires a change in behaviour. Altering a person's behaviour can be challenging; however, if attempts to change behaviour are supported by the principles of behaviour change, interventions have shown to be more effective (210). Health behaviour theory can help to understand how an individual processes information, makes decisions and what prompts the behaviour change. Using behaviour change theory can assist the selection, design and tailoring of implementation strategies to support a deprescribing intervention (208). Scott and colleagues highlight the need to focus on behavioural change and emphasise the use of theory to design proactive deprescribing interventions (209).

1.4.1 Behaviour change theory

Behavioural theories state the structural and psychological process perceived to regulate and change behaviour (211). Behaviour theory facilitates an understanding of the determinants (barriers and enablers) of any behaviour or evidence-based practice, including deprescribing. This theoretical

understanding of human behaviour can then inform the development of an intervention to increase uptake of that behaviour in real-world practice. Despite calls from researchers to consider deprescribing barriers and supportive strategies (104), interventions have not yet been trialled which utilise theory to understand key determinants of deprescribing behaviour. Similarly, studies have not involved targeted end-users in the design phases to understand the contextual influences associated with the LTC setting and tailor interventions based on their detailed knowledge. Considering that proactive deprescribing is not yet routine practice in LTC, interventions could benefit from focusing on behavioural change, incorporating a theoretical underpinning to support the design and maximise the potential effectiveness of deprescribing interventions. In 2017 the WHO acknowledged the need to consider behavioural influences when managing change, further highlighting the importance of considering behaviour change theory when designing and implementing health interventions (212).

1.5 Implementation science

Implementation science is the study of methods or strategies to promote uptake and use of evidence-based interventions and practices in real-world clinical and public health settings to improve the quality of healthcare (213). Implementation science focuses on three core concepts:

(i) The intervention: what we want to implement.

(ii) The implementation strategy: what we do to help uptake of the intervention.

(iii) Implementation outcomes: looking at engagement with the intervention and how well the intervention is being conducted (214).

The goal of implementation science is to identify the factors that affect the uptake of an intervention into real-world routine use, which involves engaging with the context, rather than looking solely at clinical effectiveness and efficacy of the intervention (215).

Many theories, models and frameworks exist in implementation science to provide support for understanding implementation challenges and can be used to help the selection of appropriate strategies to address areas of concern (216). Nilsen and colleagues identified three aims for using a

theoretical approach and categorised the various *theories, models and frameworks* which can be used to address these aims:

(i) Describe/guide process of translating research into practice; *process models.*

(ii) Understand/explain what influences implementation outcomes; *determinant frameworks, classic theories and implementation theories.*

(iii) Evaluate implementation; *evaluation frameworks.*

The choice of theory, model or framework is generally dependent on the implementation outcome being studied (217). Strategies to support the implementation of deprescribing in LTC are reported to be poorly described and not well understood (149,218,219). Prominent deprescribing investigators are calling for research to focus on implementation science to support the knowledge translation into daily clinical practice (80,140,141,201,220,221), particularly for the frailest of populations, such as those living in LTCFs (222).

1.6 Deprescribing paradigm

Proactive deprescribing is a behaviour enacted by HCPs to reduce the level of inappropriate prescribing and medication use. Proactive deprescribing is a complex and heterogenous behaviour associated with several determinants which required consideration before it is to become routine practice (223). Deprescribing interventions are formulated and characterised by techniques used to address determinants of the behaviour (209).

When considering deprescribing through the lens and vernacular of implementation science, which studies the translation of evidence-based research into routine practice (224), the behaviour of deprescribing is itself termed an 'evidence-based intervention' and the technique or combination of techniques used to form the intervention known as the 'implementation strategy' (140). Throughout this thesis, deprescribing is viewed and described from the paradigm of implementation science. In doing so does not dispute that deprescribing is a behaviour, with strategies used to target

deprescribing known as the intervention. Instead, this thesis uses the language of implementation science to describe deprescribing research.

Internationally, there has been little consideration of implementation and behavioural science in deprescribing interventions conducted in LTC, with no study conducted in Irish LTCFs using these scientific fields. To date, no study has investigated deprescribing implementation outcomes or hybrid trials as described by Curran and colleagues (225), looking at the perceived acceptability, feasibility or appropriateness of the deprescribing strategy. Existing studies do not consider all of the key elements identified for sustainable public health interventions in the design phases, including engagement of targeted stakeholders, the use of intervention champions, capacity building, creating resources and organisational structures (226).

A new generation of research is required, utilising the prism of behavioural and implementation science to build on the research conducted to date, address the research gaps, incorporate stakeholders, utilise existing frameworks and consider alternative approaches for the evaluation of interventions (222).

1.7 Research hypothesis aims and objectives

1.7.1 Hypothesis

Deprescribing can successfully be implemented by HCPs for frail older adults residing in LTCFs, to manage inappropriate polypharmacy and reduce the prevalence of PIMs.

1.7.2 Aim

The aim of this thesis is to develop and feasibility test an evidence- and theory-based implementation strategy to support HCPs engage with proactive deprescribing in routine practice for frail older adults residing in LTC.

1.7.3 Objectives

The specific objectives of the thesis are:

1. To summarise the qualitative literature and synthesise evidence, identifying global barriers and enablers to proactive deprescribing in LTC.

2. To use results from the qualitative evidence synthesis to inform a qualitative study of Irish HCPs, both in the public and private sector, to establish context-specific deprescribing barriers and enablers.
3. To investigate the prevalence of polypharmacy and use of PIMs among frail older adults, residing in Irish LTCFs, as identified using the STOPPFrail criteria.
4. To design a deprescribing implementation strategy, informed by behaviour theory and implementation science, to increase HCPs' engagement with proactive deprescribing for frail older adults residing in LTCFs.
5. Conduct a feasibility study of the implementation strategy designed to increase HCPs' engagement with deprescribing for frail older adults residing in Irish LTCFs.

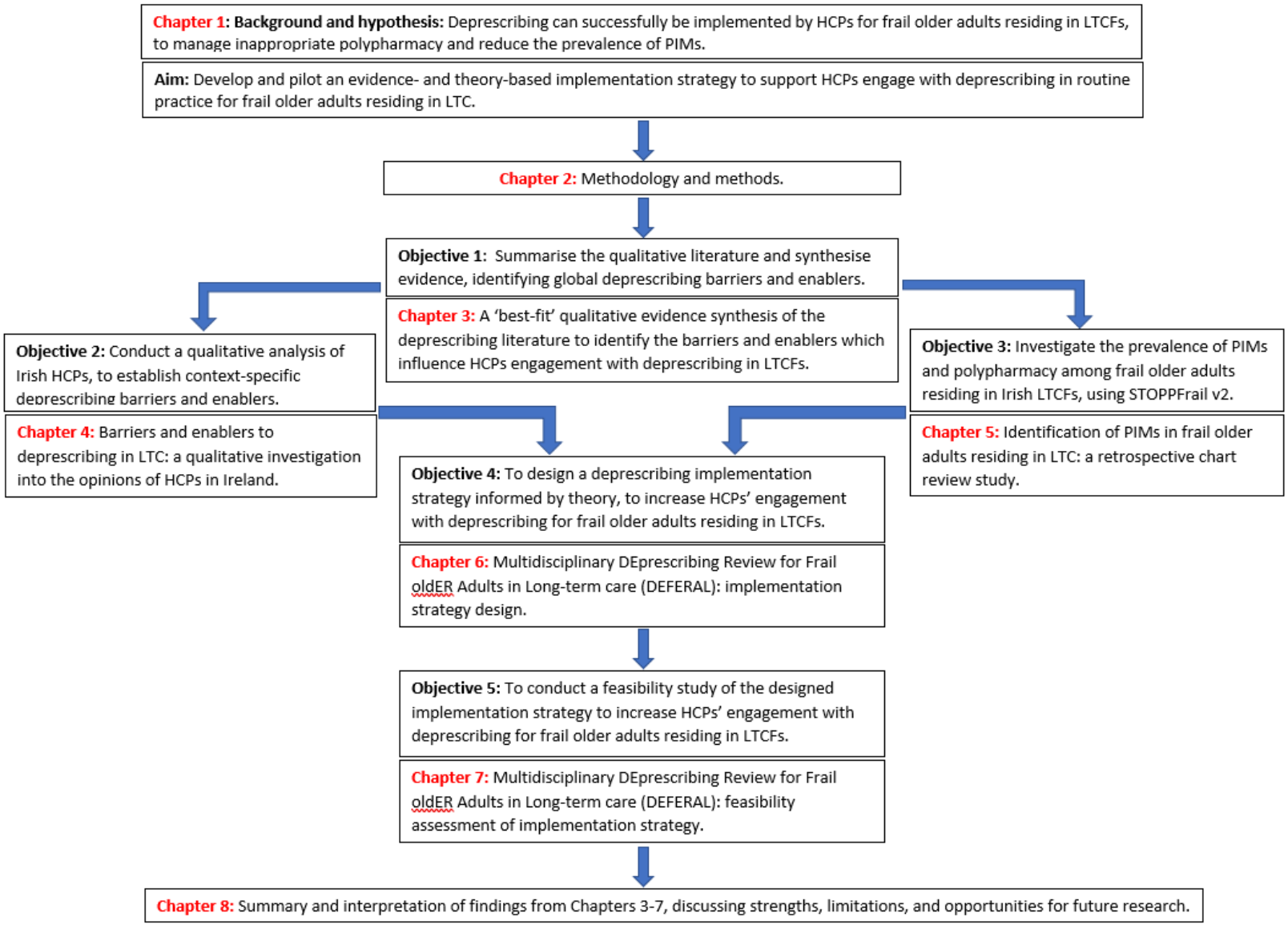


Fig. 1. Thesis outline

Chapter 2: Methodology and methods

2.1 Research Paradigm

The aim of this thesis is to address a practical problem; to explore the barriers and facilitators to deprescribing in LTC with a view to identifying potential components for an implementation strategy to support a deprescribing intervention, incorporating theory of behaviour change. To address the practical problem, we need to understand what the best method is to translate deprescribing, an evidence-based intervention, into routine practice for frail older adults residing in LTC. The objective is to develop and pilot an evidence- and theory-based deprescribing implementation strategy for Irish LTCFs. Kaushik and Walsh state that pragmatism aligns with solving practical problems in the real-world context, which matches the aim of this research (227). A pragmatic approach is flexible and facilitates the strategic combining and borrowing of established approaches to meet the research objectives (228). It has been acknowledged that it is not always necessary for a researcher to align themselves with a particular philosophical theory, and it is not considered a less rigorous approach to utilise a pragmatic methodology (229,230). A pragmatic approach was chosen for the thesis, as it allows the researcher to use the methods which are most appropriate to address the research question (231). A pragmatic approach facilitates any adaptations in research methods required to best address the research question. It prevents the researcher being limited in their choice of research methods, when striving to align with a singular approach (228,232).

2.2 Methodology

2.2.1 Conceptual framework for design

This research was guided by the Medical Research Council's (MRC) framework for developing and evaluating complex interventions (233). The MRC highlight that mixed-methods, theory-based research should be prioritised when investigating challenging interventions targeting the healthcare setting. Similarly, intervention research should emphasise implementation, context and the system fit (233). As previously stated, this research aims to develop and test the feasibility of a supportive implementation strategy for a deprescribing intervention, focusing on two of the four categories

outlined by the MRC (Fig. 2). Building on the research conducted to date, this thesis aims to utilise the core elements of context, identifying key uncertainties and engaging stakeholders to support the design and feasibility testing, following a mixed-method design approach.

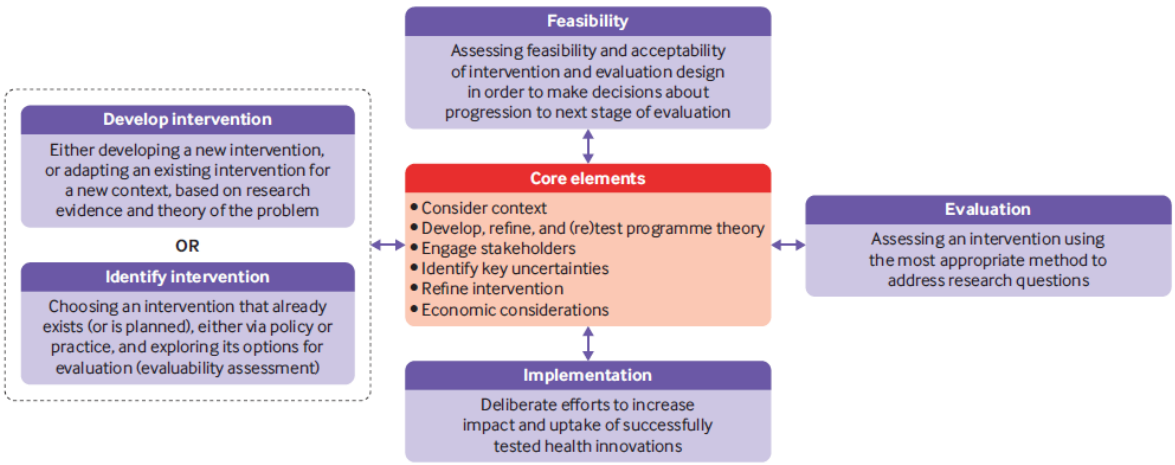


Fig. 2. Medical Research Council's framework for developing and evaluating complex interventions (233).

In keeping with the pragmatic research paradigm and as advocated by the MRC framework (233), a mixed-methods research design was chosen for this thesis, focusing on the research question and research outputs (227). Mixed-methods research is considered to offer a heightened knowledge, understanding and validity to the research area, strengthening subsequent findings (234). Mixed-methods research supports corroboration between research and development of evidence, allowing results from one method to enhance the next phase (235). Mixed-method designs often do not fit into existing mixed-method typologies (234), such as those outlined by Creswell and Plano Clark or Teddlie and Tashakkori (236,237). The research aligns best with a 'hybrid' design type suggested by Schoonenboom and Johnson building on the work of Teddlie and Tashakkori (234,236), consisting of a combination of two design types. Using notation identified by Morse and colleagues, the design chosen for a thorough investigation of the research question and to support the design of the final implementation strategy is outlined in Fig. 3 (238). The purpose of the mixed-methods approach for this research was to design an implementation strategy which considers the prevalence of PIMs in

Irish LTCFs, an understanding of barriers/enablers from HCPs working in this setting and agreement on what strategies would work to support deprescribing engagement.

2.2.1.1 Develop intervention

The majority of this doctoral research falls under the development stage of the MRC framework, largely influenced by the core elements of considering context, engaging stakeholders and identifying key uncertainties. The purpose of integration during mixed-methods research is to combine components to address an aim or research objective (234), in this case to design an implementation strategy to support HCPs deprescribing for frail older adults in LTC.

The thesis includes a sequential mixed design, where the qualitative and quantitative strands described in Chapters 3, 4 and 5 occur in chronological phases. The qualitative elements of this thesis are described in Chapters 3 and 4, consisting of a qualitative evidence synthesis (QES) of international literature on deprescribing barriers and enablers in addition to an interview study investigating deprescribing barriers and enablers in Irish LTCFs (Fig. 3). The qualitative research reported in Chapters 3 and 4 aimed to identify key uncertainties including deprescribing barriers and enablers as perceived by HCPs working in the LTC setting. The QES reviewed international barriers/enablers of deprescribing and summarised them into a 'best-fit' framework, informed by the Theoretical Domains Framework (TDF) (239). This 'best-fit' framework was used to guide a qualitative investigation of HCPs working in Irish LTCFs, to gain an understanding of the environmental, social and organisational influences and current practices. To develop the deprescribing implementation strategy, barriers and enablers identified under TDF domains were mapped to the behaviour change wheel (BCW) and Capability, Opportunity and Motivation of Behaviour (COM-B) model to identify associated Behaviour Change Techniques (BCTs), defined as the "active component" of an intervention aimed at changing behaviour (Fig. 3) (239,240).

This qualitative phase was followed by a quantitative study, as outlined in Chapter 5, which identified the main PIMs prescribed to frail older adults in LTC, using the STOPPFrail v2 evidence-based guideline.

Findings from the quantitative chart review study provided focus in the design of strategies to address barriers/enablers uncovered in the qualitative studies.

The sequential mixed design is followed in the next developmental stage by a multilevel mixed design reported in Chapter 6, where qualitative and quantitative methods are used and data are analysed and integrated to address the research question (234). This chapter describes a process to design a deprescribing implementation strategy in LTC, which includes a Delphi survey and roundtable discussion with HCPs working in or with LTC. Chapter 6 acts as a point of integration on many levels merging qualitative and quantitative data sets from Chapter 3, 4 and 5 to create a selection of potential implementation strategies.

A modified online Delphi survey of national and international HCPs was conducted to facilitate the selection of associated BCTs. The BCTs were ranked using Likert scale data to determine their implementation feasibility in LTC to support deprescribing. Further integration existed during the Delphi survey where open-ended comment boxes facilitated the inclusion of qualitative feedback. This was used to augment BCTs considered feasible from the quantitative survey and illustrate findings generated, formulating implementation strategies to address barriers/enablers to deprescribing in LTC.

Following the Delphi survey, an online roundtable discussion engaging HCPs working in public LTCFs in Ireland was conducted to prioritise determinants of deprescribing behaviour and select and tailor BCTs to form an implementation strategy to support deprescribing, based on their nuanced understanding of the LTC setting. The roundtable discussion included a ranking exercise of deprescribing barriers and enablers followed by an in-depth discussion by HCPs of how to tailor the associated strategies to best support deprescribing engagement in LTC. This resulted in the final multidisciplinary DEprescribing review for Frail oldER Adults in Long-term care (DEFERAL) strategy which was agreed by all roundtable participants as the best strategy to support deprescribing within the current structure of public LTCFs in Ireland.

2.2.2.2 Feasibility

Feasibility and acceptability of the intervention was considered in Chapter 7 where a pilot of the DEFERAL strategy was conducted in two public LTCFs in the South-West of Ireland. Data on the implementation outcomes of feasibility, acceptability, appropriateness and fidelity were collected to evaluate the utility and fit of the DEFERAL strategy as perceived by targeted end-users in a real-world setting. HCP feedback was collected using a follow-up survey to evaluate the DEFERAL strategy, to document any deviations from the strategy as designed and identify potential for refinement.

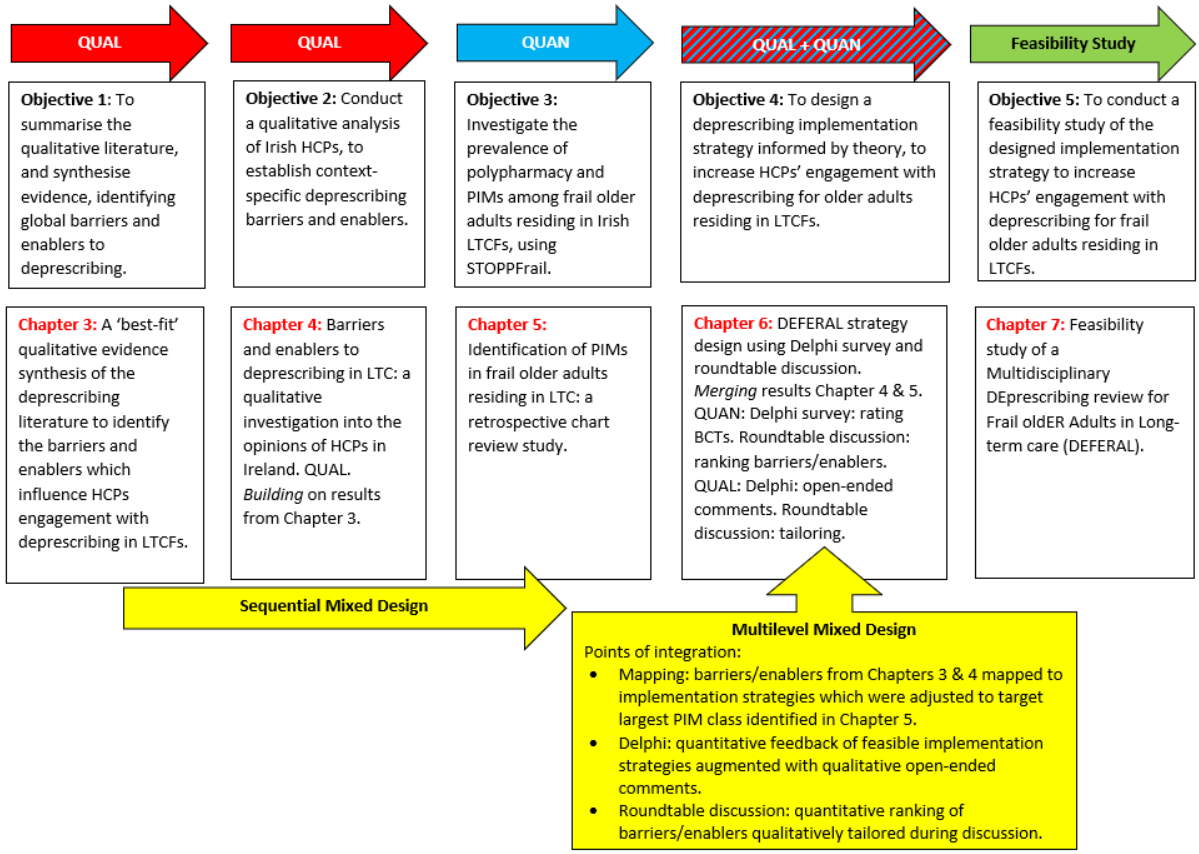


Fig. 3. Study design.

2.3 Theoretical frameworks and models for design

2.3.1 Theoretical approach

As limited evidence exists documenting deprescribing interventions and strategies conducted in Irish LTCFs, the goal of this thesis is to understand what influences engagement with proactive deprescribing in the LTC context. The aim of this research is to understand the factors influencing HCPs' decision to deprescribe and design a suitable intervention to address these determinants and

increase deprescribing engagement. Both a determinant framework, the TDF, and an implementation theory, the COM-B model, were used to understand the influences on deprescribing in LTC and how these may influence implementation outcomes (217).

Determinant frameworks provide information regarding determinants (barriers/enablers) which influence implementation outcomes. They provide a systematic approach to identify domains which are hypothesised or shown to influence implementation outcomes. Each domain identifies independent barriers or enablers which can affect outcomes, without providing an explanation of how the change takes place (217). This differentiates a framework from a theory as a theory usually implies "some predictive capacity" and tries to uncover a causal mechanism of implementation (217). A theory aims to describe and explain a relationship. They are conjectural and establish testable propositions. In comparison, a model is narrower in scope than a theory. It provides a simplification of a phenomenon and describes components which are expected to result in specific outcomes (241).

2.3.2 The Theoretical Domains Framework (TDF)

The TDF is a framework synthesised from 33 theories of behaviour change, consisting of 128 constructs, created by behavioural scientists and implementation researchers, using expert consensus process and validation (211,242). The TDF was created from theories of motivation, action and organisation to help understand the processes involved in changing the behaviour of HCPs (243). The theory of planned behaviour is an example of a motivational theory included in the TDF. This theory is used to explain an individual's intention to engage in a behaviour at a specific time and place (244). The transtheoretical model of health behaviour change is included and proposes the six stages of change involved for health behaviour (245). Another example is social cognitive theory which is described as both a motivation and action theory. Social cognitive theory explains how people acquire and maintain behaviour, considering the social context and the interaction between the individual, environment and behaviour (246). The TDF used in this research consists of 14 domains covering 84 theoretical constructs, known as version 2 (239). The TDF is used to investigate implementation problems involving HCPs and evidence-based practice (211) and can be used to understand and

examine determinants of HCP deprescribing behaviour at an individual level and what will influence behaviour change.

The TDF synthesises key constructs from theories of behaviour change and examines determinants of behaviour change related to the implementation of evidence-based interventions or practices. While the TDF is created from theories of behaviour change, the TDF itself is a framework providing a theoretical lens to view determinants of behaviour rather than suggesting mechanisms by which the constructs change behaviour (211). The TDF was used in the beginning to synthesise the qualitative evidence into a 'best-fit' framework in Chapter 3. The TDF provided a framework to conduct an in-depth analysis and interpretation of the factors influencing HCP behaviour, specifically the barriers and enablers reported internationally to deprescribing in LTCFs. This framework was further utilised in a qualitative study of HCPs working in Irish LTCFs reported in Chapter 4. The methods used in this thesis follow an alignment from theory to strategy selection.

2.3.3 Behaviour Change Wheel (BCW) and Capability Opportunity Motivation of Behaviour (COM-B) model

The COM-B model found at the core of the BCW (Fig. 4) is an implementation theory used to understand and explain aspects of implementation and what influences implementation outcomes. The COM-B model is used to identify appropriate targets for interventions which aim to change behaviour (247), supporting the translation of evidence-based interventions into real world practice (240).

The TDF, BCW and COM-B model guided this research with detail on how they were utilised reported in Chapter 6. Domains of the TDF relate to specific components of the COM-B model, central to the BCW. The BCW and COM-B model were used in the implementation strategy design process, linking determinants of HCP behaviour to implementation strategies. Determinants of HCP behaviour were mapped to intervention types using the BCW (Fig.4). The BCW provides a detailed description of the behaviour with the COM-B model suggesting that capability, opportunity and motivation generate behaviour, and behaviour can also influence these three components (240). The BCW identifies nine

intervention types which surround the COM-B model. These are broad categories of means by which an intervention is likely to address barriers/enablers and effectively change behaviour (240). Intervention types map to associated BCTs which are strategies used to support behaviour change and implementation of an evidence based intervention (248). Taxonomies exist which organise and structure BCTs (249–251). The BCT taxonomy version 1 (BCTTv1) provides a hierarchical structure of 93 BCTs which can describe the active component of implementation strategies and support intervention design (249). A hierarchy of BCTs also exists, where BCTs have been grouped under domains of the TDF, potentially assisting the selection of BCTs when designing interventions or implementation strategies (251).

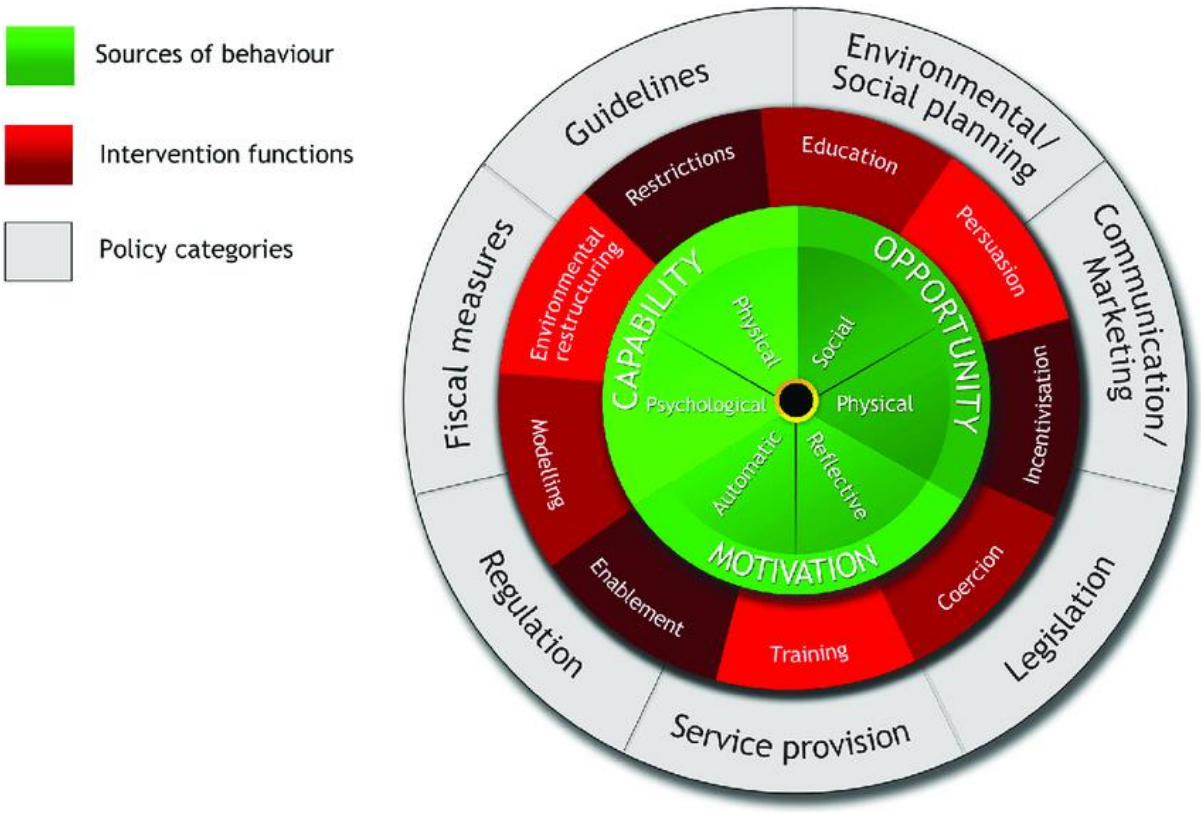


Fig. 4. The Behaviour Change Wheel (240).

Chapter 3: Barriers and enablers to deprescribing in long-term care facilities: A 'best-fit' framework synthesis.

The work of this chapter has been published as *Clara H. Heinrich, Eoin Hurley, Suzanne McCarthy, Sheena McHugh, Maria D. Donovan. Barriers and enablers to deprescribing in long-term care facilities: a 'best-fit' framework synthesis of the qualitative evidence. Age and Ageing, Volume 51, Issue 1, January 2022, afab250, https://doi.org/10.1093/ageing/afab250*

3.1 Abstract

3.1.1 Introduction

Older adults are at risk of adverse outcomes due to a high prevalence of polypharmacy and potentially inappropriate medications (PIMs). Deprescribing interventions have been demonstrated to reduce polypharmacy and PIMs. However, deprescribing is not performed routinely in long-term care facilities (LTCFs). This qualitative evidence synthesis aims to identify the factors which limit and enable healthcare professionals (HCPs) engagement with deprescribing in LTCFs.

3.1.2 Methods

The 'best-fit' framework approach was used to synthesise evidence, using the Theoretical Domains Framework (TDF) as the *a priori* framework. Included studies were analysed qualitatively to identify LTCF barriers and enablers of deprescribing and mapped to the TDF. Constructs within domains were refined to best represent the LTCF context. A conceptual model was created, hypothesising relationships between barriers and enablers.

3.1.3 Results

Of 655 records identified, 14 met the inclusion criteria. The 'best-fit' framework included 17 barriers and 16 enablers, which mapped to 11 of the 14 TDF domains. Deprescribing barriers included perceptions of an 'established hierarchy' within LTCFs, negatively affecting communication and insufficient resources which limited HCPs' engagement with deprescribing. Enablers included tailored deprescribing guidelines, interprofessional support and working with a patient focus, allowing the patients' condition to influence decisions.

3.1.4 Conclusion

This study identified that education, interprofessional support and collaboration can facilitate deprescribing. To overcome deprescribing barriers, change is required to a patient-centred model and HCPs need to be equipped with necessary resources and adequate reimbursement. The LTCF organisational structure must support deprescribing, with communication between healthcare systems.

3.2 Introduction

Older adults living in LTCFs are amongst the frailest members of our society (138). Their health status is affected by age-related physiological changes, their life expectancy is reduced and often, they experience a substantial medication burden potentially leading to adverse drug events (ADEs) (21,252). With ageing, the pharmacokinetics and pharmacodynamics of the body change, potentially altering the benefit-to-risk ratio of medications (30,253). However, medications started years prior to admission to a LTCF are often not reviewed, switched for safer alternatives or discontinued as time, ageing and clinical conditions progress (161).

While no single definition of polypharmacy exists, this study identified polypharmacy as the combined use of five or more prescription medications (37,39,86). European studies have shown that 32% of older adults are exposed to polypharmacy, with this increasing to greater than 50% of LTCF residents (254,255). Polypharmacy can be beneficial when indicated, however in the older adult population, it is associated with an increased risk of ADEs (39,86,256).

Polypharmacy has also been shown to be associated with an increased risk of receiving a PIM (257). A systematic review identified that half of all older adults resident in a LTCF were prescribed a PIM (58,194,258). Considering that excessive and inappropriate use of medication in LTCFs is high, deprescribing should remain a healthcare priority (57,127,255,259).

Deprescribing is defined as 'the process of withdrawal of an inappropriate medication, supervised by a healthcare professional with the goal of managing polypharmacy and improving outcomes' (260). This has been expanded to include the process of identifying and discontinuing a medication in a patient where the benefit of taking the drug is outweighed by the potential harm. It incorporates dose reduction, tapering or switching to a more appropriate drug class or formulation, whilst monitoring patient response (86,87,209,256,261). The benefits of deprescribing medications for LTCF residents include improved medication adherence, improved quality of life and reduced time spent on medication administration (102,103).

Deprescribing trials have been conducted in LTCFs, investigating drug classes (184,262–264), pharmacist involvement (161,265) and associated health outcomes (194,266). These trials have reported positive outcomes, such as reduced mortality, PIMs, hospitalisations, and polypharmacy (158,161,182,184,264,267–269). Despite the variety of deprescribing support strategies for HCPs, such as drug-specific guidelines and patient engagement tools, interventions to effect change and increase engagement with deprescribing behaviours have not been widely adopted and have demonstrated marginal success (105,209). Engagement with deprescribing behaviours in LTCFs remains a challenge (267), and therefore, further research is required to understand the factors which affect HCPs engagement with deprescribing practices in LTCFs.

To develop effective strategies to support deprescribing, identifying barriers is important, along with understanding the determinants which influence this behaviour (104,270). Investigating barriers and enablers offers a greater understanding of HCPs' experiences, beliefs and priorities, identifying targets for deprescribing interventions (271). Research on deprescribing barriers and enablers has been conducted in different settings (223,272), patient cohorts (273–275) and from different stakeholder perspectives (276,277). This systematic review investigates the barriers and enablers perceived by HCPs toward deprescribing in LTCFs. Therefore, this qualitative evidence synthesis (QES) will summarise the evidence, generate findings and provide an insight into why deprescribing is not currently routine practice; in doing so this QES will support the development of deprescribing interventions (267,278–282).

3.2.1 Aims

The aim of this QES, utilising a 'best-fit' framework method, is to summarise the thoughts and attitudes of HCPs toward deprescribing in LTCFs and identify potential barriers and enablers affecting deprescribing.

3.3 Methods

Details of the protocol for this systematic review were registered on PROSPERO (CRD42021232672), the International Prospective Register of Systematic Reviews.

3.3.1 Synthesis

The qualitative data were synthesised using a 'best-fit' framework synthesis approach. Data from studies are coded initially against an *a priori* framework and any data which cannot be accommodated by the *a priori* framework are considered for incorporation using inductive, thematic techniques (283). The RETREAT (Review question, Epistemology, Time, Resources, Expertise, Audience and purpose, Type of data) framework was used to select the most appropriate analytical approach. The RETREAT framework consists of a seven-domains which summarise important factors to consider when choosing a method to summarise qualitative evidence in a systematic review (284). The 'best-fit' approach was chosen as it is both augmentative and deductive, allowing an existing framework to be used as the *a priori* framework (285). Data from selected studies were extracted to the framework and any new ideas which did not map directly underwent thematic analysis to create new themes which were added to the *a priori* framework, creating an adapted version, which was specific to deprescribing in the LTCF context.

3.3.2 Search strategy

In formulating the research question, the Setting, Perspective, Interest, Phenomenon of, Comparison, Evaluation (SPICE) framework was used (Appendix 1) (286). An initial search strategy was developed by the primary researcher (CHH) and amended through consultation with a medical librarian. A detailed search string was developed to explore each component of the SPICE structure. Search terms included a combination of Medical Subject Heading terms, keywords, and a comprehensive list of synonyms for the following: 'long term care home', 'deprescribing', 'opinion' and 'older adult'.

3.3.3 Eligibility criteria

This QES included qualitative studies reporting primary data. No limits on location or publication dates were applied. The inclusion and exclusion criteria are summarised in Appendix 2. As the study investigated deprescribing for older adults in LTCF, older adult was defined as a person aged 65 years or more; however, this review did not exclude studies where some residents were younger (287). If data collection or analysis methods could not be identified in the qualitative study, the papers were omitted. Studies were not excluded for containing the opinions of other HCPs outside the scope of

this review. If there was no description of the HCPs included in a study, the corresponding author was contacted to provide clarity.

3.3.4 Systematic search

A systematic search of the following electronic bibliographic databases was undertaken from inception to December 2020: Pubmed, Web of Science, EMBASE, Medline (EBSCO), CINAHL (EBSCO), PsycInfo (EBSCO), The Cochrane Central Register of Controlled Trials (CENTRAL), and ClinicalTrials.gov. Grey literature and internet searching was conducted to source further studies. 'Berry picking' techniques of citation searching and reference searching of identified papers using Google Scholar were also carried out to identify all relevant papers (288,289). In the event there was no online access to a potentially relevant publication, the author was contacted directly.

3.3.5 Study selection

Initially, titles were screened for eligibility by the primary researcher (CHH). Studies were excluded if deemed not relevant based on predefined exclusion criteria; not deprescribing focused, not qualitative, not discussing HCPs' opinions, educational interventions, or end-of-life/palliative studies. Potentially relevant studies were subject to an abstract review, performed independently by the primary researcher and one other (EH). An abstract extraction form was completed by both researchers (CHH and EH), indicating reason for inclusion or exclusion based on predetermined criteria (Appendix 3). Full texts of potentially eligible studies were retrieved, and the articles were assessed independently by the two reviewers (CHH and EH) to determine whether they met the inclusion criteria. Consensus on inclusion at all stages was reached by discussion between the two reviewers (CHH and EH). Any discrepancies were discussed and resolved by consulting a third reviewer (MDD) to reach consensus.

3.3.6 Data extraction

An agreed data extraction document was used. Full-text articles were imported to QSR International's NVivo Version 12® qualitative data analysis software, for data synthesis and analysis. Data for analysis

consisted of the results section of identified papers. This included direct quotes from the HCPs and any secondary author interpretation.

3.3.7 Quality appraisal and confidence in synthesised findings

Quality of included studies was assessed using the Critical Appraisal Skills Programme (CASP) tool for qualitative research (290). CASP is the most frequently used tool for QES in Cochrane and the WHO guideline process (291). The quality appraisal was performed by two researchers (CHH and EH) with any disagreements resolved by discussion with a third researcher (MDD). Studies were not excluded based on the risk of bias assessments.

Confidence in findings was assessed using Grading of Recommendations Assessment – Development and Evaluation and Confidence in Evidence from Reviews of Qualitative Research (GRADE-CERQual) criteria and associated guidance publications (293–298). GRADE-CERQual consists of a four-stage assessment (adequacy, coherence, methodological limitations, and relevance), to provide transparency in the confidence assessment.

3.3.8 Analytic strategy: 'Best-fit' approach to framework synthesis

The review question was fixed and non-emerging, therefore the 'best fit' framework QES format is appropriate with the rigid structure anchoring the research question (284,299).The *a priori* framework chosen for this review was the TDF version 2 (239). The chosen framework does not perfectly facilitate the research question however it acts as 'best-fit', providing structure to allow researchers to engage with theory but not acting as a restraint (283,285,300). The reason for choosing the TDF is twofold. The TDF fulfils the initial step of the 'best-fit' method, described by Booth and Carroll (300), as the TDF in itself is a systematic review and synthesis of theories of behaviour change conducted by Michie *et al.* (242). The TDF is used to investigate implementation problems, supporting our research question (239). The TDF synthesises key constructs used across theories of behaviour change and examines determinants of behaviour change related to the implementation of evidence-based practice. The TDF expands on the core components of behaviour set out in the Behaviour Change Wheel (BCW) - capability, opportunity and motivation, and thus, provides a more detailed diagnosis of the barriers

to and enablers of behaviour. Each domain of the TDF relates to a component of the Capability, Opportunity, Motivation, Behaviour (COM-B) model therefore the results of this study can be linked to the BCW for implementation strategy design (240,301,302).

The TDF, consisting of 14 domains and 128 theoretical constructs, was used as the coding framework (239). A codebook of definitions was developed by two reviewers (CH and EH) to ensure consensus and transparency while coding. Identified papers were coded using this codebook with any aspect of the primary data which did not directly map identified for thematic analysis. Code frequency was documented, along with the number of papers in which each code was discussed. Upon completion, meetings were organised between the two researchers to report findings, discuss differences and reach consensus. In the event consensus was not reached, the entire research team (MDD, SMcC and SMcH), who have experience in qualitative research, were consulted until all agreed.

Any further data which did not map to pre-existing codes, required a method to allow inclusion in the framework for analysis. New data were analysed thematically by the researchers (CH and EH). Researchers familiarised themselves with the information, generated codes and summarised those into smaller relevant domains, to capture the concepts presented (283,303). These were then discussed to determine their incorporation into the framework and to identify potential relationships with other domains as defined by Braun and Clarke's method of thematic analysis (303,304). Both the *a priori* and new themes were discussed by two researchers (CH and EH) to determine their incorporation into the framework, with consensus reached at all stages. The 'best-fit' framework was then reviewed by the entire research team to ensure appropriateness and consistency of coding and categorisation of data.

The influencing factors are identified under the 'best-fit' framework domains and divided into barriers, enablers, or both. From the findings, a conceptual model was created. The conceptual model was developed by the lead researcher (CHH), based on the results of the data analysis. Of the six elements for conceptual model development, five were applied: (i) the researcher, (ii) working

conceptualisations (iii) study goals, (iv) LTCF context and (v) the TDF (305). It includes further interpretation in which potential relationships between identified factors are hypothesised. These relationships were formed through familiarisation with the data, building on secondary interpretations and creating tertiary interpretations to generate new theory.

3.3.9 Reporting

Results were reported in line with the '*ENhancing Transparency in REporting the synthesis of Qualitative research* (ENTREQ) statement (Appendix 4) (306).

3.4 Results

3.4.1 Included studies

The initial searches, including grey literature, citation and reference searching identified 655 papers. Following removal of duplicates, 434 papers were eligible for screening by title. The abstracts of 93 papers were read, identifying 21 papers eligible for inclusion. In total, 14 studies met the inclusion criteria (Fig. 5). Of the included papers, three were identified through the various 'berry picking' techniques (288). Search strategy results were reported as a Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow diagram (307).

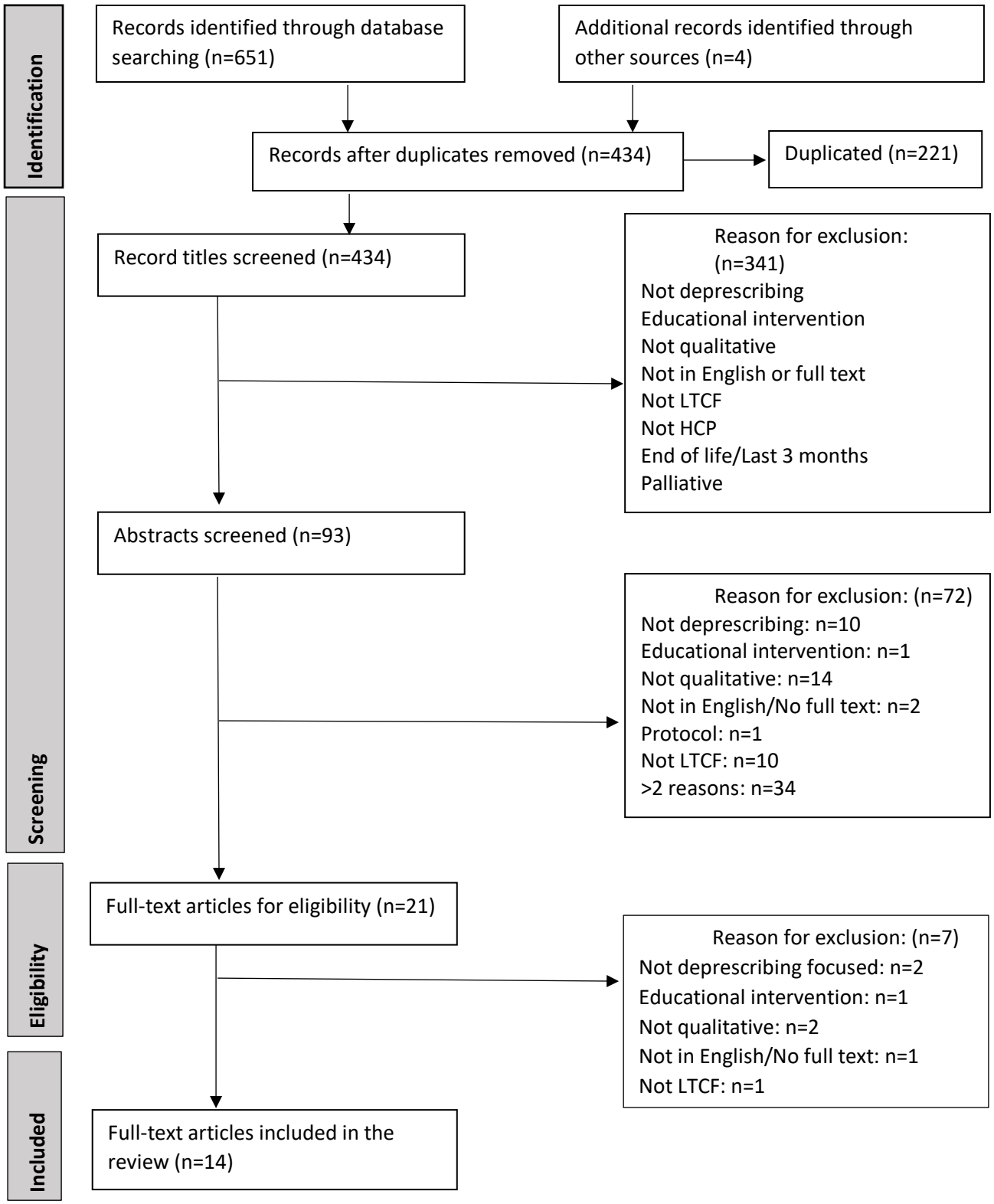


Fig. 5. Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow diagram of study selection (307).

The characteristics of the included studies are summarised in Table 1. The studies were conducted in nine different countries: Australia (n=5), Canada (n=1), Netherlands (n=1), New Zealand (n=1), Singapore (n=1), Sweden (n=1), Switzerland (n=1), United Kingdom (n=1) and the United States (n=2). Nine studies were based on deprescribing in general, while four focused on antipsychotic medication and one focused on both antipsychotic medication and benzodiazepines. Eleven studies were exclusively qualitative, while three studies used mixed-methods. Primary data collected in one included study were utilised for another study included in this QES, which compared the thoughts of general practitioners (GPs) from Australia and Sweden towards deprescribing (308,309). Any data already coded in the original study were not recoded. Eight of the studies captured the perspectives of the full LTCF multidisciplinary team (including GPs, pharmacists, and nursing staff), while other studies focused on single HCP groups (GPs, n=3; pharmacists, n=1; LTCF staff, n=2).

Table 1: Characteristics of Study.

First Author	Year	Country	Study Objective	Methods	Data collection	Qualitative data analysis	Participant characteristics
Ailabouni **(178)**	2016	New Zealand	Explore challenges and enablers faced by GPs to deprescribing in LTCF. Explore GPs' views on deprescribing guidelines and a possible role for pharmacists in the process. Use the TDF, to help understand the possible barriers and enablers of deprescribing in LTCF.	Qualitative	Semi-structured face to face interview	Constant comparison techniques, Framework analysis (M) TDF (F)	GPs (n=10)
Aerts **(310)**	2019	Australia	To identify: the primary driver of discontinued deprescription/ represcription; the reasons that antipsychotic therapy was restarted /continued; changes in selected indicators of functioning that occurred before and after represcription/discontinued deprescription; and their personal feelings about the represcription/ discontinued deprescription.	Mixed methods	Questionnaire with open ended questions	Content analysis (M)	HALT nursing champion (n=27), GPs (n=22), and person responsible for residents (n=21)
Bolmsjö **(308)**	2016	Australia and Sweden	Compare behavioural factors influencing the deprescribing practices of GPs providing care for LTCF residents in two separate countries. Review health policy and LTCF systems in each setting for their potential impact on the prescribing in LTCF. Provide recommendations for future LTCF deprescribing initiatives.	Qualitative	Focus group and semi-structured interviews	Framework analysis –(M) Integrative Model of Behaviour Prediction Framework (F)	Australian GPs (n=8). Swedish GPs (n=10).
Bolton **(311)**	2020	UK	To describe the barriers and facilitators to deprescribing in LTCF, as perceived by care home residents, relatives, healthcare professionals and care home staff. To map the barriers to deprescribing in care homes identified by healthcare professionals and care home staff to the TDF.	Qualitative	Interviews	Framework analysis (M) TDF (F)	GPs (n=6), pharmacists (n=6), nurses (n=4), carers (n=4), residents (n=11), relatives (n=4)

Disalvo **(312)**	2019	Australia	Explore pharmacist perspectives on barriers and facilitators to the Residential Medication Management Review's potential for improving Quality Use Medicines, with reference to residents with advanced dementia.	Qualitative	Interview	Content analysis (M)	Pharmacists (n=15)
Ellis **(313)**	2015	US	Describe how Florida LTCF are responding to the initiative of identifying challenges in reducing inappropriate antipsychotic medication use in their current practices, and to use and to recognize what is still needed to accomplish this goal.	Mixed methods	Questionnaire with open ended questions	Content analysis (M)	Director of Nursing (DON) (n = 109), LTCF administrator (n = 95), social worker (n = 7), managers (n = 28), nurses (n = 11), consultants (n = 6), minimum data set coordinators (n = 4) and other titles (n = 15)
Foley **(314)**	2020	Switzerland	To understand and compare the perspectives, needs and practices of health professionals active in Swiss LTCFs regarding deprescribing, and to conceive levers of action for implementing deprescribing in institutional care settings.	Qualitative	Focus groups with semi-structured interviews	Content analysis (M)	Pharmacists (n=11), nurses (n=10), GPs (n=6)
Kua **(315)**	2019	Singapore	Examine the factors that affect the views and acceptance of deprescribing among health professionals in nursing homes, focusing on knowledge, practice and attitude.	Qualitative	Semi-structured face-to-face interviews	Inductive and conductive analysis (M). The Knowledge, Attitudes, Practice (KAP) conceptual framework (F).	GPs (n=4), pharmacists (n=4), nurses (n=9)
Palagyi **(309)**	2016	Australia	Perceptions of medication use and the concept of deprescribing for LTCF residents. The application of these findings to informing the development of deprescribing initiatives within LTCF.	Qualitative	Focus groups – semi structured interview	Thematic analysis (M)	GPs (n=8), pharmacists (n=4), residents (n=25), relatives (n=16)
Peretti **(316)**	2016	Canada	What are the barriers and facilitators associated with antipsychotic deprescribing, from the perspective of physicians working in Canadian LTCFs?	Mixed methods	Interviews	Thematic analysis (M)	GPs (n=9)

			How do these barriers and facilitators affect physicians' ability to appropriately prescribe and deprescribe antipsychotics in this setting?				
Simmons **(317)**	2018	US	Explore nursing home staff perceptions Of antipsychotic medictaion prescribing practices and identify both benefits and barriers to reducing inappropriate use from their perspective.	Qualitative	Focus groups	Content analysis (M)	Practical nurse (n=11), registered nurse (n=4), social worker (n=4), facility administrator (n=2), nurse practitioner (n=2), DON (n=2), certified nursing assistant (n=2), assistant DON (n=1), mental health intern (n=1)
Turner **(90)**	2016	Australia	To generate and rank factors that GPs, nurses, pharmacists and residents perceive as most important when deciding whether or not to deprescribe medications.	Qualitative	Nominal group technique	Content analysis (M)	GPs (n=19), pharmacists (n=14), nurses (n=12), residents/relatives (n=11)
Westbury **(318)**	2011	Australia	Why are antipsychotic medications and benzodiazepines used so extensively in LTCF? What are the barriers to the review of psychotropic medication? What are the roles of GPs, nursing staff, pharmacists and the resident's family when psychotropic medications are initiated and reviewed?	Qualitative	Focus group with semi structured interviews	Content analysis, thematic analysis (M)	Nursing staff (n=10), pharmacists (n=5), GPs (n=5), relatives (n=2)
Wouters **(319)**	2019	Netherlands	Examine the barriers and facilitators of conducting medication reviews aimed at improving medication prescribing in LTCF residents.	Qualitative	Semi structured interviews	Thematic analysis (M)	Residents (n=9), elder care physicians (n=9), pharmacists (n=5), nurses (n=10)

(M) = Qualitative data analysis method; (F) = Framework used in analysis

3.4.2 Quality of included studies

A summary of the qualitative assessment results is shown in Table 2. The overall quality of included studies was moderate to high. Five studies satisfied all quality aspects (178,308,311,312,318). All studies clearly stated aims, except one study, which was a thesis (316). All studies added value, had appropriate methods and clear statement of findings. Seven studies insufficiently justified their research design choice (309,310,313–315,317,319). Four studies lacked quality in data analysis (90,309,310,316). Recruitment strategy was insufficiently reported in two studies (313,317), with another two studies having insufficient ethical considerations (310,313). Reflexivity was a common gap in quality, with only seven studies demonstrating consideration of the researchers' role, potential bias and influence (178,290,308,311,312,318).

Table 2: Quality appraisal of included studies using the CASP Qualitative Research Checklist (290).

CASP criteria	Foley (2020) **(314)**	Bolton (2020) **(311)**	Disalvo (2019) **(312)**	Kua (2019) **(315)**	Wouters (2019) **(319)**	Aerts (2019) **(310)**	Simmons (2018) **(317)**	Palagyi (2016) **(309)**	Bölmsjö (2016) **(308)**	Ailabouni (2016) **(178)**	Peretti (2016) **(316)**	Ellis (2015) **(313)**	Turner (2015) **(90)**	Westbury (2011) **(318)**
Clearly states aims?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓
Qualitative methodology appropriate?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Appropriate research design?	X	✓	✓	X	X	X	X	X	✓	✓	✓	X	✓	✓
Appropriate recruitment strategy?	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X	✓	✓
Data collection?	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	X	✓	✓
Reflexivity?	✓	✓	✓	?	✓	X	X	X	✓	✓	X	X	X	✓
Ethical issues considered?	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	X	✓	✓
Rigorous data analysis?	✓	✓	✓	✓	✓	X	✓	?	✓	✓	X	✓	X	✓
Clear statement of findings?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Value?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓ = Yes, X = No, ? =Unsure if methodologically sound.

3.4.3 Data synthesis and extension of TDF v2 to generate the 'best-fit' framework and model

3.4.3.1 'Best-fit' framework

Table 3 demonstrates the 'best-fit' framework. The TDF supported the majority of the barriers and enablers identified in this QES (239). Of the 14 TDF domains, 11 were populated; however, not all individual constructs within domains were identified. The 'best-fit' framework included domains which were exclusively barriers, exclusively enablers and domains which were both barriers and enablers (Fig. 6). Constructs within domains were refined to best represent the LTCF context. These adjusted constructs are specific to the LTCF context, increasing the relevance of the 'best-fit' framework to this environment. Five barriers and four enablers received a rating of high confidence, as identified by GRADE CERQual assessment. These were identified in the three most common domains in this review; 'social influence' (present in all 14 studies) 'environmental context and resources' and 'social/professional role and identity' (both of which were present in 13 studies).

Social influence was identified across all papers as an important domain, as it influenced deprescribing behaviour in the context of LTCFs. Patient social influence captured the patient's influence on HCPs' deprescribing behaviours. It summarised how HCPs determine benefit-risk ratios, making decisions based on perceived impact on the patient's quality of life. HCPs sought to understand patients' perspective, preferences and beliefs, and this in turn influenced HCPs' deprescribing behaviour.

An Australian GP summarised their thought process and social interactions when they engaged with deprescribing,

"I'd do some discussion with the patient if possible. And I would do it on the basis of trying to work out the risks versus the benefits" (178).

Similarly, a Swedish GP described how his prescribing process evolved based on the individual patient,

"I want to give the patients a good quality of life, and I follow them in the continuum of ageing, with their progressive weakness and adapt medical interventions for this"(308).

With the physiological changes of ageing, medication benefit can become outweighed by risks, becoming inappropriate (320). The patient social influence helped HCPs recognise this issue and engage with deprescribing, supporting patient health and wellbeing.

The second element of this domain focused on HCPs interprofessional relationships and interactions, and how this social influence impacted on deprescribing behaviour.

Interprofessional social support, in this context, described collaborative processes between HCPs, causing changes in attitudes and behaviours to engage with deprescribing. This understanding is accurately described by an Australian pharmacist who explained the collaborative roles,

"If the nurse feels that they [resident] might warrant a medicines review … they will highlight that for the GP, and the GP will end up referring for a medication review … a project that brings all the players in medicines together and you get an idea of the team that is available to effect change" (312).

Deprescribing in LTCFs has been shown to be affected by interprofessional social support between HCPs. Specialised support staff, communication and trust between HCPs were identified as enablers of the efficient transfer of information, communication and decision making, which facilitated deprescribing. Interprofessional social support barriers were also found, and included a lack of understanding of deprescribing benefits and lack of stakeholder 'buy-in' for deprescribing.

These elements of social influence were related to barriers and enablers identified across multiple domains, highlighting their importance and relevance in the LTCF setting.

The 'best-fit' framework combined the refined constructs with the original TDF domains. The 'findings' column in Table 3 identified the barriers and enablers from each domain, to which GRADE CERQual was applied. The conceptual model illustrates relationships between domains, providing a visual representation of the 'best-fit' framework of barriers and enablers which were found to affect deprescribing in LTCFs (Fig. 6).

Table 3: 'Best-fit' Framework of Barriers and Enablers to Deprescribing in LTCF with GRADE CERQual Assessment.

'Best-fit' domains and constructs	Findings	CERQual Assessment	Relevant papers	Barrier/ Enabler	Number of studies n
Knowledge					n=10
Knowledge requirements[1]	Education, for both HCPs and representatives is perceived as an enabler for deprescribing.	Moderate confidence	(178,308,309,311,313,315,317)	Enabler	
Deprescribing knowledge[1]	The level of deprescribing knowledge is variable among GPs and pharmacists. The majority identify that deprescribing and general medical knowledge is not a barrier, and they are able to identify deprescribing targets. However, it is acknowledged that knowledge gaps exist, especially in relation to deprescribing guidelines and specialist medications.	Moderate confidence	(178,308,309,311,314,318,319)	Barrier	
Procedural knowledge	A subset of GPs and pharmacists held negative beliefs about nurses and nursing staffs' pharmacotherapeutic knowledge to facilitate deprescribing.	Moderate confidence	(178,308,311,314,315,319)	Barrier	
Skills					n=4
Skills; competence	Deprescribing skills of nurses and nursing staff is considered dissatisfactory amongst other HCPs, with one study specifying this to be the case for inexperienced staff.	Low confidence	(308,309,314,315)	Barrier	
Social/professional role and identity					n=13
Professional role; social identity; leadership; power; professional boundaries	An 'established hierarchy' is perceived by HCPs to exist within LTCF, with GPs having seniority unless a specialist is involved. A perceived lack of authority exists for GPs to question the prescribing of specialist doctors and to engage in decision making about deprescribing medications started by a specialist.	High confidence	(90,178,308,309,312,314,315)	Barrier	
Leadership; professional role	Nurses are reported as organisational leaders in relation to deprescribing, referring patients for medication review, instigating discontinuation trials and providing patient observations during deprescription.	Moderate confidence	(308,312,314,318,319)	Enabler	
Organisational Commitment: LTCF[1]	HCPs report GPs' general disinterest and lack of organisation commitment to LTCF work. For example, one study among HCPs highlighted concerns regarding the lack of younger GPs interested in LTCF work and another study highlighted the shrinking population of LTCF GPs.	Moderate confidence	(178,308,309,311,313,316,318)	Barrier	

Organisational commitment: deprescribing[1]	Deprescribing engagement is not universal among HCPs in LTCF. A proportion of HCPs are not as receptive to deprescribing behaviours, specifically GPs and nursing staff, exhibiting a lack of 'buy-in'.	Low confidence	(90,178,308,311–313,318)	Barrier	
Professional role; social identity; *(interprofessional social support[1])*	Studies acknowledge that multiple stakeholders within the LTCF have various roles to play in deprescribing for older adults, including the GP, pharmacist, nurse, nursing staff, relatives and residents.	Moderate confidence	(90,178,308,309,311,312,314,315,318,319)	Enabler	
Beliefs about capabilities					n=6
Self-efficacy; professional confidence; *(deprescribing knowledge[1])*	Self-efficacy and professional confidence in the HCP's own knowledge and abilities influences their engagement with deprescribing. This was apparent for GPs with disease specific drugs.	Moderate confidence	(178,308,309,311,314,319)	Barrier/ enabler	
Beliefs about consequences					n=9
Beliefs: deprescribing; outcome expectancies; *(interprofessional social support[1])*	Having positive or negative beliefs about deprescribing outcomes or expectations or beliefs due to previous deprescribing experience, influences deprescribing engagement.	Moderate confidence	(178,308,311,314,315,317–319)	Barrier/ enabler	
Beliefs: prescribing; outcome expectancies	GP beliefs about prescribing influence their level of engagement with deprescribing. Those who consider prescribing iterative and focus medication reviews on reducing overtreatment are more likely to deprescribe.	Low confidence	(308,314,316,319)	Enabler	
Reinforcement					n=4
Incentives	Government incentives would positively influence HCPs' engagement with deprescribing.	Low confidence	(178,308,313,314)	Enabler	
Goals					n=5
Goal priority; implementation intention; goals (autonomous/ controlled)	When making decisions about deprescribing, HCPs are influenced by patients' care goals such as stability, physical condition, targeting unwarranted use of medications and correlating the purpose of patients' stay with prescribed medications.	Moderate confidence	(178,313–316,319)	Enabler	
Memory, attention and decision processes					n=6
Decision-making; *(interprofessional social support[1]; social influence)*	Deprescribing decision-making requires communication and collaboration between HCP to create a supportive medication management plan. The degree of patient representative involvement in decision-making varies	Moderate confidence	(178,311,312,314,318,319)	Enabler	

	depending on type of medications used, for example representatives would be involved in end-of-life decisions.				
Environmental context and resources					n=13
Resources: organisational[1]	Organisational barriers which exist within some LTCFs, such as administration burden, lack of IT, contrasting operational management, logistical issues accessing the LTCF, inappropriate institutional care models and regulations affect HCPs' ability to work efficiently within the LTCF and engage with deprescribing.	High confidence	(90,178,308,309,311,312,316,317)	Barrier	
Material resources	Insufficient resources negatively affect HCPs' engagement with deprescribing. The major barrier was a perceived lack of time, followed by insufficient staff, lack of financial support and lack of access to or insufficient medical documentation.	High confidence	(178,308,309,311,312,314–319)	Barrier	
Tailored material resources[1]	HCPs require standardised, tailored deprescribing guidelines, which are not overly comprehensive and are specific to the older adult population of the LTCF.	High confidence	(90,178,309,311,314,315,319)	Enabler	
Organisational culture/climate alignment between LTCF and other settings[1]	Communication and transfer of medical information between hospital and LTCF is insufficient to support deprescribing. Care between these settings is fragmented as each setting operates independently and prioritise different treatment goals.	Moderate confidence	(90,178,311,313,315,316)	Barrier	
Organisational culture/climate	Supportive organisational environment, culture, and regulations in LTCF is required to enable successful deprescribing, with studies suggesting this can be facilitated through LTCF medication review and integrated pharmacy services.	Low confidence	(178,308,313,314,316–318)	Enabler	
Resources; *(interprofessional social support[1])*	Multidisciplinary team (MDT) meetings and communication between LTCF HCPs is identified to facilitate deprescribing.	High confidence	(90,178,308,312–316,319)	Enabler	
Resources; (*social influence)*	Communication barriers, such as time, lack of face-to-face consultations and lack of understanding of communication and collaboration benefits between HCPs exist, negatively influenced deprescribing behaviour.	Low confidence	(178,308,309,311,312,315,316,318)	Barrier	
Social influences					n=14
Social pressure; social norms	Social pressures and social norms which are not supportive of deprescribing such as pressure to prescribe medications for challenging behaviours, not	Moderate confidence.	(178,308,309,314,317,318)	Barrier	

	adjusting a colleague's prescribing and maintain the 'status quo', negatively influence GPs' engagement with deprescribing.				
Intergroup conflict	Patient representatives are considered by HCPs to be a barrier to deprescribing, often due to the alternative care expectations representatives had for their relatives, resident in long-term care. For example, one study reported patient representative as facilitators, only if they supported deprescribing.	High confidence	(308,309,311,312,314–318)	Barrier	
Patient social influence[1]; Interprofessional social support[1]; *(decision-making, goals)*	Adopting a patient-centred focus, allowing the patient's condition to influence decision-making facilitates deprescribing. This includes communication between patients, representatives and HCPs, seeking family input, shared decision-making to enable successful deprescribing.	High confidence	(90,178,308,310–312,314–316,319)	Enabler	
Patient social influence[1;] *(knowledge)*	Barriers specific to the LTCF patient population exist including personal, behavioural and knowledge issues. These act as barriers to deprescribing, preventing HCP engagement.	High confidence	(90,178,311,314,315,317,319)	Barrier	
Interprofessional social support[1]**,** *(resources)*	HCPs value interprofessional collaboration when engaging with deprescribing in LTCF.	High confidence	(178,311–313,315,316,318,319)	Enabler	
Interprofessional social support[1;] *(decision-making)*	GPs believe that having specialised support staff to assist their decision-making is highly valuable when engaging with deprescribing.	Low confidence	(308,309,311,313,316)	Enabler	
Interprofessional social support[1;] *(beliefs about consequences)*	Trust in fellow HCPs' ability to engage with deprescribing behaviours facilitates successful deprescribing.	Moderate confidence	(178,308,309,311,312,314,316,319)	Enabler	
Emotion					n=11
Fear; anxiety; burn-out; negative affect	Negative emotions associated with deprescribing, such as anxiety, fear and burn-out are perceived to negatively impact HCPs' engagement.	Very low confidence	(90,178,308,309,311,314,317,319)	Barrier	
Fear; *patient social influence*[1]	Fear, related to patient symptom return, prevents HCPs deprescribing antipsychotic medications.	Low confidence	(310,316–318)	Barrier	

[1]= Refined original TDF constructs.

Italics: Related constructs from other domains

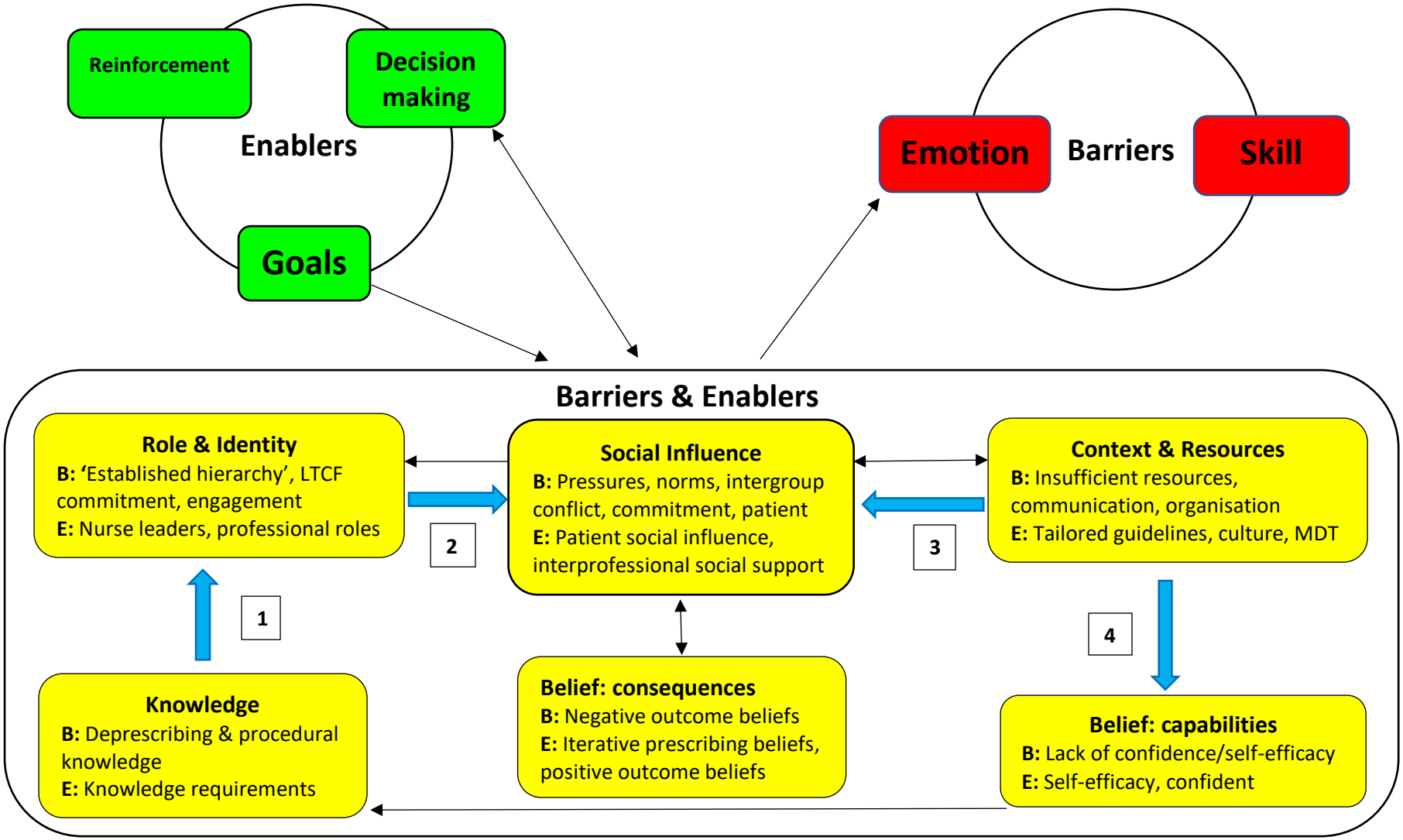


Fig. 6. Conceptual model of deprescribing barriers and enablers in LTCF. Numbering & blue arrows = relationships. 1 = education develops professional role; 2 = nurses have leaderships role, maintaining patient focus and social support; 3 = fragmented healthcare systems influence HCP ability to maintain a patient focus; 4 = availability of resources influences deprescribing engagement. Context & Resources = environmental context and resources. Role & Identity = social/professional role and identity. Black arrows indicate links between domains.

3.5 Discussion

This QES aimed to summarise the thoughts and attitudes of HCPs toward deprescribing in LTCFs, and to identify potential barriers and enablers affecting deprescribing. Barriers and enablers mapped to 11 of the 14 domains in the TDF. The main barriers identified in this review were social influences and environmental factors. There was a perceived 'established hierarchy' for managing patient care in LTCF, which limited the confidence of HCPs to question the prescribing decision of their perceived superior. Other social influences which acted as barriers to deprescribing included patient representatives' expectations, patients' beliefs and occasional challenging behaviours. The LTCF environment was a barrier to deprescribing namely the organisational aspects of administration, IT, policies, and care models. Similarly, HCPs highlighted how resources such as time, staff, documentation, and finances are insufficient to support them with deprescribing. Therefore, these barriers were identified as potential determinants to target in future implementation strategies to support deprescribing interventions.

The main enablers of deprescribing were also in the domains of social influence and environmental factors. In the environmental context domain, communication and shared decision-making between the patient/representative and HCPs promoted deprescribing. Secondly, allowing a patient's physical condition, along with their beliefs and perspectives, to influence goals and decisions, facilitated HCPs to deprescribe. Interprofessional social support was valued among HCPs. Resources such as MDT meetings offered an opportunity for communication and collaboration, which encouraged deprescribing behaviours. Finally, tailored guidelines, specific for the LTCF population, were reported as strong enablers of deprescribing. The barriers and enablers identified in this review provide targets to consider in the design of future implementation strategies to support deprescribing interventions. A Cochrane review of tailored interventions found that those designed to address prospectively identified barriers are more likely to improve professional practice than dissemination of guidelines alone (38).

The social influence domain consisted of two main influences on HCPs' deprescribing behaviour: patients and HCPs. Similar to findings from Reeve *et al.*, the refined construct, patient social influence, recognised the patient influence on HCPs' deprescribing behaviour, such as the patient belief that deprescribing is indicative of end-of-life (276). HCPs who adopted a patient focus supported deprescribing, by optimising medication regimens in collaboration with patients, based on their clinical condition (86,321). Deprescribing has been implemented successfully when HCPs consider patients' opinions when setting care goals. Shared decision-making empowered patients (273,277), and increased the likelihood of engagement with deprescribing, and has the potential to switch the LTCF culture from institutionalised to patient-centred, supporting deprescribing (322). Similarly, shared decision-making is welcomed by GPs to safely deprescribe (323). This construct overlapped with other TDF domains, such as goals, beliefs about consequences, and environmental context and resources. Patient-focused care goals, an awareness of patient consequences and tailored guidelines are suggested methods to support HCPs deprescribing engagement. This finding highlighted the significant influence of patient focus on deprescribing in LTCFs, as perceived by HCPs.

The patient social influence on decision-making related to prescribing echoed aspects of patient-centred care, a concept widely recognised in LTCFs (324–327). The differentiation between both approaches is that in patient social influence, the emphasis remains on the medical model of physical health instead of the social model associated with person-centred care (328). Maintaining a patient focus was found to be important in all aspects of LTC, including deprescribing, as it allowed an interpersonal approach, steeped in the philosophies of dignity, comfort, well-being, and respect (327).

Interprofessional social support is the second adjusted construct in the social influence domain, created specifically to reflect the collaborative processes between HCPs in LTCFs. Like patient social influence, elements of this construct mapped to existing aspects of the TDF, such as social/professional role and identity, decision-making and environmental context and resources. Collaboration through MDT meetings was valued among HCPs, and facilitated communication,

delegation and shared decision-making. The benefits of MDT meetings are reiterated by Rosell and colleagues, suggesting such meetings offer insights and knowledge from a variety of HCPs, and could support deprescribing (329). Sullivan identified behaviours and attitudes which constitute collaborative practice in healthcare and include; co-ordination, co-operation, shared decision-making and partnerships, where stakeholders work equitably together (330). Proposed patient benefits of collaborative practice include; improved quality of care, engagement and safety (331). Such behaviours are reflective of those required to support deprescribing efforts in LTCFs, as established from this QES. Therefore, engaging with collaborative behaviours as part of an implementation strategy will support deprescribing and the benefits of interprofessional social support are additional to the established deprescribing benefits.

A strong barrier identified from this QES was the perception of an 'established hierarchy' within LTCFs, which can negatively impact the effectiveness of communication and collaboration. Other deprescribing studies have uncovered similar findings, particularly where GPs feel inferior toward specialist consultants, hindering deprescribing efforts (332). This concept is reflected in the wider healthcare literature, identifying how professional hierarchies act as psychological barriers to effective communication with communications noted to be in a 'top down' direction (333–335).

Contrasting care goals between healthcare systems contributed to the problem of 'fragmented care'. This is a widely documented barrier to deprescribing for older adults in the literature (273,282,323,336,337). Hospital specialists traditionally operate in single-disease paradigms and prescribe to clinical practice guidelines, which may not be appropriate for multimorbid older adults (338). Applying numerous guidelines, to treat co-morbid conditions, leads to a highly complex treatment burden and polypharmacy (339). This negatively affected GP efforts in balancing patient care goals, quality of life and medical treatment, as they receive poor communication from other HCPs, similarly identified by Sinnott *et al.* (340). Considering GPs' reported lack of confidence when

questioning specialist prescribers, a supportive solution could include hospital teams providing clear guidance regarding review or withdrawal of medications.

The constructed conceptual model represents all main findings, identified as barriers, enablers, or both. The model also contains elements of further analysis, identifying relationships between barriers and enablers.

The first relationship described in the model was that professional role is developed through deprescribing knowledge. This hypothesised relationship suggested that further education could support the development of HCPs' professional roles and could allow for deprescribing to become part of their scope of practice. A study by Mecca *et al.* identified that a deprescribing educational intervention had the ability to change resident HCPs' clinical practice, including proactive engagement with medication reviews and deprescribing (341). GPs required resources such as guidelines and expert advice to support their decision-making (282). Considering the residents in LTCFs, the Screening Tool for Older Persons Prescriptions in Frail adults with limited life expectancy (STOPPFrail) could be an appropriate resource to resolve this barrier (342,343).

A second relationship was hypothesised between social/professional role and identity and patient social influence; nurses were seen as deprescribing leaders as they operated with a patient focus and advocated for patients when communicating with other HCPs. Despite negative beliefs from a small selection of HCPs about their pharmacotherapeutic knowledge, all professions in the included studies identified nurses as deprescribing organisational leaders. Successful deprescribing has been shown to require a nursing team to observe patient behaviour, monitor clinical responses and report their observations to the MDT (344). A study which investigated the proactive role of nurses in deprescribing reached similar conclusions, in particular that nurses can identify potential candidates for deprescribing, introduce the concept, and offer support throughout (345). Without these observations, HCPs who are not based at the LTCF, would have insufficient information to effectively

engage with and support deprescribing. A study which examined the nurse's role in LTCF similarly identified that a central feature of their position was to adopt a patient-focused perspective (346).

The third relationship between barriers to deprescribing related to the influence of insufficient communication and transfer of information on patient-focused decision-making. Fragmented communication between healthcare settings prevented HCPs fully considering patient factors when making deprescribing decisions. Patient social influence was identified as a strong enabler for deprescribing in LTCF and was hindered by communication barriers. This finding echoed research in primary care where it was also argued that the transfer of information between healthcare sectors was insufficient, and limited opportunities to tackle polypharmacy (332). A study which investigated the opinions of both LTC and hospital HCPs identified that valuable information was lost during the transition of care between settings (347). Martin and colleagues developed a tool which offered an evidence-based pharmaceutical opinion from pharmacists to doctors, and supported communication about deprescribing (348). With this intervention, prescription renewals for PIMs reduced by 43% (349). Having a similar tool tailored for the LTCF could support HCPs to engage with deprescribing and support patient safety.

An included study by Bolmsjö *et al.* hypothesised that a relationship existed between GP intrinsic factors, such as beliefs, attitudes, knowledge and skills, and extrinsic factors, such as funding (308). The final relationship hypothesised from the results of this QES was based on a similar concept, that resource availability such as tailored guidelines, influenced HCPs' self-efficacy and professional confidence to engage with deprescribing. Based on our interpretation, altering environmental factors, such as resource availability could facilitate deprescribing.

This 'best-fit' framework of deprescribing barriers and enablers has been constructed specifically for the LTCF environment, to highlight the unique and contextual factors influencing deprescribing in comparison to other settings. The authors felt that some themes, reflective of the LTCF environment, were not adequately captured in the broad TDF domain headings. In particular, the significant

influence of the patient on deprescribing behaviours in LTCFs and the specific interprofessional interactions which impacted on deprescribing behaviours were not specified under existing TDF domains. As identified by Booth, Carroll and colleagues, the best-fit framework method "harnesses the recognised strengths of both framework and thematic synthesis"; its purpose is to support the development of "context-specific models", which is what was achieved in this QES (283). In summary, by applying the best-fit framework we have identified barriers and enablers, specific to deprescribing in LTCFs which may inform future implementation strategies to support deprescribing in this setting.

This QES supports that deprescribing in LTCF is a multidisciplinary task, which requires HCPs to work together synergistically to improve the safety and wellbeing of patients. This review highlights that further education in deprescribing could improve HCPs' knowledge, confidence, and skills. It also highlights the inadequacies in resources available in these facilities, including finance, staff and patient documentation. Future changes could include facilitating the implementation of tailored deprescribing guidelines, suited to the older adult population to support HCPs' decision-making. Establishing defined deprescribing roles within LTCFs and organising channels for communication, such as MDT meetings is an option LTCFs can implement in effort to safely and efficiently deprescribe, whilst always maintaining a patient focus on decision-making.

3.5.1 Strengths and limitations

The use of the 'best-fit' method to synthesise findings from the literature allowed constructs of the TDF domains to be augmented to best represent the deprescribing barriers/enablers which are pertinent to the LTC setting. To our knowledge, this is the first evidence synthesis investigating barriers to and enablers of deprescribing behaviours in LTCFs, as identified by HCPs. An extensive search was performed, including citation searching and grey literature to maximise results. This review included robust methods; two independent reviewers at all stages and reporting in accordance with PRISMA guidelines. Analysis was conducted using a two-stage process and *a priori* theoretical framework, moving beyond description of data, to the development of a conceptual model which provides an interpretation of relationships between barriers and enablers. Majority of the review team were

pharmacists, with one psychologist. Assumptions and biases associated with pharmacists' own experiences were assessed and did not influence interpretation of the results. This inclusion of the GRADE-CERQual assessment offers confidence in the findings generated. This assessment benefits policymakers by outlining the confidence placed in findings generated, helping to decide which elements to consider for inclusion in policy.

Limitations of this evidence synthesis include that the reporting of findings was influenced by their frequency within included studies. The authors recognise that frequency can be influenced by topic guides and questions asked. A commonly reported limitation to qualitative systematic reviews is the difficulty in retrieving all eligible studies, due to the poorer established indexing system for qualitative reviews. However, the authors are confident that the search strategy was thorough enough to capture all relevant studies for inclusion.

3.6 Conclusion

Investigating the barriers and enablers to deprescribing perceived by key stakeholders and decision makers, such as HCPs, is required to adequately understand why deprescribing is not routine practice in LTCFs. GPs, pharmacists, nurses, and nursing staff all have a role to play in medication decision-making. These are the intended end users of deprescribing guidelines and algorithms; therefore, it is paramount to understand their reasoning regarding why deprescribing is not routine practice, to effectively overcome these issues. From the findings, education, interprofessional communication and collaboration are elements which can facilitate deprescribing. This, in addition to an organisational and cultural switch to a patient focused model, can support deprescribing. HCPs need to be equipped with necessary resources and require adequate reimbursement for their work to support engagement. The organisational structure must support deprescribing, with sufficient interprofessional collaboration and communication between healthcare systems, viewing the medical care of older adults in long-term care, from the same paradigm.

Chapter 4: Barriers and enablers to deprescribing in long-term care facilities: a qualitative investigation into the opinions of healthcare professionals in Ireland.

The work of this chapter has been published as *Clara H. Heinrich, Sheena McHugh, Suzanne McCarthy, Maria D. Donovan. Barriers and enablers to deprescribing in long-term care: A qualitative investigation into the opinions of healthcare professionals in Ireland. PLoS ONE 17(12): e0274552. https://doi.org/10.1371/journal.pone.0274552*

4.1 Abstract

4.1.1 Introduction

The prevalence of polypharmacy increases with age, increasing the exposure of older adults to PIMs. Deprescribing has been shown to reduce PIMs for older residing in LTC; however, deprescribing is not universally implemented. This study aims to identify the barriers and enablers to deprescribing in Irish LTCFs from the HCPs perspective.

4.1.2 Methods

A qualitative descriptive approach was conducted using semi-structured interviews with HCPs working with LTCFs (GPs, pharmacists and nurses). Purposive sampling with maximum variation was applied to select LTCF sites to identify HCPs, supplemented with convenience sampling of post-graduate HCPs from University College Cork. Data was thematically analysed and mapped to a framework of deprescribing barriers and enablers informed by the TDF.

4.1.3 Results

Twenty-six HCPs participated from 13 LTCFs. The main barriers and enablers identified mapped to five domains. Barriers included insufficient resources, lack of co-ordination between healthcare settings and negative social influences. Additional barriers exist in private LTCFs including deprescribing awareness, commitment and the need for incentives. Deprescribing enablers included interprofessional support and patient social influence. To encourage deprescribing, potential enablers include HCP education, pharmacist role expansion and tailored deprescribing guidelines within a structured process.

4.1.4 Conclusion

Implementation strategies to support a deprescribing intervention should build on existing systems, involve stakeholders and utilise guidelines within a structured process. Any intervention must account for the nuanced barriers and enablers which exist in both public and private settings.

4.2 Introduction

The prevalence of polypharmacy, generally considered the use of five or more medications, is rising (37,350,351). Globally, polypharmacy increases with age, which is mirrored in Ireland, with 31% of the population aged over 65 taking five or more medications, rising to 37% in adults over 75 (43,54). While polypharmacy can be appropriate when all medications are clinically indicated, inappropriate polypharmacy is of concern (40,352,353). Age-related physiological changes can cause older adults to be exposed to adverse consequences from medications which were once indicated and appropriate (30–32). Polypharmacy has been associated with PIMs and PIP, both of which have been linked with negative outcomes for older adults, such as adverse drug reactions, hospitalisations and mortality, particularly for frail older adults residing in LTCFs (44,51,52,257,354–356).

Internationally, PIM use is highly prevalent among older adults resident in LTCFs (357). A Belgian study identified that 64% of frail LTCF patients had one or more PIM, as identified using the STOPPFrail (33,182). PIP has been identified as a significant problem in Ireland, with studies documenting that 70% of LTC patients experienced at least one incidence of PIP (44,56). PIP is a particular challenge in LTCFs, as patients have a significantly higher medication burden than their community-dwelling counterparts (44). Considering the relationship between polypharmacy, PIMs and adverse drug reactions for LTCF patients, efforts are required to improve the appropriateness of prescribing in this setting.

Deprescribing, the process of withdrawing an inappropriate medication, including dose reduction, or switching to a more appropriate drug class, is an effective intervention to tackle polypharmacy, especially PIMs (86,260,358). A systematic review of deprescribing interventions in LTCFs found evidence of a 59% reduction in PIMs, improved patient safety and an increase in medication appropriateness (194). LTCF-specific deprescribing benefits include improved medication adherence, quality of life and reduced time spent on medication administration (103).

Considering the high incidence of PIMs among frail older adults, the risk of potential overtreatment remains high and deprescribing requires further attention. Despite best-practice guidelines, a US study documented limited PIM discontinuation rates, for older adults with limited life expectancy (359). Similarly, some deprescribing implementation strategies, such as medication reviews, are considered unlikely to be incorporated into daily practice (360). Researchers have called for an increased focus on implementation science to bridge the "research-to-practice gap", which may increase deprescribing engagement in clinical practice by, for example, tailoring strategies to reflect the LTCF environment (141,361).

As identified by the MRC's framework for developing and evaluating complex interventions, context and stakeholder engagement are core elements to intervention design (233). Evidence from a systematic review of deprescribing barriers and enablers in LTCFs suggests that social and environmental factors are the main influences over HCPs' engagement with deprescribing (362). To develop a successful deprescribing intervention, HCP behaviour change is needed. A better understanding of HCPs' deprescribing behaviour and the barriers and enablers which they experience in Irish LTCFs is required, as these are context-specific (223). Using behavioural science tools to facilitate this offers guidance, rooting implementation strategy design in behavioural theory, increasing the likelihood of achieving desired outcomes (207).

In Ireland, different organisational models for LTC exist. LTCFs are divided into state-funded (public) and private-owned (private) sites, with 80% of LTCFs owned and operated by private providers (363). Public LTCFs are managed by the HSE, who appoint a GP responsible for patient care, known as the medical officer, for each site. Private sites are owed by groups or individuals who independently manage the facility, with patients remaining under the care of their community GP. Bolmsjö *et al.* compared studies, investigating the deprescribing opinions of LTCF GPs, in two different countries; Australia, which has both public and private funding, similar to the Irish model, and Sweden, where all LTC is state funded. Results indicated contrasting opinions about interest in LTCF work and the need

for financial reimbursement (308). Understanding the barriers and facilitators in both organisational models is imperative to develop a supportive implementation strategy for a deprescribing intervention that fits with and addresses the challenges in each specific healthcare context.

4.2.1 Aims

The primary aim of this study is to generate an understanding of the barriers and enablers to deprescribing in Irish LTCFs, as perceived by HCPs who work with this setting. This is to inform the design of an implementation strategy to support a deprescribing intervention targeting inappropriate prescribing for frail older adults residing in LTC. A secondary aim of this research is to compare deprescribing barriers and enablers experienced by HCPs between public and private LTC settings. Considering the alternate funding and governance in LTCF, a nuanced deprescribing strategy may be required.

4.3 Methods

4.3.1 Design

Qualitative description was the chosen methodology for this study, aligning with the pragmatic approach of using the most appropriate research design and methods to address the research aims and inform the design of an intervention in LTCF (227,230,364–366). Ethical approval was granted for this study from University College Cork's Social Research Ethics Committee Log 2021-068.

4.3.2 Study participants

Stratified purposive sampling was used to sample sites for this study. The initial sampling criterion was public/private status. Sites were selected from a stratified list of LTCFs in the South/South-West (Cork/Kerry) region of Ireland (n=98) (367). LTCFs within this region which the primary researcher had an established professional connection with, were approached. From these settings, eligible participants were HCPs involved in the direct care of residents at the LTCF, including GPs, pharmacists and nurses. Consultants were not invited as GPs are primarily responsible for the medical needs of patients residing in Irish LTCFs (368). Healthcare assistants were not included as they are not involved in medical decisions (369). LTCFs were contacted via phone call and/or email to introduce the project, along with a request to advertise the project to their HCPs. Follow up emails were sent within three

weeks of initial contact. LTCFs referred interested nurses and HCPs working off-site (GPs and pharmacists), to the researcher. In addition, to increase the sampling pool, a convenience sample of HCPs working in LTCFs, were recruited through postgraduate courses in University College Cork. An email was distributed by university staff to post-graduate students and academics introducing the project, recruiting HCPs who worked in LTCF.

Information power was used to determine an appropriate sample size. By applying the five established criteria of information power, an initial sample of between 6 – 10 participants per HCP group, divided equally between public and private LTCFs, was deemed sufficient (371).

4.3.3 Data collection

One-to-one semi-structured interviews were conducted via Microsoft Teams with HCPs. Written, informed consent was obtained from all participants. An interview guide was developed and tailored for each HCP group, guided by the TDF-informed framework of deprescribing barriers and enablers in LTCFs (362). Each domain of the framework informed a question in the topic guide. Additional general questions were included, allowing participants to discuss any factor which they felt was important for deprescribing in LTCFs. The guide was reviewed by members of the research team who had experience in qualitative research and refined based on feedback. The interview guide was piloted with a pharmacist, GP, and nurse, all with previous experience of working in LTCFs. This confirmed that the guide was clear, understandable, and relevant to each HCP group and resulted in no change to the topic guide. As the focus of the study was not related to demographic factors, no demographic details were collected.

All interviews were audio or video-recorded, with the consent of the HCP. Following each interview, recordings were replayed to facilitate familiarisation. All interviews were transcribed verbatim by the primary researcher, anonymised and imported into QSR NVivo Version 12® to facilitate analysis.

4.3.4 Data analysis

The analytical strategy involved two processes drawing on the principles of thematic analysis (303). First, data were analysed inductively to develop themes from the data, then these themes were

mapped to the theoretical framework of deprescribing barriers and enablers, developed through qualitative evidence synthesis (362). Inductive analysis can support the theory driven deductive approach and offers both a conceptually and contextually rich understanding of the barriers and enablers to deprescribing (372).

In the first stage of analysis, interviews were analysed inductively by the primary researcher. This stage drew on the principles of Braun and Clarke's reflexive thematic analysis including familiarisation, generating initial codes, identifying initial themes, reviewing, and developing themes related to deprescribing barriers and enablers (303). Inductive analysis was preferred over direct mapping to the TDF to allow for inclusion of non-TDF related material.

In the second stage, themes were mapped to domains of the deprescribing framework (362). A second researcher reviewed the inductive themes, with supporting quotes and independently mapped these to the deprescribing framework. Any discrepancies were resolved during regular meetings with the research team, to discuss inductive codes, mapping, and dominant patterns.

Finally, domains of the deprescribing framework were compared according to professional role and type of LTCF (public/private) to investigate differences. This was conducted independently by two researchers. Meetings were organised to discuss and agree on findings.

To prioritise potential targets for a deprescribing implementation strategy, dominant domains were identified, based on frequency and the importance of barriers and enablers as perceived by participants.

The consolidated criteria for reporting qualitative research (COREQ-32) statement was used to inform reporting of the findings (Appendix 5). Transcripts were not returned nor was participant checking performed.

4.4 Results

A total of 26 interviews of HCPs from thirteen LTCFs were conducted between July and October 2021, as identified in Table 4. Twenty participants were recruited from LTCFs and six through academic networks. The interviews had a mean length of 24 mins (range 9 mins-65 mins).

Table 4: Characteristics of interview participants.

	Healthcare professionals (n=26)		
Long-term care facilities (n=13)	GP (n=7)	Pharmacist (n=7)	Nurse (n=12)
Public (n=4)	4	3	6
Private (n=9)	3	4	6

Through inductive analysis, 38 themes related to barriers and enablers to deprescribing were generated. All themes mapped to the deprescribing framework, as shown in Table 5 and 6. Findings from this study are organised at the level of the domain. The majority of the dominant domains provide evidence of both barriers and enablers. Dominant barriers and enablers mapped to five domains: 'knowledge', 'social/professional role and identity', 'beliefs about capabilities', 'environmental context and resources' and 'social influence' (Table 5). Non-dominant domains are also summarised (Table 6). Constructs representing the major barriers and enablers identified are summarised in (Fig.7).

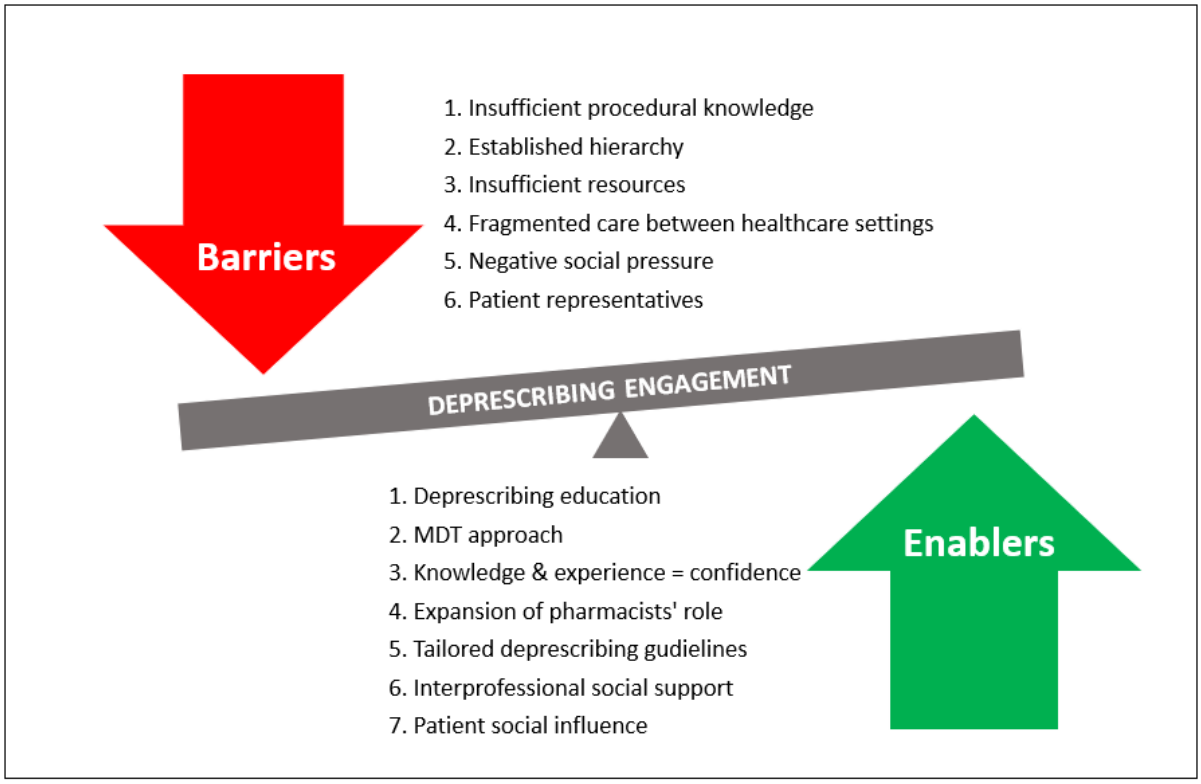


Fig. 7. Dominant barriers, enablers and potential enablers affecting deprescribing engagement. (MDT = multidisciplinary team, IT = information technology).

Knowledge

HCPs had an awareness of the term deprescribing and its definition. Despite a conceptual understanding, procedural deprescribing knowledge was limited, with the majority of HCPs recognising their limited practical experience of deprescribing in LTCF.

Beliefs about capabilities

HCPs suggested further education to support implementation of deprescribing in routine practice. HCPs explained that it is often only with knowledge and experience that they would feel confident to deprescribe or make recommendations.

Environmental context and resources

Insufficient resources at the LTCF environment were reported by all HCPs, in all settings, as a major inhibitor of deprescribing. Insufficient time was notably the main barrier reported, in addition to lack of staffing and IT.

Several GPs referred to the perceived fragmented care between LTCFs and hospital settings. Some HCPs had positive experiences, with hospital colleagues engaging with deprescribing, however the majority felt that communication and coordination between hospital and the LTCF was unsatisfactory, leading to fragmented care, negatively affecting deprescribing due to lack of information about indications and duration of treatment.

Despite lack of resources and communication channels, the LTCF environment was widely regarded as an ideal setting for deprescribing. This is due to the increased patient observations, compared to the community setting, perceived quality of nursing care and a controlled environment. Medication reviews, which should occur quarterly in LTC, were reported as a prime opportunity to engage with deprescribing. HCPs called for increased guidance and rigour within the medication review process, to increase its utility and make it less of a "tick-box" exercise which is currently conducted to variable standards by HCPs. HCPs acknowledged that deprescribing requires an MDT approach and suggested integrating pharmacist services during medication reviews. In settings where MDT meetings occurred, these were identified as an ideal opportunity to encourage deprescribing behaviours and support decision-making as HCPs benefit from the combined expertise of all HCPs involved in patient care. Opportunities for MDT discussions were not evident from all LTCFs.

In addition to organisational resources, tailored deprescribing guidelines were suggested by HCPs, to support decision-making and foster a culture of deprescribing in LTCFs. HCPs called for a structured deprescribing procedure to be implemented, to facilitate uniform engagement with deprescribing among HCPs in LTCFs. Suggestions included a policy or algorithm suitable for all HCPs to document concerns about PIMs, specifying the deprescribing plan and any observations required.

Social/professional role and identity

HCPs identified that social factors and traditional professional roles within LTCFs, largely influenced their engagement with deprescribing. HCPs identified that an 'established hierarchy' exists in Irish LTCFs, where GPs are believed to hold a position of authority compared to pharmacists or nurses. This was a perceived barrier to deprescribing for those HCPs, as they didn't feel empowered to make deprescribing suggestions to GPs.

To support deprescribing engagement, GPs and pharmacists highlighted the need to expand the role of pharmacists, to increase their scope of practice as autonomous practitioners. This included the need for pharmacists to be on-site at LTCFs with access to patient notes, providing clinical knowledge to GPs and supporting decision-making. This was perceived among GPs as a time efficient, safe way to provide care to LTC patients and engage with deprescribing, due to current pressure in general practice.

Social influences

Social factors, such as negative social pressure from colleagues, further influenced engagement with deprescribing. HCPs experienced pressure from colleagues who preferred to maintain the 'status quo' and avoid potential negative outcomes associated with deprescribing in a patient who presented clinically well. Patient representatives' understanding of deprescribing as a "removal of care" was also perceived to be a social barrier for HCPs.

HCPs suggested that the availability of interprofessional social support increased willingness to adopt deprescribing behaviours. Equally, HCPs' understanding of the patient experience, including patient opinion, and a consideration of how deprescribing outcomes can affect patient's health and wellbeing influenced their engagement. Patients' opinions and those of their representatives also influenced deprescribing engagement. This posed as a barrier or enabler, depending on the understanding patients or representatives had about deprescribing. It was considered important among all HCPs to include patients, who were considered 'compos mentis', or representatives, in deprescribing decision-making.

The importance of ‘buy-in’ and deprescribing commitment from all stakeholders was emphasised by HCPs, suggesting this would also support and encourage deprescribing engagement.

Table 5: Dominant barriers (B), enablers (E), and potential enablers (PE) mapped to domains in the deprescribing framework.

Domain/construct	Description of barrier/enabler/potential enabler	Supporting quote	B/E/ PE
Knowledge			
Knowledge requirements	All HCPs from all settings required further education to incorporate deprescribing in their daily practice.	*"You need education… as in what each of their [HCPs] roles would be, what would be expected of them and then outline the benefits of that."* Pharmacist #1 Private	B/E/ PE
Procedural knowledge	Practical application of deprescribing knowledge was not universal among HCPs.	*"Yeah, I would have come across the concept [of deprescribing] before… in college rather than in work."* Pharmacist #3 Public	B
Social/professional role and identity			
Professional role; social identity; leadership; power; professional boundaries*; (fear)*	An 'established hierarchy' in LTC was perceived by HCPs, with GPs having seniority in terms of responsibility for patient care. HCPs described fear and lack of authority to question the prescribing of GPs.	*"The difference in the superior and inferior, I mean the yeah, the position mainly, it's just you have to follow the physician's prescriptions or the advice."* Nurse #2 Private	B
Professional role; social identity; Professional boundaries; *(interprofessional social support)*	GPs and pharmacists identified the benefits of expanding pharmacist's scope of practice including during medication reviews and increasing their presence on-site, to provide clinical knowledge and support to the MDT.	*"Looking at the experience of other jurisdictions… there is an embedded pharmacist [in long-term care]. It is the pharmacist that is the person who has the technical knowledge oftentimes and can advise the GP what to do."* GP #2 Public	PE
Beliefs about capabilities			
Beliefs; professional confidence; self-efficacy; perceived competence	Knowledge and experience gave HCPs confidence and enhanced their level of engagement with deprescribing in LTC.	*"I've done the membership, I've 5 years hospital experience and a lot of GP years done as well so I think I'm kind of confident enough making decisions and backing up my decisions."* GP #5 Private	E
Environmental context and resources			
Organisational alignment between long-term care and other settings	Insufficient communication and coordination between hospital and LTCFs led to fragmented patient care, negatively affecting deprescribing.	*"There's definitely… lack of crisp, fast, electronic communication between primary and tertiary care. It is just one of the biggest reasons there are drug errors and drug overprescribing."* GP #6 Private	B
Resources: organisational;	Face-to-face MDT meetings, conducted at regular intervals, between all three HCP groups facilitated deprescribing in LTC.	*"There needs to be like a standard approach… making those quarterly reviews meaningful so that they're not just to tick-*	E

(interprofessional social support)		*box exercise… if it involved you know a sit-down MDT approach."* Nurse #12 Private	
Tailored material resources	Despite an awareness among a minority of HCPs of guidelines such as STOPP/START, most HCPs still called for clear tailored guidelines to provide confidence, support their decision-making and help gain patient and representative buy-in.	*"One thing which I think would help is some tool… structured… where you would document in a very methodical fashion, why you are deprescribing a medication… And if that was a standard… and was based on whatever guidelines were available at the time, medicolegally defensible, I would feel much more confident stopping things."* GP #7 Private	PE
Resources – Material	Insufficient resources negatively affected HCPs' engagement with deprescribing. The major barrier was a perceived lack of time, followed by insufficient staff and lack of IT support.	*"[Deprescribing] can be quite time consuming… I think it should be a priority, but it may not always be due to time constraints."* GP #3 Public	B
Social influences			
Interprofessional social support	Interprofessional social support and collaboration between all HCPs promoted engagement with deprescribing.	*"It would need to buy-in from all the parties… 'cause your prescriber does deprescribing, pharmacists implement the deprescribing… and the nurses observe the effect of deprescribing. But you very much have to have everybody on board."* Pharmacist #6 Public	E
Intergroup conflict	Sometimes a misperception existed amongst family members that deprescribing means withdrawal of care; this negatively affected HCP' engagement with deprescribing.	*"There is a misperception sometimes amongst family… that rationalizing medicine equals withdrawal of care as so it means that you're actually taking away care from them."* GP #6 Private	B
Patient social influence	For patients who are cognitively aware, involving them in deprescribing conversations can improve success rates.	*"With the patient, explain the pros and cons of each medication… I think they would be more on board with stopping a medication if they knew the risk benefit analysis of each."* GP #3 Public	E
Social pressure	Social pressures to maintain the 'status quo' and not upset patients' medication regimen negatively influenced HCP motivation to engage in deprescribing.	*"If it ain't broke, don't fix it… like it's best practice at the moment."* GP #7 Private	B

Domains and constructs from the 'best-fit' framework of barriers and enablers to deprescribing in LTCFs reported in Chapter 3 (362).
(Italics): Related constructs from other domains.

Table 6: Non-dominant barriers (B), enablers (E), and potential enablers (PE) mapped to domains in the deprescribing framework.

Domain/construct	Description of barrier/enabler/potential enabler	B/E/ PE
Knowledge		
Deprescribing knowledge	The majority of HCPs demonstrated some theoretical knowledge and awareness of deprescribing in LTC.	E
Skills		
Skills; competence	The skills of all HCPs were identified as sufficient to support deprescribing.	E
Social/professional role and identity		
Professional role; leadership	Nurses were identified as organisational leaders, promoting deprescribing.	E
Organisational commitment: to long-term care	A perceived lack of commitment from private GPs to LTC work was identified, by both GPs and other HCPs.	B
Organisational commitment: to deprescribing	HCPs described varied levels of commitment to deprescribing.	B/E
Beliefs about consequences		
Beliefs: deprescribing; outcome expectancies	Beliefs about deprescribing outcomes or previous experience of deprescribing influenced HCP engagement. Negative beliefs or experiences can negatively affect future deprescribing engagement. Similarly, positive beliefs or experiences can promote and encourage engagement.	B/E
Beliefs: about prescribing	HCPs' beliefs about medications and prescribing can influence their engagement with deprescribing. For example, some GPs expressed concerns about prescribing specific classes of medication, while nurses discussed the importance of rationalizing medication regimens.	E
Memory, attention and decision processes		
Decision-making	Deprescribing decision-making involved a benefit-risk analysis, with focus on patient safety and wellbeing.	B
Emotion		
Fear	Fear of a negative patient outcome because of deprescribing, was a barrier for all HCPs.	B
Reinforcement		
Incentives	National cost savings for the health service, operational improvements and patient benefits were examples of rewards suggested by HCPs, which may support deprescribing engagement.	PE
	Incentives would support HCPs engaging with deprescribing in long-term care. Suggested incentives included financial and legislative requirements.	PE
Goals		
Goal priority	Deprescribing was not prioritised by HCPs for patients in long-term care.	B
Environmental context and resources		

Organisational culture and climate	The LTC physical environment was thought by HCPs from both public and private settings, to be appropriate for deprescribing due to patient observations, perceived quality of nursing care and a controlled environment.	E
	The incorporation of deprescribing into existing quarterly medication reviews and integrating pharmacist services at the LTCF were suggested as mechanisms to increase HCP engagement with deprescribing.	PE
Resources: organisational; *(interprofessional social support)*	Healthmail, a secure email service between HCPs, facilitated deprescribing.	E
Tailored material resources	HCPs believed a structured procedure would be required to facilitate uniform engagement with deprescribing in LTCFs.	PE
Social influences		
Patient social influence	Patients, representatives' expectations, and anticipated patient outcomes influenced HCP' engagement with deprescribing.	B/E

Domains and constructs from the 'best-fit' framework of barriers and enablers to deprescribing in LTCFs reported in Chater 3 (362).
(Italics): Related constructs from other domains.

Analysis of domains across HCPs working in public and private settings identified different experiences related to three domains; 'knowledge', 'reinforcement' and 'social/professional role and identity' (Table 7). Commitment, both to the LTCF and deprescribing varied among HCPs in public and private settings. Staff from publicly-funded LTCFs indicated a greater commitment to deprescribing than those working in private LTCFs. Similarly, HCPs' opinions on guidelines differed, with HCPs in the private settings reporting limited awareness of deprescribing guidelines. HCPs working in the private sector increasingly referenced the need for financial incentives to support their engagement with deprescribing in LTCFs.

Analysis of barriers and enablers specific to professional role, identified two findings specific to a healthcare profession, commitment and organisational leadership. Organisational commitment was a barrier attributed only to GPs. Nurses were identified as the organisational leaders of deprescribing by all HCPs based on their knowledge of LTCF patients and their central communication role between the GP and pharmacist. Nurses have existing channels of communication between all HCPs to manage daily medical concerns and facilitate routine or as required medication reviews.

Table 7: Analysis of public versus private opinions.

Domain	Quote	
	Public	**Private**
Guidelines: greater awareness of deprescribing guidelines among HCPs in public LTCFs.	"Both in terms guiding my practice but also in terms of… audits I have done, STOPP/START and STOPPFrail are *the* guidelines." *GP #2* "The STOPP/START guidelines are very useful for the elderly population, suggesting what should be stopped and when it should be stopped." *Pharmacist #3*	"But we don't have any guidelines as it is, that's what I think (laughs)". *Nurse #10* "Amm… so I suppose there's… nothing really designed for… deprescribing you just rely on your usual resources, you know the BNF." *GP #1*
Incentives: greater emphasis placed on the benefit of financial incentives to support deprescribing engagement from HCPs in private LTCFs.	"I think that GPs would want to engage to be honest… I don't think they would require more." *GP #3* "I can't see why you would need to incentivize it you know I mean it's part of our job." *Pharmacist #6*	"If GPs were remunerated for it [deprescribing], so if you had, you know, some protected time." *GP #1* "I think pharmacists will… be going to the facilities… conducting these reviews which will be timely, and they want to be financially rewarded for that." *Pharmacist #2*
Organisational commitment: HCPs in private LTCFs showed limited commitment to LTCF work.	"It is good in fairness, if there's any issues… we have a doctor team here four times a week." *Nurse #5* "I'm the medical officer for a Community Nursing Unit. So we call there twice a week for ward rounds" *GP #4*	"The nursing home visits, there are not resourced, very often it's our registrar… the least experienced of us, winds up doing the quarterly reviews." *GP #5* "Every GP I think they're coming quarterly to review their medicines and if they have any complaints, we can send the email." *Nurse #9*
Deprescribing commitment: HCPs in private LTCFs showed reduced engagement with deprescribing behaviours.	**"**I think on the whole… staff would engage with it [deprescribing]." *Nurse #4* "I think it's something that definitely we could do from a daily basis." *Nurse #7*	"I think that that's why it's [deprescribing] not routinely done at the moment because the stakeholders are all pulling in different directions." *Pharm #2* "Prophylactic antibiotics are another [deprescribing target] say for UTIs... That can be difficult with the nursing staff sometimes to encourage. *GP #5*

4.5 Discussion

This qualitative study examined the perceived barriers and enablers to deprescribing among HCPs working in Irish LTCFs. To the best of our knowledge, this is the first study to utilise the TDF to analyse in-depth, the factors which influence deprescribing behaviour in Irish LTCFs. Additionally, this study examines how these factors contrast across publicly-funded and privately-run LTCFs. The major barriers to deprescribing included insufficient resources, lack of co-ordination between healthcare settings, negative social influences among colleagues and patient representatives' understanding of deprescribing as a removal of care. The main enablers of deprescribing in LTC were interprofessional support and patient involvement in deprescribing decision-making. Potential enablers of deprescribing suggested by HCPs included deprescribing education, role expansion for pharmacists and tailored guidelines.

Education was identified by HCPs as a strong potential deprescribing enabler, similar to other deprescribing studies in this setting (194,373). All professional groups recognised that further education would be required to support deprescribing, possibly in the form of continuing professional development courses and on-site training. Such forms of educational interventions have shown to effectively reduce PIP in older adults (374). Our study identified that knowledge and experience promoted and encouraged professional confidence and deprescribing engagement in LTCFs, similar to the results of a study on deprescribing in primary care (375).

Contrastingly, material resources such as time, staff and documentation, in the form of deprescribing templates and patient health records, were described as insufficient in Irish LTCFs. A lack of communication and co-ordination between healthcare settings was believed to be responsible for the fragmented care which is perceived to exist for LTCF patients. These environmental barriers echo deprescribing challenges identified in Irish primary care settings (376,377) and in LTCFs from other jurisdictions such as the United States, New-Zealand, United Kingdom, Switzerland and Singapore. (178,313–315,317,337). Investment in resources, such as electronic health records, which support communication and co-ordination of patient care could help to address these obstacles. Reported

benefits of electronic health records in LTCFs include improved access to patient information, increased documentation accuracy and better implementation of evidence-based practices (378). Perceived benefits of sharing health records between healthcare systems included improved communication and care planning, which could improve the time, administrative burdens and communication barriers which exist in LTCFs (379).

Similarly, HCPs in this study reported insufficient financial resources to engage in deprescribing. Insufficient financial incentives are a widely documented barrier to deprescribing in all healthcare settings (178,281,312,380). In jurisdictions where financial incentives exist, HCPs are more positive toward deprescribing and structured pharmacist-led MDT medication reviews have effectively increased deprescribing rates (308). Currently in Ireland, HCPs are not reimbursed to provide deprescribing services in LTCFs. Furthermore, community pharmacists are reimbursed per item dispensed and thus, deprescribing could be perceived as a potential financial disincentive. A similar challenge exists in Germany, with pharmacists explaining that by deprescribing PIMs, they are "doing the right thing, and getting less for it" (332). This remains a barrier which requires change in the reimbursement structure and potential governmental incentivisation to overcome.

HCPs in this study suggested that a structured procedure, consisting of an MDT approach using evidence-based tailored guidelines, would encourage deprescribing engagement. Wouters *et al.* suggested refining the STOPP/START guidelines for implementation feasibility in LTCFs, as the redundancy of criteria of PIP would overwhelm deprescribing decision-making (319). Considering the awareness among participants of the STOPP/START guidelines, a future option could be the implementation of STOPPFrail, guidelines tailored for the frail older adult, often the population seen in LTCFs (20).

Social and professional barriers also influence HCPs engagement with deprescribing. Studies have shown that deprescribing in LTCFs is negatively impacted by the widespread perception of an 'established hierarchy', where GPs hold seniority above pharmacists and nurses (309,312).

Interestingly, in this study, GPs did not feel pressure to conform to the prescribing practices of consultants, as they perceive themselves to be the HCP responsible for patient care. This contrasts with the opinions of international GPs who report consultants to occupy top priority, despite little difference in consultant roles between jurisdictions (90,178,314,315). Future deprescribing interventions could benefit from incorporating the entire MDT to mitigate fears of perceived hierarchy. Reinforcing this, HCPs called for an expansion of integrated pharmacist services in LTC. Pharmacists are identified by participants as deprescribing facilitators, offering knowledge, support and confidence in decision-making. Similar campaigns exist internationally promoting the integration of pharmacists into LTCFs, to provide clinical services, participate in discussions and educate staff (381). A systematic review by Sadowski *et al.* concluded that there is evidence to support the integration of a pharmacist into LTCFs, particularly to provide medication reviews to increase medication appropriateness, supporting the response from study participants (382).

HCPs perceived expectations of patients and their representatives to negatively influence their engagement with deprescribing in LTCF. Negative opinions of deprescribing can occur due to mismatched expectations of care and medication efficacy (276,383). This supports the importance of incorporating patient or representatives in deprescribing decision-making and in the development of future implementation strategies.

Comparing the opinions of HCPs from public and private settings, additional barriers are perceived to exist in private LTCF. This is an important consideration, if developing an implementation strategy to support deprescribing in this LTC setting. HCPs working in privately-funded LTCFs had a limited awareness of deprescribing guidelines compared to their counterparts in publicly-funded LTCFs. HCPs operating in private LTCFs increasingly called for financial incentives to facilitate their engagement with deprescribing. A similar demand was not reiterated by their colleagues in public LTCFs. GPs and pharmacists from both settings are remunerated for care provided to LTCF patients; however, HCPs

felt that the current format and extent of reimbursement for private LTCF work isn't sufficient to warrant the time required to engage with deprescribing.

Finally, commitment varied among HCPs, both to the LTCF and deprescribing. As HCPs in public LTCFs are "contractually required" to attend the LTCF, commitment was less of an issue. Contrastingly, in the private sector, GPs explained that often it is their GP registrar who attends the LTCF, as they themselves do not have sufficient time. Some GPs were reported to attend four times per year, reaching the minimum legislative requirement for medication review, in addition to responding to immediate medical needs. This perceived lack of interest and commitment appears to be an ongoing problem within Irish healthcare, as it was highlighted in 2015 by Nursing Homes Ireland as an issue of concern (384). Bolmsjö *et al.* similarly identified contrasting interest in LTCF work among HCPs from two jurisdictions with different organisational structures (308). A UK study which switched the frequency of LTCF visits from *ad hoc* to weekly, resulted in reduced hospital admissions and care home visits. The routine structure allowed 'ward round style' care, similar to public LTCFs, supporting HCP education and decision-making (385). Incorporating routine visits into the Irish private LTCF sector could support deprescribing engagement; however, reimbursement may be required to incentivise GPs to dedicate time to LTCF work. Alternatively, an organisational switch toward a medical officer model could be considered, creating a defined, reimbursed role.

The foundation to support deprescribing exists in LTCFs. The medication review is identified, both from this study and the wider literature, as an ideal opportunity to engage with successful deprescribing (104,194,386). However, in the Irish context this needs reform, switching from a "tick-box" exercise to a meaningful intervention, facilitating deprescribing. Suggested changes include creating a structured procedure, incorporating the MDT, shared decision-making and tailored guidelines, to increase uniformity, acceptability, and engagement.

4.5.1 Strengths and limitations

Building on the qualitative evidence synthesis reported in Chapter 3, this qualitative study used the 'best-fit' framework in a qualitative analysis of HCPs working in both public and private LTCFs in

Ireland. Strengths of this study include the chosen methodology and sampling strategy. Qualitative description allowed for a rich description of experiences, understanding an experience, structure or belief from the perspective of participants (366). Purposively sampling HCPs from both private and public LTCFs, in addition to triangulation of opinions from multiple HCPs involved in the immediate care of LTCF patients, offers an in-depth understanding of the barriers and enablers present in different types of LTCFs operating in Ireland. The results provide contextual information to support transferability of the findings. This study mapped barriers and enablers to a TDF-informed deprescribing framework, increasing the utility of the study to inform intervention development (196). Using a deprescribing framework, created to identify barriers and enablers in LTCF, allows incorporation of contextual influences which can moderate behaviour. Such motives may not be captured in a purely TDF-focused deductive analysis (367).

Some limitations of this study exist. The interviewer was a pharmacist who was known to the participants at the time of the interview which may have affected responses, with participants potentially tailoring their opinions to meet anticipated expectations. However, conversations were meaningful and engaging. This also could have introduced professional bias during analysis, as the majority of the research team were pharmacists. LTCFs were asked to introduce the project to their staff, therefore the risk of selection bias cannot be ruled out. Due to COVID-19 restrictions, interviews were conducted via Microsoft Teams. The use of technology may have deterred potential participants from engaging in the research, possibly due to technical issues, planning, privacy and rapport (387). To prioritise potential determinants of behaviour, dominant domains were identified based on frequency and the importance emphasised by participants. Using frequency to prioritise is a potential limitation of this research and it does not also equate to importance.

4.6 Conclusion

HCPs working in Irish LTCFs understand deprescribing; however, it is not routine practice. Deprescribing implementation strategies can build on existing structures, such as the quarterly medication review by incorporating a MDT approach, drawing on the knowledge and experiences of all HCP in a structured, routine manner. A deprescribing algorithm, supported with tailored guidelines and education could support engagement from all HCPs, both during formal medication reviews and for any change in a patient's clinical condition, requiring deprescribing. Furthering knowledge and encouraging engagement for all HCPs can offer the confidence required to make evidence-based deprescribing decisions in LTCF. It is suggested that the environment of the LTCF is an ideal setting for deprescribing, however limited resources in addition to the poor co-ordination with other healthcare settings, confines HCPs from successfully deprescribing. Expanding pharmacists' role to include deprescribing responsibilities may help to overcome time constraints for other HCPs. Patient engagement in the form of shared decision-making is an option to overcome the anticipated negative response from patients and representatives toward deprescribing. HCPs consider it feasible to implement deprescribing in LTCFs, however a deprescribing implementation strategy must be designed to account for the nuanced barriers which exist in both settings.

Chapter 5: Identification of Potentially Inappropriate Medications In Frail Older Adults Residing in Long-Term Care: A Retrospective Chart Review Study.

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5.1 Abstract

5.1.1 Introduction

Deprescribing is associated with positive health outcomes for older adults in LTC, however deprescribing is not universally implemented. The primary aim of this study is to estimate the prevalence of PIMs prescribed to frail older adults in Irish LTCFs, as identified by STOPPFrail v2.

5.1.2 Methods

A retrospective chart review was conducted in two publicly-funded LTCFs in the South-West of Ireland ('Site 1' and 'Site 2'). Eligible participants were those: (i) age ≥65 years, (ii) full-time resident in Site 1 or Site 2, (iii) deemed eligible as per the STOPPFrail v2 criteria by the site's medical officer, and (iv) receiving regular prescribed medication. Data collected included age, gender, drug, dose, frequency, regular/*pro re nata* (PRN) and indication/relevant diagnoses. Rates of polypharmacy (taking ≥ 5 medications) and excessive polypharmacy (taking ≥10 medications) were calculated. STOPPFrail v2 was used to identify PIMs. Descriptive and association statistics were calculated.

5.1.3 Results

Of the 103 patients, 89 were ≥65 years and categorised as frail, so eligible for the study. Of those eligible, 85 (95.5%) had polypharmacy and 57 (64%) experienced excessive polypharmacy. The mean number of regular medications was 10.8 (±3.8), total medications 17.7 (±5) and diagnoses 5.5 (±2.5). The mean number of PIMs per patient was 4.8 (±2.6). Of eligible participants, 59.6% had at least one medicine without a documented indication, while 61.8%, 42.7% and 30.3% had at least one PIM from the following drugs classes vitamin D, antihypertensives and PPIs, respectively. Site 2 had greater use of antipsychotic medications in dementia patients.

5.1.4 Conclusion

Medication and PIM usage was high among LTC patients, with inappropriate polypharmacy of concern. Lack of clear indication for prescribing medications appears to be an issue in LTC, potentially affecting HCPs' engagement with deprescribing.

5.2 Introduction

Globally the population is ageing; the number of adults aged 60 years or more is predicted to reach 2.1 billion by 2050, increasing exponentially from 1 billion in 2019 (1). This is reflected in the Irish population with the number of older adults, aged 65 years or more, expected to double in the same timeframe (9,388,389). The ageing population leads to the increased demand for older adults requiring LTCFs (1,4,8). In Ireland the number of older adult residing in LTCFs rose by 9.4% in 2016, with demand projected to increase by 40-54% from 2015 to 2030 (4,9). Both advancing age and LTC requirement is associated with frailty, with 52% of adults aged 60 years or more residing in LTC classified as frail and 40% classified as pre-frail (22,390). A European study investigating the epidemiology of frailty documented that the prevalence varied from 62.1% - 75.6% for adults aged 65 years or more residing in LTC (391). Various definitions of frailty exist, however it is generally defined as a state where an individual's vulnerability for developing increased dependency and adverse outcomes is increased when exposed to physiological or psychological stressors (392,393). It defines the process where the body's physiological state gradually declines due to age-related degeneration and is characterised by a loss of physical and cognitive abilities (19).

Ageing is considered the greatest risk factor for the development of most chronic diseases. Ageing, and by extension chronic disease, also increase morbidity, health complications and mortality (5,394,395). Increasing age and multimorbidity contribute to the medication burden often seen in older adults, with 32% of European older adults experiencing polypharmacy, the use of five or more medications (31,254). Polypharmacy or excessive polypharmacy, the use of ten or more medications, can be necessary to treat the multiple conditions seen in this cohort, however the association between polypharmacy and frailty must be considered (39–41,396). With the physiological alterations of ageing, some medications may become PIMs as time progresses. This contributes to inappropriate polypharmacy which could be considered a stressor for a frail older adult, as it has negative consequences such as adverse drug reactions, health decline, increased risk of hospitalisation and

mortality in older adults (30,31,86). For frail older adults with limited life expectancy, quality of life and symptom control should be prioritised over disease prevention (343).

In Ireland, there are different types of LTC available. Services are supplied by publicly-employed HSE staff in publicly-funded sites; private-sector agencies who supply approximately 75% of LTC beds; or voluntary facilities, run by charities and religious orders (15,16). In 2012, O'Sullivan and colleagues investigated the prevalence of PIP in publicly-funded Irish LTCFs utilising two tools; the STOPP and Beers' criteria (44,121,127). Results identified that 70.8% of LTC patients had PIP, with 13.7% of medications potentially inappropriate. Since this publication, evidence for deprescribing has exponentially increased, supported by resources such as guidelines and algorithms published by the Bruyère Research Institute to assist HCPs (397). In 2017, STOPPFrail was published, a list of explicit criteria for identifying PIMs in frail older adults, pertinent to the LTC population (33). This was further updated in 2020, producing STOPPFrail version 2 which included a method to identify older adults approaching end of life (34). A randomised control trial conducted in a hospital setting used a STOPPFrail-guided deprescribing plan and identified a mean change of 2.25 medications in the intervention group at three months (159). Considering the health benefits associated with deprescribing for older adults residing in LTC, such as reduced PIMs, falls and all-cause mortality, STOPPFrail offers the additional advantage of being a concise tool for HCPs and having high interrater reliability between different HCPs (159,194,398,399). This suggests that STOPPFrail could be an effective tool to support decision-making and interprofessional collaboration, which have been identified as facilitators for deprescribing in LTC (362).

Within public LTC settings in Ireland, medication is prescribed by the sites medical officer, supplied to the site by a pharmacist and administered by nurses during drug rounds. Medication reviews should be conducted at regular specified intervals by a MDT consisting of the medical officer and nurse, and pharmacist services should also be made available. These reviews are suggested to be conducted every three months (12,400).

PIMs remain an issue in LTC in Ireland (44). Evidence exists reporting determinants of proactive deprescribing for HCPs working in Irish LTCFs (362,401). To assist the design of a strategy targeting determinants of deprescribing behaviour, an additional step is required to identify the most frequent PIM prescribed for frail older adults in LTC to help streamline the design and focus on implementation outcomes.

5.2.1 Aims

The aim of this study is to establish the prevalence of PIMs among frail older adults residing in Irish LTCFs, as identified by STOPPFrail v2. Secondary outcomes include investigating the prevalence of (i) polypharmacy (ii) common diagnoses in this cohort, all based on a retrospective chart review of medications.

5.3 Methods

5.3.1 Study design, setting and participants

This is a retrospective chart review study conducted in two publicly-funded LTCFs. A convenience sample of LTCFs was identified and selected based on location in the South-West region of Ireland and existing professional relationships between the sites' medical officers and the research team. Eligibility criteria for inclusion in the study are as follows: (i) aged ≥65 years, (ii) resident in one of two LTCF study sites (referred to as Site 1 and 2), (iii) deemed eligible as per the STOPPFrail v2 criteria by the site's medical officer, and (iv) receiving regular prescribed medication. STOPPFrail v2 eligible candidates typically meet all the following criteria as defined in the guidance: (i) activities of daily living dependency and/or severe chronic disease and/or terminal illness, (ii) severe irreversible frailty (high risk of acute medical complications and clinical deterioration) and (iii) physician perceives patient to have a limited life expectancy of <12 months (34). Medical officers at each site determined severe irreversible frailty based on their clinical assessment of the patient prior to confirming study eligibility, with reference to Rockwood's Clinical Frailty Scale (CFS) (26).

5.3.2 Data collection

A retrospective chart review was conducted at each LTCF site by the primary researcher (CHH), who is also a pharmacist. LTCF recruitment began in June 2021 and data collection was conducted between November 2021 and January 2022. No follow-up assessment was included. Prescribing data were extracted from patients' drug charts and entered into Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA). Diagnoses were obtained from the clinical history in admission notes, medical notes and psychiatrist assessments without referring to prescribers. The data were collected using a standardised data collection form and included age, gender, drug, dose, frequency, regular/PRN prescribing and indication/relevant diagnoses. For combination pills, the individual drugs and dosages were documented. Short-term medications, consisting of those with an imminent end date, were excluded from the evaluation; for example, a course of antibiotics. Information on nutritional supplements was not collected as this information was not documented in drug charts in Sites 1 and 2.

As this was an observational study as per ethical approval, not all relevant information was available and thus some medicines that may not actually be inappropriate were classified as PIMs. For medications that lacked a documented indication on the admission file, all clinical and nursing notes were reviewed from inception, to help identify an indication. Clinical parameters, including blood pressure (BP), blood lipids or blood glucose (haemoglobin A1C (HbA1C)) measurements were not taken in a standardised manner for patients included in the study by the research team and therefore measurements taken at various points in time prior to the audit could not be included. PPIs and H2 receptor antagonists were only considered PIMs if used at the full therapeutic dose for > 8 weeks. If the drug chart was <8 weeks in duration, an older version was reviewed.

5.3.3 Ethics

This study obtained ethical approval from Cork's Clinical Research Ethics Committee Review Reference Number: ECM 4 (k) 10/8/2021 & ECM 3 (o) 16/11/2021 (Appendix 6).

5.3.4 Data analysis: application of STOPPFrail V2

Data analysis was conducted by the primary researcher using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) and SPSS version 28.0 (IBM Corporation, Armonk, NY, USA). Data were analysed using the STOPPFrail v2 criteria (Table 8 (adapted from Curtin *et al.* (34)) to identify and classify PIMs. From each site, a 20% proportion of anonymous drug charts were independently analysed by another member of the research team (MDD), with any discrepancies discussed and agreed with the entire research team. For drugs that coded to more than one STOPPFrail indicator, the primary code was given to the most clinically relevant criterion, for example, if a drug coded to E1 and A2, E1 was the primary code. Analysis of prevalent PIMs was based on frequency, using the primary STOPPFrail indicator. The overall prevalence of PIMs was calculated as a proportion of all eligible patients. Any medication without a clear primary indication was further analysed to identify which drug classes lack a documented indication.

Descriptive statistics were used to summarise the population; mean and standard deviation (SD) for parametric data and median and interquartile range (IQR) for non-parametric data (Table 9). Association between two groups for scaled data was measured using the T-test for parametric data. Spearman's rho was used to show correlation between the number of PIMs and the number of regular medicines and age. A point prevalence was conducted to establish the prevalence of PIMs. A statistician was consulted to conduct regression analysis. Poisson regression was conducted to see which values could predict PIMs identified in each patient's regular medication list as per STOPPFrail. A probability value of <0.05 was considered significant.

Table 8: STOPPFrail criteria adapted from Curtin *et al.* (34).

Section	STOPPFrail criteria
A1	Patient fails to take medication.
A2	No clear indication for medication.
A3	Any drug for which symptoms now resolved.
B1	Lipid-lowering therapies (statins, ezetimibe, bile acid sequestrants, fibrates, nicotinic acid, lomitapide and acipimox)
B2	Antihypertensives: in patients with a systolic blood pressure (SBP) <130mmHg.

B3	Anti-anginal therapy (specifically nitrates, nicorandil, ranolazine). Reduce and discontinue in patients who have had no reported anginal symptoms in the previous 12 months and who have no evidence of coronary artery disease.
C1	Antiplatelets for primary cardiovascular prevention.
C2	Aspirin for stroke prevention in atrial fibrillation.
D1	Neuroleptic antipsychotics in dementia patient: > 12 weeks medication use and no current clinical features of behavioural and psychiatric symptoms of dementia (BPSD).
D2	Memantine: patients with moderate-severe dementia unless clearly improved BPSD.
E1	Proton pump inhibitors (PPIs): reduce when used at full therapeutic dose ≥8 weeks unless persistent dyspeptic symptoms at lower dose.
E2	H2 Receptor antagonists: reduce when used at full therapeutic dose ≥8 weeks unless persistent dyspeptic symptoms at lower dose.
F1	Theophylline and aminophylline
F2	Leukotriene antagonists in COPD
G1	Calcium supplements - unless proven symptomatic hypocalcaemia.
G2	Vitamin D supplementation (ergocalciferol and colecalciferol).
G3	Anti-resorptive/bone anabolic drugs for osteoporosis (bisphosphonates, strontium, teriparatide, denosumab).
G4	Long-term non-steroidal anti-inflammatory drugs when taken regularly for ≥ 2 months.
G5	Long-term oral corticosteroid when taken regularly for ≥ 2 months.
H1	Drugs for benign prostatic hyperplasia (5-alpha reductase inhibitors and alpha-blockers) in catheterised male patients: No benefit with long-term bladder catheterisation.
H2	Overactive bladder drugs (muscarinic antagonists & mirabegron) unless history of painful detrusor hyperactivity
I1	Anti-diabetic drugs: de-intensify therapy. Avoid HbA1c targets (HbA1C <7.5%) Goal is to minimise symptoms related to hyperglycaemia.
J1	Multivitamin combination supplements when prescribed for prophylaxis rather than treatment for hypovitaminosis).
J2	Folic acid: discontinue when treatment course is complete (usually 1-4 months) unless malabsorption.
J3	Nutritional supplements: unless malnutrition

5.4 Results

Of the 103 residents, 89 met the STOPPFrail eligibility criteria as identified by the site's medical officer. Reasons for exclusion include <65 years old (n=8) and not classified as frail (n=6). Of the total LTC population 86.4% were eligible for inclusion in this study. Demographics of eligible patients are summarised in Table 9.

Table 9: Patient demographics.

Demographics	Site 1 (n=56)	Site 2 (n=33)	Total (n=89)
Age Median (IQR)	84 (76-91)	83 (79-89)	84 (77-90)
Male (number, (%))	24 (42.9)	11 (33.3)	35 (39.3)
Female (number, (%))	32 (57.1)	22 (66.7)	54 (60.7)

Mean number of regular medications (SD)	10.5 (±3.8)	11.2 (±3.7)	10.8 (±3.8)
Mean number of total medications (SD) [a]	17.8 (±5.3)	17.8 (±4.7)	17.7 (±5)
Mean number of regular medicines which are PIMs	5.1 (±2.8)	4.3 (±2.4)	4.8 (±2.7)
Mean number of total medicines which are PIMs [a]	5.2 (±2.9)	4.4 (±2.4)	4.8 (±2.6)
Patients taking at least 1 PIM (number, (%)) [a] Patients taking at least 3 PIMs (number, (%)) [a] Patients taking at least 5 PIMs (number, (%)) [a] Patients taking at least 7 PIMs (number, (%)) [a]			86 (96.6) 75 (84.3) 41 (46.1) 20 (22.5)
% of patients with polypharmacy (n) [b] % of patients with polypharmacy after deprescribing all PIMs (n) [b, c]	94.6 (53) 58.9 (33)	97 (32) 78.8 (26)	95.5 (85) 66.3 (59)
% of patients with excessive polypharmacy (≥10 medicines) [b] % of patients with excessive polypharmacy after deprescribing all PIMs (n) [b, c]	62.5 (35) 7.1 (4)	66.6 (22) 18.2 (6)	64 (57) 11.2 (10)
Mean number of diagnoses (SD)	5 (±2.2)	6.2(±2.7)	5.5 (±2.5)
Common diagnoses (number (% of patients)) Constipation Pain Hypertension Dementia Depression Atrial fibrillation Osteoarthritis Anxiety Type 2 Diabetes Mellites Gastroesophageal reflux disease			 54 (60.7) 49 (55.1) 31 (34.8) 29 (32.6) 25 (28.1) 19 (21.3) 17 (19.1) 16 (18) 15 (16.9) 14 (15.7)

[a] Total medicines = regular + PRN excluding short-term medicines

[b] Calculation based on regular medications.

[c] Calculation based on hypothetical deprescribing, not actual.

SD=standard deviation, IQR=Interquartile range, PIMs=potentially inappropriate medication.

Total medications = regular and PRN medications

5.4.1 Prevalence of PIMs

Of all medications prescribed, 27.3% were classified as potentially inappropriate. Almost all patients had at least one PIM and nearly half were taking at least five PIMs. Excluding patients whose only PIM criteria was 'no clear indication', 93.3% (n=83) of the population had at least one PIM. The prevalence of PIMs used by frail older adults residing in the LTCFs is summarised below (Fig. 8) and in the supplemental material (Appendix 7, 8). A strong significant relationship existed between the number of PIMs and the number of regular medicines prescribed ($\rho = 0.525$, $p<0.01$). Poisson regression analysis identified that for every one unit increase in the number of regular medicines, the number of PIMs increases by 8.1% (Incidence Rate Ratio 1.081, 95% CI 1.055-1.107, $p<0.01$) (Appendix 9).

In both LTCFs, the most common PIM identified was no clear indication (A2), with some patients prescribed multiple medications without an indication (mean = 2.2, SD ±1.3). At least one medication with no clear indication was identified for 60% of patients. Of all regular medicines prescribed, 12% did not have an indication, while only 0.3% of PRN medications lacked indications. Of all PIMs identified, 26.6% received a primary classification of 'no clear indication'. Analysis into this cohort of medication identified that the most common drug class lacking indication were PPIs (n=21), followed by lubricant eye drops (n=11) and vitamins and probiotics (n=10).

Antihypertensives were the second most common PIM. Antihypertensives was the largest drug class potentially inappropriately prescribed to 42.5% of the cohort and accounted for 13.9% of all PIMs, with some patients taking multiple antihypertensives (mean = 1.6, SD ±0.9). The antihypertensives prescribed in this setting included angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, dihydropyridine calcium channel blockers, loop diuretics and adrenoceptor antagonists (beta-blockers). The number of regular PIMs prescribed was significantly associated with a hypertension diagnosis ($t = 2.87$, $p < 0.01$).

Vitamin D supplementation with ergocalciferol/colecalciferol (G2) was the third most common STOPPFrail criterion overall and the most common individual drug prescribed, identified in the largest number of patients (61.8%).

Both sites had similar rates of each STOPPFrail PIM, apart from three criteria: antipsychotics (D1), memantine (D2) and PPIs (E1). For these STOPPFrail PIM criteria, a trend emerged where Site 2, the smaller LTCF, provided a larger contribution to the total figures (Fig. 8).

Considering the mean number of medications and PIMs identified in both sites, full implementation of STOPPFrail could result in a 44% reduction in regular medications and a 27% reduction in total medications consumed by this cohort.

5.4.2 Prevalence of Polypharmacy

Polypharmacy was prevalent in Irish LTCF with almost all patients exposed (95.5%). The mean number of regular medications in both sites was 10.8 (SD ±3.8), indicating excessive polypharmacy, which was identified in 64% of patients. The number of regular PIMs was significantly associated with polypharmacy and excessive polypharmacy ($t = 2.487$, $p < 0.016$, $t = 2.681$, $p < 0.01$). A weak significant negative relationship existed between age and total number of medicines ($\rho = -0.218$, $p < 0.05$), with the number of PIMs decreasing past approximately 90 years (Appendix 10). Full implementation of deprescribing STOPPFrail identified PIMs has the potential to reduce polypharmacy by under 30% and excessive polypharmacy by over 52%.

5.4.3 Common diagnoses

From both sites, 64 individual clinical conditions were documented, with each patient having a mean of five different co-morbidities. Over 60% of all patients experienced constipation, and over half of all older adults residing at the LTCFs had ongoing pain, which was differentiated from osteoarthritic pain. Hypertension was the third most common clinical diagnosis in this patient cohort. A dementia diagnosis was documented in 29 patients, 25 (86.2%) of whom were taking memantine or neuroleptic antipsychotics.

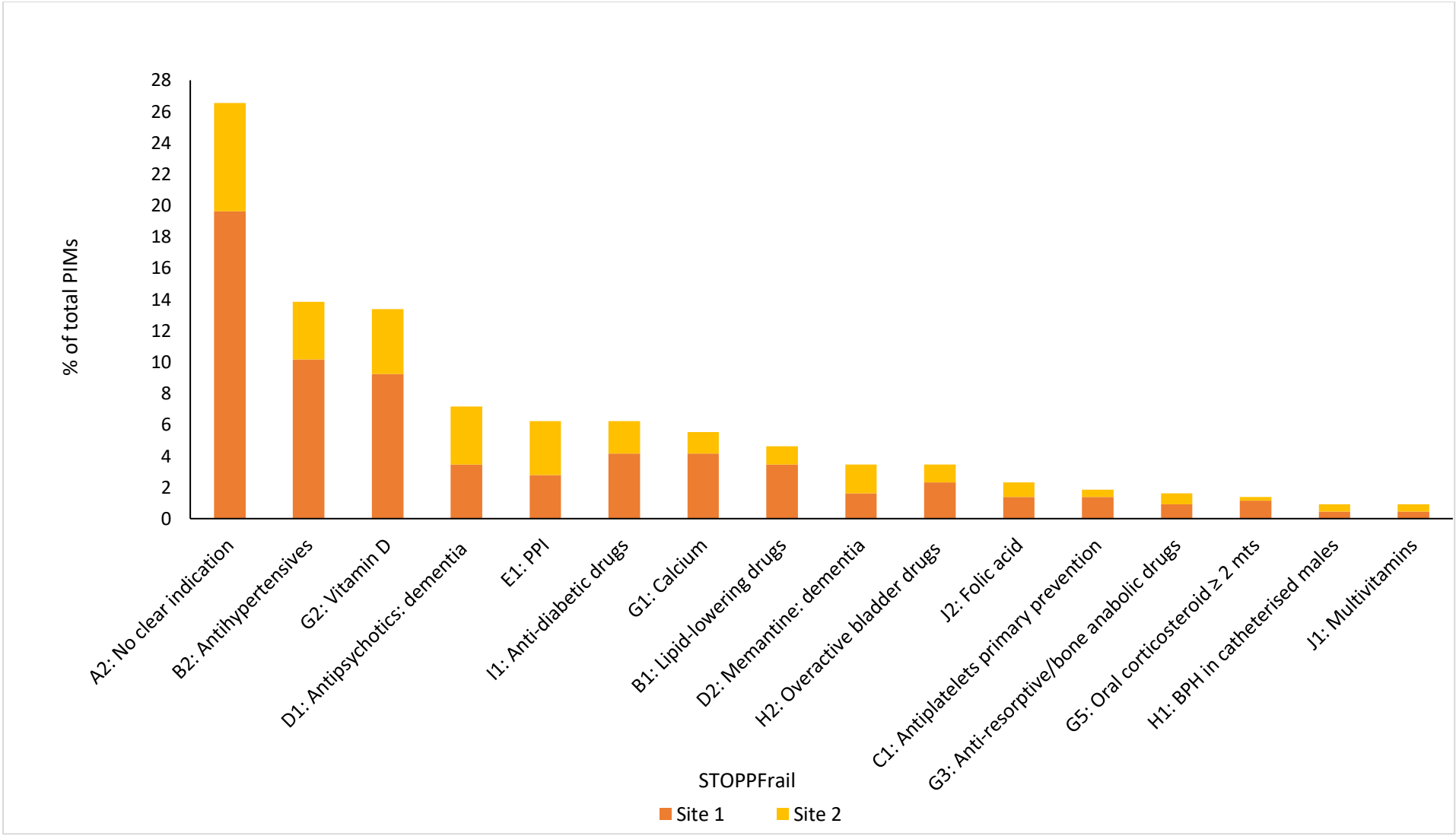


Fig. 8. Percentage of total PIMs identified using STOPPFrail criteria, broken down by site.

5.5 Discussion

To the best of our knowledge, this is the first study to investigate PIM usage among frail older adults residing in Irish LTCFs using STOPPFrail v2. In this study, almost all patients were prescribed at least one PIM, with the dominant PIM criterion being medications prescribed with 'no clear indication', followed by antihypertensives and vitamin D, while slight variation existed between sites regarding antipsychotic and memantine use in dementia patients. Patients residing in the included LTCFs experienced multimorbidity, contributing to the need for polypharmacy.

Considering the relationship between number of prescribed medicines and the prevalence of PIMs, future deprescribing strategies could include a screening process to identify patients with polypharmacy or excessive polypharmacy and help prioritise patients for a deprescribing review.

Previous studies investigating PIM rates in Irish LTCFs have used STOPP/START to identify PIP (121). O'Sullivan *et al.* identified 70.8% of patients experienced PIP, with PIM rates of 13.7% (44). Similarly, Ryan *et al.* documented PIP rates of 59.8% with 12.9% of medicines potentially inappropriate (56). The Belgian COME-ON study using STOPPFrail v1 identified 64.1% of patients residing in LTC were prescribed PIMs, accounting for 13.6% of overall medications prescribed (182). Another Belgian study using STOPPFrail v1 found that 89% of patients were prescribed at least one PIM, reporting results similar to this current study (402). A Korean study identified the prevalence of PIMs to be 81.9% using Beers criteria (61). Using STOPPFrail v2, this study identified PIM rates to be much higher at 96.6%, with PIM rates slightly declining with age, particularly past 90 years. This could suggest that prescribing patterns align with age rather than a patient's condition, supporting research that suggests Irish prescribing patterns are not reflective of the changing clinical condition and treatment priorities when a patient is approaching end of life (403).

The prevalence of polypharmacy among frail older adults residing in LTCF was high. Over half of patients experienced excessive polypharmacy, aligning with the higher results (8.8-56.7%) reported from an international study of LTCFs from eight different countries (255). A systematic review

investigating the prevalence of polypharmacy in LTCFs identified that between 38-91% of patients residing at the facility experience polypharmacy, with 10-65% experiencing excessive polypharmacy (53). This was not a meta-analysis, however findings from our study are similar to the upper limits identified in the systematic review. Nearly all patients with polypharmacy were also taking at least one PIM, suggesting inappropriate polypharmacy. This remains an important distinction as the opinion of polypharmacy in the literature has changed. It has shown to not always be harmful, rather inappropriate polypharmacy is of concern (353). Full implementation of deprescribing STOPPFrail identified PIMs has the potential to reduce polypharmacy and excessive polypharmacy however, caution must be given when interpreting such results as deprescribing PIMs requires personalisation and it may not be safe, feasible or appropriate to do so in all instances.

This study showed the lack of indication documentation for regularly prescribed medications in LTC. This gap has also been highlighted both internationally and nationally, in studies conducted in both LTC and the hospital setting (34,77,404). To support deprescribing, clear indication documentation is important, to understand the appropriateness of drug therapy within the context of the patient's clinical condition(s) (405). This lack of clinical information available for the wider MDT has the potential to limit deprescribing efforts during medication reviews. Having access to clinical information was identified as a facilitator for pharmacists to engage efficiently with medication reviews in LTC (319). Given a lack of clinical patient information is considered a barrier to deprescribing, documenting indications could help GPs and pharmacists identify deprescribing targets as consideration should be given to incorporating a dedicated section for documenting indication for each medication into the 'regular' prescribing chart and standardising this across LTCFs (377). A designated space to document indication was only present in the PRN medication section in both sites. The 'indication' element of the PRN prescribing chart was complete in most cases, and these medications did not majorly contribute to the prevalence of PIMs.

Antihypertensives can be considered potentially inappropriate when used in frail older adults with a systolic blood pressure (SBP) of <130mmHg (34). Findings from a systematic review demonstrated that for people with frailty, there was no mortality difference associated with SBP < 140 mmHg versus SBP > 140 mmHg (406). Antihypertensives are associated with an increased risk of adverse drug events including hospitalisation, falls, hypotension, syncope, acute kidney injury and electrolyte disturbances. For older adults with moderate to severe frailty, the intended treatment benefit of antihypertensives was similar to the risk of experiencing an adverse event, such as a stroke or heart attack (407). During this study, all antihypertensives were flagged as potentially inappropriate as SBP was not measured, therefore the results reported are reflective of all possible PIMs in this drug class and may overestimate the rate of this PIM. The same is true for antidiabetic drugs, as HbA1C levels were not measured. With this limitation in mind, antihypertensives were the largest drug class identified as potentially inappropriate. The rate of antihypertensive prescribing was similar to the international literature (184). A study reviewing PIP in older adults with hypertension identified that over half of all hypertensive patients had at least one potentially inappropriate antihypertensive treatment (408). Further research is required to confirm the appropriateness of prescribed antihypertensives in the frail older adult population. Evidence to support the safe deprescribing of antihypertensives exists, with Gulla *et al.* conducting a multicentred, cluster-RCT that achieved a 32% reduction in antihypertensive prescribing for patients residing in LTC, with no effect on SBP at nine months (184). Similarly, a Cochrane review reported that there is no evidence that deprescribing antihypertensives used for hypertension or primary prevention of cardiovascular disease in older adults affects all-cause mortality and myocardial infarction (409). Considering the evidence, a potential strategy for future studies could include incorporating a routine BP assessment into the three-monthly medication review. This could help identify patients with SBP measurements which suggest a revision of antihypertensive therapy may be required, similar to the study by Gulla and colleagues (184).

Vitamin D was the PIM prescribed to the greatest number of patients. While research has shown positive outcomes from level-correction in particular patient cohorts (410), there is a lack of clear

evidence to support its use to prevent falls, fractures, cardiovascular events or cancers in frail older adults (34). In this population, treatment priority remains on quality of life and symptom control (77), and HCPs should focus on reducing unnecessary medication burden. Considering its widespread use in Irish LTCFs, future studies should trial deprescribing vitamin D, documenting the clinical outcomes in this patient cohort with limited life expectancy.

Levels of antipsychotic prescribing in patients with a diagnosis of dementia was higher than previous studies (404). Discontinuing inappropriate antipsychotics and memantine prescribed to those without an appropriate indication, evidence of continued benefit or where dementia has progressed to end-stage can potentially relieve patients of the associated adverse effects, improving quality of life and reducing medication burden (411). Comparing levels of antipsychotic and memantine prescribing between the sites, Site 1 had a Specialist Care Unit for people living with dementia, where Site 2 did not. These units are designed to cater for a smaller number of residents and employ staff with additional specialised training in dementia care to help residents feel safe and manage potentially challenging behaviours. These units focus on psychosocial stimulation and meaningful activities to improve quality of life (412). This may account for the lower level of antipsychotics identified in Site 1, as an appropriate environment is a documented facilitator for antipsychotic deprescribing (317). A Cochrane review concluded that antipsychotics could be safely deprescribed for older people with dementia, however, for people with more severe neuropsychiatric symptoms at baseline, such as psychosis, aggression or agitation who responded well to long-term use of antipsychotics, withdrawal might not be recommended (413). Detailed documentation of a dementia diagnosis and the severity of symptoms could help to identify patients who could benefit from deprescribing. Internationally, implementing guidelines, supported by education and mobilisation strategies, has proven to effectively facilitate antipsychotic deprescribing in LTC (414). Therefore, consideration should be given to the appropriate implementation strategy when designing an antipsychotic deprescribing intervention for the Irish LTC context. This could help to overcome the barriers of insufficient

deprescribing knowledge and HCPs' negative beliefs about their capabilities, both barriers to deprescribing as identified in a systematic review in LTCF (362).

5.5.1 Strengths and limitations

This research took into consideration the important methodological features of retrospective chart review studies as identified by Matt and Matthew (415). The initial frailty assessment was conducted by medical officers at each LTCF who have an in-depth knowledge and accurate assessment of patients' clinical condition to determine eligibility. A proportion of the STOPPFrail assessment was carried out independently by two researchers to ensure accuracy of PIM identification. This study was conducted in two publicly-funded sites with different medical officers increasing the generalisability of the findings.

As this study was only conducted in publicly-funded LTCFs, these findings may not be true of private LTCFs which have different organisational structures which is a limitation of the study. Another limitation is the potential for selection bias, as recruitment was based on LTCFs with which the researcher had an existing professional relationship. However, the researcher did not have an in-depth knowledge of medications prescribed and the medical officers played no role in data collection or analysis, therefore this should not have affected the study's integrity. Lack of full information on indications and clinical measurements such as BP was a limitation of this study. Many drugs were marked as PIMs due to lack of data on clinical measurements, for example, antihypertensives marked as a PIM due to lack of information collected on BP measurements due to the observational nature of this study. This poses a risk of overestimating the level of potentially inappropriately prescribed antihypertensives. This gives an indication of the types of measurements a MDT may need to consider getting, to perform a full medication review and assess the appropriateness of medications in a frail older population.

5.6 Conclusion

Medication and PIM usage is extensive among LTC patients. The prevalence of polypharmacy and excessive polypharmacy remains high, with inappropriate polypharmacy of concern. Lack of clear

indication for prescribing medications is a considerable issue in LTC, potentially affecting HCPs' engagement with deprescribing. Adding an indication element to drug charts would offer clarity regarding the prescribing rationale and could help to identify targets for deprescribing. 'Antihypertensives' was the most common drug class prescribed, which could be potentially inappropriate depending on the individual resident's SBP. Incorporating a BP assessment to check if measurements and drug therapy are in line with the appropriate international guidelines as part of the three-monthly medication review process, could be an option to promote antihypertensive deprescribing. Similar strategies could be adopted for antidiabetic drugs. Implementation strategies to support deprescribing could also include adding prompts and deprescribing guidelines for specific drug classes to encourage HCP engagement.

Chapter 6: Multidisciplinary DEprescribing Review for Frail oldER Adults in Long-term care (DEFERAL): Implementation strategy design using behaviour science tools and stakeholder engagement.

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6.1 Abstract

6.1.1 Introduction

Deprescribing has been identified as a safe, effective and appropriate practice to reduce potentially inappropriate medications prescribed to older adults. Limited evidence exists on the development of implementation strategies to support HCPs deprescribing for frail older adults residing in LTC.

6.1.2 Aim

To design an implementation strategy, informed by theory, behavioural science and consensus from HCPs, which facilitates deprescribing in LTC.

6.1.3 Methods

This study was conducted from January to October 2022. The study consisted of three phases. First, barriers and enablers to deprescribing in LTC were mapped to BCTs using the BCW and two published BCT taxonomies. Second, a Delphi survey of purposively sampled HCPs (GPs, pharmacists, nurses, geriatricians and psychiatrists of old age) was conducted to select the BCTs considered to be feasible to support deprescribing in the LTC setting. HCPs were divided into two groups: HCPs working in Ireland and internationally. HCPs were identified from existing professional relationships, their engagement with LTC or deprescribing research. The Delphi consisted of two rounds. Using Delphi results and literature on BCTs used in effective deprescribing interventions, BCTs which could form an implementation strategy in LTC were shortlisted by the research team based on acceptability, practicability, effectiveness. Finally, a roundtable discussion was held with a purposeful, convenience sample of GPs, pharmacists and nurses working in public LTC settings in Ireland to prioritise barriers/enablers influencing deprescribing and tailor the proposed strategies for LTC.

6.1.4 Results

Barriers/enablers to deprescribing in LTC were mapped to 34 BCTs. The Delphi survey was completed by 16 participants. Participants reached consensus that 26 BCTs were feasible for LTC. Following the research team assessment, 21 BCTs were included in the roundtable. The roundtable discussion identified that lack of resources (time, staff, technology), was the primary barrier to address. The

agreed implementation strategy addressed the predominant barrier of lack of resources, in addition to HCPs' lack of practical deprescribing knowledge and perceptions of an 'established hierarchy' and included deprescribing enablers including education and face-to-face meetings. The agreed implementation strategy incorporated eleven BCTs and consisted of an education-enhanced 3-monthly MDT deprescribing review, led by a nurse, conducted at the LTC site.

6.1.5 Conclusion

This study describes an implementation strategy design process following principles of behavioural and implementation science. The deprescribing strategy incorporates HCPs' experiential understanding of the nuances of LTC and thus addresses systemic barriers to deprescribing in this context. The strategy designed addresses five determinant of behaviour to best support HCPs engaging with deprescribing.

6.2 Introduction

The physiological changes associated with ageing can increase the risk of experiencing an adverse event from a medication, which was once indicated and appropriate (30–32). Older adults residing in LTCFs are at a higher risk of being prescribed PIMs , as they are often exposed to greater levels of polypharmacy than those who reside in the community and commonly have a greater degree of frailty (44,416,417). This concern is emphasised by the high levels of inappropriate prescribing identified for frail older adults in LTCFs (357,418). Deprescribing, the systematic process of stopping inappropriate medicines, dose reduction or switching to safer alternatives, has been identified as a safe, effective and appropriate practice to reduce potentially inappropriate medications prescribed to older adults (149,260,419,420). To mitigate high potentially inappropriate medication levels, research is required to explore how to increase HCPs' engagement with deprescribing and implement deprescribing into routine practice in LTC.

Behavioural theory has been used to design successful interventions in other areas of healthcare (421). Incorporating behavioural theory offers an understanding of the structural and psychological processes which are perceived to regulate behaviour and the key mechanisms by which change is believed to occur (211,422). Deprescribing research is beginning to incorporate behavioural theory into strategy design (223,423,424), however evidence of effectiveness of these processes is not yet published. To date, behavioural theory has not been incorporated into deprescribing research for frail older adults residing in LTC in Europe. The TDF, a synthesis of behavioural change theories, has been used to summarise and investigate deprescribing barriers and enablers in LTCFs (239,362,401). This research utilised the BCW to provide guidance for applying behavioural theory to design an implementation strategy for deprescribing, building on its previous utility in developing complex interventions (211,240). The BCW identifies intervention types likely to support the desired behaviour, which map to BCTs, the strategies used to support behaviour change and implementation (248). The BCW was chosen to structure the strategy design based on its relationship with the TDF and history of application in health behaviour change and the design of deprescribing interventions (239,425).

In addition to being described in behavioural terms (179), deprescribing is an evidence-based clinical intervention. The approach to support the translation of this intervention into routine practice is defined as the implementation strategy (140). Implementation science describes the study of methods to encourage the uptake of evidence-based interventions into routine practice to improve the standards of healthcare services (213). Implementation strategies describe the techniques used to enhance the adoption, implementation, and sustainability of evidence-based clinical interventions (225). As identified by Sawan and colleagues, in LTCFs there are a unique set of barriers which influence deprescribing. These include organisational constraints, negative social influences or perceptions and limited supportive resources (202,426). To support deprescribing in LTCFs an approach may be required which addresses key determinants of behaviour in different clinical settings (202). Designing an implementation strategy is considered a complex process, with multiple components involved. The MRC developed a framework to support researchers in the phased development and evaluation of such strategies. The framework encompasses four key, non-sequential phases: intervention development/identification, feasibility, evaluation and implementation. Six core elements are associated with each phase and should be used to guide the research progression. Core elements which influenced the design phase included consideration of contextual factors, identifying key uncertainties and involving stakeholders (233). Using such frameworks has shown to enhance adherence to the designed strategy and support end-user adoption (233,427).

Deprescribing trials have been associated with positive health outcomes for LTC patients, however, limited evidence exists for frail older adults, despite deprescribing being suggested to significantly improve health outcomes (194). A systematic review of deprescribing for older adults in LTC identified one study focusing on frailty (100). The trial consisted of an individualised medicine review followed by planned deprescribing, without consideration of the nuanced barriers/enablers of LTC or opinions of HCPs (158). This study did not report developmental decisions, apply theory, or show evidence of implementation outcomes such as acceptability, appropriateness or sustainability of the strategy (428). Existing deprescribing studies have not been developed systematically, incorporate theory,

detail implementation strategies and/or consider stakeholders and influential contextual factors associated with the LTCF. This limits the ability to replicate or refine the implementation strategy (429), requiring further research with an increased focus on development and design processes (430). Studies which attempt to change behaviour often lack theory, therefore despite the complex nature, limits their sustainability beyond efficacy trials (205,431,432). Using theory from behavioural and implementation science can help to address determinants of HCP behaviour (20,100,433). Placing a focus on feasibility, the extent to which an intervention can be delivered as intended within a given setting (428), will help to select practical strategies which will be likely to support the target behaviour.

6.2.1 Aims and objectives

The aim was to design an implementation strategy to facilitate HCPs' engagement with deprescribing for frail older adults in LTC. The objectives were to:

(i) Map dominant TDF domains arising from deprescribing barriers/enablers to BCTs.

(ii) Identify feasible BCTs to form an implementation strategy to support deprescribing practices in LTCFs.

(iii) Identify the greatest perceived barrier(s)/enablers(s) to deprescribing in the LTC context and select and tailor feasible BCTs to form implementation strategy for a deprescribing intervention.

6.3 Methods

6.3.1 Design

A phased, systematic approach to designing an implementation strategy to increase the deprescribing in LTC was taken, informed by the MRC framework by engaging stakeholders, considering context and key uncertainties in all phases (Fig. 9). This research followed the development/identification phase of the MRC framework (233).

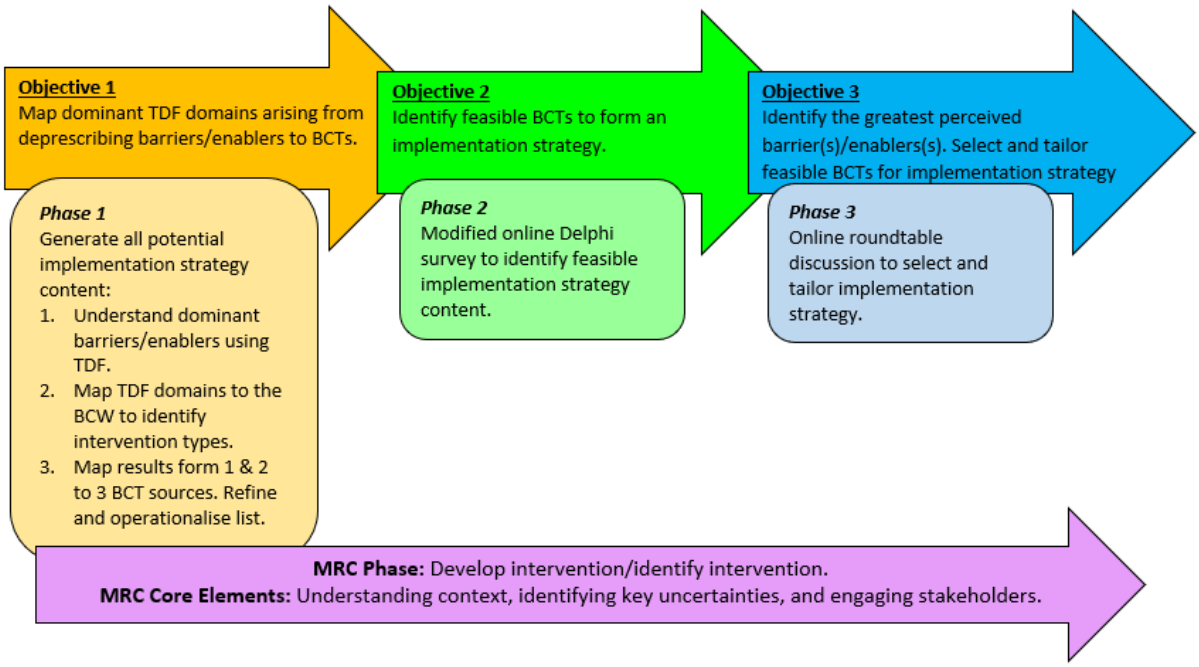


Fig. 9. Phased systematic approach to achieve research objectives (233).

6.3.2 Phase 1: generate potential implementation strategy content

The first objective was addressed in Phase 1. Michie *et al.'s* guide to applying theory for intervention design informed stages 1-3 (Fig. 10) (248).

6.3.2.1 Stage 1: understanding the behaviour

TDF domains arising from deprescribing barriers and enablers identified in a prior qualitative descriptive interview study reported in Chapter 4 were used to inform the behavioural analysis. The five dominant TDF domains were: 'knowledge', 'social/professional role and identity', 'beliefs about capabilities', 'environmental context and resources' and 'social influences' (401).

6.3.2.2 Stage 2: identify intervention options

The five domains identified in stage 1 were mapped to intervention types of the BCW (e.g. TDF domain of knowledge mapped to the intervention type education), to identify potential implementation strategies to support deprescribing (248).

6.3.2.3 Stage 3: identify content and implementation options

The mapping process to identify implementation strategy content was threefold to ensure comprehensiveness in designing the strategy. First, the intervention types from stage 2 were mapped

to corresponding BCTs using the BCT Taxonomy version 1 (BCTTv1) (producing 'BCT source 1' list) (248,249). Second, we mapped the five dominant TDF domains from stage 1 to the BCTTv1 using the mapping tool created by Cane and colleagues ('BCT source 2') (251). As identified by Walsh and colleagues, the mapping tool created by Cane *et al.* does not map BCTs to every TDF domain, hence the process was repeated using Michie *et al.'s* matrix ('BCT source 3') (434). The latter matrix was created prior to the BCTTv1, therefore some BCTs identified from Michie *et al.'s* matrix were mapped to the nearest equivalent from the BCTTv1. This mapping process was conducted by the primary researcher (CHH) and discussed and agreed by the entire research team (Fig. 10).

Duplicate BCTs were removed from the amalgamated list of BCTs from all three sources, with the number of duplications documented. This list was reviewed independently by both the primary researcher (CHH) and the research team, to ensure all BCTs could be operationalised within a deprescribing implementation strategy. BCTs which were not suitable for deprescribing were eliminated, with the reason for exclusion documented (Fig. 11).

The refined list of BCTs were operationalised for the Delphi consensus exercise, offering an example of what this BCT would look like in an implementation strategy to support a deprescribing intervention in LTC. Where relevant, the operationalisation of BCTs was focused to consider deprescribing the largest potentially inappropriately prescribed drug class for the patient cohort, antihypertensives, as identified in Chapter 5 (418).

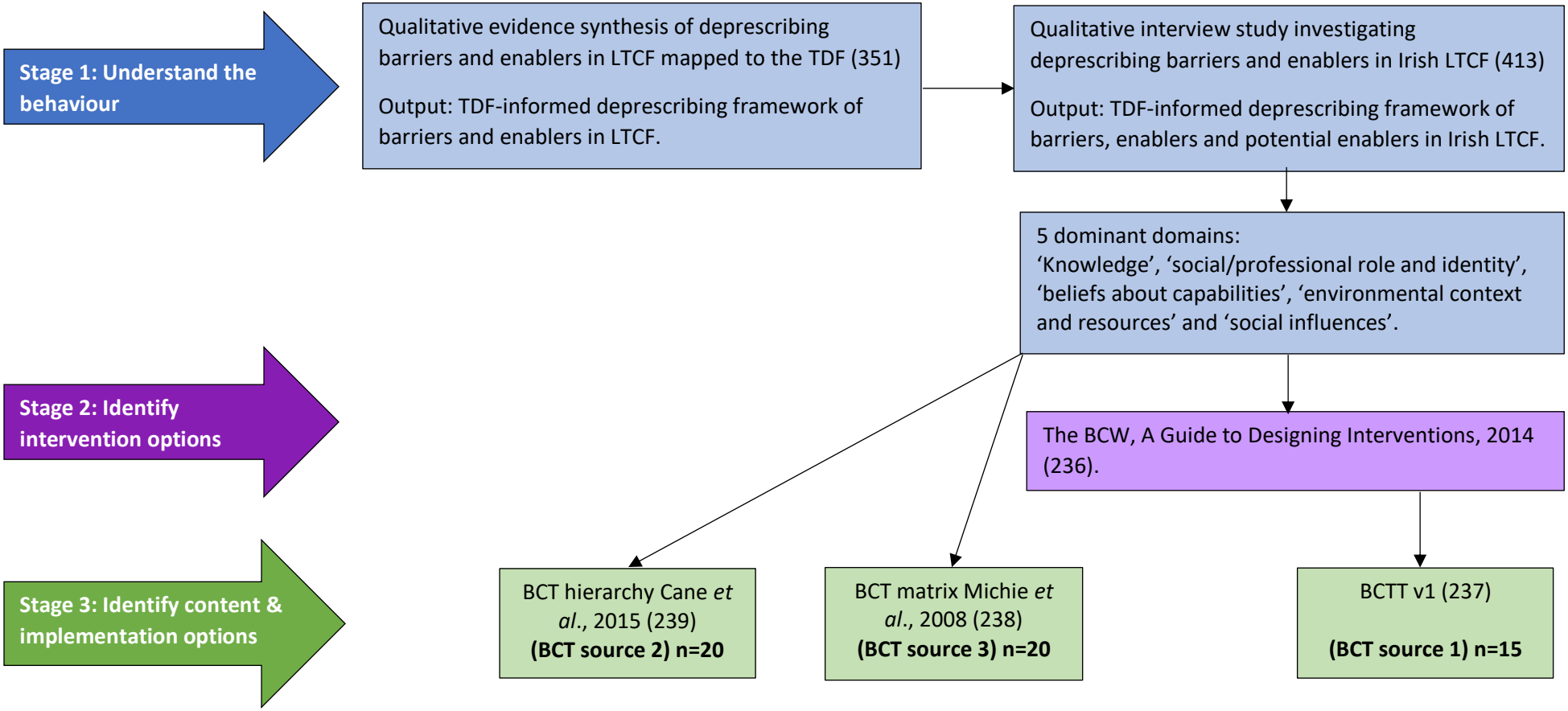


Fig. 10. Systematic process of implementation strategy design utilising the BCW approach and BCT Taxonomies (Phase 1).

6.3.3 Phase 2: Delphi survey to identify feasible implementation strategy content

6.3.3.1 Study design

Similar to research by Walsh *et al.* (434), an online modified Delphi survey was used to select feasible BCTs to include in a deprescribing implementation strategy (435). The Delphi technique allowed HCPs to select BCTs which they felt were feasible, from personal experience and created the opportunity to share qualitative information between rounds. The Delphi method followed Recommendations for the Conducting and REporting of DElphi Studies (CREDES) (Appendix 11) (436).

6.3.3.2 Ethics and consent

Ethical approval was granted for the Delphi survey and roundtable discussion from Cork's Social Research Ethics Committee Log 2022-044. Each participant provided informed consent.

6.3.3.3 Participants

Participants eligible for inclusion in the Delphi survey were purposively sampled from the following healthcare professions; GPs, pharmacists, nurses, geriatricians and psychiatrists of old age, as these HCPs are considered the end-users of the strategy. This sample included two groups to ensure different contexts were considered; HCPs working with public or private LTCFs in Ireland and international HCPs working with older adults residing in LTC. HCPs were identified from existing professional relationships, from their engagement with LTC or deprescribing research. HCPs from both public and private organisational structures were included to generate a list of BCTs considered feasible in any Irish LTCF. Secondly, international experts who were HCPs with knowledge and experience of deprescribing for frail older adults residing in LTC were invited (437). International representatives were contacted based on their engagement with deprescribing research and publications in peer-reviewed journals. Patients/representatives were not included in the Delphi as the research team wanted to understand which BCTs would be considered feasible, from HCPs who have both a clinical and organisational understanding of deprescribing for older adults residing in LTCFs. Participants were initially approached via email using publicly available information to introduce the study. Five Irish universities who offer postgraduate education in gerontological nursing were contacted to introduce the study to any interested students. This strategy was included to recruit

practising nurses pursuing additional geriatric training, who may be currently working with this cohort in LTC. Snowball sampling was used as panellists were encouraged to identify other HCPs who they believe would fit the eligibility criteria. Efforts were made to ensure a balance of HCPs was achieved, to have an equal number of panellists from different professions.

Most Delphi studies include a low double-digit number of experts (438). This project aimed to achieve a minimum of 10 expert panellists, with a minimum of two GPs, pharmacists, nurses and geriatricians. Demographic information recorded from each panellist included: name and email (only known by the primary researcher to allow for follow-up across rounds), professional role, healthcare setting, age group, years of work experience and years of experience working with LTC patients. Table 10 specifies how many of each group of participants were contacted.

Table 10: Healthcare professional recruitment for Delphi survey.

Healthcare Profession	Number invited
General practitioners	6
Geriatricians	8
Nurse	7
Pharmacists	8
Psychiatrists of old age	6

6.3.3.4 Materials: survey

The survey consisted of a list of operationalised BCTs, that is, a description of what the BCT could look like in practice. For example, BCT 4.1 'instruction on how to perform a behaviour', the example provided was 'HCP follow a step-by-step guideline/procedure on how to deprescribe a specific medicine'. The operationalised examples focused on deprescribing antihypertensives when relevant and appropriate, as published research from Chapter 5 identified that this was the largest drug class potentially inappropriately prescribed to the population of interest (418). Participants were provided with a 5-point Likert scale (1 being not at all feasible and 5 being extremely feasible), to indicate their perception of the feasibility of incorporating the BCT into a deprescribing implementation strategy from their experience of LTC. Panellists had the option to add comments at the end of each BCT

section. A definition of feasibility was not provided; this was left to participants' interpretation (Appendix 12).

6.3.3.5 Data collection

The survey was designed in Microsoft Forms (Microsoft Corporation, Redmond, WA, USA), reviewed by the research team and piloted by MDD, a pharmacist, prior to dissemination to check for errors, comprehension and establish face validity. The link to the survey was emailed individually to each participant.

The Delphi method consisted of two rounds; only panellists who completed Round 1 were invited to participate in Round 2. Each panellist had three weeks to complete each round upon receipt of email containing the Microsoft Forms link. For Round 1, reminders were sent to those who had not completed the survey two weeks after the initial email and again the day before the deadline. For Round 2, a reminder email was sent to those who had not completed the survey the day before the deadline.

6.3.3.6 Data analysis

Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) was used to quantitatively analyse the data. Feasibility percentage scores of each BCT were generated from the Likert data by assigning a score to each descriptor on the Likert scale (not at all feasible had a score of 1 and extremely feasible was assigned a score of 5). Definitions of consensus in Delphi studies vary widely in the literature (439); for this research, consensus was defined as statements with more than 70% agreement on feasibility (sum of extremely feasible, very feasible and feasible) and less than 15% disagreement (not at all feasible) similar to previous research using Delphi consensus in LTC (434,438). BCTs which did not reach the 70% threshold were included in Round 2. Qualitative feedback was analysed using thematic analysis to identify themes (Appendix 13) (303).

In Round 2, panellists received a summary of feedback on Round 1 results for each of the BCTs which were included in Round 2. This included their individual feasibility score and the overall group mean and median feasibility score, in addition to any relevant qualitative feedback. Analysis of Round 2 was conducted as described for Round 1. For BCTs which did not reach feasibility consensus after two rounds, statistical analysis using the Wilcoxon signed rank test was conducted to assess the stability of answers between rounds 1 and 2. This was used to determine the 'point of diminishing return', the point at which the answers between rounds are not statistically different, therefore an additional round is not useful (437).

Following the Delphi survey, the BCTs deemed feasible were further reviewed by the research team using the acceptability, practicability, effectiveness, affordability, safety and equity (APEASE) criteria to determine if they should be included in the roundtable discussion (248) (Appendix 14). This was conducted by the research team to mitigate against participant fatigue and attrition by overburdening participants with various scoring criteria during the Delphi process. BCTs needed to be considered acceptable, practical and effective to be included. These criteria were considered most important by the research team to develop a successful, sustainable implementation strategy and included as a screening criterion at this phase of the design process. The operationalised examples of BCTs were tailored following the qualitative Delphi feedback, to develop a proposed implementation strategy, or combination of strategies, to address each barrier/enabler. The description of each strategy was reviewed and agreed by the entire research team.

6.3.4 Phase 3: roundtable discussion to agree on implementation strategy content

6.3.4.1 Study design

A 2-hour online roundtable discussion was scheduled with HCPs (GPs, pharmacists and nurses) directly involved in the care of public LTCF patients in Ireland. The consolidated criteria for reporting qualitative research (COREQ-32) statement was used to inform reporting of the findings (Appendix 15).

6.3.4.2 Ethics and consent

Ethical approval was granted for the Delphi survey and roundtable discussion from Cork's Social Research Ethics Committee Log 2022-044. Each participant provided informed consent.

6.3.4.3 Participants

A purposeful, convenience sampling strategy was used to select participants for the roundtable discussion (440). Eligible participants included GPs, pharmacists and nurses working in different public LTCFs in Ireland, to ensure the acceptability of the planned implementation strategy to support deprescribing. The study aimed to recruit at least two members of each stakeholder group. HCPs were identified via personal and professional contacts and contacted directly via email. Public LTCFs were selected due to their uniform systems and organisational structure, limiting the variable and additional barriers which exist in private Irish LTCFs (401). Four nurses, four pharmacists and three medical officers (GPs who are responsible for the care of residents at public LTCFs) were invited to be panellists for the roundtable discussion.

6.3.4.4 Materials: strategy summary and worksheet.

A worksheet summarising the deprescribing implementation strategies to address each determinant of behaviour was created by the research team (Appendix 16). This summarised the barriers and enablers to deprescribing in LTC, and how the proposed strategies aligned with those factors. The worksheet was distributed to all participants prior to the meeting. The worksheet asked participants to reflect on how the proposed strategy would look in their setting. The purpose of the pre-meeting worksheet was to allow participants time to become familiar with the proposed strategies prior to the roundtable.

6.3.4.5 Data collection

This meeting was conducted online and recorded using Microsoft Teams (Microsoft Corporation, Redmond, WA, USA) to include stakeholders from various locations. The research team was split into facilitators and managers. The discussion was facilitated by two individuals: the primary researcher (CHH), a pharmacist, and an implementation scientist (GC) with expertise in pharmacy practice. The primary researcher was known to some, but not all, participants. The second facilitator was unknown

to all participants. The facilitators' role was to ensure all possible strategies were discussed, clarifying reasons for inclusion/exclusion of BCTs from the final implementation strategy. Two additional researchers (MDD and SMcC) managed the operations of the meeting (timing, recording, admitting participants) but were not involved in the discussion. The discussion opened with a summary of the deprescribing barriers and enablers identified in LTC, to ensure participants also identified these as being relevant to their setting (362,401). Participants were asked to individually rank these according to the importance they placed on them as barriers to or enablers of deprescribing in their practice using the audience-response system Mentimeter (https://www.mentimeter.com/), with anonymous answers being collated, agreed and discussed as a group. Each barrier/enabler was associated with a selection of BCTs. Once the group agreed on the most important barrier/enabler to address to facilitate deprescribing in LTC, participants reviewed the associated operationalised examples of feasible BCTs. The group were asked to discuss how the proposed strategy would work in the LTC environment. In this way, the strategy was tailored to the LTC context.

Towards the end of discussions, HCPs were asked to focus on which strategy/strategies they felt had the best potential for successfully increasing deprescribing engagement, if moving forward to a pilot stage in a LTCF, addressing the most important barrier/enabler agreed, and to identify any additional barrier(s)/enabler(s) which the final strategy was associated with.

6.3.4.6 Data analysis

The meeting was transcribed verbatim and pseudonymised prior to analysis. Data analysis was deductive following a summative content analysis method, looking at the frequency with which participants mentioned specific strategies and the explicit importance they verbally placed on such strategies or groups of operationalised BCTs (441). A hypothesised mechanism of action for each proposed strategy was created by the primary researcher (CHH) and reviewed by the entire research team. This process aligns with the core element of developing programme theory from the MRC

guidance and was informed by the roundtable discussion, as participants explained why they believed certain strategies would work in LTC during the tailoring process.

6.4 Results

6.4.1 Phase 1: generate potential implementation strategy content

Mapping TDF domains of barriers and enablers to various sources of BCTs led to the generation of 55 techniques (Fig. 10). Following removal of duplicates, 37 BCTs remained. Following operationalisation of BCTs to support deprescribing in LTC and assessment of appropriateness for the LTC setting, 34 BCTs remained eligible for inclusion in the Delphi survey (Fig. 11).

6.4.2 Phase 2: Delphi survey to identify feasible implementation strategy content

Initial invitations were sent to 35 HCPs: six GPs, eight pharmacists, eight geriatricians, seven nurses and six psychiatrists of old age. Of the 35 invited, eight were international HCPs. From the initial sample of 35, 22 HCPs responded and 20 agreed to take part (57.1% response rate). The breakdown of included participants is outlined in Table 11. Participants in the international sample were from UK, Canada, US, Australia.

Table 11: Demographics of Delphi participants.

Characteristics	**n (%)**
HCP role:	
General Practitioner	4 (22.2)
Geriatrician	2 (11.1)
Nurse	3 (16.7)
Pharmacist	5 (27.8)
Psychiatrist of old age	4 (22.2)
Primary healthcare setting:	
Community Pharmacy	2 (11.1)
General Practice	4 (22.2)
Hospital	2 (11.1)
Long-term care facility	7 (38.9)
Other	3 (16.7)
Age:	
18-29	0 (0)
30-39	1 (5.55)
40-49	9 (50)
50-59	5 (27.8)
60-69	2 (11.1)
70+	1 (5.55)
Years of work experience:	

0-4	0 (0)
5-9	2 (11.1)
10-14	2 (11.1)
15-19	1 (5.6)
20-24	5 (27.8)
25+	8 (44.4)
LTCF/deprescribing experience/both:	
Experience of working with LTCFs	2 (11.1)
Experience of deprescribing	5 (27.8)
Experience of both	11 (61.1)
If experience of working with LTC, what is the dominant setting:	
Public LTCF	9 (69.2)
Private LTCF	3 (23.1)
Unanswered	1 (7.7)
Years of LTCF experience:	
0-4	2 (15.4)
5-9	3 (23.1)
10-14	2 (15.4)
15-19	1 (7.7)
20-24	3 (23.1)
25+	2 (15.4)

Round 1 had a 90% (18/20) response rate. From the BCT list, 22/34 BCTs (64.7% of BCTs) were considered feasible. Round 2 consisted of the 12 BCTs which did not achieve consensus. Round 2 response rate was 88.9% (16/18). Feasibility agreement was achieved for 4/12 BCTs (33.3% of BCTs). Overall, 26/34 BCTs (76.5% of BCTs) were identified as feasible (Table 12).

Wilcoxon signed rank test identified stability of results for the majority of BCTs (11/12), showing no statistically significant difference between Round 1 and 2, suggesting no benefit in continuing for a third round. A single BCT (10.4, social reward) had a statistically significant difference between responses, therefore further analysis was conducted to determine if this should be included in the roundtable. Half of participants identified this BCT as feasible, however 18.8% scored it 'not at all feasible'. Open-ended comments from participants provided further explanation and supported the exclusion of the BCT based on lack of feasibility. For the eight BCTs which were not rated as feasible by >70% of participants, further analysis showed that the majority (5/8 BCTs) were not classified as feasible by more than half of respondents. Review of the feasibility scores and qualitative feedback

suggested that consensus would not be achieved and these BCTs were excluded from the roundtable discussion.

When the 26 BCTs, for which consensus was reached regarding feasibility, were reviewed by the research team against the APEASE criteria and qualitative feedback, a further five BCTs were excluded, leaving 21 for consideration during the roundtable. The reason for exclusion is documented in Fig. 11.

Table 12: Results Delphi survey and APEASE assessment.

BCT	Round 1 n=18			Round 2 n=16			APEASE: Include (Y) exclude (N)	Round table: Include (Y) exclude (N)
	% (n) of participants agreeing it is feasible	%: Not at all feasible	%: Mean, Median, (IQR)	% (n) of participants agreeing it is feasible	%: Not at all feasible	%: Mean, Median, (IQR)		
1.1 Goal setting (behaviour)	88.9 (n=16)	0	78.9, 80 (60-100)				Y	Y
1.2 Problem solving	72.3 (n=13)	0	65.5, 60 (45-80)				Y	Y
1.3 Goal setting (outcome)	66.6 (n=12)	5.6	62, 60 (40-80)	87.5 (n=14)	0	67.5, 60 (60-80)	Y	N
1.4 Action planning	66.6 (n=12)	5.6	68 80 (40-80)	75 (n=12)	0	68.8, 80 (55-80)	Y	Y
1.5 Review behaviour goal(s)	77.7 (n=14)	5.6	67, 60 (60-80)				Y	Y
1.7 Review outcome goal(s)	83.3 (n=15)	0	69, 60 (60-80)				Y	Y
1.8 Behavioural contract	55.5 (n=10)	0	57.8, 60 (40-75)	62.5 (n=10)	0	60, 60 (40-65)	N	
2.2 Feedback on behaviour	66.6 (n=12)	5.6	63, 60 (40-80)	75 (n=12)	0	60, 60 (40-60)	Y	N
2.3 Self-monitoring of behaviour	50 (n=9)	16.7	51, 50 (40-60)	25 (n=4)	12.5	47.5, 40 (40-45)	N	
2.7 Feedback on outcome(s) of behaviour	72.2 (n=13)	5.6	65.5, 60 (45-80)				Y	Y
3.1 Social support (unspecified)	83.3 (n=15)	0	69, 60 (60-80)				Y	Y
3.2 Social support (practical)	83.3 (n=15)	5.6	74, 80 (60-100)				Y	Y
3.3 Social support (emotional)	77.7 (n=14)	16.7	68, 80 (60-80)	62.5 (n=10)	12.5	58.8, 60 (45-65)	N	

4.1 Instruction on how to perform the behaviour[1]	94.1 (n=16)	0	78, 80 (60-100)				Y	Y
5.1 Information about health consequences[1]	76.4 (n=13)	0	58.3, 60 (40-65)				Y	Y
5.3 Information about social and environmental consequences	72.2 (n=13)	5.6	59, 60 (40-80)				Y	Y
6.1 Demonstration of the behaviour	77.7 (n=14)	5.6	66, 60 (60-80)				Y	Y
6.2 Social comparison	72.2 (n=13)	5.6	66.7, 80 (45-80)				Y	Y
6.3 Information about others' approval	83.3 (n=15)	0	69, 60 (60-80)				Y	Y
7.1 Prompts/cues	94.4 (n=17)	0	76,7, 80 (60-95)				Y	Y
8.1 Behavioural practice/rehearsal	72.2 (n=13)	5.6	63.3, 60 (45-80)				Y	N
8.7 Graded tasks	88.9 (n=16)	0	74, 80 (60-80)				Y	N
9.1 Credible source	100 (n=18)	0	74, 80 (60-80)				Y	Y
10.4 Social reward	70.6	17.6	60, 60 (40-80)	50 (n=6)	18.8	50, 50 (40-60)	N	
11.2 Reduce negative emotions	94.4 (n=17)	0	73.3, 70 (60-80)				Y	Y
12.1 Restructuring the physical environment	77.7 (n=14)	11.1	67.8, 70 (60-80)				Y	Y
12.2 Restructuring the social environment	88.9 (n=16)	0	74.4, 70 (60-100)				Y	Y
12.3 Avoidance/reducing exposure to cues for the behaviour[1]	66.6 (n=12)	5.6	64.4, 60 (40-80)	40 (n=6)	0	57.3, 40 (40-70)	N	
12.5 Adding objects to the environment	88.9 (n=16)	0	77.8, 80 (60-100)				Y	Y
13.1 Identification of self as role model	77.7 (n=14)	5.6	63.3, 60 (60-80)				Y	Y
15.1 Verbal persuasion about capability	55.5 (n=10)	0	62.2, 60 (40-80)	68.8 (n=11)	6.3	60, 50 (40-90)	N	

15.3 Focus on past success	66.6 (n=12)	11.1	65.6, 80 (40-80)	75 (n=12)	6.3	58, 60, (40-60)	Y	N
15.4 Self-talk	55.5 (n=10)	11.1	58.9, 60 (40-80)	43.8 (n=7)	0	49.2, 40, (40-60)	N	
16.3 Vicarious consequences[1]	47 (n=8)	0	62.4, 40 (40-80)	43.8 (n=7)	0	56.3, 40, (40-65)	N	

[1] One participant did not assess this BCT for feasibility. Bold and italicised BCTs = included in the roundtable discussion.

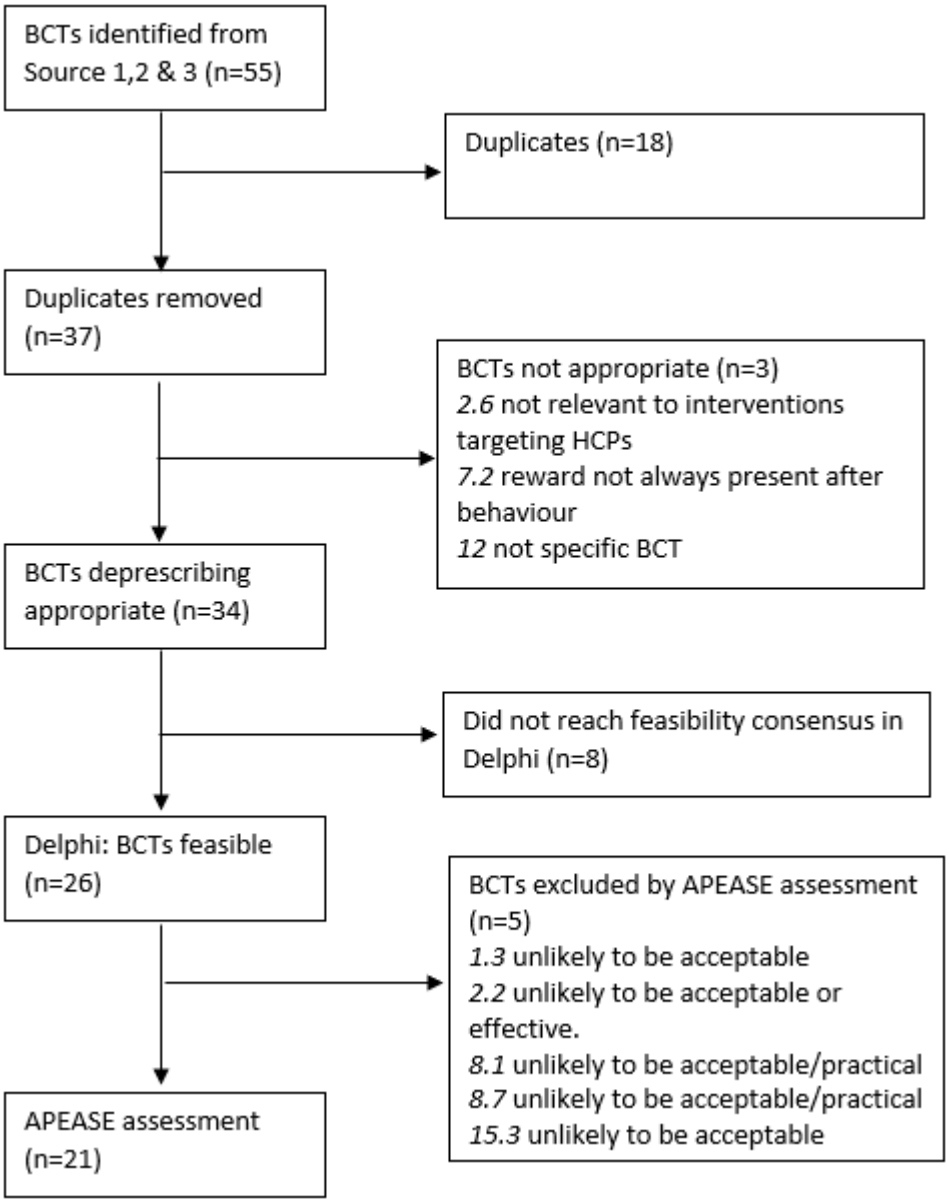


Fig. 11. Flow diagram of BCT selection for inclusion.

Italics = BCT numbers

6.4.3 Phase 3: Roundtable discussion

Eight HCPs (one nurse, four pharmacists, two medical officers and a GP registrar) participated in the roundtable discussion (66.6% response rate, 8/12 contacted) from ten different public LTC settings, with one HCP covering five LTCFs. The discussion lasted 1 hour 36 minutes.

Results of the ranking exercise are reported in Table 13 with strategies and proposed mechanisms to address each barrier/enabler outlined in Appendix 17.

Table 13: Roundtable discussion panel ranking of barriers and enablers.

Rank	Barrier/enabler
1	Insufficient resources: time, staffing and technology.
2	Fragmented care, communication and co-ordination between LTCF and hospital settings.
3 & 4	Limited practical knowledge and experience of deprescribing Further education to support implementation of deprescribing in routine practice.
5	MDT meetings support deprescribing behaviours and decision-making.
6	Knowledge and experience gave HCPs confidence and enhanced their level of engagement with deprescribing or making deprescribing recommendations.
7	Social pressures from HCPs who prefer to maintain 'status quo' and avoid potential negative outcomes inhibit deprescribing.
8	An 'established hierarchy' where GPs are believed to hold a position of superiority to pharmacists or nurses.

6.4.4 Final deprescribing intervention and implementation strategy

The entire design strategy outlining the sourcing, selection and tailoring of BCTs used to form the final implementation strategy is summarised in Fig. 12.

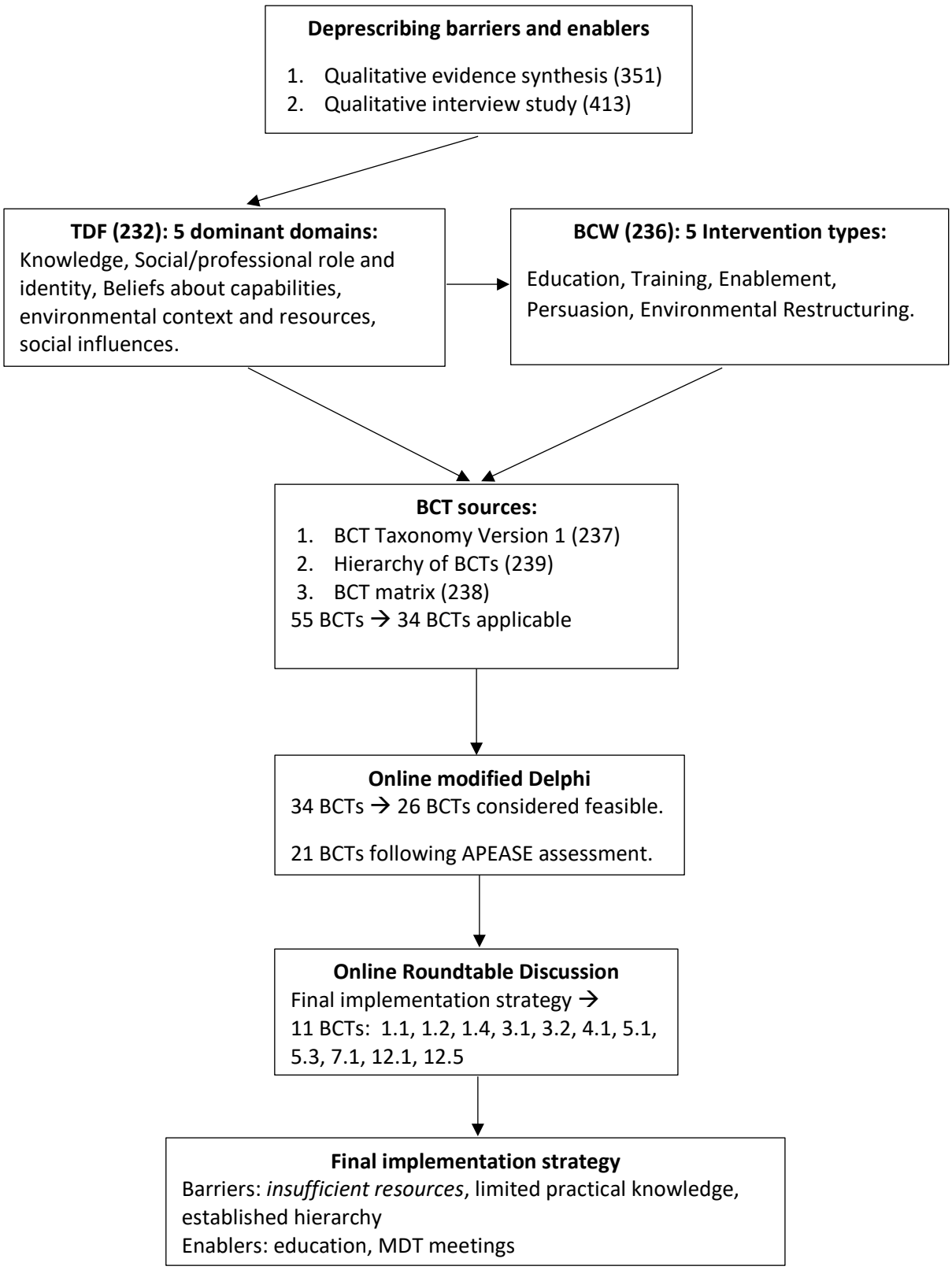


Fig. 12. Summary of implementation design strategy including barriers and enablers addressed. *Italics* = primary barrier identified by HCPs and targeted in strategy.

The agreed implementation strategy addressed three barriers and two enablers (ranked 1, 3, 4, 5 and 8) outlined in Table 14 and Appendix 18. In addition to the BCTs associated with the primary barrier of insufficient resources, a further three BCTs were incorporated and tailored following the roundtable discussion: 3.1 social support (unspecified), 5.1 information on health consequences and 5.3 information on social and environmental consequences, helping to address additional determinants of deprescribing behaviour. Table 15 describes the chronological order of events of the final strategy, which consists of 3 stages. Firstly, a two-tiered education session will be held during the pre-MDT stage, led by a 'nurse champion', a clinical nurse manager or nurse prescriber working on-site, supported by a pharmacist. The purpose of providing education is twofold; to increase knowledge and buy-in to a deprescribing ethos and also to provide reference material to support deprescribing decision-making, explaining the role of each HCP. The pre-MDT stage includes a screening process for patient inclusion in the deprescribing review. This is informed by STOPPFrail v2 and drug class specific guidelines, in this instance Sheppard's deprescribing guide, to identify appropriate patients (34,442).

Next, a 3-monthly deprescribing review of eligible patients will be held, organised by the nurse champion and conducted at the LTCF, including the MDT: staff nurse, pharmacist and GP. The deprescribing review draws on knowledge of the wider MDT to facilitate deprescribing decision-making.

The final stage describes the follow-up patient care, including implementation of decisions made and documentation of patient outcomes.

The roles and responsibilities of each HCP are outlined, linking each step back to target behaviours which each HCP should implement. The hypothesised mechanism of action for each bundle of strategies is also provided, identifying which barriers/enablers are addressed. The detailed structure of the strategy is explained in Fig. 13, focused on antihypertensive deprescribing. Guidelines offered to HCPs are outlined in Appendix 19.

Table 14: Barriers/enablers mapped to TDF domains, intervention types and associated BCTs, outlining the final implementation strategy.

Deprescribing Barrier/Enabler	TDF Domain	Intervention type	Associated BCTs	Strategy and associated BCTs
Limited practical knowledge and experience of deprescribing. ***Further education to support implementation of deprescribing in routine practice.***	Knowledge	Education	2.2 Feedback on behaviour 2.3 Self-monitoring of behaviour 2.7 Feedback on outcomes(s) of behaviour ***4.1 Instruction on how to perform the behaviour*** ***5.1 Information about health consequences*** ***5.3 Information about social and environmental consequences*** 7.1 Prompts/cues	Education needs to be *two-tiered*. Firstly, to change the ethos and gain HCP buy-in to deprescribing. This includes highlighting the value placed on deprescribing via an education session facilitated by NC, supported by pharmacist researcher, identifying the patient care value, documenting benefits of deprescribing and explaining the nursing role. *(BCT 4.1 5.1, 5.3)* The second form of education is reference guide to deprescribing for HCPs, introducing the implementation strategy, STOPPFrail guideline, deprescribing algorithm and other deprescribing resources. *(BCT 4.1)*
Insufficient resources: time, staffing & information technology. ***Multidisciplinary team meetings support deprescribing behaviours and decision making.***	Environmental context and resources	Training Restriction Environmental restructuring Enablement	***1.1 Goal setting (behaviour)*** ***1.2 Problem solving*** 1.3 Goal setting (outcome) ***1.4 Action planning*** 1.5 Review behaviour goal(s) 1.7 Review outcome goal(s) 2.2 Feedback on behaviour 2.3 Self-monitoring of behaviour 2.7 Feedback on outcome(s) of behaviour ***3.1 Social support (unspecified)***	MDT incorporating pharmacist, nurse and GP occurring every 3 months for one-hour duration at the LTCF, targeting one pre-defined drug class. (*BCT 12.1)* Nurse champion, being a clinical nurse manager/nurse prescriber on-site, take the lead by identifying drug class which he/she believes unit would benefit from reviewing, using tool such as STOPPFrail and organising a time/setting a time for all HCP to attend. *(BCT 1.1, 1.4, 12.5)*

			3.2 Social support (practical) 4.1 Instruction on how to perform the behaviour 6.1 Demonstration of the behaviour ***7.1 Prompts/cues*** 8.1 Behavioural practice/rehearsal ***12.1 Restructuring the physical environment*** ***12.5 Adding objects to the environment***	Nurse champion to identify what information is needed prior to the meeting and delegate to colleagues e.g., pharmacist run report on dispensing software to identify all patients on X class of medication, nurse champion to screen patients based on guidelines, indication and how many people feasible to review during MDT and agree on patients with this list confirmed by a GP. *(BCT 1.1, 1.4, 12.5)* Prompts to reminder staff nurses to take clinical measurement e.g., BP in the form of placing a sticker on the drug Kardex. *(BCT 7.1)*
An 'established hierarchy' where GPs are believed to hold a position of superiority to pharmacists or nurses.	Social/ professional role and identity	Education Persuasion Modelling	2.2 Feedback on behaviour 2.3 Self-monitoring of behaviour 2.7 Feedback on outcomes(s) of behaviour ***3.1 Social support (unspecified)*** ***3.2 Social support (practical)*** 3.3 4.1 Instruction on how to perform the behaviour 5.1 Information about health consequences 5.3 Information about social and environmental consequences 6.1 Demonstration of the behaviour ***7.1 Prompts/cues*** 9.1 Credible source	Delegate to nurse staff to have Kardex and notes available at the MDT. *(BCT 3.1, 3.2, 12.1, 12.5)* GPs review patient results (BP measurements) supplied by staff nurse, referred by nurse champion. GP plan deprescribing actions. *BCT 1.2, 1.4, 3.1, 3.2).* Nurse champion to arrange for next MDT. Each HCP support follow-up tasks *(BCT 1.1, 3.2)*

BCT numbers in bold and italics = BCTs included in strategy to address associated barrier/enabler.

Table 15: Implementation strategy design.

Stage	Steps	Responsibility	BCT	Proposed mechanism	Barrier/enabler addressed
Pre-MDT	Education session: Nursing champion (NC) identify appropriate time for education session (schedule on a day GP is visiting site). Nursing staff and GP in attendance, in addition pharmacist invited. NC introduce concept of deprescribing and the DEFERAL implementation strategy, supported by pharmacist and educational material.	NC supported by pharmacist from research team.	*BCT 4.1, 5.1, 5.3*	Education *offers HCP knowledge* regarding practical application of deprescribing, highlighting role and responsibilities, gaining HCP buy-in.	**Barrier:** Limited practical knowledge and experience of deprescribing. **Enabler:** Further education to support implementation of deprescribing in routine practice.
	Identify suitable time for MDT (day GP visiting, time suitable for all HCP)	NC	*BCT 1.4*	MDT facilitates *each HCP contributing a smaller amount of time* than would be required if the responsibility was placed on a single profession with *assigned responsibilities*, addressing social barriers. Meeting at the LTCF bypasses the need for technology *as all information is on-site and decisions made in real-time.* NC key as they mediate between HCPs, LTCF and residents, *facilitating communication*.	**Barrier:** Insufficient resources: time, staffing and information technology. **Barrier:** An 'established hierarchy' where GPs are believed to hold a position of superiority to pharmacists or nurses. **Enabler:** MDT meetings support deprescribing
	Identify drug class to focus review using STOPPFrail to identify PIMs	NC	*BCT 1.1, 12.5*		
	NC to instruct pharmacist to run dispense report on dispensing software to identify all patients on pre-specified medication class.	NC	*BCT 1.2, 1.4*		
	Pharmacist run dispense report on dispensing software to identify all patients on pre-specified medication class and give to NC	Pharmacist	*BCT 3.2*		

	NC screen list from pharmacy. Screening to prioritise patients for review based on:
	• Tools/guides:
	  ○ STOPPFrail (age, criteria for frailty),
	  ○ Deprescribing guide to identify eligible participants.
		NC	*BCT 1.2, 1.4*	Providing a guidance document will help to *support HCP decision-making, engagement and provide education*.
				Screening process to streamline the MDT deprescribing review, identifying eligible residents to *increase the appropriateness and time efficiency* of the review. NC key	

	• Indications: to identify contraindications • Number of patients possible to review			as they mediate between HCPs, LTCF and residents, *facilitating communication*.	behaviours and decision-making.
	NC ask GP to confirm list of eligible patients during site visit	NC	*BCT 3.2*	GP review to facilitate the streamlining of the MDT deprescribing review, *increase the appropriateness and time efficiency*. Nurse prompt addressing staffing issue – *share responsibility* among staff.	
	GP review assessment and confirm list of eligible patients during site visit	GP	*BCT 3.2*		
	NC place sticker on drug chart of patients confirmed for review, prompting nursing staff to take clinical measurements, where appropriate, on specified dates	NC	*BCT 7.1, 12.1, 12.5*		
	Nurse to take daily clinical measurements, where appropriate, on specific dates prior to MDT	Staff nurse	*BCT 3.2*	Having accurate BP data *supports deprescribing decision-making* addressing staffing issue – *share responsibility*.	
	Nurse to pull drug charts and clinical notes for patient being reviewed morning of MDT	Staff nurse	*BCT 3.2*	Increase *efficiency* – addressing time barrier.	
MDT	Structure meeting, briefly introducing aim, medications targeted and patients to be reviewed	NC	*BCT 1.4*	Increase *efficiency* – addressing time barrier.	
	Give clinical measurements/patient information as requested to support deprescribing plan	Staff nurse	*BCT 3.1, 3.2*	*Support deprescribing decision-making* by GP. Addressing staffing issue – *share responsibility.*	
	Provide pharmaceutical knowledge to support deprescribing plan e.g., available strengths/formulations	Pharmacist	*BCT 3.1, 3.2*		
	Review clinical measurements, consider patient and pharmaceutical advice, agree on deprescribing plan, adjust Kardex. Use tools/resources: • STOPPFrail v2 • Deprescribing guide	GP	*BCT 1.2, 1.4*	Providing a guidance document will help to *support HCP decision-making, engagement and provide education.*	
	Agree drug class for next MDT & organise time	NC	*BCT 1.1*	Increase *sustainability* of MDT.	
Post-MDT	Dispense new dose/remove deprescribed medication	Pharmacist	*BCT 3.2*	Support deprescribing behaviour - *share responsibility*.	

	Monitor patient & document any positive/negative outcomes	Staff nurse	*BCT 3.2*	Provide *patient-centred approach*.	
	Write new prescription for the Pharmacy	GP	*BCT 3.2*	Support deprescribing behaviour - *share responsibility*.	

Additional BCTs which participants emphasised could form an alternative implementation strategy to support deprescribing included audit and feedback. Panellists drew parallels to the recent success from their personal experience following implementation of this strategy to promote antimicrobial stewardship in Ireland, which is supported by research highlighting the positive outcomes for antimicrobial usage (443,444). Audit and feedback were proposed to address social barriers of negative pressures from staff who prefer to maintain the 'status quo' and perceptions of an 'established hierarchy' where GPs retain deprescribing authority. The proposed alternate strategy of audit and feedback included nurses conducting an audit of deprescribing decisions implemented e.g., chart with deprescribing interventions, with space for any further changes/outcomes to be documented. The suggested feedback mechanism included reporting results in a well-located area of the LTCF showing cost savings, patient clinical outcomes, and available during HIQA inspections to show their medication management policies. A 'deprescribing dashboard' has been identified as an acceptable, deliverable and effective strategy to increase engagement with proactive deprescribing in the hospital setting. This method was believed to incentivise deprescribing through social comparison where sites can evaluate their process, performance and quality of deprescribing with other hospital settings (96). For this research, audit and feedback did not address the predominant barrier affecting deprescribing in LTC therefore was not agreed as the final strategy.

A full list of proposed strategies to address each barrier/enabler is outlined in Appendix 17. A final point which all participants agreed on was the need for upgraded technology systems within public LTCFs, including electronic Kardex's. These were perceived to facilitate medication reviews, however, as this are not yet routine practice IT support did not feature in the recommended strategies.

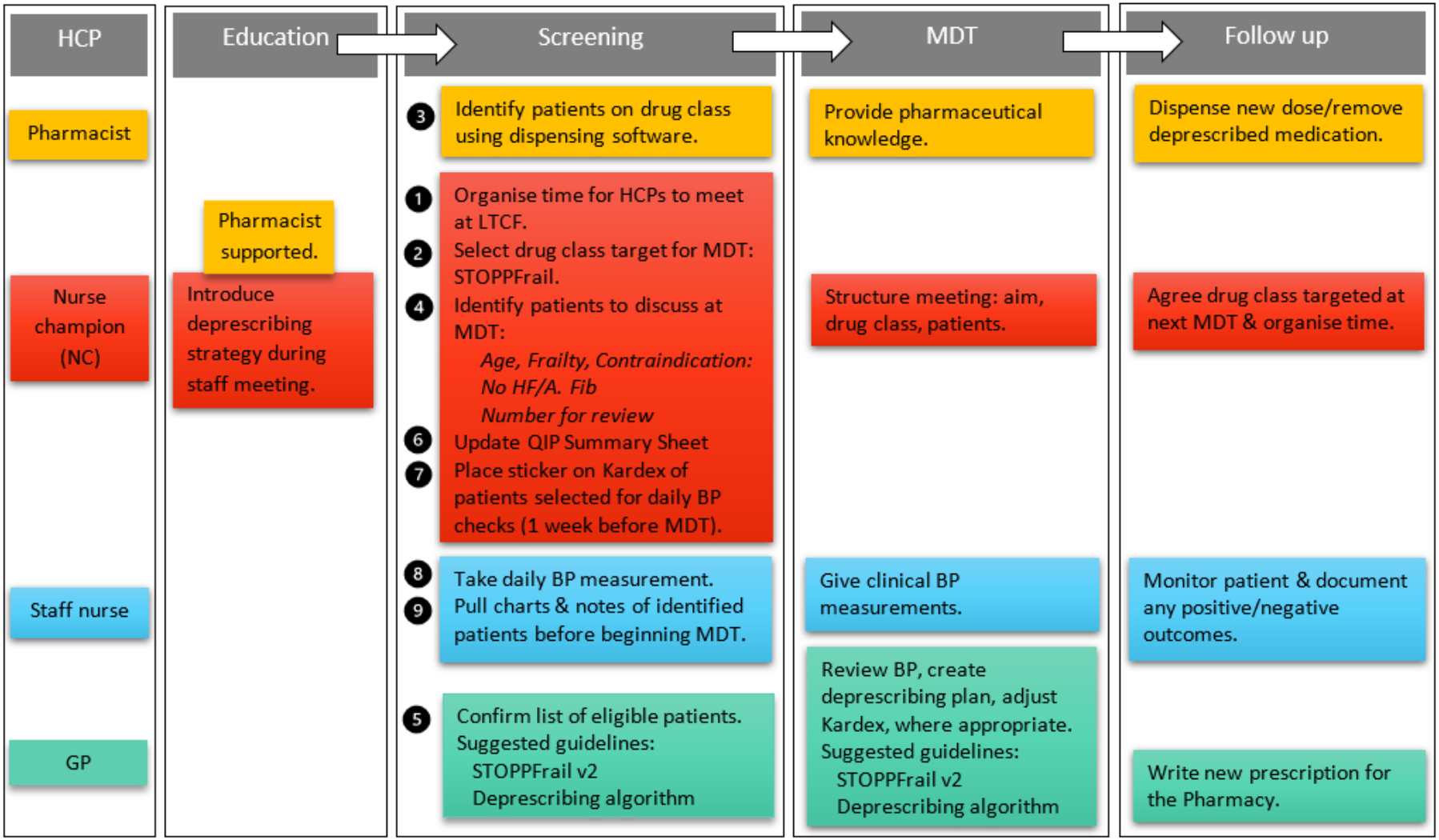


Fig. 13. Workflow of DEFERAL implementation strategy to increase HCPs' engagement with deprescribing. HCP roles colour coded. Numbers = order of tasks. LTCF = long-term care facility, MDT = multidisciplinary team, STOPPFrail v2 = Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy version 2 (34), HF = heart failure, A. Fib = atrial fibrillation. BP = blood pressure. Deprescribing algorithm = Sheppard *et al.* (442).

6.5 Discussion

This study describes an implementation strategy design and tailoring process, aimed to increase HCPs' engagement with deprescribing. This research focused on deprescribing antihypertensives, to frail older adults residing in LTC following evidence reported in Chapter 5 which identified that antihypertensives were the largest drug class potentially inappropriately prescribed in public LTCFs in Ireland (418).

6.5.1 Final deprescribing intervention and implementation strategy

The agreed strategy consisted of an education-enhanced 3-monthly MDT deprescribing review, conducted at the LTCF, focusing on one drug class pre-defined using STOPPFrail v2. This strategy was perceived to target the barriers of insufficient resources, limited practical deprescribing knowledge and negative social beliefs (Table 14 and 15).

6.5.1.1 Medication review

Such medication review strategies using the STOPPFrail tool have found to be effective at identifying and discontinuing potentially inappropriate medications for the target population (182). Decision-making tools and resources such as guidelines and algorithms, have been suggested as useful to support HCPs deprescribing for frail older adults (445,446). STOPPFrail has been identified as more useful than other algorithms and criterion-based tools (447). A review of deprescribing studies targeting older adults residing in LTC identified, if deprescribing consisted of a structured medication review conducted by HCPs, it significantly reduced all-cause mortality and the number of falls (194).

6.5.1.2 Multidisciplinary team

The agreed implementation strategy clearly identified the roles and responsibilities of each HCP to support deprescribing. A systematic review of MDT interventions in LTC settings concluded that such strategies had a positive impact on patient outcomes, particularly when involving communication and co-ordination between HCPs (448). Similarly, a review of interventions to optimise prescribing in LTCFs found that MDT meetings increased the appropriateness of prescribing (449).

The final strategy from this thesis placed a nursing professional as the key co-ordinator of the strategy, reflecting the context of public LTCFs in Ireland, in which nurse managers co-ordinate patient care. This structure supports the evidence which suggests that nurses are best placed to observe the healthcare requirements of patients under their care, to advocate on their behalf and to provide feedback on deprescribing outcomes (268,450). Additionally, prescribers value the input of pharmacists to provide pharmaceutical knowledge to assist their decision-making (401). Pharmacist-led deprescribing has demonstrated improved patient access and timeliness of care, when included as part of a primary care MDT structure (451,452). A systematic review concluded that pharmacist-led deprescribing resulted in greater discontinuation of medications than usual care (453). Considering Irish pharmacists display sufficient knowledge and willingness to engage with deprescribing (377), these findings support the potential for a future role expansion of primary care pharmacists working with LTCFs, to include deprescribing responsibilities.

6.5.1.3 Addressing determinants of deprescribing behaviour

The finalised strategy addresses the predominant barriers which currently exist in LTC. MDT meetings are considered resource efficient (329). Assigning deprescribing responsibility among the MDT can address the barriers of insufficient time and staffing and address concerns about authority. Clearly outlining roles and responsibilities within the MDT could potentially allow HCPs to provide a higher quality of care (329,454). Meeting at the LTC site was selected to sidestep the insufficient technology infrastructure, an internationally documented deprescribing barrier (362). Education to support the MDT was proposed to address the experiential gaps which currently exist for deprescribing in LTC. Education has been shown to have a small but significant effect in reducing the number of medicines prescribed by GPs in primary care (195). Providing education for both the nurse champion and the wider HCP team supports the shared understanding of each HCP's role, responsibility and contribution within the deprescribing implementation strategy, supporting successful deprescribing engagement and integrated collaboration (455,456).

6.5.2 Potential implementation strategy to support deprescribing

In addition to creating a feasible strategy to address the primary barrier affecting deprescribing in LTC, other barriers/enablers were discussed by participants and strategies were agreed to address these determinants, which were not incorporated in the final intervention and implementation strategy. One such element was audit and feedback, a method which has been shown to improve the appropriateness of antimicrobial prescribing (457). Panellists identified that this would be an effective strategy to increasing deprescribing behaviours; however, McElligott *et al.* express reservations regarding the feasibility of implementing audit and feedback in LTC, due to the significant resources which it would require, in a setting where resources are the main barrier (458). A deprescribing trial conducted in LTC, incorporating a multi-strategic program including MDT medication review, education and audit and feedback showed significant reductions in the targeted drug classes, however in this trial, each strategy was not analysed individually therefore the contribution of each strategy is unknown (459).

6.5.3 Implementation strategy design: utilising implementation science and behavioural theory

Designing implementation strategies requires a systematic approach with a robust rationale for design and clear reporting of the process (460). Key concepts of the MRC framework are further emphasised by Powell and colleagues as core elements of designing an implementation strategy, which this research has considered. Having a clear understanding of the problem, the determinants and context was achieved by including published qualitative research (401). Engagement with end-users of the strategy was conducted via the Delphi survey and roundtable discussion (461). HCPs were integral to the design of the final strategy, to select feasible BCTs, prioritising barriers/enablers and tailoring the final strategy as deemed appropriate, based on their contextual understanding of the LTC environment.

The strategy utilised behavioural theory to address key determinants of deprescribing behaviour. The TDF and BCW were chosen to structure this design process due to their application in health behaviour change and deprescribing research (425,462). Similar methods have been used in other areas of

healthcare, which resulted in positive behaviour change outcomes and implementation of evidence-based interventions (463–465). To effectively utilise BCTs to form an implementation strategy, BCTs need to be typified, specifying the content, what is being delivered, how it is being delivered, and the intensity or duration of the BCT (how much/how often it is delivered) (96,466). This was agreed by HCPs during the roundtable discussion. Using a theoretical approach is argued to allow better evaluations into implementation research as it informs the development, delivery and evaluation of interventions allowing the exploration of potential causal mechanisms (432).

To increase engagement with deprescribing and improve the medication experiences for older adults residing in LTC, McCarthy and colleagues identified the need for a "widescale cultural shift". McCarthy *et al.* published a framework to support researchers developing and implementing sustainable deprescribing practices in LTC. The framework is comprehensive, identifying four desired behaviours and supportive actions to increase engagement with deprescribing (424). The supportive deprescribing behaviours align with findings generated in this thesis; specifically, the need for an MDT approach, documented medication indications and shared decision-making.

Both the DEFERAL strategy and McCarthy *et al.'s* framework incorporated behavioural and implementation science to create a theory-informed strategy with stakeholders closely involved in the design phases. However, the DEFERAL strategy incorporated additional aspects to support HCPs' engagement with deprescribing in LTC. The strategy includes evidence-based guidelines to support decision-making, which can also be used as an educational tool. This provides the additional benefit of addressing the recognised knowledge and confidence barrier to deprescribing in LTC (178), in addition to providing an evidence-based decision support structure.

The implementation strategy produced in this chapter requires feasibility testing to assess the acceptability and appropriateness of the strategy, understanding HCPs' fidelity to the process and any adaptations. This will occur by undertaking a pilot study, focusing on implementation outcomes while monitoring clinical impact (225). Future research also needs to incorporate the opinions of

patients/representatives on the implementation strategy, as designed, to keep the healthcare needs and patients' opinion a central feature of deprescribing decision-making.

6.5.4 Strengths and limitations

The various methods used in the design of the DEFERAL strategy are a strength of this study. As identified by Ailabouni *et al.*, it is likely not feasible to address all barriers, therefore several stages were conducted to prioritise barriers and select strategies (140). The Delphi technique is widely regarded as suitable for developing evidence-based design recommendations and used in health sciences to reach consensus (467,468). The Delphi consensus and APEASE review identified BCTs which HCPs considered feasible (435), increasing the likelihood that the strategy would be acceptable and effective. The Delphi method also followed CREDES recommendations to support the credibility of the study (436). The roundtable ranking exercise facilitated the prioritisation of barriers/enablers and selection of implementation strategies. Such steps (469) led to the appropriate selection of BCTs to support HCP overcoming systemic barriers and engage with deprescribing. This method of data collection allows open dialogue where research participants feel empowered and are actively involved in the design process (470), including refinement of the strategy, as outlined by the MRC framework (233). The roundtable discussion followed COREQ-32 reporting guidelines. These methods can be replicated, not only for deprescribing, but to design an implementation strategy to support the implementation of any intervention in any setting.

In addition to barriers and enablers targeted by the DEFERAL strategy, the roundtable discussion documented strategies to address each of the main barriers and enablers identified in Chapter 4. These evidence-based strategies can be used to inform future studies or adapted for international LTC settings. All HCPs were represented in the design of this implementation strategy, allowing the thoughts and opinions of each HCP caring for frail older adults residing in LTC residents to be represented.

Considering the design of the DEFERAL strategy, potential limitations could be identified in the methods used to prioritise determinants of HCP deprescribing behaviour (barriers/enablers) and

selection of the BCTs used to create an implementation strategy to address those determinants. Feasibility was the criterion used to select BCTs, while prioritisation of the barriers/enablers was based on importance. Prioritisation of barriers/enablers could be based off criticality; how a barrier/enabler affects implementation outcomes, chronicity; frequency a barrier/enabler occurs or ubiquity; how pervasive a barrier/enabler is. Similarly, matching strategies to barriers/enablers could be based off many criteria, e.g., existing evidence or plausibility (471). Feasibility was chosen initially, as despite a BCT being considered important, if it was not feasible to implement then it may not be implemented or may not be sustainable beyond trial. Another potential limitation of this research was not using an established mapping tool such as the Theory and Techniques Tool to link determinants of behaviour with the associated BCTs (472). The implementation strategy generated requires further pilot testing to determine the utility of this method.

6.6 Conclusion

Deprescribing is not yet routine practice for frail older adults residing in LTC in Ireland, due to the unique barriers associated with the setting. This study describes an implementation strategy design process, supported by principles of behavioural and implementation science, to increase HCPs engaging with deprescribing and addressing the barriers which have limited their engagement to date. Engaging targeted end users throughout the process allows for the creation of a strategy which will address the systemic barriers, strengthening the utility of the designed deprescribing strategy, from their experiential understanding of the nuances of LTC. The rigorous methods used to generate a theory-driven tailored strategy, which reached feasibility consensus from all HCPs, strengthens the usefulness of designed strategy. The clear documentation of steps conducted allows for the implementation strategy to be adapted for different healthcare settings or jurisdictions. A MDT-deprescribing review co-ordinated by a nursing lead, supported with evidence-based guidelines, conducted at the LTC site was identified as the best method to increase HCPs' engagement with deprescribing for frail older adults residing in LTC. This strategy will require further feasibility testing

to consider implementation outcomes, measuring acceptability, appropriateness and any further adaptions required.

Chapter 7: Feasibility study of a multidisciplinary DEprescribing review for Frail oldER Adults in Long-term care (DEFERAL).

The work of this chapter is under review as *Clara H. Heinrich, Suzanne McCarthy, Sheena McHugh, Eamonn R. Shanahan, Maria D. Donovan. Feasibility pilot of a Multidisciplinary DEprescribing review for Frail oldER Adults in Long-term care (DEFERAL)* in Exploratory Research in Clinical and Social Pharmacy.

7.1 Abstract

7.1.1 Introduction

Deprescribing is a safe and effective method of reducing PIMs. Frail older adults, who often reside in LTCFs, are at a higher risk of adverse drug events due to PIMs. Despite the well documented benefits, there is evidence that deprescribing is not being carried out. The DEFERAL implementation strategy was designed to support HCPs to deprescribe PIMs for frail older adults in LTCFs. DEFERAL is a three-monthly MDT deprescribing review. It is conducted in-person at the LTCF, targeting one pre-determined class of PIMs, organised by a nurse champion on-site.

The aim of this feasibility study was to examine the perceived feasibility, acceptability and appropriateness of the strategy from HCPs' perspective and their fidelity to the DEFERAL strategy. The study also examined the extent to which deprescribing occurred.

7.1.2 Methods

A non-randomised feasibility study of the DEFERAL implementation strategy was conducted. A convenience sample of two public LTCFs in the South-West region of Ireland were recruited. The LTCF had to have a MDT of a GP, pharmacist and nursing staff to be eligible. To be included in the MDT deprescribing review, patients had to be ≥65 years, a full-time resident of the LTCF, considered frail by their HCPs, prescribed ≥1 antihypertensive medication, and have no contraindications for deprescribing. This feasibility study followed a hybrid type three design, focusing on implementation outcomes of feasibility, acceptability, appropriateness and fidelity to the DEFERAL strategy while collecting intervention outcome data of deprescribing decision-making. HCP feedback on implementation outcomes and fidelity was collected using a post-implementation survey. Quantitative data on intervention outcomes were collected using a summary sheet documenting meeting attendance, recruitment and decision-making.

7.1.3 Results

From a total of 90 residents, 56 (62.2%) were prescribed ≥1 antihypertensive medication. Of these 16 (28.6%) patients were eligible for review, with deprescribing occurring for six patients (37.5%)

following the DEFERAL strategy. The survey was completed by ten HCPs (83.3%). Of completed surveys, 100% (n=10) agreed that the DEFERAL strategy was acceptable and appropriate to support deprescribing in LTCFs and 90% (n=9) agreed that it was feasible to undertake. The majority (90%) of HCPs indicated that they completed their designated roles exactly as described by DEFERAL; however qualitative feedback described site-specific modifications. In Site 1, the wider MDT were not engaged as intended by DEFERAL. Site 2 introduced an additional resource to facilitate documentation of clinical measurements to support deprescribing decision-making during the MDT meeting.

7.1.4 Conclusion

The DEFERAL implementation strategy supported HCPs to deprescribe antihypertensive medications in frail older adults residing in LTCFs, evidenced through positive feedback on implementation outcomes and deprescribing of antihypertensive medications. Future research will test the DEFERAL strategy for effectiveness. Future modifications could include targeting different classes of PIMs prescribed to this population.

7.2 Introduction

Frailty is a health state which can affect any individual; however, frailty is correlated with ageing and is more often identified in older adults (473,474). Older adults residing in LTC have high levels of physical frailty, with a large-scale retrospective study categorising 75% of patients as frail (475). Frailty is defined by a gradual decline in the body's physiological state with poor return to homeostasis (19). Addressing consequences of frailty remains a healthcare priority and a key consideration when planning healthcare services, both in Ireland and internationally (23,476–478).

Frail older adults have complex medication regimens and are frequently exposed to suboptimal prescribing (479). Frailty scores are significantly correlated with PIP (R=0.92) (29). PIP describes the prescription of medicines for which the risk outweighs the intended clinical benefit. PIP is prevalent in Irish LTCFs with almost 70% of residents exposed to at least one instance of PIP (44). PIP is a cause of concern as it is associated with hospitalisations (RR 1.63; 95% CI, 1.32-2.00) and adverse drug events (RR 1.34; 95% CI, 1.09-1.66) (480). An Irish retrospective chart review study investigating PIM use in LTC documented that 86.4% of older adults were considered frail, using criteria outlined in STOPPFrail v2, and of those patients 96.6% had at least one PIM prescribed, with an average of 4.8 PIMs per person (418). Considering that the population is ageing (481), becoming increasingly frail with a poorer physiological reserve to overcome adverse events (482), inappropriate prescribing will lead to much greater healthcare utilisation in the future, unless changes are made.

Deprescribing is defined as a systematic medication review process focused on stopping, reducing or switching inappropriate medications to safer alternatives (260). The practice of deprescribing itself is considered an evidence-based clinical intervention and has been identified as a safe and effective method to tackle PIP for frail older adults (140,149,419). Systematic reviews have documented the positive impact of deprescribing on patient clinical outcomes, medication adherence and healthcare cost (99,148,167,194), supporting the need to include deprescribing in routine practice. Despite the favourable outcomes, deprescribing is not happening as often as it should be (95), as evidenced by the increasing rate of PIP for older adults residing in LTCFs in Ireland, rising from 59.8% in 2008 to 70%

in 2010 (44,56). Similar rates can be identified internationally with a Canadian study documenting PIP rates to be 54.7% in LTCFs (57). It has been suggested that tools and algorithms to support deprescribing decision-making for frail older adults are supportive (445,446); however such deprescribing tools are reported to be poorly utilised in routine practice (483). Limited evidence exists detailing strategies which can be used to support the sustainable implementation of deprescribing into routine practice in LTC (141,360).

Implementation science plays a key role in the translation of research into routine practice, focusing on the adoption of evidence-based interventions by providers or care systems (224,484). Implementation strategies are distinct from deprescribing tools/algorithms. Implementation strategies describe the methods or techniques used to increase the adoption, implementation and sustainability of evidence-based interventions (422,485). Deprescribing tools/guidelines can form part of a deprescribing strategy, but do not describe the translation of evidence into routine practice on their own (361). Implementation outcomes serve as proxies for implementation success (428). Consideration of implementation outcomes is important to help differentiate between an ineffective intervention or failure of its implementation (428). Feasibility, acceptability and appropriateness are considered to be important, valid and reliable implementation outcome measures, in addition to being important indicators of further implementation outcomes, such as adoption (428,486).

To date, deprescribing interventional studies for frail older adults residing in LTC have not been systematically developed, theoretically informed or offer adequate detail of the supporting implementation strategy (361,487). To support the translation of deprescribing into routine practice, the research team developed an implementation strategy, guided by the MRC's framework on the design and evaluation of complex interventions (233,487). The design process was informed by behavioural theory and implementation science, incorporating the opinions of HCPs with methods described in Chapter 6 (239,240,362,401,487). The finalised strategy, named DEFERAL, consisted of a three-monthly MDT deprescribing review, targeting one pre-defined drug class, using an appropriate

deprescribing tool for the patient cohort (487). Aligning with the feasibility phase of the MRC's framework and core element of refinement, the DEFERAL strategy requires testing in a real-world context to determine the feasibility, acceptability and appropriateness of the strategy and identify if any adaptations are necessary to support incorporation into routine practice (488).

7.2.1 Aim and objectives

The aim of this feasibility study was to examine the implementation and intervention outcomes of the DEFERAL strategy.

The implementation objectives were to:

(i) Understand HCPs' perceptions of the feasibility, acceptability and appropriateness of the DEFERAL implementation strategy,

(ii) Assess HCPs' fidelity to the DEFERAL implementation strategy.

The intervention objective was to:

(i) Summarise engagement with deprescribing from aggregate, quantitative data collected from the MDT deprescribing review.

7.3 Methods

7.3.1 Study design

This was a single-arm, non-randomised, open feasibility study of an implementation strategy, which aimed to increase HCPs' engagement with deprescribing (489). The design of the DEFERAL implementation strategy has been described in Chapter 6, where details of the contextual barriers/enablers addressed by the strategy are outlined (487). The feasibility study was conducted in two public LTCFs in the South-West of Ireland. The DEFERAL strategy was tailored to target the inappropriate prescribing of antihypertensives, the drug class identified in Chapter 5 as most frequently potentially inappropriately prescribed to frail older adults residing in LTC (418). A logic model was created to provide a visual presentation of how the strategy is believed to work, showing the intended contribution of individual techniques to the overall impact or result (490). This linked

the included BCTs with the proposed mechanism of action, outputs of those actions and outcomes measured. To complement the logic model, a process evaluation was conducted to evaluate how the DEFERAL strategy was implemented, comparing the strategy designed with the strategy delivered (491). Elements considered in the process evaluation were informed by Sott and colleagues (177).

This feasibility study followed a hybrid type three design, focusing on implementation outcomes of feasibility, acceptability and appropriateness, as well as fidelity to the strategy, whilst also collecting data on the clinical intervention (225). Implementation outcomes, definitions, methods and type of data collected are reported in Table 16. A fidelity framework was created, informed by the conceptual framework for implementation fidelity created by Carroll *et al.* (492), to monitor adherence and moderators of fidelity.

Table 16: Implementation outcomes, definitions, methods and type of data collected.

Implementation outcome	Definition	Method and type of data collection
Feasibility	Extent which the DEFERAL strategy can be "successfully carried out" in LTC (486).	Survey: Four items collecting Likert scale data from psychometrically validated statements (486).
Acceptability	If the DEFERAL strategy is considered "agreeable, palatable or satisfactory" (486).	Survey: Four items collecting Likert scale data from psychometrically validated statements (486).
Appropriateness	The "fit, relevance or compatibility" of the DEFERAL strategy for the LTC setting, stakeholders and deprescribing (486).	Survey: Four items collecting Likert scale data from psychometrically validated statements (486).
Fidelity	Degree to which the DEFERAL strategy was "implemented as it was prescribed" (428).	Survey: Statements developed for this study to determine fidelity to roles/responsibilities assigned to each HCP, with open ended comment boxes to describe deviations. GP = two items, pharmacist = three items, nurse champion = ten items, staff nurse = four items

This study received ethical approval from Cork's Clinical Research Ethics Committee Reference Number: ECM 4 (c) 13/12/2022 and ECM 5 (4) 06/04/2023.

7.3.2 Study participants and recruitment

7.3.2.1. Sites

The primary researcher (CHH) introduced the DEFERAL implementation strategy to a convenience sample of two LTCF sites in the South-West of Ireland, at which the primary researcher had an existing professional relationship. Both sites were public state-funded LTCFs. Site 1 had a capacity for 26 patients, with one GP and a GP registrar providing medical care. Medications and pharmaceutical care were provided by a state employed hospital pharmacist who visited the LTCF once weekly on a specified day. Site 2 consisted of three wards, with a capacity for 68 patients, with one GP providing medical care. Medications and pharmaceutical care were provided by a community pharmacist with a state contract associated with the LTCF. This pharmacist supplied medications monthly to the site, with additional medications provided as required. A designated time to visit the LTCF weekly did not exist. Both sites decided to implement the DEFERAL implementation strategy as a quality improvement project (Appendix 19).

7.3.2.2 Inclusion/exclusion criteria

7.3.2.2.1 LTCF

As part of the DEFERAL implementation strategy, a MDT consisting of a GP, a pharmacist and nurse, led by a nurse champion, had to be in place at the LTCF. Information sheets and consent forms were provided to each LTCF running the pilot of the DEFERAL implementation strategy.

7.3.2.2.2 LTC patient

As the feasibility testing of the DEFERAL implementation strategy was focused on supporting the deprescribing of antihypertensives, patients had to meet the following criteria to be included in the deprescribing review:

(i) ≥ 65 years,

(ii) Prescribed at least one antihypertensive medication.

(iii) No contraindications for deprescribing antihypertensive e.g., heart failure, atrial fibrillation.

(iv) Full-time resident in one of the two identified LTCFs.

(v) Considered frail by the nurse champion, confirmed by GP.

7.3.2.3 Sample size

This feasibility study was not designed to a detect statistical significance in clinical outcomes; therefore, no formal power calculations were conducted.

7.3.3 Deprescribing intervention and implementation strategy

7.3.3.1 Education

The pre-MDT review stage consisted of an educational introduction which had two objectives; to gain HCP buy-in for deprescribing, explaining the practical application and to provide education for HCPs in the form of written guidelines to support and structure their engagement with a MDT deprescribing review (Appendix 19). The education session was organised by the nurse champion, a clinical nurse manager working at the LTCF. Education was supported by the primary researcher on the DEFERAL implementation strategy (487) and the guidelines for deprescribing antihypertensives (34,442).

7.3.3.2 Eligibility Screening

Both sites were provided with the guideline outlining the screening process for ascertaining patient eligibility (Appendix 19). The function of the eligibility screening was to identify patients prescribed the drug class of interest and confirm their appropriateness for inclusion in MDT deprescribing review. This process involved all HCPs and included tools and guides such as STOPPFrail v2 and an antihypertensive-specific deprescribing guide (34,442). Older adult eligibility was based on age and frailty status. Frailty criteria as outlined by STOPPFrail v2 were provided to assist decision-making (34).

The pharmacist identified all patients who were prescribed an antihypertensive drug class. The nurse champions reviewed this list to identify eligible patients based on age, frailty status and diagnoses. Medication indications were reviewed by the nurse champion to identify any contraindications which would deem a patient ineligible for review. Exclusion criteria included a diagnosis of heart failure/atrial fibrillation. The list of patients was reviewed and confirmed by the GP. For patients deemed eligible based on age, frailty and contraindications, the primary researcher supplied nurse champions with stickers labelled 'Daily BP Measurements' identifying the dates BP measurements should be taken. Clinical measurements were collected for a week prior to the MDT deprescribing review by staff nurses

to provide accurate up-to-date measurements to influence GP decision-making. BP measurements were taken at variable timepoints throughout the week to get an accurate overview of the patient's systolic blood pressure (SBP).

7.3.3.3 MDT review

The MDT deprescribing review of eligible patients was conducted on site, with all relevant HCPs invited by the nurse champion. SBPs were reviewed to determine the appropriateness of prescribing, as per guidelines (34,442).

7.3.3.4 Follow up

GPs adjusted the Kardex during the MDT once a deprescribing decision was made and followed up with new prescriptions to be issued to the pharmacy. HCPs agreed to follow up on patients four weeks after deprescribing antihypertensive medication.

7.3.4 Data collection

7.3.4.1 Implementation outcomes: survey and interviews

Information collected in the post-feasibility study survey was used to the process evaluation. In keeping with another core element of the MRC guidance, strategy refinement (233), participants were asked for feedback on the implementation of the deprescribing strategy via a post-feasibility study survey which was available online or in paper format (Appendices 18-21), including the option for follow-up interviews. The survey collecting feedback on strategy fidelity, investigating adherence and moderators of fidelity (492). Participants had three weeks to complete the survey upon receipt, with the primary researcher providing an email reminder after two weeks. Section 1 of the survey investigated HCPs perceptions of the feasibility, acceptability and appropriateness of the DEFERAL strategy, using implementation outcome measures created by Weiner and colleagues (486). Information was collected using a five-point Likert scale data, asking participants to what extent do they agree with the included statements (strongly disagree to strongly agree). Section 2 questioned HCPs' fidelity to the strategy as designed, specifying every role assigned to each HCP and asking if they completed the task as outlined. If the HCP indicated they did not facilitate a specific role as designed, they were asked to elaborate in the open-ended comment box to define the variation. The survey

ended with the option of follow-up interviews at the discretion of the HCP. HCPs were asked to provide their email address if they wished to partake in an interview to further discuss their perceptions of and adherence to the implementation strategy.

7.3.4.2 Deprescribing intervention outcomes: review meeting summary sheet

Aggregate data were collected by the nurse champion to reflect the deprescribing process as follows:

(i) Attendance: profession and number of each profession in attendance for both education session and deprescribing MDT.

(ii) Patient screening data:

a. Number of patients on-site,

b. Number of patients prescribed drug class of interest,

c. Number of patients eligible for review and reasons for exclusion.

(iii) Deprescribing data:

a. Number of patients reviewed,

b. Number of patients who had a medication deprescribed and the type of deprescribing decision made (withdrawal/dose reduction/switching to safer alternative),

c. Number of eligible patients who did not have an antihypertensive medication deprescribed and reason why (SBP too low/fear of negative consequences/agreement not reached among HCPs/other).

Following the meeting, the nurse champion posted the completed review sheet to the primary researcher.

7.3.5 Data analysis

7.3.5.1 Implementation outcomes

7.3.5.1.1 Section 1: Analysis of feasibility, acceptability and appropriateness

The Likert data were analysed using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) to calculate the percentage of HCPs who found the implementation strategy feasible, acceptable and appropriate. The percentage agreement was calculated from the number of HCPs who

agreed/strongly agreed which each statement. Data from Site 1 and Site 2 were combined and analysed together. This identified if the designed strategy would be suitable for progression to a larger trial or if it required revision and adaptation.

7.3.5.1.2 Section 2: Analysis of fidelity to DEFERAL strategy

Categorical data investigating fidelity to the strategy were analysed quantitatively using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA). Analysis was conducted individually between Site 1 and 2 to identify any site-specific strategy adaptations or modifications. The open-ended comment boxes were analysed using conventional qualitative content analysis (441,493), to examine fidelity to the DEFERAL strategy as designed and identify any deviations or modifications to the strategy. Fidelity assessment was included to identify intentional/unintentional changes from the strategy as designed and investigate why these occurred and the perceived effect.

7.3.5.2 Deprescribing intervention outcomes

Count data were analysed using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) to calculate the percentage of patients eligible for inclusion in the MDT deprescribing review and reasons for exclusion. Data was analysed individually for Site 1 and Site 2.

The Standard for Reporting Implementation Studies (StaRI) guidelines were used to report findings from this study, with consideration of StaRI-65 recommendations, which include further considerations for interventions with older adults (494,495) (Appendix 20).

7.4 Results

7.4.1 Implementation

A logic model linking BCTs, the proposed mechanism of action, outputs of those actions and outcomes measured is reported in Appendix 21. A detailed report of outcomes measured is documented in Appendix 22.

7.4.1.1 Section 1: Analysis of feasibility, acceptability and appropriateness

The survey was completed by ten of the twelve HCPs involved in the pilot, three GPs (Site 1 and 2), one pharmacist (Site 1), one nurse champion (Site 2) and five staff nurses (Site 2) (Appendix 23-26).

HCPs perceptions of the feasibility, acceptability and appropriateness of the DEFERAL implementation strategy as designed are summarised in Table 17. These moderators of fidelity provided feedback on the strategies used and participant responsiveness (Appendix 27). None of the HCPs indicated an interest in a follow-up interview.

Section 1, investigating the feasibility, acceptability and appropriateness of the DEFERAL strategy was fully completed by 70% (n=7) of HCPs and partially completed by 30% (n=3). Some HCPs potentially misinterpreted the instruction on the questionnaire and only responded to one statement within each section, meaning data are missing for some statements. Of completed surveys, 100% of HCPs agreed/strongly agreed with the acceptability and appropriateness statements and 90% agreed/strongly agreed with the feasibility statements. One HCP, a GP, remained neutral for a single statement under the feasibility assessment when asked if the strategy to support deprescribing seems easy to do.

Table 17: Section 1: survey of the perceived feasibility, acceptability and appropriateness of the DEFERAL strategy.

	HCP*	**Completely Disagree/ Disagree** % (n)	**Neither agree nor disagree** % (n)	**Completely Agree/Agree** % (n)	**No answer** % (n)
Feasibility					
The strategy to support deprescribing seems implementable	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			60 (3)	40 (2)
The strategy to support deprescribing seems possible	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			100 (5)	
The strategy to support deprescribing seems doable	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			60 (3)	40 (2)
The strategy to support deprescribing seems easy to do	GP		33.3 (1)	66.6 (2)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			60 (3)	40 (2)
Acceptability					
The strategy to support deprescribing meets my approval	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			60 (3)	40 (2)
The strategy to support deprescribing is appealing to me	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			80 (4)	20 (1)

I like the strategy to support deprescribing	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			80 (4)	20 (1)
I welcome the strategy to support deprescribing	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			60 (3)	40 (2)
Appropriateness					
The strategy to support deprescribing seems fitting	GP			66.6 (2)	33.3 (1)
	Pharm			100 (1)	
	NC			100 (1)	
	SN			60 (3)	40 (2)
The strategy to support deprescribing seems suitable	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			80 (4)	20 (1)
The strategy to support deprescribing seems applicable	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			80 (4)	20 (1)
The strategy to support deprescribing seems like a good match	GP			100 (3)	
	Pharm			100 (1)	
	NC			100 (1)	
	SN			60 (3)	40 (2)

* NC = nurse champion, SN = staff nurse, GP = general practitioner, Pharm = pharmacist.

7.4.1.2 Section 2: Fidelity to DEFERAL strategy

Fidelity to the strategy was measured using the post-feasibility study survey (Appendix 27). Section 2 was completed in full by all HCPs (n=10). The majority (n=9) of HCPs indicated that they completed their designated roles exactly as described. This section investigated adherence to the strategy including content delivered, HCPs involved, frequency and duration of delivery. Qualitative feedback from open-ended comment boxes provided an insight into variation between sites. One GP from Site 1 documented a deviation from the DEERAL strategy during the screening process. The pattern of deviation from Site 1 is summarised by limited engagement with the wider MDT to support the deprescribing review meeting. Site 2 report strong fidelity to the strategy, with the only documented deviation being the addition of a resource to support deprescribing decision-making during the MDT meeting. Attendance at pre-MDT education session and MDT deprescribing meeting is summarised in Table 18.

7.4.1.2.1 Education

Site 1 did not conduct an education session, as outline by DEFERAL. Site 2 conducted the education session in two phases in March 2023. The site consisted of three wards, with one nurse champion associated with each ward. This session was led by one nurse champion and attended by another, supported by the primary researcher disseminating the guidance document (Appendix 19) and explaining the structure of the deprescribing implementation strategy. The nurse champions in attendance shared the knowledge to their wider nursing team. The pharmacist and GP associated with the facility were provided with the guidance document via email in addition to the original articles from which the guidance document was informed (Appendix 19) (34,442). Part two of the education session involved the LTCF's Director of Nursing, one nurse champion, the site's GP and the primary researcher. This phase of the education session focused on clarifying inclusion criteria, clinical parameters and gathering information prior to the MDT. The education session was conducted in two parts to facilitate HCPs' schedules. A modification of the DEFERAL strategy was introduced by the nurse champion during this session. To support the documentation of BP measurements for selected

patients, the nurse champion introduced a specific BP monitoring chart to be added to the Kardex of selected patients to record daily BP measurements.

7.4.1.2.2 Screening

The HCPs at Site 1 deviated from the screening process in three ways, limiting the involvement of the wider MDT, as reported by the follow up survey. Firstly, the screening process was intended to be conducted by the nurse champion, using a list of patients prescribed the drug class of interest issued by the pharmacist, with eligibility confirmed by the GP. Instead, the screening was conducted on-site during the deprescribing review meeting by the MDT. Secondly, a staff nurse was intended to be included, to take daily BP measurements and provide this information during the MDT. A staff nurse was not involved in the MDT meeting with no reason for exclusion provided. Finally, 'Daily BP Measurement' stickers were planned to be placed on the Kardex of eligible patients for inclusion in the deprescribing MDT review to remind nursing staff to take BP measurements prior to the deprescribing meeting. As the screening process did not occur prior to the MDT, Site 1 did not use the 'Daily BP Measurement' stickers therefore nursing staff did not take daily BP measurements prior to the MDT deprescribing meeting. All HCP communication required to conduct the DEFERAL strategy; including planning, screening and deprescribing occurred in person during GP and pharmacist visits to the LTCF.

In Site 2, qualitative feedback from the survey identified strong fidelity to the DEFERAL strategy as described. Email was the most common method of communication between the nurse champion and the HCPs who were located offsite. Email was used to agree on a suitable time and date to conduct the MDT and for the pharmacist to share dispensing reports of patients prescribed antihypertensives with the nurse champion. Patients' eligibility was confirmed by the GP verbally, in-person, during the routine weekly GP visit and was documented in the selected patients' medical notes. The nurse champion introduced a BP monitoring chart to record daily BP measurements. This BP monitoring chart was attached to their drug chart for the week with the 'Daily BP Measurements' sticker placed on the front to remind nursing staff to measure BPs. Five different nurses were involved in the BP

measurements and completed the follow up survey. The nurse champion noted that the sticker placed on the drug Kardex of selected patient to remind staff nurses to take daily BP measurements one week prior to the MDT was “very effective”.

7.4.1.2.3 MDT

Site 1 utilised guidelines supplied to the LTCF by the pharmacist researcher (Appendix 19) to support the MDT deprescribing review as described. Site 1 utilised HCPs’ clinical judgement to determine the appropriateness of antihypertensive prescribing. Staff nurses were not involved in the MDT deprescribing review.

In Site 2, HCPs reviewed the BP monitoring charts to support their clinical judgement. The GP used an average SBP of 130mmHg as outlined in STOPPFrail v2 to assist deprescribing decision-making (34).

7.4.1.2.4 Follow up

In Site 1, the MDT deprescribing review concluded with the nurse champion specifying the next date for an MDT deprescribing review and identified that the drug class of interest will be PPIs. Site 2 agreed on a date to conduct a four-week follow up for patients who have had antihypertensives deprescribed. Site 2 agreed to conduct further deprescribing reviewed using this structure.

Table 18: Attendance at pre-MDT education session and MDT deprescribing meeting.

Attendance	**Site 1 (number of HCPs)**		**Site 2 (number of HCPs)**	
Healthcare professional	**Education**	**MDT**	**Education**	**MDT**
Nurse champion	0	1	2	1
Pharmacist	0	1		1
Staff nurse	0	0		
GP	0	2	1	1
Other attendees (title of profession)			1 (Clinical Development Officer) 1 (Director of Nursing)	1 (Assistant Director of Nursing)

7.4.2 Deprescribing intervention

Both Site 1 and Site 2 conducted the MDT deprescribing review focusing on antihypertensives between February and March 2023. The summary of aggregate findings is documented in Table 19.

Table 19: Summary of deprescribing decision-making following DEFERAL implementation.

Pre-meeting screening: Recruitment	**Site 1** Number of patients	**Site 2** Number of patients
Number of patients on site:	26	64
Number of patients prescribed drug class of interest (as per pharmacy list):	18	38
Number of patient eligible for review:	8	8
Reason for exclusion:		
Age		
Frailty status	5	8
>12 months life expectancy		
Contraindication		7
Clinical parameters not supportive	2	13 (9 = cerebrovascular event, 4 = multimorbidity)
Other	3	2 (1 = transferred LTCF 1 = death)
MDT meeting: Deprescribing review	**Site 1** Number of patients	**Site 2** Number of patients
Number of patients reviewed	8	8
Number of patients who had a medication deprescribed:	2	4
Dose reduced	2	4
Drug stopped		
Switched to a safer alternative		
Number of deprescribing eligible patients who did not have PIM deprescribed	6	4
Reason for not deprescribing:		
SBP not appropriate		4
Fear of negative consequences	6	
HCPs not agreed		
Other		

7.4.2.1 Deprescribing intervention outcomes

In Site 1, of the 26 patients on site at the point of data collection, 18 (69.2%) were prescribed antihypertensives and eight (44.4%) were deemed eligible for inclusion in the MDT deprescribing review. Frailty, unsupportive clinical parameters and 'other' were the documented reasons for exclusion following the screening process. Of the eight patients considered eligible for the review by their GP, deprescribing occurred for 2/8 (25%) through dose reduction. For the remaining six patients (75%), fear of negative consequences was the reason deprescribing did not occur, recorded in the

meeting summary sheet. Of the total LTCF population prescribed antihypertensives, deprescribing occurred for 2/18 (11.1%).

In Site 2, of the 64 patients on site at the time of patient screening, 38 (59.4%) were prescribed antihypertensives and eight (21%) were eligible for inclusion. Of the patients prescribed an antihypertensives, two patients were no longer resident; one transferred to a different LTCF and the second passed away. History of a cerebrovascular attack or multiple co-morbidities where the GP decided that it would not be safe of appropriate to deprescribe were the documented reasons for exclusion following the screening process. Of the eligible patients, deprescribing occurred for 4/8 (50%) through dose reduction. For the remaining four patients (50%) deprescribing did not occur due to unsupportive SBP measurements. Of the total population prescribed antihypertensives and remaining resident at the LTCF, deprescribing occurred for 4/36 (11.1%). During the MDT, the nurse champion and GP agreed to clinically review the four residents for whom antihypertensives were deprescribed, four weeks after initiating the change.

In total, antihypertensive deprescribing occurred for 6/16 (37.5%) of eligible patients across both sites. For all patients, the dose of an antihypertensive drug was reduced, rather than a medication completely stopped or switched for a safer alternative.

7.5 Discussion

The designed implementation strategy, DEFERAL, which was created to assist HCPs deprescribe PIMs for frail older adults residing in LTC, supported deprescribing in a small-scale feasibility study. The implementation strategy was considered feasible, acceptable and appropriate by most HCPs involved in the pilot. While most respondents reported perfect fidelity to the strategy as designed, some deviated from the strategy giving rise to potential adaptations. The strategy targeted the inappropriate prescribing of antihypertensives and supported deprescribing through dose reduction for nearly 40% of eligible patients.

The implementation strategy consists of a MDT deprescribing review, conducted on-site with HCPs routinely involved in patient care, targeting the potentially inappropriate prescribing of antihypertensives (487). The strategy is designed to address the resource barriers of time, staffing and information technology, a limitation across all LTC settings (362,401), tailored based on HCPs understanding of the LTC context. The strategy facilitates inclusion of drug class-specific guidance, with the option to account for contraindications for deprescribing specific drug classes e.g., antihypertensives used in patients with a diagnosis of heart failure or based on clinical measurements.

7.5.1 Implementation outcomes

Carpenter *et al.* highlight the need to consider implementation science to support the uptake and sustainability of new research, in all team-based healthcare settings caring for older adults (494). In this study HCPs agreed/strongly agreed with statements discussing implementation outcomes, bar one HCP remaining neutral on a single statement, suggesting the strategy as designed was feasible, acceptable and appropriate. This, and the positive feedback received through open-ended comment boxes from the survey, suggest that it would be reasonable to progress the DEFERAL implementation strategy to a larger scale pilot RCT.

It is acknowledged that modifications to implementation strategies are sometimes required to fit the particular intervention, contextual parameters or stakeholders involved (461). This feasibility study focused on understanding how targeted users interacted with the strategy (496). Site 1 deviated from

the DEFERAL strategy mainly through lack of engagement with the wider MDT, identified by the coverage consideration of the fidelity framework.

The GP and pharmacist from Site 1 were involved in the design stages of the DEFERAL strategy. This potentially explains why HCPs did not provide an education session or engage with support offered from a pharmacist researcher, as they had a detailed understanding of the DEFERAL strategy. Evidence suggests that to support deprescribing for older adults residing in LTC, HCPs require access to detailed knowledge or tailored evidence (401). The education offered by a pharmacist could have created an opportunity to provide tailored evidence to assist decision-making and support deprescribing confidence.

The screening process of the DEFERAL strategy was conducted by the MDT from both sites, although not following the same format. Site 1 conducted the eligibility screening process during the MDT deprescribing meeting, creating a deviation from adherence, specifically regarding the duration of the designed strategy. Site 1's organisational structure differed slightly, with pharmaceutical care being provided by a hospital pharmacist and the GP supported with a registrar. A combination of the smaller capacity, different organisational structure and increased social support within the LTCF may have influenced this decision to alter the screening process, as the nurse champion may have had the time and detailed patient knowledge required to support deprescribing decision-making, without the need of a staff nurse to provide clinical and patient details. Despite the variation, deprescribing opportunities still profited from the increased efficiency and benefits associated with interdisciplinary collaboration (329).

The deviations documented from the DEFERAL strategy in Site 1 involve coverage, specifically roles/responsibilities delegated to nursing staff. However, nursing staff were not involved in the MDT deprescribing meeting therefore did not complete a follow-up experiential survey, limiting our understanding of these modifications. Site 1 further deviated from the content as they did not use the BP measurement reminder stickers and it is unclear if BP measurements were conducted. If this step

was omitted or adjusted, this could explain the fear documented as cause for exclusion from the deprescribing trial. Even though an antihypertensive deprescribing trial which excluded a BP check has shown positive outcomes, to reduce fear of negative consequences (152), the DEFERAL implementation strategy could be modified to consider a minimum number of BP measurements or a selection of times for which BP measurements are required, if the current strategy was too onerous.

In Site 2, an adaptation was documented to support deprescribing decision-making by providing a monitoring chart to facilitate a clear and swift review of BP measurements. Based on feedback, when clinical measurements are required to support deprescribing, the DEFERAL strategy could incorporate a monitoring chart distinct from routine patient documentation, which can be easily reviewed during the MDT. This supports findings that adaptations, a form of modification defined as "deliberate alterations" to improve a strategy's "fit or effectiveness in a given context" (497), may be required due to the complex nature of implementation and individual site-specific contextual factors (498).

Documenting modifications is important to understand the mechanisms by which the strategy affects outcomes (499). Using a fidelity framework allows any deviation in delivery to be captured, adaptations documented and facilitate an understanding of how strategies are received by targeted end-users (177). A process evaluation was used to help determine the extent to which the DEFERAL strategy adhered to the theoretically derived mechanism of action. The process evaluation considered adherence and fidelity, with feedback collected using a post-feasibility study survey, contextual factors from published qualitative research (401), acceptability and process outcomes collected using the aforementioned survey and deprescribing worksheet included in the guidance document (Appendix 19). Observations or clinical measurements were not included due to ethical limitations accessing identifiable patient information. The process evaluation help to identify which elements of the strategy were adhered to, which were not and reasons why. It was intended that participants would engage in follow-up interviews to perform a mixed methods process evaluation, identifying essential strategy elements, however this did not occur, being a limitation of the study. Despite being part of

the same overall structure, a degree of flexibility may be required for individual phases to ensure engagement, delivery and sustainability to the complex deprescribing implementation strategy while maintain the integrity of the core components of the strategy (233). Future modifications of the DEFERAL strategy could allow for the combination of pre-MDT and MDT phases, or only including one nurse representative, depending on the deprescribing knowledge and confidence levels of HCPs, site size and knowledge or confidence of supporting staff.

7.5.2 Deprescribing intervention outcomes

The implementation strategy supported HCPs to deprescribe in a small-scale feasibility study, by tapering the doses of antihypertensive medications. The deprescribing rates were similar to a Norwegian study targeting antihypertensives prescribed to older adults residing in LTC, which used a systematic medication review strategy with collegial mentoring, resulting in antihypertensive prescriptions decreasing by 32% (184).

In Site 2, the explanation provided for not deprescribing for a potentially eligible patient was that their SBP did not meet the guideline parameters. The MDT agreed on a SBP threshold of <130mmHg to focus on, reflecting the STOPPFrail v2 guidelines (34). Using a SBP threshold of <130mmHg could be considered cautious compared to existing antihypertensive deprescribing trials where the SBP inclusion criteria was <150mmHg and age of >80 years (152,442) or the European Society of Cardiology guideline which recommends an upper limit of 140mmHg (500). Similarly, a Canadian consensus guideline suggest that for frail older adults, antihypertensive treatment should only be initiated if SBP ≥160mmHg, with an appropriate target being 140-160mmHg. Deprescribing is recommended if the SBP drops <140mmmHg (501). The lower threshold could account for the relatively small proportion of patients who were prescribed antihypertensives being eligible for deprescribing. In the frail population who have a high risk of falls secondary to antihypertensives, guidelines suggest dose reduction or withdrawal for this cohort (502).

The choice to reduce the dose rather than immediately withdraw antihypertensives for both sites may be influenced by the fact that very frail older adults with limited life expectancy residing in LTC have

been excluded from major antihypertensive trials, such as the Hypertension in the Very Elderly Trial (HYVET) and the Systolic Blood Pressure Intervention Trial (SPRINT) (503–505). Evidence is generated from younger individuals, with mild or moderate frailty, fewer co-morbidities, who do not require nursing care and have reduced rates of polypharmacy (36). There is an argument for a more personalised approach to be taken for the frail older adult cohort, by undertaking an individualised risk/benefit evaluation, as opposed to aiming for a specific target (503). Similar to other resources (139), the DEFERAL strategy supports rather than replaces clinical judgement and deprescribing decisions are individualised based on patient condition. This demonstrates that the DEFERAL strategy is supportive of deprescribing, whether it is done according to specific guidelines or based on clinical judgement.

7.5.3 Strengths and limitations

To the best of our knowledge, the DEFERAL strategy is the first implementation strategy to support HCPs deprescribing for frail older adults in LTC, which has been specifically tailored to address barriers/enablers inherent in the setting. A strength of the DEFERAL strategy is its universal nature. The strategy could be adjusted to target various classes of PIMs prescribed to frail older adults in LTC settings, including deprescribing guidelines and clinical measurements where relevant and appropriate. Including a logic model supports the transparency of the DEFERAL strategy, outlining the links between theory, mechanisms and outputs. This could be used to reproduce the strategy under various conditions. Strengths of the study include the methods used to detect adaptations or deviations from the DEFERAL strategy, including a fidelity framework. The follow-up survey was designed to allow HCPs to document any deviations relating to their roles/responsibilities and provide an explanation. This assists the understanding of what modifications occurred and why, potentially influencing the future design of the DEFERAL strategy. Conducting the study in two public LTCFs which have slightly different organisational structures helped to identify nuances which could influence implementation when scaled up to a larger trial.

A limitation of the DEFERAL feasibility study is the lack of participant completion of the follow-up research. The survey investigating fidelity to the DEFERAL strategy was not completed by all HCPs and no participant volunteered for a subsequent interview. Quality of delivery was not considered nor were essential elements of the strategy identified. This limits the completeness of the feedback on the feasibility, acceptability and appropriateness of the implementation strategy as designed. It also prevents exploration of reasons for deviation or an understanding of the perceived positive/negative elements of the DEFERAL strategy. In some cases, a single HCP from a particular profession gave feedback, introducing the possibility of bias or a limited perspective on the strategy. In Site 1, the nurse champion did not complete the survey. Subsequently, reasons for strategy deviations from a nursing perspective remain unknown, limiting the ability to adapt the strategy. To prevent this attrition, future feasibility testing should supply HCPs involved with the follow-up survey immediately after the MDT. Additionally, some data was missing for some statements in the first section of the survey on feasibility, acceptability and appropriateness, minimising the feedback obtained. HCPs potentially misinterpreted the instruction on the questionnaire and only responded to one statement within each section.

7.6 Conclusion

The DEFERAL deprescribing implementation strategy was tested for feasibility in two LTCFs. The strategy led to successful implementation of deprescribing in LTC, with deprescribing of antihypertensives occurring in nearly 40% of eligible frail older adults. HCPs who took part in the deprescribing feasibility study considered the strategy to be feasible, acceptability and appropriate. Possible modifications to the strategy as designed include the inclusion of a clinical monitoring chart to support deprescribing decision-making during the MDT meeting. Additionally, the strategy may require flexibility to consider LTCF size and organisational structure. For smaller LTCFs the screening phase could occur during the MDT with the nurse champion having sufficient patient knowledge, not

requiring the involvement of additional nursing staff. Future research could take the DEFERAL strategy and modify for different classes of PIMs prescribed to frail older adults residing in LTC.

Chapter 8: Discussion

8.1 Summary of findings

The aim of this thesis was to develop a theory- and stakeholder-informed implementation strategy to support deprescribing, targeting PIMs frequently prescribed to frail older adults residing in LTC to increase the safety and appropriateness of medications and to help address the research-practice gap.

Deprescribing is a widely researched area (506), with evidence demonstrating the positive clinical and medication-related benefits (100,194,507). Ample literature exists highlighting strategies to facilitate deprescribing (101,119,150,155–157,161,349). Deprescribing can increase the appropriateness of medication and is a potential solution to tackle polypharmacy and PIP; however, strategies to support deprescribing in LTC are reported to be poorly described and understood (149,218,219). Deprescribing is not happening as often as it should (93,95,96,179,483) and PIMs remain a cause of concern for LTC patients (357).

To begin the process of developing a theory- and stakeholder-informed implementation strategy to increase deprescribing, it was essential to first understand the barriers and enablers of deprescribing for frail older adults in LTC. The 'best-fit' framework method allowed for the incorporation of behavioural theory to support an in-depth literature review. The dominant factors which influenced behaviour stemmed from social and environmental contextual issues, as emphasised by the MRC framework (233). Social determinants were divided into patient and peer influences. Considering deprescribing from the patient's perspective encouraged HCPs' engagement however, reservations remained regarding possible misperceptions. Looking at the peer influence, an 'established hierarchy' was believed to exist with prescribers maintaining control, discouraging other HCPs' from engaging with deprescribing. Contrastingly, HCPs valued interprofessional social support, particularly the opportunity for MDT meetings. Lack of resources in conjunction with organisational barriers and inappropriate care models negatively impacted deprescribing.

A more detailed understanding of the context-specific deprescribing barriers and enablers in Irish LTCFs was needed. Interviews were carried out with HCPs, guided by the 'best-fit' framework for data collection and analysis. Deprescribing barriers included insufficient resources, negative social pressures and the risk of patient/representative conflict. HCPs suggested potential enablers of further deprescribing education and guidelines, tailored for frail older adults. Placing a nurse as the deprescribing lead and expanding the pharmacist's scope of practice was suggested to encourage deprescribing. Additional challenges associated with private LTCFs were identified including reduced commitment to deprescribing and LTC work. In summary, the LTC landscape in Ireland is complex. This study laid the foundation for developing a context-specific implementation strategy to support deprescribing in public LTCFs in Ireland.

To support the development of a contextually relevant deprescribing intervention, an understanding of prescribing patterns for frail older adults in Irish LTCFs was required. A medication chart review was conducted, using STOPPFrail v2 to classify PIMs. While a high rate of polypharmacy and PIM usage was expected based on the literature (58–60,508,509), this study confirmed that rates of PIMs are high among frail older adults in Irish LTCFs, demonstrating the need for deprescribing. Antihypertensives were the largest potentially inappropriate drug class prescribed; therefore, selected as the focus of the deprescribing intervention. This research produced the first insight into prescribing patterns and PIM usage for frail older adults residing in Irish LTCFs.

The qualitative and quantitative data gathered during this research, in addition to behavioural theory and implementation science, were used to design a strategy to support the implementation of deprescribing into routine practice. The implementation strategy is designed to overcome inherent barriers and build on enablers in the LTC setting. The DEFERAL strategy addressed the dominant barrier of insufficient resources in addition to insufficient experience of deprescribing, perceptions of an 'established hierarchy' and incorporated the enablers of education and MDT meetings. The selection and tailoring of the strategy was conducted by HCPs working in LTCFs utilising a modified

online Delphi and roundtable discussion. Engaging stakeholders has been shown to positively impact implementation and clinical outcomes (510–513) and is believed to result in a more feasible strategy, appropriate for the context in which it is to be implemented (512,513).

A pilot study of the theory-informed, stakeholder-designed DEFERAL strategy was performed, which targeted potentially inappropriate antihypertensive medications. The study utilised a hybrid type three design (225), a structure not yet specified in deprescribing trials. The pilot measured the implementation outcomes of acceptability, feasibility and appropriateness in addition to HCPs' fidelity to the strategy as designed, helping to inform if it is favourable to progress to a larger scale trial or if modifications are required. The DEFERAL strategy supported HCPs deprescribing antihypertensives and was deemed feasible, acceptable, and appropriate to implement in LTC with minor modifications reported.

8.2 Interpretation of findings

It is acknowledged that the LTC sector is a difficult healthcare setting in which to conduct research (514,515). The number of frail older adults has increased dramatically (36), reflected in an increased demand for LTCFs (1,4,8,9). Majority of the deprescribing research in LTC includes all older adults as the population of interest and are not focused on those living with frailty as a distinct patient cohort (101,181,183,184,186,516,517). Even though deprescribing tools suitable for use in frail older adults exist (342), they were not created using a structured design approach with incorporated theory, may not be fully reflective of LTC-specific barriers/enablers or did not consider the opinions of targeted end users in their design.

When deprescribing does occur it is often reactive, in response to a clinical trigger rather than proactive, when the risk of harm may outweigh the potential benefit (92,93). Those residing in LTC are at higher risk of the negative impact of PIP and PIMs (44,416,417), therefore this research targets an existing area of concern within a growing healthcare sector, which is currently considered to be "underserved" (518).

This thesis has shown that deprescribing can successfully be implemented by a MDT of HCPs for frail older adults residing in LTCFs, to manage inappropriate polypharmacy and reduce the prevalence of PIMs. Results from the pilot study show that the DEFERAL strategy was considered acceptable, feasible and appropriate by HCPs in LTC. The DEFERAL strategy was shown to facilitate HCPs deprescribing antihypertensive medications, which are considered PIMs in frail older adults. The DEERAL strategy is flexible and can be applied to other classes of medicines also known to be PIMs such as PPIs, statins and antipsychotics, by including drug class specific deprescribing guidelines or algorithms (397). This research compliments the immense body of deprescribing knowledge published to date, providing a method for HCPs to facilitate deprescribing, allowing frail older adults to benefit from the documented positive clinical outcomes of deprescribing in LTC (194). The MDT structure described in the DEFERAL strategy aligns with supportive deprescribing behaviours outlined by McCarthy and colleagues to consider when creating an environment to support sustainable deprescribing in LTC (424).

The methods to design the DEFERAL strategy strengthen the confidence that the designed strategy should successfully support the integration of deprescribing into routine practice. Using a theoretical approach to facilitate the selection of strategies can potentially increase the likelihood of resolving existing barriers and achieving behaviour change (513). HCPs tailored strategies to address each dominant deprescribing barrier/enabler in LTC. The tailoring of BCTs helps ensure that the nuances of the setting and concerns of different stakeholders are addressed in the design. The modified Delphi approach is increasingly being used in the design of interventions and implementation strategies targeting inappropriate prescribing (139,434,519,520). This research has definitively shown that the Delphi approach can support the development of an implementation strategy for healthcare.

The DEFERAL strategy responds to the evidence gap identified by international deprescribing researchers, who emphasise the need for implementation science to support successful, sustainable deprescribing (101,141,148,253,521–523). To date, the description of implementation strategies is poor, which limits the ability of researchers or HCPs to replicate and scale-up evidence-based interventions, influence practice and bridge the knowledge to research gap (495,524). The DEFERAL strategy has created a blueprint, to support the integration and application of principles from implementation science into future deprescribing research.

Deprescribing researchers have suggested using frameworks and theory to support the translatability of deprescribing research into practice (95). While the 'best-fit' framework is designed to consider determinants of deprescribing relating to HCPs, the framework includes barriers/enablers associated with the patient, environment and organisational structure, in addition to policy, reflecting core elements of the social-ecological deprescribing framework published by Thorpe *et al.* (525). The 'best-fit' framework considers patient, prescriber and system levels factors which influence deprescribing, as outlined by Linsky *et al.* (176). Similarly, the designed framework highlights elements of the collaborative model for a person-centred approach to deprescribing for patients living with frailty, published by Peat *et al.* (526). Considering the similarities with published frameworks, the 'best-fit'

framework can be used in future deprescribing research to investigate determinants of behaviour which occur at different social-ecological levels. The 'best-fit' framework has the added utility of being underpinned by the TDF, offering researchers a theoretical understanding of implementation barriers/enablers (211) and supporting the design of future implementation strategies.

The DEFERAL strategy has clearly outlined that an MDT approach is crucial to support deprescribing in LTC. While doctors and nurses have defined roles which form part of routine clinical care for patients residing in the LTCF, the same is not true for pharmacists. This research has highlighted the value of including a pharmacist in the MDT and has established channels of communication for pharmacists to provide defined roles and increase their engagement with clinical services in LTC in Ireland. Research investigating expansion opportunities for clinical pharmacists in LTC has shown that pharmacists can identify medication problems and that their recommendations, following a medication review, are usually accepted and led to a statistically significant reduction in the number of falls, PIMs and the number of medications (161,180,527,528). Pharmacist interventions tailored for specific drug classes similarly increased the appropriateness of prescribing (529). The inclusion of pharmacists with defined roles in the MDT structure in LTC is valued by HCPs, as evidenced from the qualitative feedback during the implementation strategy design.

Compared to other jurisdictions, the role of the pharmacist in Irish LTCFs is limited. In Australia, the government fund an on-site pharmacist in LTCFs, to improve medication safety and management (530,531). In the UK, research evaluating the impact of prescribing pharmacists in LTC have documented positive clinical and quality outcomes (532). In Ireland, research is ongoing to investigate the role and value of a general practice-based pharmacist (533,534). A potential role for a general practice-based pharmacist could be in supporting deprescribing for frail older adults as part of the MDT in the GP practice.

Reflecting on this research, its fit within the wider literature and the current structures of service provision in Ireland, this thesis offers a novel, important contribution by providing an in-depth analysis

of deprescribing within a niche healthcare setting. This doctoral thesis has assisted the transition of deprescribing research in a new direction, looking at both intervention and implementation outcomes, specifically the best strategies to support the sustainable translation of deprescribing knowledge to change routine practice. This research incorporates elements outlined by Scott and colleagues which should be considered when designing deprescribing studies to have the greatest potential patient benefit. These include consideration of barriers/enablers, utilisation of implementation science theories and frameworks, incorporating an MDT approach and providing tailored information to inform deprescribing decision-making (535).

8.3 Implications of findings for healthcare provision

8.3.1 Strategy to support deprescribing for specific drug classes/patient cohorts within LTC

The DEFERAL strategy is inherently flexible and can be used to support HCPs to deprescribe various PIMs prescribed to this cohort, by using the relevant deprescribing tools, algorithms, guides and clinical measurements where appropriate, depending on the deprescribing target. The strategy could be modified to help focus HCPs to deprescribe PIMs for a different cohort of frail older adults in LTC, such as palliative patients by including an identification step in the screening process. The STOPPFrail guidelines could be supported with tools specific for the patient cohort such as OncPal or the Good Palliative-Geriatric Practice algorithm (130,536). Both pilot sites in the DEFERAL study have sustained the strategy and continued with deprescribing MDT meetings, focusing on a new class of drug at each meeting. This suggests that the strategy is becoming mainstreamed and part of usual practice.

8.3.2 Strategy to support deprescribing in alternate LTC settings and jurisdictions

The DEFERAL strategy aims to address social and environmental barriers which have, thus far, limited HCPs' engagement with deprescribing in LTC. The implementation strategy was designed to address the most concerning barrier identified by HCPs, insufficient resources, mainly a lack of time, insufficient staffing levels and access to technology, which is echoed internationally within LTCFs (178,312,314,319). Considering the widespread nature of the barrier addressed, the DEFERAL strategy could be adapted for HCPs working in various LTC settings, including those with alternative organisational structures or within different jurisdictions. Insufficient resources are a potential obstacle which could oppose the implementation of any new evidence-based intervention in LTC. Therefore, this strategy could be adopted to support HCPs in the implementation of future interventions, focusing on reviewing medications and improving prescribing practices for LTC patients.

8.3.3 Strategy to support interprofessional collaboration and communication for medication reviews/quality improvement interventions in LTC

In addition to insufficient resources, the DEFERAL implementation strategy is designed to address the social barrier of an 'established hierarchy'. Social influence has been identified as an important factor to consider for interventions which aim to improve quality. Fulop and Robert note that most social

factors which affect success rates of quality improvement interventions occur at the 'meso' or organisation level, encompassing "leadership, cultures, climate, organisational experience... organisational size, financial and clinical performance, data and information systems, knowledge and training" (537). The workflow described in the DEFERAL strategy clearly identifies the contribution of each HCP in deprescribing PIMs, ascertaining leaders of the initiative, aiming to create a culture of deprescribing, assigning responsibility and incorporating an educational element to help overcome social barriers and the "hierarchical culture", which HCPs perceive to exist in LTC (538). Interprofessional collaboration is a determinant of deprescribing behaviour which is considered more important than the organisational structure of LTC (455). The DEFERAL workflow outlines the steps of interprofessional collaboration before and during the deprescribing review meeting. By following the organisational structure created in DEFERAL, HCPs could use these channels of communication for various quality improvement interventions in LTC which require a MDT approach.

8.3.4 Strategy to support the integration of pharmacists into routine practice in LTC

Similar to research conducted in primary care in the UK, HCPs in Irish LTCFs prioritised a team-based approach to deprescribing, with clear differentiation of roles and responsibilities (85). Teamwork is reported to support proactive deprescribing (539), with an MDT approach required to support successful and sustainable implementation of deprescribing (540). Accounting for the existing evidence documenting the perceived benefit of incorporating pharmacist services in LTC (161,180,527,528), this thesis has created a specific structure and workflow to support pharmacists to routinely and sustainably engage in clinical services in LTC and increase the safety and appropriateness of medicines prescribed.

8.3.5 Identification of targets for future deprescribing interventions

The retrospective chart review study identified opportunities for improvement in prescribing practices. The review highlighted areas of prescribing which HCPs could improve to bring prescriptions in line with the best available evidence. Findings highlighted that a 'lack of clear indication' for prescribed medications was a clear issue, suggesting the need to improve the documentation of

prescribing indications on patients' drug charts. This could in turn support medication safety and appropriateness, helping HCPs to identify medications without an indication as deprescribing targets (541). The review highlighted drugs/drugs classes which were frequently prescribed and may be potentially inappropriate in the patient cohort, providing HCPs with a drug class to target for future deprescribing interventions using the DEFERAL strategy.

8.3.6 Strategy to structure mandatory medication reviews in LTC

The DEFERAL strategy has created a structure for conducting medication reviews focusing on deprescribing for a single drug class in LTC. The DEFERAL strategy could be adjusted, to conduct a holistic medication review in line with current HIQA standards (12). The Pharmaceutical Society of Ireland state that "pharmacists should make themselves available to participate in the interdisciplinary review of each patient on long-term medication, at least on a three monthly basis" (400), however no formal structure exists to support this role. Policy makers could consider the strategy designed in this doctoral thesis to provide structure and guidance to HCPs conducting the required medication reviews for older adults residing in LTC.

8.3.7 Contextual understanding of Irish LTCFs

The 'best-fit' framework and qualitative study investigating barriers/enablers of deprescribing in LTC can be incorporated into future policy or guideline development regarding the implementation of deprescribing interventions in LTCF. This research offers policy makers, guideline developers and management of LTCFs a unique insight and understanding of the experiences and opinions HCPs have with regard to deprescribing within the current LTCF setting. These findings could provide decision-makers with a more detailed understanding of HCPs' experience which could be incorporated when deciding on change or creating new procedures. For example, a baseline audit of prescribing might be advised/mandated for each LTCF to identify the most prevalent PIMs to focus deprescribing efforts, considering the limited resources of time, staffing and information technology. Similarly, guidelines or policies may specify the roles and responsibilities designated to each HCP in the MDT to address social concerns.

8.4 Opportunities for future research

8.4.1 Method to facilitate behavioural and implementation science to support future deprescribing research

The methods used to design the implementation strategy provide a blueprint for future researchers to facilitate the integration of theory, implementation science and targeted end-users to develop a strategy which addresses determinants of HCPs' behaviour. Underpinning the DEFERAL strategy design with behavioural change theory, mapping barriers/enablers to intervention types and BCTs, allows future researchers to understand which BCTs were included in the strategy and the associated determinants of behaviour. Depending on individual contexts, these strategies can be selected and incorporated into future LTC interventions, aimed at changing prescribing practices. The psychometrically validated implementation outcome measures used in this study (486), could be replicated in future deprescribing research to help identify if the strategy chosen for deprescribing PIMs in the population and context of interest is sustainable beyond the trial. The methods used in this study can be replicated to design a theory- and stakeholder-informed implementation strategy to support deprescribing in any context.

8.4.2 Develop, test and refine the recruitment process

The DEFERAL pilot study followed a hybrid type three design and was piloted in two LTCFs. This strategy would require further testing, initially a larger scale feasibility pilot, aiming to recruit a larger number of public LTCFs from a greater geographical location, followed by a pilot RCT. Prior to expansion to a large scale RCT, further research is required to develop, test and refine the recruitment process to recruit GPs and LTCFs who do not have an existing professional relationship with the research team.

8.4.3 Change in trial design to focus on clinical outcomes

As a result of HCPs engaging with the DEFERAL strategy, informed deprescribing decisions are made. Reporting on the clinical outcomes of deprescribing decision-making could help to further advance the deprescribing literature and promote deprescribing. Future research using the DEFERAL strategy should consider reporting on clinical outcomes to maximise research output. This would require a

change in trial design from hybrid type three to hybrid type two, which places equal focus on both implementation and clinical outcomes (225).

8.4.4 Definition of modifications

The follow-up survey collecting information on implementation outcomes could be enhanced in future research by incorporating FRAME-IS, a tool for documenting modifications to implementation strategies (499). As outlined by Pinnock *et al.*, future research could focus on specifying the core components for which complete fidelity is expected and identifying those which may be adapted to facilitate implementation. Defining modifications as either active innovations, passive changes or active subversions could also be included in future research to understand end-user engagement with the implementation mechanism (496).

8.4.5 Patient involvement in shared deprescribing decision-making

Considering the importance of patient engagement, shared decision-making and person-centred deprescribing (526,541–543), future research should consider how care goals of patients and/or their representative can be incorporated into the DEFERAL strategy. Patients' beliefs and attitudes can influence the success of a deprescribing intervention (321,544), therefore involving patients in shared decision-making and providing support is considered important for future research (141,221,543), Patients are generally willing to have their medication deprescribed if recommended by a doctor (545,546), which is true for frail older adults and LTC patients (547,548). A recent study which included a patient/representative approval stage for deprescribing decision-making resulted in sustained reductions in the number of prescribed medications (507). Incorporating patients' preferences and care goals could help to prioritise deprescribing targets and increase the likelihood of deprescribing success (549,550). McCarthy *et al.* investigated the association between patients' deprescribing attitudes and subsequent prescription changes which concluded if a patient confirmed they were willing to stop a medication, this was associated with higher rate of deprescribing success (551).

To increase patient involvement future adaptations of the DEFERAL strategy could include patients/representatives in the pre-MDT educational element, highlighting the risks/benefits of

deprescribing. Alternatively, the screening process could be streamlined by removing potentially eligible patients who are unwilling or have a negative history of deprescribing. Shared decision-making could be achieved by involving patients/representatives in a deprescribing conversation, as an additional step following the MDT deprescribing meeting, providing them with a risk/benefit analysis of medications and an opportunity to express their opinions (552,553). The impact of patient involvement could be analysed by including an additional arm of the implementation strategy in an RCT for comparison. To determine the most appropriate method to include patient/representative in the DEFERAL strategy an additional roundtable with patients/representatives could be conducted. Although patients/representatives are not the targeted end-users of the deprescribing strategy, they are central to the patient-centred element of deprescribing. Their inclusion during the design phase could facilitate the fundamental consideration of this stakeholder group.

8.4.6 Core outcome set for deprescribing research for frail older adults residing in LTC

Further opportunities to advance deprescribing research for frail older adults residing in LTC could include developing a core outcome set (COS). A COS is an agreed, minimum collection of standardised outcomes which should be measured and reported for all investigations in a particular area (554). A COS is perceived to allow for higher quality studies, facilitate comparison of results and reduce research waste (555). Researchers have published general outcomes to consider for deprescribing studies (556), a COS for deprescribing in older, hospitalised adults under the care of a geriatrician (557) and a COS for trials which aim to optimise prescribing in care homes (558). To date, a COS has not been developed for deprescribing trials involving frail older adults residing in LTC. A COS could allow for consistency and mitigate against potential bias in the reporting of clinical effectiveness. An additional future direction for this research would be to augment the COS created by Millar and colleagues (558), tailoring for deprescribing and frailty, using stakeholder engagement to facilitate the process.

8.4.7 Understanding of additional deprescribing barriers which exist in private LTCFs in Ireland

This study identified additional challenges which exist in the private LTCFs which may require consideration if researching or designing a strategy for this setting. To support the expansion of the DEFERAL strategy into the private LTC sector, the strategy would require adaptation to address the organisational differences between sectors, an important variation being the lack of a MDT and medical officer role in the private sector. Including HCPs working with private LTC settings in the roundtable discussion would facilitate the selection and tailoring of BCTs to address the most prevalent barrier(s)/enabler(s) which exist in private settings. This could facilitate the adaptation of the strategy to cater for the largest provider of LTC in Ireland, potentially increasing the public health impact. This strategy would require further feasibility testing considering the variation in structure which is reported in private LTCFs (14). To the best of our knowledge, this is the first piece of deprescribing research investigating the difference of opinions between HCPs working in both public and private LTC settings.

8.4.8 Impact of organisational structures on memantine and antipsychotic prescribing

As identified by Reeve and colleagues, pharmacoepidemiology allows researchers to identify and understand the largest drug classes potentially inappropriately prescribed, investigating if associations or correlations exist with any demographic factors (95), allowing for the tailoring of future deprescribing strategies and increasing the likelihood of success.

This study identified a difference in the levels of potentially inappropriate memantine and neuroleptic antipsychotics prescribing in dementia patients between the two LTC sites. The site which operated a specialised dementia unit had lower levels of antipsychotic and memantine prescribing than the site which did not. Deprescribing inappropriate antipsychotics and memantine can potentially relieve patients of the associated adverse effects, improving quality of life and reducing medication burden (411,559). This finding supports the value of such social and environmental interventions in reducing inappropriate prescribing of specific medications. This difference could invite an opportunity for further research, investigating which factors specifically help HCPs manage residents non-

pharmacologically and contribute to a lower level of inappropriate prescribing, as identified in this setting.

8.4.9 Cost-utility analysis

The literature calls for future deprescribing research to include a cost-effectiveness analysis in addition to reporting on clinical outcomes (141,560). Pharmacoeconomic evaluations provide evidence on the value of deprescribing, by documenting healthcare utilisation and intervention costs. This data could potentially influence policy makers to fund deprescribing research and augment policy to facilitate the implementation of deprescribing into routine practice. This could be conducted by estimating cost-utility analysis measuring intervention costs versus usual care and quality adjusted life years, measured using patient questionnaires such as the EuroQol EQ-5D-5L (561).

8.5 Strengths and limitations

The aim of this doctoral thesis was the develop and pilot an evidence- and theory-based implementation strategy. To reach the thesis aim, five objectives were outlined and addressed in Chapter 3-7 where study-specific strengths and limitations are reported. A strength of this overall research stems from the application of the MRC framework on the design and evaluation of complex interventions to structure the project, specifically the phases of intervention development/identification and feasibility (233). Key concepts of this framework which were applied to each phase included understanding context, key uncertainties, engaging stakeholders and refining the intervention. Consideration of context and stakeholder perspectives allowed for the inclusion of social, environmental, organisational and economic factors in the design of the implementation strategy. Meaningful engagement with a diverse range of stakeholders was achieved at all decision-making points of the research, maximising the potential of developing a strategy which will have a positive impact on changing HCP behaviour (219). The MRC framework supported the inclusion of behavioural theory, which was used to understanding the structural and psychological processes which are perceived to regulate behaviour and the key mechanisms by which change is believed to occur (211,422).

The robust methods used to design the DEFERAL strategy, incorporating behavioural and implementation science, strengthens this doctoral research. Rather than trialling a researcher-designed 'medication cessation' intervention, attentive only to clinical outcomes, this study created a theory-informed strategy targeting behaviours considered to influence deprescribing, incorporating targeted end-users at all major design decision points while considering implementation outcomes.

The methods used to develop existing tools to support deprescribing for frail older adults are poorly described in the literature (342). The detailed reporting of contextual factors, application of theory, selection of BCTs and methods to tailor the final strategy offered in this thesis is a strength of the research. Trials which aim to change practice are believed to be more effective if based on principles of behaviour change (210). Incorporating the TDF and BCW facilitates the clear progression from theory to strategy design. This will allow for these methods to be replicated and can facilitate the utilisation of the DEFERAL strategy in further research, allowing it to be adapted for different LTC organisational structures, healthcare settings, or drug classes.

Including HCPs as key decision makers in all phases of strategy design allows the inclusion of the necessary contextual insight through a partnership between the targeted end-users of the strategy, being the experts in the organisational, and structural determinants, and researchers, utilising theory and the qualitative evidence to design the strategy (96). Stakeholder involvement helps to maximise the possibility of changing practice (233). Incorporating HCPs in the design process will help to ensure that strategy is considered acceptable, feasible and appropriate for the setting, supporting its implementation.

Adopting an implementation science lens is thought to support the synthesis of findings across deprescribing research, inform the selection of contextually relevant implementation strategies and progress the field of deprescribing research (140). A strength of this research is the consideration of implementation outcomes which serve as proxies for implementation success (428). These can be

used to identify areas for further refinement and predict the likelihood of integration of the DEFERAL strategy into routine practice.

The early stages of this research were conducted during the COVID-19 pandemic, where strict infection control measures were in place to protect our vulnerable populations, including those residing in LTC. As a result, the majority of the research was conducted online to mitigate the potential transmission of disease. While this may have altered original research plans, this allowed for both national and international representation without the need to travel. The methods used are accessible, time saving, low cost and transferable for other healthcare settings/procedures which would require expert consensus and tailoring of implementation strategies. The use of technology may have deterred potential participants from engaging in the research, possibly due to technical issues, planning, privacy and rapport (368).

An understanding exists that both HCP and patient behaviour are required to change, to facilitate proactive deprescribing (209). This research focused on developing an implementation strategy only targeting HCPs' deprescribing behaviour as deprescribing is considered to be a HCP activity (260), with environmental and social factors being major influences on HCPs' engagement (258). While not including patients/representatives in the strategy may be seen as a limitation, the importance of incorporating patients' goals and values was not overlooked by the researcher (541,562). Instead, we wanted to target HCPs as the main stakeholder as without their engagement, changes to prescribing could not occur. Frail, multimorbid older adults and older adults residing in LTC are reported to consider deprescribing only if recommended by their doctor (547,548). Therefore, the decision was made to first focus on HCPs' deprescribing engagement, but future research could consider how to integrate the patient's voice into the DEFERAL strategy.

HCPs report that older adults with limited life expectancy can challenge deprescribing inherently, as they approach end-of-life, potentially experience cognitive impairment and may insist on treatment continuation (563). Whilst considering that LTC patients are key stakeholders in the deprescribing

process, they may themselves be associated with a distinct set of deprescribing barriers. Considering HCPs working in the Irish LTCFs did not consider patients/representatives to be dominant deprescribing barriers (401), the final implementation strategy did not incorporate patients in the structure. Within the designed DEFERAL strategy, nurses could provide the patient advocate role communicating the views of the patient, as qualitative research identified nurses to be the communication link between HCPs and the patient (362,401). The ultimate ability to deprescribe remains with the prescriber, therefore the focus of this research was to target deprescribing barriers and enablers as perceived by HCPs working in the LTC setting.

8.6 Conclusion

This thesis hypothesised that deprescribing can successfully be implemented by HCPs for frail older adults residing in LTCFs, to manage inappropriate polypharmacy and reduce the prevalence of PIMs. To test this hypothesis, this doctoral research aimed to develop and pilot an evidence- and theory-based implementation strategy to support a deprescribing intervention targeting a PIM frequently prescribed to the population of interest.

Core elements of the MRC framework which guided this research were consideration of context, identifying key uncertainties and stakeholder engagement. This research utilised behavioural theory and implementation science to understand the determinants of deprescribing behaviour and identify associated implementation strategies. Feasible strategies were selected and tailored by HCPs to form an implementation strategy. The DEFERAL strategy is cognisant of existing LTC workflow and is designed to overcome the most important barrier limiting HCP engagement with deprescribing, insufficient resources of time, staff and IT support. The DEFERAL strategy was considered feasible, acceptable and appropriate by HCPs as a way to support deprescribing for frail older adults residing in public LTCFs in Ireland.

The DEFERAL strategy assisted the MDT to identify patients who may benefit from deprescribing antihypertensive medications and successfully supported HCPs to engage with deprescribing potentially inappropriate antihypertensive medications prescribed to frail older adults.

Chapter 9: Courses undertaken during PhD studies

9.1 University College Cork

9.1.1 PG6001 – 5 credits

STEPS – Scientific Training for Enhanced Postgraduate Studies

An introduction to principles and practice of scientific research, particularly through focussing on scientific writing and presentation skills.

9.1.2 PG6024 – 5 credits

Qualitative Research

An education on how to critically engage in philosophical and methodological debates around qualitative inquiry and how to develop knowledge and skills in the application of qualitative research methods.

9.1.3 ST6013 – 10 credits

Statistics and Data Analysis for Postgraduate Research Students

An introduction to the statistical methods relevant to data analysis and practical applications of these methods.

9.2 International Behavioural Trials Network

9.2.1 Summer School 2021.

An academic programme designed to: identify challenges in conducting behavioural trials, explore new methodologies and expand the reach, capacity, and impact of behavioural interventions

9.3 Health Research Board- Trials Methodology Research Network

9.3.1 Using the Person Based Approach to plan and develop healthcare interventions.

9.4 Evidence Synthesis Ireland and Cochrane Ireland

9.4.1 'Using GRADE-CERQual Approach in Qualitative Evidence Synthesis Online Training'

9.5 Epigeum

9.5.1 Research Integrity – Social and Behavioural Sciences

9.6 Irish Implementation Science Training Institute

9.6.1 CPD1778 Implementation Science Training March – July 2022

9.7 DMC The Learning Experts

9.7.1 Facilitation Skills Training, October 2022

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Appendices

Appendix 1: Search strategy using SPICE framework

Setting	Perspective	Interest, Phenomenon of	Comparison	Evaluation
"long term care home*" OR "residential aged care facilit*" OR "care home*" OR "nursing home*" OR "aged care facilit*" OR "skilled nursing facilit*" OR "residential care") older adult* OR aged OR elder* OR "over 65" OR geriatric* OR senior*	doctor* OR GP* OR "general practitioner*" OR practitioner* OR physician* OR pharmacist* OR pharmacy OR nurs* OR "healthcare professional*" Qualitative OR "mixed method*" OR "focus group*" OR interview* OR observation* OR "conversation analysis" OR "action research"	Deprescrib* OR de-prescrib* OR deprescription* OR (reducing medication*) OR (withdrawal medication) OR (cessation medication) OR (cease medication) OR (stop* medication) OR (discontinue* medication) OR "medication review" OR "medicine review" OR "potentially inappropriate medic*" OR "appropriate use of medic*" OR "reducing inappropriate medication*"	N/A	barrier* OR facilitator* OR challenge* OR enabler* OR thought* OR opinion* OR belief* OR attitude* OR experience* OR perception* OR insight* OR perspective* OR view OR implement* OR intervention OR policy OR policies

Appendix 2: Inclusion and Exclusion Criteria

Inclusion Criteria
• Thoughts/opinions/barriers/enablers perceived by HCPs toward deprescribing for adults/older adults in LTCF. • Primary qualitative research with qualitative data collection and analysis methods. • Mixed methods studies were only included if they utilise recognised qualitative research methods as a component of the study. For these, only the aspects which had been analysed using qualitative methods were included. • HCPs of interest: medical practitioners, nurses, and nursing staff (nursing assistants), social workers, carers and care service employees and pharmacists, all who provide care for LTCF residents. • Full-text and English text availability. • Appropriate grey literature
Exclusion Criteria
• Thoughts/opinions/barriers/enablers perceived by HCPs toward deprescribing in adults/older adults delivered outside of LTCF or equivalent. • Residents/relatives of residents' perceptions of and/or perceived barriers and enablers to deprescribing. • The opinions of HCPs not directly involved in the care of older adults in LTCF or equivalent. • Investigating barriers towards deprescribing in palliative care (an approach that improves the quality of life of patients facing problems associated with life-threatening illness)/last 3 months of life care/cancer patient care. • Healthcare students' perspectives. • HCP thoughts and attitudes toward deprescribing in LTCF following educational interventions. • Quantitative data exclusively: Questionnaire (Patients Attitude Toward Deprescribing (PATD)/revised PATD)/Survey.

Appendix 3: Abstract screening

Author (Year)	Title	Deprescribing focus in LTCF setting. (Excluding palliative setting, last 3 months of life, primary or secondary care, educational interventions, cancer care)	Qualitative study design. (Focus groups, interviews, open ended questions/free text from questionnaires)	Healthcare worker: medical practitioners; nurses and nursing staff: nursing assistants pharmacists: community or on-site (all who provide care for LTCF residents)	Selected for full text screen (Yes/No)	Inclusion (Yes/No)
Mills et al. (2001)	Pharmacist medication review decreased death, and number and cost of drugs prescribed for residents in nursing homes.	Yes	RCT	No	No	> 2 reasons
Abdulla et al. (2020)	Deprescribing: Barriers, Benefits, and Harms	Yes deprescribing. Not specified LTCF	Unclear what their design is, not specified.	Not specified	Yes	No – review article
Aerts et al. (2019)	Why deprescribing antipsychotics in older people with dementia in long-term care is not always successful: Insights from the HALT study	Yes, deprescribing and LTCF	Yes - questionnaire with open-ended questions	Nursing staff, general practitioner	Yes	Yes
Ahmad Nizaruddin et al. (2017)	A qualitative study exploring issues related to medication management in residential aged care facilities.	Not deprescribing – medication management	Yes, interviews.	Yes, 'health care providers'	No	Not Deprescribing
Ailabouni et al. (2016)	Challenges and Enablers of Deprescribing: A General Practitioner Perspective.	Yes	Yes	Yes - GP	Yes	Yes
Ailabouni et al. (2017)	Do Residents Need All Their Medications? A Cross-Sectional Survey of RNs' Views on Deprescribing and the Role of Clinical Pharmacists	Yes, deprescribing and LTCF	Yes – questionnaire with open-ended questions	Nurses	Yes	No – opened ended questions not analysed qualitatively

Almutairi et al. (2018)	The health professional experience of using antipsychotic medication for dementia in care homes: A study using grounded theory and focussing on inappropriate prescribing.	Not deprescribing focused – investigating PIP of antipsychotics	Yes, Interviews	Unclear participants from eight 'professional groups'	No	> 2 reasons
Al Rasheed et al. (2018)	Knowledge and willingness of physicians about deprescribing among older patients: a qualitative study	Yes deprescribing, Unclear if LTCF	Yes	Physicians	Yes	No – not LTCF
Alves et al. (2016)	Deprescribing of medicines in care homes - Primary care pharmacists' practices and perspectives.	Yes	Yes	Yes	Yes	No - full-text was not available
Andrew et al. (2018)	Polypharmacy and use of potentially inappropriate medications in long-term care facilities: does coordinated primary care make a difference?	No, Investigating rates of PIM	Not qualitative-observational study	No	No	> 2 reasons
Avraham and Biglow (2018)	Implementation of Proton Pump Inhibitor Deprescription Protocol in Geriatric Residents.	Yes	No qualitative	No	No	> 2 reasons
Banerjee et al. (2018)	Nursing Home Physicians Discuss Caring for Elderly Residents: An Exploratory Study.	Unclear, mentioned 'working to reduced unnecessary medications'	Yes, interviews	Yes, physicians	Yes	No – not deprescribing
Barnett and Garfinkel (2018)	Deprescribing one year on: Challenging the first iatrogenic epidemic	Yes	Not qualitative - article	No	No	> 2 reasons
Bolmsjö et al. (2015)	"It is meaningful; I feel that I can make a difference" -A qualitative study about GPs'	Not deprescribing focused GP experiences of working	Yes	Yes - GPs	No	Not Deprescribing

	experiences of work at nursing homes in Sweden	with elderly in NHs in Sweden.. Yes LTCF focused				
Bolton et al. (2020)	The barriers and facilitators to stopping inappropriate medicines ('deprescribing') for older people living in care homes	Yes, deprescribing and LTCF	Yes – semi structured interviews	Yes – residents, relatives, care home staff, GPs and pharmacists	Yes	Yes
Bolmsjö et al. (2016)	Factors influencing deprescribing for residents in Advanced Care Facilities: insights from General Practitioners in Australia and Sweden.	Yes	Yes	Yes - GPs	Yes	Yes
Bredhold et al. (2020)	Deprescribing opportunities for elderly inpatients in an academic, safety-net health system	Yes, deprescribing. Not LTCF	No	No	No	> 2 reasons
Cateau et al. (2018)	Opportunities and limits to deprescribing in nursing homes (OLD-NH)	Yes , but published as foley (2020).	Yes , but published as foley (2020).	Yes , but published as foley (2020).	Conference abstract no full paper	Not LTCF
Chen et al. (2012)	Evaluation of potentially inappropriate medications among older residents of Malaysian nursing homes.	Deprescribing – utilising STOPP tool	Not qualitative	No	No	> 2 reasons
Chenoweth et al. (2018)	Critical Contextual Elements in Facilitating and Achieving Success with a Person-Centred Care Intervention to Support Antipsychotic Deprescribing for Older People in Long-Term Care.	Educational intervention – questionnaire before and after Interview based on findings from implementing person based approach	Yes, open ended questionnaires/semi structured interviews.	Unclear, 'HALT champions'.	Yes	No – educational intervention
Clough et al. (2019)	Health professionals' and researchers' opinions on conducting clinical deprescribing trials	Yes, deprescribing. Not LTCF	Unclear, not stated if survey has an open comment section.	Yes, health professionals.	No	Not LTCF

Cooper et al. (2019)	Mental health professionals' views and experiences of antipsychotic reduction and discontinuation	Not LTCF	Yes – focus groups	Yes	No	Not LTCF
Crowe et al. (2020)	Deprescribing in chronic disease: perspectives of nurse prescribers	Yes deprescribing. Not LTCF	Yes	Yes - nurse	No	Not LTCF
Crutzen et al. (2020)	Barriers and Enablers of Older Patients to Deprescribing of Cardiometabolic Medication: A Focus Group Study	Yes, deprescribing. Not LTCF	Yes – focus groups	No - patients	No	Not LTCF
Cullinan et al. (2017)	Challenges of deprescribing in the multimorbid patient	Yes deprescribing. LTCF? – unsure	Not specified	Not clear	No	> 2 reasons
D'Avanzo et al. (2020)	Views of medical practitioners about deprescribing in older adults: Findings from an Italian qualitative study	Yes deprescribing. Not LTCF specific.	Yes – focus groups	Yes	No	Not LTCF
Delgado-YSilveira et al. (2018)	Pharmacist comprehensive review of treatment compared with STOPP-START criteria to detect potentially inappropriate prescription in older complex patients	Yes – START/STOPP	Not qualitative - Observational study	No	No	> 2 reasons
Diggins et al. (2019)	Deprescribing: Polypharmacy management in older adults with comorbidities	Yes – deprescribing. LTCF? Not specific.	Not specified	Not specified	No	> 2 reasons
Disalvo et al. (2019)	Pharmacists' perspectives on medication reviews for long-term care residents with advanced dementia: a qualitative study	Yes – medication review facilitating deprescribing	Yes	Yes - pharmacist	Yes	Yes
Djatche et al. (2018)	How confident are physicians in deprescribing for the elderly and what barriers prevent deprescribing?	Yes, deprescribing. Not LTCF	No - survey	Yes – physicians	No	> 2 reasons

Djatche et al. (2017)	How Can We Effectively Engage Physicians in the Deprescribing Process?	Yes deprescribing. Not LTCF	No – review.		No	> 2 reasons
Roughead et al. (2003)	Quality use of medicines in aged-care facilities in Australia.	No, 'Quality use'	No, opinion piece	No, opinion piece	No	> 2 reasons
Ellis et al. (2015)	Assessing approaches and barriers to reduce antipsychotic drug use in Florida nursing homes.	Yes -medication review to facilitate deprescribing	Yes – open ended questionnaire	Yes – LTCF staff	Yes	Yes
Elmo et al. (2010)	Inappropriate drug prescription in elderly nursing home residents	No – incidence of PIP	Not qualitative	No, review article	No	> 2 reasons
Evrard et al. (2020)	Benzodiazepine Use and Deprescribing in Belgian Nursing Homes: Results from the COME-ON Study.	Yes	Not qualitative, cluster controlled trial to evaluate use of BZDs and factors associated with use and deprescribing.	No, cluster controlled trial to evaluate use of BZDs and factors associated with use and deprescribing.	No	> 2 reasons
Fischer et al. (2011)	Better use of medicines: Using clinical pharmacy for empowerment of nursing homes, implementing safe medication	No deprescribing focused	Not qualitative	Yes LTCF staff	No	> 2 reasons
Foley et al. (2020)	Physicians', Nurses' and Pharmacists' Perceptions of Determinants to Deprescribing in Nursing Homes Considering Three Levels of Action: A Qualitative Study.	Yes	Yes – semi structured interviews	Yes	Yes	Yes
Granas et al. (2018)	Deprescribing for frail older people - Learning from the case of Mrs. Hansen.	Yes, Mrs. Hansen is a residential nursing home resident.	Not qualitative – case study	No	No	> 2 reasons
Green et al. (2019)	Clinicians' Perspectives on Barriers and Enablers of	Not LTCF	Yes - interviews	Yes - physicians	No	Not LTCF

	Optimal Prescribing in Patients with Dementia and Coexisting Conditions					
Gupta et al. (1996)	Inappropriate drug prescribing and related outcomes for elderly medicaid beneficiaries residing in nursing homes.	Not deprescribing	Not qualitative	No	No	> 2 reasons
Halvorsen et al. (2011)	A qualitative study of physicians' and nurses' experiences of multidisciplinary collaboration with pharmacists participating at case conferences.	Not deprescribing focused	Yes - interview	Yes – physicians and nurses	No	Not Deprescribing
Harrison et al. (2019)	Approaches to Deprescribing Psychotropic Medications for Changed Behaviours in Long-Term Care Residents Living with Dementia	Yes – deprescribing. Yes – LTCF	No – narrative review	No – narrative review	No	Not qualitative
Henderson et al. (2016)	Nurses' perceptions of the impact of the aged care reform on services for residents in multi-purpose services and residential aged care facilities in rural Australia.	Not deprescribing focused	Yes - interview	Yes nurses	No	Not Deprescribing
Kennie-Kaulbach et al. (2020)	Influencers on deprescribing practice of primary healthcare providers in Nova Scotia: An examination using behavior change frameworks	Yes – deprescribing. Not LTCF.	Yes – interviews and focus group	Yes	No	Not LTCF
Kua et al. (2019)	Perspectives of health professionals towards deprescribing practice in Asian nursing homes: A qualitative interview study	Yes	Yes - interview	Yes	Yes	Yes
Kwak et al. (2019)	Perspectives of Non-Pharmacy Professionals in Long-Term	No deprescribing focused – medication management	Yes - interview	Yes – non pharmacy professionals	No	Not Deprescribing

	Care Facilities on Pharmacist-Involved Medication Management in South Korea: A Qualitative Study					
Langford et al. (2020)	Challenges of opioid deprescribing and factors to be considered in the development of opioid deprescribing guidelines: a qualitative analysis	Yes – deprescribing. Not LTCF	Yes – focus groups	Yes	No	Not LTCF
Lavan et al. (2018)	Adverse drug reactions and targets for deprescribing in high risk older adults	Yes – deprescribing. Not LTCF	No	No	No	> 2 reasons
Leten et al. (2017)	[A qualitative exploration of the chronic use of psychotropic drugs in nursing homes].	Yes – deprescribing. Yes LTCF	Yes - interviews	Yes	No Full-text available in Dutch	No full-text
Lüscher et al. (2020)	A survey on what pharmacists and physicians caring for nursing home residents expect of user-friendly lists of potentially inappropriate prescribing (PIP lists).	PIP medication focus – not deprescribing. Not investigating barriers/facilitators to increasing deprescribing implementation in LTCF	Yes - interview	Yes, physician and pharmacist	No	Not Deprescribing
Malek Makan et al. (2017)	Prevalence of Preventive Cardiovascular Medication Use In Nursing Home Residents. Room for Deprescribing? The SHELTER Study	Not focused on thought/opinions regarding deprescribing – focused on classes of cardiovascular medications	No	No	No	> 2 reasons
Mantelli et al. (2018)	How general practitioners would deprescribe in frail oldest-old with polypharmacy — the LESS study	Deprescribing – yes. LTCF - no	Yes - Online survey with open ended response	Yes GPs	No	Not LTCF
McDerby et al. (2020)	Canaries in the coalmine: Stakeholder perspectives of medication management	No – focus more on the organisational culture and appropriateness of the	Yes – open ended text of questionnaires	Yes	Yes	No – not deprescribing more

	reviews for residents with dementia.	current medication review system in the country.				medication management
McDerby et al. (2020)	The role of a residential aged care pharmacist: Findings from a pilot study.	No	Not qualitative	Yes - pharmacist	No	> 2 reasons
Nadarajan et al. (2018)	The attitudes and beliefs of doctors towards deprescribing medications	Yes – deprescribing. Not LTCF	Not qualitative – survey	Yes	No	> 2 reasons
O' Mahony (2018)	Discontinuation of Long-term Medications in Older People Entering Nursing Home Care	Yes	Not qualitative	no	No	Not qualitative
Nishtala et al. (2011)	A retrospective study of drug-related problems in Australian aged care homes: Medication reviews involving pharmacists and general practitioners	Not deprescribing – drug related problems	Not qualitative – retrospective study	No	No	> 2 reasons
Niznik et al. (2019)	Factors Associated With Deprescribing Acetylcholinesterase Inhibitors in Older Nursing Home Residents With Severe Dementia	Yes – deprescribing. Yes - LTCF	Not qualitative	No	No	Not qualitative
Page et al. (2018)	A concept analysis of deprescribing medications in older people	Yes – deprescribing. No – not LTCF	Not qualitative	No	No	Not qualitative
Palagyi et al. (2016)	Barricades and brickwalls - a qualitative study exploring perceptions of medication use and deprescribing in long-term care	Yes	Yes – focus groups and interviews	Yes – GPs, pharmacists, nursing staff	Yes	Yes
Pammett et al. (2017)	Applying STOPP/START criteria to elderly patients in the primary care home	Yes	Not qualitative – retrospective observational study	No	No	Not qualitative
Paque et al. (2019)	Balancing medication use in nursing home residents with life-limiting disease.	Yes	Not qualitative	No	No	Not qualitative

Parsons et al. (2012)	Potentially Inappropriate Prescribing in Older People with Dementia in Care Homes.	PIP using the STOPP criteria	Not qualitative – retrospective analysis	No	No	> 2 reasons
Peretti et al. (2018)	Barriers and Facilitators Associated with Antipsychotic Deprescribing for Individuals with Dementia Residing in Long-Term Care as Reported by Physicians: A Mixed Methods Study	Yes – deprescribing. Yes – LTCF.	Mixed methods study. Interview.	Physicians	Yes	Yes
Poudel et al. (2015)	Geriatrician interventions on medication prescribing for frail older people in residential aged care facilities.	No, medication changes recommended by geriatricians, focus not deprescribing.	Not qualitative – prospective observational study	No	No	> 2 reasons
Pruskowski and Handler (2017)	The perceived utility of deprescribing in the nursing home setting	Yes	Survey – no open-ended free test options	Yes	No	Not qualitative
Pruskowski et al. (2018)	Perceptions of Nursing Facility Providers on the Utility of Deprescribing	Think this is the full text and above is a conference abstract?	Think this is the full text and above is a conference abstract?	Think this is the full text and above is a conference abstract?	No	Not qualitative
Ruggiero et al. (2009)	Inappropriate Drug Prescriptions among Older Nursing Home Residents The Italian Perspective	Potentially inappropriate drug prescriptions	Not qualitative	No	No	> 2 reasons
Ryota et al. (2018)	Outcomes of pharmacists' involvement with residents of special nursing homes for the elderly	Pharmacist involvement in NH	Not qualitative	No	No	> 2 reasons
Sawan et al. (2016)	A qualitative study exploring visible components of organizational culture: what influences the use of psychotropic medicines in nursing homes?	Not deprescribing – psychotropic medication use	Yes	Yes	No	Not Deprescribing
Sawan et al. (2020)	Perspectives of residential aged care facilities' staff on	Not deprescribing focused	Yes	Yes	No	Not Deprescribing

	the identification and recording of residents' medication-related goals of care.					
Sawan et al. (2016)	A qualitative study exploring visible components of organizational culture: what influences the use of psychotropic medicines in nursing homes?	LTCF focused Focused on organisational culture not deprescribing	Yes	Yes	No	Not Deprescribing
Scott et al. (2015)	Reducing Inappropriate Polypharmacy The Process of Deprescribing	Yes	Not qualitative	No	No	Not qualitative
Silva et al. (2015)	Drug-related problems in institutionalized, polymedicated elderly patients: opportunities for pharmacist intervention.	Not deprescribing focused – need for pharmaceutical care for the polymedicated elderly in NH	Not qualitative	No	No	> 2 reasons
Simmons et al. (2018)	Reducing Antipsychotic Medication Use in Nursing Homes: A Qualitative Study of Nursing Staff Perceptions.	Yes – reducing antipsychotic use - deprescribing	Yes	Yes	Yes	Yes
Smith et al. (2019)	Person-Centred Care Including Deprescribing for Older People	Deprescribing- yes. LTCF - No	No	No	No	> 2 reasons
Springer et al. (2020)	Incidence and Predictors of Aspirin Discontinuation in Older Adult Veteran Nursing Home Residents at End of Life.	Yes	Not qualitative – retrospective cohort study	No	No	Not qualitative
Stojanović et al. (2020)	GheOP(3) S tool and START/STOPP criteria version 2 for screening of potentially inappropriate medications and omissions in nursing home residents.	Yes – deprescribing tools	Not qualitative – retrospective, observational study	No	No	Not qualitative

Sun et al. (2019)	Exploration of home care nurse's experiences in deprescribing of medications: a qualitative descriptive study	Yes deprescribing. No – home care not LTCF – community dwelling older adults.	Yes – focus group	Yes nurse	No	> 2 reasons
Tandun et al. (2019)	Who has the guts to deprescribe proton pump inhibitors? A pharmacist-led intervention in a long-term care facility setting	Yes	No qualitative – intervention study	No	No	Not qualitative
Tang et al. (2016)	Pain monitoring and medication assessment in elderly nursing home residents with dementia.	No deprescribing focus	Not qualitative	No	No	> 2 reasons
Thorpe et al. (2020)	Discontinuation of Statins in Veterans Admitted to Nursing Homes near the End of Life.	Yes	Not qualitative – retrospective cohort study	No	No	Not qualitative
Tommelein et al. (2018)	Screening for potentially inappropriate prescribing in the community pharmacy: Development, validation and implementation of the GheOP3S-tool	Setting – primary care – no LTCF focus	No	No	No	> 2 reasons
Turner et al. (2016)	What factors are important for deprescribing in Australian long-term care facilities? Perspectives of residents and health professionals.	Yes	Yes	Yes	Yes	No – data not collected qualitatively
Van Buul et al. (2014)	The effect of tailored antibiotic stewardship programmes on appropriateness of antibiotic prescribing in nursing homes	Appropriateness of antibiotic prescribing – not deprescribing	No	No	No	> 2 reasons
Victoria and Claire et al. (2017)	An investigation into the barriers and facilitators to deprescribing in care homes	Yes	Unsure	Unsure	No – study protocol	Protocol

Watson and Hatcher (2020)	Factors influencing management of agitation in aged care facilities: a qualitative study of staff perceptions.	Not deprescribing focused	Yes	Yes	No	Not Deprescribing
Wauters et al. (2019)	Reducing Psychotropic Drug Use in Nursing Homes in Belgium: An Implementation Study for the Roll-Out of a Practice Improvement Initiative.	Educational intervention	No	No	No	Educational intervention
Weeks et al. (2019)	Comparing Three Methods for Reducing Psychotropic Use in Older Demented Spanish Care Home Residents.	Yes	Not qualitative – retrospective, propensity score-matched, controlled, patient level observational analysis	No	No	Not qualitative
Westbury et al. (2015)	Expansion of the reducing use of sedatives (RedUSe) project to Australian nursing homes	Yes	Yes	No	No - Conference abstract	No full-text
Westbury et al. (2011)	Roles for pharmacists in improving the quality use of psychotropic medicines in Residential Aged Care Facilities	Yes	Yes - interviews	Yes	Yes	Yes
Wouters et al. (2019)	Barriers and Facilitators of Conducting Medication Reviews in Nursing Home Residents: A Qualitative Study	Yes – medication review to facilitate deprescribing. Discusses deprescribing toolkits.	Yes	Yes	Yes	Yes
Zuidema et al. (2015)	A consensus guideline for antipsychotic drug use for dementia in care homes. Bridging the gap between scientific evidence and clinical practice.	Not focused on deprescribing	Yes	Unsure	No	> 2 reasons

Appendix 4: ENTREQ statement

No.	Item	Guide and description
1	Aim	To summarise the findings of qualitative studies conducted to date, investigating the thoughts and attitudes HCPs have toward deprescribing in LTCF. The purpose of this paper is to investigate the barriers and enablers perceived by HCP which impact on their engagement with deprescribing in LTCF, and provide an insight into why deprescribing is not currently routine practice
2	Synthesis methodology	'Best-fit' framework qualitative evidence synthesis as described by Carroll and Booth (283).
3	Approach to searching	Predefined, comprehensive search strategy was created and published on PROSPERO (protocol registration number CRD42021232672)
4	Inclusion criteria	Appendix 2: Inclusion and Exclusion Criteria • Thoughts/ opinions/barriers/enablers perceived by HCP toward deprescribing for adults/older adults in LTCF. • Primary research with qualitative data collection and analysis. • Mixed methods studies were only included if they utilise recognised qualitative research methods as a component of the study. For these, only the aspects which had been analysed using qualitative methods were included. • HCP of interest: medical practitioners, nurses, and nursing staff (nursing assistants), social workers, carers and care service employees and pharmacists, all who provide care for LTCF residents. • Full-text and English text availability. • Appropriate grey literature
5	Data sources	Electronic databases: PubMed, EMBASE, CINAHL, MEDLINE (via CINAHL), PsycINFO (via CINAHL) The Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science, and ClinicalTrials.gov. Searched Inception – December 2020. Grey literature will be searched from relevant sources. Citation and reference searching of identified papers via Google Scholar.
6	Electronic search strategy	Described in detail in Table 1 and Appendix 1.
7	Study screening methods	Initially, potentially relevant papers received from the search strategy will be screened for appropriateness based on their title by the primary researcher (CHH). Subsequently, an abstract review will be performed independently, by the primary researcher (CHH) and one other (EH) utilising an abstract review form. Finally, full texts of potentially eligible studies will be retrieved, and the articles will be assessed by the two reviewers (CHH and EH) to determine which papers should be included in the systematic review. Consensus on inclusion in all stages will be reached by discussion between the two reviewers, with consensus reached by a third member (MDD) if necessary.
8	Study characteristics	Details can be found from Table 1.
9	Study selection results	Details can be found from PRISMA flow diagram Fig. 5.

10	Rationale for appraisal	To assess quality of chosen studies for this review.
11	Appraisal items	The CASP tool was utilised to appraise quality of included studies.
12	Appraisal process	This was carried out independently by two researchers (CHH and EH), with any disagreements resolved by discussion with a third researcher (MDD).
13	Appraisal results	The quality assessment is available in Table 2. We did not exclude any paper based on the quality assessment however the results were documented in the review.
14	Data extraction	Characteristics of study are reported in Table 1 and report: first author, year, country of origin, study objective, methods, data collection, qualitative data analysis and participant characteristics. Data for analysis consisted of the results section of identified papers. This included direct quotes from the HCPs and any secondary author interpretation.
15	Software	QSR NVivo version 12
16	Number of reviews	Two researchers (CHH and EH) were involved in the screening of abstracts, CASP assessment and initial coding, with any disagreements resolved by discussion with a third researcher (MDD). Three researchers (CHH, EH and MDD) were involved in reading and selecting included papers. Five researchers were involved in the qualitative evidence synthesis stages.
17	Coding	Two researchers (CHH and EH) were involved in comprehensive coding to *a priori* framework. All results and author interpretations were analysed individually, reading line-by-line, to either map to existing codes or separate for thematic analysis.
18	Study comparison	All papers were coded to the existing *a priori* framework, comparing data reported within the selected paper, to *a priori* codes as defined by the 'Best-Fit' codebook. Any ideas from identified studies unsuited to the *a priori* framework, researchers familiarised themselves with the information, generated codes and summarised those into smaller relevant themes, to capture the concepts presented.
19	Derivation of themes	Derivation of themes was both deductive and inductive. Deductive themes were generated by mapping results to the pre-existing framework. Developing new themes and subthemes to add to the existing *a priori* framework was conducted inductively through thematic analysis.
20	Quotations	Direct quotes from the participants of identified studies were coded to facilitate generation of QES findings, to support the ideas generated.
21	Synthesis output	'Best-fit' framework of findings, identifying deprescribing barriers and enablers in LTCF with associated level of confidence as per GRADE CERQual.

Appendix 5: COREQ-32 Statement

Domain 1: Research team and reflexivity	
Personal characteristics	
Interviewer	Clara H. Heinrich
Credentials	BPharm, MPharm, MPSI
Occupation	Pharmacist.
Gender	Female
Experience and training	Qualitative research training at university level.
Relationship with participants	
Relationship established	A small selection of HCP had a previous professional relationship with the interviewer through her role as a pharmacist, prior to study commencement.
Participant knowledge of the interviewer	Participants were aware of the researcher's profession and aims for the research of developing a deprescribing intervention.
Interviewer characteristics	No characteristics were reported.
Domain 2: Study design	
Theoretical Framework	
Methodological orientation and theory	Qualitative description methodology using thematic analysis to develop themes and mapping to TDF-informed framework of barriers and enablers
Participant selection	
Sampling	Convenience and stratified purposive sampling.
Method of approach	Phone call and/or email.
Sample size	Between 6-10 participants per HCP group.
Non-participation	No participants dropped out.
Setting	
Setting of data collection	Microsoft Teams.
Presence of non-participants	N/A
Description of sample	Table 4
Data collection	
Interview guide	Semi-structured interview guide piloted on one GP, pharmacist, and nurse.
Repeat interviews	No.
Audio/visual recording	Either, depending on participant preference
Field notes	No
Duration	Average: 24 mins (9 mins - 65min)
Data saturation	No, sample size identified via information power.
Transcripts returned	No
Domain 3: Analysis and findings	
Number of data coders	Inductive coding conducted by one researcher, mapping of inductive codes to 'best-fit' framework conducted by two researchers.
Description of the coding tree	Initially inductive coding, then mapped to 'best-fit' framework of deprescribing barriers and enablers.
Derivation of themes	Derived from the data, informed by researchers' knowledge and experience.
Software	NVivo

Participant checking	No.
Reporting	
Quotations presented	Yes.
Data and findings consistent	Yes.
Clarity of major themes	Yes.
Clarity of minor themes	Yes.

Appendix 6: Clinical Research Ethics Committee of Cork Teaching Hospitals approval for retrospective chart review study

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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 (k) 10/8/2021
& ECM 3 (o) 16/11/2021

Date: 29th October 2021

Ms Maria Donovan
School of Pharmacy
Cavanagh Pharmacy Building
University College Cork
Cork
T12 YN60

Study Title: Assessment of medication appropriateness for older adults resident in Irish long-term care facilities using the STOPPFrail Criteria

Dear Ms Donovan

The following document has been approved:

- Revised application form version 2.2 dated 20th October 2021 clarifying that the study is insured under the clinical indemnity scheme.

The date of this letter is the date of authorization of the study.

Please keep a copy of this signed approval letter in your study master file for audit purposes. The study must be carried out in accordance with General Data Protection Regulation and Health Research Regulation 2018.

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). **We would encourage you to keep note of this date as the CREC will not issue a reminder.**
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

Appendix 7: Number and percentage of PIMs for each STOPPFrail criterion

Primary STOPPFrail (SITE 1 & 2)	Total (n=433)	%
A2 = No clear indication	115	26.6
B2 = Antihypertensives (SBP<130mmHg)	60	13.9
G2 = Vitamin D	58	13.4
D1 = Neuroleptic antipsychotics in dementia patient (> 12 wks and no BPSD)	31	7.2
E1 = PPI: reduce when full therapeutic dose ≥8 wks unless persistent dyspeptic symptoms at lower	27	6.2
I1 = Anti-diabetic drugs: Avoid HbA1c targets (HbA1C <7.5% [58 mmol/mol] goal of care is to minimise symptoms related to hyperglycaemia (e.g. excessive thirst, polyuria)	27	6.2
G1 = Calcium supplements - unless symptomatic hypocalcaemia	24	5.5
B1 = Lipid-lowering therapies	20	4.6
D2 = Memantine: mod-severe dementia unless clearly improved BPSD	15	3.5
H2: overactive bladder drugs (muscarinic antagonists & mirabegron) unless history of painful detrusor hyperactivity	15	3.5
J2 = Folic acid: Tx usually 1-4 months unless malabsorption	10	2.3
C1 = Antiplatelets for primary CV prevention	8	1.8
G3 = anti-resorptive/bone anabolic drugs for osteoporosis	7	1.6
G5 = long-term oral corticosteroids ≥ 2 months	6	1.4
H1 = BPH in catheterised male patients	4	0.9
J1 = Multivitamin combination supplements (unless Tx hypovitaminosis)	4	0.9
C2 = Aspirin for stroke prevention in A. Fib	1	0.2
G4 = Long-term NSAIDs ≥ 2 months	1	0.2
A1 =Persistently fails to take/tolerate despite education and consideration of formulations.	0	0
A3 = Symptom now resolved	0	0
B3 = Anti-anginal therapy (no angina symptoms in 12 months AND no evidence of CAD)	0	0
E2 = H2R antagonists	0	0
F1 = Theophylline and aminophylline	0	0
F2 = Leukotriene antagonists in COPD	0	0
J3 = Nutritional supplements: unless malnutrition	0	0

Appendix 8: Rate of each STOPPFrail criterion

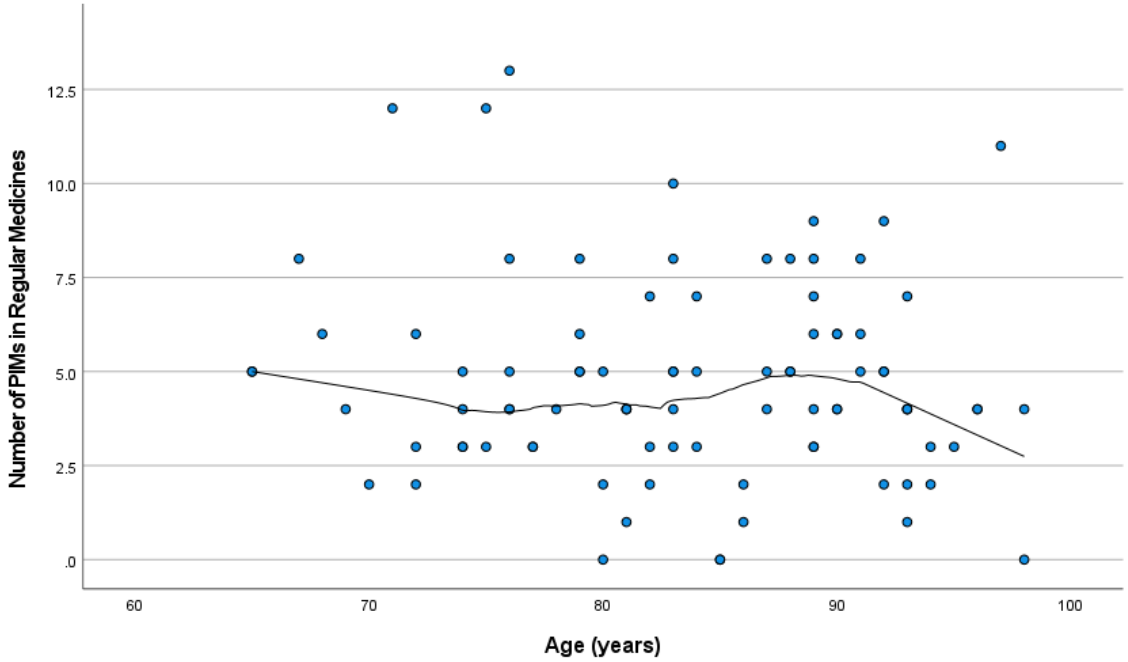
Primary STOPPFrail (SITE 1 & 2)	Total (n=89)	%
G2 = Vitamin D	55	61.8
A2 = No clear indication	53	59.6
B2 = Antihypertensives (SBP<130mmHg)	38	42.7
E1 = PPI: reduce when full therapeutic dose ≥8 wks unless persistent dyspeptic symptoms at lower	27	30.3
D1 = Neuroleptic antipsychotics in dementia patient (> 12 wks and no BPSD)	25	28.1
G1 = Calcium supplements - unless symptomatic hypocalcaemia	24	27
B1 = Lipid-lowering therapies	21	23.6
I1 = Anti-diabetic drugs: Avoid HbA1c targets (HbA1C <7.5% [58 mmol/mol] goal of care is to minimise symptoms related to hyperglycaemia (e.g. excessive thirst, polyuria)	18	20.2
D2 = Memantine: mod-severe dementia unless clearly improved BPSD	15	16.9
H2 = Overactive bladder drugs (muscarinic antagonists & mirabegron) unless history of painful detrusor hyperactivity	15	16.9
J2 = Folic acid: Tx usually 1-4 months unless malabsorption	10	11.2
C1 = Antiplatelets for primary CV prevention	8	9
G3 = anti-resorptive/bone anabolic drugs for osteoporosis	7	7.9
G5 = long-term oral corticosteroids ≥ 2 months	6	6.7
J1 = Multivitamin combination supplements (unless Tx hypovitaminosis)	4	4.5
H1 = BPH in catheterised male patients	2	2.2
C2 = Aspirin for stroke prevention in A. Fib	1	1.1
G4 = Long-term NSAIDs ≥ 2 months	1	1.1
A1 =Persistently fails to take/tolerate despite education and consideration of formulations.	0	0
A3 = Symptom now resolved	0	0
B3 = Anti-anginal therapy (no angina symptoms in 12 months AND no evidence of CAD)	0	0
E2 = H2R antagonists	0	0
F1 = Theophylline and aminophylline	0	0
F2 = Leukotriene antagonists in COPD	0	0
J3 = Nutritional supplements: unless malnutrition	0	0

Appendix 9: Statistical analysis from retrospective chart review study.

Demographic	Mean (Mean PIMs per group)	Standard deviation	Poisson: predict number of PIMs	Relationship with number of PIMs
Age	83.62	8.22	IRR 0.994, p=0.288	Spearman's Correlation: ρ -0.061, p 0.568
Age group: <80 years ≥ 80 years	 (5.39) (4.48)	 2.948 2.534		T-test: t 1.506, p 0.068
Gender Male Female	 (4.8) (4.74)	 2.22 2.973	 IRR 1.012 p=0.914	T-test: t 0.101, p 0.460
Number of regular medicines	10.74	3.773	IRR 1.081 p=<0.01	Spearman's Correlation: ρ 0.525, p<0.01
Number of regular medicines 0-4 5-9 ≥ 10	 (1) (3.57) (5.61)	 1.155 1.317 2.827	 IRR 3.571 p=0.012 IRR 5.614 p = <0.01	One way ANOVA F 11.879, p <0.01
Polypharmacy Yes No	 (5.26) (1.33)	 2.704 1.155		T-test: t 2.487, p <0.016
Excessive polypharmacy Yes No	 (5.9) (4)	 3.059 2		T-test: t 2.681, p <0.01
Constipation diagnosis Yes No	 (4.57) (5.06)	 2.613 2.808	 IRR 0.903, p=0.396	T-test: t -0.842, p 0.201
Pain diagnosis Yes No	 (4.61) (4.93)	 2.736 2.658	 IRR 0.935, p=0.57	T-test: t -0.562, p 0.288
Hypertension diagnosis Yes No	 (5.87) (4.2)	 3.082 2.295	 IRR 1.396, p <0.01	T-test: t 2.87, p <0.01
Dementia diagnosis Yes No	 (5) (4.63)	 2.562 2.774	 IRR 1.081, p=0.51	T-test: t 0.633, p 0.264
Depression diagnosis Yes No	 (4.84) (4.73)	 2.478 2.785	 IRR 1.022, p=0.859	T-test: t 0.166, p 0.434
Atrial Fibrillation diagnosis Yes No	 (5.21) (4.64)	 2.551 2.730	 IRR 1.122, p=0.374	T-test: t 0.815, p 0.209

IRR = Incidence rate ratio.

Appendix 10: Number of potentially inappropriate regular medications V's age in years.



Appendix 11: Conducting and REporting of DElphi Studies (CREDES)

Rationale for the choice of the Delphi technique

1. *Justification.*

   The Delphi method was chosen for the purpose of collating expert opinion and achieving consensus on the selection behaviour change techniques (BCTs) to form a deprescribing strategy. The Delphi method allowed healthcare professionals (HCPs) to select BCTs which they felt were feasible, from their own experience and understanding of deprescribing and the context of long-term care (LTC) and it also allowed the opportunity to feedback qualitative information to all participants between selection rounds. Selecting an expert panel who are actively involved in deprescribing allowed a realistic selection of BCTs in addition to those who are working in LTC, selecting feasible BCTs which would take into consideration the social influences of the setting.

Planning and design

2. *Planning and process.*

   A modified Delphi method was conducted, informed by previously conducted work by the research team, identified barriers and facilitators through qualitative interviews with the targeted end-users of the strategy. The Delphi was conducted online, to facilitate continued social distancing restrictions during the COVID-19 pandemic. This facilitated an international panel, including HCP with vast deprescribing experience.

3. *Definition of consensus.*

   Consensus was pre-defined as statements with more than 70% agreement on feasibility (sum of extremely feasible, very feasible and feasible) and less than 15% disagreement (not at all feasible). These parameters have been used in previous Delphi studies referenced in the manuscript. BCTs which reached feasibility consensus in Round 1 were separated for inclusion

in the roundtable discussion. BCTs which did not reach consensus were included in Round 2. Any BCTs which do not reach feasibility consensus, statistical analysis using the Wilcoxon signed rank test will be conducted to assess the stability of answers and determine if a statistically significant difference in answers exists between rounds. This will help to determine the 'point of diminishing return' and identify if further rounds are necessary.

Study conduct

4. *Informational input.*

   The survey will be designed in Microsoft Forms© by the primary researcher, consisting of contextual examples of the BCTs. The survey will be reviewed by the research team and piloted by another member prior to disseminations to check for errors and comprehension. Feedback between rounds will include panellists' individual feasibility score, the overall group mean and median feasibility score, in addition to any relevant qualitative feedback (in the form of anonymous participant quotes) from Round 1 for unagreed BCTs. The summary of qualitative feedback will be reviewed by the entire research team.

5. *Prevention of bias.*

   No member of the research team will have an input which could potentially cause bias. All feedback will be the feasibility scores or participant quotes, not interpretation of qualitative feedback.

Appendix 12: Delphi Survey Round 1

Designing a deprescribing intervention using Delphi technique

Thank you for considering participating in this research project. The purpose of this information sheet is to explain to you what the research is about and what your participation would involve, to enable you to make an informed choice.

The purpose of this study is to design an intervention to support deprescribing in long-term care facilities. In this questionnaire you will be asked for your opinion on intervention content, known as behaviour change techniques. You will be shown the name of a behaviour change techniques and an example of how this technique could be used to support deprescribing in long-term care. You will be asked to indicate the extent to which you believe the technique is **feasible** to implement in long-term care. This information will help us decide on the content to include in an intervention to support deprescribing.

If you decide to take part, you will be asked to complete up to three questionnaires, approximately 4 weeks apart. The first questionnaire will include a list of behaviour change techniques which were deemed relevant from previous deprescribing research. The second questionnaire will include those behaviour change techniques that did not reach agreement among participants and may be modified based on feedback given in Round 1, in addition to any elements mentioned by participants. The first questionnaire will take approximately 20-30 minutes to complete, and you have 3 weeks to complete it. Subsequent rounds are anticipated to take 15-20 minutes and you will have 2 weeks to complete it.

Participation in this study is completely voluntary. There is no obligation to participate, and should you choose to do so you can refuse to answer specific questions or decide to withdraw from the study prior to completing the first round of the questionnaire. All information you provide will be confidential. Your personal details and responses will only be known to the researchers on this project. IP addresses will not be collected at any point, meaning the data you provide cannot be traced back to you.

You maintain the right to withdraw from the study at any stage up to the point of data submission. At this point, your data will be collated with that of other participants and can no longer be retracted.

The anonymous data will be stored on a University College Cork supported cloud storage platform Microsoft OneDrive. The data will be stored for minimum of ten years.

The information you provide may contribute to research publications and/or conference presentations and a PhD thesis.

We do not anticipate any negative outcomes from participating in this study.

This study has obtained ethical approval from the UCC Social Research Ethics Committee.

If you have any queries about this research, you can contact myself, Clara Heinrich at cheinrich@ucc.ie or my research supervisor Dr Maria Donovan, at mariadonovan@ucc.ie.

If you agree to take part in this study, please complete the consent form overleaf.

Please note: once you begin there is no option to save and complete at a later date, however you can keep the tab open and complete at a suitable time, ensuring the tab is not closed

1. Name: *

2. Email address: *

3. The purpose and nature of the study has been explained to me in writing.

I am participating voluntarily.

I understand the information provided may contribute to research publications and/or conference presentations and a PhD thesis.

I understand that my data will be kept confidential and will be stored at UCC for at least ten years, in line with UCC Policy.

I understand that my anonymity will be ensured in the write-up.

I understand that I maintain the right to withdraw from the study at any stage up to the point of data submission. At this point, my data will be collated with that of other participants and can no longer be retracted.

I have read the information provided and I understand that information provided by me will be used to inform intervention design if I give permission below.

Do you consent to participate in this study? *

I agree to participate in this study

I do not agree to participate in this study

Demographics

4. Please select one of the following which best describes your role:

General Practitioner
Geriatrician
Nurse
Pharmacist
Psychiatrist of old age

5. Please select the primary healthcare setting you work in:

Community Pharmacy
General Practice
Hospital
Long-term care facility/Community Hospital
Other

6. If selected 'Other' from Question 5, please specify

7. Please select one or both of the following as applicable:

I have experience of working with frail older adults resident in Irish long-term care facilities.

I have knowledge and experience of deprescribing potentially inappropriate medications for older adults.

8. If answered yes above to working in long-term care facilities, which would be your dominant long-term care facility setting:

Public long-term care facility

Private long-term care facility

9. If answered yes to working in long-term care facilities, how many years of experience do you have working with long-term care patients:

0-4
5-9
10-14
15-19
20-24
25+

10. Please indicate your age category:

18-29
30-39
40-49
50-59
60-69
70+

11. Please indicate your years of work experience

0-4
5-9
10-14
15-19
20-24
25+

Information & Instruction

The questionnaire consists of 15 sections with a total of 34 behaviour change techniques, with opportunity to provide feedback on each section.

We acknowledge that not all behaviour change techniques will be directly related to your role, however, we would appreciate if you could please indicate the extent to which you believe the technique is feasible to implement in long-term care, based on:

1. Your experience of working in/with residents in long-term care, and/or

2. Your experience of deprescribing.

Please note: once you begin there is no option to save and complete at a later date, however you can keep the tab open and complete at a suitable time, ensuring the tab is not closed

For our international participants:

In Ireland, there are different types of long-term care available. Services are supplied by:

(i) Publicly-employed Health Services Executive staff in publicly-funded long-term care sites.

(ii) Private-sector agencies who supply approximately 75% of LTC beds.

(iii) Voluntary facilities, run by charities and religious orders.

Throughout, you will see reference to a General Practitioner (GP). These are primary care physicians who work in a primary care practice and visit long-term care facilities to provide care.

In all sectors, only nurses and nursing staff are on site full-time. Geriatricians and psychiatrists may visit to review residents on-site or else in an outpatient setting. GPs and pharmacists visit the long-term care facility to provide their services. GPs are the healthcare professional responsible for prescribing for long-term care residents.

The Irish Health Information and Quality Authority recommends an interdisciplinary review of each patient on long-term medications every 3 months.

Section 1: Goals and Planning

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Goal setting (behaviour)
Example: GP/prescriber, Nurse and Pharmacist agree to engage with deprescribing a specific potentially inappropriate medication, as identified by a deprescribing guideline during medication review.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Problem solving
Example: Prescriber must analyse and document indication for all drugs and consider deprescribing if no clinical indication exists/original condition resolved when writing Kardex/during medication review/during patient review.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Goal setting (outcome)
Example: Set a goal of reducing potentially inappropriate medication usage by a certain percentage in a specified time frame.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Action planning
Example: For any potentially inappropriate medicine prescribed, the procedure to deprescribe should be documented in drug chart and clinical notes, to include detail on dose reductions, intervals and a review date.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Review behaviour goal(s)
Example: Review deprescribing goals with multidisciplinary team, including the prescriber, pharmacist and nurse during quarterly review – when to consider deprescribing, how it is facilitated, who is involved, what drugs to focus on.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Review outcome (goals)
Example: Review levels of quarterly prescribing of potentially inappropriate medications though pharmacist audit of dispensing of particular drug.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Behavioural contract
Example: Written specification of deprescribing behaviour created, agreed on by the prescribers, and witnessed by a HCP/patient/representative e.g. a note in the chart about reducing a dose of a medicine over time.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible

- Extremely feasible

Feedback on Section 1:
Do you have any comments on the techniques in Section 1?
For any technique which you found not at all feasible/slightly feasible, can you explain why?

Section 2 Feedback and monitoring

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Feedback on behaviour
Example: Nursing staff provide quarterly update on deprescribing decisions implemented by GP/prescriber – why successful or why not successful?
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Self-monitoring of behaviour
Example: GP/prescriber reflect in patient clinical notes their engagement with deprescribing monthly.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Feedback on outcomes(s) of behaviour
Example: Nurses inform GP/prescriber and pharmacist about individual patient's clinical presentation, symptoms and form, on a quarterly basis during medication review.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Feedback on Section 2:

Do you have any comments on the techniques in Section 2?
For any technique which you found not at all feasible/slightly feasible, can you explain why?

Section 3: Social support

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Social support (unspecified)
Example: Nurses providing GPs/prescribers with feedback at specified intervals regarding patient clinical condition following deprescribing – patient review documented in notes or in person during GP visit.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Social support (feasible)
Example: Pharmacists providing GPs with a list of patients taking a potentially inappropriate medication for review/Pharmacists highlighting medications for which there is no documented indication.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Social support (emotional)
Example: Scheduled meeting between GP/prescriber and pharmacist to discuss deprescribing decision making and mitigate potential fears relating to deprescribing prior to/during medication review.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Feedback on Section 3:

Do you have any comments on the techniques in Section 3?
For any technique which you found not at all feasible/slightly feasible, can you explain why?

Section 4: Shaping Knowledge

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Instruction on how to perform a behaviour
Example: HCP follow a step-by-step guideline/procedure on how to deprescribe a specific medicine.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible

- Very feasible
- Extremely feasible

Section 5: Natural consequences

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Information about health consequences
Example: Provide information (leaflets/learning video/information session/continuing professional development) to HCPs on health consequences of over prescribing/prescribing potentially inappropriate medications on the health of frail older adults resident in long-term care. Inappropriate polypharmacy can increase the risks of adverse drug effects, falls, cognitive impairment, drug interactions and drug-disease interactions.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Information about social and environmental consequences
Example: Provide information (leaflets/learning video/information session/continuing professional development) to inform staff about the social and environmental consequences. Environmental consequences for staff include time saved on drug rounds and dispensing medication. For the healthcare system includes reduced medication cost.

Social consequences for staff and patients include potential negative effect of disruption if deprescribing unsuccessful or potential positive effect of patient include reduces falls risk or improved quality of life as patients happy to be on less medication.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Feedback on Section 4 and 5

Do you have any comments on the techniques in Section 4 and 5?
For any technique which you found not at all feasible/slightly feasible, can you explain why?

Section 6: Comparison of behaviour

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Demonstration of the behaviour
Example: Provide a video to show staff of how to successfully engage with deprescribing, utilising the multidisciplinary team in LTC.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Social comparison
Example: Compare number of drugs deprescribed/potentially inappropriate medication levels between different LTCFs.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Information about others' approval
Example: Share anonymous feedback from a qualitative study of HCPs sharing their thoughts and opinions of deprescribing in long-term care as a part of an introductory session.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Section 7: Associations

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Prompts/cues
Example: Introduce 'Consider deprescribing' heading to drug Kardex consisting of potentially inappropriate medication list as per STOPPFrail (Screening Tool of Older Persons Prescriptions in Frail Adults with Limited Life Expectancy) to prompt HCP to engage with deprescribing.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Feedback on Section 6 & 7

Do you have any comments on the techniques in Section 6 and 7?
For any technique which you found not at all feasible/slightly feasible, can you explain why?

Section 8: Repetition and substitution

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Behavioural practice/rehearsal
Example: HCPs practice deprescribing potentially inappropriate medications during simulated learning environment as a part of continuing professional development workshop.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Graded tasks
Example: Deprescribe one class of potentially inappropriate medicines according to an evidence-based algorithm, before extending to multiple classes of medication.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Section 9: Comparison of outcomes

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention

Name: Credible sources
Example: Presentation of the evidence supporting deprescribing, individually tailored to the role of each healthcare professional group.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Section 10: Reward and threat

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Social reward
Example: Senior staff to offer praise to nurses/pharmacists/GPs for making deprescribing suggestions during medication review.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible

- Feasible
- Very feasible
- Extremely feasible

Feedback on Section 8, 9 and 10

Do you have any comments on the techniques in Section 8, 9 and 10?
For any technique which you found not at all feasible/slightly feasible, can you explain why?

Section 11: Regulation

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Reduce negative emotions
Example: Provide reference material/evidence to support HCP overcoming any negative emotions e.g. fear associated with deprescribing.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Section 12: Antecedents

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Restructuring the physical environment
Example: Editing the format of the drug Kardex to a minimum number of medication slots e.g 10 in effort to prompt HCP to be aware of polypharmacy and consider deprescribing.

Adding 'indication' box to Kardex to ensure GP documents a reason for prescribing each medication.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Restructuring the social environment
Example: Restructure the social environment, encouraging nurses to refer residents who they feel would benefit from deprescribing to the prescriber, during the prescriber's site visit.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Avoiding/changing exposures to cues for the behaviour
Example: Change exposures to cues for deprescribing to include prescribers re-writing of complete drug charts, allowing this to be an opportunity to deprescribe potentially inappropriate medications.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Adding objects to the environment
Example: Adding guidelines/posters about deprescribing to nursing station/day rooms to educate HCPs/residents/representatives.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Section 13: Identity

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Identification of self as a role model
Example: Inform GPs/prescriber during information session of the 'established hierarchy' which is perceived to exist among other HCPs in long-term care and inform GPs/prescriber that they lead by example. If GPs/prescriber seen to engage with deprescribing, this may filter down to other HCPs.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Feedback on Section 11, 12 and 13.

Do you have any comments on the techniques in Section 11, 12 and 13?
For any technique which you found not at all feasible/slightly feasible, can you explain why?

Section 14: Self belief

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Verbal persuasion to boost self-efficacy
Example: Nurses supporting GPs/prescriber reassuring them that stopping/reducing the dose of a medication could improve patient's quality of life.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Focus on past success
Example: Ask GPs/prescriber to consider previous positive deprescribing experiences when reviewing the appropriateness of medications during the quarterly medication review with the multidisciplinary team including pharmacists and nurses.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Name: Self-talk
Example: Prompt prescribers to tell themselves that deprescribing is beneficial during quarterly medication review.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Section 15: Covert learning

Here you are provided with the name of the behaviour change technique, and an example of how it could be incorporated into a deprescribing intervention.

Name: Vicarious consequences/reinforcement
Example: 'Consider deprescribing' aspect of Kardex documenting the potential positive health outcomes of deprescribing for frail older adults.
To what extent do you think that this technique is feasible in long-term care?

- Not at all feasible
- Slightly feasible
- Feasible
- Very feasible
- Extremely feasible

Feedback on Section 14 & 15

Do you have any comments on the techniques in the last two Sections?

For any technique which you found not at all feasible/slightly feasible, can you explain why?

Closing statement

Thank you for your time in participating in this research. If you have any queries about this research, you can contact myself, Clara Heinrich at cheinrich@ucc.ie or my research supervisor Dr Maria Donovan, at mariadonovan@ucc.ie.

Appendix 13: Qualitative feedback supporting the operationalisation of BCTs from Delphi survey.

Intervention function	Qualitative feedback supporting the operationalisation of BCTs associated
Education	Panellist 1:" Education is always very important to impact culture" Panellist 3: "Education is key" Panellist 17: "I think it is feasible to provide the education, but not feasible to expect that anyone will interact with a leaflet in a meaningful manner if that is the only technique being used. If there is an interactive multi-disciplinary education session with CPE points awarded, it may be feasible to attract healthcare providers. However, coordinating such an event may be not at all feasible. Providing information about social consequences that are based on the facilities data may improve uptake of the messageing and education" Panellist 6: "It would be a good idea to perhaps have a national webinar hosted by ICGP with stake holders all invited. This would be educational in so far as giving guidelines regarding de prescribing safely. And would provide a framework for local sub groups to reference when performing this quarterly reviews" Panellist 1: "In my experience requests for prescriptions are driven by staff on units and not prescriber per se so the educational support adequate staffing appropriate environment are key"
Training	Panellist 3: "Training and education for nurses to focus on deprescribing will be appropriate here" Panellist 2: "I see the benefits of deprescribing for the individual but many staff don't. This needs a lot of training/support." Panellist 17 International: "I like the interactive workshop idea to allow people to practice deprescribing, however, as with all education, how are you going to entice the participants to attend? this would impact the feasibility of the educational session's impact."
Environmental restructuring	Panellist 13: "Prompt can be very useful, when do staff have time to watch another training video? comparisons between sites can be very powerful, recent antimicrobial audit for us comparing to other units really helpful." Panellist 17 International: "If the data collected for comparisons between facilities could be done electronically, then it is feasible. If it requires someone to do an audit in each facility, it becomes much less feasible." Panellist 4: "I think a quarterly update from nursing could be extremely feasible if a monitoring system was put in place. If it was a checklist that could be completed at the end of the quarter to quickly review the drug-charts to see who is still on the medication, then it could be done quickly. Similarly, if the medications are supplied by a pharmacy, then checking the dispense records could be automated quickly."

	Panellist 18: “Monthly documentation is excessive and not realistic in real world setting of time constraints.” Panellist 10: “Monthly documentation is excessive - a record should be/ is made in the clinical notes when a change is made to the persons medications - outside of that medications must be reviewed quaterly as per legislation.” Panellist 7: “I don't think this would be feasible to implement like for every patient the GP sees--but for select cases, I think this would be quite feasible.” Panellist 12: “In my experienced deprescribing needs to be initiated by a Consultant Geriatrician - GPs and specialist nurses are reluctant to do it although they agreed that it is necessary. The existence of an agree protocol or guidelines would make life a lot easier and should be agreed also with Palliative Care Physicians.” Panellist 1: “Indications for prescription are complex and may relate to multiple conditions. If someone has an existing serious mental illness it is important that is reviewed, and medication changes not made inappropriately. The Doctor in the long term setting must link with secondary care team or previous GP to clarify indications for treatment.” Panellist 8: “I feel this would be very feasible if clinical pharmacists were embedded in primary care supporting GP prescribing. So I agree a change to current structures are necessary to facilitate this.”
Enablement	Panellist 1: “It is probably more relevant for pharmacist to support and meet nurse on the ground as that is where anxiety lies” Panellist 12: “Pharmacist recommendations key to achieving deprescribing.” Panellist 5: “Availability of an appropriately trained and motivated pharmacist would be very helpful.” Panellist 8: “I feel this would be very feasible if clinical pharmacists were embedded in primary care supporting GP prescribing. So I agree a change to current structures are necessary to facilitate this.”
Persuasion	Panellist 17 International: “I think providing the feedback is feasible (and a great idea), however, I think that expecting the prescriber to write it in the patient notes is less feasible due to time constraints (although it is also a great idea because "if it's not written, it never happened").” Panellist 4: “Social reward for "appropriate prescribing" (rather than just incentivising stopping of medications) can work, but it depends on the HCP team's relationships. I have seen audit and feedback delivered this way, with social reward (and peer pressure) being used to motivate a reduction in sedative prescribing across different ACFs in a regional area. I suspect it would be very feasible in a collaborative and knowledgeable environment and not feasible in an environment where HCPs don't know each other.” Panellist 5: “Regular, clear and positive feedback to nursing staff is essential.”

	Panellist 15: “Whilst most HCP do not need the 'pat on the head' positive feedback albeit intermittently does at least make you feel that your efforts are being noted positively.” Panellist 2: “Main fears of deprescribing relate to nursing home staff, they need to be involved. Also, massively time consuming.”
Modelling	Panellist 8: “Inform GPs/prescriber that they lead by example. If GPs/prescriber seen to engage with deprescribing, this may filter down to other HCPs.” Panellist 17 International: “I like the interactive workshop idea to allow people to practice deprescribing”

Appendix 14: APEASE assessment of BCTs

DOMAIN Barrier (-) or enabler (+)	**COM-B component**	**Intervention function** *definition* (intervention options)	**Feasible BCTs as identified by Delphi consensus**	**Does BCT meet the criteria? (Rationale for exclusion based on APEASE criteria)**
Limited practical knowledge and experience of deprescribing in LTCF. (-) *Knowledge* Further education needed to support implementation of deprescribing in routine practice. (+)	Capability (psychological)	→ **Education** *Increasing knowledge/ understanding* (Knowledge: educate about ways of deprescribing)	~~2.2 Feedback on behaviour~~ ~~2.7 Feedback on outcome(s) of behaviour~~	No, deprescribing not yet routine practice and lack of knowledge was identified by HCPs in qual research, therefore intervention should focus on education rather than feedback. Rejected: unlikely to be acceptable.
			4.1 Instruction on how to perform the behaviour	
			5.1 Information about health consequences	
			5.3 Information about social and environmental consequences	
			7.1 Prompts/cues	

Proposed intervention design:

Pharmacist researcher (*provider)* to provide evidence-based deprescribing document *(content and mode of delivery)* to ward as refence material *(setting, recipient, intensity)* for drug class of interest (antihypertensives).

Provide this guidance in addition to a training session (*mode of delivery*) at the LTCF *(setting)*, with all HCP staff available to attend (GP, Pharm, Nurse) *(recipients)* where staff will be told about the consequences of continuing the inappropriate medication (inappropriate BP control, risks associated with low BP), by a pharmacist researcher *(provider, content)* (BCT 5.1, 5.3) when to consider deprescribing and how to use the guideline (BCT 4.1).

Provide this guidance in addition to amending drug Kardex to include a banner entitled 'Consider deprescribing: contact prescriber if SBP persistently <130mmHg' as a prompt *(content, mode of delivery)* (BCT 7.1) to remind HCPs to deprescribe the drug class of interest.

Barrier ***TDF domain***	**COM-B**	**Intervention function** *definition* (intervention options)	**Feasible BCTs as identified by Delphi consensus**	**Does BCT meet the criteria? (Rationale for exclusion based on APEASE criteria)**	**Description of BCT in action/context**
Insufficient resources: time, staffing and IT. *Environmental context & resources* Insufficient resources negatively affected HCPs' engagement with deprescribing. The major barrier was a perceived lack of time for HCPs to engage with deprescribing, followed by insufficient staff to support deprescribing and lack of IT	Opportunity (Physical)	→ Training *Imparting skills* (Time: train to reduce time demands/ competing time demands for deprescribing).	~~2.2 Feedback on behaviour~~	Training not believed to be appropriate to improve time demands, staffing issues or IT support Qual feedback was v negative against role play/rehearsal – felt it was feasible but not acceptable Rejected: unlikely to be effective or acceptable	Prompt *(mode of action)* in Kardex *(setting)* to review BP measurements every 3 months **AND/OR** prompt *(mode of action)* in observation charts *(setting)* for nurse/pharmacist *(recipient)* to call prescriber if predefined criteria is met *(content)* (e.g., >2 SPB measurements of <130mmHg) **AND/OR** pharmacy send email to CNM *(provider, mode of action)* to as a reminder to perform 3 monthly BP checks priori to medication review *(content, frequency)*. (BCT 1.4)
			~~2.7 Feedback on outcome(s) of behaviour~~		
			4.1 Instruction on how to perform the behaviour		
			~~6.1 Demonstration of the behaviour~~		
			~~8.1 Behavioural practice/rehearsal~~		
		→ Environmental restructuring *Change the physical or social context* (Location/physical barriers: restructure the environment to reduce time demands/ competing time demands for deprescribing).	7.1 Prompts/cues		
			12.1 Restructuring the physical environment		
			12.2 Restructure the social environment		
			12.5 Adding objects to the environment		Adding Healthmail services from LTCF allowing communication about deprescribing decisions with pharmacy.
		→ Enablement *Increasing means/ reducing barriers to increase capability*	1.1 Goal setting (behaviour)		LTCF set goal of creating time to discuss deprescribing for drug class of interest (antihypertensives) during 3 monthly medication review.

to support deprescribing.		*(beyond education and training) or opportunity (beyond env restructuring)* (Resources: restructure the environment to increase social support and cultural norms for deprescribing. Interpersonal influences/cultural expectations: restructure the social environment or use modelling to shape people's way of thinking).	1.2 Problem solving		GPs review results (BP measurements) of patient referred by nursing staff. GP plan deprescribing actions, where appropriate, using healthmail to inform the pharmacy about any medication changes *(provider, content, setting, mode of delivery, recipient, duration)* (BCT 1.2, 1.4).
			~~1.3 Goal setting (outcome)~~	Due to the individualised nature of deprescribing decision making, goal setting (outcome) may not be considered appropriate. Rejected: unlikely to be acceptable	
			1.4 Action planning		See above
			1.5 Review behaviour goal(s)		During 3 monthly reviews, pharmacist to keep track on structured medication review form of how many deprescribing conversations were conducted for eligible patients, duration of discussion, and feed this information back to MDT.
			~~1.7 Review outcome goal(s)~~	Due to the individualised nature of deprescribing decision making, review outcome goals may not be considered appropriate. Rejected: unlikely to be acceptable.	
			3.2 Social support (practical)		Increase pharmacist support to nurses by identifying patients on potentially inappropriate prescribed drug class using pharmacy dispensing software (antihypertensives) and emailing results to the LTCF using Healthmail.

Proposed intervention:

Addressing barrier of time: protected time to engage with deprescribing: LTCF set goal of discussing deprescribing for drug class of interest (antihypertensives) with MDT during 3 monthly medication review (BCT 1.1). During 3 monthly reviews, pharmacist to keep track of how many deprescribing conversations were conducted for eligible patients, duration of discussion, and feed this information back to MDT (BCT 1.5).

Addressing staffing and time barrier: fast way of identifying patients for deprescribing, nurse or pharmacist can refer to GP reducing work burden of each HCP: Reminder prompt in Kardex *(mode of action, setting)* to review BP measurements every 3 months **AND/OR** prompt *(mode of action)* in observation charts *(setting)* for nurse/pharmacist *(recipient)* to call prescriber if predefined criteria is met *(content)* (e.g., >2 SPB measurements of <130mmHg) **AND/OR** pharmacy send email to CNM at LTCF to as a reminder to perform screening method (3 monthly BP checks) priori to medication review (BCT 1.4, 4.1, 7.1, 12.1, 12.2, 12.5).

Increase pharmacist support to nurses by identifying patients on potentially inappropriate prescribed drug class using pharmacy dispensing software (antihypertensives) and emailing results to the LTCF using Healthmail (BCT 3.1, 3.2).

GPs review results (BP measurements) of patient referred by nursing staff. GP plan deprescribing actions, where appropriate, using healthmail to inform the pharmacy about any medication changes *(provider, content, setting, mode of delivery, recipient, duration)* (BCT 1.2, 1.4).

Barrier ***TDF domain***	**COM-B**	**Intervention function** *definition* (intervention options)	**Feasible BCTs as identified by Delphi consensus**	**Does BCT meet the criteria? (Rationale for exclusion based on APEASE criteria)**	**Description of BCT in action/context**
Fragmented care, communication and co-ordination between LTCFs and hospital settings. (-) *Environmental context & resources* Insufficient communication and coordination between hospital and long-term care leads to fragmented patient care, negatively affecting deprescribing engagement	Opportunity (Physical)	→ Training	~~2.2 Feedback on behaviour~~ ~~2.7 Feedback on outcome(s) of behaviour~~	System failure in communication and coordination of care between healthcare settings. BCTs need to target environment, creating pathways for communication. Rejected: unlikely to be acceptable	
			4.1 Instruction on how to perform the behaviour		Provide protocol *(mode of delivery)* to administrative staff *(recipient)* that on admission/readmission from hospital, LTC staff contact hospital/patient's discharge letter to gain indications for all medications and this is to be documented in the notes using secure email system Healthmail *(setting)*. BCT 1.4, 4.1, 3.2, 3.1)
			~~6.1 Demonstration of the behaviour~~ ~~8.1 Behavioural practice/rehearsal~~	System failure in communication and coordination of care between healthcare settings. BCTs need to target environment first, not individual. Qual feedback has identified that behavioural practice/rehearsal is not appropriate. Rejected: unlikely to be acceptable	
		→ Environmental restructuring	7.1 Prompts/cues		Adjust drug Kardex to include indication box *(mode of delivery)* beside all drugs prescribed to be completed by GP/pharmacist *(setting,*
			12.1 Restructuring the physical environment		

		(Location/ physical barriers: train or restructure the environment to provide cues and prompts for desired behaviour).	12.2 Restructure the social environment		*provider, recipient)*. Those without indications following admission/readmission from hospital, nurse to identify these and prompt GP/pharmacist to document indication or contact hospital and determine indication if not clear. (BCT 7.1, 12.1, 12.2, 12.5).
			12.5 Adding objects to the environment		
		→ Enablement (Interpersonal influences/cultural expectations: restructure the social environment or use modelling to shape people's way of thinking.)	1.1 Goal setting (behaviour)		Site/organisation *(provider)* setting deprescribing as a high priority. MDT to meet and agree specific goals to support deprescribing when patients admitted from hospital, such as nurse to screen patients (>2 BP measurements) discharged from hospital who are prescribed drug class of interest (antihypertensives) and refer to GP if SBP <130mmHg for > 2 readings. (BCTs 1.1, 1.4, 3.2)
			1.2 Problem solving		LTC staff (HCPs and management) meet to discuss best way to obtain all information required from hospital setting to safely deprescribe. They decide and agree on information required and roles and responsibilities for system.
			~~1.3 Goal setting (outcome)~~	Not appropriate to set outcome goal of reaching predetermined degree of communication between healthcare settings as a result of engaging with strategy. Rejected: unlikely to be acceptable	

			1.4 Action planning		As above
			1.5 Review behaviour goal(s)		Annual/biannual review of behaviour goals. MDT meet to discuss if the goals set help them to increase deprescribing engagement.
			~~1.7 Review outcome goal(s)~~	Due to the heterogeneity of deprescribing outcomes, this may not be appropriate. Rejected: unlikely to be acceptable	
			3.1 Social support (unspecified)		As above
			3.2 Social support (practical)		
			12.1 Restructuring the physical environment		As above
			12.2 Restructuring the social environment		
			12.5 Adding objects to the environment		

Proposed intervention:

Site/organisation *(provider)* set deprescribing as a high priority. MDT to meet and agree specific goals to support deprescribing when patients admitted from hospital, such as nurse to screen patients (>2 BP measurements) discharged from hospital who are prescribed drug class of interest (antihypertensives) and refer to GP if SBP <130mmHg for > 2 readings. Review goals at fixed interval e.g., annual/biannual by MDT meeting to discuss if the goals were effective in helping to increase deprescribing engagement. (BCT 1.1, 1.4, 1.5, 3.2).

Provide protocol *(mode of delivery)* to nursing staff *(recipient*) that on admission/readmission from hospital, nursing staff screen patients as identified above. (BCT 1.4, 3.1, 3.2, 4.1).

Adjust drug Kardex to include indication box *(mode of delivery)* beside all drugs prescribed which requires completion by GP/pharmacist *(setting, provider, recipient)*. Those without indications (e.g. hypertension diagnosis) following admission/readmission from hospital, nurse to identify these and prompt GP/pharmacist to document indication or contact hospital and determine indication if not clear. (BCT 1.4, 7.1, 12.1, 12.2, 12.5).

Barrier ***TDF domain***	**COM-B**	**Intervention function** *definition* (intervention options)	**Feasible BCTs as identified by Delphi consensus**	**Does BCT meet the criteria? (Rationale for exclusion based on APEASE criteria)**	**Description of BCT in action/context**
An 'established hierarchy' in long-term care was perceived by HCPs, with GPs having seniority in terms of responsibility for patient care. HCPs described fear and lack of authority to question the prescribing of GPs. (-) *Social/professional role and identity*	Motivation (reflective)	→ Education (Evaluations: Educate/persuade to create more positive beliefs about desired outcomes.)	~~2.2 Feedback on behaviour~~	Education should be about roles and responsibilities regarding deprescribing. Rejected: unlikely to be effective	
			~~2.7 Feedback on outcome(s) of behaviour~~		
			4.1 Instruction on how to perform the behaviour		Educate how to engage with deprescribing through single educational event *(mode of delivery, intensity)* conducted on-site *(setting)* by pharmacist researcher *(provider)*, identifying examples of how they could identify/initiate/support deprescribing, defining roles and persuading engagement *(content).*
			~~5.1 Information about health consequences~~	Barrier is related to professional role and identity. Providing information on health, social or environmental consequences would not help to address the opportunity or motivation barriers as HCPs already recognise the value of deprescribing as evidenced in the qualitative data. Rejected: not likely to be effective	
			~~5.3 Information about social and environmental consequences~~		
			7.1 Prompts/cues		Include a prompt on observation chart for nurse to call prescriber if predefined criteria is met *(content)* (e.g., >2

					SPB measurements of <130mmHg).
		→ Persuasion *Using communication to induce positive or negative feelings to stimulate action*	1.1 Goal setting (behaviour)		LTC staff (HCPs and management) meet on-site to decide role and responsibilities to promote and facilitate deprescribing. (BCT 1.1, 1.2)
			1.2 Problem solving		
			~~2.2 Feedback on behaviour~~	Barrier related to professional boundaries. Feedback on individual behaviour is unlikely to address this barrier. Rejected: not likely to be acceptable or effective.	
			2.7 Feedback on outcome(s) of behaviour		Pharmacists engage in the deprescribing process by identified patients on drug class of interest (antihypertensives) prior to 3 monthly medication review. Nurses' engage in the deprescribing process by taking BP measurement for identified patients prior to medication review and referring those with > 2 measurement < 130mmHg to the GP. Pharmacist available as support to deprescribing, providing guidance when requested by GPs/prior to medication review (BCT 3.2). Nurse role to monitor patient and provide feedback to
			3.1 Social support (unspecified)		
			3.2 Social support (practical)		

					prescriber on outcome of deprescribing (BCT 2.7).
			~~5.1 Information about health consequences~~ ~~5.3 Information about social and environmental consequences~~	Barrier is related to professional role and identity. Providing information on health, social or environmental consequences would not help to address the opportunity or motivation barriers as HCPs already recognise the value of deprescribing as evidenced in the qualitative data. Rejected: not likely to be effective	
			~~8.1 Behavioural practice/rehearsal~~	Due to nature of the behaviour (deprescribing) practice or rehearsal is not appropriate. Qual feedback showing rehearsal not acceptable. Rejected: unlikely to be acceptable	
			~~8.7 Graded tasks~~	Due to nature of the behaviour (deprescribing) performing graded tasks is not appropriate. Rejected: unlikely to be acceptable	
			9.1 Credible source		Single educational event *(mode of delivery, intensity)* conducted on-site *(setting)* facilitated by pharmacist researcher who as expertise in deprescribing *(provider).*
			11.2 Reduce negative emotions		Educational event *(mode of delivery, intensity)* conducted on-site *(setting)* by pharmacist researcher *(provider)*, provides an opportunity for HCP to ask questions regarding opportunities to engage with deprescribing *(content).*

			~~15.3 Focus on past success~~	Barrier is social. Persuasion should be in relation to deprescribing roles and responsibilities, not past outcomes. Rejected: not likely to be acceptable	
		→ Modelling (Responses: Model desired behaviour to induce automatic imitation.)	6.1 Demonstration of the behaviour		Display simulated video during educational event *(mode of delivery, intensity)*, showing how each HCP can engage with deprescribing *(content)*.

Proposed intervention:

LTC staff (HCPs and management) meet on-site to decide role and responsibilities to promote and facilitate deprescribing (BCT 1.1, 1.2)

Single educational event *(mode of delivery, intensity)* conducted on-site *(setting)* facilitated by pharmacist researcher who has expertise in deprescribing *(provider)* (BCT 4.1, 9.1). The focus of the event is to explain HCP roles and responsibilities and the importance of the MDT in deprescribing by giving examples. This event will display a simulated video *(mode of delivery, intensity)*, showing how each HCP can engage with deprescribing, also providing an opportunity for HCPs to ask questions regarding opportunities to engage with deprescribing *(content)*. (BCT 4.1, 6.1, 9.1, 11.2).

For example, when deprescribing antihypertensives: pharmacist identifying patients on antihypertensive medicines prior to 3 monthly medicine review. Nurses take blood pressure measurement for identified patients prior to medication review.

Include a prompt on observation chart for nurses to refer patients with > 2 SBP measurements <130mmHg to the GP. (BCT 4.1)

Barrier *TDF domain*	**COM-B**	**Intervention function** *definition* (intervention options)	**Feasible BCTs as identified by Delphi consensus**	**Does BCT meet the criteria? (Rationale for inclusion or exclusion based on APEASE criteria)**	**Description of BCT in action/context**
Social pressures from any HCP, who prefers to maintain the 'status quo' and avoid potential negative patient associated outcomes, inhibits other HCPs from engaging with deprescribing. (-) *Social influence*	Opportunity (social)	→ Environmental restructuring	7.1 Prompts/cues		Place posters at nurses' station 'consider deprescribing,' highlighting the potential positive and negative outcomes of deprescribing a drug class of interest. **OR** include 'consider deprescribing' banner along the top of drug Kardex/front of drug Kardex: drugs deprescribed successfully/unsuccessfully. (BCT 7.1, 12.5)
			12.1 Restructuring the physical environment		Add new deprescribing audit to nursing documentation. Enlist the responsibility to one nurse and provide protected time once every fixed time interval (e.g.,3 months) to review deprescribing attempts considering goals set out and provide feedback from site/wards. (BCT 12.1, 13.1)
			12.2 Restructuring the social environment		As below
			12.5 Adding objects to the environment		As above
		→ Enablement	1.1 Goal setting (behaviour)		Pharmacist researcher *(provider)* meet with staff at

		Interpersonal influences/cultural expectations: restructure the social environment or use modelling to shape people's way of thinking	1.2 Problem solving		LTCF and enable HCP to engage with deprescribing by helping to set deprescribing goals within each LTC setting *(content, recipient, mode of delivery, setting)*. This includes identifying a drug class to target, creating a plan to encourage engagement with deprescribing and creating a MDT support system, delegating roles and responsibilities to provide guidance on deprescribing. Following initial meeting, review of deprescribing engagement and goal set conducted after 3 months. (BCT 1.1, 1.2, 1.4, 1.5, 1.7, 3.1, 12.2)
			~~1.3 Goal setting (outcome)~~	Not possible to set outcome goal of predetermined level of social support for deprescribing from engaging with strategy Rejected: not likely to be acceptable	
			1.4 Action planning		As above
			1.5 Review behaviour goal(s)		
			1.7 Review outcome goal(s)		
			3.1 Social support (unspecified)		

			3.2 Social support (practical)		
			12.1 Restructuring the physical environment		As above
			12.5 Adding objects to the environment		As above
			13.1 Identification of self as role model		
		→ Modelling *Providing an example for people to aspire to or imitate*	6.1 Demonstration of the behaviour		As above
			6.2 Social comparison	Not appropriate as deprescribing decision are individualised based on the resident and not all LTCF residents are identical. Rejected: acceptability	
			6.3 Information about others approval		The MDT team consisting of GP, Pharm and Nurse will act as deprescribing champions, leading the deprescribing and providing a demonstration for other staff.

Proposed intervention:

Pharmacist researcher *(provider)* meet with staff at LTCF and enable HCP to engage with deprescribing by helping to set deprescribing goals within each LTC setting *(content, recipient, mode of delivery, setting)*. This includes identifying a drug class to target, creating a plan to encourage engagement with deprescribing and creating a MDT support system, delegating roles and responsibilities to provide guidance on deprescribing.

Following initial meeting, review of deprescribing engagement and goal set conducted after 3 months. Add new deprescribing audit to nursing documentation. Enlist the responsibility to one nurse and provide protected time once every fixed time interval (e.g.,3 months) to review deprescribing attempts considering goals set out and provide feedback from site/wards. The MDT team consisting of GP, Pharm and Nurse will act as deprescribing champions, leading the deprescribing and providing a demonstration for other staff.

Place posters at nurses' station 'consider deprescribing,' highlighting the potential positive and negative outcomes of deprescribing a drug class of interest. **OR** include 'consider deprescribing' banner along the top of drug Kardex/front of drug Kardex: drugs deprescribed successfully/unsuccessfully. (BCT 7.1, 12.5)

Enabler ***TDF domain***	**COM-B**	**Intervention function** *definition* (intervention options)	**Feasible BCTs as identified by Delphi consensus**	**Does BCT meet the criteria? (Rationale for inclusion or exclusion based on APEASE criteria)**	**Description of BCT in action/context**
MDT meetings support deprescribing behaviours and decision making. (+) E*nvironmental context and resources*	Opportunity (Physical)	→ Training	~~2.2 Feedback on behaviour~~	Feedback on behaviour is intrapersonal – feedback on individual performance. Enabler is social/resource discussing MDT meetings therefore need interpersonal BCTs. Rejected: not likely to be acceptable	
			2.7 Feedback on outcome(s) of behaviour		Nurse provide feedback to prescriber on outcome of deprescribing resulting from MDT deprescribing discussion.
			~~4.1 Instruction on how to perform the behaviour~~	Instruction/demonstration/practice of deprescribing is personal. Enabler is social discussing MDT meetings therefore need interpersonal BCTs to promote MDT. Negative qual feedback on rehearsal Rejected: not likely to be acceptable	
			~~6.1 Demonstration of the behaviour~~		
			~~8.1 Behavioural practice/rehearsal~~		
		→ Environmental restructuring *Resources: restructure the environment to increase social support and cultural norms for desired*	7.1 Prompts/cues		Email sent at the beginning of every quarter by LTC management staff *(provider, mode of delivery, duration, setting)* to remind CNMs to organise 3 monthly review *(content)*.
			12.1 Restructuring the physical environment		Introduce 3 monthly medication review meetings

		behaviour (restrict undesired behaviour)			*(mode of delivery)* for MDT at the LTCF *(setting, recipients)*.
			12.2 Restructuring the social environment		
			12.5 Adding objects to the environment		Add deprescribing guidelines *(content)* as reference to support deprescribing.
		→ Enablement	1.1 Goal setting (behaviour)		Deprescribing goal set prior to meeting and agreed by MDT e.g., review particular drug class (antihypertensive therapy)
			~~1.2 Problem solving~~	Analysing factors influencing deprescribing behaviour not appropriate to support enabler or organising MDT meetings. Rejected: not likely to be acceptable or effective	
			~~1.3 Goal setting (outcome)~~	Difficult to set goal in terms of positive outcomes from deprescribing as result of MDT as deprescribing decisions are individual to the patient. Rejected: not likely to be acceptable	
			1.4 Action planning		Medication reviews conducted for patients prescribed drug class of interest (antihypertensives) on the ward and MDT engage with deprescribing particular drug class where appropriate.
			~~1.5 Review behaviour goal(s)~~	Review behaviour goals is intrapersonal – review of individual performance. Enabler is social discussing MDT	

				meetings therefore need interpersonal BCTs. Rejected: not likely to be acceptable	
			1.7 Review outcome goal(s)		Provide a report of deprescribing outcomes of previous attempts to deprescribe drug class of interest prior to discussing medication review.
			3.1 Social support (unspecified)		Pharmacist role: identifying patients on drug class of interest (antihypertensive meds) from dispensing software prior to 3 monthly med review and giving list to nurse. Nurse role: patient symptoms analysis (taking BP measurement) prior to meeting GP role to review therapy and if appropriate, determine deprescribing plan, leaving drug PRN in the event of symptom return (hypertension). Pharmacist available as support to deprescribing, providing guidance. Nurse role to monitor patient and provide feedback to prescriber on outcome of deprescribing
			3.2 Social support (practical)		

			12.1 Restructuring the physical environment		As above
			12.2 Restructuring the social environment		
			12.5 Adding objects to the environment		

Proposed intervention:

Introduce 3 monthly medication review meetings *(mode of delivery)* for MDT at the LTCF *(setting, recipients)* (BCT 12.1). Email sent at the beginning of every quarter by LTC management staff *(provider, mode of delivery, duration, setting)* to remind HCPs to organise 3 monthly review *(content)* (BCT 7.1). Deprescribing goal set prior to meeting and agreed by MDT e.g., review particular drug class (antihypertensive therapy) (BCT1.1). Add deprescribing guidelines to ward *(content)* as reference to support deprescribing (BCT 12.5).

Medication reviews conducted for patients prescribed drug class of interest (antihypertensives) on the ward and MDT engage with deprescribing particular drug class where appropriate (BCT 1.4). Pharmacist role: identifying patients on drug class of interest (antihypertensive meds) from dispensing software prior to 3 monthly med review and giving list to nurse. Nurse role: patient symptoms analysis (taking BP measurement) prior to meeting GP role to review therapy and if appropriate, determine deprescribing plan, leaving drug PRN in the event of symptom return (hypertension) (BCT 3.1, 3.2, 12.2).

Pharmacist available as support to deprescribing, providing guidance. Nurse role to monitor patient and provide feedback to prescriber on outcome of deprescribing (BCT 2.7). Provide a report of deprescribing outcomes of previous attempts to deprescribe drug class of interest prior to discussing medication review (BCT 1.7).

Enabler ***TDF domain***	**COM-B**	**Intervention function** *definition* (intervention options)	**Feasible BCTs as identified by Delphi consensus**	**Does BCT meet the criteria? (Rationale for inclusion or exclusion based on APEASE criteria)**	**Description of BCT in action/context**
Knowledge and experience offers the confidence required to deprescribe or make recommendations. (+) *Beliefs about capabilities*	Motivation (reflective)	→ Education *Impulses/inhibition: train/enable to strengthen habitual engagement in the desired behaviour*	~~2.2 Feedback on behaviour~~	Not feasible to monitor each HCP and provide feedback on each decision they made in the deprescribing process Rejected: acceptability and practicability	
			2.7 Feedback on outcome(s) of behaviour		Share clinical feedback following deprescribing intervention. Allow an opportunity to learn from engaging with the behaviour to build knowledge and confidence.
			4.1 Instruction on how to perform the behaviour		Organise training day *(mode of delivery)* at LTCF *(setting)*. Provide information such as the consequences of continuing the inappropriate medication (inappropriate BP control, risks associated with low BP), when to consider deprescribing, risks associated with deprescribing (hypertension) and how to understand deprescribing guidelines and engage with behaviour (check BP when
			5.1 Information about health consequences		
			5.3 Information about social and environmental consequences		

					resident dizzy/fall/incoherent etc) *(content)*.
			7.1 Prompts/cues		Placing deprescribing guidelines in nurses station as a prompt to increase HCPs knowledge.
		→ Persuasion *Evaluations: Educate/persuade to create more positive beliefs about desired outcomes*	~~1.1 Goal setting (behaviour)~~	Goal setting and problem solving does not increase knowledge, experience or confidence in deprescribing Reject: not likely to be acceptable	
			~~1.2 Problem solving~~	Analysing factors influencing deprescribing behaviour not appropriate to support deprescribing due to the individualised nature of various knowledge/confidence issues Rejected: not likely to be acceptable or effective	
			~~2.2 Feedback on behaviour~~	As above	
			2.7 Feedback on outcome(s) of behaviour		As above
			3.1 Social support (unspecified)		Organise training day with all HCP (GP, pharmacist and nurses) available at LTCF conducted by pharmacist deprescribing researcher, with the support of medical officer and CNM.
			3.2 Social support (practical)		
			5.1 Information about health consequences		As above

			5.3 Information about social and environmental consequences		
			~~8.1 Behavioural practice/rehearsal~~ ~~8.7 Graded tasks~~	This would be appropriate to support HCP gaining confidence with deprescribing however due to the nature of the behaviour, this may not practical or acceptable Rejected: not likely to be acceptable or practical	
			9.1 Credible source		Organise training day at LTCF conducted by pharmacist deprescribing researcher, with the support of medical officer and CNM. Provide information such as the consequences of continuing the inappropriate medication (inappropriate BP control, risks associated with low BP), when to consider deprescribing, risks associated with deprescribing (hypertension) and how to understand deprescribing guidelines and engage with behaviour (check BP when resident dizzy/fall/incoherent etc).
			11.2 Reduce negative emotions		Give opportunities for HCPs to ask questions and deal with any concerns.

			~~15.3 Focus on past success~~	Deprescribing not yet routine practice and deprescribing is individualised to the patient therefore not appropriate Rejected: not likely to be acceptable	
		→ Modelling *Responses: Model desired behaviour to induce automatic imitation*	6.1 Demonstration of the behaviour		Provide video of simulated example of deprescribing: showing when to consider deprescribing, who is involved and the potential positive and negative outcomes.
		→ Enablement	~~1.1 Goal setting (behaviour)~~	BCTs don't affect confidence by offering knowledge or experience Rejected: not likely to be effective	
			~~1.2 Problem solving~~		
			~~1.3 Goal setting (outcome)~~		
			~~1.4 Action planning~~		
			~~1.5 Review behaviour goal(s)~~		
			~~1.7 Review outcome goal(s)~~		
			3.1 Social support (unspecified)		As above
			3.2 Social support (practical)		
			~~12.1 Restructuring the physical environment~~	BCTs don't affect confidence by offering knowledge or experience Rejected: not likely to be effective	
			~~12.5 Adding objects to the environment~~		

Proposed intervention

Organise training day with all HCP (GP, pharmacist and nurses) available at LTCF conducted by pharmacist deprescribing researcher, with the support of medical officer and CNM at the LTCF setting (BCT 3.1, 3.2, 9,1).

Provide information such as the consequences of continuing the inappropriate medication (inappropriate BP control, risks associated with low BP), when to consider deprescribing, risks associated with deprescribing (hypertension) and how to understand deprescribing guidelines and engage with behaviour (check BP when resident dizzy/fall/incoherent etc) *(content)*.

Share clinical feedback following deprescribing intervention. Allow an opportunity to learn from engaging with the behaviour to build knowledge and confidence (BCT 2.7)

Give opportunities for HCPs to ask questions and deal with any concerns whist providing a video of a simulated example of deprescribing: showing when to consider deprescribing, who is involved and the potential positive and negative outcomes (BCT 6.1, 11.2). Placing deprescribing guidelines in nurses station as a prompt to increase HCPs knowledge.

Appendix 15: Consolidated criteria for reporting qualitative research (COREQ-32)

Domain 1: Research team and reflexivity	
Personal characteristics	
Primary facilitator	Clara H. Heinrich.
Credentials	BPharm, MPharm, PhD Scholar.
Occupation	Pharmacist.
Gender	Female.
Experience and training	Qualitative research training at university level.
Co-facilitator	Geoffrey M. Curran
Credentials	BA Sociology, MA Sociology, PhD Sociology
Occupation	Director, Centre for Implementation Research Professor, Department of Pharmacy Practice, College of Pharmacy Professor, Department of Psychiatry, College of Medicine Research Health Scientist, Central Arkansas Veterans Healthcare System
Gender	Male
Experience and training	Extensive qualitative experience and implementation science expert.
Relationship with participants	
Relationship established	A small selection of HCP had a previous professional relationship with the primary facilitator through her role as a pharmacist, prior to study commencement. Co-facilitator had no established relationship with any participants.
Participant knowledge of the interviewer	Participants were aware of the primary facilitator's profession and aims for PhD research of developing a deprescribing intervention. Participants had no prior knowledge of the co-facilitator.
Interviewer characteristics	No characteristics were reported.
Domain 2: Study design	
Theoretical Framework	
Methodological orientation and theory	Qualitative description methodological orientation of primary facilitator using a summative content analysis method. Barriers and enablers discussed during roundtable were mapped to the Theoretical Domains Framework.
Participant selection	
Sampling	Convenience and purposive sampling strategy
Method of approach	Email.
Sample size	At least 2 participants per HCP group.
Non-participation	No participants dropped out.
Setting	
Setting of data collection	Microsoft Teams.
Presence of non-participants	Research team (MDD, SMcC, SMcH) managed the operations of the meeting but were not involved in or contributed to the discussion.
Description of sample	Section 6.5.3

Data collection	
Interview guide	Participants were asked to rank previously identified barriers/enablers to deprescribing (which themselves were associated with the Theoretical Domains Framework). Each barrier/enabler was associated with behaviour change techniques. Participants were asked to describe what the behaviour change techniques would look like based on their understanding of the LTC context.
Repeat interviews	No.
Audio/visual recording	Both audio and visual recording with participant consent
Field notes	No
Duration	1 hr 36 minutes
Data saturation	N/A
Transcripts returned	No
Domain 3: Analysis and findings	
Number of data coders	Deductive coding conducted by one researcher (CHH), are reviewed by the entire research team.
Description of the coding tree	Deductive coding (codes based on BCTs – potential implementation strategy content) looking at the frequency with which participants mentioned specific strategies and the explicit importance they verbally placed on such strategies.
Derivation of themes	Derived from the data, informed by researchers' knowledge and experience.
Software	NVivo
Participant checking	No.
Reporting	
Quotations presented	No.
Data and findings consistent	Yes.
Clarity of major themes	Yes.
Clarity of minor themes	Yes.

Appendix 16: Deprescribing roundtable discussion: implementation strategy summary and worksheet.

UCC
Coláiste na hOllscoile Corcaigh
University College Cork, Ireland

School of Pharmacy
University College Cork

Deprescribing Roundtable Discussion:

Intervention Summary and Worksheet

Below you will find five barriers and three enablers to deprescribing in long-term care, as identified by healthcare professionals (HCPs) working in a long-term care facility (LTCF). Based on these findings, I have proposed *seven* interventions to support deprescribing.

How did I develop the interventions?

First, we conducted a qualitative evidence synthesis of international research to identify barriers/enablers to deprescribing in LTCF as perceived by HCPs.

Secondly, we conducted qualitative interviews with HCPs working in Irish LTCFs, both public and private, to understand the barriers/enabler present in the Irish context.

We mapped each barrier/enabler to the Behaviour Change Wheel (BCW), a behavioural science tool for intervention design. Using the BCW we identified a list of possible strategies.

A survey (Delphi consensus), of HCPs working in LTCFs identified which intervention strategies would be feasible in LTCF. The final list of strategies to address the barriers and enablers are presented today as operationalised examples of interventions to target a barrier/enabler.

We chose to focus on antihypertensives in the proposed interventions following a retrospective chart review study of frail older adults resident in LTC, which identified that antihypertensives was the largest drug class potentially inappropriately prescribed to 42.5% of the frail older adult population as identified using Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy (STOPPFrail) criteria.

Purpose of Roundtable Discussion

Some proposed interventions contain several strategies, and some strategies tackle a number of barriers and enablers. The aim of the roundtable discussion is to discuss and adjust the proposed interventions to ensure they are appropriate, relevant, and feasible for Irish HSE-funded LTCFs.

What do you need to do before we meet?

Please review the seven proposed interventions and document any changes which you would suggest for discussion at the roundtable meeting. You can do this using the space provided on this document and return to myself via email in addition to the consent forms by September 20th.

Barrier #1: Experience or practical application of deprescribing knowledge was not universal among healthcare professionals working in long-term care.

(This barrier also addresses an enabler identified by HCPs - the need for education)

Proposed intervention design #1:

Pharmacist researcher to provide evidence-based document to ward as reference material for deprescribing drug class of interest (antihypertensives).

And/or

Provide this guidance in addition to a training session at the LTCF, with all HCP staff available to attend (GP, Pharmacist, Nurse) where staff will be told about the consequences of continuing the inappropriate medication (inappropriate blood pressure (BP) control, risks associated with low BP), by a pharmacist researcher, when to consider deprescribing and how to use the document.

And/or

Provide this document/training in addition to amending drug Kardex to include a banner entitled 'Consider deprescribing: contact prescriber if systolic blood pressure (SBP) persistently <130mmHg' as a prompt to remind HCPs to deprescribe the drug class of interest.

Question to consider: How do you think that this would work in your setting (which elements would work best, which elements would you change etc)?

Barrier #2: Insufficient resources negatively affected HCPs' engagement with deprescribing. The major barrier was a perceived lack of time for HCPs to engage with deprescribing, followed by insufficient staff to support deprescribing and lack of IT to support deprescribing.

Proposed intervention design #2:

Addressing time and staffing – creating opportunity to deprescribe and sharing responsibilities:

Set goal of discussing deprescribing for drug class of interest (antihypertensives) with multidisciplinary team (MDT) during 3 monthly medication review. During reviews, pharmacist to keep track on structured medication review form, of how many deprescribing conversations were conducted for eligible patients and feed this information back to the MDT.

And/or

Reminder prompt in Kardex to review BP measurements every 3 months **AND/OR** prompt in observation charts for nurse/pharmacist to call prescriber if predefined criteria is met (e.g., >2 SBP measurements of <130mmHg) **AND/OR** pharmacy send email to clinical nurse manager at the LTCF as a reminder to perform 3 monthly BP checks prior to medication review.

And/or

Addressing time, staffing and IT – teamwork to overcome staffing and time barrier, Healthmail to increase IT support:

Increase pharmacists' support to nurses by identifying patients on potentially inappropriate prescribed drug class using pharmacy dispensing software (antihypertensives) and emailing results to the LTCF using Healthmail.

And/or

GP to review results (BP measurements) during 3 monthly medication review and deprescribe where appropriate using Healthmail to inform the pharmacy about any medication changes.

Question to consider: How do you think that this would work in your setting (which elements would work best, which elements would you change etc)?

Barrier #3: Insufficient communication and coordination between hospital and long-term care leads to fragmented patient care, negatively affecting deprescribing engagement.

Proposed intervention design #3:

Site/organisation set deprescribing as a high priority. MDT to meet and agree specific goals to support deprescribing when patients admitted from hospital. Example: nurse to screen patients (>2 SBP measurements) discharged from hospital who are prescribed drug class of interest (antihypertensives) and refer to GP if SBP <130mmHg for > 2 readings. Review goals at fixed interval e.g., annual/biannual by MDT meeting to discuss if the goals were effective in helping to increase deprescribing engagement.

And/or

Provide protocol to nursing staff that on admission/readmission from hospital, nursing staff screen patients as identified above.

And/or

LTC staff (HCPs and management) meet to discuss best way to obtain all information required from hospital setting to safely deprescribe. They decide and agree on information required and roles and responsibilities to obtain the information.

And/or

Adjust drug Kardex to include indication box beside all drugs prescribed to be completed by GP/pharmacist. Those without indications (e.g. hypertension diagnosis) following admission/readmission from hospital, nurse to identify these and prompt GP/pharmacist to document indication or contact hospital and determine indication if not clear.

Question to consider: How do you think that this would work in your setting (which elements would work best, which elements would you change etc)?

Barrier #4: An 'established hierarchy' in long-term care was perceived by HCPs, with GPs having seniority in terms of responsibility for patient care. HCPs described fear and lack of authority to question the prescribing of GPs.

Proposed intervention design #4:

LTC staff (HCPs and management) meet onsite to decide role and responsibilities to promote and facilitate deprescribing.

And/or

Single educational event conducted onsite facilitated by pharmacist researcher who has expertise in deprescribing. The focus of the event is to explain HCP roles and responsibilities and the importance of the MDT in deprescribing by giving examples.

And/or

This event will display a simulated video, showing how each HCP can engage with deprescribing, also providing an opportunity for HCPs to ask questions regarding opportunities to engage with deprescribing.

For example, when deprescribing antihypertensives: pharmacist identifying patients on antihypertensive medicines prior to 3 monthly medicine review. Nurses take blood pressure measurement for identified patients prior to medication review.

And/or

Include a prompt on observation chart for nurses to refer patients with > 2 SBP measurements <130mmHg to the GP.

Question to consider: How do you think that this would work in your setting (which elements would work best, which elements would you change etc)?

Enabler #1: Knowledge and experience gave HCPs confidence and enhanced their level of engagement with deprescribing or making deprescribing recommendations in long-term care.

Proposed intervention

Organise training day with all HCPs (GP, pharmacist and nurses) available at LTCF conducted by pharmacist deprescribing researcher, with the support of medical officer and clinical nurse manager at the LTCF. Display a video of simulated example of how to engage with deprescribing, routinely and as required. Give opportunity for HCPs to ask questions and work through with any concerns.

And/or

Provide information such as the consequences of continuing the inappropriate medication (inappropriate BP control, risks associated with low BP), when to consider deprescribing, risks associated with deprescribing (hypertension) and how to understand deprescribing guidelines and engage with behaviour (check BP when resident dizzy/fall/incoherent etc).

And/or

Share clinical feedback following deprescribing intervention. Allow an opportunity to learn from engaging with the behaviour to build knowledge and confidence. Placing deprescribing document in nurses' station as a prompt to increase HCPs knowledge.

Question to consider: How do you think that this would work in your setting (which elements would work best, which elements would you change etc)?

Barrier #5: Social pressures from any HCP, who prefers to maintain the 'status quo' and avoid potential negative patient associated outcomes, inhibits other HCPs from engaging with deprescribing

Proposed intervention design #5:

Pharmacist researcher to meet with staff at LTCF and enable HCPs to engage with deprescribing by helping to set deprescribing goals within each LTCF. This includes identifying a drug class to target, creating a plan to encourage engagement with deprescribing and creating a MDT support system, delegating roles and responsibilities to provide guidance on deprescribing.

For example, add deprescribing audit to nursing documentation. Give the responsibility to one nurse and provide protected time once every fixed time interval (e.g., 3 months) to review deprescribing attempts for specific drug class on his/her ward and provide feedback to MDT on audit findings, both positive and negative.

And/or

Create MDT team consisting of GP, Pharmacist and Nurse to act as deprescribing champions, leading the deprescribing and providing a demonstration for other HCPs.

And/or

Place posters at nurses' station 'consider deprescribing,' highlighting the potential positive and negative outcomes of deprescribing a drug class of interest **AND/OR** include 'consider deprescribing' banner along the top of drug Kardex/front of drug Kardex: drugs deprescribed successfully/unsuccessfully, to encourage nurse/pharmacist engagement.

Question to consider: How do you think that this would work in your setting (which elements would work best, which elements would you change etc)?

Enabler #2: Face-to-face MDT meetings, conducted at regular intervals, between all three HCP groups facilitates deprescribing decision making in long-term care.

Proposed intervention:

Introduce 3 monthly medication review meetings for MDT at the LTCF. Email sent at the beginning of every quarter by LTC management to remind clinical nurse managers to organise 3 monthly reviews with GP and Pharmacist.

Deprescribing goal set prior to meeting and agreed by MDT during planning stages e.g., review specific drug class (antihypertensives). Deprescribing guidelines added to ward as reference, provided by researcher.

Medication reviews conducted at fixed interval (e.g. 3 monthly) for patients prescribed drug class of interest (antihypertensives). MDT engage with deprescribing targeted drug class where appropriate.

- Pharmacist role: identifying patients on drug class of interest (antihypertensives) from dispensing software prior to 3 monthly med review and giving list to nurse. Available as support to deprescribing, providing guidance.
- Nurse role: patient symptoms analysis (taking BP measurement) prior to meeting. Provide feedback to prescriber on outcome of deprescribing.
- GP role: review therapy and if appropriate, determine deprescribing plan, leaving drug PRN in the event of symptom return (hypertension). Provide a report of deprescribing outcomes of previous attempts to deprescribe drug class of interest during medication review, if applicable.

Question to consider: How do you think that this would work in your setting (which elements would work best, which elements would you change etc)?

Appendix 17: Operationalisation of BCTs following roundtable discussion.

Rank	Barrier/enabler	Proposed strategy: pre-roundtable	Updated strategy: post-roundtable	Proposed mechanism
1	Insufficient resources negatively affected HCPs' engagement with deprescribing. The major barrier was a perceived lack of time for HCPs to engage with deprescribing, followed by insufficient staff to support deprescribing and lack of IT to support deprescribing.	Set goal of discussing deprescribing for drug class of interest (antihypertensives) with MDT during 3 monthly medication review. During 3 monthly reviews, pharmacist to keep track of how many deprescribing conversations were conducted for eligible patients, duration of discussion, and feed this information back to MDT. Reminder prompt in Kardex to review BP measurements every 3 months **AND/<u>OR</u>** prompt in observation charts for nurse/pharmacist to call prescriber if predefined criteria is met (e.g., >2 SPB measurements of <130mmHg) **AND/OR** pharmacy send email to CNM at LTCF to as a reminder to perform screening method (3 monthly BP checks) priori to medication review. Increase pharmacist support to nurses by identifying patients on potentially inappropriate prescribed drug class using pharmacy dispensing software (antihypertensives) and emailing results to the LTCF using Healthmail. GPs review results (BP measurements) of patient referred by nursing staff. GP plan deprescribing actions, where appropriate,	MDT incorporating Pharmacist, Nurse and GP occurring every 3 months for one-hour duration at the long-term care facility, targeting one pre-defined drug class. *Nurse champion,* being a clinical nurse manager/nurse prescriber on-site, take the lead by identifying drug class which he/she believes unit would benefit from reviewing, using tool such as STOPPFrail and organising a time/setting a time for all HCP to attend. Nurse champion to identify what information is needed prior to the meeting and delegate to colleagues e.g., pharmacist run report on dispensing software to identify all patients on X class of medication, nurse champion to screen patients based on guidelines, indication and how many people feasible to review during MDT and agree on patients. Delegate to nurse staff to have Kardex and notes available at the MDT. *Prompts* to reminder staff nurses to take clinical measurement e.g., BP in the form of placing a sticker on the drug Kardex.	The strategy is hypothesised to address the insufficient resources of staff, resources and time as an MDT approach facilitates each HCP contributing a smaller amount of time than would be required if the responsibility was placed on a singular profession. Having the meeting at the LTCF bypasses the need for IT, which is limited in this setting.

		using healthmail to inform the pharmacy about any medication changes.	BCTs not considered: BCT 1.5, 12.2	
2	Insufficient communication and coordination between hospital and long-term care leads to fragmented patient care, negatively affecting deprescribing engagement.	Site/organisation set deprescribing as a high priority. MDT to meet and agree specific goals to support deprescribing when patients admitted from hospital, such as nurse to screen patients (>2 BP measurements) discharged from hospital who are prescribed drug class of interest (antihypertensives) and refer to GP if SBP <130mmHg for > 2 readings. Review goals at fixed interval e.g., annual/biannual by MDT meeting to discuss if the goals were effective in helping to increase deprescribing engagement. Provide protocol to nursing staff that on admission/readmission from hospital, nursing staff screen patients as identified above. Adjust drug Kardex to include indication box beside all drugs prescribed which requires completion by GP/pharmacist. Those without indications (e.g. hypertension diagnosis) following admission/readmission from hospital, nurse to identify these and prompt GP/pharmacist to document indication or contact hospital and determine indication if not clear.	*Proforma letter/email* sent by LTC admission staff to previous GP to get a patient history including prescribed medications and indications. *This list to be added to patient summary page*. Any drugs without indication highlighted by nursing staff for review by the GP. BCTs not considered: BCT 1.1, 1.2, 1.5, 3.1, 4.1, 12.2	The proforma letter/email will provide the communication channel between LTCF and admitting GP. The hospital was believed to be a more difficult setting to communicate with, and the admitting GP would have a more detailed patient record.

3 & 4	Experience or practical application of deprescribing knowledge was not universal among healthcare professionals working in long-term care. Need for education	Pharmacist researcher to provide evidence-based deprescribing document to ward as refence material for drug class of interest (antihypertensives). Provide this guidance in addition to a training session at the LTCF, with all HCP staff available to attend (GP, Pharmacist, Nurse) where staff will be told about the consequences of continuing the inappropriate medication (inappropriate BP control, risks associated with low BP), by a pharmacist researcher when to consider deprescribing and how to use the guideline. Provide this guidance in addition to amending drug Kardex to include a banner entitled 'Consider deprescribing: contact prescriber if SBP persistently <130mmHg' as a prompt to remind HCPs to deprescribe the drug class of interest.	Education needs to be *two-tiered*. Firstly, to change the ethos and gain HCP buy-in to deprescribing. This includes highlighting the value placed on deprescribing via an education session facilitated by nurse champion, supported by pharmacist researcher, identifying the patient care value, documenting benefits of deprescribing and explaining the nursing role. The second form of education is reference guide to deprescribing for HCPs, introducing the implementation strategy, STOPPFrail guideline, deprescribing algorithm and other deprescribing resources. BCTs not considered: BCT 7.1	The education enabler is being addressed in the form of providing an in-person event to gain buy-in, support and explain the practical application of deprescribing. The barrier of lack of experience/practical knowledge is being addressed by providing a guidance document to support HCP decision making and engagement.
5	Face-to-face MDT meetings, conducted at regular intervals, between all three HCP groups facilitates deprescribing decision making in long-term care.	Introduce 3 monthly medication review meetings for MDT at the LTCF. Email sent at the beginning of every quarter by LTC management staff to remind HCPs to organise 3 monthly review. Deprescribing goal set prior to meeting and agreed by MDT e.g., review particular drug class (antihypertensive therapy).	MDT incorporating Pharmacist, Nurse and GP occurring every 3 months for one-hour duration at the long-term care facility, targeting one pre-defined drug class. Nurse champion, being a clinical nurse manager/nurse prescriber on-site, take the lead by identifying drug class which he/she believes unit would benefit from reviewing, using tool such as STOPPFrail	The strategy is hypothesised to work by each HCP contributing a smaller amount of time than would be required if the responsibility was placed on a singular profession, addressing the time and staffing barrier. Having the meeting at the LTCF bypasses the need

		Add deprescribing guidelines to ward as reference to support deprescribing. Medication reviews conducted for patients prescribed drug class of interest (antihypertensives) on the ward and MDT engage with deprescribing particular drug class where appropriate. Pharmacist role: identifying patients on drug class of interest (antihypertensive meds) from dispensing software prior to 3 monthly med review and giving list to nurse. Nurse role: patient symptoms analysis (taking BP measurement) prior to meeting GP role to review therapy and if appropriate, determine deprescribing plan, leaving drug PRN in the event of symptom return (hypertension). Pharmacist available as support to deprescribing, providing guidance. Nurse role to monitor patient and provide feedback to prescriber on outcome of deprescribing. Provide a report of deprescribing outcomes of previous attempts to deprescribe drug class of interest prior to discussing medication review.	and organising a time/setting a time for all HCP to attend. Nurse champion to identify what information is needed prior to the meeting and delegate to colleagues e.g., pharmacist run report on dispensing software to identify all patients on X class of medication, nurse champion to screen patients based on guidelines, indication and how many people feasible to review during MDT and agree on patients. Prompts to reminder staff nurses to take clinical measurement e.g., BP in the form of placing a sticker on the drug Kardex. Delegate to nurse staff to have Kardex and notes available at the MDT. GPs review patient results (BP measurements) supplied by staff nurse, referred by nurse champion. GP plan deprescribing actions. Nurse champion to arrange for next MDT. Each HCP support follow-up tasks. BCTs not considered: BCT 1.7, 2.7 *BCT 1.2 (ruled out in APEASE assessment however relevant in above MDT strategy).*	for IT, which is limited in this setting. Face-to-face MDT supports deprescribing decision making.

6	Knowledge and experience gave HCPs confidence and enhanced their level of engagement with deprescribing or making deprescribing recommendations in long-term care.	Organise training day with all HCP (GP, pharmacist and nurses) available at LTCF conducted by pharmacist deprescribing researcher, with the support of medical officer and clinical nurse manager at the LTCF. Display a video of simulated example of how to engage with deprescribing, routinely and as required. Give opportunity for HCPs to ask questions and work through with any concerns. Provide information such as the consequences of continuing the inappropriate medication (inappropriate blood pressure control, risks associated with low blood pressure), when to consider deprescribing, risks associated with deprescribing (hypertension) and how to understand deprescribing guidelines and engage with behaviour (check blood pressure when resident dizzy/fall/incoherent etc) Share clinical feedback following deprescribing intervention. Allow an opportunity to learn from engaging with the behaviour to build knowledge and confidence.	Nursing staff at LTCFs require more awareness of deprescribing. Ideally to have *more specialised nurses trained in gerontology, advanced nurse practitioners and/or nurse prescribers* acting as champions to continue training. Another motivator to engage with training would be *CPD requirements* which are not yet required for continued registration for nurses in Ireland. Start with awareness training: benefits and potential consequences to deprescribing. BCTs not considered: 2.7, 3.1, 3.2, 7.1, 9.1	Specialised training would address the knowledge and experience barrier, giving nurses the confidence to make deprescribing recommendations to GPs in LTC as they are the HCP on site most frequently.

		Placing deprescribing guidelines in nurses' station as a prompt to increase HCPs knowledge.		
7	Social pressures from any HCP, who prefers to maintain the 'status quo' and avoid potential negative patient associated outcomes, inhibits other HCPs from engaging with deprescribing	Pharmacist researcher to meet with staff at LTCF and enable HCP to engage with deprescribing by helping to set deprescribing goals within each LTCF. This includes identifying a drug class to target, creating a plan to encourage engagement with deprescribing and creating a MDT support system, delegating roles and responsibilities to provide guidance on deprescribing. For example, add deprescribing audit to nursing documentation. Enlist the responsibility to one nurse and provide protected time once every fixed time interval (e.g.,3 months) to review deprescribing attempts for specific drug class on his/her ward and provide feedback, both positive and negative, of intervention. The MDT consisting of GP, Pharmacist and Nurse will act as deprescribing champions, leading the deprescribing and providing a demonstration for other staff. Place posters at nurses' station 'consider deprescribing,' highlighting the potential positive and negative outcomes of deprescribing a drug class of interest. **OR** include 'consider deprescribing' banner	Audit and feedback: member of nursing staff delegated by CNM to conduct an audit of deprescribing decision implemented e.g., have a chart with deprescribing decisions implemented, with space for any further changes/adverse outcomes/positive outcomes to be documented. Results from this audit fed back to the unit on a chart in a well-located area e.g., nurses station – showing patient clinical outcomes, cost savings, used in HIQA inspections to show their medication management policies. BCTs not considered: 1.1, 1.2, 3.1, 6.1, 12.2.	Making deprescribing a priority by introducing an audit will help to change perceptions and engage 'buy-in' around deprescribing – moving away from the 'status quo' of keeping behaviours the same. This strategy was informed from the success of antimicrobial stewardship audit and feedback interventions. Feeding back the results from the audit will help HCPs to see the positive outcomes, from a patient, facility and management perspective and increase engagement.

		along the top of drug Kardex/front of drug Kardex: drugs deprescribed successfully/unsuccessfully, to encourage nurse/pharmacist engagement.		
8	An 'established hierarchy' in long-term care was perceived by HCPs, with GPs having seniority in terms of responsibility for patient care. HCPs described fear and lack of authority to question the prescribing of GPs.	Single educational event conducted on-site facilitated by pharmacist researcher who has expertise in deprescribing. The focus of the event is to explain the importance of the MDT in deprescribing by giving examples of each HCPs' individual role. This event will display a simulated video, showing how each HCP can engage with deprescribing, also providing an opportunity for HCP to ask questions regarding opportunities to engage with deprescribing. For example, when deprescribing antihypertensives: pharmacist provide support and engage by identifying patients on antihypertensive medicines prior to 3 monthly medicine review. Nurses provide support and engage by taking blood pressure measurement for identified patients prior to medication review and referring those with > 2 SBP measurements <130mmHg to the GP. Pharmacist available as support to deprescribing, providing guidance while nurses monitor patient and provide feedback to prescriber on outcome of	Audit and feedback and MDT strategies as described above. BCTs not considered: 6.1, 11.2 Additional BCTs relevant from MDT strategy: 1.4, 12.1, 12.5 Additional BCTs relevant to audit and feedback strategy: 1.4, 1.5, 1.7, 12.1, 12.5 BCTs not linked to the above MDT strategy but identified as feasible 4.1, 9.1 BCTs not linked to the original audit and feedback strategy but identified as feasible 2.7	Audit and feedback and MDT structure would empower HCPs, as with these processes defined role and responsibilities exist, therefore HCPs are aware of the scope of practice and feel that they have the authority to engage with deprescribing.

		deprescribing. To encourage nurse engagement, observation charts will be updated to include prompt for nurse to call prescriber if predefined criteria is met (e.g., >2 SBP measurements of <130mmHg).		

Finalised strategies to address barriers and enablers

Barrier ranked #1:

MDT incorporating Pharmacist, Nurse and GP occurring every 3 months for one-hour duration at the long-term care facility, targeting one pre-defined drug class. *BCT 12.1*

Nurse champion (NC), being a CNM/nurse prescriber on-site, take the lead by identifying drug class which he/she believes unit would benefit from reviewing, using tool such as STOPPFrail and organising a time/setting a time for all HCP to attend. *BCT 1.1, 1.4, 12.5*

NC identify what information is needed prior to the meeting and delegate to colleagues e.g., pharmacist run report on dispensing software to identify all patients on X class of medication, NC to screen patients based on guidelines, indication and how many people feasible to review during MDT and agree on patients. Delegate to nurse staff to have Kardex and notes available at the MDT. ***B****CT 1.2, 1.4, 3.1, 3.2, 4.1*

Prompts to reminder staff nurses to take clinical measurement e.g., BP in the form of placing a sticker on the drug Kardex. *BCT 7.1, 12.1, 12.5*

BCTs not considered: BCT 1.5, 12.2.

Barrier ranked #2:

Proforma letter/email sent by LTC admission staff to previous GP to get a patient history including prescribed medications and indications. This list to be added to patient summary page. *BCT 1.4, 3.2, 12.1, 12.5.*

Any drugs without indication highlighted by nursing staff for review by the GP. *BCT 7.1*

BCTs not considered: BCT 1.1, 1.2, 1.5, 3.1, 4.1, 12.2

Barrier ranked #3 and #4:

Education needs to be *two-tiered*.

Firstly, to change the ethos and gain HCP buy-in to deprescribing. This includes highlighting the value placed on deprescribing via an education session facilitated by NC, supported by pharmacist researcher, identifying the patient care value, documenting benefits of deprescribing and explaining the nursing role. *BCT 4.1 5.1, 5.3*

The second form of education is reference guide to deprescribing for HCPs, introducing the implementation strategy, STOPPFrail guideline, deprescribing algorithm and other deprescribing resources. *BCT 4.1*

BCTs not considered: BCT 7.1

Barrier ranked #5:

MDT meetings is the only way to engage HCPs with deprescribing, as described above.

MDT incorporating Pharmacist, Nurse and GP occurring every 3 months for one-hour duration at the long-term care facility, targeting one pre-defined drug class. *BCT 12.1*

Nurse champion, being a clinical nurse manager/nurse prescriber on-site, take the lead by identifying drug class which he/she believes unit would benefit from reviewing, using tool such as STOPPFrail and organising a time/setting a time for all HCP to attend. *BCT 1.1, 1.4, 12.5*

Nurse champion to identify what information is needed prior to the meeting and delegate to colleagues e.g., pharmacist run report on dispensing software to identify all patients on X class of medication, nurse champion to screen patients based on guidelines, indication and how many people feasible to review during MDT and agree on patients with this list confirmed by a GP. *BCT 1.1, 1.4, 12.5*

Prompts to reminder staff nurses to take clinical measurement e.g., BP in the form of placing a sticker on the drug Kardex. *BCT 7.1*

Delegate to nurse staff to have Kardex and notes available at the MDT. *(BCT 3.1, 3.2, 7.1, 12.1, 12.5)*

GPs review patient results (BP measurements) supplied by staff nurse, referred by nurse champion. GP plan deprescribing actions. *BCT 1.2, 1.4, 3.1, 3.2). BCT 1.2 (ruled out in APEASE assessment however relevant in above MDT strategy).*

Nurse champion to arrange for next MDT. Each HCP support follow-up tasks *(BCT 1.1, 3.2)*

BCTs not considered: BCT 1.7, 2.7 (feedback not mentioned specifically for this strategy), 12.2.

Barrier ranked #6:

Nursing staff at LTCFs require more awareness of deprescribing. Ideally to have more specialised nurses trained in gerontology, advanced nurse practitioners and/or nurse prescribers acting as champions to continue training.

Another motivator to engage with training would be CPD requirements which are not yet required for continued registration for nurses in Ireland therefore may not occur. Start with awareness training: benefits and potential consequences to deprescribing. *BCT 4.1, 5.1, 5.3,*

BCTs not considered: 2.7, 3.1, 3.2, 7.1, 9.1 (not mentioned)

Barrier ranked #7:

Audit and feedback: member of nursing staff delegated by nurse champion to conduct an audit of deprescribing decision implemented e.g., have a chart with deprescribing decisions implemented, with space for any further changes/adverse outcomes/positive outcomes to be documented. *BCT 1.4, 3.2, 12.1, 12.5.*

Results from this audit fed back to the unit on a chart in a well-located area e.g., nurses' station – showing patient clinical outcomes, cost savings, used in HIQA inspections to show their medication management policies. *BCT 1.5, 1.7, 6.2, 7.1*

BCTs not considered: 1.1, 1.2, 3.1, 6.3, 12.2.

Barrier ranked #8

MDT

MDT incorporating Pharmacist, Nurse and GP occurring every 3 months for one-hour duration at the long-term care facility, targeting one pre-defined drug class. *BCT 1.1, 3.1, 3.2 (additional BCT 12.1 from strategy above)*

Nurse champion, being a clinical nurse manager/nurse prescriber on-site, take the lead by identifying drug class which he/she believes unit would benefit from reviewing, using tool such as STOPPFrail and organising a time/setting a time for all HCP to attend. *BCT 1.1 (additional BCT 1.4, 12.5 from strategy above)*

Nurse champion to identify what information is needed prior to the meeting and delegate to colleagues e.g., pharmacist run report on dispensing software to identify all patients on X class of medication, nurse champion to screen patients based on guidelines, indication and how many people feasible to review during MDT and agree on patients with this list confirmed by a GP. Delegate to nurse staff to have Kardex and notes available at the MDT. GPs review patient results (BP measurements) supplied by staff nurse, referred by nurse champion. GP plan deprescribing actions. Nurse champion to arrange for next MDT. Each HCP support follow-up tasks ***B**CT 1.2, 3.1, 3.2, 4.1, 9.1 (not linked to MDT strategy but identified as feasible) (additional BCT 1.1, 1.4 from strategy above)*

Prompts to reminder staff nurses to take clinical measurement e.g., BP in the form of placing a sticker on the drug Kardex. *BCT 7.1*

Audit and feedback

Member of nursing staff delegated by nurse champion to conduct an audit of deprescribing decision implemented e.g., have a chart with deprescribing decisions implemented, with space for any further changes/adverse outcomes/positive outcomes to be documented. *BCT 3.2 (additional BCT 1.4, 6.2, 12.1, 12.5 from strategy above)*

Results from this audit fed back to the unit on a chart in a well-located area e.g., nurses' station – showing patient clinical outcomes, cost savings, used in HIQA inspections to show their medication management policies. *Additional BCT 1.5, 1.7 BCT 7.1, 2.7 (not linked to original audit and feedback strategy but identified as feasible)*

BCTs not considered: BCT 6.1, 11.2

Appendix 18: Dominant barriers/enablers mapped to TDF domains, intervention types and associated BCTs.

Deprescribing Barrier/Enabler	TDF Domain	Intervention type	Associated BCTs
Limited practical knowledge and experience of deprescribing.	Knowledge	Education	2.2 ***5.1*** 2.3 ***5.3*** 2.7 ***7.1*** ***4.1***
Further education to support implementation of deprescribing in routine practice.			
Insufficient resources: time, staffing & information technology.	Environmental context and resources	Training Restriction Environmental restructuring Enablement	***1.1*** 2.7 12.2 ***1.2*** ***3.1*** 12.3 1.3 ***3.2*** ***12.5*** ***1.4*** ***4.1*** 1.5 6.1 1.7 ***7.1*** 2.2 8.1 2.3 ***12.1***
Fragmented care, communication, and co-ordination between LTF and hospital settings.			
Multidisciplinary team meetings support deprescribing behaviours and decision making.			
Social pressures from HCPs who prefer to maintain 'status quo' and avoid potential negative outcomes inhibit deprescribing.	Social influence	Restriction, Environmental restructuring, Enablement, Modelling	3.1 6.2 13.1 3.2 6.3 16.3 3.3 10.4 6.1 12.2
An 'established hierarchy' where GPs are believed to hold a position of superiority to pharmacists or nurses.	Social professional role and identity	Education Persuasion Modelling	2.2 ***3.1*** ***4.1*** 6.1 2.3 ***3.2*** ***5.1*** ***7.1*** 2.7 3.3 ***5.3*** 9.1
Knowledge and experience gave HCPs confidence and enhanced their level of engagement with deprescribing or making deprescribing recommendations.	Belief about capabilities	Education Persuasion Modelling Enablement	1.1, 1.2, 1.3, 1.4, 1.5, 1.7, 1.8, 2.2, 2.3, 2.7, 3.1, 3.2, 3.3, 4.1, 5.1, 5.3, 6.1, 7.1, 8.1, 8.7, 9.1, 11.2, 12.1, 12.5, 15.1, 15.3, 15.4

Red = barrier, green = enabler. Barriers/enablers and BCTs in bold and italics = targeted/included in the final implementation strategy to support deprescribing.

Appendix 19: Guidance document for implementation strategy to support HCP engaging with deprescribing potentially inappropriately prescribed antihypertensives for frail older adults residing in LTC.





Guidance document for Quality Improvement Project:

Multidisciplinary team meeting to support deprescribing potentially inappropriately prescribed medications for frail older adults resident in long-term care.

Contents

Quality Improvement Project strategy for *antihypertensives* ..... **Error! Bookmark not defined.**

Deprescribing guidance for antihypertensives ..... **Error! Bookmark not defined.**

Quality Improvement Project Summary Sheet ..... **Error! Bookmark not defined.**

References ..... **Error! Bookmark not defined.**

Quality Improvement Project Strategy for *Antihypertensives*

Overall strategy is a 3-monthly one-hour deprescribing meeting at the long-term care (LTC) site, including the nursing lead (referred to a nursing champion), a staff nurse, pharmacist and GP. This guidance is specific for antihypertensives.

Stage	Steps	Responsibility	Location
Pre-MDT	**Education session:** Nursing champion (NC) identify appropriate time for education session (schedule on a day GP is visiting site). Nursing staff and GP in attendance, in addition pharmacist invited. NC introduce the intervention, supported by educational material.	NC supported by pharmacist from research team.	LTCF
	Screening: Identify suitable time for MDT (day GP visiting, time suitable for all healthcare professionals)	NC	LTCF/phone/ email
	Identify drug class to focus review using STOPPFrail to identify potentially inappropriate medications *(in this case, it will be antihypertensives).*	NC	LTCF
	NC to instruct pharmacist to run dispense report on dispensing software to identify all patients on pre-specified medication class *(antihypertensive medications[1]).*	NC	LTCF/phone/ email
	Pharmacist run dispense report on dispensing software to identify all patients on pre-specified medication class and give to NC *(antihypertensives)*.	Pharmacist	Pharmacy Deliver in person/email

	NC screen list from pharmacy. Screening to prioritise patients for review based on:
	• Tools/guides:
	  ○ STOPPFrail (age, criteria for frailty),
	  ○ Deprescribing guide to identify eligible participants
	• Indications: to identify contraindications *(Heart failure/atrial fibrillation = not eligible)*
	• Number of patients possible to review.
		NC	LTCF

	NC to ask GP to confirm list of eligible patients during site visit.	NC	LTCF
	GP review assessment and confirm list of eligible patients during site visit.	GP	LTCF/phone/ email
	NC to complete 'Pre-Meeting Screening' on Quality Improvement Project Summary Sheet	NC	LTCF
	NC place sticker on drug chart of patients confirmed for review, prompting nursing staff to take clinical measurements, where appropriate, on specified dates *(BP).*	NC	LTCF
	Nurse to take daily measurements, on specific dates prior to MDT, if applicable *(BP).*	Staff nurse	LTCF

	Nurse to pull drug charts and clinical notes for patients being reviewed on the morning of MDT.	Staff nurse	LTCF
MDT	Structure meeting, briefly introducing aim, medications targeted and patients to be reviewed	NC	LTCF
	Give clinical measurements/patient information as requested to support deprescribing plan *(BP).*	Staff nurse	LTCF
	Provide pharmaceutical knowledge to support deprescribing plan e.g., available strengths/formulations	Pharmacist	LTCF
	Review patient, clinical measurements *(BP),* consider patient and pharmaceutical advice, agree on deprescribing plan, adjust Kardex. Use tools/resources: • STOPPFrail v2 • Deprescribing guide	GP	LTCF
	Agree drug class for next MDT & organise time	NC with MDT	LTCF
Post-MDT	Dispense new dose/remove deprescribed medication	Pharmacist	LTCF/ Pharmacy
	Monitor patient & document any positive/negative outcomes	Staff nurse	LTCF
	Write new prescription for the Pharmacy	GP	LTCF / GP practice

[1] Antihypertensive medications = angiotensin-converting enzyme inhibitors/angiotensin receptor blockers/calcium channel blockers/diuretics/alpha-blockers/aldosterone antagonists/beta-blockers/centrally acting antihypertensives/peripheral vasodilators.

LTCF = long-term care facility

STOPPFrail v2 = Screening Tool of Older Persons Prescriptions in frail adults with limited life expectancy version 2 (34)

BP = blood pressure

MDT = multidisciplinary team

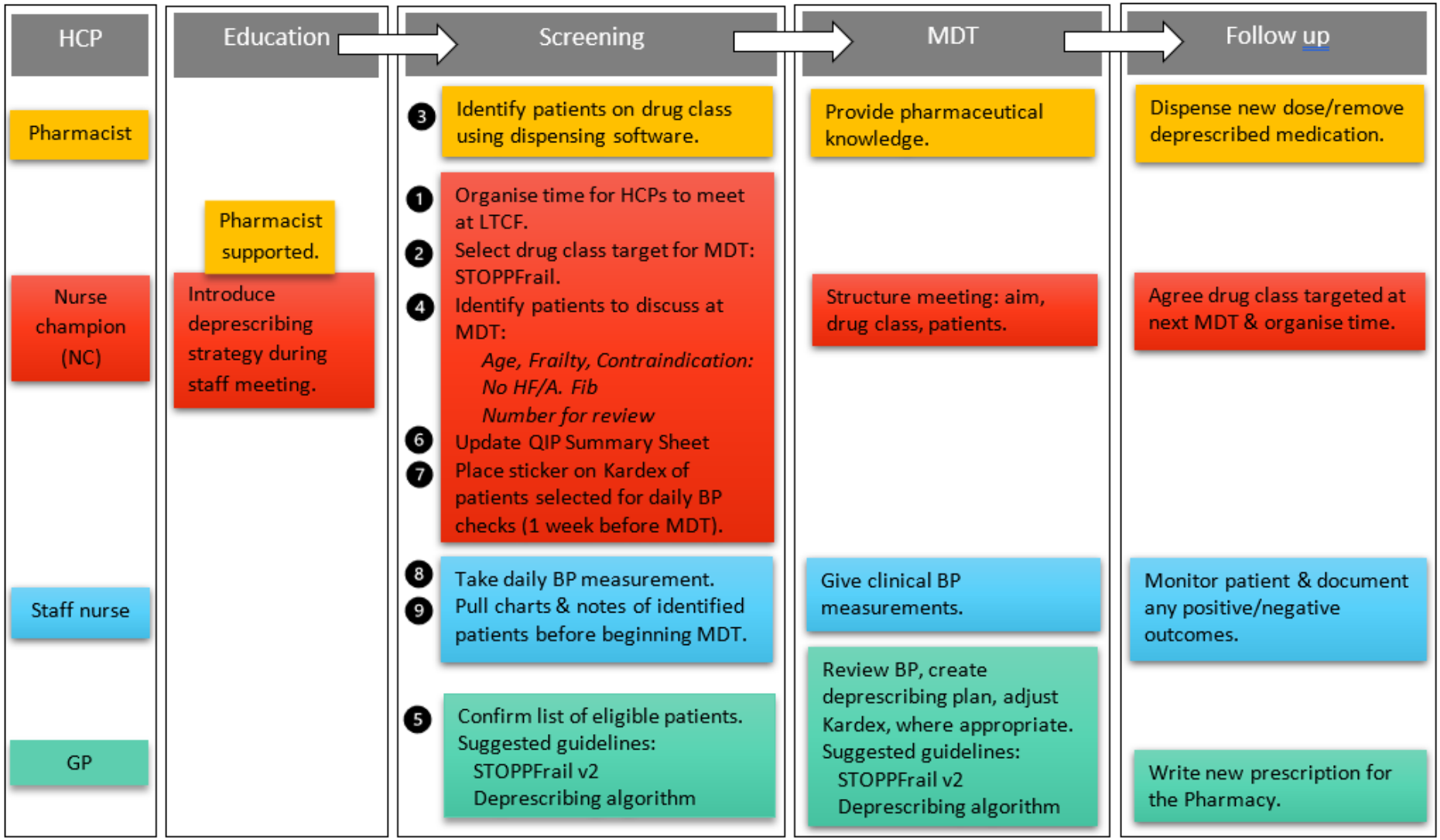


Fig.1. Workflow of implementation strategy to increase HCPs' engagement with deprescribing. HCP roles colour coded. Numbers = order of tasks. LTCF = long-term care facility, MDT = multidisciplinary team, STOPPFrail v2 = Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy version 2 (34), QIP = Quality Improvement Project, HF = heart failure, A. Fib = atrial fibrillation. BP = blood pressure. Deprescribing algorithm = Sheppard et al. (442).

Deprescribing guide: antihypertensives

Steps (442)	**Content from Sheppard *et al.* antihypertensive deprescribing algorithm** (442)*	**Content from STOPPFrail v 2** (34)~
Identify eligible patients	Age: 75+ years *And* (a) Previous adverse event OR (b) Moderate-to-severe frailty OR (c) High predicted risk of serious adverse events	Age: older people with limited life expectancy *And* (a) Activities of daily living dependency AND (b) Severe irreversible frailty AND (c) Physician overseeing care of patient would not be surprised if the patient died in the next 12 months
Measure blood pressure	Systolic blood pressure (SBP): < 150mmHg (80+ years) < 140mmHg (75-79 years)	SBP persistently < 130mmHg Appropriate target 130mmHg-160mmHg
Identify drugs for deprescribing	Alpha blockers Thiazide diuretics in patients with gout Beta blockers in combination with verapamil Beta blockers in patients with COPD *Avoid heart failure/atrial fibrillation.* Deprescribe in the following order: 1. Loop diuretics/aldosterone antagonists/centrally acting antihypertensives/peripheral vasodilators/alpha blockers. 2. Beta-blockers 3. Thiazides and thiazide-like diuretics 4. ACEi/ARBs 5. Calcium channel blockers	All antihypertensive therapies *Avoid heart failure/atrial fibrillation.*
Withdraw medication	Remove one antihypertensive at a time at four-week intervals. (Gradually reduce beta-blockers to avoid rebound adrenergic hypersensitivity)	
Monitor outcomes	Check SBP remains controlled after 4 weeks. Check for adverse events associated with the withdrawal. • Accelerated hypertension (BP>200/120mmHg) • Palpitations (withdrawal verapamil/diltiazem/beta blockers) • Prostatism (withdrawal alpha blockers) • Peripheral oedema (withdrawal thiazide diuretics)	

* Deprescribing algorithm is not specific for frailty

~ STOPPFrail focus is deprescribing for frail older adults

Quality Improvement Project Summary Sheet

Date of education:

Date of meeting:

Duration of meeting:

Drug class of interest:

Attendance:

Healthcare professional	Attended education session(Y/N)	Attended deprescribing MDT (Y/N)	Number in attendance
Nurse champion			
Pharmacist			
Staff nurse			
General Practitioner			
Other attendees (title of profession)			

Pre-meeting screening:

Recruitment	Number of patients
Number of patients on site:	
Number of patients prescribed drug class of interest (as per pharmacy list):	
Number of patients eligible for review:	
Reason for exclusion:	
Age	
Frailty status	
>12 months life expectancy	
Contraindications (as per guideline)	
Clinical measurements not supportive of deprescribing	
Other (please write on back of sheet)	

MDT meeting:

Deprescribing review	Number of patients
Number of patients reviewed:	
Number of patients who had a medication deprescribed:	
Dose reduced	
Drug stopped	
Switched to a safer alternative	
Number of deprescribing eligible patients who did not have a potentially inappropriate medication deprescribed	
Systolic blood pressure too low	
Fear of negative consequences	
Not agreed among healthcare professionals	
Other	

Appendix 20: StaRI checklist

Checklist item		Reported on page #	Implementation Strategy	Reported on page #	Intervention
			"Implementation strategy" refers to how the intervention was implemented		"Intervention" refers to the healthcare or public health intervention that is being implemented.
Title and abstract					
Title	**1**	1	Feasibility pilot of a deprescribing implementation strategy: Multidisciplinary DEprescribing review for Frail oldER adults in long-term care (DEFERAL).		
Abstract	**2**	1-2	Identification as an implementation study, including a description of the implementation strategy to be tested, the evidence-based intervention being implemented, and defining the key implementation and health outcomes.		
Introduction					
Introduction	**3**	3-4	Description of the problem, challenge or deficiency in healthcare or public health that the intervention being implemented aims to address.		
Rationale	**4**	5, 7-8	The scientific background and rationale for the implementation strategy (including any underpinning theory/framework/model, how it is expected to achieve its effects and any pilot work).	3	The scientific background and rationale for the intervention being implemented (including evidence about its effectiveness and how it is expected to achieve its effects).
Aims and objectives	**5**	4-5	The aims of the study, differentiating between implementation objectives and any intervention objectives.		
Methods: description					
Design	**6**	5	The design and key features of the evaluation, (cross referencing to any appropriate methodology reporting standards) and any changes to study protocol, with reasons		
Context	**7**	5-7	The context in which the intervention was implemented. (Consider social, economic, policy, healthcare, organisational barriers and facilitators that might influence implementation elsewhere).		
Targeted 'sites'	**8**	6-7	The characteristics of the targeted 'site(s)' (e.g locations/personnel/resources etc.) for implementation and any eligibility criteria.	7	The population targeted by the intervention and any eligibility criteria.

Description	**9**	7-11	A description of the implementation strategy	3	A description of the intervention
Sub-groups	**10**	N/A	Any sub-groups recruited for additional research tasks, and/or nested studies are described		
Methods: evaluation					
Outcomes	**11**	12-13	Defined pre-specified primary and other outcome(s) of the implementation strategy, and how they were assessed. Document any pre-determined targets	12-13	Defined pre-specified primary and other outcome(s) of the intervention (if assessed), and how they were assessed. Document any pre-determined targets
Process evaluation	**12**	12-13	Process evaluation objectives and outcomes related to the mechanism by which the strategy is expected to work		
Economic evaluation	**13**	N/A	Methods for resource use, costs, economic outcomes and analysis for the implementation strategy	N/A	Methods for resource use, costs, economic outcomes and analysis for the intervention
Sample size	**14**	7	Rationale for sample sizes (including sample size calculations, budgetary constraints, practical considerations, data saturation, as appropriate)		
Analysis	**15**	13-14	Methods of analysis (with reasons for that choice)		
Sub-group analyses	**16**	N/A	Any a priori sub-group analyses (e.g. between different sites in a multicentre study, different clinical or demographic populations), and sub-groups recruited to specific nested research tasks		
Results					
Characteristics	**17**	15	Proportion recruited and characteristics of the recipient population for the implementation strategy	25-26	Proportion recruited and characteristics (if appropriate) of the recipient population for the intervention
Outcomes	**18**	16-20, 22	Primary and other outcome(s) of the implementation strategy	25-26	Primary and other outcome(s) of the Intervention (if assessed)
Process outcomes	**19**	16-20, 22, 25-26	Process data related to the implementation strategy mapped to the mechanism by which the strategy is expected to work		
Economic evaluation	**20**	N/A	Resource use, costs, economic outcomes and analysis for the implementation strategy	N/A	Resource use, costs, economic outcomes and analysis for the intervention

Sub-group analyses	**21**	N/A	Representativeness and outcomes of subgroups including those recruited to specific research tasks		
Fidelity/ adaptation	**22**	22-25	Fidelity to implementation strategy as planned and adaptation to suit context and preferences	25-26	Fidelity to delivering the core components of intervention (where measured)
Contextual changes	**23**	N/A	Contextual changes (if any) which may have affected outcomes		
Harms	**24**	N/A	All important harms or unintended effects in each group		
Discussion					
Structured discussion	**25**	27-32	Summary of findings, strengths and limitations, comparisons with other studies, conclusions and implications		
Implications	**26**	32-33	Discussion of policy, practice and/or research implications of the implementation strategy (specifically including scalability)	32-33	Discussion of policy, practice and/or research implications of the intervention (specifically including sustainability)
General					
Statements	**27**	5	Include statement(s) on regulatory approvals (including, as appropriate, ethical approval, confidential use of routine data, governance approval), trial/study registration (availability of protocol), funding and conflicts of interest		

Appendix 21: DEFERAL strategy logic model.

BCT	Mechanism of action	Output of action	Outcome measure
4.1 Instruction on how to perform the behaviour *5.1 Information about health consequences* *5.3 Information about social and environmental consequences*	**Pre-MDT Meeting:** Nursing champion (NC) identify appropriate time for education session (schedule on a day GP is visiting site). Nursing staff and GP in attendance, in addition pharmacist invited. NC introduce concept of deprescribing and the DEFERAL implementation strategy, supported by pharmacist and educational material.	Attendance at education session documented on deprescribing worksheet found in guidance document.	Number of patients reviewed
1.4 Action planning	Identify suitable time for MDT (day GP visiting, time suitable for all HCP)	Date documented on deprescribing worksheet found in guidance document.	
1.1 Goal setting (behaviour) *12.5 Adding objects to the environment*	Identify drug class to focus review using STOPPFrail to identify PIMs	Drug class documented on deprescribing worksheet found in guidance document. Availability of dispense report with list of patients prescribed drug/class of interest.	
1.2 Problem solving *1.4 Action planning*	NC to instruct pharmacist to run dispense report on dispensing software to identify all patients on pre-specified medication class.		
3.2 Social support (practical)	Pharmacist run dispense report on dispensing software to identify all patients on pre-specified medication class and give to NC	Availability of dispense report with list of patients prescribed drug/class of interest.	

1.2 Problem solving
 	
1.4 Action planning
	NC screen list from pharmacy. Screening to prioritise patients for review based on:
	• Tools/guides:
	  ○ STOPPFrail (age, criteria for frailty),
	  ○ Deprescribing guide to identify eligible participants.
	• Indications: to identify contraindications
	• Number of patients possible to review
		Utilisation and completion of deprescribing worksheet on guidance document.	

3.2 Social support (practical)	NC ask GP to confirm list of eligible patients during site visit	Completion and GP endorsement of pre-meeting screening section of deprescribing worksheet on guidance document.	
3.2 Social support (practical)	GP review assessment and confirm list of eligible patients during site visit		
7.1 Prompts/cues *12.1 Restructuring the physical environment* *12.5 Adding objects to the environment*	NC place sticker on drug chart of patients confirmed for review, prompting nursing staff to take clinical measurements, where appropriate, on specified dates	Utilisation of sticker prompt.	
3.2 Social support (practical)	Nurse to take daily clinical measurements, where appropriate, on specific dates prior to MDT Nurse to pull drug charts and clinical notes for patient being reviewed morning of MDT	Documentation of BP measurements in patient's clinical notes.	
1.4 Action planning	**MDT Meeting** Structure meeting, briefly introducing aim, medications targeted and patients to be reviewed	Documentation of drug class on deprescribing worksheet on guidance document.	Number of patients who had a medication deprescribed via dose reduction/ stopping a medication/ switching to a safer alternative. Reason for not deprescribing
3.1 Social support (unspecified *3.2 Social support (practical)*	Nurse: Give clinical measurements/patient information as requested to support deprescribing plan Pharmacist: Provide pharmaceutical knowledge to support deprescribing plan e.g., available strengths/formulations	Deprescribing decision making documented on patient clinical notes/Kardex. Completion of deprescribing review section of deprescribing worksheet on guidance document.	
1.2 Problem solving *1.4 Action planning*	Review clinical measurements, consider patient and pharmaceutical advice, agree on deprescribing plan, adjust Kardex. Use tools/resources: • STOPPFrail v2 • Deprescribing guide		
1.1 Goal setting (behaviour)	Agree drug class for next MDT & organise time	Meeting scheduled verbally/email by NC with GP and Pharmacist. Date of next meeting documented on deprescribing worksheet.	

3.2 Social support (practical)	**Post MDT Meeting** Pharmacist: Dispense new dose/remove deprescribed medication Nurse: Monitor patient & document any positive/negative outcomes GP: Write new prescription for the Pharmacy	Change in prescription Kardex Generation of new prescription for pharmacy Supply of new medication Removal of changed medication.	

Appendix 22: DEFERAL strategy outcome measures

Outcome measures **Process outcomes**	**Data sources/measure**	**Frequency of collection**	**Method of collection**
Number of patients reviewed	Pharmacy dispensed report of patient prescribed drug class of interest List of eligible patients prescribed drug class of interest as outlined on pre-meeting screening section of deprescribing worksheet on guidance document.	3 monthly	Deprescribing worksheet on guidance document: pre-meeting screening
Number of patients who had a medication deprescribed via dose reduction	Patient's drug chart and clinical notes.	3 monthly	Deprescribing worksheet on guidance document.
Number of patients who had a medication deprescribed via stopping a medication	Patient's drug chart and clinical notes.	3 monthly	Deprescribing worksheet on guidance document.
Number of patients who had a medication deprescribed via switching to a safer alternative	Deprescribing worksheet on guidance document. Patient's drug chart and clinical notes.	3 monthly	Deprescribing worksheet on guidance document.
Reason for not deprescribing	Patient clinical notes and observation charts. HCP case discussion during MDT meeting	3 monthly	Deprescribing worksheet on guidance document.

Appendix 23: Experiential survey for pharmacists

Please indicate the extent to which you agree with the below statements:

Feasibility of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing seems implementable	1	2	3	4	5
The strategy to support deprescribing seems possible	1	2	3	4	5
The strategy to support deprescribing seems doable	1	2	3	4	5
The strategy to support deprescribing seems easy to do	1	2	3	4	5

Acceptability of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing meets my approval	1	2	3	4	5
The strategy to support deprescribing is appealing to me	1	2	3	4	5
I like the strategy to support deprescribing	1	2	3	4	5
I welcome the strategy to support deprescribing	1	2	3	4	5

Appropriateness of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing seems fitting	1	2	3	4	5
The strategy to support deprescribing seems suitable	1	2	3	4	5
The strategy to support deprescribing seems applicable	1	2	3	4	5
The strategy to support deprescribing seems like a good match.	1	2	3	4	5

Please answer the following questions in relation to the roles and responsibilities.

Pharmacist

Did you carry out each of the following roles and responsibilities assigned to your profession exactly as described?

Role	Yes/No?
1. Run dispense report on dispensing software to identify all patients on pre-specified medication class and give to NC in person/via email/via post	
If yes, which method of communication did you use? If no, what did you do differently and why?	

Role	Yes/No?
2. Provide pharmaceutical knowledge during MDT as required	
If no, why was this? What did you do differently and why?	

Role	Yes/No?
3. Dispense new dose/remove deprescribed medication from the LTCF	
If no, why was this? What did you do differently and why?	

Appendix 24: Experiential survey for GPs

Please indicate the extent to which you agree with the below statements:

Feasibility of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing seems implementable	1	2	3	4	5
The strategy to support deprescribing seems possible	1	2	3	4	5
The strategy to support deprescribing seems doable	1	2	3	4	5
The strategy to support deprescribing seems easy to do	1	2	3	4	5

Acceptability of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing meets my approval	1	2	3	4	5
The strategy to support deprescribing is appealing to me	1	2	3	4	5
I like the strategy to support deprescribing	1	2	3	4	5
I welcome the strategy to support deprescribing	1	2	3	4	5

Appropriateness of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing seems fitting	1	2	3	4	5
The strategy to support deprescribing seems suitable	1	2	3	4	5
The strategy to support deprescribing seems applicable	1	2	3	4	5
The strategy to support deprescribing seems like a good match.	1	2	3	4	5

Please answer the following questions in relation to the roles and responsibilities.

General Practitioner

Did you carry out each of the following roles and responsibilities assigned to your profession exactly as described?

Role	Yes/No?
1. Review NC assessment of patient eligibility and confirm list of patients for review at the MDT meeting during site visit/via telephone/via email	
If yes, which method of communication did you use? If no, what did you do differently and why?	

Role	Yes/No?
2. Review clinical measurements, create deprescribing plan, adjust Kardex using guidelines: a. STOPPFrail b. Deprescribing algorithm	
If no, what did you do differently and why?	

Appendix 25: Experiential survey for staff nurse

Please indicate the extent to which you agree with the below statements:

Feasibility of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing seems implementable	1	2	3	4	5
The strategy to support deprescribing seems possible	1	2	3	4	5
The strategy to support deprescribing seems doable	1	2	3	4	5
The strategy to support deprescribing seems easy to do	1	2	3	4	5

Acceptability of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing meets my approval	1	2	3	4	5
The strategy to support deprescribing is appealing to me	1	2	3	4	5
I like the strategy to support deprescribing	1	2	3	4	5
I welcome the strategy to support deprescribing	1	2	3	4	5

Appropriateness of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing seems fitting	1	2	3	4	5
The strategy to support deprescribing seems suitable	1	2	3	4	5
The strategy to support deprescribing seems applicable	1	2	3	4	5
The strategy to support deprescribing seems like a good match.	1	2	3	4	5

Please answer the following questions in relation to the roles and responsibilities.

Staff Nurse

Did you carry out each of the following roles and responsibilities assigned to your profession exactly as described?

Role	Yes/No?
1. Take daily clinical measurements for one week prior to MDT	
If no, what did you do differently and why?	

Role	Yes/No?
2. Pull drug charts and clinical notes for patient being reviewed morning of MDT	
If no, what did you do differently and why?	

Role	Yes/No?
3. Provide MDT with clinical measurements and patient information as requested	
If no, what did you do differently and why?	

Role	Yes/No?
4. For patients who had medications deprescribed, monitor patient & document any positive/negative outcomes	
If no, what did you do differently and why?	

Appendix 26: Experiential survey for Nurse Champion

Please indicate the extent to which you agree with the below statements:

Feasibility of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing seems implementable	1	2	3	4	5
The strategy to support deprescribing seems possible	1	2	3	4	5
The strategy to support deprescribing seems doable	1	2	3	4	5
The strategy to support deprescribing seems easy to do	1	2	3	4	5

Acceptability of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing meets my approval	1	2	3	4	5
The strategy to support deprescribing is appealing to me	1	2	3	4	5
I like the strategy to support deprescribing	1	2	3	4	5
I welcome the strategy to support deprescribing	1	2	3	4	5

Appropriateness of the intervention

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The strategy to support deprescribing seems fitting	1	2	3	4	5
The strategy to support deprescribing seems suitable	1	2	3	4	5
The strategy to support deprescribing seems applicable	1	2	3	4	5
The strategy to support deprescribing seems like a good match.	1	2	3	4	5

Please answer the following questions in relation to the roles and responsibilities.

Nurse champion

Did you carry out each of the following roles and responsibilities assigned to your profession exactly as described?

Role	Yes/No?
1. Identify appropriate time for education session (schedule on a day GP is visiting site). Nursing staff and GP in attendance, in addition pharmacist invited.	
If no, what did you do differently and why?	

Role	Yes/No?
2. Introduce the intervention to the wider LTCF team, supported by UCC PhD student.	
If no, what did you do differently and why?	

Role	Yes/No?
3. Identify suitable time for MDT (day GP visiting, time suitable for all healthcare professionals) and inform relevant healthcare professionals via email/telephone/in person	
If yes, which method of communication did you use? If no, what did you do differently and why?	

Role	Yes/No?
4. Identify drug class to focus review using STOPPFrail to identify PIMs	
If no, what did you do differently and why?	

Role	Yes/No?
5. Instruct pharmacist to run dispense report on dispensing software to identify all patients on pre-specified medication class via email/telephone/in person.	
If yes, which method of communication did you use? If no, what did you do differently and why?	

Role	Yes/No?
6. Screen patients to identify those eligible for review using guidance to determine patient eligibility	
If no, what did you do differently and why?	

Role	Yes/No?
7. Ask GP to confirm list of eligible patients during site visit/email/telephone	
If yes, which method of communication did you use? If no, what did you do differently and why?	

Role	Yes/No?
8. Place sticker on drug chart of patients confirmed for review, prompting nursing staff to take clinical measurements, where appropriate, on specified dates	
If no, what did you do differently and why?	

Role	Yes/No?
9. Structure MDT meeting, briefly introducing aim, medications targeted and patients to be reviewed	
If no, what did you do differently and why?	

Role	Yes/No?
10. Agree drug class targeted at next MDT & organise time	
If no, what did you do differently and why?	

Appendix 27: Conceptual framework for implementation fidelity to DEFERAL strategy.

Conceptual framework for implementation fidelity (492)		**Measure and data sources**
Adherence	Content (BCTs delivered)	Post-feasibility study survey specifically developed for each HCP asking each participant: "Did you carry out each of the following roles and responsibilities assigned to your profession exactly as described" Measuring delivery of content, coverage, frequency and timing
	Coverage (HCPs involved)	
	Frequency (How often)	
	Duration (timing)	
Moderators of fidelity	Intervention complexity	Feedback on strategies and participant responsiveness was measured using post-feasibility study survey asking HCPs about the perceived feasibility/acceptability and appropriateness of the strategy. Complexity of intervention or quality of delivery not measured.
	Facilitation strategies	
	Quality of delivery	
	Participant responsiveness	
Essential components	Adaptations	Any deviation from the strategy as designed to be documented explaining why deviation made in open-ended comment boxes of post-feasibility study survey. Identification of essential elements was not conducted.