CORA Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

Title	Do economic incentives influence the provision of dental services in a third-party funded dental scheme?
Authors	Mullen, J.;Woods, Noel;Whelton, Helen
Publication date	2013-12-01
Original Citation	Mullen J, Woods N, Whelton H. Do economic incentives influence the provision of dental services in a third-party funded dental scheme? OA Dentistry 2013 Dec 30;1(1):7.
Type of publication	Article (peer-reviewed)
Link to publisher's version	http://www.oapublishinglondon.com/oa-dentistry, http://www.oapublishinglondon.com/article/1111
Rights	© 2013, The Authors. Licensee OA Publishing London 2013. Creative Commons Attribution License (CC-BY). The final HTML/PDF is also available at http://www.oapublishinglondon.com/ - http://creativecommons.org/licenses/by/2.0/uk/
Download date	2026-11-05 15:05:47
Item downloaded from	https://hdl.handle.net/10468/1531

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

OA Dentistry
Open Access

Mullen J, Woods N, Whelton H. Do economic incentives influence the provision of dental services in a third-party funded dental scheme? OA Dentistry 2013 Dec 30;1(1):7.

This is a provisional PDF file.

Licensee OA Publishing London 2013. Creative Commons Attribution License (CC-BY)

Competing interests: none declared. Conflict of interests: none declared.
All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript.
All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.

Section: Epidemiology & Oral Health

Do economic incentives influence the provision of dental services in a third-party funded dental scheme?

J Mullen[1], N Woods[2], H Whelton[3]

[1]*Principal Dental Surgeon, Health Service Executive, Sligo, Ireland,*

[2]*Lecturer in Economics, Centre for Policy Studies, University College Cork, Ireland* [3]*Dean of University of Leeds Dental School, Dental School University of Leeds, UK*

Abstract

Objectives: To investigate whether the provision of dental services is influenced by economic incentives in a third-party funded dental service in the Republic of Ireland.

Methods: Four treatment items were identified as outcome variables. These items were characterised by variation in regulation among administrative regions or variation in regulation over time. The items were Extra Oral Radiographs, Endodontics, Prolonged Periodontal Treatment, and Surgical Extractions. Claims data were obtained from the Primary Care Reimbursement Service (PCRS), formerly known as the General Medical Services Payments Board (GMSPB). Population data were obtained from the Central Statistics Office. Data were obtained from the Principal Dental Surgeons in Ireland who apply local regulatory or price controls for certain items of treatment. The data were analysed to determine the impact of the variation in regulatory approach on claims data among the eight regional health administrative areas whilst controlling for known clinical or population structural factors. ***Results*** There was a substantially lower than average provision of Extra-Oral Radiographs in regions where regulation was stringently applied. The provision of Prolonged Periodontal Treatment was positively correlated with price. The dentist-to-population ratio is positively correlated with claims for Surgical Extractions.

Conclusions There is evidence from within the funding system that economic incentives, arising from either the contract itself or due to the geographical structure of the dentist workforce in Ireland, leads to variations in certain items of service provision which are potentially inefficient and independent of known treatment need.

Keywords: Economic incentives, Regulation, 3rd party payments system, Evidence-based guidelines, Probity.

Correspondence:

Dr Noel Woods, Centre for Policy Studies, University College, Cork, 5 Bloomfield, Terrace, Western Road, Cork, Republic of Ireland. Email: n.woods@ucc.ie

Introduction

The Dental Treatment Services Scheme (DTSS) is a publicly funded choice of dentist scheme (budgeted to cost €63 million in 2010) which in the period under review provided basic dental care to less well-off adults (Medical Card Holders) and was free of charge to the recipients. In this scheme dental services were delivered by private dentists in their own practices and dentists were subsequently remunerated for services by the Health Service Executive (HSE) Primary Care Reimbursement Service (PCRS). Incentivisation of patients to "over consume", and dentists to "over-provide" services is a potential risk in such third party funded systems where there is zero monetary cost to the patient. Moral hazard is a term used by economists to describe the potential change in the attitudes of consumers (consumer moral hazard) and providers (provider moral hazard) of health care which results from becoming insured against the full costs of such care. Thus, in insurance based health care systems, such as the DTSS, there is potential for an inflated demand for and provision of services than would be the case in a perfect market with paying consumers.

Moral hazard on the part of dentists occurs for two related reasons. First, on the supply side, a third party (in this case a government agency, the PCRS) pays for dental care provided by dentists. With this third party bearing the costs of care, dentists have few incentives to moderate the amount of care they supply. They do not bear the costs of their decision-making. Second, on the demand side there is asymmetric information between patients and dentists characterized by an imbalance of power whereby the dentists largely determines the level and the amount of services required. The patient seeks advice on what services to demand from the very person who is supplying the service. Thus, the dentist can both influence demand, and supply a service, for which s/he bears little, if any, of the financial burden. Such a situation can lead to overutilization of services (1). This type of provider moral hazard is most often associated with systems of payment based on fee-for-service, such as the DTSS, where the dentist receives a fee for each item of service performed. The more services provided the more income for the dentist. This phenomenon is also known as 'supplier induced demand' (SID).

The first type of SID effect occurs where an increase in supply of dentists paradoxically may lead to an increase in the income of dentists. Normally, an increase of suppliers in a competitive market leads to increased competition with a reduction in prices charged to the consumer. The SID theory holds that dentists use their position as an agent of the patient to inform the patient that they require more treatment than would previously have been deemed necessary. Thus the volume of work increases and, surprisingly, the prices charged increase as dentists become busier. The question of whether this is, in fact, a moral hazard or not depends on whether the extra work induced is of benefit to the patient. For example inducing patients to have unnecessary check-ups or unwarranted diagnostic tests represents moral hazard, whereas offering clinically justified services does not.

A second SID-type effect can occur in a state or insurance system where the relative remuneration for different items of treatment varies. The possibility here is that dentists may over- or under-provide treatments based on the payment they receive. An increase in the level of payment for a specific item on the scheme schedule may lead to a dentist switching their time to preferentially providing that item.

While the theory of SID is well developed, the published literature reports conflicting findings on the magnitude of the phenomenon. Birch (2), Grembowski *et al* (3), Porter *et al* (4), and Chalkley and Tilley (5), suggest evidence of induced demand by dentists in specific cases. Evidence also exists in the case of physicians, a similar group of professionals, as described by Grytten (6), Izumida *et al* (7), Delattre and Dormont (8), and Xirasagar and Lin (9). Woods *et al* (10) found that dentists providing oral health services in the DTSS were influenced by both economic incentives and system changes. However, in contrast, Sorensen and Grytten (11) and Madden *et al* (12) report a failure to find SID effects in specific medical care schemes.

Donaldson and Gerard argue that some ‘overuse’ of service may be warranted, implying that some provider moral hazard can be efficient. The implication is that certain types of provider behavior, such as SID, should not be seen as all ‘bad’. There are neoclassical economic arguments that suggest that, in at least some cases,

professional ethical and altruistic motives provide a satisfactory explanation for the observed behaviour. De Vany *et al* (13), Lambert (14), De Jaegher and Jegers (15), and Richardson and Peacock (16), provide evidence that an observed extra demand may derive from professionals being willing to deliver extra benefits to the population, such as the provision of night clinics, domiciliary visits, and improved quality of care. In such cases, the observed effect is clearly not a moral hazard.

Methods to control consumer moral hazard in medicine and dentistry tend to be ineffective (17, 18, 19, 20). As the supplier in this case holds most of the power in the relationship, it is not surprising that efforts to curb moral hazard should concentrate on the provider side. The DTSS service provides an opportunity to study the impact of design of a third party funded system on claims for payment for service provided and evidence of moral hazard. Although the DTSS is a single system it is administered at regional level, there being eight administrative regions. Thus simple geographic comparisons of the frequency of claims for services where there is no variation in payment or in regulations governing the provision of that service is possible, the example used is Surgical Extraction. The impact of regional variation in remuneration can be explored using comparison of claims for Endodontic Treatment and Prolonged Periodontal Treatment as the rates of remuneration varied by region during the reference period. Variation in the requirement for justification of extra oral radiography among regions allows the study of the impact of regulation.

The aim of this paper is to investigate whether economic incentives influence the provision of third-party funded dental services within the DTSS in the Republic of Ireland.

Materials and Methods

Data were obtained from a number of existing sources for secondary analysis. Regionally aggregated data for treatment carried out under the DTSS between 2001 and 2006 were assembled in annual report form by the Primary Care Reimbursement Service (PCRS) for the eight administrative regions, the Eastern, Midlands, Mid Western, North Eastern, North Western, South Eastern, Southern, and Western. The data provided details of claims for payment submitted by private dentists at the completion of courses of treatment. The PCRS also publish annual reports for each administrative region which include the numbers of contracted dentists, number of patients seen, the numbers of each item of treatment provided, and the costs for each item of treatment. Data were collected from the published reports from 2002 to 2006 (21, 22, 23, 24, 25).

Population structures were derived from from the Census reports of 2002 and 2006 from the Central Statistics Office in Dublin (26, 27). The proportions of the age groups in each region were determined. The population profiles were broadly similar in terms of the percentage distribution across the age categories. The Eastern region had the highest percentage of population aged 16-44 at 62% and the North West the lowest at 53%. The combination of information on the number of contracted dentists and the number of eligible adults from data obtained from the annual report of the PCRS allowed the estimation of the dentist to population ratio in the service by region (Table 1). The Southern region had the highest number of dentists per 10,000 population and the ratio increased from 15.9 to 17.1 between 2002 and 2006. The second highest density of dentists was in the Eastern region with the lowest in the North West.

Information on levels of remuneration for treatment provided was obtained at regional level from personal correspondence to the author from the Principal Dental Surgeons managing the services. The distribution of practices with orthopantomograph machines for extra-oral radiography was obtained from the licensing data held by the Radiological Protection Society of Ireland in 2006, communicated personally to the author. Four DTSS treatment items were selected for investigation. Surgical

Extraction, Endodontics, Prolonged Periodontal Treatment and Extra-oral Radiographs

Surgical Extraction does not vary in price regionally. It is a treatment of interest as it is a direct replacement for another DTSS treatment, Extraction. The definition of a Surgical Extraction in the DTSS contract makes it clear that this is a specific surgical procedure, not merely a time-consuming or difficult extraction. Surgical Extraction attracts a fee of approximately three times that of an ordinary Extraction. The moral hazard effect here involves the simple substitution of a claim properly made for Extraction by one of Surgical Extraction which results in an overcharging of services to the State.

Endodontics, and Prolonged Periodontal Treatment, are treatments of interest as both showed a regional variation in price and thus provided a natural experiment on the effect of price on claims for treatment. As endodontic treatment can be complex and the treatment is operator sensitive and requires irreversible expiration of the pulp, it does not lend itself to demand inducement except perhaps as an alternative to extraction where the substitution would in many cases be a positive choice favouring tooth retention. In contrast, periodontal treatment is a type of service where one might expect to see demand-inducement for a number of reasons. Firstly periodontal disease is often only diagnosable by a dentist, thus the patient is less likely to demand treatment themselves. Secondly, it is a chronic condition where the dentist usually has no urgent black-and-white acute treatment decisions to make. In this way it is quite unlike endodontic treatment. Finally, probity assurance is difficult. It can be difficult to tell whether the treatment has even been carried out.

Extra-oral Radiography is of interest as it is the subject of variation in regulations among the regions. Authorities in one of the eight regions, the North Western, regulated the provision of extra-oral radiographs formally since 2000 by the introduction of a written set of regulations for the prescription of orthopantomographs (OPGs), the “OPG Protocol”. Orthopantomographs account for virtually all extra-oral radiographs taken in general dental practice in Ireland.

To explore the effect of the structure of the third party funding system on the claiming pattern for the four selected items of treatment three approaches were adopted.

- Where there was no regional variation in remuneration or regulation a simple comparison across regions was carried out and regional variation was studied and discussed, this approach was adopted for the exploration of surgical extraction claims.
- Where there was regional variation in remuneration the correlation between number of claims per dentist and the level of fees by region was analysed using linear regression and the Pearson's correlation coefficient. This approach was adopted for the exploration of endodontic treatment and prolonged periodontal treatment.
- Where there was regional variation in regulations regarding a treatment, the number of claims per dentist for the regulated treatment item in the highly regulated region was compared with the less regulated regions. This approach was adopted for the exploration of claims for extra-oral radiography.

In each case the impact of the regional dentist to population ratio (dentist density) was included as it is a measure of competition in the market.

In each case temporal effects across the regions were also examined because the health service appointed 20 examining dentists in April 2006 to peer review in the Dental Treatment Services Scheme (DTSS) in the Republic of Ireland. The dentists would have anticipated the possibility of direct scrutiny of their work in the months preceding these appointments. Prior to this time probity assurance was carried out in a much more limited fashion and indirectly through the observation of claim patterns.

Results

In the case of Surgical Extractions, there was an increase in claims activity between 2002 and 2005 followed by a fall in 2006. This pattern was not related to any price or regulatory mechanism, because the price was fixed and no prior approval is required. Dentist density per eligible patient could explain 32% of the variation ($r^2 = 0.319$, $p<0.001$). The decrease in the trend in 2005-2006 may be due to a national probity exercise that began in May 2006, whereby practitioners with very high ratios of

Surgical Extractions were challenged on their claim patterns by the funding agency. Individual dentists who had claimed a large proportion of Surgical Extractions to total extractions were asked to justify their claim patterns (Table 2).

Endodontic treatment is available in the DTSS for anterior teeth only. As caries in incisors and canines is relatively rare, particularly for the 70% of the population residing in fluoridated areas, it is unsurprising that the average number of endodontic treatments per dentist in a year is quite low. The variation within each region's time trend is small in absolute terms. The variation between regions is also quite small in absolute terms, being a difference of approximately 1% of all examinations between highest and lowest in each year, and there is a peak of activity in 2003 (Table 3). Endodontic treatment requires prior approval and local price negotiation. The unit fees paid in each region were consistently highest in the Midland Region (for instance €207.96 in 2006) and lowest in the North Western and Western regions (€156 and €147.75 respectively in 2006). The highest fee was of the order of 30% greater than the lowest between 2002 and 2006. There was a negative association between magnitude of remuneration and level of provision ($r = -0.538$, $p<0.001$) and also between dentist density and mean number of endodontic treatments per annum per dentist ($r = -0.759$, $p < 0.001$), suggesting that there were fewer claims per dentist in areas where prices were higher and where there were more dentists per head of population. There is a notable peak in 2003 in almost all regions. This coincided with increased dentist availability due to a withdrawal by contracted dentists from a separate State scheme for insured workers. The data do not provide evidence of economic moral hazard in relation to the provision of endodontic treatment on the DTSS.

Claims for Prolonged Periodontal Treatment showed considerable variation across the regions (Table 4). The regions with the highest and lowest claims, North Western and Western, are regions which closely resemble each other geographically and demographically. The correlation between the number of claims per dentist and dentist density was low and not statistically significant ($p = 0.13$). There was wide variation in the average fee paid per course of treatment in this time period (Table 5). There was a positive correlation between the price per course of treatment paid and the number of periodontal treatments claimed by dentists ($r = +0.561$, $p<0.001$). This indicates that price may play a role in determining the output of periodontal treatment,

explaining approximately 31% of the variation seen ($r^2 = 0.315$). These data suggest that moral hazard may exist in regard to claims for periodontal treatment in the DTSS.

The pattern of OPG prescription across the regions from 2002 to 2006 shows that the North Western region's rate of provision of this item is notably less than for the other regions. The five-year average is 4%, while the closest comparisons are the Eastern, Western and Mid-Western at 12%. The remaining regions average about 14% (Table 6). These data illustrate the impact of putting protocols in place to ensure appropriate use of OPGs. They also indicate that moral hazard may exist with regard to the provision of Extra Oral Radiographs in the DTSS.

Discussion

Before considering issues of induced demand, it is necessary to consider the factors which can contribute to an automatic variation in treatment demand in the Irish regions. Such factors include personal income, regional demography, and regional access to dentists.

Personal income of patients, or ability to afford attendance for treatment, should not be factor in determining regional variations because eligibility for DTSS services is defined by an income limit, and this income limit is consistent nationally across all regions.

The impact of regional variation in the distribution of ethnic groups or immigrant groups has not been factored into this analysis as the required data were not available, it is unlikely however to account for the differences seen. Regional demographic factors considered were age and gender as treatment needs may vary with age and by gender. The most noticeable demographic variations noted were with regards to gender, notably a majority female population in the two areas with the largest conurbations, Dublin (part of Eastern) and Cork (part of Southern). The Male-Female ratio varies from 0.97 in the Eastern region at one extreme, to 1.02 in the Midland. Gender balance is very similar in the Mid Western, North Western, South Eastern and Western regions. Although there was variation in the age profiles of the Irish administrative regions, this was manifestly a difference between the Eastern region and the rest, with the Eastern having a higher proportion of younger adults. The variations in claim patterns tended to occur among regions with similar age structures as well as with the East.

In terms of dentist density, the North Western, Midland and Western are similar in having the sparsest dentist to population coverage. There is a multiple of 2.7 dentists per patient between the most and least advantaged regions. This is greater than the variation for other professionals contracted to the medical card scheme. Within dentistry, the Southern and Eastern regions had the highest dentist-to-population ratio while the North Western had the lowest. The two dental schools in the state are located in the Southern and Eastern Regions,

Where Surgical Extraction claims are made as a substitute for ordinary Extraction claims, each unit of work commands a significantly higher fee; the Surgical Extraction fee is a 2.67 multiple of the fee for a simple Extraction. Rather than providing extra and unnecessary treatment, with a negative impact on patient welfare as defined in the SID model, this paper substitution of claim description is a "victimless crime" (if one does not count the State as a victim). A dentist may feel entitled to claim this fee if an extraction proves to be simply more difficult than the norm. The Surgical Extraction requires no prior approval and no local price negotiation is involved. Therefore in theory, there should be no reason why Surgical Extraction rates should vary among regions, other than, possibly, demographic reasons. However, the literature is silent on the relationship between demography and the need for surgical extractions. While it might be surmised that an older population might have a greater need for extractions, there is no reason to think that the proportion requiring the surgical approach should vary. Surprisingly, the difference is most marked between the two most similar demographic and dentist-sparse regions with the Western region having roughly twice the rate of claims of the North Western. The total number of extractions, surgical plus ordinary, is remarkably constant across the regions at around 0.44 teeth per person. There is no ready explanation for these findings. There is evidence of simple substitution of Surgical Extraction claims for Extraction claims in some regions, at almost three times the cost to the State per item claimed, suggesting evidence of moral hazard.

In the case of Endodontics, there is no evidence of unwanted economic behaviour. The consequences of unnecessary treatment are significant and it seems likely that the vast majority of dentists would be inhibited by their professional ethics from exploiting any potential agency power to induce this item in the DTSS. In addition, the ability of an investigator to demonstrate fraudulent practice is probably greater with this treatment item than most others, as it is easy to determine whether a tooth has been endodontically treated or nor, and this in itself is an inhibitor to false claiming.

In the case of Prolonged Periodontal Treatment, the consequences for the patient of induced unnecessary treatment are usually not severe, thus there is not a great deal of

inhibition to be expected from the dentists' professional ethics in risking overtreatment. Also, treatment need is very subjective, thus differences of opinion among dentists are more likely to be present than with other items of treatment. The prices paid in the Western area were by far the highest paid in Ireland, and the number of treatments provided was also the highest. Minor differences in price between other regions produce no clear pattern of effect. This indicates that the price difference probably requires a threshold magnitude before it becomes important. For Prolonged Periodontal Treatment, there is evidence of increased price inducing increased claims.

Dentists do not receive marginal payments for intra-oral radiographs in the DTSS as the Examination fee includes a component for these. Therefore, the taking of an intra-oral radiograph imposes a cost on the dentist with no financial benefit accruing. By contrast, in 2007 a fee of almost €40 was payable for an OPG. There is a financial motive to provide more Extra-oral Radiographs in cases where they could be positive-income substitutes for zero-income treatment items. In the region where dentists had to comply with evidence-based regulations regarding the use of OPG radiography, the average dentist claimed at about one-third of the rate of dentists elsewhere.

The variation in utilisation of OPGs is not explained by population structures; the North West has a very similar population structure to other areas, while having a far lower level of OPG provision. Another variable to consider is the regional distribution in the availability of OPG machines. Data provided by the Radiological Protection Institute of Ireland (RPII) indicated that the number of private dentist practices with OPG machines in each region in 2006, the nearest year available for comparison, was highest in the South Eastern at 0.36 machines per contractor, with the lowest in the Western at 0.19 and North Western at 2.0. The distribution of OPG machines does not provide an explanation for the frequency of OPGs per examination ($r = +0.02$). While it might appear that perhaps 22% of the variation can be explained by dentist densities ($r^2 = 0.223$, $p<0.001$), this seems to be an artefact due to the North West's extreme low dentist density and its extreme low OPG utilisation; if the North Western area is excluded from the analysis, there is no relation at all ($r^2 = 0.001$). By a process of elimination, only one variable can satisfactorily explain the observed behaviour, and that is the existence of extra regulation in the North Western area due to the utilisation of its OPG Protocol. This finding suggests evidence of moral hazard.

Conclusion

There is evidence to suggest an oversupply of extra oral radiographs compared with that which would be provided were an evidence based OPG protocol adhered to. These data suggest that that the implementation of protocols provide an effective means of are ensuring that all OPGs taken by contractors can be justified. Considering the radiation dose delivered by an OPG, the use of such protocols by third party funding agencies would appear indicated.

There is a positive relationship between fee level and volume of claims for prolonged periodontal treatment. However, there may be a threshold difference at which price becomes important. Minor price differences are not associated with higher claim rates.

The regional and temporal variation in claim patterns appear to indicate that dentist density is positively related to the rate of claim for fees for Surgical Extractions, ($r = 0.565$, $p<0.001$) which is in keeping with the classical SID model. The data also suggest that oversight, in the form of a well-publicised probity exercise, was effective in changing practitioner behaviour regarding claims for surgical extractions.

There is no evidence for induced demand for Endodontic treatment in the DTSS.

Supplier Induced Demand has been described previously in situations where dentists and doctors have been paid by a third party. The data considered in this paper is consistent with such previous findings. It should be no surprise that dentists should behave as rational economic agents. The findings regarding Endodontics suggest that in clear-cut situations, dental ethics dominates economic incentivisation. However, many areas are less clear cut, as with the examples selected, and in such cases it behoves the designers of third party contracts to carefully crystallise their requirements in such a way as to avoid the ambiguity that might encourage Moral Hazard. The data also suggest the need for external clinical supervision in such third party arrangements.

References

1. Donaldson C., and Gerard K. Economics of Health Care Financing – The Visible Hand. Palgrave Macmillan, New York: Palgrave Macmillan, 2005

2. Birch, S. Item of service remuneration in general practice in the UK: What can we learn from the dentists? Family Practice 1988;**5**(4) 265-270

3. Grembowski, D., Fislet, L., Milgrom, P., Conrad, D., Spadafora, A. Does fluoridation reduce the use of dental services among adults? Medical Care 1997;**35**(5) 454-471.

4. Porter, J., Coyte, P.C., Barnsley, J., Croxford, R. The effects of fee bundling on dental utilisation. Health Services Research 1999;**34**(4) 901-921.

5. Chalkley, M., Tilley, C. The existence and nature of physician agency: evidence of stinting from the British National Health Service. Journal of Economics and Management Strategy 2005;**14**(3) 647-664.

6 Grytten, J. Supplier inducement - its relative effect on demand and utilisation. Community Dentistry and Oral Epidemiology 1992;**20**(1) 6-9.

7. Izumida, N., Urushi, H., Nakanishi, S. (1999): An empirical study of the Physician-Induced Demand hypothesis – the Cost Function approach to medical expenditure of the elderly in Japan. Review of Population and Social Policy 1999;No.8 11-25.

8 Delattre, E., Dormont, B. Fixed fees and physician-induced demand: a panel data study on French physicians. Health Economics 2003;**12**(9) 741-754.

9 Xirasagar, S., Lin, H.C. Physician supply, supplier induced demand and competition; empirical evidence from a single-payer system. International Journal of Health Planning and Management 2006;21(2) 117-131.

10. Woods, N., Whelton H., Considine J., Lucey S. The Impact of Economic Incentives on Dental Treatment Patterns. Community Dental Health 2010;Vol. 27, (1): 18-22.

11. Sorensen, R.J., Grytten, J. Competition and supplier-induced demand in health care systems with fixed fees. Health Economics 1999;**8**(6) 497-508.

12. Madden, D., Nolan, A., Nolan, B. GP reimbursement and visiting behaviour in Ireland. Health Economics 2005;**14**(10) 1047-1060.

13. De Vany, A.S., House, D.R., Saving, T.R. The role of patient time in the pricing of dental services: the fee-provider density relation explained. Southern Economic Journal 1983;**49**(3) 669-680.

14. Lambert, M.L. Young general practitioners in an area with oversupply of doctors: the case of Brussels. Cah Sociol Demogr Med 1998;**38**(4) 271-296.

15. De Jaegher, K., Jegers, M. A model of physician behaviour with demand inducement. Journal of Health Economics 2000;**19**(2) 231-258.

16. Richardson, J.R., Peacock, S.J. Supplier-induced demand: reconsidering the theories and new Australian evidence. Applied Health Economics and Health Policy 2006;**5**(2) 87-98.

17. Lohr, K.N., Brook, R.H., Kamberg, C.J., Goldberg, G.A., Leibowitz, A. Use of medical care in the Rand Health Insurance Experiment: diagnoses and service-specific analyses in a randomised control trial. Medical Care 1986;**24** (supplement).

18. Manning, W.G., Newhouse, J.P., Guan, N., Keeler, E.B., Leibowitz, A, Marguis, M.S. Health insurance and the demand for medical care: evidence from a randomised experiment. American Economic Review 1987;**77** 251-277

19. Keeler, E.B., Rolph, J.E. The demand for episodes of treatment in the health insurance experiment. Journal of Health Economics 1988;**7** 337-367.

20. Cockx, B., Brasseur, C. The Demand for physician services: evidence from a natural experiment. Journal of Health Economics 2003;**22**(6) 881-913.

21. General Medical Services (Payments) Board. Financial and Statistical analysis of claims and payments. Dublin: Government Publications 2002

22. General Medical Services (Payments) Board. Financial and Statistical analysis of claims and payments. Dublin: Government Publications 2003

23. General Medical Services (Payments) Board. Financial and Statistical analysis of claims and payments. Dublin: Government Publications 2004

24. Primary Care Reimbursement Service. Financial and Statistical analysis of claims and payments. Dublin: Government Publications 2005

25. Primary Care Reimbursement Service. Financial and Statistical analysis of claims and payments. Dublin: Government Publications 2006

26. Central Statistics Office (2002). Census 2002 Report. Dublin: Government Publications

27. Central Statistics Office (2006). Census 2006 Preliminary Report. Dublin: Government Publications

Table 1: Tables.docx

Table 1: Contracted Dentist per 10,000 DTSS-Eligible Population, by Region and Year 2002 – 2006.

Region	2002	2003	2004	2005	2006
Eastern	12.3	12.0	12.5	13.6	12.2
Midland	10.5	10.9	11.1	9.7	9.6
Mid Western	9.7	9.7	10.0	10.1	10.5
North Eastern	13.9	13.9	12.3	10.3	10.4
North Western	7.8	6.1	6.1	6.5	6.1
South Eastern	10.0	10.3	8.9	9.5	8.8
Southern	15.9	15.8	16.9	17.5	17.1
Western	8.3	10.1	10.6	12.0	12.5

Notes: DTSS - Dental Treatment Services Scheme, Ireland

Table 2: Surgical Extractions as a percentage of all Extractions (%),

Region	2002	2003	2004	2005	2006
Eastern	17.4	20.8	24.6	23.7	16.9
Midland	10.8	14.5	15.7	14.4	11.8
Mid Western	10.4	15.1	18.3	19.2	15.9
North Eastern	10.2	14.4	14.5	15.5	15.2
North Western	8.7	11.2	11.2	12.4	9.9
South Eastern	10.6	13.7	17.2	16.2	14.7
Southern	16.9	20.4	22.4	23.2	20.7
Western	17.9	22.4	25.7	15.2	20.9

Table 3: Mean Number of Claims for Endodontics per Dentist per Annum

Region	2002	2003	2004	2005	2006
Eastern	2.71	3.30	3.03	2.68	2.85
Midland	3.04	4.45	3.45	3.78	4.21
Mid Western	5.27	5.78	5.44	5.55	5.31
North Eastern	3.21	3.57	3.73	5.01	4.95
North Western	5.84	8.28	8.07	8.00	7.86
South Eastern	4.75	5.20	6.04	5.87	5.58
Southern	3.65	3.55	3.18	3.08	2.72
Western	5.68	5.50	4.80	4.10	3.99

Table 4: Mean Number of Claims for Prolonged Periodontal Treatment per Dentist per Annum

Region	2002	2003	2004	2005	2006
Eastern	15.80	21.48	21.61	20.35	18.16
Midland	23.32	31.85	24.35	32.97	30.25
Mid Western	21.67	30.24	32.03	34.28	35.93
North Eastern	20.43	24.30	26.41	34.69	35.28
North Western	14.37	21.33	19.27	20.16	23.13
South Eastern	28.41	33.99	44.59	43.11	41.00
Southern	25.09	19.92	18.11	18.49	18.31
Western	47.30	47.05	47.62	50.76	49.66

Table 5: Mean price per course of prolonged periodontal treatment (€), converted to Net Present Value in 2007

Region	2002	2003	2004	2005	2006
Eastern	123.08	128.81	128.38	130.02	123.06
Midland	116.87	119.26	125.38	121.79	119.64
Mid Western	95.32	99.30	100.84	102.00	97.86
North Eastern	105.87	111.15	119.32	118.87	112.89
North Western	89.42	95.67	105.29	121.54	132.55
South Eastern	126.79	126.89	130.80	130.87	125.76
Southern	146.07	147.65	146.38	142.34	135.56
Western	159.81	175.78	202.50	206.26	189.93

Table 6: Claims for Extra Oral Radiographs per 100 Claims for Examinations 2002-2006.

Region	2002	2003	2004	2005	2006
Eastern	14.8	14.7	11.6	9.8	9.5
Midland	19.4	19.9	13.6	14.6	14.4
Mid Western	8.5	11.7	13.0	14.1	15.1
North Eastern	15.8	15.5	12.6	12.5	11.2
North Western	3.9	5.3	4.2	3.9	4.0
South Eastern	16.7	14.7	13.5	12.1	12.1
Southern	19.7	14.2	11.9	12.3	11.8
Western	12.2	13.2	10.6	10.7	11.0