

Factors influencing the need for dental care amongst the elderly in the Republic of Ireland

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Objective To identify the socio-economic, demographic and behavioural determinants of dental treatment needs of those aged 65 and over in the Republic of Ireland. **Design** The treatment needs data is based on detailed clinical oral examinations in the NSAOH carried out between October 2000 and June 2002. To determine factors influencing treatment needs, three measures are used: a dichotomous variable expressing the need for any dental treatment, a dichotomous variable expressing the need for dentures, and a dichotomous variable expressing a Community Periodontal Index of Treatment Need (CPITN) score of three or greater representing a need for periodontal treatment. **Methods** Factors such as age, gender, dental services eligibility status, fluoridation, employment status, educational attainment, anxiety about dental visits, frequency of brushing, and attendance patterns were regressed on a dichotomous version of prevalence of Decayed Missing Filled Surfaces, DMFS including the visual component, and CPITN scores. Associations were estimated using multivariate logistic regression and expressed as odds ratios (OR) with 95% confidence intervals (CI). Goodness of fit was evaluated by estimating sensitivity, specificity, positive/negative predictive values and accuracy. **Results** Being female, smoking, frequent snacking and anxiety about dental visits increased the odds of having a periodontal treatment need. Having primary education only, and being a smoker increased the odds of having a need for any treatment including dentures, whereas being female, regular usage of dental services, and access to fully fluoridated water supplies reduced the odds. **Conclusions** Socio-economic factors such as lower levels of educational attainment, demographic factors such as age and gender and not having access to fully fluoridated water supplies, and behavioural factors such as smoking, frequent snacking, anxiety about dental visits, influence above average treatment needs amongst the elderly in the Republic of Ireland.

Keywords: Elderly, logistic regression, need for care, resource allocation, targeted approach.

Introduction

The proportion of older people continues to grow worldwide. In Ireland, 11% of the population are aged 65 years or older (CSO 2006). Recent trends indicate a clear shift in the Irish population structure from young to old as 22% of the population are between 45 and 64 and will shortly begin to inflate the ranks of the elderly. The prevalence of oral diseases increases with age. In the older adult population tooth loss, dental caries and periodontal diseases frequently can be observed as characteristic features of their oral health condition. In coming decades health and social policy-makers will face tremendous challenges posed by the rapidly changing burden of chronic diseases in old age. Chronic disease and most oral diseases share common risk factors (Petersen and Yamamoto, 2005). Globally, poor oral health amongst older people has been particularly evident in high levels of tooth loss, dental caries experience, and the prevalence rates of periodontal disease, xerostomia and oral precancer/cancer (Ettinger and Mulligan, 1999).

The National Survey of Adult Oral Health (NSAOH) carried out by the Oral Health Services Research Centre in University College Cork, undertaken between October 2000 and June 2002, found significant unmet need for extractions, fillings, dentures, and periodontal treatment amongst those aged 65 and over (Whelton *et al.*, 2007).

Over 41% of the elderly were edentulousness, with their denture treatment requirement increasing from 57% in 1990 to 68% in 2002. Levels of periodontal disease had also increased. Of those clinically examined, 30% had a highest score of 'C' (Calculus) and required scaling and polishing of the teeth with instruction in oral hygiene, with 50% requiring more complex periodontal treatment (maximum score of 'P1' (Shallow pocketing 4-5 mm) or 'P2' (Deep pocketing ≥ 6 mm)) such as root planing or surgical intervention.

The survey established that a minority of individuals now produce a majority of the disease with the elderly clearly having the greatest need for dental care. The survey also established that the majority of this group were unaware of their dental care entitlements. Furthermore, the survey found very low utilisation rates amongst this group with just 9.5% of those aged 65 and over visiting a dentist in 2002. Less frequent utilisation of dental services by elderly subjects is generally as result of not having teeth, with tooth loss significantly associated with being older (Ettinger and Mulligan, 1999). Also, studies such as Niessen and Fedele, (2002) found that as age increases, and especially after retirement, income decreases.

Bailit (1988) found that one of the main reasons that patients from lower socioeconomic groups do not visit the dentist is lack of knowledge about dental disease. The elderly are often not aware that oral disease and tooth loss

can be prevented. Where all teeth are lost there may be a significant effect on diet, nutrition, general well-being (Steele 1998) and quality of life (McGrath *et al.*, 1999; Akifusa *et al.*, 2005; Locker and Gibson, 2005) found that in the UK regular dental attendance was associated with a number of socio-demographic and oral health factors, such as age, social class, income level and educational attainment.

Low utilisation in the long term increases the need for dental care, and need varies according to the demographic, socio-economic, and cognitive characteristics of individuals (Kavanagh, 1994; Hunt, 1990). Morita *et al.*, (2006) found that behavioural factors such as frequency of eating snacks between meals, tooth brushing frequency, smoking and drinking were associated with tooth retention in Japan. Borrell *et al.*, (2006) found that individual income and education were associated with severe periodontitis in the US.

Preventing oral diseases in older adults requires an understanding of the risk factors for oral diseases and how these risk factors change over time (Niessen and Fedele, 2002). This paper investigates whether certain socio-economic, demographic, and behavioural characteristics of the elderly influence their need for dental care in Ireland. Three measures of need are investigated: (1) the need for any dental treatment, (2) the need for dentures and (3) the need for periodontal treatment.

Methods

The treatment needs data for this analysis is based on the detailed clinical oral examinations in the NSAOH. The oral health status of 714 adults aged 65 and older (average age 71.2) was assessed by means of commonly used parameters of dental health (percent edentulous, number of natural teeth, wearing of dentures) and of dental disease (dental caries, periodontal disease, other oral conditions). A team of 30 health board dentists, and 30 dental nurses, conducted the fieldwork having been trained and calibrated in survey methodology in the University Dental School and Hospital, Cork. An epidemiologist visited each examining team at least once during the survey period to ensure examination procedures (including diagnostic standards), developed during training, were maintained throughout the study.

The survey consisted of a clinical oral examination, recorded electronically or on paper, and a detailed questionnaire, which was completed by respondents. The clinical examination for a survey differs from a regular dental check-up in that caries is recorded at the dentinal level of involvement and recorded at a fixed stage of development, not on an absolute presence or absence basis. Teeth are examined wet, whereas in a regular dental check-up the teeth are dried to aid diagnosis. Radiographs were not taken. Periodontal disease was recorded by examining index teeth. Normative need was assessed – subjects' own preferences were not sought.

Because the epidemiological assessment of tooth surface condition does not equate with a clinical diagnostic examination, the examining dentist recorded separately their opinion of treatment need, based on clinical experience, and on the visual condition of the tooth. The clinical assessment process standardises the recording of clinical conditions,

but recognises that variations may exist amongst clinical examiners in their assessment of treatment need.

Each clinical examiner was provided with a set of 'treatment-need' codes, and general guidelines on how to arrive at a decision on the treatment required. However, it was emphasised during training and calibration that the examiners' own clinical judgement would be a major factor, and individual variations were therefore to be expected. Despite these individual variations amongst the clinicians, it is practicable to suggest that the combined treatment-need scores of the 30 clinicians reasonably reflect subjects' treatment-needs, as perceived by a group of practicing dentists. In deciding on the required treatment, the tooth was examined and treatment required was recorded. This was followed by an examination for root caries, after which the appropriate treatment of the root was determined.

In order to determine estimates of treatment needs for individuals or groups having specific demographic, socio-economic and behavioural profiles, the general approach in dental research (Kingman, 1990; Kavanagh, 1994; Hausen *et al.*, 2000; Pienihäkkinen and Jokela, 2002; Bachelor and Sheiham, 2002) has been to use multivariate logistic regression with a dichotomous (need versus zero need) measure of treatment needs as the dependent, or outcome, variable. Three measures of treatment need were used as the dependant variables in this analysis:

1. A dichotomised variable (***tneed***) expressing the need for any dental treatment as distinct from zero need.
2. A dichotomised variable (***dentneed***) expressing the need for dentures as distinct from zero need for dentures.
3. A dichotomised variable (***perioneed***) expressing a CPITN score of three or greater.

Table 1 shows the dependant and explanatory variables used in the analysis. The socioeconomic variables included eligibility for a medical card, third level education, unemployed, and primary education only. Over 65% of subjects had a medical card entitling them to free dental services. Just 12% were in receipt of third level education, 6% were unemployed and 34% were in receipt of primary education only. Cognitive variables include smoking, frequency of snacking, regular brushing, regular use of dental services and fear of the dentist. Health board variables were included to test for regional variations but conclusions on geographical issues may be imprecise due to difficulties in calibrating examiners for periodontal disease.

The relationships between treatment need and the explanatory variables were estimated using logistic regression and expressed as odds ratios (OR) with 95% confidence intervals (CI). Goodness of fit was evaluated by estimating sensitivity, specificity, positive/negative predictive values and accuracy.

Results

Estimates of the logistic regression with associated diagnostic tests are presented in Tables 2, 3 and 4. The combined sensitivity/specificity of each estimate suggests that the explanatory variables are good predictors of treatment need.

Table 1. Dependant and explanatory variables used in the analysis. Dentate and edentate elderly (65 years and older) subjects included.

tneed	= 1 if subject has need for any dental treatment, 0 = otherwise
dentneed	= 1 if subject has need for any denture treatment, 0 = otherwise
perioneed	= 1 if subject has need for periodontal treatment, 0 = otherwise
Age	Age in years at time of clinical examination
Female	1 = female, 0 = male
Medical Card	1 = medical card, 0 = other (including PRSI, None, Private)
Third Level	1 = subjects who received third level education, 0 = otherwise
Unemployed	1 = unemployed for 5 years prior to retirement, 0 = otherwise
Primary Education	1 = primary education only, 0 = otherwise
Smoker	1 = smoker, 0 = other (doesn't smoke cigarettes, cigars or a pipe)
Frequent Snacks	1 = frequent snacks, 0 = other (less than twice a day)
Regular Brusher	1 = regular brusher, 0 = other (if less than twice a day)
Regular User	1 = regular user, 0 = other (not visited the dentist in the past 24 months)
Fear of dentist	1 = frightened, 0 = other (worried to relaxed while waiting in the dentist chair)
Part-Fluoride	1 = access to partially fluoridated water supply, 0 = otherwise
Full-Fluoride	1 = access to fully fluoridated water supply, 0 = otherwise
ERHA	= 1 if Eastern Regional Health Authority, 0 = otherwise
MHB	= 1 if Midlands Health Board, 0 = otherwise
MWHB	= 1 if Mid Western Health Board, 0 = otherwise
NEHB	= 1 if North Eastern Health Board, 0 = otherwise
NWHB	= 1 if North Western Health Board, 0 = otherwise
SEHB	= 1 if South Eastern Health Board, 0 = otherwise
SHB	= 1 if Southern Health Board, 0 = otherwise
WHB	= 1 if Western Health Board, 0 = otherwise

Base: Dentate and Edentulous

Table 2. Demographic, socio-economic, and behavioural determinants of need for any dental treatment

Variable	Odds Ratios	Std. Error	z	P z	95% Conf. Interval
Age	1.002	0.017	0.12	0.907	0.967 1.038
Female	0.714	0.204	-1.64*	0.100	0.479 1.066
Medical Card	0.915	0.221	-0.40	0.689	0.593 1.411
Third Level	1.033	0.283	0.11	0.909	0.592 1.801
Unemployed	1.579	0.451	1.01	0.311	0.652 3.824
Primary Education only	1.905	0.239	2.69***	0.007	1.191 3.046
Smoker	1.411	0.299	1.15	0.249	0.785 2.536
Frequent Snacks	1.621	0.253	1.65*	0.100	0.401 1.082
Regular Brusher	0.723	0.231	-1.40	0.161	0.459 1.137
Regular User	0.675	0.240	-1.64*	0.103	0.421 1.082
Fear of dentist	1.274	0.532	0.46	0.648	0.449 3.615
Part-Fluoride	0.673	0.296	-1.34	0.182	0.376 1.203
Full-Fluoride	0.713	0.318	-1.65*	0.102	0.385 1.340
ERHA	3.056	0.294	3.79***	0.000	1.716 5.442
MHB	5.871	0.644	2.75***	0.006	1.661 20.742
MWHB	1.542	0.291	1.49	0.137	0.871 2.732
NEHB	4.513	0.378	3.99***	0.000	2.151 9.470
NWHB	3.294	0.589	2.02***	0.043	1.038 10.453
SEHB	2.803	0.400	2.57***	0.010	1.278 6.148
WHB	1.907	0.396	1.63	0.104	0.876 4.148
SHB (reference HB)					
No of Observations	698				
LR chi ² (20)	73.481				
Prob > chi ²	0.000				
Pseudo R ²	0.099				
Count R ²	0.768				

Goodness of Fit Diagnostic Tests

Sensitivity	Pr(+ D = 1) = 97.3%
Specificity	Pr(- D = 0) = 85.3%
Positive predictive value	Pr(D = 1 +) = 91.8%
Negative predictive value	Pr(D = 0 -) = 95.0%
Correctly Classified	92.9%

Notes: Classified + if estimated Pr(D = 1) >= 0.5. *, **, *** Statistically significant at 10%, 5% and 1% levels respectively.

Table 3. Demographic, socio-economic, and behavioural determinants of need for dentures

<i>Variable</i>	<i>Odds Ratio</i>	<i>Std. Error</i>	<i>z</i>	<i>P z </i>	<i>95% Conf. Interval</i>	
Age	0.973	0.016	-1.61	0.107	0.943	1.006
Female	0.706	0.195	-1.78*	0.075	0.482	1.036
Medical Card	1.363	0.219	1.41	0.158	0.886	2.096
Third Level	0.664	0.323	-1.26	0.207	0.353	1.253
Unemployed	1.088	0.380	0.22	0.824	0.517	2.291
Primary Education only	1.474	0.206	1.88*	0.059	0.985	2.209
Smoker	1.638	0.249	1.96**	0.041	0.998	2.656
Frequent Snacks	1.521	0.268	1.56	0.118	0.899	2.578
Regular Brusher	1.131	0.247	0.50	0.618	0.696	1.839
Regular User	0.443	0.265	-3.06***	0.002	0.264	0.746
Fear of dentist	1.740	0.407	1.36	0.174	0.783	3.872
Part-Fluoride	1.184	0.262	0.65	0.518	0.708	1.983
Full-Fluoride	1.036	0.293	0.12	0.904	0.583	1.843
ERHA	1.271	0.291	0.83	0.409	0.719	2.249
MHB	2.232	0.471	1.70	0.088	0.886	5.621
MWHB	0.666	0.325	-1.24	0.213	0.352	1.263
NEHB	0.874	0.324	-0.41	0.680	0.463	1.653
NWHB	1.184	0.498	0.34	0.734	0.448	3.147
SEHB	1.470	0.407	0.95	0.344	0.661	3.269
WHB	0.757	0.429	-0.65	0.517	0.326	1.758
SHB (reference HB)						
No of Obs.	541					
LR chi ² (20)	54.640					
Prob > chi ²	0.000					
Pseudo R ²	0.074					
Count R ²	0.821					

Goodness of Fit Diagnostic Tests

Sensitivity	Pr(+ D = 1) = 87.6%
Specificity	Pr(- D = 0) = 75.4%
Positive predictive value	Pr(D = 1 +) = 81.8%
Negative predictive value	Pr(D = 0 -) = 85.0%
Correctly Classified	83.4%

Notes: Classified + if estimated Pr(D = 1) >= 0.5. *, **, *** Statistically significant at 10%, 5% and 1% levels respectively.

Our estimates of need for any dental treatment found that of those clinically examined 79% needed some dental treatment. Table 2 shows that for each additional female the odds of needing any dental treatment decrease by 28%. Being a recipient of primary education only, and frequent snacking, both increased the odds of having a need for any dental treatment, whereas regular use of dental services, and being resident in a fully-fluoridated region, reduced the odds of needing any dental treatment. Relative to the Southern Health Board (SHB) region, residing in other health board areas significantly increases the odds of having a need for dental treatment. This may be as a result of the above-average utilisation rate amongst the elderly in the SHB (Woods, 2005).

Our estimates of need for dentures found that 47% needed some denture treatment. Table 3 again shows that being female, and a regular user of dental services, reduce the odds of needing dentures whereas being a recipient of primary education only, and smoking, both increased the odds of needing dentures. Regional differences were not significant.

Our estimates of need for periodontal care found that amongst the elderly examined, 24% had a CPITN score of greater than or equal to three, indicating a need for

periodontal treatment. Table 4 shows that being female reduced the odds of needing periodontal treatment. Having frequent snacks, being a regular brusher, a smoker, a regular user of periodontal dental services, and fear of the dentist all significantly increased the odds of need for periodontal dental treatment. Relative to the SHB area, residing in the Eastern Regional Health Authority (ERHA) or MHB areas significantly increases the odds of having periodontal treatment need.

Discussion

This paper investigates whether certain socio-economic, demographic, and behavioural characteristics of the elderly influence their need for dental care in Ireland using data from the 2000/02 national survey. One of the significant findings was that elderly females were less likely to need any dental treatment and the survey established a higher level of tooth loss in females than in males. Logically, elderly male adults – who have more teeth than their female contemporaries, require more extractions. For example, the survey indicates that males have, on average, eight natural teeth (1.7 of which require extractions), whereas females in this group have, on average, 6.5 natural teeth

Table 4. Demographic, socio-economic, and behavioural determinants of need for periodontal treatment

Variable	Odds Ratio	Std. Error	z	P z	95% Conf. Interval
Age	1.001	0.019	0.04	0.969	0.964 1/039
Female	0.558	0.211	-2.75***	0.006	0.369 0.845
Medical Card	0.753	0.222	-1.28	0.202	0.487 1.164
Third Level	0.851	0.306	-0.53	0.598	0.467 1.551
Unemployed	0.727	0.409	-0.78	0.437	0.326 1.623
Primary Education only	0.897	0.237	-0.45	0.653	0.564 1.433
Smoker	1.621	0.304	1.64*	0.102	0.335 1.104
Frequent Snacks	3.246	0.248	4.74***	0.000	1.996 5.279
Regular Brusher	2.699	0.228	4.35***	0.000	1.726 4.211
Regular User	2.863	0.231	4.54***	0.000	1.818 4.507
Fear of dentist	2.293	0.467	1.78*	0.076	0.918 5.729
Part-Fluoride	1.259	0.293	0.79	0.432	0.709 2.239
Full-Fluoride	0.899	0.331	-0.32	0.749	0.471 1.720
ERHA	2.539	0.321	2.90***	0.004	1.352 4.768
MHB	3.754	0.448	2.95***	0.003	1.559 9.036
MWHB	0.704	0.380	-0.92	0.356	0.334 1.483
NEHB	1.680	0.365	1.42	0.155	0.821 3.439
NWHB	0.673	0.646	-0.61	0.541	0.189 2.392
SEHB	1.448	0.438	0.84	0.399	0.612 3.419
WHB	1.669	0.420	1.22	0.223	0.732 3.805
SHB (reference HB)					
No of Obs.	698				
LR c ² (20)	150.68				
Prob > c ²	0.000				
Pseudo R ²	0.191				
Count R ²	0.866				

Goodness of Fit Diagnostic Tests

Sensitivity	Pr(+ D = 1) = 69.8%
Specificity	Pr(- D = 0) = 93.7%
Positive predictive value	Pr(D = 1 +) = 67.9%
Negative predictive value	Pr(D = 0 -) = 82.2%
Correctly Classified	80.1%

Notes: Classified + if estimated Pr(D = 1) >= 0.5. *, **, *** Statistically significant at 10%, 5% and 1% levels respectively.

(1.0 of which require extractions). Males also require, on average, 0.7 teeth filled, whereas females require 0.6 teeth filled. Females attended the dentist more frequently and were more likely to have much of their needs catered for before they entered the ranks of the elderly.

Denture wearing and edentulism are common in older patients and can be related to poor quality of life and risk for undiagnosed oral disease and may be a marker for other medical comorbidities. The survey revealed a significant denture requirement which may be worsened by the very low utilisation rate for this age group. Clinical examination revealed that of those wearing partial dentures, the dentures were adversely affecting the surrounding tissues in 35% of subjects. The source of partial denture trauma to oral soft tissues warrants further investigation to enable improvement of this situation. Given the high level of mucosal trauma reported among partial denture wearers, consideration should be given to minimizing tooth loss and avoiding the need for provision of partial dentures. The Dental Treatment Services Scheme, which provides state funded dental care to all medical card holders, does not cover endodontic treatment of premolar teeth. The system only provides for extraction of these teeth. Loss of molar teeth leads to a shortened dental arch, which can function

very well (Allen *et al.*, 2007). However, loss of premolar teeth leads in many cases to a need for a partial denture to restore function as well as aesthetics. Consideration should be given to the provision of endodontic treatment of premolars among medical card holders to avoid the extraction of these teeth. This change would promote the retention of a functional natural dentition without the need for partial dentures. Geriatricians need to include oral health status evaluations and understand that attention to the oral cavity should be part of an older adult's care.

Our study found a higher prevalence of periodontal pocketing among those who smoke tobacco and that smoking increased the odds of needing both periodontal treatment and dentures. Studies such as Bergstrom and Bostrom (2001) have established an association between smoking and the destruction of periodontal tissue, leading to the removal of teeth and the subsequent requirement of dentures. Lifelong tobacco use is a modifiable risk factor for poor dental health among older adults (Jette *et al.*, 1993). These data support the concept of a common risk factor approach to health promotion. Health promotion activities designed to reduce the consumption of cigarettes will benefit oral health as well as many of the common diseases affecting general health. Dentists have

an important responsibility to advise their adult patients and to discourage use of tobacco products for oral as well as general preventive health care.

To ascertain the nature of the dental visiting pattern, subjects were asked ‘When you do go to the dentist, why do you normally go?’ The responses were dichotomised into regular and irregular visiting patterns. Those taken to have a regular visiting pattern were those that reported visiting the dentist for a check up at least every two years, the rest (i.e. those that went only when they felt they needed treatment, when in pain or with a problem, or who never visited) were taken to have an irregular visiting pattern. We found that regular use of dental services reduced the odds of needing dental care including dentures. Mariño *et al.*, (2007) found that regular use of dental services was influenced by higher level of education, non-pension sources of income, lower age, and more social support.

In many cases oral healthcare is not optimal due to low economic and social circumstances (Petersen and Yamamoto, 2005). They argue that it is essential to recognize the risk factors, to treat the oral diseases properly and to organize an effective oral/dental care system for the elderly.

In Ireland, the above average need for care amongst the elderly could be selectively targeted for preventive programmes. Resources could be put in place so that so that Public Health dentists could visit both residential care centres and day care centres and provide information and services to the elderly as poor oral health can influence their general health by impacting on their ability to chew their food, their diet and nutrition. Oral health promotion activities for the elderly should also include a program of denture hygiene.

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