

1. Introduction

Two nationwide surveys on the oral health of adults have been carried out in Ireland to date – the first in 1989-90 and the second a decade later in 2000-2. Both surveys were directed by the Oral Health Services Research Centre, University College Cork, and covered a range of age groups representing young adults, middle-aged adults and older adults.

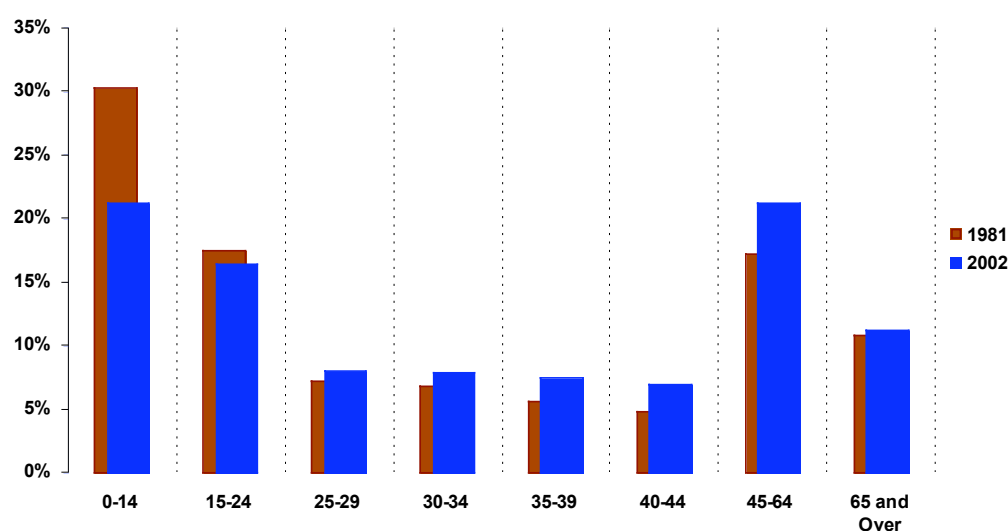
Of a total 436,001 people aged 65 years and over in Ireland (Central Statistics Office (CSO), 2004), 714 (or 0.2 per cent) were clinically examined in the National Survey of Adult Oral Health in Ireland (NSAOH) 2000-2 (Whelton, *et al.*, 2007). Using data from the NSAOH 2000-2, section 2 of this report describes the current oral health status of older Irish people – those aged 65 years and over. It presents commonly used parameters of oral health and of dental disease. The findings are compared with those of the previous National Survey of Adult Oral Health conducted in 1989-90 (O'Mullane & Whelton, 1992). Section 2 also briefly looks at the sociological factors affecting the oral health knowledge, attitudes and behaviour of older people.

Section 3 assesses the treatment needs of older people, attempts to determine the factors affecting need, and compares the treatment provided to medical card holding older people through the Dental Treatment Services Scheme (DTSS) with their empirically assessed need.

1.1. Older People in Ireland

Based on latest available statistics, 11.13 per cent of the total population in Ireland are aged 65 years or over (CSO, 2004). Though Ireland still has a relatively young population, over the last 20 years there has been a clear shift in population structure from young to old. As shown in Figure 1 below, the proportion of those aged 0-14 years dropped from 30.3 per cent in 1982 to 21.1 per cent in 2002 while the proportion of the adult population aged 25 years and over increased, with the largest increase (4.1 per cent) coming from the 45-64 age band. By 2010, the post-war baby boomers currently within the 45-64 age band will be turning 65 and further inflating the ranks of older people.

Figure 1 Population Age Structure in Ireland, 1981 and 2002



The age and gender breakdown of the older people examined in the NSAOH 2000-2, and of the total population aged 65 years and over, are given in Table 1 below. In keeping with the overall gender ratio for the 65+ population in 2002 (Table 2), 46.4 per cent of the older people surveyed were male and 53.6 per cent were female. As age increases, however, the gender balance tips towards females. From a fairly even 49:51 for the 65-69 age band, the male-to-female ratio swings to an unbalanced 30:70 for the 85+ population. Clearly, females tend to outlive males.

Table 1 Numbers examined in the NSAOH 2000/02 as a percentage of the General Population in 2002 by age and gender

Age	NSAOH 2000/2002 Number Surveyed			CSO 2002 Population Number			Numbers Surveyed as % of Population in 2002		
	Male	Female	All	Male	Female	All	Male	Female	All
65 and over	331	383	714	189,155	246,846	436,001	0.2%	0.2%	0.2%
65-69	141	172	313	65,290	68,184	133,474	0.2%	0.3%	0.2%
70-74	102	99	201	51,719	60,410	112,129	0.2%	0.2%	0.2%
75-79	51	65	116	37,377	52,438	89,815	0.1%	0.1%	0.1%
80-84	26	31	57	22,283	36,574	58,857	0.1%	0.1%	0.1%
85 and over	11	16	27	12,486	29,240	41,726	0.1%	0.1%	0.1%

Table 2 Comparison of the gender composition of the elderly examined in the NSAOH 2000/02 with that of the general population in 2002

	NSAOH 2000/2002			CSO 2002		
	Male	Female	All	Male	Female	All
65 and over	46.4%	53.6%	100.0%	43.4%	56.6%	100.0%
65-69	45.0%	55.0%	100.0%	48.9%	51.1%	100.0%
70-74	50.7%	49.3%	100.0%	46.1%	53.9%	100.0%
75-79	44.0%	56.0%	100.0%	41.6%	58.4%	100.0%
80-84	45.6%	54.4%	100.0%	37.9%	62.1%	100.0%
85 and over	40.7%	59.3%	100.0%	29.9%	70.1%	100.0%

Between 1996 and 2002, the 85+ population grew at an average annual rate of 3.1 per cent, outpacing the total population growth rate of 1.3 per cent and the 65+ population growth rate of 0.9 per cent (Table 3). As a percentage of total population, the 85+ population increased from 0.67 per cent in 1981 to 1.07 per cent in 2002. At present, one

out of every 10 older people is aged 85 or over. Ireland is not only an ageing society but an ageing society with an increasing proportion of "old" older people.

Table 3 Rate of population increase between 1996 and 2002

	CSO 2002 Population (Number)	Population Increase Rate (%)
All Ages	3,917,203	1.3
0-14	827,428	-0.6
15-24	641,522	0.2
25-29	312,693	3.1
30-34	304,676	2.6
35-39	290,906	2.1
40-44	271,984	2.1
45-64	831,993	2.8
65 and Over	436,001	0.9
65-69	133,474	0.9
70-74	112,129	-0.1
75-79	89,815	1.1
80-84	58,857	0.9
85 and Over	41,726	3.1

The vast majority of older people reside in their own home and are integrated with their local community. However, from the Long-Term Stay Statistics for 2002 published by the Department of Health and Children (DoHC), it can be estimated that circa 5% of older people are in residential care, with this proportion increasing to 20% - one in every five - for those aged 85 and over.

2. Oral Health Profile of Older Irish People

2.1. Parameters of Oral Health

The Dental Health Action Plan (DoHC, 1994b), which was published following the launch of the Irish health strategy in 1994 (DoHC, 1994a), set out oral health goals for the year 2000. The goal for adults aged 65 years and over was that *no more than 42 per cent should have no natural teeth*. Increased retention of teeth and reduction in the levels of total tooth loss are important goals for the population because of the role of natural teeth in basic functions of daily living such as eating, speaking, laughing and smiling. Research suggests that where all teeth are lost, there may be a significant effect on diet, nutrition, general well-being (Steele, *et al.*, 1998) and quality of life (Akifusa, *et al.*, 2005; Locker & Gibson, 2005; Petersen, *et al.*, 2005).

To profile the oral health status of Irish people aged 65 and over, the levels of three dental parameters will be presented:

- total loss of natural teeth (edentulousness)
 - the percentage of subjects who are edentulous
- number of natural teeth
 - the mean number of natural teeth
 - the percentage of subjects in possession of more than 20 natural teeth
 - the percentage of subjects in possession of 18 or more sound untreated natural teeth
- wearing of dentures
 - the percentage of dentate and edentulous (toothless) adults wearing a full or partial denture according to denture type
 - the proportion of those wearing partial dentures whose denture is adversely affecting the oral mucosa.

The results are weighted for gender, fluoridation status, medical card status and health board, as these are factors which may affect the mean figures presented. Each of the parameters will be presented for the country as a whole and for the four Health Board regions (Eastern - EHB, Mid Western - MWHB, North Eastern - NEHB and Southern -SHB) whose sample sizes were sufficient to allow for reporting at health board level. The results will be presented broken down by gender, possession of a medical card, fluoridation status, geographic location and general health status.

The findings will be compared with those of the previous National Survey of Adult Oral Health which was conducted in 1989-90 (O'Mullane & Whelton, 1992). Oral health data are available from this survey for the country as a whole and for the EHB. The results will also be compared with those of an interview survey carried out in 1979 where reported levels of edentulousness were recorded (DoHC, 1981). International comparisons will be made where appropriate.

2.1.1. Total Loss of Natural Teeth - Edentulousness

The 1994 Dental Health Action Plan set a goal for the year 2000 that not more than 42 per cent of those aged 65 years and over would have no natural teeth. In 2000-2, 41 per cent of this age group was edentulous. However, a greater percentage of females than males are edentulous (Table 4). Thus, while the 35 per cent figure for males is well within the target, the 46 per cent figure for females remains outside the goal.

Table 4 The Percentage of subjects aged 65+ who were edentulous by gender, year of examination and health board

Base: Dentate and Edentulous

	Male	Female	Total
National 2000/'02	35%	46%	41%
National 1989/'90	33%	61%	48%
National 1979	64%	79%	72%
EHB 2000/'02	39%	50%	45%
MWHB 2000/'02	38%	44%	41%
NEHB 2000/'02	35%	52%	45%
SHB 2000/'02	38%	55%	47%
EHB 1989/'90	24%	44%	35%

Comparing these figures with those reported in 1979 and 1989-90, it can be seen that overall there has been a considerable decline in levels of edentulousness – from 72 to 48 per cent between 1979 and 1989-90, and to 41 per cent by 2000-2. The difference in reported levels of edentulousness between females and males was 15 per cent in 1979. In 1989-90, the gender gap was 28 per cent, based on clinical exam. In 2000-2, this difference had decreased to 11 per cent. Thus, the gender gap in terms of edentulousness has decreased among older people.

The MWHB region had the lowest (41 per cent) and the SHB had the highest (47 per cent) levels of edentulousness. Between 1989-90 and 2000-2, the levels of edentulousness in the EHB increased from 35 to 45 per cent. It should be noted that the figures reported in 1989-90 for the EHB are markedly different to those reported for the country as a whole, whereas the current figures are in line with national data. The levels of edentulousness in the EHB, NEHB and SHB are still greater than the national goal set for 2000 in *The Dental Health Action Plan*.

2.1.1.1. Percentage of Edentulous Subjects by Gender & Medical Card Status

Medical card possession is used as a surrogate for disadvantage in this study. However, since July 1st 2001, every person aged 70 years and over – regardless of income – is eligible for a medical card on application to their local health authority. The clinical examinations of 84 subjects aged 70+ (comprising 12 per cent of the entire sample of older people and 20 per cent of the 70+ sample) took place after this date. Whilst before July 1st 2001, 70 per cent of those aged 70+ examined held medical cards, after this date 96 per cent held medical cards (Table 5). Clearly, the introduction of

medical card eligibility for all persons aged 70 and over calls into question the validity of using medical card possession as a surrogate for disadvantage, and must be kept in mind when interpreting the results. Despite this, disparities between medical card holders and non-medical card holders are still evident for older people as a whole.

Table 5 The number and percent of subjects aged 70+ examined before and after 1 July 2001 by medical card ownership and gender

	Examined <i>before</i> 1Jul 01			Examined <i>after</i> 1Jul 01		
	Male	Female	Total	Male	Female	Total
Medical Card Holder	97	120	217	32	49	81
	63%	76%	70%	94%	98%	96%
Non Medical Card Holder	56	37	93	2	1	3
	37%	24%	30%	6%	2%	4%
Total	153	157	310	34	50	84
	100%	100%	100%	100%	100%	100%

It is also interesting to note that the ratio of medical card to non-medical card holders is higher among older females (69:31 or 2.2) than among older males (61:39 or 1.6) (Table 6).

Table 6 Number and percentage of subjects aged 65+ by medical card status and gender in 2000/'02

Base: Dentate and Edentulous

		N	Per Cent
Medical Card Holders	Male	197	61%
	Female	259	69%
	Total	456	65%
Non Medical Card Holders	Male	126	39%
	Female	116	31%
	Total	242	35%

Table 7 The Percentage of subjects aged 65+ who were edentulous according to gender and medical card status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

		1989/'90	2000/'02
Medical Card Holders	Male	48	40
	Female	72	49
	Total	62	46
Non Medical Card Holders	Male	17	24
	Female	43	35
	Total	31	29

In 2000-02, the percentage of subjects who were edentulous was considerably higher among medical card holders for both males and females: 40 per cent of male and 49 per cent of female medical card holders were edentulous, as opposed to 24 per cent of male and 35 per cent of female non-medical card holders (Table 7).

Looking at the change in levels of tooth loss since 1989-90, the levels of edentulousness found among male and female medical card holders and female non-medical card holders in 2000-2 is lower than that found in 1989-90. However, the level of edentulousness reported for male non-medical card holders is higher in 2000-2 than in 1989-90. It should be remembered that due to changes in the Irish economy between the times of the two surveys, the profile of adults without a medical card may have altered.

2.1.1.2. Percentage of Edentulous Subjects by Fluoridation Status

Water fluoridation in Ireland commenced in Dublin in 1964. At the time of this survey, fluoridation had been in place for 36-38 years in those areas that were fluoridated in 1964.

Table 8 The Percentage of subjects aged 65+ who were edentulous according to fluoridation status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

	Fluoridation status		
	Non	Part	Full
2000/'02	42	39	42
1989/'90	54	46	42

Table 8 shows the percentage of older people examined during the survey who had no natural teeth, according to their exposure to water fluoridation. In the 'Non' group, older people had less than one year exposure to domestic water fluoridation. In the 'Part' group, they had more than one year exposure but less than 35 years exposure. In the 'Full' group, they had at least 35 years exposure to water fluoridation.

The gradual in edentulousness is evident in the 'Non' and 'Part' fluoridation groups. Amongst the older people in the 'Non' fluoridated group, edentulousness decreased from 54 per cent to 42 per cent, bringing them into line with those having 35 years exposure to domestic water fluoridation. Though the decline amongst the 'Part' fluoridated group was less, this group continues to have a lower level of edentulousness than the 'Non' fluoridated group. Interestingly, the 'Full' fluoridated group shows no decline in levels of edentulousness. This finding is unexpected and warrants further investigation.

As almost half of the population of Ireland resides in the EHB region, changes in edentulousness in that region have a major impact on national figures. Data for the EHB and the rest of the country (OHB) for 2000-2 and 1989-90 are presented in Table 9.

Table 9 Percent of subjects aged 65+ who were edentulous according to fluoridation status in the Eastern Health Board (EHB) and other health boards (OHB) in 1989/90 and in 2000/02

Base: Dentate and Edentulous

	Non		Part		Full	
	N	%	N	%	N	%
EHB						
2000/02	1	*	40	49	115	44
1989/90	4	*	2	*	59	36
OHB						
	N	%	N	%	N	%
2000/02	141	42	260	37	140	38
1989/90	103	54	55	47	19	*

* n<30

When the change in edentulousness over time is reviewed separately for the EHB and the rest of the country, it is clear that levels of edentulousness among older people in the rest of the country (OHB) have decreased since 1989-90. Given the general increase in tooth retention over time, this pattern of change is as expected. Also, in the OHB regions in 2000-2, edentulousness is lower among older people in the 'Full' fluoride group than among those in the "Non" fluoride group. In the EHB region there appears to have been an increase from 36 per cent edentulous to 44 per cent edentulous in the 'Full' fluoride group. This increase is difficult to explain.

When looking at differences according to fluoridation status for the 65+ age group, it is important to remember that in 2000-2 this cohort would have been more than 27 years old when water fluoridation commenced in 1964. Thus, much of their decay and tooth loss may have already taken place prior to the introduction of fluoridation. Those in the 65+ age group in 1989-90 were at least 40 years old when fluoridation commenced in 1964. Clearly, in that era of very high levels of caries and tooth loss, it is likely that a high proportion of adults in the 65+ age group would have been edentulous or nearly edentulous prior to the introduction of water fluoridation. In 1961-63, 15 year olds had an average of 8 decayed, missing or filled teeth (O'Mullane, *et al.*, 1986). Thus, data for the 65+ age group is of limited use when examining the impact of water fluoridation. Future monitoring of the difference in oral health between adults who have been lifetime recipients of water fluoridation and those with no water fluoridation will be important to quantify the benefit of fluoride to the oral health of older people.

2.1.1.3. Percentage of Edentulous Subjects by General Health Status

Oral health is an integral component of general health, and the association between oral health and general health is of interest. The American Society of Anesthesiologists (ASA; 2001) Physical Status Classification System was used to categorise participants general health status. Among the older people classified as normally healthy, without systemic disease (ASA Class 1), 35 per cent were edentulous (Table 10). Among those having mild to moderate systemic disease (ASA Class 2), 54 per cent of subjects had no natural teeth. Among those classified as having severe systemic disease that limits activity but is not incapacitating (ASA Class 3), edentulousness was at 48 per cent. It would

appear that older people with systemic disease have higher levels of edentulousness than those without systemic disease, thus warranting the inclusion of oral health promotion in integrated care plans for those with systemic disease.

Table 10 The Number of subjects aged 65+ according to general health status (ASA) by the percentage who were edentulous

Base: Dentate and Edentulous

ASA								Total	
1		2		3		4		N	% Edent
N	% Edent	N	% Edent	N	% Edent	N	% Edent		
464	35	206	54	43	48	1	*	714	41

* n < 30

2.1.2. Mean Number of Natural Teeth

The full complement of natural teeth in the mouth is taken to be 32. However, this includes four wisdom teeth, which in many people are not present and for whom the possession of 28 natural teeth represents the full complement. The mean number of natural teeth possessed by older people in 2000-2 was eight.

2.1.2.1. Mean Number of Natural Teeth by Gender

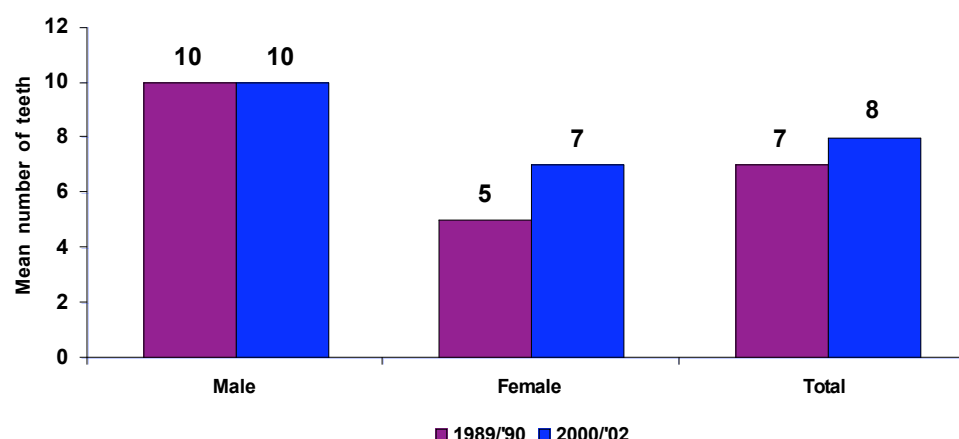
Older males tend to possess more natural teeth than older females. The lower mean number of natural teeth present among females is not fully explained by the higher level of edentulousness within this group. Among dentate older people, the mean number of natural teeth present is 15.2 for males and 13.6 for females (Table 11).

Table 11 The mean number and *standard error* of natural teeth present in subjects aged 65+ by gender, year of examination and health board

Base: Dentate and Edentulous

	Male		Female		Total	
	N	SE	N	SE	N	SE
National 2000/'02	10	1	7	1	8	1
National 1989/'90	10	1	5	1	7	1
EHB 2000/'02	10	1	7	1	8	2
MWHB 2000/'02	9	1	7	1	8	1
NEHB 2000/'02	10	2	7	1	8	2
SHB 2000/'02	9	1	6	1	7	1
EHB 1989/'90	14	2	8	2	11	1

Regional variations are small, both by gender and overall. For example, the average number of teeth in the EHB, MWHB and NEHB is 8 whilst it is 7 in the SHB.

Figure 2 The mean number of natural teeth present by gender and year of examination*Base: Dentate and Edentulous*

Two obvious changes have taken place since 1989-90: an overall increase in the number of teeth present, and a reduction in the difference in the number of natural teeth present by gender (Figure 2). In 1989-90, males and females aged 65 years and over had on average 10 and 5 teeth, respectively; in 2000-2, they had 10 and 7 teeth, respectively. Whereas males experienced no increase in natural teeth present since 1989, females in this age group had an average increase of two natural teeth present, resulting in an overall increase of one natural tooth present.

2.1.2.2. Mean Number of Natural Teeth by Gender & Medical Card Status

Table 12 The mean number and *standard error* of natural teeth present by gender and medical card status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

Medical Card Holders						
	Male		Female		Total	
	1989/'90	2000/'02	1989/'90	2000/'02	1989/'90	2000/'02
	mean nt	SE	mean nt	SE	mean nt	SE
	8	1	3	1	5	1
	8	1	7	1	7	1
Non Medical Card Holders						
	Male		Female		Total	
	1989/'90	2000/'02	1989/'90	2000/'02	1989/'90	2000/'02
	mean nt	SE	mean nt	SE	mean nt	SE
	12	1	8	1	10	1
	13	1	10	1	12	1

Subjects in possession of medical cards – both males and females, tended to have fewer natural teeth present than those who did not possess a medical card (Table 12 & Figure 3). Within both the medical card and the non-medical card groups, females tended to have fewer natural teeth present than males. However, females experienced greater improvements over time than males.

Figure 3 The mean number of natural teeth present by gender and medical card possession (MC / Non MC) in 2000/02

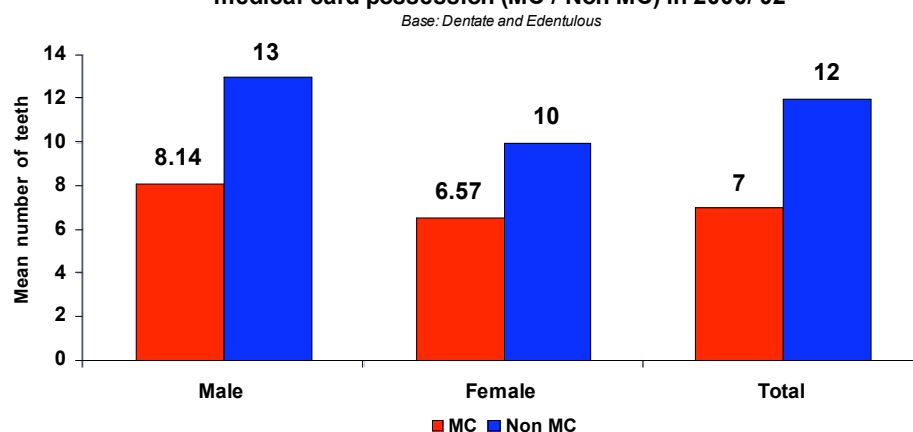
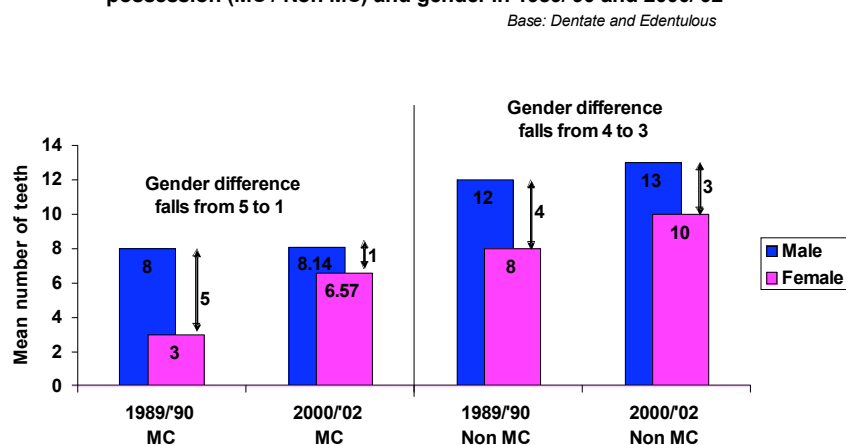


Figure 4 shows that gender differences in number of natural teeth present have decreased both for the less well off (medical card holders) and the rest of the older population since the 1989-90 survey.

Figure 4 Mean number of natural teeth present by medical card possession (MC / Non MC) and gender in 1989/90 and 2000/02



2.1.2.3. Mean Number of Natural Teeth by Fluoridation Status

Water fluoridation commenced in 1964 – 36 to 38 years prior to the 2000-02 survey. In this report, fluoridation status is classified only on the basis of the subject's domestic water fluoridation status. It does not take into account the effect of fluoride toothpastes, which had been widely available for some 25 years by the time of the survey. Subjects aged 65+ who had resided in a fluoridated community for at least 35 years ('Full' group), or for one or more years ('Part' group), had more natural teeth present in comparison to the 'Non' fluoridated group (Table 13).

Table 13 The mean number and *standard error* of natural teeth present in subjects aged 65+ by Fluoridation Status in 1989/90 and in 2000/02

Base Dentate and Edentulous

	Non		Part		Full	
	1989/90	2000/01	1989/90	2000/01	1989/90	2000/01
mean nt	6	7	7	9	9	8
SE	1	1	1	1	1	1

It is worth noting that in 1961-63, when the current cohort of 65-70 year olds were in their mid-twenties, the mean DMFT of 15 year old adolescents was 8 (O'Mullane, *et al.*, 1986). This illustrates that prior to the introduction of water fluoridation in 1964, dental caries had already impacted upon the dentition of this age group.

As with edentulousness, reported earlier in this chapter, it is useful to review changes in the mean number of teeth present according to fluoridation status for the EHB region and for the other health boards (OHB) separately.

In 1989-90, most of the 'Full' fluoride sample came from the EHB while the 'Non' fluoride sample came from the OHB (Table 14). Thus, the 'Full' and 'Non' fluoride group comparison in 1989-90 can only be made between the 'Full' fluoride group in the EHB and the 'Non' fluoride group in the OHB. In 2000-02, the sample size in the 'Non' fluoride EHB group was again too small to allow comparison for the EHB.

Table 14 Mean number of natural teeth present in subjects aged 65+ according to fluoridation status in the Eastern Health Board (EHB) and other health boards (OHB) in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

	Non		Part		Full	
	N	mean nt	N	mean nt	N	mean nt
EHB						
1989/'90	4	*	2	*	59	10.2
2000/'02	1	*	40	8.7	115	7.9
OHB						
	N	mean nt	N	mean nt	N	mean nt
1989/'90	103	5.7	55	6.8	19	*
2000/'02	141	7.3	260	9.6	140	8.4

* n<30

Looking at the differences in the mean number of teeth present according to fluoridation status in 1989-90, those in the 'Full' fluoride category have more teeth than those in the 'Non' fluoride group. The findings for OHB areas in 2000-02 are similar: older people in the 'Full' fluoride group (8.4) had on average 1.1 more teeth than those in the 'Non' fluoride group (7.3).

There was an increase in the mean number of teeth present since 1989-90, except in the case of the 'Full' fluoride group in the EHB where the mean number of teeth decreased from 10.2 in 1989-90 to 7.9 in 2000-02 (Table 14). This unexpected finding mirrors the increase in the percentage edentulous in the EHB since 1989-90 (Table 10).

2.1.2.4. Mean Number of Natural Teeth by General Health Status

As with edentulousness, older people with no systemic disease (ASA Class 1) generally had more teeth than older people with systemic disease (ASA Classes 2 and 3) (Table 15).

Table 15 The mean number and *standard error* of natural teeth present in subjects aged 65+ according to general health status (ASA)*Base: Dentate and Edentulous*

	ASA				Total
	1	2	3	4	
mean nt	9	7	6	*	8
SE	1	1	1	*	2

* n<30

2.1.2.5. Impact of Gender, Medical Card Status & Fluoridation Status on Number of Teeth – Multivariate Analysis

Data on the mean number of natural teeth possessed by older people have been presented above according to gender, medical card status, fluoridation status, and health board. A multivariate analysis is used to look at the impact of each of these variables on the number of natural teeth remaining in the mouth whilst controlling for the effect of the other variables.

Table 16 Number and percent of subjects aged 65+ according to categorisation of number of teeth

High	Medium	Low
NT ≥ 17	1 ≤ NT ≤ 16	NT = 0
177	234	283
25.5%	33.7%	40.8%

Number of sound natural teeth (NT) values were categorized as good, moderate, or poor in accordance with divisions roughly corresponding to the 25th and 75th percentiles (Table 16). Over 40% of older people fall into the poor category for NT. This category roughly corresponds to the edentulous portion of the older population.

Proportional polytomous and dichotomous logistic regression were used to assess the risk of poorer levels of NT. The two dichotomous logistic regression models considered were:

(1) Low/Medium vs. High

(2) Low vs. Medium/High.

The proportional polytomous regression requires the assumption that these odds are proportional, essentially assuming that all possible dichotomisations of the response variable are equivalent. The validity of this assumption is tested using the standard score test. The statistical significance of interactions was evaluated using a backwards step-wise procedure with the likelihood ratio test.

The variables age (within the 65+ age group), gender, medical card status, health board, and fluoridation status were included in the model. Results from the dichotomous logistic regression are presented here. The significance of predictors was assessed using the Wald test statistic. Pairwise comparisons of health boards used the Wald statistic with the Bonferroni correction.

Gender and medical card status are significantly associated for both models, whereas age is only significant for model 2 (Table 17, following page).

Table 17. Results from the dichotomous logistic regression. Number and % in parenthesis of subjects aged 65+ with poor, moderate and good numbers of natural teeth remaining in their mouths (NT); adjusted odds ratio of having Poor/Moderate vs. Good (model 1) number of teeth and Poor vs. Moderate/Good (model 2) number of teeth, 95% CI and significance (p value), according to the independent variables tested.

Characteristic	Number (%) by level of number of teeth (NT) (unadjusted)			Model	Adjusted odds ratio	95% CI	P-value
	Good	Moderate	Poor				
Age							
				1	1.03	1.00-1.06	0.0979
				2	1.06	1.03-1.09	0.0001
Health Board							
Eastern	45 (28.8%)	44 (28.2%)	67 (42.9%)	1	1		
				2	1		
Mid West	22 (18.5%)	49 (41.2%)	48 (40.3%)	1	1.45	0.78-2.69	0.2415
				2	0.73	0.43-1.25	0.2559
North East	27 (25.5%)	34 (32.1%)	45 (42.5%)	1	0.78	0.41-1.51	0.4692
				2	0.64	0.35-1.15	0.1331
Southern	32 (23.9%)	42 (31.3%)	60 (44.8%)	1	1.13	0.64-1.97	0.6762
				2	0.92	0.56-1.51	0.738
Other	51 (28.5%)	65 (36.3%)	63 (35.2%)	1	0.72	0.41-1.25	0.2436
				2	0.52	0.31-0.86	0.0116
Gender							
Male	97 (30.1%)	111 (34.5%)	114 (35.4%)	1	1		
				2	1		
Female	80 (21.5%)	123 (33.1%)	169 (45.4%)	1	1.5	1.05-2.14	0.0261
				2	1.48	1.07-2.03	0.0166
Medical Card Status							
No	92 (38.3%)	77 (32.1%)	71 (29.6%)	1	1		
				2	1		
Yes	85 (18.7%)	157 (34.6%)	212 (46.7%)	1	2.48	1.70-3.62	<0.0001
				2	1.83	1.28-2.62	0.0009
Fluoridation Status							
Non	27 (19.1%)	51 (36.2%)	63 (44.7%)	1	1		
				2	1		
Part	80 (26.8%)	97 (32.4%)	122 (40.8%)	1	0.72	0.43-1.21	0.2097
				2	0.82	0.53-1.27	0.3797
Full	70 (27.6%)	86 (33.9%)	98 (38.6%)	1	0.66	0.37-1.18	0.1626
				2	0.66	0.40-1.08	0.0943

In summary, the multivariate analysis shows that whilst controlling for confounding among age, health board of residence, gender, medical card status and fluoridation status:

- Age and gender have a statistically significant impact on number of teeth present; i.e. “old” older people have fewer teeth than “young” older people; older women have fewer teeth than older men.
- Possession of a medical card is associated with lower levels of teeth presence, indicating the statistical significance of the impact of disadvantage on number of teeth remaining.

2.1.3. Possession of More Than Twenty Natural Teeth

In 1982, the WHO set the retention of more than 20 natural teeth (i.e., 21+ teeth) – out of a maximum of 32 – as a goal for oral health. Although the possession of more than 20 teeth was arbitrarily equated with a reasonable level of oral health (Todd & Lader, 1991), subsequent research suggests that where there are more than 20 natural teeth, the functional, dietary and aesthetic needs of most people are met without the need for a partial denture.

2.1.3.1. Possession of More Than Twenty Natural Teeth by Gender

Applying the WHO parameter of 21+ natural teeth, older females fare considerably worse than older males. Twenty one percent of males aged 65+ possess more than 20 natural teeth, compared to just 14 per cent of females (Table 18). These percentages have increased from 15 and 7 per cent for males and females, respectively, since 1989-90. The reduction of the gender difference in levels of oral health over time is again apparent in Table 18. These changes represent encouraging improvements in the oral health of older people.

Table 18 Percentage of subjects aged 65+ with more than 20 natural teeth present, by gender, year of examination and health board

Base: Dentate and Edentulous

	Male	Female	Total
National 2000/'02	21	14	17
National 1989/'90	15	7	11
EHB 2000/'02	18	12	14
MWHB 2000/'02	19	10	14
NEHB 2000/'02	26	13	18
SHB 2000/'02	22	13	17
EHB 1989/'90	35	14	23

2.1.3.2. Percentage of Subjects with More Than Twenty Natural Teeth by Gender & Medical Card Status

Table 19 Percentage of subjects aged 65+ with more than 20 natural teeth present by gender and medical card status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

		1989/'90	2000/'02
Medical Card Holders	Male	11	12
	Female	1	11
	Total	5.2	11
Non Medical Card Holders	Male	21	36
	Female	16	22
	Total	17.8	29

The percentages of older males and females possessing more than 20 natural teeth have increased since 1989-90 for both medical card and non-medical card holders. However, the disparity between

the less well off (medical card holders) and the rest of the older population remains pronounced. In 2002-2, per hundred older males, three times as many non-medical card holders (36 per cent) had more than twenty teeth compared to medical card holders (12 per cent). Per hundred older females, twice as many non-medical card holders (22 per cent) had more than twenty teeth compared to medical card holders (11 per cent).

2.1.3.3. Percentage of Subjects with More Than Twenty Natural Teeth by Fluoridation Status

Table 20 Percentage of subjects aged 65+ with more than 20 natural teeth present by fluoridation status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

	Non	Part	Full
2000/'02	13	21	14
1989/'90	8	9	17

The percentage of older people with more than 20 natural teeth present was higher in the 'Part' and 'Full' fluoridated groups in 1989-90 (Table 20). The situation was not as clear in 2000-2. However, as previously explained, this age cohort were in their mid-twenties or older by the time water fluoridation was introduced – too late in many cases to prevent considerable tooth loss due to caries.

2.1.3.4. Percentage of Subjects with More Than Twenty Natural Teeth by General Health Status

Table 21 Percentage of subjects aged 65+ with more than 20 natural teeth present according to general health status (ASA)

Base: Dentate and Edentulous

ASA				Total
1	2	3	4	
19	13	5	*	17

* n<30

Possession of more than 20 natural teeth appears to be associated with general health status among older people (Table 21).

2.1.4. Possession of Eighteen or More Sound Untreated Natural Teeth

A reasonable objective in oral health is the retention of a high proportion of sound natural teeth. Using 18 teeth that were not decayed, filled, otherwise restored or traumatised on their coronal surfaces (18+ SUNT) as an arbitrary measure¹, it is clear that only a minute proportion of the older Irish population achieve this level of oral health (Table 22). However, the situation has improved since 1989-90: for those aged 65 and over, the proportion increased from 2 to 3 per cent.

¹ It must be stressed that teeth counted as sound (no disease) in a survey may have caries, visible only with a full clinical examination with the use of radiographs to aid diagnosis. Dental surveys underscore the true level of caries in the population; hence the proportion of adults with 18+ SUNT is an overestimate. Although the estimate of decay levels provided by the survey examination is an underestimate, the survey examination system has the important advantage of being very reliable and reproducible. These features are essential to allow valid comparisons of changes in disease levels over time. Because the same examination system is widely used internationally it permits meaningful international comparisons of disease levels.

Table 22 Percentage of subjects aged 65+ with 18 or more sound, untreated natural teeth (18+ SUNT) present by gender, year of examination and health board

Base: Dentate and Edentulous

	Male	Female	Total
National 2000/'02	6	2	3
National 1989/'90	5	0	2
EHB 2000/'02	3	0	1
MWHB 2000/'02	7	2	4
NEHB 2000/'02	4	1	2
SHB 2000/'02	8	2	5
EHB 1989/'90	7	0	3

2.1.4.1. Possession of 18+ SUNT by Gender

The percentage of older females with 18+ SUNT tended to be lower than in older males (Table 22). As with the other parameters measured, the gender gap is less now than it was in 1989-90.

2.1.4.2. Possession of 18+ SUNT by Gender & Medical Card Status

Table 23 Percentage of subjects aged 65+ with 18 or more sound, untreated natural teeth (18+ SUNT) present by gender and medical card status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

		1989/'90	2000/'02
Medical Card Holders	Male	7	5
	Female	0	2
	Total	3	3
Non Medical Card Holders	Male	2	7
	Female	0	2
	Total	1	4

The presence of 18+ SUNT was not consistently related to disadvantage, as measured by possession of a medical card (Table 23).

2.1.4.3. Possession of 18+ SUNT by Fluoridation Status

Table 24 Percentage of subjects aged 65+ with 18 or more sound, untreated natural teeth (18+ SUNT) present by Fluoridation Status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

	Non	Part	Full
2000/'02	3	3	4
1989/'90	4	0	1

In 2000-2, the percentage of older people with 18+ SUNT was highest amongst those who had domestic water fluoridation for at least 35 years (Table 24). This is a reversal of the 1989-90 results and indicates a positive benefit of introducing water fluoridation at an earlier age. When water

fluoridation was introduced in 1964, the older people 2000-2 would have been at least ten years younger than the older people surveyed in 1989-90.

Table 25 Percentage of subjects aged 65+ with 18 or more sound, untreated natural teeth (18+ SUNT) present according to general health status (ASA)

Base: Dentate and Edentulous

ASA				Total
1	2	3	4	
4	2	0	*	3

* n<30

2.1.4.4. Possession of 18+ SUNT by General Health Status

Though the percentages are small, possession of 18 or more sound, untreated natural teeth appears to be associated with general health status among older people (Table 25).

2.1.5. Denture Wearing

Historically, a high proportion of older people have worn full dentures; the provision of dentures – a costly and time consuming service – has been a very regular part of general dental practice. A denture is commonly provided for people with missing teeth. Where some teeth remain, partial dentures can be provided. Combinations of full and partial dentures (i.e. where all of the teeth are missing in one arch and only some teeth are missing in the other) are also possible.

An increase in the proportion of older people retaining some natural teeth, as well as an increase in the numbers of teeth retained, has been reported in this chapter. It is to be expected that this change would be reflected in the level of denture wearing and the types of dentures worn. Such changes are of interest because they impact on the nature of dental services required. These data are presented here for 2000-2 and compared with 1989-90.

Table 26 Percentage of subjects aged 65+ wearing full upper and lower dentures (F/F), full upper denture only (F/-), full lower only (-/F) and partial dentures (P/P, P/-, -/P) and combinations of both (P/F, F/P) in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

	n	No Dentures	F/F	F/-	-/F	P/P	P/- or -/P	P/F or F/P
2000/'02	714	26.0	31.0	12.8	0.3	8.0	16.4	5.4
1989/'90	242	42.6	29.8	12.0	0.8	4.6	5.8	4.6

The number of subjects wearing dentures was recorded according to the type of denture. The percentages wearing full dentures in either or both arches have remained at roughly the same level as in 1989-90 (Table 26). Very few older people wear a full lower denture only. In keeping with the finding of increased retention of teeth, there has been a substantial increase in the percentage wearing partial dentures. The increase in numbers wearing partial dentures accounts for the reduction in the percentage of older people with no dentures from 42.6 per cent in 1989-90 to 26 per cent in 2000-2.

Table 27 Percentage of subjects aged 65+ wearing full upper and lower dentures (F/F), full upper denture only (F/-), full lower only (-/F), and partial dentures (P/P, P/-,-/P) and combinations of both (P/F,F/P) in 1989/90 and in 2000/02

Base: Edentulous

	n	No Dentures	F/F	F/-	-/F	P/P, P/- or -/P	P/F or F/P
2000/02	292	6.0	75.3	10.0	0.0	8.7	0.0
1989/90	117	21.4	61.5	11.1	1.7	3.4	0.9

It might be expected that adults with no teeth would wear both upper and lower full dentures.

However, this is not always the case. Some people prefer not to wear dentures; others find them uncomfortable. Some continue to wear partial dentures which were made for them prior to losing their last remaining natural teeth. The pattern of denture wearing among older people with no natural teeth in 1989-90 and in 2000-2 is presented in Table 27. In 2000-2, only 6 percent of older people with no natural teeth had no dentures. This is an improvement from 1989-90 when 21.4 per cent of edentulous older people had no dentures.

Table 28 Percentage of subjects aged 65+ wearing full upper and lower dentures (F/F), full upper denture only (F/-), full lower only (-/F), and partial dentures (P/P, P/-,-/P) and combinations of both (P/F,F/P) by medical card status

Base: Edentulous

Medical Card Holders							
N	No Dentures	F/F	F/-	-/F	P/P	P/- or -/P	P/F or F/P
213	6.8	71.9	11.3	0.0	8.0	2.1	0.0

Non Medical Card Holders							
N	No Dentures	F/F	F/-	-/F	P/P	P/- or -/P	P/F or F/P
73	2.3	88.6	5.6	0.0	3.5	0.0	0.0

The percentage of older people with no dentures is higher amongst medical card holders (6.8 percent) than amongst non-medical card holders (2.3 per cent) (Table 28). More non-medical card holders (88.6 per cent) have full upper and lower dentures than medical card holders (71.9 per cent). Though a higher level of edentulousness was reported amongst medical card holders (see Table 7), the data indicate a lower level of treatment for this group. However, as stated earlier, the data must be interpreted with caution due to the extension of eligibility for medical card ownership to all adults age 70 years and over during the course of the fieldwork for the survey.

Table 29 The number and percentage of subjects aged 65+ wearing a partial denture in which the denture(s) is affecting the oral mucosa in 1989/90 and in 2000/02

Base: Dentate subjects wearing a partial denture

	Number Wearing partial denture	Affecting the oral mucosa	
		n	%
2000/02	149	49	35
1989/90	34	8	24

Partial dentures are frequently provided where some but not all teeth are missing; they can improve both aesthetics and function. A major consideration in partial denture construction is to minimise the impact of the denture on the remaining teeth and on the oral mucosa. Partial dentures can have a

negative impact on both hard and soft tissues in the mouth through physical forces, food trapping and plaque retention. High quality design and manufacture and good denture hygiene are important factors in maintaining a healthy oral environment for partial denture wearers.

Clinical examination revealed that of those wearing partial dentures, the dentures were adversely affecting the surrounding tissues in 35 per cent of cases (Table 29). This figure is higher than that reported in 1989-90. Most subjects examined in the earlier survey were examined in their homes, whereas in the 2000-02 survey most subjects were examined in a clinical setting where visibility is likely to have been better. However, the figure is very high in both surveys and the source of partial denture trauma to oral soft tissues warrants 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 (DTSS), 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. 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.

Furthermore, oral health promotion activities for adults should include a program of denture hygiene. Poor denture hygiene affects the oral mucosa and can cause disease on the adjacent teeth, thus leading to a further deterioration of oral health for those affected.

2.2. Parameters of Dental Disease

2.2.1. Dental Caries

The most common disease affecting the dentition is dental caries. The mean number of decayed, missing (due to caries), and filled teeth (DMFT) is the index commonly used for measuring dental caries. However, it has major shortcomings when used in older age groups, since the reason for loss of a tooth cannot always be unequivocally ascertained. In this report, all missing teeth (all reasons) are included in the DMFT scores, edentulous subjects being given a count of 32 missing teeth.

2.2.1.1. Examination Criteria, Changes Since 1989-90 & Calculation of Mean Number of Decayed, Missing & Filled Teeth

World Health Organisation (WHO) examination criteria (1997) were used in the adult oral health survey in Ireland in 1989-90. Under the WHO criteria, dental caries are recorded at the cavitation level only. That is, it must be possible to confirm cavitation to dentine by placing a probe in the cavity. Non-cavitated dentine caries – where the caries is visible as a shadow under the enamel - were not recorded.

However, for regular dental visitors, visual non-cavitated dentine caries would be diagnosed and treated with a restoration, whereupon the caries would be counted in the filled component of the DMFT at any subsequent examination. The impact of the exclusion of visible but not cavitated dentine caries is likely to be expressed as an apparently higher DMFT in areas with good services, and a lower DMFT in areas with less access to services.

Accordingly, the British Association for the Study of Community Dentistry amended its criteria in the 1990s and now includes visible, non-cavitated dentine caries (visual caries) in its DMFT count (Pitts, *et al.*, 1997). The 1998 UK Survey of Adult Oral Health (Kelly, *et al.*, 2000) included visual non-cavitated dentine caries in its criteria. Since the late-1990s, oral health surveys in Ireland have followed suit. The original WHO criteria have been maintained to allow for retrospective comparison of disease levels. 'Visual caries' have also been recorded but coded separately, thus permitting analysis of the data both with and without the inclusion of caries at the 'visual' level. In this report, data are presented for the DMFT at 'cavitation' level and at 'visual' level. Where 'visual caries' is referred to, it is implied that the data include caries at both 'visual' and 'cavitation' level.

It is acknowledged that indices for caries record a stage of the disease rather than the absolute presence or absence of the disease. It is also acknowledged that survey examinations give an underestimate of caries relative to full clinical dental examinations in which the teeth are dried and often radiographed. However, survey examinations provide a measure according to nationally and internationally standardised criteria and allow temporal, regional and international comparisons of oral health.

2.2.1.2. Mean DMFT & Proportion of DMFT Due to Anterior Caries

Table 30 Mean number and standard error (SE) of decayed (cavitated), missing, and filled teeth by gender, year of examination and health board

Base: Dentate and Edentulous

	Male		Female		Total	
	DMFT	SE	DMFT	SE	DMFT	SE
National 2000/'02	24.7	0.5	26.9	0.5	25.9	0.7
National 1989/'90	25.6	0.6	28.8	0.4	27.3	0.4
EHB 2000/'02	25.0	1.1	27.3	0.8	26.4	0.8
MWHB 2000/'02	26.4	0.7	28.0	0.5	27.3	0.4
NEHB 2000/'02	24.8	1.2	27.8	0.5	26.6	0.6
SHB 2000/'02	24.8	0.9	27.8	0.7	26.5	0.6
EHB 1989/'90	24.1	1.2	27.3	0.9	25.9	0.7

Table 30 shows caries at the cavitation level. The mean DMFT score for subjects aged 65 years and over decreased from 27.3 in 1989-90 to 25.9 in 2000-2 – a decrease of 5 per cent. Older females, on average, have 2.2 more decayed, missing or filled teeth than older males. The difference between genders has narrowed by 1 DMFT since the 1989-90 survey. Though the MWHB shows the highest mean DMFT scores for both genders, the difference in mean DMFT scores between the health boards (particularly for females) is small.

Table 31 Mean number and standard error (SE) of decayed (cavitated and visual), missing, and filled teeth (vDMFT) by gender and health board

Base: Dentate and Edentulous

	Male		Female		Total	
	vDMFT	SE	vDMFT	SE	vDMFT	SE
National 2000/'02	24.8	0.5	27.0	0.5	26.0	0.7
EHB 2000/'02	25.1	1.1	27.4	0.8	26.5	1.3
MWHB 2000/'02	26.5	0.7	28.2	0.4	27.4	0.8
NEHB 2000/'02	25.0	1.2	28.0	0.5	26.7	1.3
SHB 2000/'02	24.8	0.9	27.8	0.7	26.5	1.1

The inclusion of visual non-cavitated dentine caries increases the DMFT score by 0.1 from 25.9 to 26.0 (Table 31).

Table 32 Mean number of decayed (cavitated), missing, and filled teeth (DMFT) and DMFT in anterior teeth (ant DMFT) according to gender in 2000/'02. Percentage of total DMFT that is attributable to anterior DMFT also given in parenthesis.

Base: Dentate and Edentulous

	Male		Female		Total	
	DMFT	ant DMFT (%)	DMFT	ant DMFT (%)	DMFT	ant DMFT (%)
2000/'02	24.7	7.3 (30)	26.9	8.6 (32)	25.9	8.0 (31)
1989/'90	25.6	7.8 (30)	28.8	9.5 (33)	27.3	8.7 (32)

A further breakdown of DMFT was undertaken in order to determine the proportion of total caries experience which affects anterior (front) teeth (Table 32). The rationale for this is that exposure to fluoride (e.g. fluoridated water and tooth paste) tends to have its greatest preventive effect on the anterior teeth. In those aged 65 years and older, approximately one third of the total DMFT (31%) is

attributable to anterior teeth. The percentage of the DMFT score attributable to anterior teeth has changed little since 1989-90.

Table 33 Mean number of decayed (cavitated + visual), missing, and filled teeth (vDMFT) and mean vDMFT in anterior teeth (ant vDMFT) according to gender in 2000/'02. Percentage of total vDMFT that is attributable to anterior vDMFT also given in parenthesis.

Base: Dentate and Edentulous

Male		Female		Total	
vDMFT	ant vDMFT (%)	vDMFT	ant vDMFT (%)	vDMFT	ant vDMFT (%)
24.8	7.4 (30)	27.0	8.6 (32)	26.0	8.1 (31)

Inclusion of visual caries in the calculation of DMFT (Table 33) does not change the proportion of DMFT due to anterior teeth. In fact, very little visual non-cavitated caries was recorded on anterior teeth, evidenced by the similarity of DMFT and vDMFT scores on anterior teeth.

2.2.1.3. Mean DMFT by Medical Card Status

Table 34 Mean number and standard error (SE) of decayed (cavitated), missing, and filled teeth by medical card status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

		DMFT	SE
Medical Card Holders	2000/'02	26.7	0.5
	1989/'90	28.3	0.5
Non Medical Card Holders	2000/'02	24.2	0.6
	1989/'90	26.2	0.5

Among those aged 65 years and older, medical card holders tend to have higher DMFT scores (26.7) than non-medical card holders (24.2) (Table 34). The mean DMFT has decreased for both medical card and non-medical card groups since 1989-90.

The picture is similar when visual caries is included in the DMFT score (Table 35).

Table 35 Mean number and standard error (SE) of decayed (cavitated + visual), missing, and filled teeth by medical card status in 2000/'02

Base Dentate and Edentulous

	vDMFT	SE
Medical Card Holders	26.7	0.5
Non-Medical Card Holders	24.4	0.6

Table 36 Mean number of decayed (cavitated + visual), missing, and filled teeth (vDMFT) and vDMFT in anterior teeth (ant vDMFT) according to medical card status in 2000/'02. Percentage of total vDMFT that is attributable to anterior vDMFT also given in parenthesis.

Base: Dentate and Edentulous

	vDMFT	ant vDMFT (%)
Medical Card Holders	26.7	8.5 (32)
Non-Medical Card Holders	24.4	7.1 (29)

Medical card holders (the less well off) tend to have a greater proportion of their mean DMFT score on their anterior teeth than non-medical card holders.

2.2.1.4. Mean DMFT by Fluoridation Status

Table 37 Mean number and standard error (SE) of decayed (cavitated), missing, and filled teeth by fluoridation status in 1989/'90 and in 2000/'02

Base: Dentate and Edentulous

	Non			Part			Full		
	DMFT	SE	% decrease	DMFT	SE	% decrease	DMFT	SE	% decrease
2000/'02	26.7	0.9	4.5	25.6	0.6	6.9	25.9	0.6	2.2
1989/'90	27.9	0.6		27.5	0.7		26.5	0.7	

For those aged 65 years and over, the change in mean DMFT score since 1989-90 was small, and tended to be greater among those within the non- and part-fluoridated groups compared to the full-fluoridated group (Table 37). This cohort would have had well established high DMFT levels prior to the introduction of water fluoridation in 1964, when its youngest member would have been at least 28 years old. As a DMFT count is irreversible, there would have been little potential for fluoride to limit the DMFT score of this age group.

Table 38 Mean number and standard error (SE) of decayed (cavitated + visual), missing, and filled teeth (vDMFT), mean number of decayed (cavitated + visual), missing, and filled anterior teeth (ant vDMFT) and % of vDMFT due to ant vDMFT according to fluoridation status in 2000/'02

Base: Dentate and Edentulous

	Non			Part			Full		
	DMFTv	SE	ant vDMFT (%)	DMFTv	SE	ant vDMFT (%)	DMFTv	SE	ant vDMFT (%)
	26.8	0.8	8.5 (32)	25.8	0.6	7.9 (31)	26.0	0.6	8.1 (31)

The mean DMFT at the visual plus cavitated dentinal level score was lower in the part and full fluoridated groups compared to the non fluoridated group (Table 38). On average, those with fluoridated water supplies have 0.8 more healthy teeth. Another way of looking at this is to say that for every 1,000 older people living in fluoridated areas, there are 800 teeth saved from disease. Also worth noting is that those with water fluoridation have less caries on the aesthetically important anterior teeth. As expected, the relative contribution of anterior caries to the mean DMFT score is lower in fluoridated areas.

2.2.1.5. Mean DMFT by General Health Status

Table 39 Mean number and *standard error* of decayed (cavitated), missing, and filled teeth (DMFT) according to general health status (ASA)

Base: Dentate and Edentulous

	ASA				Total
	1	2	3	4	
mean DMFT	25.3	27.0	27.8	*	25.9
SE	0.4	0.7	0.9	*	0.7

*n<30

The mean DMFT was slightly lower amongst healthy subjects (ASA Class 1) at 25.3 when compared with those in ASA Class 2 at 27.0.

2.2.1.6. Percentage of Total Decay Experience Which Is Attributable to Decayed Teeth, Missing Teeth or Filled Teeth

Table 40 Percentage of the total DMFT (cavitated) which is attributable to the decayed (DT), missing (MT) or filled (FT) components by year of examination and health board

Base: Dentate and Edentulous

	Mean DMFT	% Attributable to					
		DT		MT		FT	
		mean	% of DMFT	mean	% of DMFT	mean	% of DMFT
National 2000/'02	25.9	0.5	2	22.8	88	2.6	10
National 1989/'90	27.3		4		90		6
EHB 2000/'02	26.4	0.4	2	23.2	88	2.8	11
MWHB 2000/'02	27.3	0.8	3	24.3	89	2.2	8
NEHB 2000/'02	26.6	0.6	2	23.4	88	2.5	10
SHB 2000/'02	26.5	0.4	1	23.9	90	2.2	8
EHB 1989/'90	25.9		2		82		15

Note: Percentages may not add to 100 due to rounding errors

Analysis of the components of total decay experience (DMFT) gives an indication of the pattern and extent of treatment for dental caries. It is generally accepted that the decayed (DT) component is an indication of unmet need, that the filled component (FT) represents successful treatment and that the missing component (MT) represents failed treatment (Whelton, *et al.*, 2007). It should be kept in mind that missing teeth in this report refers to teeth missing for whatever reason and thus overestimates failed treatment. In 2002, older people in Ireland had on average 22.8 missing teeth (MT), 2.6 filled teeth (FT) and 0.5 decayed teeth (DT) out of a full complement of 32 teeth (Table 40).

The proportion of total DMFT which was attributable to untreated decay (DT) was 2 per cent, to filled teeth (FT) 10 per cent and to missing teeth (MT) 88 per cent. Changes in the relative contribution of decayed, missing and filled teeth to the DMFT since 1989-90 indicate a favourable trend in the pattern of disease treatment. The contributions of decayed and missing teeth have declined from 4 to 2 per cent and from 90 to 88 per cent, respectively, while the contribution of filled teeth has increased from 6 to 10 per cent. These changes indicate more treatment of caries by filling than by extraction (though extraction remains by far the largest component), and less untreated disease. The health boards showed the same pattern of caries treatment with very minor differences (Table 41).

Table 41 Mean vDMFT and percentage of the total vDMFT (cavitated+visual) which is attributable to the Decayed cavitated+visual (vDT), Missing (MT) or Filled (FT) components by health board in 2000/'02

Base: Dentate and Edentulous

	Mean vDMFT	% Attributable to					
		vDT		MT		FT	
		mean	% of vDMFT	mean	% of vDMFT	mean	% of vDMFT
National	26.0	0.6	2	22.8	88	2.6	10
EHB	26.5	0.5	2	23.2	88	2.8	10
MWHB	27.4	0.9	3	24.3	89	2.2	8
NEHB	26.7	0.8	3	23.4	88	2.5	9
SHB	26.5	0.4	2	23.9	90	2.2	8

Inclusion of visual caries in the DMFT score has the effect of increasing the decayed component of the DMFT whilst the missing and filled components remain the same. This should increase the percentage of the DMFT attributable to the decayed component and reduce the per cent attributable to the other two components. However, because the decayed component is so small among older people, inclusion of visual caries in their DMFT score brings about no noticeable change in the relative contributions of the decayed, missing and filled components (Table 42).

Table 42 Mean DMFT (cavitated) and percentage of total DMFT (cavitated) which are attributable to the Decayed (DT), Missing (MT) or Filled (FT) components by gender, health board and year of examination

Base: Dentate and Edentulous

	Mean DMFT		% Attributable to					
	Male	Female	DT		MT		FT	
			Male	Female	Male	Female	Male	Female
National 2000/'02	24.7	26.9	3	1	87	89	11	10
National 1989/'90	25.6	28.8	7	1	85	94	8	5
EHB 2000/'02	25.0	27.3	3	1	86	89	12	10
MWHB 2000/'02	26.4	28.0	4	2	89	90	8	8
NEHB 2000/'02	24.8	27.8	3	2	86	90	12	8
SHB 2000/'02	24.8	27.8	2	1	89	91	9	8

Note: Percentages may not add to 100 due to rounding errors

Comparing males with females, on average, the older male has a higher proportion of untreated teeth than the older female. However, when the older male does go for treatment, it seems he is more likely to get his tooth filled than extracted. For both males and females, the missing component predominates, accounting for 87 and 89 per cent, respectively, of mean DMFT.

Table 43 Mean vDMFT (cavitated+visual) and percentage of total vDMFT (cavitated+visual) which are attributable to the Decayed cavitated+visual (vDT), Missing (MT) or Filled (FT) components by gender and health board in 2000/'02

Base: Dentate and Edentulous

	Mean vDMFT		% Attributable to					
	Male	Female	vDT		MT		FT	
			Male	Female	Male	Female	Male	Female
National	24.8	27.0	3	2	86	89	10	10
EHB	25.1	27.4	3	1	85	89	12	10
MWHB	26.5	28.2	4	3	88	89	8	8
NEHB	25.0	28.0	3	3	85	89	11	8
SHB	24.8	27.9	2	1	89	91	9	8

Note: Percentages may not add to 100 due to rounding errors

The inclusion of visual caries in the DMFT has little effect on the pattern of caries treatment of males and females (Table 43).

In 1989-90, medical card holders tended to have a higher proportion than non-medical card holders of their total DMFT attributable to missing teeth, and a lower proportion attributable to fillings. As tooth

loss due to extraction is irreversible, it is not surprising that the difference between medical card group and non-medical card group that existed a decade ago has not changed.

Table 44 Percentage of total DMFT (cavitated) which is attributable to the Decayed (DT), Missing (MT) and Filled (FT) components by medical card (MC) status, health board and year of examination

Base: Dentate and Edentulous

	% DT		% MT		% FT	
	Yes MC	No MC	Yes MC	No MC	Yes MC	No MC
National 2000/'02	2	3	91	80	7	17
National 1989/'90	3	5	94	83	3	12
EHB 2000/'02	1	2	92	81	7	17
MWHB 2000/'02	3	3	92	83	5	14
NEHB 2000/'02	2	4	91	76	7	19
SHB 2000/'02	1	1	92	85	6	14

Note: Percentages may not add to 100 due to rounding errors

When visual caries is included in the DMFT score, the findings are similar to those for the cavitated DMFT (Table 45).

Table 45 Percentage of total DMFT (cavitated+visual) which is attributable to the Decayed cavitated+visual (vDT), Missing (MT) and Filled (FT) components by medical card (MC) status and health board in 2000/'02

Base: Dentate and Edentulous

	% DT		% MT		% FT	
	Yes MC	No MC	Yes MC	No MC	Yes MC	No MC
National	2	3	91	80	7	17
EHB	1	3	92	80	7	17
MWHB	3	3	92	82	5	14
NEHB	2	6	91	75	7	19
SHB	2	2	92	85	6	14

Mean DMFT tends to be higher in the 'Non' fluoridated group compared to the 'Full' fluoridated group (with the exception of the NEHB) (Table 46). The percentages of total DMFT which are attributable to missing teeth were 91 and 89 per cent for the 'Non' and 'Full' fluoridated groups, respectively.

Table 46 Percentage of total DMFT (cavitated) which is attributable to the Decayed (DT), Missing (MT) and Filled (FT) components by fluoridation status, health board and year of examination

Base: Dentate and Edentulous

	Fluoridation Status											
	Non				Part				Full			
	DMFT	%DT	%MT	%FT	DMFT	%DT	%MT	%FT	DMFT	%DT	%MT	%FT
National 2000/'02	26.7	2	91	7	25.6	2	86	12	25.9	2	89	9
National 1989/'90	27.9	4	93	3	27.5	6	89	6	26.5	3	86	11
EHB 2000/'02	32.0	0	97	3	27.2	1	83	16	26.1	2	89	9
MWHB 2000/'02	27.8	3	94	4	26.7	2	90	8	27.5	4	87	9
NEHB 2000/'02	26.0	1	91	8	26.5	3	85	12	31.5	2	96	2
SHB 2000/'02	26.0	2	86	12	27.5	2	90	8	25.5	1	92	7

Note: Percentages may not add to 100 due to rounding errors

Table 47 Percentage of total DMFT (cavitated+visual) which is attributable to the Decayed cavitated + visual (vDT), Missing (MT) and Filled (FT) components by fluoridation status and health board in 2000/'02

Base: Dentate and Edentulous

	Fluoridation Status											
	Non				Part				Full			
	vDMFT	%vDT	%MT	%FT	vDMFT	%vDT	%MT	%FT	vDMFT	%vDT	%MT	%FT
National	26.8	3	90	7	25.8	3	85	12	26.0	2	89	9
EHB	32.0	0	97	3	27.3	1	83	16	26.1	2	89	9
MWHB	28.1	4	93	4	26.9	3	89	8	27.5	4	87	9
NEHB	26.1	2	90	8	26.7	4	84	12	31.5	2	96	2
SHB	26.0	2	86	12	27.5	2	90	8	25.5	1	92	7

The percentage of the DMFT attributable to the decayed, missing and filled components when visual caries is included in the score is presented in Table 47.

2.2.1.7. Mean Number of Decayed, Missing & Filled Surfaces

Table 48 Mean number of Decayed, Missing, and Filled Surfaces (DMFS) by gender, medical card status, health board and year of examination
(Standard Deviations in Brackets)

Base: Dentate and Edentulous

	Yes Medical Card		No Medical Card	
	Male	Female	Male	Female
National 2000/'02	75.7 (24.0)	81.3 (20.2)	67.9 (24.3)	75.7 (20.2)
National 1989/'90	103.6 (45.8)	125.8 (37.8)	82.4 (35.2)	103.8 (41.6)
ERHA 2000/'02	76.4 (22.8)	84.0 (17.8)	66.6 (26.2)	74.9 (22.1)
MWHB 2000/'02	81.7 (22.4)	84.0 (16.8)	71.4 (21.6)	79.2 (15.5)
NEHB 2000/'02	72.6 (28.3)	85.0 (15.4)	72.0 (21.6)	75.7 (20.6)
SHB 2000/'02	73.2 (25.4)	82.4 (20.6)	69.6 (25.8)	77.6 (20.8)

Another outcome variable for caries is the DMFS score which counts decay on tooth surfaces rather than teeth. The DMFT Index has a range of 0-32 whereas the DMFS Index has a range of 0-148.

The DMFS results by gender and medical card supplement and support the DMFT results (Table 48). Females tend to have higher DMFS scores than males; medical card holders generally have higher DMFS scores than non-medical card holders. At health board level, the MWHB had above-average levels of DMFS for all groups and ERHA had below-average levels of DMFS for non-medical card holders.

2.2.1.8. Identifying Risk Indicators Associated with Dental Caries

Because of the intense competition for resources within the health system, individuals or groups at high-risk to caries should be selectively targeted for preventive measures (Kavanagh, 1994; O'Mullane, *et al.*, 1986). Giving high-risk groups priority for preventive dental services would improve the cost-effectiveness of services. The identification of characteristics of low- and high-risk groups

provides policy makers with a tool for predicting future levels of dental caries in groups and individuals, and thus enables better targeting of those at high-risk to caries.

The DMFS Index is a widely used measure of the prevalence of caries in permanent teeth. DMFS scores were recorded in both national surveys and hence are available for use as an outcome measure in modelling high caries risk. DMFS is the dependent or outcome variable used in this analysis of the Irish population aged 65+.

It is well established that the prevalence of caries varies according to the demographic, socio-economic, and behavioural characteristics of individuals (Kavanagh, 1994; Hunt, 1990; Whelton, 1989). For this investigation, the explanatory variables are presented in groups (or blocks): demographic, socio-economic and cognitive. The significant demographic variables are age, gender, fluoridation and health boards. As socio-economic differences in the population may also impact on need, medical card possession, educational attainment, and employment status are included as controls for socio-economic differences. In what is described by Grembowski, *et al.* (1988) as the 'cognitive block,' variables representing fear of the dentist, regular brushing, regular dental attendance and frequent snacking are included. Table 49 provides a description of the main variables used in this investigation.

Table 49 Description of Variables included in multivariate analysis

Base=Dentate and Edentulous

Variable	Description
DMFS	Decayed Missing Filled Surfaces, based on clinical examination from NSAOH 2000/02, ranging from 0 to 148
Age	Age in years at the time of the clinical examination
Age 65+	= 1 if aged over 65 years, 0 = otherwise
Female	0 = male, 1 = female
Fluoride	1 = fluoridated water supply, 0 = non-fluoridated water supply
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
medicard	1 = medical card, 0 = other (including PRSI, None, Private)
thirdlev	1 = subjects who received third level education, 0 = otherwise
unemploy	1 = unemployed, 0 = otherwise
primaryedu	1 = primary education only, 0 = otherwise
freqsnacks	1 = frequent snacks, 0 = other (less than twice a day)
regbrusher	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)
feardentist	1 = frightened, 0 = other (worried to relaxed while waiting in the dentist chair)

Table 50 presents the distribution of the dependent variable – DMFS prevalence - for the older Irish population.

Table 50 Mean and Standard Deviation of DMFS scores for elderly subjects aged 65+ in the NSAOH 2000/02

			Percentiles						
			Low Risk DMFS		Med Risk DMFS	High Risk DMFS			
N	Mean	Std. Dev	10%	25%	50%	75%	90%	Min	Max
705	76.3	22.6	44	58	83	96	96	0	118

For this analysis, subjects with DMFS prevalence scores above the 75th percentile were categorized as high caries risk, and subjects below the 25th percentile as low-risk. Individuals between the 25th and 75th percentiles are deemed medium risk.

2.2.1.9 Empirical Estimates

The likelihood, or odds, of being of high-risk to caries was calculated using logistic and ordered logistic regression.

Table 51 Logistic and Ordered Logistic Estimates of factors influencing “High or “Low” levels of DMFS (Reference Health board = SHB) for elderly subjects aged 65+

	Logistic estimates	Ordered logit estimates
Age 65+	0.05 (0.04)	0.03 (0.02) **
Female	1.24 (1.44) ***	0.83 (0.18) ***
Fluoride	0.43 (0.73)	0.06 (0.22)
ERHA	-0.32 (0.46)	-0.21 (0.26)
MHB	-1.57 (0.18) *	-0.06 (0.39)
MWHB	-0.35 (0.46)	-0.06 (0.27)
NEHB	-0.62 (0.39)	-0.14 (0.29)
NWHB	0.60 (2.46)	0.37 (0.45)
SEHB	-2.40 (0.07) ***	-1.96 (0.36) ***
SHB	Reference Health Board	
WHB	-1.35 (0.24)	-0.60 (0.36) *
medicard	0.75 (0.88) *	0.28 (0.18)
primaryedu	0.91 (1.11) **	-0.03 (0.18)
unemploy	1.97 (8.61)	0.59 (0.35) *
regbrusher	-3.74 (0.02) ***	-1.28 (0.21) ***
freqsnacks	4.97 (91.70) ***	2.29 (0.20) ***
regular user	-1.39 (0.15) **	-0.66 (0.21) ***
feardentist	-0.40 (0.27)	-0.21 (0.18)
Number of Observations	476	705
LR c2 (17)	425.93	443.05
Prob > c2	0	0
Pseudo R²	0.68	0.29
Count R²	0.93	0.68

Notes: Standard Errors reported in parenthesis. *Statistically significant at 10% level; **statistically significant at 5% level; *** statistically significant at 1% level. A coefficient with a positive sign indicates the variable increases the likelihood of being of high caries risk, whereas a negative coefficient implies that the variable reduces the likelihood of high caries risk. Count R² measures the proportion of correct predictions by the logistic and ordered logistic models.

In terms of explained variation using the count R^2 – which measures the proportion of correct predictions by the logistic and ordered logistic models - the logistic regression fitted the data better than the ordered logistic regression. The logistic model explains approximately 93% of the correct predictions of DMFS scores, compared with 68% for the ordered logistic model. The odds of being in a high or low risk group for those aged 65 and over are presented in Table 51. For those aged 65 and over, the logistic model estimated that being in the high-risk group increased with age, for females, and for subjects with primary education only. Exposure to fluoridated water was not significant for this age group, as many of those aged 65 and over may have dentures and may have had high DMFS scores prior to the introduction of water fluoridation in 1964.

For older people, having a medical card, being unemployed and having primary education only all increased the odds of being in the high-risk group. If the subject is a regular brusher, and/or a regular user of dental services, the maximum likelihood of being at high-risk to dental caries is reduced. Having frequent snacks had a positive and significant relationship with high DMFS scores.

Age, gender and health board of residence have an impact on one’s chances of having high caries levels – this information should assist policy makers in their deliberations on the allocation of resources for preventive services.

The fact that brushing twice a day or more was a significant variable underscores the importance of supporting people to brush their teeth with fluoride toothpaste at least twice per day. The development of twice daily brushing as part of routine grooming early in life is a very worthwhile objective. Clearly, however, the targeting of adults with this dental health education message is also important.

Frequency of snacking was also a significant variable in the model. This information provides support for the development of health promotion programs to advise adults to reduce the frequency of their consumption of foods and drinks sweetened with sugar between meals. Efforts to reduce the frequency of consumption of foods and drinks sweetened with sugar have potential to impact general health as well as oral health. Given the current concern about rising levels of obesity in Ireland, oral health promoters should work with those in other disciplines to adopt a common risk factor approach to the prevention of oral disease.

Table 52 summarises the significant variables influencing categorisation of older people’s DMFS according to “High,” “Medium” or “Low” levels.

Table 52 Summary of significant variables influencing categorisation of DMFS according to “High”, “Medium” or “Low” levels using Logistic Regression for elderly subjects aged 65+	
Gender	
Health Board	
Education to primary level only	
Brushes twice a day or more	
Consumes sweet foods or drinks twice a day or more between meals	
Visited dentist in last 24 months	
Fears the dentist	

2.2.2. Periodontal Disease

Periodontal disease is the second most common oral disease after dental caries. It is a disease which affects the supporting structures of the tooth: the gingivae (or gum), the bone supporting the tooth, and the periodontal ligament which surrounds and attaches the tooth to its bony socket.

The earliest visible sign of disease of the gingivae is redness due to inflammation. The most common cause of inflammation of the gingivae is dental plaque. Gingival inflammation resolves if the plaque is removed and the tooth is kept clean. Because it is usually painless, people are often unaware of gingival inflammation until the gingivae start to bleed during tooth brushing. Bleeding gingivae usually indicate an inadequate brushing technique, which fails to remove sufficient plaque for gingival health. Not all gingivitis proceeds to periodontitis; for that which does, the earliest sign is gingival pocketing.

Pocketing occurs where inflammation destroys the periodontal ligament such that a probe can be placed in a 'pocket' between the root of the tooth and the gingivae. It is not possible to insert a probe between the root of a tooth and the gingivae where the periodontal ligament has not been affected by disease. Deeper pockets indicate more advanced destruction, unless the gingivae have receded apically. Where the gums have receded, pocket depth is only a partial representation of the total amount of periodontal destruction.

Periodontal disease is painless and the first symptoms experienced by those with the disease may be gingival recession or looseness of the tooth. If left untreated, tooth loss may result.

The WHO Community Periodontal Index of Treatment Need (CPITN) – which has been in worldwide use for several decades - was used in this survey to estimate the need for treatment to prevent and treat periodontal disease among older people in Ireland. The CPITN is useful for estimating the levels of disease that would benefit from oral hygiene instruction, basic scaling and polishing, deep scaling and root planing, and more advanced periodontal treatment. What the index does not measure is the total loss of periodontal support experienced when there is gingival recession or a combination of recession and pocketing. For such cases, in addition to the use of the CPITN index, loss of attachment was also measured.

The mouth is divided into six sextants when examining for the CPITN. Examiners for the 2000-2 survey were asked to record the presence or absence of each condition in each sextant; hence where there were a variety of conditions, multiple codes were recorded per sextant. This is a departure from the original CPITN method where only the worst score per sextant is recorded. The recording of all conditions permits analysis of the index for all conditions present as well as for the highest score present.

There are different methods of presenting CPITN data. To estimate the *severity* of the periodontal condition, the percentage of subjects with one or more sextants affected by codes H (Healthy), B

(Bleeding), C (Calculus), P1 (Shallow pocketing) and P2 (Deep pocketing) as a maximum score will be presented. To estimate the prevalence or *extent* of the periodontal condition, the mean number of sextants affected by the different codes will be used. Data on loss of attachment and some indications of the treatment needed will also be discussed.

Comparisons with the 1989-90 data are not drawn because the 2000-2 survey examinations were largely carried out with the subject in a reclined position in a dental chair with good access to all sites in the mouth and under ideal lighting conditions. The examinations for the 1989-90 survey were largely carried out in people's homes with the subject in an upright sitting position on a non-dental chair and using a portable dental light. Whereas it is unlikely that these differences would have affected the caries examination, the periodontal examination is less robust and potentially more sensitive to changes in examining conditions. Hence the validity of retrospective comparisons is questionable.

2.2.2.1. Community Periodontal Index of Treatment Need (CPITN) – Severity: Maximum Scores per Subject

Table 53 Periodontal Disease--Severity

The number and percentage of subjects aged 65+ with subject-wise maximum CPITN score of H (healthy), B (bleeding), C (calculus), P1 (shallow pocketing), P2 (deep pocketing), all X (all sextants excluded) or UR (no reliable recording was possible) by health board in 2000/02

Base: Dentate

Total N		maximum CPITN score													
		H		B		C		P1		P2		X		UR	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
National	390	23	7	15	4	129	30	144	38	38	12	38	10	3	1
EHB	83	2	2	2	2	15	19	43	50	13	17	8	11		
MWHB	66	4	5	2	3	27	41	20	30	2	3	10	16	1	2
NEHB	59		0		0	28	46	21	35	7	13	3	6		
SHB	75	6	8	7	11	29	38	22	29	5	6	6	8		

Table 53 shows the distribution of the highest CPITN scores which were recorded in each dentate subject. Seven per cent of 65+ year olds had a maximum score of 'H' (Healthy), indicating that they had no periodontal treatment requirement. Four per cent had a highest score of 'B' (Bleeding) on probing. Older people in this group require instruction in oral hygiene procedures to improve their plaque control and thus resolve their gingival inflammation. A high proportion – 30 per cent, had a highest score of 'C' (Calculus) and required scaling and polishing of the teeth with instruction in oral hygiene. A hefty 50 per cent required 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. Ten percent of the dentate older people scored 'X' for all sextants (excluded because the required teeth were not present or were designated for extraction). There were very few cases where all sextants were scored 'UR' (unrecordable) due, for example, to heavy deposits of calculus preventing probing of pocket depth.

There was regional variation among the health boards with ERHA showing the largest proportion requiring complex periodontal treatment (67% 'P1' or 'P2') and the SHB with the largest proportion scoring 'Healthy' (8% 'H').

These results confirm a high level of periodontal disease among dentate older people. As fewer teeth are lost due to caries, more teeth remain in the mouth for longer, thus more teeth are susceptible to periodontal disease. Effective plaque removal from an early age would prevent much of the periodontal diseases that occur later in life.

2.2.2.2. CPITN – Extent: Mean Number of Sextants per Subject Affected by CPITN Scores

2.2.2.2.1. Maximum Score per Sextant

Table 54 Periodontal Disease--Extent

Mean number of sextants per person affected by the different maximum CPITN codes per sextant of H (healthy), B (bleeding), C (calculus), P1 (shallow pocketing), P2 (deep pocketing) or all X (all sextants excluded) in subjects aged 65+ by health board in 2000/'02

Base: Dentate

	H	B	C	P1	P2	X
National	0.8	0.2	1.0	1.1	0.2	2.7
EHB	0.5	0.2	0.7	1.8	0.2	2.6
MWHB	0.6	0.1	1.3	0.6	0.1	3.2
NEHB	0.8	0.1	1.3	0.7	0.3	2.7
SHB	1.0	0.5	1.1	0.7	0.1	2.6

Table 54 shows the mean number of sextants per dentate subject affected by the different codes and provides an indication of the extent of periodontal disease among dentate older people. Dentate subjects aged 65 years and over had, on average, 0.8 healthy sextants, 0.2 with bleeding, 1.0 with calculus, 1.3 (1.1 + 0.2) with pocketing, and 2.7 sextants excluded due to tooth loss. Because of the high proportion of sextants excluded due to tooth loss, the extent of periodontal disease among the dentate older people appears small.

Table 55 Periodontal Disease--Extent

Mean number of sextants per person affected by the different maximum CPITN codes per sextant of H (healthy), B (bleeding), C (calculus), P1 (shallow pocketing), P2 (deep pocketing) or all X (all sextants excluded) in subjects aged 65+ by gender and health board in 2000/'02

Base: Dentate

	H		B		C		P1		P2		X	
	M	F	M	F	M	F	M	F	M	F	M	F
National	0.8	0.7	0.2	0.3	1.0	1.0	1.2	0.9	0.2	0.1	2.4	2.9
EHB	0.5	0.5	0.1	0.2	0.7	0.7	2.1	1.5	0.2	0.2	2.4	2.8
MWHB	0.7	0.6	0.2	0.1	1.2	1.3	0.6	0.7	0.1	0.0	2.9	3.4
NEHB	0.7	0.8	0.2	0.1	1.5	1.2	0.9	0.5	0.2	0.4	2.3	3.0
SHB	0.9	1.1	0.4	0.6	1.2	1.0	0.8	0.6	0.1	0.0	2.6	2.7

Among those aged 65 and over, the higher level of tooth loss among females is illustrated by the greater number of sextants with a score of 'X' for females (2.9) compared to males (2.4) (Table 55). Older males have more teeth and thus more periodontal pocketing – 1.4 sextants (1.2 + 0.2) compared to females 1.0 (0.9 + 0.1). The gender differences were consistent throughout the health board areas.

Table 56 Periodontal Disease--Extent

Mean number of sextants per person affected by the different maximum CPITN codes per sextant of H (healthy), B (bleeding), C (calculus), P1 (shallow pocketing), P2 (deep pocketing) or all X (all sextants excluded) in subjects aged 65+ by medical card status and health board in 2000/'02

Base: Dentate

	H		B		C		P1		P2		X	
	MC	No MC	MC	No MC	MC	No MC	MC	No MC	MC	No MC	MC	No MC
National	0.6	1.0	0.2	0.2	0.9	1.2	0.9	1.3	0.2	0.2	3.0	2.1
EHB	0.3	0.7	0.1	0.2	0.7	0.7	1.5	2.1	0.3	0.2	3.2	2.1
MWHB	0.4	1.0	0.2	0.0	1.1	1.5	0.6	0.5	0.1	0.0	3.4	2.9
NEHB	0.6	1.2	0.0	0.3	1.3	1.4	0.7	0.7	0.3	0.3	3.0	2.1
SHB	0.8	1.3	0.6	0.3	1.0	1.4	0.7	0.7	0.1	0.1	2.9	2.1

Medical card holders have fewer teeth than non-medical card holders, as illustrated by their higher mean number of sextants with a maximum CPITN score of 'X' – 3.0 compared with non-medical card holders 2.1 (Table 56). Non-medical card holders (the better off) tend to have more healthy sextants than medical card holders in all health board regions.

Table 57 Periodontal Disease--Extent

Mean number of sextants per person affected by the different maximum CPITN codes per sextant of H (healthy), B (bleeding), C (calculus), P1 (shallow pocketing), P2 (deep pocketing) or all X (all sextants excluded) in subjects aged 65 years+ by general health status in 2000/'02

Base: Dentate

		H	B	C	P1	P2	X
ASA 1	(n =284)	0.8	0.3	1.0	1.1	0.2	2.6
ASA 2	(n = 92)	0.4	0.2	1.2	1.3	0.2	2.8
ASA 3	(n = 14)	1.0	0.1	0.8	0.4	0.0	3.2

The number of dentate subjects aged 65 years and over classified as ASA 3 (severe systemic disease that limits activity but is not incapacitating) is low (n=14), hence this group will not be included when discussing the relationship between general health and the extent of periodontal disease (Table 57). Comparing subjects classified as ASA 1 (no systemic disease) or ASA 2 (mild to moderate systemic diseases), those with mild to moderate systemic diseases have a lower mean number of healthy sextants (0.4 compared with 0.8), have a higher mean number of sextants with calculus (1.2 compared with 1.0) and shallow pocketing (1.3 compared with 1.1), and have a higher mean number of excluded sextants (missing teeth) (2.8 compared with 2.6).

2.2.2.2. All Scores per Sextant

For each subject in the study, the CPITN examination was extended beyond the recording of the maximum score per sextant to include a record of all other conditions besides the worst one. For example, where pocketing was recorded, the examiner examined the sextant further to see if there was calculus in the sextant and if the gingiva bled on probing. The presence of any healthy scores was also recorded. Table 58 shows the full extent of the scores recorded per subject. For example, 51 per cent of subjects aged 65+ had calculus on their teeth. The lowest level of calculus was recorded in the EHB.

Table 58 Periodontal Disease--Prevalence of Condition Recorded

The percentage of subjects aged 65+ with any CPITN score of H (healthy), B (bleeding), C (calculus), P1 (shallow pocketing), P2 (deep pocketing), all X (all sextants excluded) or UR (no reliable recording was possible) in 2000/02

Base: Dentate

	any CPITN score						
	H %	B %	C %	P1 %	P2 %	X %	UR %
National	36	16	51	47	12	76	1
EHB	26	11	37	62	17	79	1
MWHB	31	8	59	33	3	81	4
NEHB	36	12	68	40	13	78	2
SHB	41	24	63	36	6	75	0

In the UK, the 1998 National Survey of Adult Oral Health (Kelly, *et al.*, 2000) reported that 83 per cent of adults in the 65+ age group had calculus. The prevalence of calculus appears to be lower in Ireland than the UK.

2.2.2.3. Loss of Attachment

Whilst the CPITN is a widely used measure of periodontal treatment need, it does not capture the loss of tooth support as a result of bony resorption, or the loss of attachment accompanied by gingival recession. Even subjects with CPITN scores of 'Healthy' can have extensive loss of attachment. To determine the extent to which loss of attachment of the periodontal ligament to the tooth root affects adults in Ireland, in addition to the CPITN measurement, loss of attachment was also recorded. The CPITN probe was used to measure the distance between the base of the gingival crevice or pocket and the cemento enamel junction, and the data were recorded as falling within certain ranges. Two measures of loss of attachment are presented: maximum loss of attachment, which is an indication of severity; and mean number of sextants affected, which indicates the extent of the loss of attachment.

Table 59 The number and percentage of dentate subjects aged 65+ with maximum loss of attachment score of ≤3mm, 4-5mm, 6-8mm, 9-11mm, ≥12mm, X (sextant excluded) in 2000/02*Base: Dentate*

	≤3mm		4-5mm		6-8mm		9-11mm		≥12mm		X	
	n	%	n	%	n	%	n	%	n	%	n	%
National	95	24	156	40	57	16	27	7	18	5	35	8
EHB	12	16	46	53	8	9	5	7	5	7	7	8
MWHB	19	28	24	35	8	13	4	7		0	10	16
NEHB	12	20	24	40	13	21	3	5	4	8	3	6
SHB	26	34	26	36	6	9	8	11	4	5	5	6

It can be expected that attachment loss increases with age. Sixty-eight per cent of subjects aged 65+ had a maximum attachment loss score of more than 3 mm (Table 59). The most common level of attachment loss was 4-5 mm with 40 per cent having this level of attachment loss. Attachment loss at the 6-8mm level was not very common, with only 16 per cent of older people having this level of attachment loss.

Though there was some variation amongst the health boards in the severity of attachment loss (Table 60; for example, 16 per cent of older subjects in the EHB had a maximum attachment loss of 3 mm or less compared with 34 per cent in the SHB), 4-5 mm was the most common level of attachment loss for all health boards.

Table 60 Mean number of sextants per dentate person according to degree of loss of attachment of the periodontium in subjects aged 65+ in 2000/02 (X= Sextant excluded)*Base: Dentate*

	≤3mm	4-5mm	6-8mm	9-11mm	≥12mm	X
National	1.8	1.1	0.3	0.1	0.1	2.6
EHB	1.7	1.4	0.2	0.1	0.1	2.5
MWHB	1.6	0.7	0.2	0.1	0.0	3.2
NEHB	1.8	0.9	0.3	0.2	0.1	2.7
SHB	2.1	1.0	0.2	0.1	0.1	2.4

The mean number of sextants with 4-5 mm attachment loss in subjects aged 65+ is 1.1 (Table 60). As with coronal and root caries, the increase in tooth loss with age makes it difficult to interpret the results of the extent of attachment loss among older people. Of 6 sextants examined, on average 2.6 sextants (43%) were excluded due to tooth loss. Thus, while it is likely that many extracted teeth would have extensive loss of attachment, this is not reflected in the loss of attachment data presented in Tables 59 to 61. It could be hypothesized, for example, that the loss of attachment data for medical card holders is underestimated in comparison with non-medical card holders due to the higher levels of tooth loss in the former group (Table 61).

Table 61 Mean number of sextants per dentate person according to degree of loss of attachment of the periodontium in subjects aged 65+ according to medical card status in 2000/02 (X=Sextant excluded)*Base: Dentate*

	<=3mm		4-5mm		6-8mm		9-11mm		>=12mm		X	
	MC	No MC	MC	No MC	MC	No MC	MC	No MC	MC	No MC	MC	No MC
National	1.7	2.2	0.9	1.4	0.3	0.2	0.1	0.1	0.1	0.1	2.9	1.9
EHB	1.6	1.7	0.9	1.9	0.2	0.2	0.2	0.1	0.1	0.1	3.0	2.0
MWHB	1.3	2.2	0.6	0.9	0.3	0.1	0.2	0.0	0.0	0.0	3.4	2.9
NEHB	1.7	2.0	0.7	1.2	0.2	0.4	0.1	0.3	0.1	0.0	3.0	2.1
SHB	1.7	3.0	1.1	0.6	0.2	0.2	0.1	0.1	0.2	0.1	2.7	2.0

2.2.2.4. Smoking & Periodontal Disease

Adults were asked whether they smoked cigarettes, cigar or a pipe, and whether they drank alcohol. The higher prevalence of periodontal pocketing among those who smoke tobacco or drink alcohol is clearly illustrated in Table 62. These data support the concept of a common risk factor approach to health promotion. Health promotion activities designed to reduce the consumption of cigarettes and alcohol will benefit oral health as well as many of the common diseases affecting general health. Dentists have an important responsibility to advise their patients of the impact of smoking and alcohol consumption on their oral health as well as on their general health.

Table 62 Number and per cent of subjects aged 65+ with periodontal pocketing (CPITN scores P1 & P2, shallow and deep pockets) according to whether they smoke and consume alcohol*Base: Dentate*

Smoker	n	%
Yes	48	50.9
No	330	48.7
Consume Alcohol		
Yes	193	51.2
No	180	46.4

2.2.3. Other Oral Conditions

The previous sections have presented details of the more common oral conditions – tooth loss, caries and periodontal disease. This section presents an overview of three other conditions that affect the dentition of older people, namely:

- Temporomandibular Joint Dysfunction
- Tooth Wear & Erosion
- Lesions of the Oral Mucosa

2.2.3.1. Temporomandibular Joint Dysfunction

The condition of the temporomandibular joint (TMJ) was assessed using the Modified Helkimo Index (Mohlin, 1991). The index is expressed using a dysfunction score which summarises the component scores for:

- impaired movement (based on maximal opening and maximal protrusion);
- impaired TMJ function (based on hearing crepitus or clicking sounds, deviation or locking of the joint);
- muscle pain; and
- TMJ pain.

The distribution of adults by scores for the individual conditions is presented in Tables 63-8, followed by the distribution of the combined dysfunction score in Table 69. The index was not used in the 1989-90 survey.

Table 63 TMJ Maximal Opening Score: Percent of subjects aged 65+ by gender

Base=Dentate

	MHI Score (Maximal Opening Range)		
	0 (≥40mm)	1 (30-39mm)	2 (<30mm)
Male	76.7	20.4	2.9
Female	64.3	28.8	6.9
All	70.2	24.8	5.0

Only 70.2% of subjects aged 65+ had a maximum opening capacity of 40 mm or more with 5% having a maximal opening range of less than 30 mm. More males than females had a maximum opening capacity of ≥40 mm, and more females than males had a maximum opening capacity of <30 mm.

Table 64 TMJ Maximal Protrusion Score: Percent of subjects aged 65+ by gender

Base: Dentate

	MHI Score (Maximal Protrusion Range)		
	0 (≥7mm)	1 (4-6mm)	2 (0-3mm)
Male	48.8	27.8	23.5
Female	43.5	38.1	18.4
All	46.1	33.1	20.9

Maximal protrusion measures the ability to protrude the mandible, which is a dimension of joint mobility. Only 46% of those aged 65+ have the ability to protrude the mandible 7 mm or more from its resting position. Over one fifth of this age group are restricted to a maximal protrusion of 3 mm.

Table 65 Impaired Movement Score (Maximal Opening Score + Maximal Protrusion Score): Percent of subjects aged 65+ by gender

Base: Dentate

	MHI Score (Impaired Movement Score)		
	0 (0 points)	1 (1-2 points)	2 (3-4 points)
Male	44.8	45.2	10.0
Female	37.5	52.1	10.4
All	41.0	48.8	10.2

The impaired movement score is obtained by summing the maximal opening and maximal protrusion scores: a sum of 0 is scored 0; a sum of 1 or 2 is scored 1; a sum of 3 or 4 is scored 2. Impaired movement is evident in 59% of older people, with greater impaired movement (3-4 points) experienced by 10.2% (Table 65). A greater proportion of older females (62.5%) show symptoms of impaired movement than males (55.2%).

Table 66 Impaired TMJ Function Score: Percent of subjects aged 65+ by gender*Base: Dentate*

	MHI score (Impaired TMJ Function Score)	
	0 (no impairment)	1 (any sound, deviation or locking/luxation)
Male	75.4	24.6
Female	60.3	39.7
All	67.6	32.4

The TMJ was examined for clicking or crepitus sounds, deviation of the mandible on opening, locking during movement, or dislocation of the condylar head (either observed or reported). Overall, 32.4% of subjects aged 65+ showed some TMJ function impairment (Table 66). A considerably higher proportion of women (39.7%) than men (24.6%) displayed symptoms of TMJ dysfunction.

Table 67 Muscle Pain Score: Percent of subjects aged 65+ by gender*Base: Dentate*

	MHI Score (Muscle Pain Score)		
	0 (no pain)	1 (pain in 1-2 muscle sites)	2 (pain in 3 or more sites)
Male	97.4	1.4	1.2
Female	98.1	1.9	0.0
All	97.8	1.6	0.6

Three muscles of mastication – Masseter, Temporalis and Lateral Pterygoid - were palpated on the right and left sides. The fingertips were used to apply gentle pressure to the Masseter and Temporalis, while the Lateral Pterygoid was checked by an indirect method. The patient was asked to report any pain during the examination, muscle pain being considered an indication of some dysfunction. The distribution of subjects by gender and number of muscle groups where pain was elicited is shown in Table 67. Amongst those aged 65+, only 1.9% of females and 2.6% of males had some muscle pain.

Table 68 TMJ Pain Score: Percent of subjects aged 65+ by gender*Base: Dentate*

	MHI Score (TMJ Pain Score)	
	0 (no pain / tenderness on palpation)	1 (tenderness on either side)
Male	97.2	2.8
Female	95.3	4.7
All	96.2	3.8

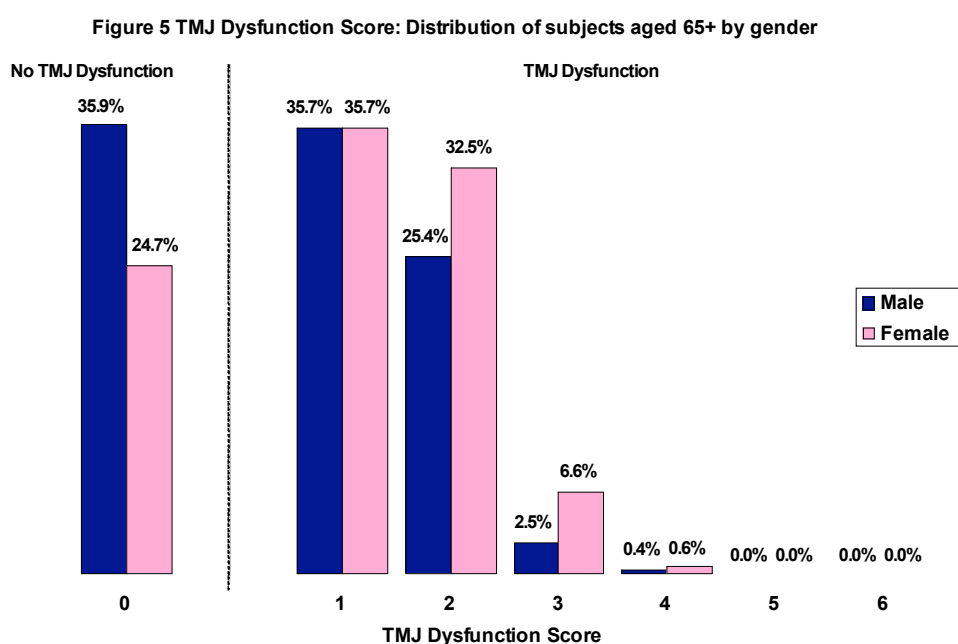
For all dentate subjects, the clinical examiner palpated the TMJ both laterally and dorsally on either side. Any reported pain or tenderness was recorded. As with muscle pain, TMJ pain is reported by a very small percentage of older people (Table 68). Women were more frequently affected than men – 4.7% of women and 2.8% of men reported pain on palpation of the joint.

Table 69 Total Dysfunction Score [Impaired Movement Score+Impaired TMJ Function Score+Muscle Pain Score +TMJ Pain Score]: Percent of subjects aged 65+ by gender
Base: Dentate subjects with a score for each component

		MHI Total Dysfunction Score						
		[Impaired Movement+Impaired TMJ Function+Muscle Pain+TMJ Pain]						
	Number	0	1	2	3	4	5	6
		%	%	%	%	%	%	%
Male	169	35.9	35.7	25.4	2.5	0.4	0.0	0.0
Female	167	24.7	35.7	32.5	6.6	0.6	0.0	0.0
All	336	30.1	35.7	29.1	4.6	0.5	0.0	0.0

The Modified Helkimo Index (MHI) Total Dysfunction Score summarises a group of symptoms of TMJ dysfunction, the assumption being that the greater number of different aspects of TMJ movement and function affected, the greater the dysfunction. It is calculated by summing the MHI scores for Impaired Movement (range 0-2; Table 65), Impaired TMJ Function (range 0-1; Table 66), Muscle Pain (range 0-2; Table 67) and TMJ Pain (range 0-1; Table 68). The Total Dysfunction Score has a range of 0 to 6 where index level 0 indicates no dysfunction and index level 6 indicates maximum TMJ dysfunction.

The distribution of the MHI Total Dysfunction Score is presented in Table 69. Overall, 69.9% of older subjects showed some degree of dysfunction (score>0). Looking at the distribution of scores by gender illustrated as a bar chart in Figure 5, one can see that older females have a greater frequency and severity of TMJ dysfunction than older males.



2.2.3.2. Tooth Wear & Erosion

Anecdotal reports suggest that in recent years there has been an increase in the prevalence of tooth wear. There are insufficient standardised data reported in the literature to determine whether this is the case. The tooth wear data collected in this study will act as a baseline against which future changes can be monitored. The 12 upper and lower anterior teeth were examined for wear. For the upper teeth, the severity of wear was recorded on labial and palatal surfaces; on incisal surfaces, the presence of wear typical of erosion was also recorded. On the lower teeth, the condition of the most worn surface was recorded.

Table 70 Percent of subjects aged 65+ by level of maximum tooth wear and gender

Base: Dentate

	N	Any Wear	Level of Maximum Tooth Wear		
			Slight	Moderate	Severe
Male	208	94.7	48.1	38.1	8.5
Female	198	91.3	59.8	25.8	5.7
All	406	93.0	54.1	31.8	7.1

It can be expected that tooth wear will increase with age. In the 1998 UK Adult Oral Health Survey (Kelly, *et al.*, 2000), in which the same index was used, 89% of those aged 65 and over had evidence of tooth wear. In the Republic of Ireland survey, 93% of the older people were recorded as having signs of 'Any Wear' (Table 70) – this result is comparable with the UK survey results.

Looking at tooth wear by gender among this age group, a higher proportion of males were recorded with signs of any tooth wear than females. Males also had higher levels of moderate and severe wear than females. One in 12 (8.5%) males and more than 1 in 20 females (5.7 %) aged 65+ had wear that was so severe it exposed the secondary dentine or pulp (Table 70).

The prevalence of incisal wear is shown in Table 71 and of incisal erosion in Table 72. Incisal wear was more common than incisal erosion among the older people: 27.6% had incisal wear; 9.3% had incisal erosion.

Table 71 Percent of subjects aged 65+ by level of maximum incisal wear and gender

Base: Dentate

	N	Any Incisal Wear	Level of Incisal Wear	
			Moderate	Severe
Male	208	34.1	27.3	6.8
Female	198	21.4	18.2	3.2
Total	406	27.6	22.6	5.0

The NSAOH 2000-02 is the first national survey in which the levels of tooth wear were recorded. These data will facilitate monitoring of population trends in tooth wear and erosion in the future. Due to the dramatic changes in oral health which have taken place in recent decades, the population aged 65 and over are

Table 72 Percent of subjects aged 65+ by level of maximum incisal erosion and gender

Base: Dentate

	N	Any Incisal Erosion	Level of Incisal Erosion	
			Moderate	Severe
Male	208	12.9	11.5	1.4
Female	198	5.8	3.3	2.5
Total	406	9.3	7.3	2.0

increasingly dentate. Retention of more teeth increases the importance of long-term maintenance of tooth function. Prevention of detrimental tooth wear in older life requires a life-course approach with early identification and prevention of pathological wear. Development of acceptable 'norms' for age-related levels of tooth wear compatible with good oral health would be a useful adjunct for such an approach.

2.2.3.3. Lesions of the Oral Mucosa

Of 706 older people examined, 69.6% had no lesions of the oral mucosa (Table 73). Denture stomatitis was the most common condition with 9.8% affected, followed by cheek and lip biting (3.7%) and flabby ridges (3.4%). Acute necrotising ulcerative gingivitis was found in 0.8% of those examined.

Many of the conditions recorded (e.g. acute necrotising ulcerative gingivitis - 0.8%, denture stomatitis - 9.8%, candidiasis - 1.5%) could benefit from clinical treatment. Regular dental inspection of older people is important for the prevention and treatment of such conditions, as well as the early detection of oral cancer.

Table 73 Lesions of the oral mucosa: Distribution of subjects aged 65+ by type of lesion

Base: Dentate and Edentulous

Lesion of the oral mucosa	% (n = 706)
None	69.6
Denture stomatitis	9.8
Cheek and Lip Biting	3.7
Flabby Ridge(s)	3.4
Amalgam Tattoo	1.8
Denture Granuloma	1.6
Candidiasis	1.5
Apthous ulceration	1.4
Other	1.3
Lesions that can not be clearly identified	1.2
Sinus associated with infected tooth	0.9
Acute necrotizing ulcerative gingivitis	0.8
Median rhomboid glossitis	0.7
Frictional keratosis	0.7
Leukoplakia of oral mucosa	0.6
Geographic tongue	0.5
Smoker's palate	0.3
Suspect oral neoplasm	0.1
Erythroplakia	0.1
Oral Lichen planus	0.0
Discoid Lupus Erythematosus	0.0
Leukodema	0.0

2.3. Oral Health Knowledge, Attitudes & Behaviour

The survey used a questionnaire to assess levels of oral health knowledge and oral health related attitudes and behaviour among the adult population in Ireland. The questionnaire also assessed subjective perceptions of the current oral health services.

2.3.1. Knowledge of Fluorides

The majority of piped public water supplies in Ireland have been fluoridated since the 1960s. Public awareness of the role of fluoride and the use of fluoride in water and in toothpaste was ascertained by a series of questions. Each person was asked:

- Have you ever heard of the substance fluoride?
- Have you ever heard about water fluoridation; i.e. fluoride being added to public water supplies?
- *If 'Yes, Where have you heard about this?*
- What do you think is the purpose of adding fluoride to public water supplies?
- What do you think is the purpose of adding fluoride to toothpaste?

The responses are presented for dentate and edentulous older people separately in Table 74.

Between 12% and 20% of respondents had not heard of fluoride, with awareness of fluoride being lower among edentulous (80%) than dentate older people (88%). A slightly lower proportion (78% edentulous; 87% dentate) knew about the addition of fluoride to water supplies.

The two most commonly cited sources of information on water fluoridation were Radio / TV and Newspapers / Magazines – indicating the importance of the mass media for disseminating information. Family and friends were reported to be a greater source of information than dentists, doctors and other health care professionals who were a source of information for 8% or less of older people.

Knowledge of the reason for water fluoridation was very poor. Only 51% of dentate and 36% of edentulous older people knew that the purpose of adding fluoride to water is to reduce decay levels. Over one-quarter of the respondents thought that fluoride was used to purify the water, possibly due to some confusion between fluoridation and chlorination. Knowledge of the purpose of adding fluoride to toothpaste was better, with 65% of dentate and 48% of edentulous older people stating that the purpose was to reduce tooth decay.

The older population are not well briefed on water fluoridation. Although dentists could disseminate information to the public on water fluoridation, they are not currently seen as a source of information on this important public health measure. The media is clearly the major source of information on the topic of fluoridation. Care should be taken to ensure the validity of media coverage on fluoridation, and dentists should be made aware of their role in educating the public on the issue. As 71% of the Irish

population have domestic water fluoridation, efforts should be made to increase public awareness of the rationale for this measure.

Table 74 Distribution (%) of subjects aged 65+ by response to questions relating to fluoride and dentate or edentulous status

		Dentate	Edentulous
◆ Have you ever heard of the substance fluoride?			
	n	411	283
	Yes	88%	80%
	No	12%	20%
◆ Have you ever heard about water fluoridation i.e. fluoride being added to public water supplies?			
	n	409	282
	Yes	87%	78%
	No	13%	22%
◆ If 'Yes', Where have you heard about this? <i>Record two major sources of information.</i>			
	n	359	228
	Radio/TV	76%	82%
	Newspapers/magazines	65%	64%
	Internet	0%	0%
	Dentist, doctor, health care professional	7%	8%
	Family/Friends	18%	10%
	School	2%	1%
	Other	1%	2%
◆ What do you think is the purpose of adding fluoride to public water supplies?			
	n	408	279
	<i>To purify water</i>	28%	30%
	<i>To reduce tooth decay</i>	51%	36%
	<i>To improve the taste of water</i>	2%	3%
	<i>Don't know</i>	18%	31%
	<i>Other</i>	1%	0%
◆ What do you think is the purpose of adding fluoride to toothpaste?			
	n	408	281
	<i>To whiten teeth</i>	7%	10%
	<i>To reduce tooth decay</i>	65%	48%
	<i>To improve the taste of the toothpaste</i>	1%	2%
	<i>Don't know</i>	25%	38%
	<i>Other</i>	1%	2%

2.3.2. Oral Health Attitudes

The range of attitudes covered in the questionnaire included: attitudes to extraction of teeth, tooth loss and denture wearing; satisfaction with tooth colour and alignment; attitudes to orthodontic treatment; and, attitudes to frequency of dental visiting. The following questions were asked:

- If you had a painful back tooth would you prefer it to be filled or taken out?
- How about a front tooth?
- How would you feel if you lost all of your natural teeth and had to wear full dentures upper and lower?

- Do you think you will always have some of your own natural teeth?
- How do you feel about the colour of your teeth?
- How do you feel about the position/alignment of your teeth?
- Would you be willing to wear a brace to straighten your teeth?
- What stops you from having orthodontic treatment: braces to straighten your teeth?
- How often do you think you should actually go to the dentist?

Attitudes to extraction and to denture wearing are presented in Table 75. The relationship between the reported attitudes and oral health status is shown for extraction of a back tooth in Table 76, and for attitudes to wearing a denture in Table 77. These tables present the mean number of teeth, the mean DMFT and the percent with 18 or more sound, untreated natural teeth (18+ SUNT) by varying attitudes. Feelings about colour, alignment and dental visiting are presented in Table 78.

Table 75 Distribution (%) of subjects aged 65+ by response to questions relating to extraction of teeth and denture wearing (1989/'90 responses in parenthesis, where available)

Base=Dentate

- If you had a painful back tooth would you prefer it to be filled or taken out?

	n	395
<i>Filled</i>	58%	(55%)
<i>Taken Out</i>	33%	(41%)
<i>Don't know</i>	5%	(6%)
<i>Wouldn't bother me. Either option okay</i>	4%	
<i>Taken out and replaced if possible</i>	1%	

- How about a front tooth?

	n	400
<i>Filled</i>	77%	
<i>Taken Out</i>	16%	
<i>Don't know</i>	3%	
<i>Wouldn't bother me. Either option okay</i>	4%	
<i>Taken out and replaced if possible</i>	1%	

- **Non-denture wearers: Do you find the thought of wearing a partial denture**

	n	185
<i>Very upsetting?</i>	19%	
<i>A little upsetting?</i>	30%	
<i>Not at all upsetting?</i>	50%	

- How would you feel if you lost all of your natural teeth and had to wear full dentures upper and lower?

	n	399
<i>Very Happy</i>	1%	
<i>Happy</i>	2%	
<i>Wouldn't bother me</i>	37%	(39%)
<i>Upset</i>	30%	(29%)
<i>Very Upset</i>	30%	(32%)

- Do you think you will always have some of your own natural teeth?

	n	401
<i>Yes (hopefully)</i>	80%	
<i>No</i>	8%	
<i>Don't know</i>	12%	

When asked “If you had a painful back tooth would you prefer it to be filled or taken out?” 58% of dentate older people would opt for a filling. Though one in three dentate older people (33%) would opt for extraction, this figure is down from 41% in 1989-90.

The pattern was similar for choice of treatment for a painful front tooth: 77% would opt for a filling and 16% for extraction. The cosmetic importance of the anterior teeth is reflected in the higher percentage opting for filling.

For 19% of the dentate sample with no dentures, the thought of wearing a partial denture would be ‘very upsetting’. For the entire dentate sample, the thought of losing all natural teeth and wearing full dentures was acceptable to 40%, with 3% responding they would be happy or very happy with full dentures. There was no change in the last decade in the percentage of dentate older people reporting that they would be ‘upset’ or ‘very upset’ at the idea of wearing a denture (61% in 1989-90; 60% in 2000-02).

The vast majority (80%) of the dentate older people thought that they would always have some of their own natural teeth.

Table 76 The number of subjects aged 65+, mean number of natural teeth present, mean DMFT and the percentage with 18+ SUNT by preference for the treatment of a painful back tooth

Base=Dentate

Preference	N	Mean Number of Natural Teeth	Mean DMFT	18+SUNT
Filled	232	16.9	20.8	7%
Removed	124	11.9	22.1	4%
Don t know	19	11.3	23.2	0%
No preference	18	13.1	23.7	6%
Removed & Replaced	2	10.4	25.6	0%

In Table 76, we see that the dentate older people who opt for filling rather than extraction of a painful back tooth tend to have more natural teeth, a lower DMFT and a greater prevalence of 18 or more sound, untreated natural teeth (18+ SUNT). On average, those who opt for filling have 16.9 teeth and a DMFT of 20.8; those opting for removal (extraction) of the tooth have 11.9 teeth and a DMFT of 22.1. Of those opting for filling, 7% have 18+ SUNT; of those opting for extraction, 4% have 18+ SUNT.

Table 77 The number subjects aged 65+, the mean number of natural teeth present, mean DMFT and the percentage with 18+ SUNT by attitude to wearing full dentures

Base=Dentate

Attitude	N	Mean Number of Natural Teeth	Mean DMFT	18+SUNT
Very Happy	5	9.6	23.6	0%
Happy	8	13.5	22.4	7%
Would Not Bother Me	137	11.6	23.2	5%
Upset	129	15.4	20.7	9%
Very Upset	120	18.0	20.3	5%

It is interesting to note that the mean number of teeth present increased and the DMFT decreased according to how upset older people were at the thought of wearing full dentures (Table 77). This appears to indicate that the more concerned people are about retaining their teeth, the better their dental health.

Table 78 Distribution (%) of subjects aged 65+ by response to questions relating to colour, alignment and dental visiting

<i>Base=Dentate</i>		
◆ How do you feel about the colour of your teeth?	n	397
	<i>Very satisfied</i>	7%
	<i>Satisfied</i>	40%
	<i>Doesn't concern me</i>	25%
	<i>Dissatisfied</i>	23%
	<i>Very Dissatisfied</i>	4%
◆ How do you feel about the position/alignment of your teeth?	n	394
	<i>Very satisfied</i>	12%
	<i>Satisfied</i>	48%
	<i>Doesn't concern me</i>	29%
	<i>Dissatisfied</i>	10%
	<i>Very Dissatisfied</i>	1%
◆ <i>Dissatisfied or very dissatisfied respondents only: Would you be willing to wear a brace to straighten your teeth?</i>	n	87
	<i>Yes</i>	14%
	<i>No</i>	56%
	<i>Haven't ever thought about it</i>	30%
	<i>Currently undergoing ortho treatment</i>	
◆ <i>Dissatisfied or very dissatisfied respondents only: What stops you from having orthodontic treatment/ braces to straighten your teeth?</i>	n	59
	<i>Cost</i>	1%
	<i>Too old</i>	85%
	<i>Embarrassed</i>	8%
	<i>Other</i>	6%

Tooth whitening products are widely marketed in Ireland. Adults were asked whether they felt satisfied with the colour of their teeth. Although few were 'very satisfied' (7%), many were 'satisfied' (40%) among dentate subjects aged 65+ (Table 78). Twenty-seven percent were 'dissatisfied or 'very dissatisfied' with the colour of their teeth.

More people were satisfied with the alignment of their teeth. However, 11% of dentate older people were either 'dissatisfied or 'very dissatisfied' with the alignment of their teeth. The 'dissatisfied' or 'very dissatisfied' group were asked whether they would wear a brace to straighten their teeth and 14% replied 'Yes'. They were then asked what the greatest deterrent to their having orthodontic treatment was and 85% replied they were 'Too old'.

Future expectations appear to be influenced by past experiences. Thus those providing care should be reminded that if a patient has a tooth extracted because of disease, they may be more likely to opt for extraction in the future and further compromise the integrity and function of their dentition. Looking at the level of dissatisfaction with tooth colour, it is interesting to note the high number of people who are dissatisfied with the colour of their teeth. It will be interesting to monitor this figure as tooth whitening products become more common in the marketplace.

Dissatisfaction with tooth alignment is common but many of those dissatisfied would not be willing to wear a brace because of their age.

2.3.3. Oral Health Behaviour

The three main oral health messages used to advise the public on prevention and control of oral disease are:

- Brush your teeth and gums thoroughly at least twice a day with a fluoride toothpaste.
- Reduce the frequency of eating sweet food and drinking sweet drinks between meals.
- Visit the dentist regularly.

To gain insight into the oral health behaviour of adults, questions regarding factors that affect oral health were asked. The responses to the questions on the practice of toothbrushing, frequency of snacking, and visits to the dentist are given in Table 79.

Table 79 Distribution (%) of subjects aged 65+ by response to questions on oral health behaviour			
<i>Base=Dentate</i>			
The most striking feature of these results is the low frequency of sweet snacking among dentate older people: 38% of respondents never have a sweet snack between normal meals; 31% snack just once a day; 39% never take any carbonated drinks or fruit juices.	• "How many times a day do you eat sweet foods or drink sweet drinks (such as biscuits, cakes, sweets, Coca-Cola, Pepsi cola, 7UP, tea with sugar etc) between normal meals?"	n	398
		Never	38%
		Once a day	32%
		Twice a day	18%
		Three times a day	6%
		Four times a day	2%
		Five times a day	2%
		Six times a day	0%
		Seven or more times a day	1%
		Don't know	2%
However, only 52% of dentate older people brush their teeth at least twice a day (up from 48% in 1989-90), 35% brush just once a day and 5% never brush at all. Brushing twice per day or more often prevents more dental caries than brushing once a day or less.	• Do you drink at least once a day any of the following? Please tick all that apply.	n	413
		Pure fruit juice	35%
		Fizzy soft drinks	13%
		Carbonated water	16%
		Other types of soft drinks	4%
		None of the above	39%
Dental clinicians advise patients to visit the dentist regularly. Optimal frequency of dental visiting is individually determined and depends on host susceptibility to oral disease. Among dentate older people, 22% never visit the	• How often do you brush your teeth?	n	401
		Twice/day or more	52%
		Once/day	35%
		A few times a week	6%
		About once a week	2%
		Never	5%
	• Over the last few years how often have you attended the dentist? Call out options	Dentate	Edentulous
		n	281
		Every six months or more often	9%
		Every 6-12 months	1%
		Every 12-24 months	1%
		Every 2 years/more	7%
		Occasionally	20%
		Never	71%

dentist and 25% visit only occasionally. The situation among edentulous older people is considerably worse with 71% never visiting the dentist and 20% visiting only occasionally. Less than 30% of dentate older people visit the dentist at least once every 12 months.

Figure 6 Frequency of attendance (per cent) at the dentist according to eligibility status: Age group 65+

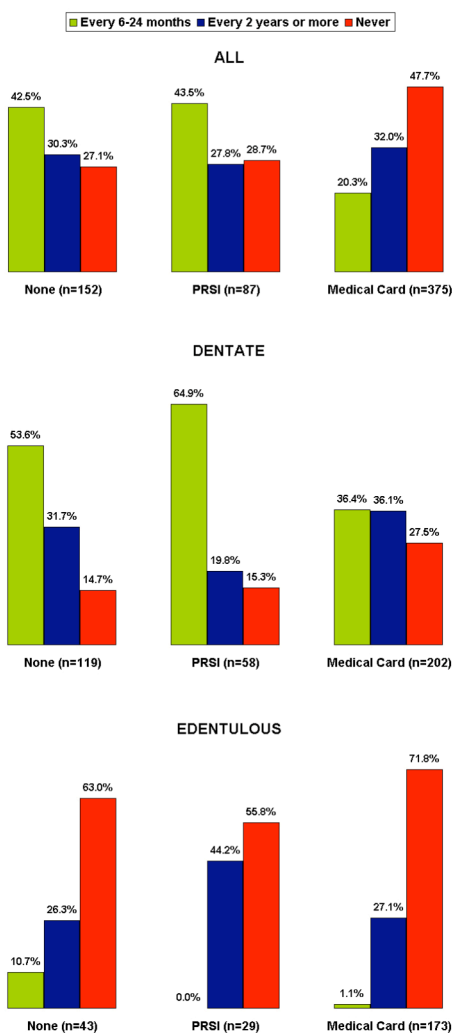


Figure 6 shows that the distribution of responses for the older people with no eligibility for third-party funded oral care ('None') compares similarly to the distribution for those with eligibility for Dental Benefit under the state Pay Related Social Insurance scheme ('PRSI'). In both groups, 43% reported visiting the dentist at least once every 2 years. This contrasts with 20% for the 'Medical Card' group.

As the edentulous tend not to visit the dentist, Figure 6 also presents the distribution of responses by eligibility status for dentate and edentulous older people separately. The differences in the pattern of dental attendance of the 'Medical Card' group compared with the 'None' and 'PRSI' groups are more clearly evident among the dentate older people. The highest frequency of never visiting a dentist is found within the edentulous 'Medical Card' group (72%).

2.3.4. Barriers to Dental Care

To further ascertain the nature of the dental visiting pattern, adults were also 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 remainder (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.

Those with an irregular visiting pattern were asked 'Why do you not visit a dentist regularly?' in an attempt to identify the major barriers to regular dental visits. They were asked to choose from a range of reasons for their infrequent dental attendance and were allowed to give two main reasons. The responses were categorised by the basic nature of the reason – 'Need', 'Fear', 'Cost' or 'Other'. 'Other' included not knowing a good dentist, not having time to go to a dentist, distance to a dentist, no downstairs dental surgery and other unspecified reasons.

The results are presented in Table 80 for the dentate and edentulous groups separately. They are also presented by Medical Card status to help explore barriers to care for Medical Card Holders because they had the most unfavourable dental visiting pattern.

The most common reason for infrequent dental attendance was the perception that there was 'No Need' to attend. This reason was given by 89.5% of older people with irregular dental visiting patterns and was higher among those with no teeth (95.4%) than those with teeth (83.1%). By eligibility status, medical card holders had the greatest proportion (91.0%) citing "No need" as a reason for not going to the dentist. While fear was not a major factor for those with no teeth (edentulous), among those with teeth (dentate) 16.0% had anxieties about going to a dentist. The highest levels of dental anxiety was shown by dentate medical card holders (18.0%). Cost was cited as a barrier to dental attendance by 20.0% of those with no third-party funded care, 17.5% of those who were unsure of their eligibility for dental benefits and 10.1% of those with PRSI benefits, but was a factor for only 4.1% of medical card holders. It is interesting to note that for older people, other reasons – such as not knowing a good dentist, distance to and accessibility of the dental clinic, and time – were cited as reasons for not going to a dentist more frequently than either fear or cost.

Table 80 Per cent of subjects aged 65+ by reason cited for infrequent dental attendance and by Medical Card /Dental Benefit eligibility status

		n	No Need	Fear	Cost	Other
Dentate	Medical Card	139	85.1	18.0	5.8	18.7
	PRSI	22	77.1	17.7	17.7	13.1
	None	65	86.4	9.6	23.1	19.1
	Other/Don't know	22	63.2	16.4	31.3	17.3
	All	248	83.1	16.0	12.6	18.2
Edentulous	Medical Card	167	96.0	0.3	2.6	4.3
	PRSI	27	100.0	0.0	4.0	6.6
	None	39	83.8	3.5	14.7	20.1
	Other/Don't know	38	100.0	0.0	9.5	1.7
	All	271	95.4	0.6	5.0	6.0
ALL	Medical Card	306	91.0	8.4	4.1	10.9
	PRSI	49	89.9	7.9	10.1	9.5
	None	104	85.5	7.4	20.0	19.5
	Other/Don't know	60	86.6	6.0	17.5	7.4
	All	519	89.5	8.0	8.6	11.9

3. Oral Treatment Needs of Older Irish People

Section 3 focuses on the epidemiological measurement of the need for dental treatment among older people aged 65 and over in the Republic of Ireland. In the first segment, data from the NSAOH 2000-2 (Whelton, *et al.*, 2007) are analysed to determine current level of oral treatment needs among older people according to gender, treatment type and eligibility status. Temporal changes in need are estimated by comparing current levels with the levels determined from the NSAOH 1989-90 baseline survey (O'Mullane & Whelton, 1992).

The investigation of risk indicators associated with the prevalence of dental caries in the second segment goes beyond a simple expression of normative need and the presentation of mean values, to the modelling of a profile of adults with high levels of dental caries and thus high levels of treatment need. The conceptualisation of “high need” indicators can be interpreted as the amount of dental care necessary to achieve “normal” dental health, where “normal” will be the level of need among populations with recognised levels of fully adequate access to dental care. The variables identified as high-risk can be incorporated into a population-based resource allocation formula, which reflect the equity of access criterion.

The “high need” indicators approach enables the identification of groups who could be prioritised for dental services. With dental caries declining in the developed economies, the identification of those at greatest risk to dental disease (targeted approach) may have clear economic benefits over the population-based approach of the Dental Health Action Plan (DHAP; Dept. of Health & Children, 1994). From an economic perspective it may be more appropriate to identify, target and divert resources toward groups at high risk of dental caries.

By comparing the results of the oral health survey conducted in 2000-2 with those of 1989-90, policy makers can assess the relative performances of the Dental Treatment Benefit Scheme (DTBS) and the DTSS in terms of oral health outcomes.

The final segment compares the treatment provided to low-income older people eligible for treatment in the DTSS with their treatment needs as assessed by the NSAOH 2000-2.

3.1 Assessment of the Treatment Needs of Older Irish People

This segment has four main aims:

- (1) To quantify and assess current normative oral health needs of older Irish people based on the NSAOH 2000-2.
- (2) To compare oral health treatment need based on the NSAOH 2000-02 with the need estimated from the baseline NSAOH 1989-90 survey. This comparison identifies changes in the levels of oral disease over time.

- (3) To compare the oral health treatment need of medical card holders with that of subjects eligible for dental services in other schemes (e.g. PRSI) and of those eligible for private services only.
- (4) To use predictions of need and changes in patterns of need to assess the objectives set for the DTSS and DTBS in the DHAP (1994).

When assessing changes in estimated needs over time, it must be kept in mind that blanket eligibility to medical card was extended to all persons aged 70 and over while the NSAOH 2000-2 was on-going.

3.1.1. Estimated Need for Any Treatment

The purpose of this section is to quantify and assess the proportion of older Irish people requiring any dental treatment, and to compare predictions of need between the recent NSAOH 2000-2 and the 1989-90 baseline survey. The significance of changes over time was tested using the z-test of equality of two proportions. Estimations of treatment need according to eligibility for the different dental services are also compared, as the nature of the system under which dental treatment is available might be expected to influence the extent to which subjects' treatment needs have been fulfilled (O'Mullane & Whelton, 1992). The statistical significance of differences within eligibility groups is assessed using the F-test for analysis of variance (ANOVA).

Table 81 shows the percentage of subjects requiring any treatment by eligibility for dental treatment schemes in 2000-02. Regardless of eligibility status for the various dental services, a high proportion of Irish older people (83.4%) required dental treatment. There has been a substantial increase in the proportion of older people with treatment needs from 64.5% in 1989-90 to 83.4% in 2000-02.

Table 81 Percentage of subjects aged 65+ requiring Any Treatment (for crown or root caries or prosthetic replacement of teeth) by eligibility for dental treatment schemes

Base: Dentate and Edentulous

	None	PRSI	MC	Other	All
National 2000/'02	81.0	69.7	87.2	**	83.4
National 1989/'90	68.4	50.0	64.4	**	64.5
z - value	2.035*	1.523	4.853*		5.390*
EHB 2000/'02	75.4	50.7	91.8	**	67.8
MWHB 2000/'02	94.6	87.2	88.7	**	66.6
NEHB 2000/'02	95.9	83.7	87.0	**	74.0
SHB 2000/'02	74.6	90.8	77.4	**	62.1

Note 1: None – no cover/private payment, fee per item of service; PRSI – eligible for pay-related Social Welfare Dental Benefit; MC – medical card holders eligible for health board dental services; Other – employers dental schemes e.g. Gardaí, Armed Forces.

*Note 2: ** Sample size below significant levels.*

Note 3: The percentages reported in the 'All' are not averages of the other columns as some subjects examined were covered by both PRSI and medical card.

Note 4: missing records account for the non-additivity of the data.

*Note 5: * Statistically significant at 95% level based on z-test comparing two proportions.*

The 1989-90 survey established that proportionally more medical card holders had treatment requirements than those eligible for either PRSI or other dental benefits (O'Mullane & Whelton, 1992). Table 81 shows that this comparison remains true in 2000-2. Medical card holders have the highest proportion with treatment requirements (87.2% compared to 81.0% for the 'None' group and 69.7% for the 'PRSI' group). Differences in treatment need by eligibility status in 2000-2 are statistically significant based on the ANOVA F-test.

Eligibility for dental services can serve as an indicator of accessibility to dental services. Access to dental services through the Dental Treatment Services Scheme (DTSS) has been extended to adult medical card holders on a phased basis since 1994. Subjects with PRSI benefits can access dental treatment through the Dental Treatment Benefit Scheme (DTBS). Adults with no eligibility for a medical card, PRSI or other dental benefits pay for dental treatment on a fee-per-item basis.

3.1.2. Estimated Need for Denture Treatment

The purpose of this section is to quantify the proportion of older Irish people requiring denture-related treatment, and to compare predictions of need between the surveys. The significance of changes over time is tested using the z-test of equality of two proportions. The need for treatment involving dentures (according to eligibility status) is presented in Table 82.

Table 82 Number and percentage of subjects aged 65+ requiring Denture Treatment (including repairs, adjustments, replacements or new dentures (full or partial)) by eligibility for dental treatment schemes

Base: Dentate and Edentulous

	None	PRSI	MC	All
National 2000/'02	52.3	43.7	67.5	60.9
National 1989/'90	57.0	22.0	57.0	54.1
z - value	-0.644	1.629	1.925	1.668
EHB 2000/'02	47.2	22.9	79.3	55.9
MWHB 2000/'02	67.6	37.4	57.6	49.0
NEHB 2000/'02	36.7	27.9	57.4	50.5
SHB 2000/'02	49.4	90.8	71.2	56.6

Note 1: None – no cover/private payment, fee per item of service; PRSI – eligible for pay-related Social Welfare Dental Benefit; MC – medical card holders eligible for health board dental services; Other – employers dental schemes e.g. Gardaí, Armed Forces.

Of those aged 65+, 60.9% required denture treatment, again with medical card holders having the highest requirement (67.5%). At health board level, the SHB had the greatest denture treatment requirement, with 90.8% of those with PRSI eligibility requiring treatment.

The denture treatment requirement for medical card holders increased significantly from 57% in 1989-90 to 67.5% in 2000-2, and almost doubled for those with PRSI eligibility from 22% to 43.7% in the period between the surveys. Differences in oral treatment need according to eligibility status were tested using the ANOVA F-test, but were not statistically significant.

The introduction of the DTSS in 1994 for adult medical card holders did not reduce the denture requirement for those aged 65+. This may be explained by the very low utilisation rate for this age group. Analysis of the DTSS database revealed that even though 397,590 of those aged 65+ were eligible for treatment, only 37,776 or just 9.5% made a dental visit in 2001.

3.1.3. Estimated Need for Conservative Treatment

The purpose of this section is to quantify the requirement of older Irish people for conservative treatments by eligibility status, and to compare predictions of need between the surveys. The conservative treatments analysed are categorised as follows:

- mean number of extractions (which includes extractions for all reasons);
- mean number of teeth requiring fillings (regardless of extent, location or number of surfaces involved);
- mean number of advanced restorations (which includes endodontics, crowns, bridges and veneers);
- mean number of teeth requiring other treatment (for example, polishing of margins, repair of fillings, fissure sealing, and treatment of sensitive teeth); and
- mean number of teeth requiring any treatment.

It is important to compare the mean number of teeth requiring treatment with the mean number of natural teeth present². Hence, the latter is given for each eligibility group. The nature of the dental treatment services required by older subjects based on clinical examination is presented at national level in Table 83.

Table 83 Mean number of natural teeth present (nt) and mean number of teeth requiring treatment (of the crown or root) in subjects aged 65+ by treatment type and eligibility status (standard error in brackets)

Base: Dentate and Edentulous

	None	PRSI	MC
National 2000/02			
nt	11.7 (9.57)*	11.2 (10.10)*	6.9 (8.40)*
Extractions	1.6 (0.29)	1.6 (0.60)	2.4 (0.42)*
Fillings	1.6 (0.23)*	0.9 (0.21)	1.2 (0.14)*
Advanced Restorations	0.2 (0.08)*	0.1 (0.04)*	0.0 (0.01)
Other treatment	3.2 (0.78)*	2.6 (1.09)*	5.0 (0.72)*
Any Treatment	5.3 (0.81)*	3.7 (1.27)*	6.6 (0.77)*
National 1989/90			
nt	9.7 (9.36)*	12.1 (8.76)*	5.3 (7.81)*
Extractions	1.3 (3.54)	0.8 (1.69)	0.8 (2.83)*
Fillings	0.5 (1.38)*	0.6 (1.10)	0.4 (1.16)*
Advanced Restorations	0.1 (0.46)*	0.0 (0.00)*	0.0 (0.09)
Other treatment	0.2 (0.79)*	0.0 (0.00)*	0.0 (0.00)*
Any Treatment	1.8 (3.56)*	1.2 (1.89)*	1.2 (3.16)*

Note 1: None – no cover/private payment, fee per item of service; PRSI – eligible for pay-related Social Welfare Dental Benefit; MC – medical card holders eligible for health board dental services; Other – employers dental schemes e.g. Gardaí, Armed Forces.

² If an individual has all their natural teeth present, they have 32 teeth. In calculating the percentage of teeth requiring treatment, the mean number of teeth present should be used as the denominator, not 32.

The results of NSAOH 2000-2 are compared with the results from the baseline 1989-90 survey. To test the significance of changes over time, the t-test is used. The statistical significance of differences within eligibility groups is also assessed using the F-test for analysis of variance (ANOVA), and the Scheffé test.

There are increased levels of estimated need for any dental treatment by eligibility status. This is largely explained by the significant increases in the mean number of teeth present. Medical card holders had the least number of teeth present in 2000-2, yet they had the greatest number of teeth requiring any treatment. They also had the greatest estimated need for extractions and 'Other treatment'.

Table 83 shows that any change in the mean number of teeth present by eligibility status between the two surveys is statistically significant. Medical card holders now have on average 6.9 natural teeth present, compared with just 5.3 in 1989-90. For those with PRSI benefits, the mean number of teeth present decreased from 12.1 to 11.2, but increased from 9.7 to 11.7 for those eligible for private services only. The estimated need for any dental treatment increased significantly for all eligibility groups. Significant increases in need were also encountered in the 'Other treatment' category.

Table 84 presents the mean number of teeth present and the mean number of teeth requiring treatment for older medical card holders by gender and health board. The t-test is used to test the significant difference between males and females at the national level for each treatment category.

Table 84 Mean number of natural teeth present and mean number of teeth requiring treatment (of the crown or root) for medical card holders aged 65+ by treatment type and gender in 2000/02 (Standard Error in Brackets)

Base: Dentate and Edentulous

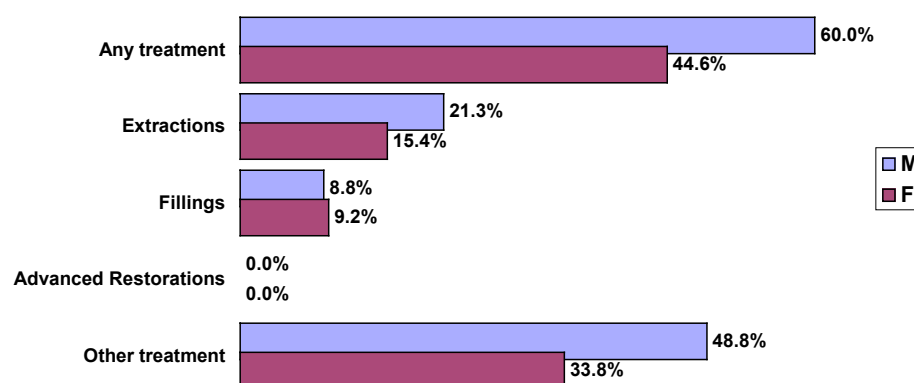
	No. of Natural teeth		Extractions		Fillings		Advanced Restorations		Other treatment		Any treatment	
	M	F	M	F	M	F	M	F	M	F	M	F
National	8.0 (0.75) t = 20.107*	6.5 (0.83)	1.7 (0.30) t = 28.478 *	1.0 (0.19)	0.7 (0.11) t = 9.301*	0.6 (0.08)	0.0 (0.01) t = 1.229	0.0 (0.01)	3.9 (0.59) t = 33.437*	2.2 (0.46)	4.8 (0.61) t = 35.259*	2.9 (0.47)
EHB	7.8 (1.63)	5.2 (1.22)	2.9 (0.80)	1.3 (0.40)	0.5 (0.17)	0.3 (0.09)	0.0 (0.03)	0.0 (0.00)	7.0 (1.51)	3.3 (1.25)	7.6 (1.60)	3.6 (1.26)
MWHB	6.5 (1.40)	5.7 (0.91)	1.9 (0.72)	0.8 (0.40)	1.3 (0.57)	0.8 (0.24)	0.0 (0.03)	0.0 (0.00)	1.4 (0.91)	0.5 (0.26)	4.0 (1.22)	1.7 (0.47)
NEHB	8.1 (2.26)	5.6 (0.88)	0.3 (0.14)	0.8 (0.38)	0.3 (0.13)	0.7 (0.16)	0.0 (0.00)	0.0 (0.03)	1.2 (0.86)	0.7 (0.43)	1.6 (0.85)	2.0 (0.51)
SHB	8.1 (1.37)	5.5 (1.02)	1.8 (0.81)	0.9 (0.34)	0.3 (0.14)	0.6 (0.21)	0.0 (0.00)	0.0 (0.03)	1.9 (0.95)	0.9 (0.36)	2.4 (0.90)	1.6 (0.42)

Note 1: Advanced restorations includes: endodontics, crowns, bridges and veneers. Other treatment includes: polishing of margins, repair of fillings, fissure sealing, and treatment of sensitive teeth.

*Note 2: * Statistically significant at 95% level based on t-test for the difference between two means, from independent samples.*

Table 84 shows that there is a higher level of tooth loss in females than in males among older medical card holders. Logically, older males – who have more teeth than their female contemporaries - require more extractions. For example, males have, on average, 8 natural teeth (1.7 of which require extractions), whereas females in this group have, on average, 6.5 natural teeth (1.0 of which require extractions). Males also require, on average, 0.7 teeth filled, whereas females require 0.6 teeth filled.

Figure 7 Percentage of natural teeth present requiring treatment in medical card holders aged 65+ by treatment type and gender in 2000/02



Looking at the total number of teeth that required treatment relative to the number of teeth present (Figure 7), male subjects consistently had greater treatment requirements than females, indicating that perhaps females are more likely to seek treatment for dental problems than males (O'Mullane & Whelton, 1992).

3.1.4. Estimates of Disease Prevalance & Incidence – DMFT Index

The prevalence and incidence of dental caries is generally measured by the DMF index, developed by Klein and Palmer (1937). The purpose of this section is to assess the prevalence and incidence of caries among older people using the DMFT and DMFS indices, and to compare and test the significance of differences in their index scores between the 1989-90 and 2000-2 surveys. These indices of disease prevalence and incidence are considered to be good predictors of need (DePaola, 1990; Beck, 1990; Kingman, 1990). Changes in the index scores between the surveys indicate changes in levels of need for dental care. Table 85 presents the mean DMFT and the percentages attributable to each DMFT component for subjects aged 65+ by gender.

The statistical significance of changes in mean DMFT over time is tested using the *t*-test. The change in the proportion of DMFT attributable to decayed teeth (DT), missing teeth (MT), and filled teeth (FT) is also assessed. The significance of the difference in proportions between the two surveys is tested using the *z*-test for the equality of two proportions.

Table 85 Mean DMFT and % attributable to the Decayed (DT), Missing (MT), or Filled (FT) components in subjects aged 65+ by gender*Base: Dentate and Edentulous*

	Mean DMFT		% Attributable to					
	M	F	DT		MT		FT	
			M	F	M	F	M	F
National 2000/'02	24.7	26.9	3	1	87	89	10	10
National 1989/'90	25.6	28.8	7	1	85	94	8	5
	t = -1.527	t = -4.556**	z = -2.022*	z = 0.000	z = 0.586	z = -1.703	z = 0.964	z = 1.676
EHB 2000/'02	25.0	27.4	3	1	86	89	12	10
MWHB 2000/'02	26.7	28.5	4	2	89	90	8	8
NEHB 2000/'02	25.3	27.8	2	2	86	90	12	8
SHB 2000/'02	25.1	27.8	2	1	90	91	9	8

Note 1: ** Statistically significant at 95% level based on t-test for the difference between two means, from independent samples.

Note 2: *Statistically significant at 95% level based on z-test comparing two proportions.

As expected, mean DMFT scores increase with age. Results of the clinical examinations establish that females had a higher mean DMFT than males, and that the percentage of total DMFT attributable to the decayed or untreated component (DT) is consistently lower for older females than older males (Table 85). According to O'Mullane & Whelton (1992), although females may have a greater disease level, they are more likely to have their disease treated than males. This finding is supported by the data in Tables 84 and 85.

The mean DMFT scores for all four health boards are above the national mean (Table 85). There is a higher-than-average proportion of DMFT attributable to the DT component in the MWHB, indicating a higher level of untreated dental caries in this health board. The lowest mean DMFT for both males and females is shown by the EHB, which has a higher-than-average proportion of DMFT due to the FT (or treated) component. Table 85 shows statistically significant reductions at the 95% level in the mean DMFT of older females between the two surveys. Older males had a significant reduction in the proportion of DMFT attributable to the DT component.

Table 86 presents the DMFT index according to medical card status. Because exposure to fluoride (i.e. fluoridated water and tooth paste) tends to have the greatest preventive effect on anterior teeth, the caries experience attributable to the anterior (front) teeth is also shown.

The statistical significance of changes over time is tested using the *t*-test. At the national level, the DMFT index score decreased significantly between the surveys. Among older people, approximately one third of total mean DMFT is attributable to anterior teeth. The portion of DMFT attributable to anterior teeth declined between 1989-90 and 2000-2. This may be due to the effects of water fluoridation and fluoride toothpaste, which have the greatest impact on smooth surface caries. All four health boards had a mean DMFT above the national average for both medical and non-medical card holders.

Table 86 Mean number of Decayed, Missing, and Filled Teeth (DMFT) and DMFT in Anterior Teeth (antDMFT) in subjects aged 65+ by medical card status (Percentage of total DMFT attributable to anterior DMFT in brackets)
Base: Dentate and Edentulous

	Yes MC		No MC	
	DMFT	antDMFT	DMFT	antDMFT
National 2000/'02	26.65	8.47 (32%)	24.2	6.96 (29%)
National 1989/'90	28.26	9.48 (34%)	26.2	7.76 (30%)
	t = -3.1920*	t = -3.0458*	t = -3.7523*	t = -2.0866*
ERHA 2000/'02	27.58	8.87 (32%)	24.63	7.30 (30%)
MWHB 2000/'02	27.85	9.10 (33%)	26.08	7.73 (30%)
NEHB 2000/'02	26.94	8.56 (32%)	25.01	6.93 (28%)
SHB 2000/'02	26.98	8.80 (33%)	25.03	7.40 (30%)

Note 1: All missing teeth are included in DMFT scores with edentulous subjects given a score of 32 missing teeth.

*Note 2: * Statistically significant at 95% level based on t-test for the difference between two means, from independent samples.*

Another approach to estimating treatment need is to use the DMFS (surface) score as a measure of treated and untreated caries. Table 87 presents the mean DMFS for those aged 65 and over by gender and medical card status. Table 87 largely supplements and supports the DMFT results in Table 86. Medical card holders generally have higher DMFS scores than non-medical card holders.

Table 87 Mean number of Decayed, Missing, and Filled Surfaces (DMFS) in subjects aged 65+ by gender and medical card status (Standard Deviations in Brackets)
Base: Dentate and Edentulous

	Yes MC		No MC	
	Male	Female	Male	Female
National 2000/'02	75.72 (24.02)	81.27 (20.20)	67.90 (24.31)	75.73 (20.23)
National 1989/'90	103.63 (45.78)	125.80 (37.76)	82.41 (35.22)	103.77 (41.60)
	t = -4.393*	t = -10.296*	t = -2.795*	t = -4.631*
EHB 2000/'02	76.42 (22.76)	84.04 (17.80)	66.60 (26.18)	74.92 (22.14)
MWHB 2000/'02	81.72 (22.44)	84.02 (16.81)	71.41 (21.61)	79.21 (15.47)
NEHB 2000/'02	72.65 (28.33)	85.05 (15.43)	72.00 (21.55)	75.68 (20.56)
SHB 2000/'02	73.17 (25.40)	82.38 (20.64)	69.57 (25.77)	77.61 (20.81)
	f = 1.371	f = 0.268	f = 0.473	f = 0.382

*Note 1: * Statistically significant at 95% level based on t-test for the difference between two means from independent samples.*

*Note 2: ** Statistically significant based on f-test for the Analysis of Variance.*

Females had a tendency to have higher DMFS scores than males. At health board level, the ERHA had below-average levels of DMFS for non-medical card holders. Both the DMFT (Table 86) and DMFS (Table 87) indices provide evidence of declining levels of dental caries between 1989-90 and 2000-2. This decline is also evident in international studies (Grytten, *et al.*, 1990; Sintonen & Maljanen, 1995a, b). The statistical significance of differences between the means for the sample health boards is assessed using the F-test for analysis of variance (ANOVA). None of the differences between health boards were statistically significant.

3.1.5. Estimates of Need for Periodontal Treatment

There are different methods of presenting CPITN data. In Table 88, the mean number of sextants affected by codes H (Healthy), B (Bleeding), C (Calculus), P₁ (Shallow pocketing) and P₂ (Deep pocketing) as a maximum score are presented. The mean number of sextants per dentate older medical card holder affected by the different codes indicates the extent of the various conditions recorded. The mean number of sextants given a score of healthy (H) was highest amongst non-medical card holders.

Table 88 Mean number of sextants/person affected by different CPITN codes of: H (healthy), B (bleeding), C (calculus), P₁ (shallow pocketing), P₂ (deep pocketing) or X (all sextants excluded) in subjects aged 65+ by medical card status and health board

Base=Dentate

	H		B		C		P ₁		P ₂		X	
	MC	No MC	MC	No MC	MC	No MC	MC	No MC	MC	No MC	MC	No MC
National 2000/'02	0.64	0.98	0.24	0.22	0.89	1.18	0.94	1.33	0.19	0.15	3.01	2.05
National 1989/'90	0.50	0.80	0.20	0.20	1.70	2.00	0.30	0.20	0.10	0.00	2.80	2.30
EHB 2000/'02	0.30	0.70	0.12	0.23	0.65	0.69	1.51	2.07	0.26	0.17	3.15	2.10
MWHB 2000/'02	0.41	1.04	0.15	0.04	1.14	1.52	0.56	0.51	0.09	0.04	3.44	2.85
NEHB 2000/'02	0.57	1.15	0.03	0.32	1.29	1.38	0.70	0.74	0.28	0.33	3.02	2.08
SHB 2000/'02	0.82	1.34	0.57	0.34	0.97	1.41	0.69	0.72	0.05	0.09	2.90	2.09

Table 88 shows that the mean number of sextants given a maximum score of bleeding (B) was similar in those with and without a medical card. The mean number of sextants given a maximum score of shallow pocketing (P₁) was greater for older people without a medical card. The mean number of sextants given a maximum score of deep pocketing (P₂) was greater for those in possession of a medical card.

The mean number of sextants which could not be scored because of lack of teeth (X) was higher amongst medical card holders than amongst those who did not possess a medical card. This result follows from the data on the number of natural teeth present (Table 83), which showed that medical card holders have fewer teeth present than non-medical card holders. At health board level, the mean number of excluded sextants was highest in the MWHB.

Healthy sextants for both medical card holders and non-medical card holders increased between the two surveys. Bleeding sextants and Pocketing also increased between the two surveys.

3.1.6. Previously Received Treatments

The purpose of this section is to quantify the levels and types of previously received treatment, and to compare the extent of treatments received with those from the 1989-90 survey. Table 89 presents previously received treatments by eligibility status. For each subject, clinicians determined the mean number of teeth that had previously received treatment at the time of examination.

The statistical significance of changes over time is tested, using the *t*-test for the difference between two means with independent samples. The statistical significance of differences within eligibility groups is assessed using the F-test for analysis of variance (ANOVA).

Table 89 Mean number of teeth that had previously received treatment at the time of examination in subjects aged 65+ by treatment type and eligibility status (Standard errors in brackets)

Base: Dentate and Edentulous

		Extractions	Fillings	Teeth replaced by bridge	Crowns	Total Treatment
National 2000'02	None	13.50 (0.80)*	5.70 (0.47)*	0.16 (0.09)*	0.88 (0.29)*	20.20 (0.65)*
	PRSI	13.00 (1.60)*	6.00 (0.69)	0.00 (0.00)	0.28 (0.15)*	19.20 (1.16)*
	MC	17.20 (0.72)*	3.90 (0.36)*	0.06 (0.03)*	0.17 (0.04)*	21.40 (0.54)*
National 1989'90	None	22.20 (9.45)*	3.10 (5.00)*	0.00 (0.00)*	0.20 (0.74)*	25.60 (6.20)*
	PRSI	19.80 (8.79)*	5.80 (6.42)	0.00 (0.00)	0.00 (0.00)*	25.60 (4.86)*
	MC	26.70 (7.89)*	1.00 (3.04)*	0.00 (0.00)*	0.03 (0.27)*	27.70 (6.83)*

Note1: None – no cover/private payment, fee per item of service; PRSI – eligible for pay-related Social Welfare Dental Benefit; MC – medical card holders eligible for health board dental services.

The mean number of teeth which had previously received any treatment did not vary considerably by eligibility status. It is notable that medical card holders received more extractions and fewer fillings than either those with PRSI dental benefit or those with no eligibility. Those in receipt of dental services through the PRSI scheme had the least number of teeth extracted and the most fillings: The mean number of teeth extracted for the 'None', 'PRSI', and 'MC' groups were 13.5, 13.0 and 17.2, respectively; and the mean number of fillings 5.7, 6.0, and 3.9, respectively.

A comparison between the surveys revealed a statistically significant reduction in the mean number of all treatments received and in the mean number of extractions received. The mean number of teeth extracted for medical card holders declined from 26.7 to 17.2 for those aged 65+. This represents an important change in treatment patterns, which will impact on demand for future services. All eligibility groups had significant increases in the number of crowns previously received.

For those eligible for private services only, the mean number of teeth filled increased from 3.1 to 5.7. There was a significant increase in the mean number of fillings received by medical card holders, from 1.0 to 3.9. An F-test was used to test for differences between the means according to eligibility status and revealed all differences to be statistically significant.

3.1.7. Using Survey Results to Assess *The Dental Health Action Plan*

In this section, the results of the NSAOH 2000-2 are used to assess the oral health outcomes of the DHAP and the DTSS in terms of their objectives. The DTSS for adult medical card holders was established in 1994, aiming '*to achieve the oral health goals agreed for adults*' in the DHAP (Dept. of Health & Children, 1994). A further objective for the DTSS was '*to improve the oral health of adult medical card holders, and thereby reduce the equity gap between this population group and the population as a whole ...*'.

One objective of the DHAP was that no more than 42% of people aged 65 and over would have no natural teeth. Table 90 presents an assessment of this objective. To test the significance of the target objective against the observed value, the χ^2 test is used to test that there is no difference between the two distributions. The survey established that the target oral health outcomes set by the DHAP were met by 2000 for the older population in general, but not for the sub-group of the population with medical cards.

Table 90 Assessing DHAP (1994) target of no more than 42% edentulous using NSAOH 2000/02 results

	% Edentulous in NSAOH 2000/02	Target Met	χ^2
General Population aged 65+	41.60%	Yes	0.000038
Medical card holders aged 65+	46.50%	No	0.004355

Note 1: A χ^2 test showed no significant difference between the target number of teeth present and the actual number of teeth present for both medical card holders and the population in general.

Note 2: When a χ^2 test was performed for all medical card holders ($\chi^2 = 0.011516$) and the population in general ($\chi^2 = 0.005859$), it was found that there is no significant difference between the target number of teeth present and the actual number of teeth present for both groups.

In relation to the targets for narrowing the equity gap in terms of need between medical card holders and other groups, the DTSS had varying degrees of success. Table 91 shows that for total tooth loss (% edentulous) and mean number of teeth present, the gap between medical card holders and non-medical card holders has narrowed. The number of teeth requiring any treatment increased for all groups, and the gap between medical card holders and non-medical card holders widened between the surveys. The gap in denture requirements narrowed while the gap in mean DMFT widened.

Table 91 Change in the gap between medical card holders and non-medical card holders between NSAOH 1989/90 and NSAOH 2000/02

	Gap in				
	% Edentulous	Mean Number of Teeth Present	Mean No.Teeth Requiring any Treatment	% Requiring Denture Treatment	Mean DMFT
NSAOH 1989/90	30.2%	7.0	No Gap	35.0%	2.4
NSAOH 2000/02	17.1%	3.7	2.9	23.8%	2.6
	Gap Narrowed	Gap Narrowed	Gap Widened	Gap Narrowed	Gap Widened

The DHAP objective to reduce the equity gap between medical card holders and other groups has, in the main, not been met. As in 1989-90, medical card holders generally had the greatest levels of unmet need, with the gap widening in some instances between this population group and those with other types of dental benefit eligibility.

3.2. Multivariate Determinants of Treatment Need

To empirically determine the factors influencing the treatment needs of the Irish people aged 65+, three measures of treatment need are analysed:

- Number of older people with a clinically determined need for any dental treatment;
- Number of older people with a clinically determined need for dentures; and
- Number of older people with a clinically determined CPITN score of three or greater.

3.2.1. Methods

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 has been to use a dichotomous (need versus zero need) measure of treatment needs as the dependent, or outcome, variable (Pienihäkkinen & Jokela, 2002; Bachelor & Sheiham, 2002; Hausen, *et al.*, 2001; Kavanagh, 1994; DePaola, 1990; Stamm, *et al.*, 1988).

The distribution of treatment needs can be dichotomised into “need” and “zero need”. One can model the dependent variable $P(\text{treatment need})$, $P(\text{treatment need})/P(\text{zero treatment need})$, or logit $P(\text{treatment need})$ as a function of socio-economic, demographic and behavioural factors (Kingman, 1990). With logistic regression, one models the $P(D|X)$ – more specifically logit $P(D|X)$ – where X is the joint set of values for the explanatory variables, and D is a dichotomised version of the treatment needs variable ($D = 1$ for subjects with treatment needs, $D = 0$ for subjects with zero need).

The logistic regression procedure produces estimates of the parameters in the model that can be expressed as odds ratios: simple odds ratios for individual variables, or products of odds ratios for groups of variables. The odds ratios represent the relative odds of being in the treatment needs group. A likelihood ratio test provides a perspective between the logistic regression and the diagnostic test for goodness of fit of the model.

3.2.2. Data

The treatment need data for this analysis is based on the detailed clinical oral examinations of the National Survey of Adult Oral Health (NSAOH) carried out between October 2000 and June 2002 (Whelton, *et al.*, 2007). One of the aims of this national survey was to estimate the need for dental treatment amongst adults, including older people, according to eligibility for dental services.

Because the epidemiological assessment of tooth surface condition does not equate with a routine clinical diagnostic examination, the examining dentist records separately his/her opinion of treatment need, based on his/her 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 clinicians reasonably reflect subjects' treatment needs, as perceived by a group of practicing dentists. In deciding on the required treatment, the crown of the tooth was examined and treatment required recorded. This was followed by an examination for root caries, after which the appropriate treatment of the root was determined.

Table 92 presents the main variables used in this analysis of older people's treatment needs.

Table 92 Description of Variables on the Treatment Needs of the Elderly

Base: Dentate and Edentulous

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, 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

3.2.2.1. Dependent Variables

Three measures of treatment need are used 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 representing a need for periodontal treatment. Those with CPITN scores of less than three are deemed to have zero need for periodontal treatment.

Table 93 presents summary statistics for these three measures of treatment need.

Table 93 Summary Statistics of the Dependent Variables

	Obs	Mean	StdDev	Min	Max
tneed	714	0.791	0.407	0	1
dentneed	714	0.468	0.499	0	1
perioneed	714	0.240	0.427	0	1

Table 93 shows that 79% of those aged 65+ had a clinical need for dental treatment, and 47% of those examined required denture treatment. Twenty-four per cent of the older subjects had a CPITN score of greater than or equal to 3, indicating a need for periodontal treatment.

3.2.2.2. Explanatory Variables

Table 94 presents summary statistics of the explanatory variables. It shows that the older participants in this study ranged from 65 to 95 years, with a mean age of 71.72. Sixty-five per cent were in possession of a medical card, 12% had third level education, and 34% had primary level education only. In the sample, 16% of older people were smokers, and 24% were regular users of dental services.

Table 94 Summary Statistics of the Explanatory Variables

	Obs	Mean	StdDev	Min	Max
Age	714	71.720	5.840	65	95
Female	714	0.536	0.499	0	1
Medical Card	714	0.653	0.476	0	1
Third Level	714	0.123	0.328	0	1
Unemployed	714	0.062	0.241	0	1
Primary Education only	714	0.343	0.475	0	1
Smoker	714	0.163	0.370	0	1
Frequent Snacks	714	0.141	0.348	0	1
Regular Brusher	714	0.275	0.447	0	1
Regular User	714	0.244	0.430	0	1
Fear of dentist	714	0.045	0.207	0	1
Part-Fluoride	714	0.395	0.489	0	1
Full-Fluoride	714	0.336	0.473	0	1
ERHA	714	0.208	0.406	0	1
MHB	714	0.053	0.224	0	1
MWHB	714	0.171	0.377	0	1
NEHB	714	0.144	0.351	0	1
NWHB	714	0.043	0.204	0	1
SEHB	714	0.072	0.259	0	1
SHB	714	0.181	0.385	0	1
WHB	714	0.069	0.253	0	1

3.2.3. Results

This section presents the results of the logistic regression for any dental treatment need, denture treatment need, and periodontal treatment need for older people. The results of the logistic regression for any treatment need are presented in Table 95. Based on the count R^2 , the proportion of correct predictions by the logistic model of any treatment need is approximately 77%.

Table 95 Results of the Logistic Regression for Treatment Need

Variable	Coefficient	Std. Error	z	P z
Age	0.0021	0.0179	0.12	0.907
Female	-0.3355	0.2042	-1.64	0.100
Medical Card	-0.0885	0.2211	-0.40	0.689
Third Level	0.0326	0.2838	0.11	0.909
Unemployed	0.4570	0.4512	1.01	0.311
Primary Education only	0.6446	0.2395	2.69	0.007
Smoker	0.3444	0.2991	1.15	0.249
Frequent Snacks	-0.4165	0.2530	-1.65	0.100
Regular Brusher	-0.3245	0.2313	-1.40	0.161
Regular User	-0.3928	0.2408	-1.63	0.103
Fear of dentist	0.2425	0.5320	0.46	0.648
Part-Fluoride	-0.3955	0.2962	-1.34	0.182
Full-Fluoride	-0.3302	0.3180	-1.04	0.299
ERHA	1.1172	0.2944	3.79	0.000
MHB	1.7700	0.6440	2.75	0.006
MWHB	0.4337	0.2916	1.49	0.137
NEHB	1.5072	0.3781	3.99	0.000
NWHB	1.1924	0.5891	2.02	0.043
SEHB	1.0309	0.4007	2.57	0.010
SHB		Reference Health Board		
WHB	0.6455	0.3966	1.63	0.104
No. of Obs.	714			
LR c^2 (20)	73.48			
Prob > c^2	0.0000			
Pseudo R^2	0.0994			
Count R^2	0.768			

Having primary education only has a significant positive effect on the probability of having a need for any dental treatment. Being female has a significant negative effect on the probability of having a need for any dental treatment. This may be due to the fact that women frequent the dentist more often than men, thus reducing their need for care (Woods, 2005). Being a regular user significantly reduces the odds of need for any dental treatment. Relative to the SHB, residing in the remaining 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 older people in the SHB region (Woods, 2005). In the MWHB and WHB, the positive effect is not statistically significant.

The results of the logistic regression for need for denture treatment are presented in Table 96. The proportion of correct predictions by the logistic model for denture treatment need is approximately 65%.

Being female or a regular user of dental services has a significant negative effect on the probability of having a need for denture treatment. Having primary education only and smoking significantly increase the odds of having a need for denture treatment. Relative to the SHB, residing in the MHB significantly increases the odds of having a denture treatment need.

The results of the logistic regression for need for periodontal treatment are presented in Table 97. The proportion of correct predictions by the logistic model for need for periodontal treatment is approximately 80%.

Table 97 Results of the Logistic Regression for Periodontal Treatment Need

Variable	Coefficient	Std. Error	z	P> z
Age	0.0007	0.0190	0.04	0.969
Female	-0.5830	0.2119	-2.75	0.006
Medical Card	-0.2834	0.2221	-1.28	0.202
Third Level	-0.1614	0.3061	-0.53	0.598
Unemployed	-0.3184	0.4096	-0.78	0.437
Primary Education only	-0.1068	0.2379	-0.45	0.653
Smoker	-0.4969	0.3039	-1.64	0.102
Frequent Snacks	1.1774	0.2482	4.74	0.000
Regular Brusher	0.9928	0.2282	4.35	0.000
Regular User	1.0518	0.2316	4.54	0.000
Fear of dentist	0.8300	0.4671	1.78	0.076
Part-Fluoride	0.2308	0.2935	0.79	0.432
Full-Fluoride	-0.1056	0.3306	-0.32	0.749
ERHA	0.9319	0.3215	2.90	0.004
MHB	1.3227	0.4482	2.95	0.003
MWHB	-0.3506	0.3800	-0.92	0.356
NEHB	0.5192	0.3653	1.42	0.155
NWHB	-0.3954	0.6468	-0.61	0.541
SEHB	0.3698	0.4386	0.84	0.399
SHB		Reference Health Board		
WHB	0.5124	0.4203	1.22	0.223
No. of Obs.	714			
LR χ^2 (20)	150.68			
Prob > χ^2	0.0000			
Pseudo R^2	0.1912			
Count R^2	0.801			

Being female and smoking both have significant negative effects on the probability of having a need for periodontal treatment. Having frequent snacks, being a regular brusher, a regular user of periodontal dental services, and fear of the dentist all significantly increase the odds of need for periodontal dental treatment. Relative to the SHB, residing in the ERHA or MHB significantly increases the odds of having periodontal treatment need.

3.3. Comparing DTSS Utilisation with Need

An empirical investigation is undertaken in this section, both descriptively and econometrically, to compare the treatment provided to low-income older people eligible for treatment via the Dental Treatment Services Scheme (DTSS), with their treatment needs as assessed by the National Survey of Adult Oral Health (NSAOH) 2000-2 (Whelton, *et al.*, 2007).

The rationale for the investigation is twofold. Firstly, the comparison will determine the extent to which the utilisation of oral health services is aligned with treatment need. The egalitarian principle of distributing health care according to need has wide appeal for policy makers and has been adapted in the Irish Health Strategy (Dept. of Health & Children, 2001), which states, “*medical card holders will be entitled to receive services free of charge within the shortest possible timeframe in accordance with need*”. The identification of gaps between estimated need and service provision, and the direction, location, and magnitudes of these gaps, constitute the main focus of this chapter. If need is greater than oral health services provided, this unmet need requires identification. The identification of unmet need within the population will inform planners and budget providers so that resources can be put in place to meet that need.

Secondly, the comparison will provide greater understanding of the extent to which patients and providers react to economic incentives. Recalling that where dental services are provided at zero monetary cost to the patient, as in the DTSS, there may be an incentive for patients to over-consume. Similarly, in a fee-per-item type of remuneration system such as the DTSS, the dentist may act economically and over-provide services when they know that the patient does not incur any monetary cost. If there is evidence of over-consumption and/or over-provision of services for particular treatments, or in certain groups or regions, then resources should be diverted from areas of excess provision to groups with greatest need. Schonfeld (1981) argues that gaps between treatment needs and treatment provided may indicate a need for additional manpower, an increase in productivity of existing manpower, or a change in the system of delivery of dental care.

The theories of justice most frequently encountered in the literature of medical care provision are the libertarian and egalitarian viewpoints. The libertarian viewpoint suggests that a mainly privately financed system should predominate, with health care being rationed primarily according to willingness (and ability) to pay. The egalitarian principle suggests that a publicly financed system should prevail, with health care distributed in accordance with “need”, and financed according to “ability to pay”. When the allocations of health services are provided according to need, resources are consumed both efficiently and equitably. Most studies of equity in the delivery of health care – in both Europe and the United States – start with the premise that health care ought to be distributed according to need rather than willingness and ability to pay (Wagstaff & van Doorslaer, 2000).

Andersen (1975) suggests that an equitable distribution of health care is one in which the amount of health care received correlates highly with indicators of need, and is independent of variables (such as income) which are irrelevant to need. Le Grand (1978) states that the receipt of health care should depend on need, and not on socio-economic status. In the Irish context, the relationship between utilisation and need, in general health care, has been the subject of some research (Layte & Nolan, 2003; Nolan, *et al.*, 1992; Nolan, 1991; Tussing, 1985). However, it has been the subject of little research in the context of oral health care in Ireland. The main reason for the scarcity of analyses has been the lack of available data to assess the relationship. However, the establishment of the GMS (Payments) Board database on service provision, following the introduction of the DTSS, combined with the availability of treatment needs data from national surveys, provided a unique opportunity to assess the utilisation / need relationship in oral health.

A distinctive contribution of this assessment is that the data on services provision is from a third party payments system database, whereas generally oral health services provided are assessed by follow-up studies (Ugur & Gaengler, 2002; Sivanewaran, *et al.*, 1999; Reiger, *et al.*, 1999; Kavanagh, 1994; McLoughlin, 1990; Nuttall & Davies, 1988). The limitation of the follow-up study approach is that it is often difficult to re-establish contact with the initial survey sample. A study in Finland by Hausen, *et al.* (2001) compared public health records with data based on examinations by trained examiners, and their results suggest that data collected from public health records were not decisively inferior.

3.3.1. Descriptive Assessment of Need / Utilisation Relationship

Based on the findings of the NSAOH 2000-2 and on the treatment provided to medical card holders in the DTSS from October 2000 to June 2002 (the period of the survey), a descriptive assessment of the relationship between estimated needs is presented here. The mean service provision to medical card holders is compared to mean estimated needs for the main oral health services, such as extractions, fillings, dentures/prosthetics, periodontal, other, and all treatments. Any misalignment between need and service provision will identify either sub-groups or regions with unmet need, or areas of excess provision.

From a dental perspective, medical card patients are not entirely homogenous and are generally disaggregated into the following sub-groups:

- (1) users and non-users of the DTSS-base, dentate and edentulous (Table 98);
- (2) those who used the DTSS during the survey period, dentate and edentulous (Table 99);
- (3) dentate DTSS users only (Table 100);
- (4) regular dentate DTSS users³ (Table 101); and
- (5) non-regular dentate DTSS users⁴ (Table 102).

To get a broad overview, it is useful to compare utilisation and need across these sub-groups of medical card holders.

³ A regular user is defined in the national survey as "a subject who attended the dentist at least once over the last two years" (Beirne, 2003).

⁴ A non-regular user is defined in the national survey as "a subject who has not attended the dentist at least once over the last two years" (Beirne, 2003).

3.2.2. Comparing Need with Service Provision: All Medical Card Holders

The comparison between utilisation and need commences at the broadest level of aggregation: all medical card holders (dentate and edentulous), including both users and non-users of the DTSS (Table 98). Variations between need and service provision are compared across groups by gender, treatment type, and health board area.

Table 98 Mean number of estimated treatment needs versus treatments provided to DTSS users and non-users aged 65+ by treatment type and gender, October 2000 to June 2002

Base=Dentate and Edentulous Medical Card Holders

	Extractions		Amalgams / Composite Fillings		Dentures / Prosthetics		Other Treatment		All Treatment	
	Estimated	Provided	Estimated	Provided	Estimated	Provided	Estimated	Provided	Estimated	Provided
Male	1.66*	0.13	0.66*	0.17	0.65*	0.10	3.91*	0.31	6.88*	0.71
	(0.30)	(0.81)	(0.11)	(0.98)	(0.30)	(0.37)	(0.59)	(0.12)	(0.61)	(2.30)
Female	0.97*	0.06	0.57*	0.12	0.54*	0.10	2.20*	0.27	4.28*	0.55
	(0.19)	(0.49)	(0.08)	(0.78)	(0.24)	(0.36)	(0.46)	(0.10)	(0.47)	(1.89)
All	1.20*	0.09	0.60*	0.14	0.58*	0.10	2.90*	0.29	5.28*	0.62
	(0.25)	(0.64)	(0.10)	(0.87)	(0.25)	(0.36)	(0.53)	(0.11)	(0.54)	(2.06)

Note1: The Other Treatment category is a combination of Advanced Restorations (endodontics, crowns, bridges, veneers, periodontal) and Other (polishing of margins, repair of fillings, fissure sealing and treatment of sensitive teeth).

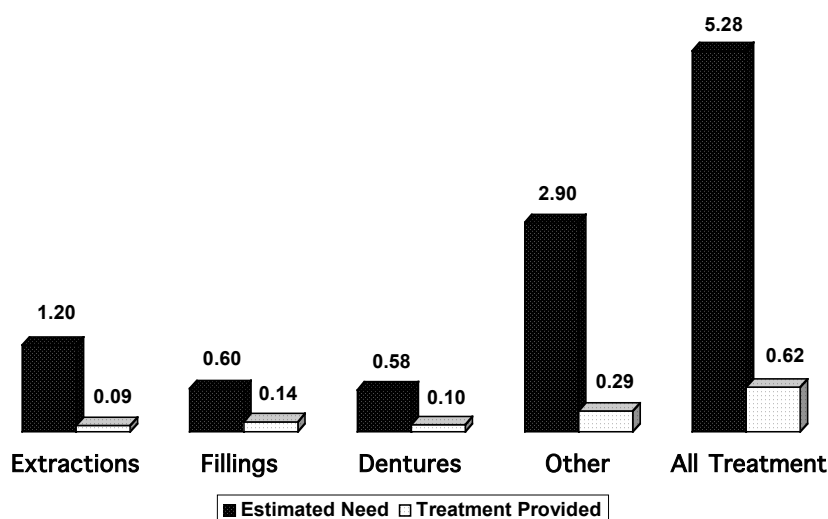
Note2: Data on treatment needs based on NSAOH 2000/02; data on treatment provided based on utilisation data provided by GMS (Payments) Board.

*Note3: * Difference between predicted treatment need and treatment provided is statistically significant at the 95% level of significance (Standard Deviations in parenthesis).*

Note 4: The methodological differences between the clinical examination and what happens in practice should result in an under-estimation of need and may account for the difference in instances where service provision is in excess of need estimated by the survey.

The comparisons indicate levels of unmet need; males have a greater estimated need. Figure 8 presents a breakdown of estimated need and treatment provided.

Figure 8 Comparing mean treatment needed with mean treatment provided to DTSS users and non-users aged 65+ by treatment type, June 2000 to October 2002



For those aged 65 and over, the mean estimated need for extraction was 1.20 per person, compared with a DTSS provision of 0.09 per eligible person. The mean estimated need for fillings was estimated at 0.60 per person, compared to a provision of 0.14. Their mean dentures/prosthetics need was

estimated at 0.58 per person, compared with a DTSS provision of 0.10. The gap between estimated need and service provision overall is large (4.66), particularly in the 'Other Treatment' category (2.61) which includes bridges, crowns and root canals. These services are not provided by the DTSS, which might explain the wide gap for those aged 65 and over. The main component of unmet need for this age group is in the 'Other Treatment' category.

3.3.3. Comparing Need with Service Provision: DTSS Users Only

In this section, the estimated needs, based on the survey, are compared with the patterns of utilisation of those medical card holders for whom there was a DTSS claim for dental treatment during the period of the national survey (Table 99). This comparison may determine whether a different relationship between utilisation and need exists for those subjects who actually made a dental visit.

Table 99 Mean number of estimated treatment needs versus treatments provided to DTSS users aged 65+ (based on the 20% who use scheme) by treatment type and gender, October 2000 to June 2002

Base=Dentate and Edentulous Medical Card Holders

	Extractions		Amalgams / Composite Fillings		Dentures / Prosthetics		Other Treatment		All Treatment	
	Estimated	Provided	Estimated	Provided	Estimated	Provided	Estimated	Provided	Estimated	Provided
Male	1.66* (0.30)	0.88 (1.99)	0.66* (0.11)	1.17 (2.37)	0.65 (0.30)	0.69 (0.73)	3.91* (0.59)	2.25 (0.30)	6.88* (0.61)	4.99 (4.01)
Female	0.97* (0.19)	0.47 (1.30)	0.57* (0.08)	0.94 (1.99)	0.54* (0.24)	0.75 (0.71)	2.20* (0.46)	2.11 (0.28)	4.28 (0.47)	4.27 (3.40)
All	1.20* (0.25)	0.64 (1.64)	0.60* (0.10)	1.03 (2.16)	0.58* (0.25)	0.73 (0.72)	2.90* (0.53)	2.17 (0.29)	5.28* (0.54)	4.57 (3.68)

Note 1: The Other Treatment category is a combination of Advanced Restorations (endodontics, crowns, bridges, veneers, periodontal) and Other (polishing of margins, repair of fillings, fissure sealing and treatment of sensitive teeth).

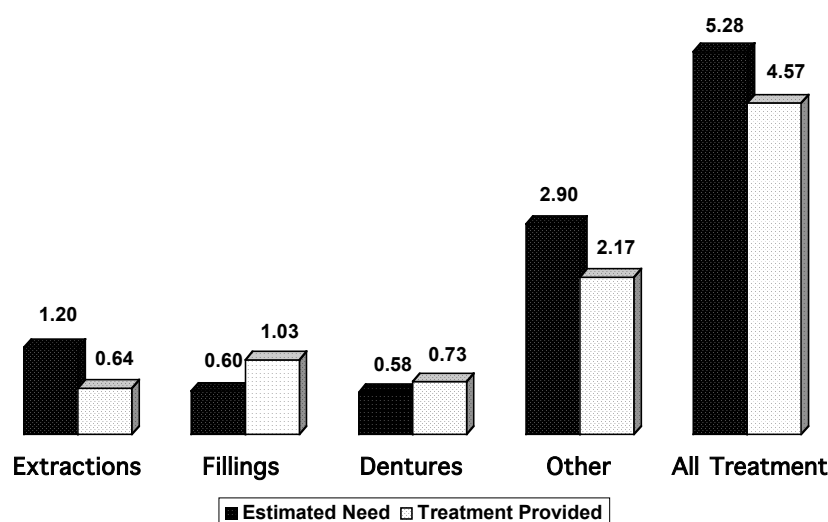
Note 2: Data on treatment needs based on NSAOH 2000/02; data on treatment provided based on utilisation data provided by GMS (Payments) Board.

*Note 3: * Difference between predicted treatment need and treatment provided is statistically significant at the 95% level of significance (Standard Deviations in parenthesis).*

Note 4: The methodological differences between the clinical examination and what happens in practice should result in an under-estimation of need and may account for the difference in instances where service provision is in excess of need estimated by the survey.

For those aged 65 and over, the provision for fillings and dentures/prosthetics was greater than estimated needs. Figure 9 compares treatment needed with treatment provided, by treatment type, for all DTSS users. The unmet need amongst those aged 65 and over is largely accounted for by extractions and services in the 'Other Treatment' category.

It would appear that once an eligible DTSS person makes a dental visit, the nature of the relationship between utilisation and need changes when compared with the relationship between utilisation and need of both users and non-users.

Figure 9 Comparing mean treatment needed with mean treatment provided to DTSS users aged 65+ by treatment type, June 2000 to October 2002

3.3.4. Comparing Need with Service Provision: Dentate DTSS Users

From a dental perspective, the relationship between utilisation and need of medical card holders might be expected to be different for dentate patients, when compared to data on both dentate and edentulous subjects. Table 100 compares the need and service provision for dentate subjects.

Dentate subjects aged 65 and over have a mean estimated need for any treatment of 8.80 (Table 100), whereas the mean for dentate and edentulous subjects was 5.28 (Table 98).

Table 100 Mean number of estimated treatment needs versus treatments provided to dentate DTSS users aged 65+ by treatment type and gender, October 2000 to June 2002
Base=Dentate Medical Card Holders

	Extractions		Amalgams / Composite Fillings		Other Treatment		Any Treatment	
	Estimated	Provided	Estimated	Provided	Estimated	Provided	Estimated	Provided
Male	2.83*	0.13	1.11*	0.17	6.64*	0.41	10.58*	0.71
	(0.50)	(0.81)	(0.17)	(0.98)	(0.92)	(0.12)	(0.92)	(2.30)
Female	1.93*	0.06	1.14*	0.12	4.40*	0.37	7.47*	0.55
	(0.38)	(0.49)	(0.15)	(0.78)	(0.90)	(0.10)	(0.93)	(1.89)
All	2.30*	0.09	1.10*	0.14	5.40*	0.39	8.80*	0.62
	(0.44)	(0.64)	(0.16)	(0.87)	(0.91)	(0.11)	(0.93)	(2.06)

Note 1: The Other Treatment category is a combination of Advanced Restorations (endodontics, crowns, bridges, veneers, periodontal) and Other (polishing of margins, repair of fillings, fissure sealing and treatment of sensitive teeth).

Note 2: Data on treatment needs based on NSAOH 2000/02; data on treatment provided based on utilisation data provided by GMS (Payments) Board.

*Note 3: * Difference between predicted treatment need and treatment provided is statistically significant at the 95% level of significance (Standard Deviations in parenthesis).*

Note 4: The methodological differences between the clinical examination and what happens in practice should result in an under-estimation of need and may account for the difference in instances where service provision is in excess of need estimated by the survey.

3.3.5. Comparing Need with Service Provision: Dentate Regular / Non-regular DTSS Users

From a dental perspective, regular users⁵ of dental services may have different levels of estimated needs to non-regular users. This group may correspond best, in terms of their treatment needs, with those medical card holders who used the DTSS during the survey period. Table 101 compares the need of those defined as regular users with the oral health services provided to them during the survey period.

The provision of fillings exceeds that estimated as needed in the survey. For extractions and 'Other Treatments' (such as periodontal, bridges, crowns, etc.), estimated need was in excess⁶ of that provided. Need is much greater for subjects defined as non-regular users. For example, regular users aged 65 and over have a mean estimated need for any treatment of 11.69 (Table 101), whereas the mean for non-regular users is 18.35 (Table 102).

Table 101 Mean number of estimated treatment needs versus treatments provided to regular dentate DTSS users aged 65+ by treatment type and gender, October 2000 to June 2002

Base=Dentate Medical Card Holders

	Extractions		Amalgams / Composite Fillings		Other Treatment		Any Treatment	
	Estimated	Provided	Estimated	Provided	Estimated	Provided	Estimated	Provided
Male	4.22* (2.16)	0.88 (1.99)	0.56* (0.35)	1.17 (2.37)	9.22* (4.40)	2.94 (0.30)	14.00* (4.57)	4.99 (4.01)
Female	2.88* (1.07)	0.47 (1.30)	0.50* (0.26)	0.94 (1.99)	6.00* (2.13)	2.86 (0.28)	9.38* (2.08)	4.27 (3.40)
All	3.55* (1.62)	0.64 (1.64)	0.53* (0.31)	1.03 (2.16)	7.61* (3.27)	2.90 (0.29)	11.69* (3.33)	4.57 (3.68)

Note 1: The Other Treatment category is a combination of Advanced Restorations (endodontics, crowns, bridges, veneers, periodontal) and Other (polishing of margins, repair of fillings, fissure sealing and treatment of sensitive teeth).

Note 2: Data on treatment needs based on NSAOH 2000/02; data on treatment provided based on utilisation data provided by GMS (Payments) Board.

*Note 3: * Difference between predicted treatment need and treatment provided is statistically significant at the 95% level of significance (Standard Deviations in parenthesis).*

Note 4: The methodological differences between the clinical examination and what happens in practice should result in an under-estimation of need and may account for the difference in instances where service provision is in excess of need estimated by the survey.

⁵ In the national survey, regular user is defined as "a subject who attended the dentist at least once over the last two years." (Beirne, 2003) For utilisation, any medical card holder who used the DTSS during the survey period is therefore by definition a regular user.

⁶ 'Excess' is the extent to which DTSS service provision exceeds the need estimated by NSAOH 2000-02

Table 102 Mean number of estimated treatment needs versus treatments provided to non-regular dentate DTSS users aged 65+ by treatment type and gender, October 2000 to June 2002

Base=Dentate Medical Card Holders

	Extractions		Amalgams / Composite Fillings		Other Treatment		Any Treatment	
	Estimated	Provided	Estimated	Provided	Estimated	Provided	Estimated	Provided
Male	6.33* (1.72)	0.13 (0.81)	1.11* (0.42)	0.17 (0.98)	16.33* (3.40)	0.41 (0.12)	23.77* (3.54)	0.71 (2.30)
Female	3.08* (1.20)	0.06 (0.49)	0.67* (0.27)	0.12 (0.78)	9.17* (4.43)	0.37 (0.10)	12.92* (4.37)	0.55 (1.89)
All	4.71* (1.46)	0.09 (0.64)	0.89* (0.35)	0.14 (0.87)	12.75* (3.92)	0.39 (0.11)	18.35* (3.96)	0.62 (2.06)

Note 1: The Other Treatment category is a combination of Advanced Restorations

(endodontics, crowns, bridges, veneers, periodontal) and Other (polishing of margins, repair of fillings, fissure sealing and treatment of sensitive teeth).

Note 2: Data on treatment needs based on NSAOH 2000/02; data on treatment provided based on utilisation data provided by GMS (Payments) Board.

Note 3: * Difference between predicted treatment need and treatment provided is statistically significant at the 95% level of significance (Standard Deviations in parenthesis).

Note 4: The methodological differences between the clinical examination and what happens in practice should result in an under-estimation of need and may account for the difference in instances where service provision is in excess of need estimated by the survey.

3.3.6. Utilisation versus Need at Health Board Level: All Medical Card Holders

The assessment at health board level may identify any regional disparities, in terms of both need and service provision. The analysis is limited to the MWHB, NEHB, SEHB and the SHB, as the MCR data is available for these health boards only. Figure 10 presents the gap between utilisation and need at health board level for dentate and edentulous subjects. The gap between utilisation and need was calculated by subtracting the mean number of treatments provided during the survey period from the mean number of any treatment estimated as needed by the NSAOH 2000-2.

Figure 10 shows that, overall, estimated needs were significantly in excess of service provision for the four health boards examined. This is in line with national trends. The gap between need and utilisation was greatest in the SEHB (4.44), and lowest in the SHB (2.87).

Figure 10 Gap between utilisation and need at health board level for medical card holders aged 65+, June 2000 to October 2002

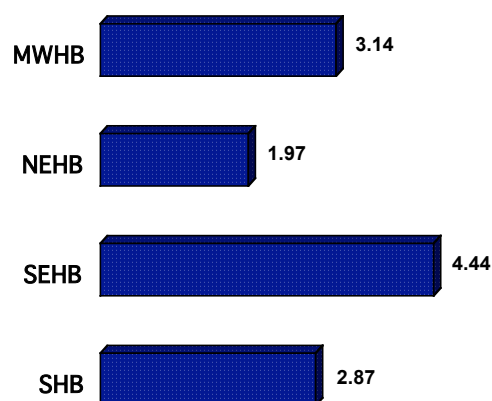


Figure 11 Gap between utilisation and need at health board level for dentate medical card holders aged 65+, June 2000 to October 2002

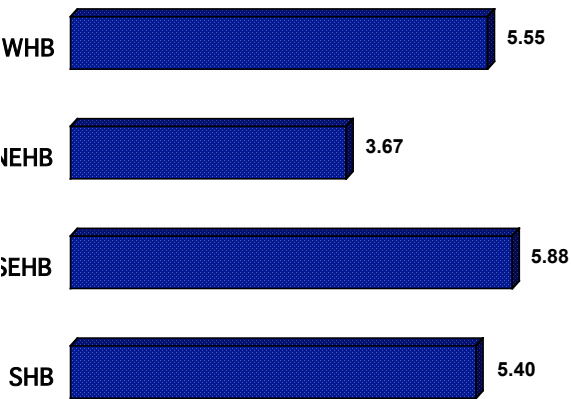


Figure 11 presents the gap between utilisation and need at health board level for dentate medical card holders. The SEHB had the greatest levels of unmet need (5.88), closely followed by the MWHB (5.55). The gap between utilisation and estimated needs was narrowest in the NEHB (3.67).

Figure 12 shows the relationship between utilisation and need for those defined as regular users. Figures 12 and 13 reveal a similar relationship between utilisation and need for regular and non-regular users, respectively. Both regular and non-regular users are characterised by unmet need. The greatest level of unmet need for regular users was in the SHB.

Figure 12 Gap between utilisation and need at health board level for regular dentate DTSS users aged 65+, June 2000 to October 2002

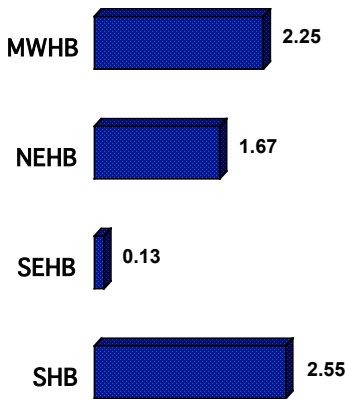


Figure 13 Gap between utilisation and need at health board level for non-regular dentate DTSS users aged 65+, June 2000 to October 2002

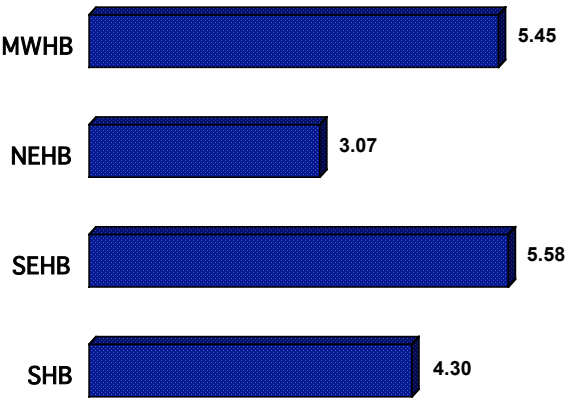


Figure 13 shows the relationship between utilisation and need for those defined as non-regular users. For non-regular users, there were significant levels of unmet need. The greatest unmet need exists for non-regular users in the SEHB (5.58).

Clearly, a wide variation exists between service provision and treatment needs at health board level, for all categories investigated.

3.3.7. Utilisation versus Need for Periodontal Treatment

Table 103 Mean estimated need for periodontal treatment* compared to mean protracted periodontal treatment provided for users and non-users of the DTSS aged 65+, October 2000 to June 2002

Base=Dentate

Mean Estimated Need	Mean Treatment Provided
0.19	0.01

*Note 1: *Mean estimated need for periodontal disease is for deep pockets only, i.e. pockets of 4-5mm and/or > 6mm.*

The periodontal service provision to those aged 65 and over, did not match their need for periodontal treatment (Table 104). The relationship between utilisation and need (periodontal) follows the same pattern as the need/utilisation for caries.

In Table 103, an assessment is carried out of the utilisation / need relationship for periodontal disease for both users and non-users of the DTSS during the period of the NSAOH 2000-2. The comparison of need with the provision of periodontal treatment largely follows the same pattern as caries. Unmet need was encountered amongst those aged 65 and over.

Table 104 Mean estimated need for periodontal treatment* for those defined as regular users of dental services compared to mean protracted periodontal treatment provided to users of the DTSS aged 65+, October 2000 to June 2002

Base=Dentate

Mean Estimated Need	Mean Treatment Provided
0.23	0.09

*Note 1: *Mean estimated need for periodontal disease is for deep pockets only, i.e. pockets of 4-5mm and/or > 6mm.*

3.3.8. Summary of Descriptive Analysis

There is a divergence in the relationship between utilisation and need amongst those aged 65 and over for each treatment type. There was significant unmet need for extractions, fillings, dentures, and periodontal treatment. When utilisation and need were compared, a wide variation was encountered at health board level.

4. Conclusions

- The oral health of older people has improved between 1989-90 and 2000-2.
- While the 2000 oral health goal for older people set by the *Dental Health Action Plan* in 1994 was achieved at the national level, it was not achieved for older females, nor for the socially disadvantaged, as represented by medical card holders.
- Older females tend to have poorer oral health than older males, though the gap between genders has lessened.
- Disparities in oral health between medical card holders and non-medical card holders are evident. This is despite the introduction of medical cards for all persons aged 70 or over in 2001, which reduced the likelihood of showing statistical differences between these groups.
- Older people classified as healthy generally have better oral health than those with systemic disease, supporting the proposed link between oral health and general health.
- Among older people with one or more natural teeth, 22% never visit the dentist and 25% visit only occasionally. Among older people with no natural teeth, 71% never visit the dentist and 20% visit only occasionally.
- The most common reason for infrequent dental attendance was the perception that there was 'No Need' to attend. Other reasons – such as not knowing a good dentist, distance to and accessibility of the dental clinic and time – were cited as reasons for not going to a dentist more frequently than either fear or cost.
- A very high proportion of older people examined in the NSAOH 2000-2 required dental treatment – 83.4%.
- Older medical card holders had the lowest average number of teeth, yet the greatest number of teeth requiring any treatment.
- Older people with PRSI benefits had the highest average number of teeth and the least number requiring any treatment.
- Among older people, there appears to be a very low rate of use of the DTSS. Only 9.5% of those eligible for treatment made a dental visit in 2001; only 20% of medical card holders surveyed in 2000-2 were regular DTSS users.
- Having only primary level education increases the likelihood of needing any dental treatment. Being female decreases the probability of needing any dental treatment (possibly due to the fact that women frequent the dentist more often than men). Being a regular user of dental services significantly reduces the odds of needing any dental treatment.

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