ORIGINAL ARTICLE

Oral health-related quality of life and associated factors in Norwegian adults

KARI ELISABETH DAHL[1], NINA J. WANG[2], IRENE SKAU[3] & KERSTIN ÖHRN[4]

[1]*Faculty of Dentistry, School of Dental Hygiene and Oral Health, University of Oslo, Oslo, Norway,* [2]*Faculty of Dentistry, Institute of Clinical Dentistry, Department of Pediatric Dentistry and Behavioural Science, University of Oslo, Oslo, Norway,* [3]*Faculty of Dentistry, Institute of Clinical Dentistry, Department of Community Dentistry, University of Oslo, Oslo, Norway, and* [4]*School of Health and Social Studies, Dalarna University, Falun, Sweden*

Abstract

Objective. To investigate associations between oral health-related quality of life assessed with the Oral Health Impact Profile (OHIP)-14 and demographic factors, number of teeth present, dental visits, dental health behaviour and self-rated oral health in a representative sample of 20–80-year-old Norwegians. ***Material and methods.*** The study was conducted in a stratified random sample of 3538 individuals. Questionnaires including questions on demographic factors, number of remaining teeth, dental visits, dental health behaviour, self-rated oral health and OHIP-14 were mailed to the sample. Bivariate and multivariate analyses were performed. ***Results.*** The response rate was 69%. The mean OHIP-14 score was 4.1 (standard deviation = 6.2). No problem was reported by 35% of the respondents. The most frequently reported problems were: physical pain (56%), psychological discomfort (39%) and psychological disability (30%). When the effect of all independent variables was analysed in multivariate analysis, self-rated oral health, frequency of dental visits, number of teeth, age and sex were significantly ($P < 0.05$) associated with the prevalence of having problems and frequent problems. Self-rated oral health had the strongest association with having problems [odds ratio (OR) 4.5; 95% confidence interval (CI) 3.4–6.0] and with having frequent problems (OR 4.0; 95% CI 2.7–5.8). Dental health behaviour, use of floss and toothpicks and oral rinsing were not associated with having problems related to oral quality of life in multivariate analyses. ***Conclusion.*** In this Norwegian adult sample, self-rated oral health, frequency of dental visits, number of teeth, age and sex were associated with having problems as estimated using the OHIP-14.

Key Words: *Epidemiology, Oral Health Impact Profile-14, self-rated oral health*

Introduction

Dental health has improved significantly among adults in Norway and the number of individuals who are completely edentulous has decreased [1–4]. However, there is a growing consensus that disease measured by professionals is conceptually and empirically not the same as illness/health self-assessed by individuals [5]. This suggests that besides the clinical signs of oral conditions, evaluations of functions and well-being should also be undertaken [6–8]. Health-related quality of life is a concept used in medicine and nursing to capture the impact of disease on individuals' daily lives. During recent decades, there has been, also

in dentistry, a growing interest in assessing people's experiences of oral health-related quality of life (OHR-QoL) [5,9]. OHRQoL is a multidimensional concept dealing with QoL related specifically to oral health and diseases. It includes people's perspectives of oral health and the possible impact of oral health on their everyday well-being [6,9–11].

One of the instruments frequently used to assess OHRQoL is the Oral Health Impact Profile (OHIP) questionnaire. OHIP-49, a 49-item questionnaire, was developed with the aim of providing a comprehensive measure of self-reported dysfunction, discomfort and disability, and impairment attributable to oral conditions [11]. The OHIP-14 is a shortened

Correspondence: Kari Elisabeth Dahl, Faculty of Dentistry, School of Dental Hygiene and Oral Health, University of Oslo, P.O. Box 1109, Blindern, N-0317 Oslo, Norway. Tel: +47 22 85 22 20. Fax: +47 2285223. E-mail: k.e.dahl@odont.uio.no

version of a scale which assesses seven dimensions of impacts of oral conditions on people's OHRQoL and has previously been tested and found to be valid, reliable and precise [5,8,12]. It has been translated into several languages and has been widely used [13,14].

In the Nordic countries, some studies of OHRQoL have been conducted. Einarson et al. found, in a Swedish population [7], that poorer OHRQoL was reported more by women than men and more by younger than older individuals. This is in contrast to a Finnish study by Lahti et al. [15], who found that older rather than younger individuals reported poorer OHRQoL; however, younger individuals with low education were more likely to report adverse effects on oral health. Women reported poorer OHRQoL also in the Finnish study. In Norway, Dahl et al. [16] found that elderly individuals with few (five to nine) remaining teeth reported the poorest OHRQoL. This is in agreement with the findings of Åstrøm et al. [17], who observed a relatively strong association between higher numbers of missing teeth and impaired daily performance. However, little is known about how Norwegian adults assess their oral health and the impact of oral status on their daily life.

The aim of this study was to investigate the association between OHRQoL assessed with the OHIP-14 and demographic factors, number of teeth, number of dental visits, dental health behaviour and self-rated oral health in a representative sample of Norwegian adults.

Material and methods

Participants and data collection

The present study was a cross-sectional Norwegian national study initiated by TNS Gallup (TNS Gallup, Oslo, Norway) in 2004. TNS Gallup has a general licence to collect data in population studies.

A questionnaire including a reply-paid envelope was sent by ordinary mail in the spring of 2004 to a sample of inhabitants aged ≥20 years. No reminder was sent. The sample was drawn from a stratified population in the population register based on age, sex and place of residence. Within each stratum, a proportional random sample was drawn, and the final sample comprised 3538 inhabitants. Residents in institutions were not included. To ensure a sufficiently high response rate from individuals aged ≥80 years, the questionnaire was mailed to a larger proportion of individuals in this age group than their actual proportion of the population. The datasets are representative of a non-institutionalized adult population. The distribution of participants in regard to demographic factors corresponded well to the Norwegian population (Table I).

Table I. Proportions of the sample and of the national population according to sex, age group and size of municipality.

	Sample (n = 2438)	Population ≥21 years[a]
Sex (%)		
Female	51.0	51.1
Male	49.0	48.9
Age (years)		
21–29	20.8	15.5
30–39	18.5	21.0
40–49	15.5	19.2
50–59	15.9	17.9
60–69	15.9	11.3
70–79	7.2	9.0
≥80	6.2	6.3
Size of municipality		
<5000 inhabitants	13.3	13.2
5000–30 000 inhabitants	42.7	41.5
>30 000 inhabitants	44.0	45.4

[a]Sources: Statistics Norway population statistics and Norwegian Social Science Data Services' Regional database 2004.

Questionnaire

The questionnaire comprised questions about demographics (sex, age, length of education and place of residence), number of teeth present, dental visits, dental hygiene behaviour, self-rated oral health and the OHIP-14. The number of teeth was assessed with the question: "Nearly all adults have lost some of their teeth. How many teeth do you have?" The response categories were: none, 1–4, 5–9, 10–14, 15–19, 20–24 and ≥25 teeth. Dental visits were assessed with the question: "Have you visited the dentist/dental hygienist regularly (at least once per year) during the last 5 years?" The responses were yes or no. Dental hygiene behaviour was assessed with five questions: "How often do you brush your teeth, and do you use dental floss, tooth picks, fluoride tablets and/or mouth rinse?" The responses were daily, irregularly (weekly or monthly) and rarely (less frequently or never). Self-rated oral health was assessed with the question: "How do you rate your oral health?" The responses were given on a five-point Likert scale ranging from very poor to very good. In the multivariate analyses, they were dichotomized into good (good and very good) and poor (all other responses).

OHRQoL was assessed using the OHIP-14 [12]. This is a 14-item questionnaire that focuses on seven dimensions of impact (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap). The time frame was the previous 12 months. The participants were asked to respond according to

the frequency of impact on a five-point Likert scale (never = 0, seldom = 1, sometimes = 2, fairly often = 3 and very often = 4). The response never indicated the highest possible OHRQoL. The overall OHIP-14 score was calculated by adding the scores for the 14 items to give a total score ranging from zero to 56, with higher scores indicating poorer oral QoL.

The OHIP-14 questionnaire was originally translated into Norwegian by an experienced researcher and was back-translated into English independently by two dental researchers who had English as their first language. The translations were very similar to the original OHIP-14 questionnaire.

Statistical analyses

The categorization of variables is presented in Table II. OHIP-14 scores were analysed using three different outcome variables according to Lahti et al. [15]. Two prevalence measures were defined. The prevalence of respondents with problems included respondents reporting one or more items with an impact on OHRQoL (scores 2, 3 and 4). The prevalence of respondents reporting frequent problems included respondents reporting one or more items fairly often or very often (scores 3 and 4). Severity was defined as the sum of all 14 item scores.

Cronbach's alpha was calculated. Differences in OHIP-14 scores between groups were analysed with *t*-tests and ANOVA with the Bonferroni test for post-hoc comparisons. The associations between dichotomous variables were analysed using the Chi-square test. Non-parametric tests were also performed and the conclusions were identical.

The independent variables were included in multivariate regressions; having problems and having frequent problems were the dependent variables. The results are presented as odds ratios (ORs) with 95% confidence intervals (CIs).

Data were analysed using SAS software, version 9.1 (SAS Institute Inc., Cary, NC). *P*-values < 0.05 were considered statistically significant.

Results

A total of 2438 individuals (69%) responded to the questionnaire and, of these, 2180 (62%) answered all items in the OHIP-14. The distributions of the independent variables are presented in Table II.

In all, 44% of the participants lived in municipalities with >30,000 inhabitants, and 13% resided in municipalities with fewer than 5000 inhabitants (Table I). No significant difference in OHIP-14 scores could be found according to the size of municipality. Most of the participants (96%) reported that they brushed their teeth on a daily basis. Fluoride tablets were used daily by 1% of participants, and

rarely by 73%. These variables were not analysed in regard to the OHIP-14.

Internal consistency for the OHIP-14 as measured by Cronbach's alpha was 0.85. The mean OHIP-14 score in the entire population was 4.1 (standard deviation 6.2). The distribution of OHIP-14 scores was positively skewed, with a range from 0 to 35, and 65% of the individuals reported at least one score >0 (Figure 1).

The proportion of individuals who reported problems using the OHIP-14 ranged from 11% to 56%, with pain as the most frequently reported item (Table III). The most frequently reported problem according to dimension was physical pain (56%), followed by psychological discomfort (39%) and psychological disability (30%) (Table III).

The bivariate associations between demographic factors, number of teeth, dental visits, dental hygiene behaviour, self-rated oral health and the OHIP-14 score are shown in Table II. In the analyses of severity, there was a statistically significant difference in OHIP-14 scores according to all variables except for the use of dental floss. The analyses of both prevalence measures showed the same results with the exception of the prevalence of frequent problems, which varied according to education.

Self-rated oral health was strongly associated with the OHIP score. Individuals who rated their oral health as very poor reported the highest OHIP-14 score. Women reported significantly higher OHIP-14 scores compared with men. The youngest individuals, those with the lowest educational level and individuals with few or no remaining teeth reported higher OHIP scores than other individuals. Individuals who used toothpicks regularly had significantly lower OHIP-14 scores in contrast to individuals who used oral rinse regularly. The use of dental floss had no significant association with OHIP-14 score.

When the effects of all variables associated with OHIP-14 scores were analysed simultaneously in the logistic regression, self-rated oral health, frequency of dental visits, number of teeth, age and sex were significantly associated with the prevalence of having problems and of often having problems (Table IV). Self-rated oral health was the variable most closely associated with having problems (OR 4.5; 95% CI 3.4–6.0) and with having frequent problems (OR 4.0; 95% CI 2.7–5.8). Oral health behaviour and use of floss, toothpicks and rinse were not associated with the prevalence of having problems and of often having problems related to oral QoL.

Discussion

This is the first nationwide study in Norway in which adults assessed their oral health and the impact of oral status on their daily life using the OHIP-14 questionnaire. The results showed that a substantial

Table II. Mean OHIP-14 score (SD) and proportion of persons reporting problems and frequent problems on the OHIP-14 scale, according to demographic factors, number of teeth, number of dental visits, dental hygiene behaviour and self-rated oral health (*n* = 2180).

Variable	*n*	%	OHIP-14 score; mean (SD)	*P*	Problems (%)	*P*	Frequent problems (%)	*P*
Sex	2180	100		<0.001		<0.001		<0.001
Female	1078	49	4.6 (6.9)		45		13	
Male	1102	51	3.5 (5.3)		36		9	
Age (years)	2180	100		<0.001		<0.001		0.001
20–29	441	20	5.1 (6.5)		48		16	
30–39	409	19	4.5 (6.9)		44		12	
40–49	326	15	3.5 (5.6)		38		10	
50–59	356	16	4.1 (5.7)		43		9	
60–69	376	17	3.4 (6.1)		33		7	
70–79	192	9	3.0 (5.1)		29		7	
≥80	80	4	3.1 (6.3)		39		10	
Education (years)	1987	100		0.004		0.002		0.295
<8	204	10	4.9 (10.9)		40		13	
8–12	858	43	4.2 (6.7)		44		11	
>12	925	47	3.5 (3.6)		35		10	
Number of teeth	2163	100		<0.001		<0.001		0.001
0	43	2	7.7 (10.5)		64		17	
1–19	277	13	6.0 (8.1)		53		16	
≥20	1843	85	3.7 (5.5)		38		10	
Dental visits	2180	100		<0.001		<0.001		<0.001
Regular	1540	71	3.3 (5.4)		35		8	
Irregular	640	29	5.9 (7.3)		55		19	
Dental floss	1872	100		0.065		0.689		0.815
Daily	291	16	3.7 (5.2)		40		11	
Irregularly	1030	55	4.1 (5.8)		41		12	
Rarely	540	29	4.7 (7.3)		44		11	
Toothpicks	1782	100		0.006		0.016		0.013
Daily	598	32	3.6 (5.8)		37		9	
Irregularly	912	49	4.0 (5.6)		39		11	
Rarely	272	15	4.9 (7.8)		47		14	
Oral rinse	1682	100		<0.001		0.010		0.011
Daily	193	11	5.4 (7.6)		49		18	
Irregularly	328	20	5.1 (7.2)		47		13	
Rarely	1161	69	3.8 (5.5)		40		10	
Self-rated oral health	2169	100		<0.001		<0.001		<0.001
Very good	494	23	1.3 (2.3)		38		17	
Good	1037	48	2.8 (3.9)		34		6	
Moderate	471	22	5.8 (6.2)		58		14	
Poor	14	6	11.8 (9.5)		90		4	
Very poor	26	1	22.6 (14.1)		89		83	

proportion of Norwegian adults reported experience of oral problems, and that these had an impact on their daily lives. The majority reported having had at least one problem during the past year. The distribution of OHIP-14 scores was positively skewed, indicating that a small group of individuals had many problems or a few very frequent problems. Impaired oral health was more often reported by women, younger individuals, those with a lower educational level, those with fewer remaining teeth,
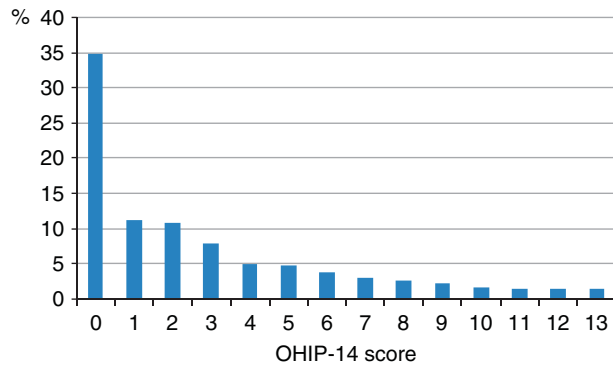
Figure 1. Frequency distribution of individuals according to OHIP-14 score. OHIP-14 scores of ≥13 were reported by 7% of respondents (*n* = 2180).

irregular seekers of dental care and those who rated their oral health as very poor. The most significant association was between self-rated oral health and OHIP-14 scores, indicating that it may be sufficient to ask one question to capture a person's assessment of her or his oral health. However, the impact on daily living may not be captured by such a single question. The most frequently experienced problems were physical pain, such as aching in the mouth, and discomfort eating food, which agrees with previous Scandinavian studies [7,15,16]. The second most frequently reported problem was psychological discomfort, which is also in line with Scandinavian studies. Psychological problems may not be reported as easily and frequently as pain and may need specific attention in clinical practice. Older persons do not complain in general and may not report psychological discomfort unless they are specifically asked.

An interesting, but perhaps surprising, finding was that younger individuals had higher OHIP-14 scores than older people. However, residents of institutions were not included in the study population, indicating that the positive oral health in the oldest age groups may have been overestimated. However, the results are in line with Swedish studies by Einarson et al. [7] and Steel et al. [18], who also reported problems more often in the youngest age group. Although the pattern is the same in Sweden and Norway, the figures are higher in Sweden throughout. The total mean value in the present Norwegian study was 4.1, compared with 6.4 in Sweden. In Finland, the pattern is totally the opposite: the younger age groups reported fewer problems, but the total mean score of 4.0 was more in concordance with the Norwegian score [15]. This is an interesting divergence; a possible explanation could be that Swedes are more demanding than Norwegians and Finns, possibly as a result of different dental insurance systems. The oral status assessed by dental professionals shows a similar prevalence in Norway and Sweden [4,19]. The difference in regard to age may depend on expectations and demands for oral health. Older individuals may experience pain differently than younger individuals because of previous experiences. Dental problems may be considered minor in comparison with more serious diseases. Younger individuals without caries experience may be more sensitive to pain and, furthermore, they may be more aware of psychological factors, as appearance is very important for young people. Oral impacts and subjective oral health may have different meanings for individuals of different ages.

Table III. Frequency of adults reporting problems related to oral conditions in the preceding 12 months. Distribution of responses (%) according to dimensions and individual items on the OHIP-14 scale (*n* = 2180).

Dimension	OHIP-14 score >0; *n* (%)	Item	Never	Seldom	Sometimes	Fairly often	Very often
Functional limitations	244 (11)	Trouble pronouncing words	93	4	2	1	0
		Worsened sense of taste	93	4	2	1	0
Physical pain	1214 (56)	Painful aching in mouth	51	23	22	3	1
		Uncomfortable to eat food	65	17	13	3	2
Psychological discomfort	849 (39)	Been self-conscious	65	16	14	3	2
		Felt tense	75	13	8	3	1
Physical disability	273 (13)	Unsatisfactory diet	92	5	2	1	0
		Interrupting meals	91	6	2	1	0
Psychological disability	654 (30)	Difficulty relaxing	82	11	5	1	1
		Embarrassed	78	12	7	2	1
Social disability	239 (11)	Irritable with other people	92	5	3	0	0
		Difficulty doing usual jobs	93	4	2	1	0
Handicap	391 (18)	Life less satisfying	83	9	6	2	0
		Unable to function	96	3	1	0	0
OHIP-14 score	417 (65)	One or more items	35	24	30	7	4

Table IV. Individuals reporting problems and frequent problems according to demographic and clinical variables. Multivariate logistic regression (*n* = 1402). All variables included; significant (*P* < 0.05) variables reported.

Variable	Problems; OR (CI)	*P*	Frequent problems; OR (CI)	*P*
Sex				
Male (ref)				
Female	1.6 (1.2–2.0)	0.002	1.9 (1.3–2.7)	0.001
Age (years)				
>60 (ref)				
20–39	2.2 (1.5–3.2)	<0.001	2.5 (1.3–4.6)	0.004
40–59	2.0 (1.4–2.8)	0.001	1.7 (1.0–3.0)	NS
Number of teeth				
≥20 teeth (ref)				
0–19 teeth	1.6 (1.1–2.4)	0.02	2.0 (1.2–3.6)	0.01
Dental visits				
Regular (ref)				
Irregular	1.5 (1.1–2.0)	0.007	1.7 (1.1–2.5)	0.01
Self–rated oral health				
Good (ref)				
Poor	4.5 (3.4–6.0)	<0.001	4.0 (2.7–5.8)	<0.001

ref = reference value.

Several studies have reported a significant association between number of teeth and OHRQoL [15–18], which was also confirmed in the present study. The magnitude of these associations varies between countries, partly because of different cultural perceptions of health but also because different questionnaires were used [17,20].

The fact that women reported poorer OHRQoL compared with men supports the study by Einarson et al. in Sweden [7]. However, in Finland, the opposite was found, with poorer OHRQoL being reported among men. Once again, an interesting divergence is obvious in the Scandinavian countries, which needs further research. In general, women visit dental clinics more regularly than men [19–21]. Women may be more concerned about their appearance and their oral health and consequently visit dentists more often. Annual demand for dental services is high in Norway: 71% of individuals in this study visited a dental service at least once a year. In a Norwegian population, Holst et al. [21] found that differences in demand for dental services according to income are small. Demand for dental services may reflect a desire to check one's dental status but also a desire to receive preventive care. However, greater awareness may entail greater problems. The fact that regular dental attendees reported having better OHRQoL may be because they care more about their oral health than irregular attendees. A recall system for preventive dental care could therefore facilitate good health.

Almost all respondents reported that they brushed their teeth daily and no analysis in regard to OHIP-14 was performed. However, individuals who used toothpicks daily and thus had better oral hygiene reported better OHRQoL. Oral hygiene habits are consequently of importance for oral health and for its impact on daily life.

A surprising finding was that individuals who rinsed their teeth on a daily basis reported poorer OHRQoL. They may very well have been aware that their oral health was poor and were trying to do something to improve the situation. A rinsing solution is an aid that is easy to administer and creates the feeling of a clean mouth. Individuals who assessed their oral health as good may be of the opinion that they do not need any supplementary rinsing.

The present study of OHRQoL in Norway used a large representative sample of the population and had a reasonable response rate, strengthening its validity. The questionnaire had been used earlier and had been found to be reliable. The reliability of the OHIP-14 was good in this study (Cronbach's alpha = 0.85), and it has previously been assessed as valid and reliable [16]. Buhlin et al. [22] have reported a good reliability of questionnaires concerning the number of remaining teeth and use of removable dentures, indicating that the method is valid and reliable. However, individuals who choose to participate in surveys often have a more positive attitude towards health behaviour than a general population [23,24]. It may be reasonable to assume that the responses regarding oral hygiene in the present study are therefore somewhat overestimated. Nevertheless, the patterns of associations of variables with OHRQoL are very clear and are likely to be valid.

Conclusions

The results of this study showed that, in the Norwegian adult population, self-rated oral health, frequency of dental visits, number of teeth, age and sex were associated with having problems as identified using the OHIP-14.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

[1] Skudutyte-Rysstad R, Eriksen H. Endodontic status amongst 35-year-old Oslo citizens and changes over a 30-year period. Int Endod J 2006;39:637–42.

[2] Skudutyte-Rysstad R, Eriksen H. Changes in caries experience among 35-year-old Oslo citizens, 1973-2003. Acta Odontol Scand 2007;65:72–7.

[3] Skudutyte-Rysstad R, Eriksen H, Hansen B. Trends in periodontal health among 35-year-olds in Oslo, 1973-2003. J Clin Periodontol 2007;69:867–72.

[4] Holst D. Oral health equality during 30 years in Norway. Community Dent Oral Epidemiol 2008;36:326–34.

[5] Ingelhart M, Bagramian R, editors. Oral health related quality of life. Chicago, IL: Quintessence Publishing Co; 2002.

[6] Locker D, Miller Y. Evaluation of subjective oral health status indicators. J Publ Health Dent 1994;54:167–76.

[7] Einarson S, Gerdin E, Hugoson A. Oral health impact on quality of life in an adult Swedish population. Acta Odontol Scand 2009;67:85–93.

[8] Locker D. Measuring oral health: a conceptual framework. Community Dent Health 1988;5:3–18.

[9] Slade G, editor. Oral health impact profile. Chapel Hill, NC: Department of Dental Ecology, School of Dentistry, University of North Carolina; 1997.

[10] McGrath C, Bedi R. Measuring the impact of oral health on life quality in two national surveys—functionalist versus hermeneutic approaches. Community Dent Oral Epidemiol 2002;30:254–9.

[11] Slade G, Spencer A. Development and evaluation of the Oral Health Impact Profile. Community Dent Health 1994; 11:3–11.

[12] Slade G. Derivation and validation of a short-form oral health impact profile. Community Dent Oral Epidemiol 1997;25: 284–90.

[13] Larsson P, List T, Lundstrom I, Marcusson A, Ohrbach R. Reliability and validity of a Swedish version of the Oral Health Impact Profile (OHIP-S). Acta Odontol Scand 2004;62:147–52.

[14] John M, Patrick D, Slade G. The German version of the Oral Health Impact Profile—translation and psychometric properties. Eur J Oral Sci 2002;110:425–33.

[15] Lahti S, Suominen-Taipale L, Hausen H. Oral health impacts among adults in Finland: competing effects of age, number of teeth, and removable dentures. Eur J Oral Sci 2008;116: 260–6.

[16] Dahl KE, Wang NJ, Holst D, Ôhrn K. Oral health-related quality of life among adults 68-77 years old in Nord-Trøndelag, Norway. Int J Dent Hyg 2011; In press.

[17] Astrom A, Haugejorden O, Skaret E, Trovik T, Klock K. Oral Impacts on Daily Performance in Norwegian adults: the influence of age, number of missing teeth, and socio-demographic factors. Eur J Oral Sci 2006;114: 115–21.

[18] Steele J, Sanders A, Slade G, Allen P, Lahti S, Nuttall N, et al. How do age and tooth loss affect oral health impacts and quality of life? A study comparing two national samples. Community Dent Oral Epidemiol 2004;32:107–14.

[19] Hugoson A, Koch G, Gothberg C, Helkimo AN, Lundin SA, Norderyd O, et al. Oral health of individuals aged 3-80 years in Jonkoping, Sweden during 30 years (1973-2003). II. Review of clinical and radiographic findings. Swed Dent J 2005;29: 139–55.

[20] Astrom A, Rise J. Socio-economic differences in patterns of health and oral health behaviour in 25 year old Norwegians. Clin Oral Investig 2001;5:122–8.

[21] Holst D, Grytten J, Skau I. Demand for and consumption of dental services in adult population in Norway. Community Dent Oral Epidemiol 2011; In press.

[22] Buhlin K, Gustafsson A, Andersson K, Hakansson J, Klinge B. Validity and limitations of self-reported periodontal health. Community Dent Oral Epidemiol 2002;30:431–7.

[23] Kalsbeek H, Truin GJ, Poorterman JH, van Rossum GM, van Rijkom HM, Verrips GH. Trends in periodontal status and oral hygiene habits in Dutch adults between 1983 and 1995. Community Dent Oral Epidemiol 2000;28: 112–18.

[24] Christensen LB, Petersen PE, Krustrup U, Kjoller M. Self-reported oral hygiene practices among adults in Denmark. Community Dent Health 2001;20:229–35.