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ORIGINAL ARTICLE

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Attitudes to dental care, Sweden 2003-2013, and clinical correlates of oral health-related quality of life in 2013

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Abstract

Objective: To investigate attitudes to dental care, and to assess possible associations with socio-economic and clinical variables over a period of ten years, and to investigate the association between OHRQoL assessed by oral impact on daily performance (OIDP), and socio-economic, dental care habits, smoking and oral status.

Materials and methods: Cross-sectional studies performed in the county of Dalarna, Sweden, in 2003, 2008 and 2013. Random samples of 1,107-1,115 dentate individuals, aged 30-85 years, who answered a questionnaire and who were radiographically and clinically examined were included.

Results: The importance of preventive treatment, regular recalls and meeting the same caregiver as on previous visits became less important. In individuals with alveolar bone loss, meeting the same caregiver as on previous visits was important ($P<.05$). In individuals with manifest caries, information on treatment cost was important, while prevention became less important ($P<.05$). OIDP was reported by 31% of the individuals in the study, and frequent impact was reported by 10%. Individuals with manifest caries lesions, less than 20 remaining teeth, and temporomandibular disorders (TMD) reported OIDP to a significantly higher degree, compared to orally healthy individuals.

Conclusion: Attitudes important in maintaining and improving good oral health, such as preventive care and regular recalls to dentistry, became less important during this period of 10 years. Oral impact was found to be associated with irregular dental visits and limited economy for dental care, individuals with less than 20 remaining teeth, TMD and manifest caries.

KEYWORDS

dental caries, epidemiology, oral health-related quality of life, socio-behavioural, socio-economic, tobacco

1 | INTRODUCTION

Epidemiological studies serve to investigate the distribution and determinants of disease frequency. However, very often the patient's perspective is neglected. The patient's experience of, and satisfaction with dental care and oral health are important factors within oral health prevention and promotion. Attitudes and perceptions have been found to influence dental conditions, and dental attendance pattern and concerns of cost for dental care.[1-3] Favourable attitudes regarding dental care have been found to result in more frequent preventive visits to dental care, and a lower prevalence of toothache pain, darting pain and painful gums.[3] In a study carried out

by Unell and co-workers, it was found that visiting the same dentist or dental hygienist, having confidence in the dentist and continuity in dental care were important factors in a 50-year-old population.[4] There is evidence of the influence of socio-economic factors on oral health.[5] Poor health-related behaviours have been found to be more common among less educated individuals and individuals with low income.[6] Low socio-economic position, in terms of the individual's own socio-economic position, or parental education or income, and occupational background, have been associated with dental caries lesions,[7,8] while smoking and negative life events have been found to be associated with periodontal disease in several studies.[9-11]

Ordinarily, oral status has been measured in biomedical terms and associated with number of teeth and absence of oral diseases, such as periodontitis and dental caries. However, in recent decades, it has been more common to assess the patient's perspective on oral health and possible impact on daily living. Different assessment methods have been used to identify oral condition and how the condition influences and impairs daily living.[12] Lower oral health-related quality of life (OHRQoL) has been reported among individuals with few teeth and periodontal disease, assessed by the short form of oral health impact profile (OHIP-14),[13,14] by oral impact on daily performances (OIDP) and among individuals with limited jaw opening, assessed by OIDP.[15] Independent of the OHRQoL instrument used, dental caries has not been found to correlate with OHRQoL.[13,15]

The aim of the present study was to investigate attitudes to dental care, and to assess possible associations with clinical variables over a period of ten years. A further aim was to investigate OHRQoL and the association with socio-economic factors, dental care habits, smoking and oral status.

2 | MATERIAL AND METHODS

2.1 | Study design

Cross-sectional studies, consisting of questionnaires and clinical examinations, including radiographs were used in the study.

2.2 | Study population

In 2003, 2008 and 2013, random samples of 1,542, 1,800 and 2,244 individuals, respectively, aged 30-85 years and evenly distributed over six geographical areas were selected from the Dalarna population register and invited to participate in the study. In 2003, 1,542 individuals in the age groups 35, 50, 65 and 75 years were selected, corresponding to 14% of the population in each age group. In 2008, the age group 85 years was added, and random samples corresponding to 0.6% of the total population were selected (360 individuals in each of the five age groups). In 2013, random samples of 204 individuals in each of the age intervals 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79 and 80-85 years were selected, corresponding to 1.2% of the population. The sample was then grouped into five age intervals: 30-41, 42-58, 59-71, 72-77 and 78-85 years, resulting in mean ages as close to 35 (35.2), 50 (50.2), 65 (65.2), 75 (74.7) and 85 (80.5) as possible (Table 1). For further details, see Edman et al.[8,11]

2.3 | Procedure

All participants were invited to take part by mail and were sent a questionnaire and a prestamped envelope. Two reminders were sent at 3-week intervals. Potential participants were informed of the purpose of the study and told that a clinical and radiographic examination would be performed free of charge; they were furthermore informed that participation was voluntary. Due to stricter ethical rules, written informed consent was obtained for the two latter study years, 2008 and 2013. The clinical examinations, including radiographs (two to four bite-wing radiographs), were conducted by each participant's regular dental practitioner. Those not in regular contact with a dental practitioner were offered a referral to a practitioner of their choice. Comprehensive written instruction on how to carry out the examination was sent to the caregiver performing the clinical assessment. Before data processing, all documents and radiographs were coded and personal identification details were deleted. The same procedure was used for all study years.

2.4 | Questionnaire

The questionnaire was expanded during the study years, and the number of questions was increased from 63 to 74. The questions included demographics, socio-economic and socio-behavioural factors, and attitudes to dental care. In 2013, questions relating to oral health-related quality of life were added. *Marital status* was dichotomized

TABLE 1 Distribution of random study samples (RS) in study years 2003, 2008 and 2013 and response rates to the questionnaire (Q) and the clinical examination (CE). Proportion of response rate in brackets. Complete data are not available for all study years

	2003			2008			2013		
Age group	RS	Q (%)	CE (%)	RS	Q (%)	CE (%)	RS	Q (%)	CE (%)
35	412		284 (69)	360	247 (69)	207 (58)	484	238 (49)	198 (41)
50	468		349 (74)	360	280 (78)	246 (68)	694	404 (58)	335 (48)
65	355		282 (79)	360	303 (84)	268 (74)	540	388 (72)	329 (61)
75	307		231 (75)	360	300 (83)	247 (69)	251	180 (72)	145 (58)
85				360	245 (68)	190 (53)	274	156 (57)	126 (46)
Total	1542	1294 (84)	1146 (74)	1800	1375 (76)	1158 (64)	2243	1366 (61)	1133 (51)

into (0) "cohabiting with or without children," and (1) "living single with or without children." *Level of education* was dichotomized into (0) "high education" (university or college of higher learning) and (1) "low education (up to secondary school)." *Less dental care due to financial limitations* was dichotomized into (0) "no limitation for dental care" and (1) "limitation for dental care" (refrained dental care/cheaper treatment alternatives). *Medication* was dichotomized into (0) "no daily intake of prescribed medicine" and (1) "daily intake of prescribed medicine." Dental care habits were dichotomized into (0) "regular" (if the participant visited dental service at least every second year) and (1) "irregular." *Smoking* was dichotomized into (0) "no smoking" and (1) "current smoking."

Two questions regarding attitudes to dental care were analysed in this study. *What items do you consider to be most important in your contact with dentistry*? The five most frequent alternatives reported for the original nine alternatives (in 2003 and 2008), and ten alternatives (in 2013), were analysed as follows: being called for treatment on a regular basis; meeting the same caregiver as on previous visits; information about treatment cost; being offered preventive treatment, and safe and gentle treatment. The respondents could choose three alternatives. The second question was *how do you experience the possibility of booking treatment time*? The response alternatives were "easy," "quite easy," "hard" and "very hard." The four alternatives regarding the possibility of booking treatment time were dichotomized into (0) "easy" (easy/quite easy) and (1) "hard" (hard/very hard).

2.5 | Oral health-related quality of life (OHRQoL)

A measure of OHRQoL was included for the first time in study carried out in 2013 and was assessed using the Swedish version[16] of the OIDP.[17] This is a nine-item questionnaire that focuses on different dimensions of daily performance. The questions were as follows: "during the past 6 months, how often have problems with your mouth or teeth caused any difficulty with: eating and enjoying food; speaking and pronouncing clearly; doing light physical activities; cleaning teeth; sleeping and relaxing; smiling, laughing and showing teeth without embarrassment; maintaining usual emotional state without being irritable; carrying out major work or social role and enjoying contact with people?" The response rate was on a five-point Likert scale, ranging from "never" (1), to "every, or nearly every day" (5). The summation produces an overall OIDP score from 9 (best possible) to 45 (worst possible). Each of the nine OIDP items was dichotomized into (0) "no impact" (category 1) and (1) "impact" (including categories 2, 3, 4 and 5). Furthermore, dichotomization was made for (0) "less frequent OIDP" (categories 1, 2 and 3) and (1) "frequent OIDP" (categories 4 and 5).

2.6 | Clinical examination

The clinical examination conducted by the participant's regular dental practitioner consisted of registration of number of teeth, manifest caries (MC) and alveolar bone loss (ABL). The severity of ABL was based on bone levels at interproximal sites visible on radiographs in the premolar and molar regions, and categorized into "no bone loss," "moderate bone loss" and "severe bone loss." The categorization of ABL was performed by two of the authors, and manifest caries was confirmed on bite-wing radiographs by the authors. Details regarding the different parameters have been reported in greater detail elsewhere.[8,11,18] Temporomandibular disorders (TMD) were determined by three anamnestic questions, based on validated self-reported pain questions[19]: "Have you constantly or often (once a week or more) problems with ache in the jaws or face?"; "Are you tired or exhausted (once a week or more) in the jaws when, for example, chewing?"; "Have you often (once a week or more) problems with opening wide or locking of the jaw?" The response alternatives were "yes" or "no." The three *TMD-questions* were dichotomized into (0) "no TMD problems" and (1) "TMD problems" (response to at least one of the three questions). *Dental caries* was dichotomized into "no caries" and "manifest caries" (at least one manifest caries lesion). *ABL* was dichotomized into (0) "no bone loss" and (1) "bone loss" (moderate or severe).

The study was conducted according to the Helsinki Declaration and was approved by the Research Ethical Review Board at Uppsala University, Uppsala, Sweden, in 2008 and 2013.

2.7 | Statistical analysis

Data were analysed using IBM SPSS 21.0, SPSS Inc. Chicago, IL, USA. The mean values, median values, frequency distributions and 95% confidence intervals (CIs) were calculated. Statistical differences between groups were calculated with the Kruskal-Wallis test and over time with the chi-square test with Bonferroni correction. A *P*-value <.05 was considered to indicate statistical significance. Multiple logistic regression was used to analyse the influence of OHRQoL on clinical variables.

The age group 85 years was not included in the study in 2003 and is accounted for separately, and only dentate and clinically examined individuals are included in the analysis.

3 | RESULT

The study sample is presented in Table 1. In 2003, 1,107 dentate individuals (72%) responded to the questionnaire and the clinical examination and were included in the study. The corresponding number for study in 2008 was 1,105 individuals (61%), and in 2013, 1,115 individuals (50%).

3.1 | Attitudes

Regular recalls were reported as important by 72% of the participants in 2003, increasing significantly to 81% in 2008, and decreasing significantly to 68% in 2013 (*P*<.05). Meeting the same caregiver as on previous visits was reported as important by 49% in 2003 and 2008, decreasing significantly to 33% in 2013 (*P*<.05). Information

about treatment cost was reported as important by 35% in 2003, decreasing significantly to 21% in 2013 ($P<.05$). Preventive treatment was reported as important by 36% in 2003, decreasing significantly to 22% in 2013 ($P<.05$). In 2003, safe and gentle treatment was reported as important by 39%, increasing significantly to 51% in 2008 and decreasing significantly to 42% in 2013 ($P<.05$). Difficulty in booking treatment time was reported by 11% of participants in 2003, increasing significantly to 17% in 2013 ($P<.05$). Frequency distribution and changes of attitudes in the different study years and age groups are presented in Table 2. Regular recalls and meeting the same caregiver as on previous visits became more important with increasing age.

3.2 | Manifest caries and attitudes

Manifest caries lesions were found in 40% (n=447) of participants in 2003. This decreased significantly to 34% in 2008 (n=321) and to 33% (n=330) in 2013 ($P<.05$) (not shown in the table). In 2003, regular recalls, preventive treatment, and safe and gentle treatment were less important among individuals with manifest caries, compared to those without manifest caries. In 2008 and 2013, information about treatment cost was reported as important to a significantly higher degree by individuals with manifest caries, compared to those without caries. Difficulty in booking treatment time was reported by significantly more individuals with manifest caries, compared to those without manifest caries in all study years (Table 3).

3.3 | Alveolar bone loss and attitudes

ABL was found in 28% (n=307) of participants in 2003, 25% (n=235) in 2008, increasing significantly to 40% (n=395) in 2013 ($P<.05$) (not shown in the table). In all study years, meeting the same caregiver as on previous visits was reported as important to a significantly higher degree by individuals with ABL, compared to those without ABL. Preventive treatment, and safe and gentle treatment were reported as less important to a significantly higher degree by individuals with ABL, compared to those without ABL, in the study years 2003 and 2008. In 2013, regular recalls were reported as important to a significantly higher degree by individuals with ABL, compared to those without ABL (Table 3).

3.4 | TMD and attitudes

Temporomandibular disorders was reported by 13% (n=146) of participants in 2003, 15% (n=142) in 2008 and decreased significantly to 7% (n=67) in 2013 ($P<.05$) (not shown in the table). In 2003, regular recalls were reported as less important to a significantly higher degree by individuals with TMD, compared to those without TMD. In 2013, information on treatment cost was reported as important by individuals with TMD to a significantly higher degree, compared to those without TMD. No significant differences in attitudes among those with and without TMD were found in 2008 (Table 3).

TABLE 2 Frequency distribution (%) and changes of attitudes in the different study years and age groups

	35 years			50 years			65 years			75 years			Total			85 years			P-Value
	2003	2008	2013	2003	2008	2013	2003	2008	2013	2003	2008	2013	2003	2008	2013	2008	2013		
Regular recalls	56	71[a]	54	76	80	62[b]	81	85	79	77	85	74[c]	72	81[a]	68	76	75		.815
Same caregiver as previous visits	34	34	19[b]	45	44	29[b]	65	58	41[b]	58	58	45[c]	49	49	33[b]	51	44		.273
Information on treatment cost	34	56[a]	25	31	31	21[b]	40	44	17[b]	37	34	27	35	41	21[b]	30	22		.165
Importance of preventive treatment	40	49	23[b]	40	45	24[b]	38	39	20[b]	22	32	16[c]	36	41	22[b]	27	18		.088
Safe and gentle treatment	41[c]	55	51	38[c]	52	45	41	48	34[b]	37	48	36	39	51[a]	42	42	29		.029
Difficulties in booking treatment time	21	24	16	11[d]	15	20	6	8	18[b]	4	8	11[e]	11	13	17[b]	3	15		<.001

[a]Significant difference ($P<.05$) compared with 2003 and 2013.
[b]Significant difference ($P<.05$) compared with 2003 and 2008.
[c]Significant difference ($P<.05$) compared with 2008.
[d]Significant difference ($P<.05$) compared with 2013.
[e]Significant difference ($P<.05$) compared with 2003.

TABLE 3 Differences in attitudes (%) between healthy individuals (H) and individuals with manifest caries lesions (MC), alveolar bone loss (ABL) or temporomandibular disorder (TMD) in the different study years and in the age groups 35-75

	2003 %					2008 %					2013 %				
	MC (H)	*P*	ABL (H)	*P*	TMD (H)	*P*	MC (H)	*P*	ABL (H)	*P*	TMD (H)	*P*	MC (H)	*P*	ABL (H)	*P*	TMD (H)	*P*
Regular recalls	66 (76)	.001	71 (72)		62 (73)	.006	81 (81)		83 (80)		79 (81)		66 (69)		72 (65)	.027	63 (68)	
Same caregiver as previous visits	46 (51)		57 (47)	.003	51 (49)		50 (48)		57 (46)	.006	46 (49)		34 (32)		38 (30)	.007	31 (33)	
Treatment cost	34 (35)		33 (35)		39 (34)		45 (38)	.050	37 (42)		46 (40)		26 (19)	.025	21 (22)		31 (21)	.032
Importance of preventive treatment	32 (39)	.015	29 (39)	.002	35 (36)		42 (41)		35 (43)	.040	36 (42)		19 (23)		21 (22)		20 (22)	
Safe treatment	34 (43)	.002	34 (41)	.016	36 (40)		54 (49)		42 (53)	.003	54 (50)		40 (42)		39 (43)		49 (41)	
Difficulties to book treatment time	14 (9)	.032	8 (12)		12 (11)		17 (11)	.010	12 (14)		17 (13)		21 (15)	.028	18 (17)		16 (17)	

3.5 | Age group 85 years

The importance of safe and gentle treatment was reported by significantly fewer individuals in 2013, compared to 2008. Difficulty in booking treatment time was reported to a significantly higher degree in 2013, compared to 2008 (Table 2).

Manifest caries lesions were found in 46% of participants in both 2008 and 2013 (n=75 and n=53, respectively). ABL was found in 39% (n=64) in 2008 and increased significantly to 64% (n=73) in 2013 (*P*<.001). TMD was reported by 7% (n=12) in 2008 and 3% (n=4) in 2013 (not shown in the table).

In 2008, information about treatment cost was reported as important to a significantly lower degree (20%), by those with ABL, compared to those without ABL (36%, *P*=.032). Difficulty in booking treatment time was reported to a significantly higher degree (7%), by those with ABL, compared to 1% among those without ABL (*P*=.049). Preventive treatment was reported as important to a significantly lower degree by individuals with manifest caries (19%), compared to those without manifest caries (34%, *P*=.030). In 2013, regular recalls were reported as important to a lower degree by individuals with manifest caries (62%), compared to 86% among individuals without caries (*P*=.004). No other significant differences were found (not shown in the table).

3.6 | Oral impact on daily performance (OIDP) in 2013

Individuals not participating in the clinical examination (n=233) reported at least one OIDP (39%), and *frequent* OIDP (18%) to a significantly higher degree, compared to those clinically examined (31%, *P*=.012, and 10%, *P*<.001).

A total of 1095 dentate individuals completed both the OIDP questionnaire and the clinical examination, and the mean OIDP was 10.3 (SD: 3.4, median 9). A total of 31% (n=335) reported at least one OIDP, and the mean OIDP among those was 13.2 (SD: 5.1, median 12). *Frequent* OIDP was reported by 10% (n=104), and the mean OIDP was 17.8 (SD: 7.0, median 15) (Figure 1). The most frequently reported discomfort was difficulty with eating.

A significantly higher proportion (38% and 36%) of individuals in the age groups 35 and 50 years reported at least one OIDP, compared to 21% in the age group 75 years (*P*<.05). In the age groups 65 and 85 years, 27% and 24%, respectively, reported at least one OIDP.

3.7 | OHRQoL and socio-economic factors

There was a significantly higher proportion of individuals visiting dentistry irregularly, and reporting limited financial resources for dental care, who reported at least one OIDP and *frequent* OIDP. A significantly higher proportion of smokers and individuals reporting daily medication reported *frequent* OIDP. Differences in mean OIDP scores and proportions of reported OIDP according to socio-economic, demographic and socio-behavioural characteristics, unadjusted and after adjustment for age, are presented in Table 4. Regular recalls were reported as important by 56% of individuals with at least one OIDP,

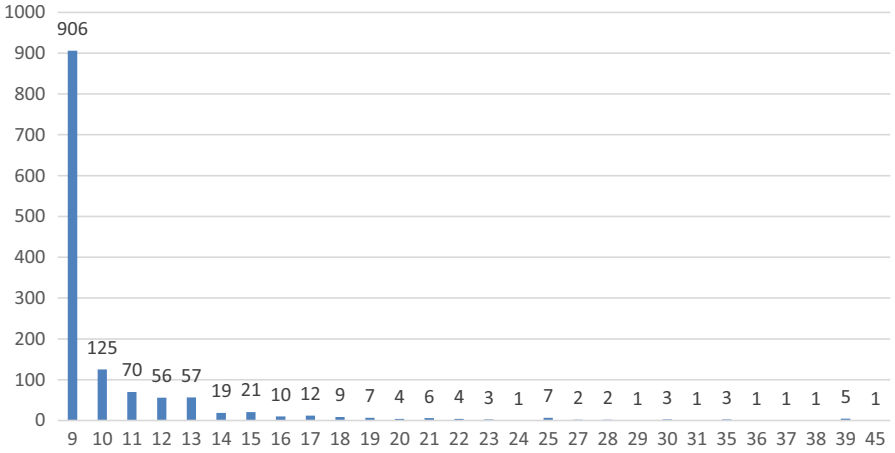

FIGURE 1 Frequency distribution of reported OHRQoL where 9 represent no impact and 45 represent impact on all nine items

and in a significantly higher proportion (74%), by individuals without OIDP (*P*<.001). A significantly lower proportion of individuals with at least one OIDP reported information about treatment cost (17% vs 31%, *P*<.001), and safe and gentle treatment (57% vs 66%, *P*=.005) as important (not shown in the table).

3.8 | OHRQoL and oral status

In the total sample, 35% (n=379), including age group 85 years had at least one manifest caries lesion, and a significantly higher proportion experienced at least one OIDP and *frequent* OIDP, compared to individuals without manifest caries lesions. ABL was found in 41% (n=446) of individuals and was not found to be associated with OIDP. In the total sample, 6% (n=71) of individuals reported TMD, and a significantly higher proportion reported at least one OIDP and *frequent* OIDP, compared to those without TMD (Table 4). In the sample, 87% (n=963) had at least 20 remaining teeth. A significantly higher proportion of individuals with <20 remaining teeth (n=104) reported at least one OIDP and *frequent* OIDP, compared to those with ≥20 remaining teeth. Individuals with <20 remaining teeth reported at least one OIDP and *frequent* OIDP to a significantly higher degree in all items, except discomfort when sleeping, compared to individuals with ≥20 remaining teeth. Comparison between individuals with ≥20 remaining teeth and those with <20 remaining teeth across OIDP items is presented in Table 5.

3.9 | Multivariate logistic regression analysis

Unadjusted OR are presented in Table 6. Adjusted for age, number of teeth, clinical variables, socio-economic and socio-behavioural variables TMD (OR: 2.16, 95% CI: 1.27-3.67) and manifest caries lesions (OR: 1.40, 95% CI: 1.04-1.90) were significantly associated with OIDP (Table 6). Less than 20 remaining teeth was associated with OIDP, after adjustment for age, socio-economic and socio-behavioural variables (OR: 2.08, 95% CI: 1.29-3.34, *P*-value .003). When including TMD, ABL and manifest caries in the model the OR was 2.05, 95% CI: 1.27-3.32 (*P*-value 0.004).

4 | DISCUSSION

There was a shift in attitudes towards a less positive view regarding items important for oral health over this period of 10 years. Fewer individuals reported preventive care and regular recalls to dentistry as important in 2013, compared with 2003 and 2008. This is of great concern as there are signs of an increase in oral diseases, such as dental caries[8,20] and periodontitis,[11] and a higher proportion of irregular dental visitors reported at least one OIDP and *frequent* OIDP. In addition, individuals may not regard dental caries as a disease and may not be aware of the importance of prevention. This indicates the need for providing new strategies and developing action to promote oral health and positive oral health behaviours.

Preventive treatment was more important among individuals without caries and ABL in 2003 and 2008, indicating a good knowledge of prevention of oral diseases, and a successful oral health promotion and prevention strategy from dentistry. However, in 2013 no such difference was found, which may indicate declined awareness, or a change in attitudes towards oral health among orally healthy individuals. This group may attend dentistry with longer intervals and receive less information, or is regarded not to be in need of information from dental staff. This might render a risk of declining oral health in the future. It is not only important to treat oral diseases, but also to keep healthy individuals healthy, to improve their knowledge and behaviours in order to prevent disease in the future. This demands an ongoing commitment from dental personnel. Difficulty in booking treatment time was more frequently reported in 2013, compared with 2003 and 2008, especially in individuals with manifest caries and in the age group 85 years. This might be an effect of an increased need for dental care in the older population, as well as high work pressure and a heavy working load at dental clinics.

In 2013, a significantly higher proportion of individuals with ABL reported regular recalls as important, compared to those without ABL, indicating that individuals with periodontal disease are aware of the importance of maintenance therapy. In individuals with ABL, it was found that meeting the same caregiver as on previous visits was important. Periodontal disease usually requires lifelong supportive treatment at regular intervals.[21,22] Feeling confident and safe, because of

TABLE 4 Mean OIDP score and proportion of individuals reporting impact and frequent impact on OHRQoL according to socio-economic, demographic and socio-behavioural characteristics, manifest caries, alveolar bone loss, temporomandibular disorder and number of teeth

		OIDP score		OIDP		Frequent OIDP		OIDP Adjusted for age		Frequent OIDP Adjusted for age	
	% (n)	Mean (SD)	*P*	% (n)	*P*	% (n)	*P*	OR	95% CI	OR	95% CI
Gender			.596		.815		.132				
Female	53 (576)	10.5 (3.9)		31 (178)		11 (62)		Reference		Reference	
Male	47 (519)	10.1 (2.8)		30 (157)		8 (42)		1.00	0.77-1.29	0.74	0.49-1.12
Dental visits			<.001		<.001		.002				
Regular	83 (892)	10.1 (3.1)		28 (251)		8 (73)		Reference		Reference	
Irregular	17 (186)	11.1 (4.8)		42 (78)		16 (29)		1.68	1.20-2.33	1.96	1.22-3.13
Education			.514		.269		.456				
High	25 (275)	10.1 (2.5)		33 (91)		8 (23)		Reference		Reference	
Low	75 (809)	10.4 (3.7)		30 (239)		10 (80)		0.97	0.72-1.31	1.33	0.81-2.18
Smoking			.030		.096		.025				
No	91 (993)	10.2 (3.1)		30 (298)		9 (88)		Reference		Reference	
Yes	9 (94)	11.6 (5.8)		38 (36)		16 (15)		1.42	0.92-2.21	1.93	1.07-3.50
Limited economy			<.001		<.001		<.001				
No	88 (951)	9.9 (2.4)		26 (244)		7 (65)		Reference		Reference	
Yes	12 (135)	13.2 (6.7)		66 (89)		28 (38)		5.43	3.69-7.99	5.21	3.31-8.21
Marital status			.786		.792		.939				
Cohabitant	74 (804)	10.2 (3.3)		31 (245)		10 (76)		Reference		Reference	
Single living	26 (281)	10.5 (3.9)		31 (88)		10 (27)		1.15	0.85-1.56	1.09	0.68-1.74
Daily medication			.033		.062		.005				
No	42 (456)	10.0 (2.7)		28 (126)		7 (30)		Reference		Reference	
Yes	58 (635)	10.5 (3.9)		33 (209)		12 (74)		1.61	1.21-2.13	2.26	1.42-3.59
Manifest caries lesion			.001		.001		.017				
No	65 (716)	10.1 (2.7)		27 (194)		8 (57)		Reference		Reference	
Yes	35 (379)	10.8 (4.4)		37 (141)		12 (47)		1.65	1.26-2.16	1.67	1.11-2.51
Alveolar bone loss			.655		.676		.247				
No	59 (645)	10.3 (3.2)		31 (200)		10 (67)		Reference		Reference	
Yes	41 (446)	10.3 (3.7)		30 (133)		8 (37)		1.25	0.93-1.68	0.89	0.56-1.42
Temporomandibular disorder			<.001		.001		.001				
No	94 (1,024)	10.2 (3.3)		29 (301)		9 (89)		Reference		Reference	
Yes	6 (71)	11.5 (5.3)		48 (34)		21 (15)		2.17	1.33-3.53	2.78	1.51-5.11
Remaining teeth			.003		.013		<.001				
≥20 teeth	87 (963)	10.1 (2.8)		30 (284)		8 (78)		Reference		Reference	
<20 teeth	13 (149)	12.0 (6.3)		40 (59)		20 (29)		2.44	1.63-3.65	4.57	2.61-7.99

TABLE 5 The number of individuals with ≥20 remaining teeth and <20 remaining teeth across the OIDP items

	OIDP (n=335)					Frequent OIDP (n=104)				
	≥20 (n=963)		<20 (n=132)			≥20 (n=78)		<20 (n=26)		
OIDP item	n	% of n	n	% of n	*P*-value[a]	n	%[c]	n	%[c]	*P*-value[b]
Eating	192	20	37	28	.039	36	19	13	35	.005
Speaking	37	4	17	13	<.001	7	19	10	59	<.001
Cleaning teeth	111	12	29	22	.002	28	25	12	41	.002
Sleeping	97	10	19	14	.133	13	13	2	11	.700
Smiling	63	6	23	17	<.001	27	43	12	52	.001
Emotion	66	7	17	13	.021	7	11	6	35	.002
Working	21	2	12	9	<.001	6	28	4	33	.024
Going out shopping	10	1	8	6	.001	2	20	5	62	<.001
Socializing	17	2	10	8	<.001	5	29	5	50	.004

[a]Compared with individuals with ≥20 teeth (impact).
[b]Compared with individuals with ≥20 teeth (frequent impact).
[c]Per cent (%) of reported impact.

TABLE 6 Unadjusted (crude data) and adjusted odds ratios (OR) and 95% confidence interval (CI) of having at least one oral health-related impact according to clinical variables

Age	TMD	Caries	ABL
Age	2.18 (1.33-3.55) 0.002	1.65 (1.26-2.16) 0.000	1.31 (0.96-1.77) 0.085
Number of teeth	2.20 (1.36-3.59) 0.001	1.56 (1.20-2.04) 0.001	0.89 (0.68-1.16) 0.381
Regular recalls	2.25 (1.38-3.66) 0.001	1.49 (1.14-1.96) 0.004	0.95 (0.73-1.24) 0.726
Education	2.28 (1.40-3.72) 0.001	1.63 (1.24-2.13) 0.000	0.95 (0.72-1.24) 0.684
Smoking	2.19 (1.35-3.55) 0.002	1.62 (1.24-2.11) 0.000	0.90 (0.69-1.18) 0.447
Limited economy	2.16 (1.30-3.59) 0.003	1.37 (1.04-1.82) 0.026	0.94 (0.71-1.24) 0.663
Marital status	2.26 (1.39-3.68) 0.001	1.61 (1.23-2.10) 0.001	0.96 (0.74-1.25) 0.747
Medication	2.14 (1.32-3.48) 0.002	1.58 (1.21-2.06) 0.001	0.90 (0.69-1.18) 0.439
Adjusted 1	2.16 (1.27-3.67) 0.004	1.40 (1.04-1.90) 0.028	1.14 (0.81-1.59) 0.458
Adjusted 2	2.10 (1.24-3.56) 0.006	1.37 (1.02-1.85) 0.037	1.16 (0.83-1.62) 0.382

Adjusted 1—Adjusted for age, number of teeth, dental visits, and level of education, smoking habits, financial resources for dental care, marital status and medication and clinical variables.
Adjusted 2—Adjusted for age, number of teeth, dental visits, and level of education, smoking habits, financial resources for dental care, marital status and medication.

the amount of visits required, might be a reason for reporting meeting the same caregiver as important in individuals with ABL.

Information about treatment cost was of importance in individuals with TMD symptoms and manifest caries. Restorative treatment, such as dental fillings, root canal fillings and crown therapy, is expensive, despite the present-day dental care benefit system. Limited financial resources have been found to correlate with the presence of dental caries[23] and may be a reason why these individuals considered information about treatment cost as important.

In the present study, approximately one-third of the respondents reported OIDP, and this is somewhat lower compared to other studies using the same instrument to measure OHRQoL.[15,16] Irregular dental visits, limited financial resources for dental care, smoking and daily medication were found to be predictors for at least one OIDP and *frequent* OIDP. Missing ten or more teeth was found to be associated with a higher OIDP score,[15,16,24] which is in accord with the present study, showing an association between <20 remaining teeth and OIDP. In contrast to other studies, no association was found between ABL and OIDP.[13,14] Periodontal disease progresses often without clear symptoms. In the present study, ABL was classified by radiographs and clinical parameters were not included, which means that some of the individuals may have the disease under control and thereby experience fewer symptoms. In addition, OIDP may not be the most suitable instrument to assess OHRQoL in patients with periodontal disease. Other studies showing an association between periodontal disease and OHRQoL have used other instruments.[25,26] However, as there were other measures to be investigated, such as caries and TMD, OIDP was considered to be the best available instrument to use in the present study as it is a validated instrument, used in similar populations.[14,15] In accord with other studies,[14,27] TMD was found to impact QoL. In contrast to other studies,[13,15] manifest caries lesions were found to be associated with OIDP in the present study. Different methodology and diagnostic criteria may be a reason for the discrepancy in results, compared with other studies. However, manifest caries

can be painful and troublesome, and it seems reasonable that this has an impact on OHRQoL.

The fact that eating was the most reported OIDP in the present study supports and verifies the clinical data regarding manifest caries, less remaining teeth and TMD affecting QoL.

A limitation in the present study is that the non-respondent rate increased over the study years. It is reasonable to expect that the non-respondents were no healthier and had a better OHRQoL compared to the respondents, as other studies have shown that non-respondents are generally less healthy than participants in health investigations.[28,29] To ensure the best conformity, comprehensive written instructions and illustrations were provided of the different clinical variables to be recorded, as there was a large number of individuals performing the clinical examinations. The same diagnostic criteria were used in all study years and the categorization of ABL was performed by two of the authors, and dental caries was confirmed on bite-wing radiographs by the authors, strengthening the clinical measures.

5 | CONCLUSION

Attitudes important in maintaining and improving good oral health, such as preventive care and regular recalls to dentistry, became less important during this period of 10 years, and the possibility of booking treatment time was reported more frequently in 2013. Oral impact on daily performance was found to be associated with irregular dental visits and limited economy for dental care, less than 20 remaining teeth, TMD and manifest caries.

6 | CLINICAL RELEVANCE

6.1 | Scientific rationale for the study

Studies investigating attitudes over an extended time are sparse in the literature, as well as OHRQoL, and the association with socio-economic and socio-behavioural factors and clinical findings.

6.2 | Principal findings

Socio-economic and socio-behaviour factors were significantly associated with manifest caries. Attitudes important in maintaining and improving oral health became less important. OIDP was found to be associated with irregular dental visits, limited economy for dental care, and individuals with less than 20 remaining teeth, manifest caries and temporomandibular disorder.

6.3 | Practical implications

As oral diseases have a negative impact on quality of life, health promotion and prevention are crucial, and existing efforts need to be highlighted and further developed. Promotion of oral health is a cost-effective strategy in reducing the burden of oral disease and maintaining oral health and quality of life, and should be a priority in early ageing populations.

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CONFLICT OF INTEREST

The authors state explicitly that there are no conflict of interests in connection with this article.

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