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Oral health-related quality of life in a birth cohort of 32-year olds

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Abstract

Objectives—To describe oral health-related quality of life (OHRQoL) among New Zealand adults and assess the relationship between clinical measures of oral health status and a well-established OHRQoL measure, controlling for sex, socioeconomic status (SES) and use of dental services.

Methods—A birth cohort of 924 dentate adults (participants in the Dunedin Multidisciplinary Health and Development Study) was systematically examined for dental caries, tooth loss, and periodontal attachment loss (CAL) at age 32 years. OHRQoL was measured using the 14-item Oral Health Impact Profile questionnaire (OHIP-14). The questionnaire also collected data on each study member's occupation, self-rated oral health and reasons for seeing a dental care provider. SES was determined from each individual's occupation at age 32 years.

Results—The mean total OHIP-14 score was 8.0 (SD 8.1); 23.4% of the cohort reported one or more OHIP problems 'fairly often' or 'very often'. When the prevalence of impacts 'fairly/very often' was modeled using logistic regression, having untreated caries, two or more sites with CAL of 4+ mm and 1 or more teeth missing by age 32 years remained significantly associated with OHRQoL, after adjusting for sex and 'episodic' dental care. Multivariate analysis using Poisson regression determined that being in the low SES group was also associated with the mean number of impacts (extent) and the rated severity of impacts.

Conclusions—OHIP-14 scores were significantly associated with clinical oral health status indicators, independently of sex and socioeconomic inequalities in oral health. The prevalence of impacts (23.4%) in the cohort was significantly greater than age- and sex-standardized estimates from Australia (18.2%) and the UK (15.9%).

Keywords

adult; dental caries; oral health; Oral Health Impact Profile; periodontal diseases; prevalence; quality of life; tooth loss

Measures of oral health-related quality of life (OHRQoL) are increasingly being used in descriptive population-based research as a means of capturing nonclinical aspects of oral health that patients deem most relevant to their overall health and well-being (1). When OHRQoL measures are used alongside traditional clinical methods of measuring oral health status, a more comprehensive assessment of the impact of oral diseases on the several dimensions of subjective well-being becomes possible (2–6). These dimensions include functional limitation,

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physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap (7), although other overlapping domains of OHRQoL have been described, such as oral functions, orofacial pain, psychosocial impact, and appearance (5). It should be noted, however, that because the concept of OHRQoL is a complex multidimensional construct, conceptualizing it has always been a challenge. Typically, OHRQoL scales are set up on a theoretical basis and are consequently constructed around theoretical domains. Subsequent analyses give rise to fewer or different domains, largely based on factor analysis and at times, these domains do not relate to the original construct of the index. Regardless of this, certain areas of conceptual agreement do exist and are reflected in the domains mentioned above. It is important for public health researchers to use instruments that appropriately assess the relevant multidimensional aspects of OHRQoL for specific populations and disease conditions. At present, we are at the beginning of the process of constructing quality-of-life indices and searching for the best measures for assessing the impact of social determinants on oral health. The aim of this research was to provide public health officials with a better method for setting health goals and prioritizing and planning services for particular populations.

To date, not many oral health surveys of national samples of adults have included measures of subjective oral health. The 1998 UK Adult Dental Health Survey and the 1999 Australian National Dental Telephone Interview Survey are among the few exceptions (8,9). Both of these surveys used the 14-item Oral Health Impact Profile questionnaire (OHIP-14) (7), and comparisons were made of the percentages of dentate adults reporting adverse impacts of oral health in each country (10). Australians reported a larger number and more severe impacts than dentate adults in the UK, most notably with respect to the dimensions of physical pain and disability. Furthermore, regional variations in prevalence within populations were reported, and the authors acknowledged that the impact of oral conditions may also differ among sociocultural subgroups in these populations.

Moreover, differences may exist in OHRQoL between younger and older adults, because of the increase in the prevalence of oral conditions with age. One of the strongest predictors for impaired OHRQoL is tooth loss, which is associated with aging. While tooth loss is linked to negative impacts, increasing age independently results in fewer oral health impacts (11). Therefore, it is important in any analyses of whole populations to account for both age and tooth loss. If either of these variables is not taken into account, an incomplete picture of OHRQoL can result (11). Failing to account for these measures as predictors may partly explain the generally weak associations found between clinical parameters and oral impacts experienced by older individuals (12–14).

It has also been suggested that sex and socioeconomic status (SES) can have a moderating role on OHRQoL. When overall oral health is considered, there are few or no differences between men and women, but sex differences are quite apparent when the utilization of dental care services, treatment outcomes, or OHRQoL are examined (15). In a nation-wide survey in the UK, more women than men perceived oral health problems as causing more pain, embarrassment, and being detrimental to their finances. Women also more frequently perceived good oral health as enhancing their life quality, moods, appearance, and general wellbeing (16). At the same time, the findings of a more recent UK study suggest that lifecourse influences on OHRQoL appear different for men and women. For women, factors from early and adult life (such as the number of retained teeth) had the greatest impact on OHRQoL, but for men, oral impacts were best explained by social class and housing conditions at birth or early in life (17).

Longitudinal epidemiologic studies using OHRQoL measures have greatly contributed to our understanding of how demographic and socioeconomic factors modify the impact of oral health problems on quality of life. Such studies have revealed that problem-oriented dental attenders

and individuals with limited financial resources are more likely to experience oral disadvantages than regular attenders and those who are financially better-off (18). Similarly, cross-sectional data from a New Zealand study showed that OHRQoL was positively related to asymptomatic dental visits and negatively to symptomatic dental visits among adults (19).

The objective of this study was to describe OHRQoL in a representative birth cohort of adults who were born in New Zealand. Additional objectives of the study were to assess the relationship between clinical measures of oral health status and OHRQoL, and to investigate sex- and SES-based differences in OHRQoL.

Materials and methods

Study population

Data were obtained from the Dunedin Multidisciplinary Health and Development Study (DMHDS), a longitudinal study of a birth cohort of children who were born at the Queen Mary Hospital, Dunedin, New Zealand between April 1, 1972 and March 31, 1973 (20). The sample that formed the basis for the longitudinal study was 1037 children who were assessed within a month of their third birthdays. Periodic collections of health and developmental data (including dental examinations) have been undertaken since the first assessment, and this study used data collected from dental examinations and interviews conducted at age 32 years. Over 90% of the cohort self-identified as being of European origin. Barriers to study members' participation were minimized by insuring that travel costs and opportunity costs (e.g. lost wages, childcare) were covered by the study budget. Ethical approval for the study was obtained from the Otago Ethics Committee.

Measures

The short-form Oral Health Impact Profile (OHIP-14; 7) was administered by trained interviewers when the birth cohort was at age 32 years. For each of the 14 items (Table 2), study members were asked how often they had experienced the problem in the previous 4 weeks. Responses were coded as 'very often' (scoring 4), 'fairly often' (3), 'occasionally' (2), 'hardly ever' (1) or 'never' (0). OHIP-14 scores were computed in two ways: first, a total OHIP-14 score was calculated by summing responses over all 14 items, with possible scores ranging from 0 to 56; secondly, OHIP-14 subscale scores were calculated for each of the dimensions indicated in Table 2 by summing the ordinal response scores for the two items comprising each subscale. Item weights were not used. The total OHIP-14 score and the subscale scores constitute measures of the 'severity' of adverse impacts caused by oral conditions and, as such, these measures used all response categories (10).

To enable comparisons with data from similar studies, two other summary measures were also computed: (i) the prevalence (percentage) of people reporting one or more items 'fairly often' or 'very often', and (ii) the extent (i.e. the number of items reported 'fairly often' or 'very often'). Unlike that for 'severity', the prevalence and extent measures only make use of the more severe response categories (9).

Estimates of social class were obtained for each participant from data collected on SES, using the study member's occupation, assessed during the age-32 interview, and standard New Zealand occupationally based indices (21,22), which employ a six-interval classification (where, e.g. a doctor scores '1' and a laborer scores '6'). The resulting scores were used to assign each individual to one of three SES groups using predetermined thresholds: scores of 1 and 2 were allocated to the 'high SES' group; those scoring 3 or 4 were allocated to the 'medium SES' group; and the remainder (scores 5 or 6) were categorized as 'low SES'.

Dental examinations for caries and missing teeth at age 32 years were conducted by calibrated dental examiners using the decayed, missing and filled surfaces (DMFS) index. An estimate of accumulated tooth loss because of caries was obtained by observing the presence or absence of each tooth at age 32 years, and ascertaining the reason for its absence and the age at which the tooth was lost. In this study, third molars were not included in the computation of tooth loss; only those teeth which had been lost because of caries were included in the analysis.

At age 32 years, periodontal measurements were made in all four quadrants. Three sites (mesiobuccal, buccal, and distolingual) per tooth were examined with probing depth (PD; the distance from the tip of the probe to the gingival margin) and gingival recession (GR; the distance from the gingival margin to the amelocemental junction) recorded using a National Institute for Dental Research (NIDR) probe. Clinical periodontal attachment loss (CAL) for each site was calculated by summing GR and PD. Midbuccal measurements for molars were made at the midpoint of the mesial root. All measurements were rounded down to the nearest whole millimeter at the time of recording. Third molars were not included in the analysis of the periodontal data. In this study, we defined a ‘case’ of periodontal disease as an individual with two or more sites with CAL of 4 mm or more, but we also reported those who had one or more sites with CAL of 4 mm or more, in order to enable comparisons with results of other studies.

Use of dental services was determined by asking participants whether they usually visited the dentist for a check-up or only when a dental problem arose. Those who reported the latter were designated ‘episodic users’ of dental services because of the intermittent use of those services. In addition, data were collected on self-reported oral health using two global measures. Study participants rated their dental health in comparison with other persons their age, with response options dichotomized as ‘better than average’ and ‘worse than average’, and by means of a global transition judgment measure which asked whether the participant’s oral health had ‘improved’, ‘stayed the same’, or ‘worsened’ since the previous assessment at age 26 years.

Data analysis

Descriptive statistics such as mean, proportions (and accompanying standard deviations or 95% confidence intervals where appropriate) were used to describe the distribution of OHIP-14 scores and the prevalence, extent, and severity of impacts of oral disorders. The independent variables selected for analysis were dichotomized based on the data distributions, and the bivariate relationships between each independent variable and the prevalence of impacts reported ‘fairly often’ or ‘very often’ were evaluated using the Pearson chi-squared test. The strength of these relationships was represented by an odds ratio computed through stratified analysis by sex and SES (high or medium versus low); this was used to determine whether sex or SES was confounder or effect modifier of the relationship between OHRQoL and clinical measures of oral health.

Multivariate analyses were used to control for the potential influences of SES, use of dental services and sex on the relationship between OHRQoL and clinical measures of oral health status. The prevalence of impacts ‘fairly often’ or ‘very often’ was modeled using logistic regression, while Poisson regression was used to explore the relationship between clinical measures of oral health status and the extent and severity of impacts. The two multivariate analyses included the same set of independent variables, which were forced into the models, while two-way interaction terms were evaluated for statistical significance at the 0.05 level. Self-rated oral health measures were intentionally left out of the multivariate analyses, because of the fact that single-item subjective indicators (such as self-rated oral health) are closely related to OHRQoL, in that perceptions of poor oral health are associated with poor OHRQoL (23). Statistical tests were two-tailed and interpreted at the 0.05 level. Data analyses were

carried out using SPSS (Version 13.0; SPSS Inc., Chicago, IL, USA) and Stata (Version 8; StataCorp, College Station, TX, USA).

Because of our interest in comparing the estimates of the prevalence, extent and severity of oral impacts in this population with those of other adult populations, descriptive statistics were obtained from relevant publications, and pairwise comparisons for statistical significance were based on non-overlap of 95% confidence intervals.

Results

Response

At age 32 years, 1015 of the study members were alive, and 972 (96% of the surviving cohort) were assessed. Dental examination data at age 32 years were available for 932 individuals, and both OHIP and dental examination data were available for 924 of those (excluding two edentulous individuals). Unless otherwise indicated, all analyses refer to those 924, of whom 51.1% were male. Most participants belonged to the high-SES (17.1%) or medium-SES (52.8%) groups, while 30.0% were in the low-SES group at age 32 years (one individual was unable to be categorized).

Oral health by sex and SES

The prevalence of decayed surfaces was higher among males, who also had a higher prevalence of periodontal sites with 4+ mm CAL and more tooth loss than females (Table 1). More males than females were episodic users of dental services. Study members in the low-SES group had worse oral health than those who were better off socioeconomically, particularly with respect to the prevalence of periodontitis and tooth loss.

OHRQoL

The distributions of responses to individual OHIP- 14 items are given in Table 2, together with item mean scores. The most commonly reported impacts were within the dimensions of ‘physical disability’, ‘physical pain’, and ‘psychological discomfort’. One in 11 study members reported an unsatisfactory diet or being self-conscious because of dental problems ‘fairly/very often’ during the previous month, while more than one-quarter experienced toothache ‘occasionally’ or more frequently. Consequently, mean item scores were also higher within these three dimensions (range: 0.53–0.99). On the other hand, only 1.3% to 4.7% reported negative impacts within the dimensions of functional limitation, psychological disability, social disability or handicap ‘fairly often’ or ‘very often’, with mean scores for those items ranging from 0.17 to 0.70.

Data on the prevalence, extent and severity of impacts by OHIP-14 dimension and total scale score are summarized in Table 3. Twenty-three percent reported one or more OHIP items ‘fairly often’ or ‘very often’, with an overall mean of 0.55 items reported ‘fairly often’ or ‘very often’. The mean severity score, summed for the 14 items in the scale was 8.00. The physical pain, psychological discomfort, and physical disability dimensions accounted for the highest prevalence, extent, and severity of impacts.

Oral health status and OHRQoL

The bivariate associations between the prevalence of impacts (fairly/very often) and the clinical measures were analyzed separately by sex (Table 4). Dental caries, periodontal disease experience and tooth loss were significantly associated with functional and psychosocial impacts among males and females. However, the significant association of periodontal disease and OHRQoL appeared stronger among females; that is, the odds ratios were higher than those observed among males (although the 95% CI did overlap). As anticipated, individuals with

worse perceptions of their oral health were more likely to report negative impacts fairly/very often, regardless of their sex. Similarly, episodic users of dental care were more likely to report more severe impacts, with the odds ratio being almost fourfold among females.

The associations between impact prevalence and the clinical oral health status measures were fairly comparable for those in the high/medium-SES and low-SES groups (Table 5). However, there were some differences, particularly with respect to the impact of dental caries experience, with the odds ratios being higher for the low-SES group for both overall DMFS and untreated decayed surfaces (although the 95% CI for the odds ratios did overlap). The impact of worse-than-average selfrated oral health was greater among the low-SES group, while perceiving one's oral health to have deteriorated between ages 26 and 32 years appeared to have a greater impact among those of higher SES (although in both of these cases, the 95% CI overlapped).

The outcome of the logistic regression model for the prevalence of impacts (fairly/very often) is presented in Table 6, with sex, SES, use of dental services, and three of the selected clinical measures of oral health status forced into the model. Other than sex (which just failed to reach statistical significance), all of the variables were significantly associated with the prevalence of oral health impacts.

The Poisson regression models for the extent and severity of impacts are shown in Table 7. The model for the extent of impacts showed the three clinical oral health indicators – as well as being female, of low SES or an episodic user of dental care – to be strongly associated with the dependent variable, but being a case of periodontal disease was not. In the model for severity, all the clinical oral health indicators (and low SES) were strongly associated with the dependent variable, but being female was not.

Discussion

This study described the occurrence of OHRQoL in a general population birth cohort of dentate 32-year olds born in New Zealand. It has found strong associations between OHRQoL and measures representing clinical oral health, with an apparent sex-based difference in the manifestation of some of those associations. Other factors most associated with 'impacts' include SES, usual reason for visiting a dentist, having already acquired dental caries experience, and having already lost teeth. These associations with oral health status and risk indicators of oral diseases suggest that the OHRQoL measures are valid and support their use in oral health surveys to augment the traditional dental public health clinical measures which count teeth, as in the DMFT, or tooth sites, when using the Community Periodontal Index of Treatment Needs (CPITN). This traditional approach is not, however, without its drawbacks, in particular, the DMFT, CPITN, and other clinical indices neglect the fact that the level of treatment (if any) carried out is influenced by the patient's perceived needs and ability or willingness to pay. Incorporating self-reported measures that address these needs will provide a complementary perspective that will be far more effective than simply counting decayed teeth.

In the current study, 23% of 32-year-old dentate subjects reported that their oral condition had negatively impacted upon them in some way fairly often or very often over the preceding 4 weeks, thereby affecting their quality of life. Most participants, however, reported only one or two problems during the previous month. Does a proportion of almost one in four individuals represent a high prevalence? In other words, how do the OHRQoL estimates from the Dunedin cohort compare with those from other populations? When the Dunedin OHIP data were compared with estimates for dentate adults in the UK and Australia (10), the prevalence of impacts was significantly greater in New Zealand (23.4%) than in either of those countries (18.2% and 15.9% respectively; Table 8). When the extent and severity scores were compared,

the New Zealand estimates were similar to those from Australia, but they were higher than those from the UK. These findings were consistent across different OHIP dimensions, and among males and females. Females in Australia and New Zealand appear to experience more 'severe' impacts of oral disorders on everyday life (represented by higher OHIP-14 mean scores) than males. However, it should be noted that the age distributions of the UK and Australian samples differed from that of the New Zealand sample: the median age in the former averaged around 40 years (10), whereas the Dunedin study participants were all aged 32 years. Thus, differences may be partly explained by differences in sampling strategies and/or participation rates. In the Dunedin study, an entire cohort was followed for 32 years (with a very high participation rate), while the data from the UK and Australia were derived from representative probability samples that had lower participation rates of 72% and 64.6%, respectively. There is the possibility that the participants in the Dunedin study are more aware than most of their oral health as a result of the regular follow-ups that are part of the study, but comparisons of the Dunedin Study members with people of the same age in the nationally representative New Zealand Health and National Nutrition Surveys found little evidence that the repeated assessments in the Dunedin Study had significantly altered the study members' health (24). It is therefore possible that nonresponse bias may have led to an underestimation of the true prevalence in the Australian and UK studies, while the Dunedin study members' regular follow-up visits may have had little or no effect.

Nevertheless, in general population samples, it is expected that relatively few people are handicapped or frequently experience the more severe dimensions of disability. OHIP data from a national survey in Germany revealed a prevalence of frequent impairment (response categories 'fairly often' or 'very often') of less than or equal to 6% for all items, while the previous-month prevalence of any impairment ranged from 13% to 46% across all items, with higher prevalence observed for people wearing removable dentures or complete dentures than those without dentures (25). Similarly, prevalence estimates were low using the Norwegian version of the Oral Impacts on Daily Performance (OIDP) instrument in a representative sample of Norwegian adults (26): 18% reported at least one oral impact during the past 6 months. As with the OHIP-14, the OIDP (27) has items which only consider the negative impact of oral health on quality of life (28).

In this study, only 7% of dentate adults experienced pain associated with their teeth, mouth, or dentures fairly/very often in the previous 4 weeks. Approximately 11% said they had an unsatisfactory diet or had to interrupt meals (physical disability), and one in 10 reported a psychological effect of their oral state (in the sense that they felt conscious or tense about their teeth). Coincidently, physical pain and physical disability were the dimensions of the OHIP that contributed most to variations in the sex- and age-category distributions of subjective impacts between adults in the UK and Australia (10). It is noteworthy that the national norms for the OHIP-14 differed dramatically from age–sex norm values previously presented for the 16-item United Kingdom Oral-health- related Quality of Life Measure (OHRQoL-UK; 29) primarily because of differences in the underlying concepts and dimensions of the two instruments (28). Using the OHRQoL-UK, 75% of respondents perceived their oral health as affecting their life quality, either in a negative or positive way (or both), but age, social class, and the number of retained teeth accounted for substantial variation in OHRQoL-UK scores. Furthermore, Slade et al. (10) included only those impacts reported 'fairly often' or 'very often' in the previous year, while McGrath and Bedi (29) included all categories, regardless of their frequency. This difference in instruments might very well explain the different levels of impact found across the two studies. We adopted the more restrictive definition of prevalence of adverse impacts, as chronic or repeated impacts are most likely to be considered as a public health problem.

The present study has several strengths. Foremost among these is that the Dunedin study used both clinical indicators of oral health status and a multi-item OHRQoL scale. Clinical indicators of oral health status were significantly related to the measure of OHRQoL in stratified analyses by sex and SES. The effects of clinical oral health status on OHRQoL persisted after controlling for sex, SES, and dental visiting in the multivariate analyses. We believe that when oral health is evaluated using true endpoints such as tooth loss, or more clinically relevant cut-points for severity of dental caries and periodontitis, poor OHRQoL parallels poor oral health, when estimated using clinical measures of disease.

Consistent with the findings of other studies, we found that women perceive their oral health as having a greater impact on their quality of life than men (15–17), and this was despite the Dunedin study women having fewer missing teeth or untreated decayed surfaces, and less periodontal attachment loss than men. They were also more likely to be preventive dental visitors. Moreover, women who were defined as cases of periodontal disease had a threefold greater risk of frequent oral impacts than females who were not cases. Sex differences in OHRQoL cannot be solely explained by poor oral health status; to further understand differences in OHRQoL between men and women, the different lifecourse influences for each sex must be considered (17).

There were also socioeconomic differences, with the impact of dental caries and self-rated oral health (and change in oral health) on OHRQoL differing between the high/medium-SES and low-SES groups. The reasons why socioeconomic circumstances are associated with oral health and OHRQoL are poorly understood and may go beyond the simple explanation of material deprivation. For example, in a recent French study (30), 63% of economically disadvantaged 35–44-year olds (who were eligible for publicly funded health insurance coverage for dental care) reported poor oral health and 79% perceived a need for care as measured by the General Oral Health Assessment Index (GOHAI) (31). While the GOHAI score was correlated with the number of decayed and missing teeth, it was unrelated to oral health behavior, as less than half (48%) of the sample had visited a dentist during the previous 12 months. This finding signals that access to care *by itself* will not improve oral health and OHRQoL in low SES groups.

It has been suggested that psychosocial factors are important in understanding pathways between socioeconomic position, oral health status and OHRQoL (32,33). A recent study using self-report data obtained from a representative Australian adult sample revealed that those with high scores for a sense of control, social support and life satisfaction reported that oral conditions disrupted their quality of life less often, while those with higher OHIP-14 scores had significantly higher levels of stress in relation to their oral health (33). A national oral health study of Finnish adults arrived at similar conclusions with respect to psychosocial factors and OHRQoL (34). The Finnish study found that people with a strong or moderate sense of coherence (SOC) had significantly fewer problems attributed to oral conditions (OHIP) than those with a weak SOC. The SOC was also associated with all of the subscales of the OHIP, and the association was most evident with the psychological discomfort, psychological disability and handicap subscales. Most importantly, rehabilitative dental treatment offered to indigent adults in San Francisco improved OHRQoL and employment (35). As 57% of the cohort was either homeless or provisionally housed, the loss to follow-up of participants was high (35%), yet those welfare recipients who completed their dental treatment program were twice as likely to achieve a more favorable employment outcome and improved quality of life.

It is important to acknowledge that the current study was unable to determine whether clinical oral health status, self-rated oral health, dental visiting behavior, sex, or SES had a direct causal association with the OHIP scores because we have had to treat it as a cross-sectional study, as the OHIP-14 measure was first used when the cohort was at age 32 years; thus, it is not possible

to establish the temporal sequence of these events at this time. Using the OHIP-14 in subsequent data collection phases with the Dunedin cohort should enable examination of the nature of the association between SES, oral health, and OHRQoL using a lifecourse approach.

In summary, OHIP-14 scores in this New Zealand birth cohort were significantly associated with oral health status after controlling for sex, SES, and use of dental services. These findings indicate that self-reported OHRQoL measures have a future in population-based surveys, not as a substitute for the oral examination, but as an adjunct to identifying the conditions with the most potential to compromise patient well-being and quality of life. From a dental public health services perspective, there is merit in using OHRQoL instruments in combination with traditional measures, particularly when planning public health services for those most in need of oral health promotion interventions or community-based oral health strategies. When healthcare resources are scarce, findings from such patient-based outcome measures can be used to ensure that funding and/or services are directed at those conditions most likely to have a negative effect on OHRQoL of specific populations.

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Table 1

Oral health characteristics of cohort at age 32 years, by sex and SES

Characteristic	Sex		SES at age 32 years [a]		All combined (*n* = 924) *n* (%)
	Male (*n* = 472) *n* (%)	Female (*n* = 452) *n* (%)	High/medium (*n* = 765) *n* (%)	Low (*n* = 158) *n* (%)	
Dental caries					
DMFS 12+ (median)	260 (55.1)	221 (48.9)*	318 (49.2)	162 (58.5)*	481 (52.1)
1+ Decayed surfaces	284 (60.2)	203 (44.9)***	308 (47.7)	178 (64.3)***	487 (52.7)
Periodontal disease					
1+ sites with CAL of 4+ mm	161 (34.1)	108 (23.9)***	154 (23.8)	114 (41.2)*	269 (29.0)
2+ sites with CAL of 4+ mm	108 (22.9)	73 (16.2)**	101 (15.6)	80 (28.9)***	181 (19.6)
Tooth loss due to caries					
1+ teeth missing	126 (26.7)	89 (19.7)*	116 (18.0)	98 (35.4)***	215 (23.3)
Self-rated oral health worse than average compared with others of the same age	231 (48.9)	216 (47.8)	282 (43.7)	164 (59.2)***	447 (48.4)
Self-rated oral health worsened since age 26 years	161 (34.1)	147 (32.6)	199 (30.8)	108 (39.1)*	308 (33.4)
Usual reason for visiting a dentist					
Check-up	192 (40.7)	242 (53.5)***	305 (47.2)	93 (33.6)***	434 (47.0)
Problem	280 (59.3)	210 (46.5)	341 (52.8)	184 (66.4)	490 (53.0)

[a] One participant unable to be classified for the age-32 SES variable.

* $P < 0.05$;

** $P < 0.01$;

*** $P < 0.001$.

Table 2

Distribution of responses to individual OHIP-14 items and mean item scores (n = 924)

Dimension and description of item 'Because of trouble with your teeth, mouth or dentures during the last 4 weeks, …'	Distribution of responses (%)			Mean (SD)
	Never (0)/ hardly ever (1)	Occasionally (2)	Fairly often (3)/very often (4)	
Functional limitation				
Have you had trouble *pronouncing any words*?	92.5	6.0	1.5	0.26 (0.63)
Have you felt that your *sense of taste* has worsened?	90.4	7.7	1.9	0.37 (0.72)
Physical pain				
Have you had *painful aching* in your mouth?	72.8	22.9	4.2	0.86 (0.95)
Have you found it *uncomfortable to eat any foods*?	72.7	21.5	5.7	0.86 (1.00)
Psychological discomfort				
Have you been *self-conscious*?	73.6	17.3	9.1	0.85 (1.08)
Have you *felt tense*?	83.9	12.1	4.0	0.58 (0.89)
Physical disability				
Has your *diet been unsatisfactory*?	65.6	25.6	8.8	0.99 (1.08)
Have you had to *interrupt meals*?	85.2	10.8	4.0	0.53 (0.89)
Psychological disability				
Have you found it *difficult to relax*?	83.2	13.7	3.0	0.60 (0.85)
Have you been a bit *embarrassed*?	80.8	14.5	4.7	0.70 (0.94)
Social disability				
Have you been a bit *irritable with other people*?	83.4	13.6	2.9	0.55 (0.85)
Have you had *difficulty doing your usual jobs*?	93.9	4.5	1.5	0.29 (0.65)
Handicap				
Have you felt that life in general was *less satisfying*?	89.9	7.4	2.7	0.39 (0.76)
Have you been totally *unable to function*?	96.5	2.2	1.3	0.17 (0.53)

Table 3

Prevalence, extent and severity of impacts by OHIP-14 subscale and total score (n = 924)

Dimension	*Prevalence*: no. reporting 1+ impacts fairly/very often (%)	*Extent*: mean no. of items reported fairly/very often (SD)	*Severity*: mean OHIP-14 score (SD)
Functional limitation	29 (3.1)	0.03 (0.20)	0.63 (1.12)
Physical pain	66 (7.1)	0.10 (0.38)	1.72 (1.78)
Psychological discomfort	95 (10.3)	0.13 (0.41)	1.43 (1.77)
Physical disability	99 (10.7)	0.13 (0.39)	1.52 (1.69)
Psychological disability	59 (6.4)	0.08 (0.31)	1.29 (1.59)
Social disability	34 (3.7)	0.04 (0.24)	0.85 (1.39)
Handicap	27 (2.9)	0.04 (0.25)	0.56 (1.16)
Total OHIP-14 score	216 (23.4)	0.55 (1.44)	8.00 (8.08)

Table 4

Prevalence of impacts (fairly/very often), by sex, oral disease prevalence, self-rated oral health and usual reason for visiting a dentist

	Males (*n* = 472)			Females (*n* = 452)		
	***n* (%)**	**Odds ratio (95% CI)**	***P*-value**	***n* (%)**	**Odds ratio (95% CI)**	***P*-value**
Dental caries						
DMFS < 12	34 (16.0)	1.00		44 (19.0)	1.00	
DMFS 12+	74 (28.5)	2.08 (1.32–3.28)	0.001	64 (29.0)	1.73 (1.12–2.69)	0.014
DS = 0	22 (11.7)	1.00		38 (15.3)	1.00	
DS 1+	86 (30.3)	3.28 (1.97–5.47)	<0.001	70 (34.5)	2.92 (1.86–4.59)	<0.001
Periodontal disease						
0 sites with CAL of 4+ mm	62 (19.9)	1.00		67 (19.5)	1.00	
1+ sites with CAL of 4+ mm	46 (28.6)	1.61 (1.03–2.50)	0.034	41 (38.0)	2.53 (1.58–4.05)	<0.001
<2 sites with CAL of 4+ mm	75 (20.6)	1.00		76 (20.1)	1.00	
2+ sites with CAL of 4+ mm	33 (30.6)	1.70 (1.05–2.75)	0.031	32 (43.8)	3.11 (1.84–5.27)	<0.001
Tooth loss due to caries						
0 teeth missing	57 (16.5)	1.00		68 (18.7)	1.00	
1+ teeth missing	51 (40.5)	3.45 (2.19–5.44)	<0.001	40 (44.9)	3.54 (2.16–5.80)	<0.001
Self-rated oral health compared with others of the same age						
Better than average	31 (12.9)	1.00		31 (13.1)	1.00	
Worse than average	77 (33.3)	3.39 (2.13–5.40)	<0.001	77 (35.6)	2.75 (1.76–4.30)	<0.001
Self-rated oral health since age 26 years						
Improved/stayed the same	47 (15.1)	1.00		53 (17.4)	1.00	
Got worse	61 (37.9)	3.43 (2.20–5.35)	<0.001	54 (36.7)	2.76 (1.74–4.38)	<0.001
Usual reason for visiting a dentist						
Check-up	23 (12.0)	1.00		31 (12.8)	1.00	
Problem	85 (30.4)	3.20 (1.93–5.31)	<0.001	77 (36.7)	3.94 (2.46–6.31)	<0.001

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Table 5

Prevalence of impacts (fairly/very often), by SES at age 32 years, oral disease prevalence, self-rated oral health and usual reason for visiting a dentist

	High/medium SES (*n* = 765)			Low SES (*n* = 158)		
	***n* (%)**	**Odds ratio (95% CI)**	***P*-value**	***n* (%)**	**Odds ratio (95% CI)**	***P*-value**
Dental caries						
DMFS < 12	52 (15.9)	1.00		26 (22.6)	1.00	
DMFS 12+ (median)	69 (21.7)	1.47 (0.99–2.19)	0.06	68 (42.0)	2.48 (1.45–4.24)	0.001
DS = 0	42 (12.4)	1.00		18 (18.2)	1.00	
DS 1+	79 (25.6)	2.43 (1.61–3.67)	<0.001	76 (42.7)	3.35 (1.86–6.05)	<0.001
Periodontal disease						
0 sites with CAL of 4+ mm	82 (16.7)	1.00		47 (28.8)	1.00	
1+ sites with CAL of 4+ mm	39 (25.3)	1.70 (1.10–2.62)	0.02	47 (41.2)	1.73 (1.05–2.87)	0.03
<2 sites with CAL of 4+ mm	92 (16.9)	1.00		58 (29.4)	1.00	
2+ sites with CAL of 4+ mm	29 (28.7)	1.98 (1.22–3.22)	0.005	36 (45.0)	1.96 (1.15–3.35)	0.013
Tooth loss because of caries						
0 teeth missing	80 (15.1)	1.00		45 (25.1)	1.00	
1+ teeth missing	41 (35.3)	3.08 (1.96–4.82)	<0.001	49 (50.0)	2.98 (1.77–5.01)	<0.001
Self-rated oral health compared with others of the same age						
Better than average	42 (11.5)	1.00		20 (17.7)	1.00	
Worse than average	79 (28.0)	2.98 (1.97–4.51)	<0.001	74 (45.1)	3.82 (2.16–6.78)	<0.001
Self-rated oral health since age 26 years						
Improved/stayed the same	57 (12.8)	1.00		43 (25.6)	1.00	
Got worse	64 (32.2)	3.24 (2.16–4.87)	<0.001	50 (46.3)	2.51 (1.50–4.19)	<0.001
Usual reason for visiting a dentist						
Check-up	37 (10.9)	1.00		17 (18.3)	1.00	
Problem	84 (27.5)	3.12 (2.04–4.77)	<0.001	77 (41.8)	3.22 (1.76–5.87)	<0.001

Table 6

Logistic regression model for prevalence of impacts (‘fairly often’ or ‘very often’) at age 32 years (n = 923) Coeff. Odds ratio 95% CI for OR P-value

	Coeff.	Odds ratio	95% CI for OR	*P*-value
Constant	−2.611	—	—	—
Female	0.313	1.37	0.98–1.91	0.065
Low SES	0.451	1.57	1.12–2.21	0.01
Episodic dental user	0.840	2.32	1.60–3.36	<0.001
Any decayed surface (DS) at 32 years	0.666	1.95	1.35–2.81	<0.001
No. of teeth missing (due to caries) by 32 years	0.153	1.17	1.05–1.29	0.003
Case of periodontal disease (2+ sites with 4+ mm CAL at 32 years)	0.401	1.49	1.02–2.19	0.04

−2 Log-likelihood = 896.69; Cox & Snell R^2 = 0.11; Nagelkerke R^2 = 0.16; Hosmer and Lemeshow chi-squared test = 3.01, d.f. = 8, P = 0.93.

Table 7

Poisson regression models for the extent and severity of impacts (n = 923)

	***Extent*: mean no. of OHIP items reported fairly/very often (pseudo-R^2 = 0.13)**				***Severity*: mean total OHIP-14 score(pseudo-R^2 = 0.09)**			
	Coeff.	**IRR[a]**	**95% CI for IRR**	***P*-value**	**Coeff.**	**IRR[a]**	**95% CI for IRR**	***P*-value**
Constant	−1.93	—	—	—	1.54	—	—	—
Female	0.30	1.35	1.12–1.64	0.002	0.04	1.04	0.99–1.09	0.148
Low SES	0.28	1.33	1.09–1.62	0.005	0.11	1.11	1.06–1.17	<0.001
Episodic dental user	0.76	2.14	1.68–2.71	<0.001	0.40	1.49	1.41–1.57	<0.001
Any decayed surface (DS) at 32 years	0.63	1.88	1.50–2.36	<0.001	0.29	1.34	1.27–1.41	<0.001
No. of teeth missing (because of caries) by 32 years	0.12	1.12	1.09–1.15	<0.001	0.06	1.07	1.06–1.08	<0.001
Case of periodontal disease (2+ sites with 4+ mm CAL at 32 years)	0.14	1.14	0.86–1.52	0.349	0.13	1.14	1.05–1.23	0.002

[a]Ratio of geometric mean values.

Table 8

International comparisons of prevalence, extent and severity of overall impacts and selected dimensions among dentate adults

	United Kingdom[a]	Australia[a]	New Zealand
No. of participants	5270	3909	924
% aged 30–39 years	24	21	100
Median age (years)[b]	40	40–42	32
% Female	50	51	49
Prevalence: % of people reporting 1+ impacts fairly/very often (95% CI)	15.9 (14.9–16.8)	18.2 (16.2–20.2)	23.4 (22.0–24.8)
Extent: mean no. of items reported fairly/very often (95% CI)	0.36 (0.32–0.40)	0.46 (0.39–0.52)	0.55 (0.46–0.65)
Severity: mean OHIP-14 score (95% CI)			
All OHIP items			
Both sexes	5.1 (4.8–5.3)	7.5 (7.1–7.9)	8.0 (7.5–8.5)
Male aged 25–34 years	5.1 (4.8–5.4)	6.9 (6.4–7.4)	8.3 (7.6–9.0)
Female aged 25–34 years	5.3 (5.1–5.5)	7.9 (7.5–8.3)	7.7 (6.9–8.4)
Physical pain/physical disability (both sexes)	2.1 (2.0–2.2)	3.4 (3.3–3.6)	3.2 (3.0–3.4)
Other dimensions (both sexes)	2.9 (2.8–3.1)	4.0 (3.8–4.3)	4.8 (4.4–5.1)

[a] Slade et al. (10).

[b] Estimated for the UK and Australian samples by scrutinizing the data distributions.