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Trends in dentate status and preventive dental visits of the adult population in Denmark over 30 years (1987-2017)

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Running Head Dental status among Danish adults

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ABSTRACT

This study analyzed the trend in self-reported dentate status over 30 years (1987-2017) among Danish adults, the self-reported frequencies of preventive dental visits undertaken annually during the period 1987-2013, and the self-reported use of the 2016 re-call scheme for preventive dental check-ups. The impact of social determinants (education, employment, civil status, and ethnic background) on these dental outcome variables in 2017 was explored. Questionnaire data were obtained from the Danish Health and Morbidity Surveys conducted 1987-2017, and they were analyzed by tri-variate frequency distributions and multivariate analyses. The prevalence of complete tooth loss was 17.7% in 1987 but 3.4 % in 2017. The frequency of adults having 20 or more teeth grew markedly from 1987 (65.9 %) to 2017 (85.1 %). Educational inequality in dentate status persisted over the period. The frequency of preventive dental visits at least annually increased from 1987 to 2013 although less frequent for young people. In 2017, preventive dental check-ups were reported in intervals: less than 12 months (56.4%), 12-18 months (18.9 %), 19-24 months (4.8 %), and more than 24 months (5.2 %). In 2017, dentate status and preventive dental check-ups varied profoundly by social determinants. In conclusion, social policies should be implemented to

tackle the persistent inequities in dentate status and public health policies should target Universal Health Coverage.

Key words

Health surveillance, public health, dentate status, dental visits, social determinants

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INTRODUCTION

Oral health is an essential component of general health and well-being. However, many adults across countries continue suffering from oral diseases and conditions, which may induce pain or discomfort (1, 2). Dental caries and periodontal disease are major causes of tooth loss. Loss of natural teeth weakens quality of life and oral function when limiting the capacity of biting and chewing of food items, smiling, speaking and social communication, and the complaints may prompt psychosocial strain (3). Moreover, a poor dentition can affect the probability of getting a job.

Oral health surveys carried out in Denmark during the 1980s revealed that the burden of oral disease, tooth loss and the need for dental treatment was high on the adult population, particularly among deprived and older population groups and those living in rural areas (4, 5). Equally, a large number of adults were wearing removable dentures (6, 7). At the time, population surveys confirmed the strong health effect of social determinants, such as material living conditions (low education, low income, and strained life chances), behavioral factors (self-care practices, use of dental health services), and the exposure to work environmental risks (4, 8). Studies also

demonstrated that tooth loss among adults was associated with several modifiable risk factors, i.e., consumption of tobacco, harmful use of alcohol, intake of sugars, and poor oral hygiene (9, 10).

By tradition, dental health care for the adult population remains delivered by private dental practitioners and the cost of treatment rests high although certain services are partly supported by the National Health Insurance. The proportion of Danish adults visiting a dentist was relatively low during the 1980s and visits were often driven by symptoms (4, 6, 10, 11). Radical care, including tooth extraction in case of toothache, was particularly frequent among underprivileged and older people. In years to follow, population surveys revealed an improved accessibility to dental care, which concurred to declining prevalence rates of dental caries and enhanced control of disease, but social inequality in oral disease of adults was sustained (12-14).

In response to the high burden of oral disease in the country, the Danish Parliament passed three acts on dental care, which have had important impacts on the provision of dental care for the adult population. On top of the initial Act on Public Child Dental Health Care 1972 (15) providing preventive and restorative dental care for all children and youth, the Act on Dental Care in 1986 (16) included dental care for adults. The National Health Insurance remained a basis for financing adult dental care. Public dental care for institutionalized elderly was introduced by 1994 and some municipal authorities successively initiated economic support for dental care of disadvantaged individuals and certain older people from special payment programs. The current Danish Act on Health was established in 2005 (17) and dental care was made integral component of primary health care and disease prevention.

Disease prevention actions provided by the public child dental health services showed to translate into better dental health in adult life. The preventive activities resulted in a low level of dental caries among young adults and the social diversities in dental health status diminished (18). A further reduction in dental caries experience was noted among young people participating in the so-called Regular Youth Dental Care Programme as organized by the National Health Insurance (17). Subsequently, in later studies of all age groups of adults (19), lower proportions of edentulous people and persons wearing removable dentures were found among those having experience from the preventive dental care offered by the public child dental health services compared to those without such experience during childhood. In parallel, adults having benefitted from child dental

health care tended to preserve a functional dentition, in contrast to the loss of natural teeth that often occurred among persons who did not participate in regular dental care during childhood.

Surveys of adults have shown that regular dental visitors are likely to preserve their natural teeth while tooth loss is frequent among persons with irregular or no dental visits (4, 5, 19). According to the Act on Dental Care (16), the National Health Insurance has provided financial support for regular visits for dental check-ups and over the 1990s and 2000s, and adult people were encouraged to make such visits annually. By 2016, the Danish Health Authorities announced up-dated guidelines for individual preventive dental check-ups of all adults (20). Hence, recall visits must now consist of a dental check-up including clinical examination of teeth, mouth and jaws; needs and risk assessment of the patient, a socio-medical anamnesis, prevention of oral disease, and attention on the relationship between oral and general health. Generally, the shortest interval between two visits should be 12 months while the longest interval should be 24 months. The National Health Insurance offers financial support to the entire preventive service.

The purpose of the present study was: i) to describe the trend in dentate status of Danish adults based on equivalent health surveys carried out over the past 30 years (1987-2017); ii) to describe the frequency of adults attending for regular dental check-ups at least annually throughout the years 1987-2013, and iii) to assess the attendance in 2017 to the new national recall scheme for preventive dental check-ups. Finally, iv) the study evaluates the impact of structural social determinants on the prevalence of a functional dentition as well as the frequency of regular preventive dental check-ups as measured in 2017.

MATERIAL AND METHODS

Data were obtained from the Danish Health and Morbidity Surveys conducted during 1987-2017 (21, 22). The National Institute for Public Health at the University of Southern Denmark has carried out the Danish Health and Morbidity Surveys at regular intervals. Surveys have taken place typically every 4-5 years, with survey waves in 1987, 1994, 2000, 2005, 2010, 2013, and 2017. All surveys received clearance from the national ethical authorities. The surveys comprised the following number of participants and response rates: 1987 (n=4752, 79.9%), 1994 (n=4667,

78.2%), 2000 (n=16688, 74.2%), 2005 (n=14566, 66.7%), 2010 (n=15165, 60.7%), 2013 (n=14265, 57.1%), and 2017 (n=14022, 56.1%). Participants were selected using stratified multi-stage random methods. In all surveys, the age range of the target population was people aged 16-99 years.

All surveys were cross-sectional and the samples were considered nationally representative of the adult population living in Denmark. The overall aim of these surveys was to describe the status and trends in health and morbidity in the adult population aged 16 years or older. Moreover, the studies intended to identify social factors that may influence the population's health status, including health behavior, mental health, and environmental risks. In all survey waves, among questions on health, morbidity and social determinants, questions about dental status and preventive dental visits were incorporated. The questionnaires included standard sociodemographic questions on age, gender, education, employment status, civil status, and ethnic background. These variables were measured by highly structured questions and the wording of questions remained the same through all survey waves.

The response rates were somewhat lower for surveys conducted in 2010, 2013 and 2017 and weights were therefore constructed in order to ensure survey representativity (23). Accordingly, auxiliary information from Statistics Denmark's registers was used to take into account different sampling probabilities and differential non-response. The personal identification numbers of both respondents and non-respondents were linked to official registers using the Danish Civil Registration System. The auxiliary information was used to compute the weight and included gender, age, municipality of residence, highest completed level of education, ethnic background, hospitalization and occupational status. However, small variations existed in the information used to compute the weights in the different surveys. The weighting procedure in the Danish Health and Morbidity Surveys has been described in more detail elsewhere (22).

In 1987, 1994, 2000, and 2005, data were collected through face-to-face interviews. In 2010, 2013, and 2017, a concurrent mixed-mode approach was used to collect the survey data, allowing the participants either to complete a self-administered web questionnaire or to fill out an identical enclosed paper questionnaire. In each survey wave, participants were made aware of the purpose of the study and how to reply to questions technically. The participants were assured of the anonymity in relation to publication of the study results. The design of the surveys is described in detail elsewhere (21, 22).

In 2017, the questionnaire for self-administration was dispersed digitally (90.1%) or by postal delivery (9.9%). The sample size was 25,000 individuals aged 16 years or older and 14,022 individuals took part in the survey. The participation rate was higher for women (60.6%) than for men (51.6 %). Among men, the participation rate was slightly lower in younger age groups, while participation for women was relatively lower among those aged 75+ years or older. Finally, the response rate was fairly lower among unmarried persons and for individuals of non-Western backgrounds.

The Department of Odontology - School of Dentistry of the Faculty of Health and Medical Sciences, University of Copenhagen has been involved in the design of the dental survey questions and reporting of dental health results. In the surveys conducted from 1987 to 2013, the questionnaire included two outcome variables relevant to describing oral health: i) Self-reported number of natural teeth, which was then categorized into presence of 20 natural teeth or more indicating a functional dentition, and complete loss of natural teeth indicating poor quality of life (3, 24). ii) The number of regular dental visits carried out for dental check-ups over the past 5 years was required for years 1987-2013 and the question read as follows: *During the past 5 years, did you visit a dentist regularly (at least once a year) for check-up of your teeth?* Answers: a) *Yes*; b) *No, but I visited a dentist 3-4 times during the past 5 years*; c) *No, but I visited a dentist 1-2 times during the past 5 years*, d) *No, I have not seen a dentist*. In 2017, the question on dental visits was modified to match the 2016 guidelines of individual intervals for preventive dental check-ups (20). The 2017 question was expressed as follows: *During the past 5 years, did you visit a dentist regularly for a check-up of teeth?* The following categories were then applied: a) *intervals of less than 12 months*, b) *12-18 months*, c) *19-24 months*, d) *more than 24 months*, and e) *no dental check-up visits were undertaken over the past 5 years*. Consequently, direct comparison of dental visiting habits between 2017 and 1987-2013 was not possible. However, the question about dentate status remained the same across all surveys.

Analysis of data

The National Institute of Public Health (NIPH) was responsible for data collection and statistical analyses. The analyses of the data involved a set of explanatory variables comprising gender, age group, education, employment status, civil status, ethnic background, region of residence, and survey year. Groupings of education and employment status followed standard classifications used

by the NIPH over the years (21). The Chi-square test and the Cochran-Armitage trend test were applied for comparisons of percentages obtained in tri-variate distribution analyses. P-values are shown in the tables. Due to multicollinearity issues, traditional regression models incorporating a series of independent variables were not suitable for the multivariate analyses of the present data. Logistic regression models were therefore used for the 2017 dataset in order to assess the relative effect of the selected explanatory social factors. A functional dentition embracing 20 natural teeth or more and preventive dental check-ups were the two principal outcome variables. The odds ratios for individual age groups were shown for men and women separately while all other odds ratios were presented for men and women combined. Odds Ratio values were adjusted for gender and age, where appropriate. The regression models including education were restricted to individuals who were likely to have completed their education, i.e., who were aged 25 years or older. Individuals enrolled in education were excluded from these models in order to avoid multicollinearity since this group generally consists of young adults. Additionally, individuals in early retirement and old-age pensioners were excluded from the regression models including employment status since these groups generally consists of elderly. Results from the logistic regression models were presented as Odds Ratios (OR) with 95% confidence intervals (CI), and P-values are shown in the tables. Statistical analysis of the present survey data was undertaken by means of SAS version 9.4 (SAS Institute).

RESULTS

Dentate status

Table 1 presents the distribution of participants aged 16 years or older by the number of natural teeth for each survey wave. The proportion of adults without natural teeth was prominent in 1987 (17.7%) but the figure declined systematically towards the year 2017 (3.4%). Edentulous persons were particularly found among older age groups; as shown in Table 2, the percentages of older people having lost all their natural teeth fell dramatically through the years. At ages 65-74 years, the proportion of edentulous persons had reduced from 51.3% in 1987 to 5.7% in 2017 whereas among people aged 75 years or older, 67.2% were edentulous in 1987 against 17.9% in 2017 ($P < 0.001$).

In all, the percentage of adults having 20 natural teeth or more grew significantly from 65.9% in 1987 to 85.1% in 2017. Likewise, the proportion of persons having at least 20 natural teeth

increased greatly for the age groups 65-74 and 75 years or older. At ages 65-74 years, the proportion elevated from 15.7% in 1987 to 69.2% in 2017 ($P<0.001$), while among people aged 75 years or older the proportion gradually raised up from 6.7% in 1987 to 46.0% in 2017 ($P<0.001$).

Dental visits

Table 3 shows the percentages of adults reporting dental check-up visits at least once a year over the past five years during the period 1987 to 2013 in age groups 25-44, 45-64, and 65 years or older. Across years of study, the percentages of regular dental visitors increased towards the year 2013 among middle-aged and in particular older individuals. The attendance rates among 25-44-year-olds were high initially while the figures were lower towards the year 2010. Tri-variate analysis revealed that the mentioned differences were statistically significant ($P<0.001$).

Table 4 presents the answers to the question in 2017 about preventive dental check-ups for male and female participants. In 2017, 16-24-year-olds are included in the table as the target group is covered by the 2016 regulation of the recall system; this system has relevance to both dental sectors. About half of all men had dental visits at intervals of less than 12 months while the number was six in ten for women. For both genders, visits at intervals of less than 12 months increased by age whereas visits at intervals of 19 months or more were relatively frequent among younger age groups. Younger persons used longer intervals between visits than did older persons.

Dental visits, education and strained economy

Table 5 reveals the association between dental check-up of intervals less than 12 months and length of education in 2017. Among older people, the proportion of frequent dental visitors varied from 63.4% among participants with less than 10 years of schooling to 79.9% in participants with 15 or more years of schooling ($P<0.001$).

In the 2017 survey, the participants were asked if they had had difficulties covering extraordinary expenses during the past year. At ages 25 years or older, 32.3% of participants had regular dental check-ups at intervals of less than 12 months when having economic difficulties during at least half the months over a year; 42.5% made dental visits in case of difficulties during a few months while 61.6% reported dental attendance in the group without such economic difficulties ($P<0.001$).

Impact of social determinants

Figure 1 illustrates the percentage of participants aged 25 years or older having a functional dentition by length of education for each survey wave. The differences between short and long education were consistent for all study years ($P < 0.001$); notably, the difference between short and long education ranged over time from 40.7% to 78.7% in 1987 and from 67.5% to 91.5% in 2017 ($P < 0.001$).

Table 6 presents the outcome of multivariate analysis of dentate status in 2017. The odds of having a functional dentition, i.e., 20 natural teeth or more, increased over each survey wave. Having a functional dentition was determined by age, education, employment status, not being married or cohabiting, or having a non-Danish background. For example, OR for a functional dentition was 1.19 in case of long-cycle higher education against 0.18 for the category basic education. Furthermore, no association was observed between gender and having a functional dentition ($P = 0.12$) (data not shown).

Table 7 indicates the results of the multivariate analysis of dental check-ups at intervals of less than once a year in 2017. The influence of social factors was observed in relation to age, education, employment status, civil status, and ethnic background. For example, the OR for visiting a dentist at intervals of less than once a year was 0.56 in case of basic education against 1.20 for the category of short-cycle higher education. Compared to men, women were more likely for visiting a dentist at this interval (OR = 1.25, 95% CI: 1.15-1.35) (data not shown).

DISCUSSION

This report shows that the prevalence of adult Danes having a functional dentition increased considerably over the past 30 years whereas edentulism declined radically. The improvement in dentate status took place among middle-aged and older people. In addition, for these population groups, the proportion of adults with regular preventive dental visits increased between 1987 and 2013; the attendance to the newly introduced recall scheme for preventive dental check-ups was generally high for all age groups. Educational inequalities as regards a functional dentition remained persistent throughout the period and the forceful impact of structural social determinants on dentate status and preventive dental check-ups in 2017 was established.

The loss of natural teeth is an oral health outcome, which not only reveals a person's history of dental diseases but the condition may also reflect delivery of dental health services and prevailing philosophies of dental care (2, 26). Dentate status comprises a vital constituent of oral health related quality of life. The evidence is strong (3) that tooth loss severely affects oral functioning and people pronounce the health impairment when the visible anterior teeth are missing and affects biting negatively, while the loss of posterior teeth primarily distresses the chewing of foods. Previous reviews (27) have confirmed the existence of four essential areas of oral function: masticatory function; aesthetics, satisfaction and psychosocial ability; occlusal support and stability, and other functionality including tactile perception, phonetics and taste. A minimum of 20 teeth with nine to ten pairs of contacting units (including anterior teeth) is associated with adequate efficiency and ability. Hence, the World Health Organization (WHO) considers the number of 20 natural teeth or more being an effective marker of a functional dentition while complete loss of natural teeth is an indication of poor function and low quality of life (24). Clinical assessment may allow an exact estimation of the number of natural teeth present; meanwhile, self-reporting is recognized to provide reliable information of dentate status (28).

Moreover, WHO has designed instruments for the use of dental health services, which allow information about dental visits performed for preventive reasons (24). Both the measures analysed in this study, i.e., dentate status and visits undertaken for dental check-ups, have planning relevance for public health care and they have been valuable in national and international surveillance of oral health systems.

Clinical surveys are often very time-consuming and costly to implement; consequently, questionnaire surveys are considered suitable for health surveillance. In the present period analysis, the shifting sample size and non-response rates across survey waves indicate a weakness of the study. Particularly, the response rates were lower in the study waves 2010, 2013, and 2017 and this may potentially influence representativeness of findings. In the 2017-study, the somewhat lower response rate among young individuals, especially among men aged 16-24 years, and women aged 85 years or older, is a matter of concern. Meanwhile, the use of calibrated weights has made it possible to adjust statistically for some of the differential non-response when analyzing the survey data. Notably, the observed non-response is in line with findings from other studies, which supports the notion that some population groups are difficult to recruit to survey participation (29-33).

The prevalence rates of tooth loss and functional dentition of adults have altered considerably in numerous European countries (34). In Denmark, the observed transitions correspond to findings from national surveys carried out in the Nordic countries (35-37), Germany (38), and the United Kingdom (39). Moreover, analogous changes are shown in the United States (40). Lately, dentate status was examined in different European welfare state regimes: Scandinavian, Anglo-Saxon, Bismarckian, Southern and Eastern (41). The Scandinavian regime presented the lowest prevalence rates of no functional dentition (less than 20 natural teeth) and edentulousness; meanwhile, the analyses revealed substantial educational inequalities concerning dentate status. Accordingly, the current national survey provides solid support to the results of this European study.

It has been suggested (2) that the dramatic epidemiological alteration in dentate status could be explained by changing societal and cultural conditions as well as coordinated efforts in treating oral diseases and preventing tooth loss throughout life. In Denmark, the general changeover in dentate status among adults may involve several factors. These include progress in standard of living, development of health cultures covering quality of life features of oral health, improvement of healthy lifestyles, gradual reduction in tobacco consumption, the exposure to disease prevention provided by the public dental health services during childhood and adolescence, and the effective delivery of preventive and restorative care by dental practitioners serving the adult population. Moreover, the settled oral hygiene practices and widespread use of toothpaste containing fluoride should be considered (42).

Social inequalities in health status originate from differences in living conditions, opportunities, and socio-cultural and behavioral dynamics. Education is a measure of social position typically chosen for the documentation of social inequalities in health as it involves dimensions of material resources and normative structures. The present study displays persistent educational inequalities in dentate status over the three decades. Seemingly, the educational differences in the prevalence of functional dentition narrowed slightly during recent years, however, it must be emphasized that this narrowing is by eyeballing only. The stability over time in health inequality is equivalent to the observations made in national studies carried out in Norway (35), Sweden (36), Finland (37), and the United Kingdom (39).

The multivariate analyses of the 2017-data have confirmed the health effect of strained living conditions. The likelihood of having a functional dentition is relatively low for people with a short education, unemployed persons, persons being on pre-pension for health reasons or age pensioners,

people with a weak social network (i.e. those living alone), and people with a non-Danish background. These results are instrumental to the creation of social policies for tackling the inequalities in oral health.

The general improvement in dental attendance among Danish adults may be due to a number of factors. Firstly, the advancement in living conditions has enabled an adoption of healthy lifestyles of the population, including the awareness of good oral health and the anticipated benefit of preventive dental check-ups. Secondly, the density of dentists developed adequately over the years and the accessibility of services improved along with the national insurance support to preventive services (20). Thirdly, fixed procedures for recalling of users for check-ups and adult dental care were established during the study period. The progress in regular dental visiting habits over the years 1987 to 2013 was found primarily for middle-aged and older adults, while the recent attendance rates were somewhat lower among younger individuals. Individuals aged 16-24 years were not presented in the table of results as from 1986 all individuals aged 16 until 18 years were covered exclusively by the public dental health services; this service involved comprehensive dental care and systematic dental check-ups. Importantly, the drop in dental attendance by young adults may be ascribed to better oral health conditions over time or the trend may be an effect of the relatively high user-fees for dental health care.

The recent modification of the Danish recall system is concordant to the changes in the dental health profile of the population (20). The 2016 system involves intervals of check-up structured individually rather than by intervals prescribed traditionally by the dental profession, such as dental visits every 6 or 12 months. According to the new recall scheme, an individual may then perform preventive dental check-ups regularly if it takes place at intervals of 19-24 months or even at more than 24 months. Over all, the population use of preventive dental check-ups at definite intervals was relatively high; even so, approximately one fifth of men and one tenth of women made no preventive dental visits. Information about reasons of non-attendance was not included in the study. On the other hand, a recent European study (43) investigated dental non-attendance among adults; as regards Denmark, about 60% of non-users claimed that this practice was due to financial concerns.

The principal objective of any health care system is to provide the population with equal access to health care, regardless of socioeconomic status or geographic location (44). However, previous

reports (43-46) have underscored that well-grounded social diversities exist in population use of dental health services. In the current analysis, the effect of education on preventive dental check-ups was high particularly among older people. Moreover, the multivariate analyses of preventive dental check-ups in 2017 confirmed the negative effect of strained living conditions such as poor education, unemployment or being on pre-pension for health reasons, living alone, and being of non-Western ethnic background. Recent European studies (44, 47) have demonstrated that personal income is a forceful determinant of dental visits; however, the income factor was not incorporated in the present study. Alternatively, as shown in Sweden (48) and Finland (49), the importance of a constrained family economy on dental visiting habits was recognised. The firm economic affliction most likely relates to the high costs of adult dental care in Denmark (50).

In conclusion, despite the general progress in dentate status over time among Danish adults the loss of natural teeth continues being extraordinary among older people and the risk of a compromised quality of life is problematic in this age group. Work for older people's right to health should include strengthening of age-friendly oral health care and integrated disease prevention.

Regular dental visits grew prominently over the years. In 2017, the attendance to the new dental recall system differed markedly by level of education and economic constraint and the effects of social determinants on preventive dental check-ups are powerful. Public health efforts should consider the non-use of preventive dental visits in order to reach the WHO target of *Universal Health Coverage*.

The educational inequalities as regards a functional dentition remain persistent over time and the study in 2017 confirms the strong impact of structural social determinants on dentate status. Policy initiatives for breaking the inequalities in dentate status rely on the right mix of social policies and future public health interventions should target the essential risk factors of disease.

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Author contribution statement

Conceptualization: Petersen PE; **Formal analysis:** Ekholm O; **Validation:** Petersen PE; **Writing-Original Draft:** Petersen PE; **Writing-Review & Editing:** Davidsen M, Jensen HR, Ekholm O, Christensen AI; **Project administration:** Christensen AI

Conflicts of interest

The authors declare no conflicts of interest.

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Figure 1. Percentages of adult people aged 25 years or older having 20 teeth or more by years of education in Denmark 1987-2017 (age-adjusted percentages) (Danish Health and Morbidity Surveys).

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Table 1. Percentage of adults aged 16 or older living in Denmark by number of teeth according to year of survey 1987-2017 (Danish Health and Morbidity Surveys).

Year of survey	1987	1994	2000	2005	2010	2013	2017
n=	4,752	4,667	16,688	14,566	14,918	13,919	12,853
Dentate status							
No natural teeth	17.7	12.7	8.7	6.9	4.7	4.1	3.4
1-9 teeth	6.9	5.7	4.9	4.4	4.3	3.8	4.3
10-19 teeth	9.4	7.2	7.3	6.6	7.9	7.1	7.2
20 teeth or more	65.9	74.6	79.1	82.1	83.1	85.0	85.1
Total	100	100	100	100	100	100	100

Table 2. Percentages of Danish adults who reported being edentulous or having 20 teeth or more by age group and year of study (Danish Health and Morbidity Surveys).

	Age group			
	45-54 years	55-64 years	65-74 years	75+ years
Edentulous				
1987	12.0	33.7	51.3	67.2
1994	3.6	24.2	40.3	55.6
2000	2.3	9.5	27.2	45.3
2005	1.0	5.4	19.9	39.8
2010	0.6	3.7	11.1	29.5
2013	0.5	3.1	8.1	24.8
2017	0.8	1.8	5.7	17.9
P-value for trend	P<0.001	P<0.001	P<0.001	P <0.001
20 teeth or more				
1987	60.1	34.9	15.7	6.7
1994	82.5	49.5	28.4	11.4
2000	88.7	65.0	39.5	20.3
2005	91.5	76.3	47.8	27.3
2010	91.3	78.4	56.4	31.9
2013	93.3	82.5	64.3	39.4
2017	92.8	84.7	69.2	46.0
P-value for trend	P<0.001	P<0.001	P<0.001	P<0.001

Table 3. The percentages of Danish adults of different ages indicating regular preventive dental visits annually in relation to year of survey 1987-2013 (Danish Health and Morbidity Surveys).

Year of survey	Total	25-44 years	45-64 years	65 years or older
1987	66.3 (n=3,893)	87.9 (n=1,785)	63.9 (n=1,244)	29.1 (n=864)
1994	73.7 (n=3,927)	85.4 (n=1,781)	78.3 (n=1,319)	44.3 (n=827)
2000	77.1 (n=14,501)	80.5 (n=5,819)	85.1 (n=5,667)	56.5 (n=3,015)
2005	77.6 (n=13,132)	75.8 (n=4,831)	86.8 (n=5,289)	65.2 (n=3,012)
2010	73.9 (n=13,176)	65.3 (n=4,172)	81.5 (n=5,677)	75.3 (n=3,327)
2013	72.5 (n=12,186)	61.2 (n=3,399)	78.9 (n=5,188)	79.0 (n=3,599)

P-value for trend P < 0.01

P < 0.001

P < 0.001

P < 0.001

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Table 4. Percentage of Danish adults who make dental visits for preventive reasons at different intervals in relation to gender and age (Danish Health and Morbidity Survey 2017).

	16-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	≥75 years	Total
Men								
Yes, intervals of less than 12 months	39.2	32.2	44.1	57.0	66.6	74.7	63.1	53.8
Yes, intervals of 12-18 months	28.5	25.5	23.3	18.0	11.4	8.3	12.3	18.3
Yes, intervals of 19-24 months	8.2	7.4	5.2	5.1	3.8	2.1	3.0	5.0
Yes, intervals of more than 24 months	8.1	9.8	8.1	5.7	3.5	2.0	2.9	5.8
No visits	16.0	25.1	19.2	14.2	14.7	12.9	18.7	17.1
Total	100	100	100	100	100	100	100	100
n=	544	570	762	1,067	1,135	1,093	593	5,764
Women								
Yes, intervals of less than 12 months	39.9	36.8	50.7	61.2	72.7	78.8	72.8	59.0
Yes, intervals of 12-18 months	29.7	28.5	24.5	20.6	14.3	9.9	7.0	19.5
Yes, intervals of 19-24 months	8.9	8.7	5.5	3.7	1.9	1.4	1.7	4.5
Yes, intervals of more than 24 months	8.0	8.1	6.3	3.3	2.6	1.8	2.2	4.6

24 months									
No visits	13.5	17.9	13.0	11.2	8.5	8.1	16.3	12.4	
Total	100	100	100	100	100	100	100	100	100
n=	781	833	940	1,223	1,305	1,234	673	6,989	

Table 5. Percentages of adult Danes aged 16 years or older with preventive dental visits of less than once a year by length of education and age groups in 2017 (Danish Health and Morbidity Survey 2017).

Age group	Length of education				P-value for trend
	<10 years	10-12 years	13-14 years	15+ years	
25-44 years	31.8 (n=78)	34.1 (n=340)	46.0 (n=942)	41.3 (n=1,589)	P<0.05
45-64 years	56.4 (n=299)	59.6 (n=773)	67.6 (n=1,816)	65.1 (n=1,698)	P<0.001
65+ years	63.4 (n= 646)	72.8 (n=1,007)	79.1 (n=794)	79.9 (n=948)	P<0.001

Table 6. Proportion of Danish adults having 20 teeth or more and Odds Ratio (OR) as measured by logistic regression analysis (Danish Health and Morbidity Survey 2017).

Explanatory variables	Pct.	OR	95 % confidence interval	Number of respondents	
Year¹	1987	65.9	0.11	(0.10;0.13)	4,752
P<0.01	1994	74.4	0.24	(0.22;0.27)	4,667
	2000	79.1	0.40	(0.37;0.44)	16,688
	2005	81.7	0.58	(0.54;0.63)	14,566
	2010	83.1	0.64	(0.59;0.70)	14,918
	2013	85.0	0.85	(0.77;0.92)	13,919
	2017	85.1	1.00		12,853
Men²	16-24 years	97.5	3.36	(1.61;6.99)	544
P<0.01	25-34 years	95.5	1.79	(1.03;3.12)	570
	35-44 years	97.2	2.98	(1.70;5.24)	760
	45-54 years	92.2	1.00		1,069
	55-64 years	83.7	0.44	(0.32;0.60)	1,143
	65-74 years	68.6	0.19	(0.14;0.25)	1,102
	≥75 years	45.3	0.07	(0.05;0.10)	616
	All	85.1			5,804
Women²	16-24 years	97.4	2.67	(1.40;5.10)	785
P<0.01	25-34 years	96.6	2.04	(1.12;3.72)	833
	35-44 years	97.3	2.51	(1.45;4.35)	934
	45-54 years	93.4	1.00		1,231
	55-64 years	85.6	0.42	(0.31;0.58)	1,310

	65-74 years	69.7	0.16	(0.12;0.22)	1,255
	≥75years	46.6	0.06	(0.05;0.08)	701
	All	85.0			7,049
<hr/>					
Education¹	Enrolled in education	97.4	n/a		942
P<0.01	Basic school	54.7	0.18	(0.14;0.22)	952
	Upper secondary education or vocational education	85.6	0.54	(0.44;0.65)	4,474
	Short-cycle higher education	90.4	0.82	(0.62;1.10)	1,057
	Middle-cycle higher education	92.4	1.00		2,807
	Long-cycle higher education	95.0	1.19	(0.83;1.70)	1,555
	Other education	72.2	0.32	(0.25;0.42)	646
<hr/>					
Employment¹	Employed	95.4	1.00		6,520
status	Unemployed	87.4	0.30	(0.18;0.52)	225
P<0.01	Pre-pension/health reasons	72.2	0.18	(0.13;0.24)	364
	Others outside employment	86.4	0.32	(0.22;0.46)	530
	Early retirement	86.0	n/a		313
	Age pensioner	59.8	n/a		3,674
<hr/>					
Civil status¹	Married	85.1	1.00		6,996
P<0.01	Cohabitant	92.7	0.82	(0.65;1.03)	1,958
	Living alone	76.0	0.57	(0.47;0.69)	967

	(separated, divorced)				
	Living alone (widowed)	51.0	0.58	(0.48;0.70)	736
	Living alone (unmarried)	92.6	0.60	(0.47;0.77)	2,196
Ethnic background¹	Danish	85.6	1.00		11,927
	Other western	80.3	0.43	(0.30;0.63)	421
P<0.01	Non-western	81.9	0.25	(0.19;0.34)	505
¹ OR adjusted for gender and age				² OR adjusted for age	

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Table 7. Proportion of adult Danes with regular preventive dental check-ups at intervals of less than 12 months during the past 5 years and Odds Ratio as measured by logistic regression analysis (Danish Health and Morbidity Survey 2017).

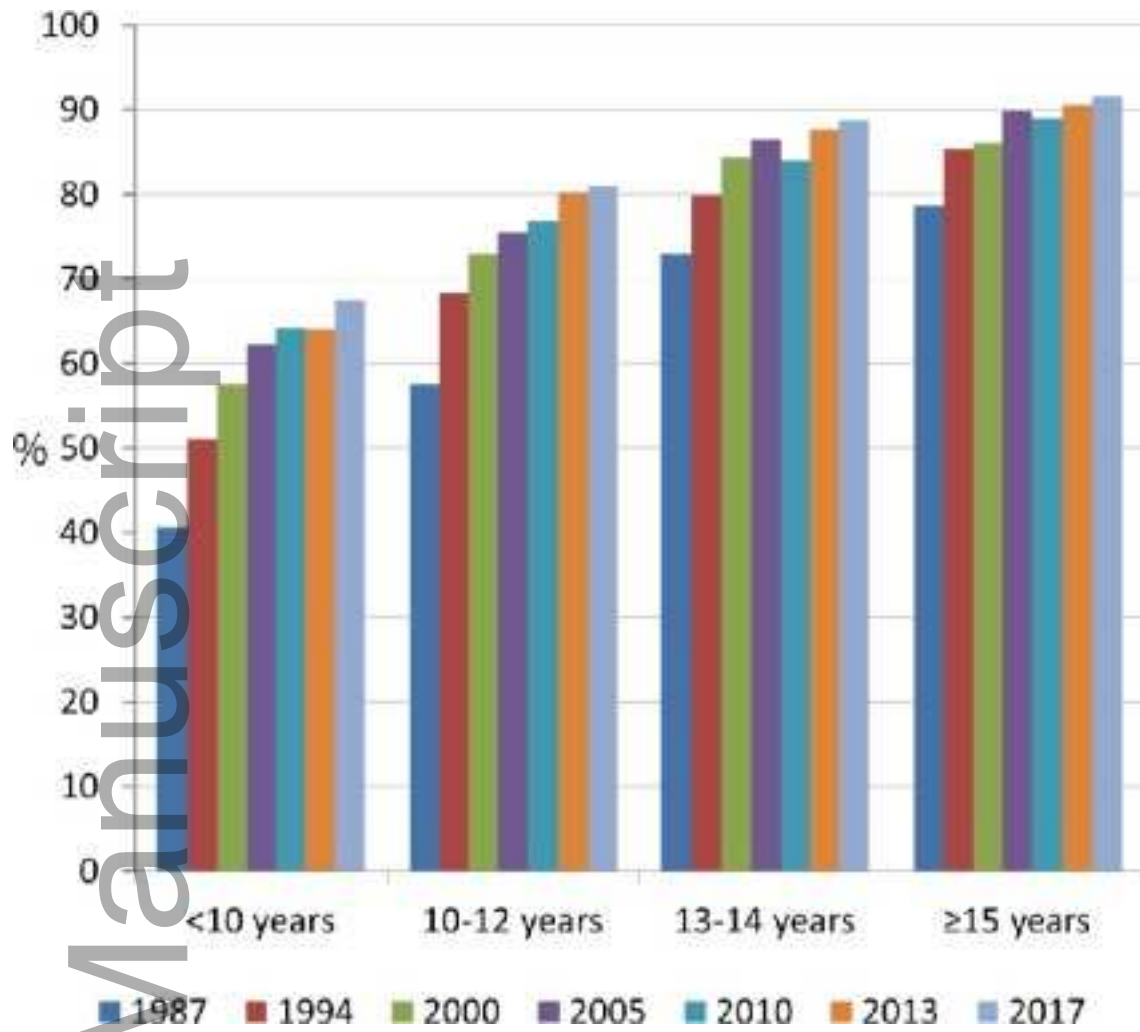
Explanatory variables		Pct.	OR	95 % Confidence interval	Number of respondents
Years	2017	56.5			12,753
Men	16-24 years	39.2	0.49	(0.39;0.61)	544
P<0.01	25-34 years	32.2	0.36	(0.29;0.45)	570
	35-44 years	44.1	0.60	(0.49;0.73)	762
	45-54 years	57.0	1.00		1,067
	55-64 years	66.6	1.51	(1.25;1.81)	1,135
	65-74 years	74.7	2.23	(1.83;2.72)	1,093
	≥75 years	63.1	1.29	(1.04;1.61)	593
	All	53.8			5,764
Women	16-24 years	39.9	0.42	(0.35;0.51)	781
P<0.01	25-34 years	36.8	0.37	(0.30;0.45)	833
	35-44 years	50.7	0.65	(0.55;0.78)	940
	45-54 years	61.1	1.00		1,223
	55-64 years	72.7	1.70	(1.42;2.03)	1,305
	65-74 years	78.8	2.36	(1.95;2.86)	1,234
	≥75 years	72.8	1.70	(1.37;2.11)	673
	All	59.0			6,989
Education¹	Enrolled in education	40.3	n/a		936
P<0.01	Basic school	57.3	0.56	(0.47;0.67)	930

	Upper secondary education or vocational education	58.7	0.94	(0.84;1.05)	4,447
	Short-cycle higher education	63.8	1.20	(1.02;1.42)	1,053
	Middle-cycle higher education	58.0	1.00		2,801
	Long-cycle higher education	51.2	0.94	(0.81;1.08)	1,555
	Other education	59.1	0.73	(0.60;0.90)	644
Employment status¹	Employed	54.1	1.00		6,518
P<0.01	Unemployed	35.8	0.47	(0.34;0.64)	223
	Pre-pension/health reasons	54.8	0.65	(0.51;0.83)	361
	Others outside employment	42.6	0.52	(0.42;0.66)	530
	Early retirement	78.6	n/a		310
	Age pensioners	73.6	n/a		3,593
Civil status¹	Married	64.0	1.00		6,954
P<0.01	Cohabitant	44.8	0.78	(0.69;0.88)	1,951
	Living alone (separate, divorced)	58.9	0.67	(0.57;0.78)	950
	Living alone (widowed)	69.2	0.73	(0.60;0.88)	709
	Living alone (unmarried)	44.4	0.83	(0.73;0.96)	2,189
Ethnic	Danish	57.8	1.00		11,832

background¹	Other western	52.8	0.97	(0.78;1.22)	421
P<0.01	Non-western	41.4	0.69	(0.56;0.84)	500

¹OR adjusted for gender and age

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