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Changes in conditions related to reported oral and general health over a ten-year period as reflected in two cohorts of 75-year-old subjects examined in 2007 and 2017

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Abstract

Background: The rapidly ageing and increasingly dentate population puts great demands on society regarding the provision of adequate medical and dental care facilities.

Objectives: To present changes in reported demographic, general and oral health factors in two cohorts of 75 year olds in 2007 and 2017, and to analyse factors associated with self-reported number of remaining teeth and chewing efficiency.

Material and methods: All 75-year-old people living in two Swedish counties received a questionnaire in 2007 and in 2017. The response rates in 2007 and in 2017 were 71.9% (n = 3735) and 70.7% (n = 5091), respectively. Reported number of teeth was clinically validated in a selected subgroup.

Results: The 2017 cohort reported significantly better general health and dental state. Edentulousness was 7.8% in 2007 and 2.3% in 2017, while 'very good' chewing efficiency was 55.2% and 60.5%, respectively. Born outside Sweden, single living, not feeling healthy and smoking predicted reduced number of teeth in both cohorts. Impaired chewing efficiency in both cohorts was predicted by being born outside Sweden, lower education, not feeling healthy, reduced number of teeth and denture wearing.

Conclusions: Seventy-five-year-old people in Sweden reported much better oral and general health in 2017 compared to 2007. In 2017, 75% had practically all natural teeth present and only 2% were edentulous. This development of an increasingly dentate and partially dentate ageing population will put high demands on the oral healthcare system and will need adapting undergraduate/postgraduate education and management strategies to meet the requirements of the elderly.

KEYWORDS

ageing, chewing efficiency, edentulousness, epidemiology, questionnaire

1 | INTRODUCTION

Demographic trends suggest that the world is currently undergoing rapid change. At a global level, the World Health Organization (WHO) estimates that the total number of individuals over the age of 60 years in 2050 will double as compared to that of today.[1] Within the European Community (EU), 19% of the population was aged 65 years or older in 2018. Due to low birth rates and higher life expectancies across the EU, the proportion of people aged 80 years or more is estimated to more than double as compared to that of today, and to reach 14.6% of the population in 2100.[2] In Sweden, there were 65 438 75 year olds in 2007, compared to 90 457 in 2017, which represented a 38% increase over the 10-year period.[3] Similarly, those aged 65 years or older in the UK were predicted to increase from 15.9% of the population in 2001 to 19.3% in 2020.[4]

Whereas population ageing would appear to be undisputed in both developed and developing countries, the future implications of these changes, not only for dentistry, need more serious consideration than presently seems to be the case.[5] A rapidly ageing population, experiencing changing patterns of tooth loss, with steady reductions in the numbers of edentulous individuals and accompanying increases among older age groups of those who are partially dentate, puts great demands on society in terms of offering adequate medical and dental care facilities. Retention of teeth into older age to a much greater extent than earlier results in dental care management challenges which are often compounded by the detrimental effect imposed by impaired general health. For example, dental caries experience may become uncontrollable in the presence of hyposalivation, or by a reduced capacity of the elderly to maintain proper oral hygiene and dietary habits. Other oral problems such as mucosal diseases, tooth wear and symptoms of temporomandibular disorder (TMD) are also commonly present in the older population.[6]

Epidemiological studies that are repeated over periods of time may reveal changes that occur in the population. In the Swedish counties of Örebro and Östergötland, extensive studies of oral health of 50-year-old subjects (born 1942) were performed in 1992,[7] and repeated on the same group every 5 years up to 2017 (when they were 75 year olds). In 2007, a cohort of 75 year olds was also examined (born 1932).

The purpose here was to present changes in demographic and reported oral and general health factors between 2007 and 2017 in two cohorts of 75 year olds, and in addition to analyse factors associated with self-reported number of remaining teeth and chewing efficiency.

2 | MATERIAL AND METHODS

In 2007, a questionnaire was sent to all 75-year-old persons (born 1932) living in the two counties of Örebro and Östergötland, Sweden (N_{total} = 5195). In 2017, the questionnaire was sent to all 75 year olds in the same counties (born 1942) (N_{total} = 7204). The response rates in 2007 and in 2017 were 71.9% (n = 3735) and 70.7% (n = 5091), respectively. In 2007, there were 45.3% men and 54.7% women in the total population while responders corresponded to 46.8% and 53.2% for men and women, respectively. In 2017, the total population in Örebro and Östergötland comprised 48.6% men and 51.4% women, and among those who responded 48.0% were men and 52.0% women.

2.1 | Questionnaire

The questionnaire comprised 56 and 55 questions in 2007 and 2017, respectively, as well as an 8 item Oral Impact on Daily Performance (OIDP). The questionnaire was divided into six different sections: (a) social conditions (place of birth, marital status, education, residency), (b) general health conditions (e.g. physician visits, tobacco habits, drug consumption), (c) oral conditions (e.g. satisfaction with teeth, oral problems, oral hygiene habits, number of teeth), (d) a series of attitude questions concerning oral function and appearance of teeth, (e) experience and use of oral healthcare system, and (f) OIDP.[7,8]

2.2 | Data recording and method error

A clinical examination had been performed in 1997 in a randomly selected subgroup of the 2017 cohort (born 1942, 457 men and 484 women) to validate and quantify the responses regarding reported number of remaining teeth and jaw opening capacity. There was good congruence between self-reports and clinical recordings and the level of congruence did not differ significantly between men and women.[9] The complete questionnaire design and methodological aspects have been discussed previously.[7] The STROBE cohort reporting guidelines were used.[10]

2.3 | Statistics and ethical considerations

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS, Release 25) on an IBM Personal Computer. Chi-square test and odd ratios (OR) were used to analyse differences between the cohorts and between men and women.

Logistic regression was performed separately for each of the cohorts (2007 and 2017), with reported number of remaining teeth and self-assessed chewing efficiency as dependent variables. Demographic and general health variables were used as independent variables. Number of reported remaining teeth and use of removable prostheses were additional independent variables used in the regression analysis regarding chewing efficiency. All independent variables that presented a significant association in unadjusted logistic regression were entered in the adjusted logistic regression model (Forward conditional method).

The Ethics Committee in Uppsala, Sweden, approved the study (Dnr 2016/424).

3 | RESULTS

3.1 | Demographic data

When comparing the two cohorts of 75-year-old subjects examined in 2007 and 2017, some demographic changes were evident (Table 1). Compared to the 2007 cohort, the 2017 cohort had significantly more participants born in Sweden, were married/cohabiting, had attended higher education and had more weekly social contacts ($P < .05$ to $P < .001$), and also reported a higher frequency of residing in village/countryside communities ($P < .01$). As regards gender differences, women were significantly more frequently living in densely populated areas (2017), were single (2007 and 2017), had higher education (2007) and had fewer frequent social contacts (2007) (Table 1).

3.2 | General health

As regards self-reports related to general health, significantly more participants considered themselves healthy in the 2017 cohort (79.0%) compared to the 2007 cohort (69.2%) ($P < .001$). The 2017 cohort also reported better health than their same-aged counterparts in the 2007 cohort (34% vs 30.1%; $P < 001$), less frequent contact with the doctor in the past 3 months (58% vs 60.7%; $P < .01$), but greater usage of prescribed medicine (81.5% vs 78.9%; $P < .01$). Smoking and use of smokeless tobacco were less common in 2017 (8.5% and 4.5%, respectively) than in 2007 (43.6% and 6.7%, respectively) ($P < .001$), while intake of alcohol on a weekly basis was more common in 2017 (48.8% vs 34.3%; $P < .001$). Men reported significantly more frequently better health than the same-aged women in both 2007 and 2017. Women took more prescribed medicine (2007) but visited the doctor less frequently (2017). Smoking was more common among men (2007) as was the use of smokeless tobacco (2007 and 2017). Frequent intake of alcohol was more common in men both in 2007 and 2017 (Table 2).

3.3 | Dental state

The dental state in the 75-year-old subjects underwent noteworthy changes between 2007 and 2017 (Table 3). The prevalence of

TABLE 1 Percentage distribution of some demographic data in two cohorts of 75-y-old subjects, examined in 2007 and in 2017

	2007				2017		
	Women	Men	Total	OR (CI)	Women	Men	Total
Place of birth							
Sweden	92.3	92.4	92.3	1.3[a,**] (1.1-1.5)	94.4	93.7	94.0
Nordic country/Other	7.7	7.6	7.7		5.6	3.3	6.0
Residence							
Densely populated areas	49.6	47.7	48.7	0.87[b,**] (0.80-0.95)	47.2	43.1	45.2
Village/countryside	50.4	52.3	51.3		52.8	56.9	54.8
Marital status							
Married/cohabiting	57.6	78.8	67.5	1.1[c,**] (1.0-1.2)	61.6	79.5	70.2
Unmarried/divorced/widow(er)	42.4	21.2	32.5		38.4	20.5	29.8
Education							
Elementary school	64.3	62.9	63.7	0.38[d,***] (0.34-0.41)	38.2	41.2	39.5
High school/college/university	35.7	37.1	36.3		62.0	58.8	60.5
Social contacts/wk							
0-10	71.3	67.9	69.7	0.75[e,***] (0.69-0.83)	64.0	62.7	63.4
>10	28.7	32.1	30.3		36.0	37.3	36.6

Note: OR denotes the comparison between the total figures in 2007 and 2017. Pearson Chi-Square, OR = Odds Ratio, CI = 95% Confidence Interval. Footnotes refer to gender differences for each cohort.

[a]No gender differences.

[b]2007 cohort: NS; 2017 cohort: OR 0.85** (CI 0.76-0.95).

[c]2007 cohort: OR 2.8*** (CI 2.3-3.2); 2017 cohort: OR 2.4*** (CI 2.1-2.8);

[d]2007 cohort: NS; 2017 cohort: OR 1.1* (CI 1.0-1.3).

[e]2007 cohort: OR 0.86* (CI 0.74-0.99); 2017 cohort: NS.

***$P \leq .001$;

**$.001 < P \leq .01$;

*$.01 < P \leq .05$.

TABLE 2 Percentage distribution of answers to questions related to general health in two cohorts of 75 y-old subjects, examined in 2007 and in 2017

	2007				2017		
	Women	Men	Total	OR (CI)	Women	Men	Total
Do you consider yourself healthy							
Yes, absolutely/Yes, a great deal	68.1	70.4	69.2	1.7[a,***] (1.5-1.8)	78.9	79.0	79.0
No, not particular/No, absolutely not	31.9	29.6	30.8		21.1	21.0	21.0
Self-judged health in relation to same-aged							
Yes, much better/yes, a great deal	26.7	33.9	30.1	1.2[b,***] (1.1-1.3)	31.6	36.5	34.0
Equal/worse/much worse	73.3	66.1	63.1		68.4	63.5	66.0
Use of medicine prescribed by doctor last 2 wk							
Yes	80.8	76.7	78.9	1.2[c,**] (1.1-1.3)	80.9	82.1	81.5
No	19.2	23.3	21.1		19.1	17.9	18.5
Contact with medical doctor in past 3 mo							
Yes, several times/ sometimes/once	60.8	60.7	60.7	0.90[d,**] (0.82-0.97)	56.6	59.5	58.0
No	39.2	39.3	39.3		43.4	40.5	42.0
Smoking							
Daily/occasional smoking	32.8	55.9	43.6	0.12[e,***] (0.11-0.14)	8.9	8.1	8.5
Stopped smoking/never smoked	67.2	44.1	56.4		91.1	91.9	91.5
Smokeless tobacco							
Daily/occasional smokeless tobacco	0.4	13.7	6.7	0.67[f,***] (0.55-0.80)	0.8	8.4	4.5
Stopped/never used smokeless tobacco	99.6	86.3	93.3		99.2	91.6	95.5
How often do you drink distilled spirits, wine or strong beer							
One to several times weekly	25.3	44.4	34.3	1.8[g,***] (1.7-2.0)	41.4	56.7	48.8
A couple of times monthly/ never	74.7	55.6	65.7		58.6	43.3	51.2

Note: OR denotes the comparison between the total figures in 2007 and 2017. Pearson Chi-Square, OR = Odds Ratio, CI = 95% Confidence Interval. Footnotes refer to gender differences for each cohort.

[a]No gender differences.

[b]2007 cohort: OR 1.4*** (CI 1.2-1.6); 2017 cohort: OR 1.2*** (CI 1.1-1.4).

[c]2007 cohort: OR 0.78** (CI 0.67-0.92); 2017 cohort: NS.

[d]2007 cohort: NS; 2017 cohort: OR 1.1* (CI 1.0-1.3).

[e]2007 cohort: OR 2.6*** (CI 2.3-3.0); 2017 cohort: NS.

[f]2007 cohort: OR 37.0*** (CI 18.3-75.2); 2017 cohort: OR 10.8*** (CI 6.9-17.0).

[g]2007 cohort: OR 2.4*** (CI 2.1-2.7); 2017 cohort: OR 11.9*** (CI 1.7-2.).

***$P \leq .001$;

**$.001 < P \leq .01$; NS = $P > .05$

subjects who reported that they had all their natural teeth present or had only a single missing tooth was 55.9% in 2007 and 75.0% in 2017 ($P < .001$). Edentulousness was 7.8% in 2007 and was down to 2.3% in 2017 (data not shown in table) (Figure 1). The proportion of those who reported that they could chew all kinds of food 'very good' was 55.2% in 2007 and 60.5% in 2017 ($P < .001$). Those who reported 'bad chewing' were fewer in 2017 (1.3%) compared to 2007 (2.3%) (data not shown in table) (Figure 2). Satisfaction with appearance of teeth and belief that they could keep their teeth throughout life were each higher in 2017 than in 2007 (82.2% vs 80.3% and 37.2% vs 27.9%, respectively) ($P < .05$ to $P < .001$). By gender, women reported 'very good' chewing significantly more frequently than did men (2017), but they were less satisfied with the appearance of their teeth (2017) and had a lower

TABLE 3 Percentage distribution of answers to questions related to global assessment of dental state in two cohorts of 75-y-old subjects, examined in 2007 and in 2017

	2007				2017		
	Women	Men	Total	OR (CI)	Women	Men	Total
How many remaining teeth do you have							
All teeth left/missing a single tooth	55.3	56.5	55.9	2.4[a,b,***] (2.2-2.6)	75.2	74.7	75.0
Missing rather many/almost no left/edentulous	44.7	43.5	44.1		24.8	25.3	25.0
Can you chew all kinds of food							
Yes, very good	56.3	54.0	55.2	1.2[b,c,***] (1.1-1.4)	62.2	58.7	60.5
Yes, relatively good/not so good/bad	43.7	46.0	44.8		37.8	41.3	39.5
Are you satisfied with the appearance of your teeth							
Yes, very satisfied/rather satisfied	79.4	81.4	80.3	1.1[d,*] (1.0-1.3)	80.8	83.7	82.2
No, not especially satisfied/absolutely not satisfied	20.6	18.6	19.7		19.2	16.3	17.8
Do you believe that you can keep the teeth throughout your whole life							
Yes, absolutely	25.5	30.5	27.9	1.5[d,***] (1.4-1.7)	37.6	36.8	37.2
Yes, maybe/don't know/probably not/absolutely not	74.5	69.5	72.1		62.4	63.2	62.8
OIDP - Impact from any of the scale items from any of the 8 questions							
Impact	73.5	73.8	73.6	NS[a]	72.8	70.9	71.9
No impact	26.5	26.2	26.4		27.2	29.1	28.1

Note: OR denotes the comparison between the total figures in 2007 and 2017. Pearson Chi-Square, OR = Odds Ratio, CI = 95% Confidence Interval.

[a]No gender differences.

[b]2007 cohort: NS; 2017 cohort: OR 0.86* (CI 0.77-0.97).

[c]2007 cohort: NS; 2017 cohort: OR 1.2** (CI 1.1-1.4).

[d]2007 cohort: OR 1.3** (1.1-1.5); 2017 cohort: NS.

***$P \leq .001$;

**$.001 < P \leq .01$;

*$.01 < P \leq .05$.

expectation of keeping their teeth throughout life (2007) (Table 3). OIDP score was lower in 2017 but the difference was not statistically significant.

The reported use of removable prostheses was considerably less in 2017 compared to 2007 ($P < .001$) (Table 4). In this regard, complete denture usage in both jaws was 7% and 2% in 2007 and 2017, respectively. The corresponding figures for complete denture usage in one jaw were 8.8% and 4.1% ($P < .001$), and removable partial denture usage 11.0% and 6.1% in 2007 and 2017, respectively ($P < .001$). Implant retained reconstructions were more common in 2017 (14.6% vs 9.6%) ($P < .001$), as were porcelain reconstructions (31.6% vs 27.8%) ($P < .001$) and white fillings (71.1% vs 59.2%) ($P < .001$). The presence of gold reconstructions was fewer in 2017 compared to 2007 (20.0% vs 34.8%) ($P < .001$), while no significant differences in amalgam and temporary restorations were noted. By gender, men reported a significantly higher frequency of complete denture usage in one jaw in 2007, and fewer porcelain restorations (2007 and 2017) and white fillings (2017) than women (Table 4).

3.4 | Logistic regression

As regards reported number of remaining teeth and chewing efficiency, almost all the independent variables showed significant association in the unadjusted model (Tables 5 and 6). In the adjusted model, in the 2007 cohort, missing teeth/edentulousness was significantly associated with being born outside Sweden, living in village/countryside, single living and not feeling healthy (OR 0.62-0.83), while all teeth present/missing a single tooth was associated with higher education, stopped/never used tobacco and more frequent alcohol consumption (OR 1.2-2.0) (Table 5). In the 2017 cohort, missing teeth/edentulousness correlated with being born outside

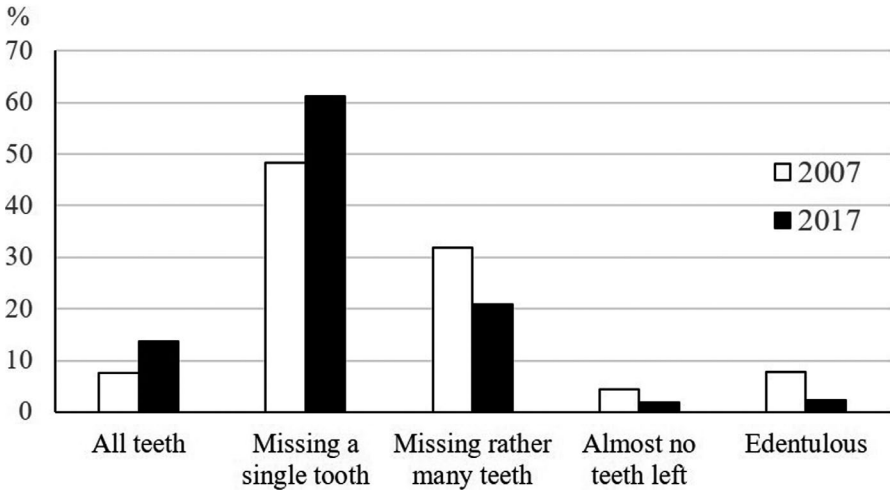

FIGURE 1 Self-reported number of remaining teeth in 75 y olds in 2007 (n = 3488) and 2017 (n = 4800) responding to the question 'How many remaining teeth do you have?'

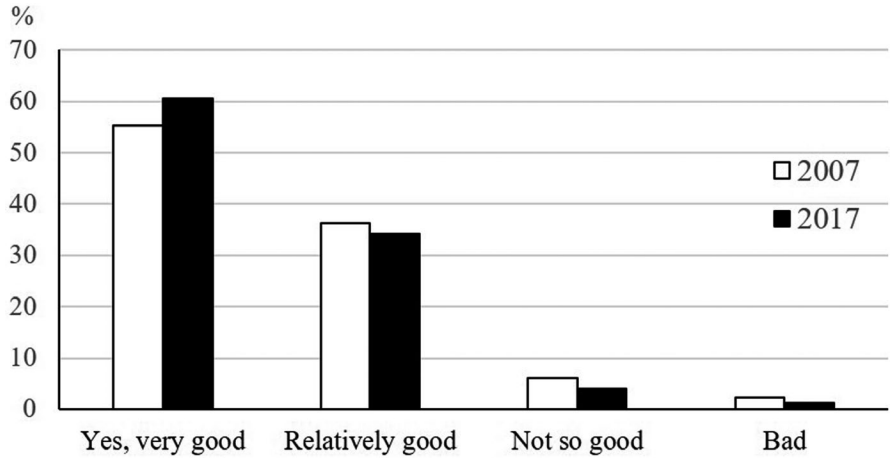

FIGURE 2 Chewing efficiency in 75 y olds in 2007 (n = 3578) and 2017 (n = 4032) responding to the question 'Can you chew all kinds of food?'

Sweden, single living, fewer weekly social contacts, not feeling healthy and health being perceived as equal to or worse than same-aged counterparts (OR 0.53-0.78), while all teeth present/missing a single tooth was associated with higher education, stopped/never smoked and more frequent alcohol consumption (OR 1.2-2.5) (Table 5).

In the adjusted model, impaired chewing efficiency in the 2007 cohort was associated with being born outside Sweden, not feeling healthy and health being perceived as equal to or worse than same-aged counterparts (OR 0.55-0.66), while 'very good' chewing was more common in those with higher education, frequent weekly social contacts, stopped/never used smokeless tobacco, all teeth present/missing a single tooth, and not having a complete denture in one jaw or a removable partial denture (OR 1.3-5.3) (Table 6). The corresponding figures for the 2017 cohort for impaired chewing were being born outside Sweden, single living, not feeling healthy and health being perceived as equal to or worse than same-aged counterparts (OR 0.49-0.80), while 'very good' chewing was more commonly reported by females and those with higher education, all teeth present/missing a single tooth, and not having a removable partial denture (OR 1.3-4.0) (Table 6).

4 | DISCUSSION

For the whole of Sweden, gender distribution of 75 year olds in 2017 comprised 48.5% men and 51.5% women, while in 2007 it was 45.4% men and 54.6% women.[3] These figures correspond well with that found in the two examined cohorts, regarding both the total population in the two counties as well as the responders. The increase in the total population of 75 year olds in Örebro and Östergötland counties from 2007 to 2017 was about 38% which is about the same as for the country as a whole.[3] Consequently, regarding gender distribution and population growth, the population samples examined seems to be fairly representative for the whole population of 75 year olds in Sweden, both in 2007 and in 2017.

There were considerable differences between the two cohorts of 75-year-old subjects examined 10 years apart regarding both social and demographic conditions, and in general and oral state. Compared to the 2007 cohort, in 2017 a significantly higher proportion of the 75 year olds were born in Sweden, resided in village/countryside, were married/cohabiting, had more social contacts and achieved a notably higher educational level.

As regards parameters related to general health, the 2017 cohort reported much better health than those in 2007, with close to 80%

TABLE 4 Percentage distribution of affirmative answers to questions related to type of dental reconstructions in two cohorts of 75-y-old subjects, examined in 2007 and in 2017

	2007				2017		
	Women	Men	Total	OR (CI)	Women	Men	Total
Complete dentures in both jaws	7.0	6.9	7.0	0.27[*,***,a] (0.21-0.34)	1.8	2.2	2.0
Complete denture in one jaw	7.5	10.2	8.8	0.44[b,***] (0.37-0.52)	3.6	4.6	4.1
Removable partial denture	10.4	11.7	11.0	0.53[*,***,a] (0.45-0.61)	5.5	6.7	6.1
Implant retained reconstructions	9.5	9.8	9.6	1.6[***,a] (1.4-1.8)	14.5	14.6	14.6
Porcelain reconstructions	30.7	24.4	27.8	1.2[c,***] (1.1-1.3)	33.8	29.2	31.6
Gold reconstructions	37.6	31.5	34.8	0.41[d,***] (0.43-0.52)	19.7	20.3	20.0
White fillings	60.3	57.9	59.2	1.7[e,***] (1.6-1.9)	73.0	69.1	71.1
Amalgam fillings	66.5	68.2	67.3	NS[a]	68.0	67.1	67.6
Temporary fillings	2.3	2.5	2.4	NS[a]	2.7	2.9	2.8

Note: OR denotes the comparison between the total figures in 2007 and 2017. Pearson Chi-Square, OR = Odds Ratio, CI = 95% Confidence Interval.

[a]No gender differences.

[b]2007 cohort: OR 1.4** (1.1-1.8); 2017 cohort: NS.

[c]2007 cohort: OR 0.73*** (0.63-0.84; 2017 cohort: OR 0.81*** (CI 0.72-0.91).

[d]2007 cohort: OR 0.77*** (0.66-0.87; 2017 cohort: NS.

[e]2007 cohort: NS; 2017 OR 0.83** (CI 0.73-0.93).

***$P \leq .001$;

**$.001 < P \leq .01$;

*$.01 < P \leq .05$.

reporting good health representing an approximately 10% improvement in perceived health from one cohort to the next. This figure is higher than was reported for the whole country in 2017, at which time the age span of 65-84 year olds reported good health in the range of 63.5%-72.8%, and the latter figure (72.8%) representing men aged 65 to 74 years of age.[11] In this regard, it has been shown that self-rated health is a good indicator of an individual's health status and that poor self-rated health is a consistent and better predictor for mortality than the 'doctor's opinion', based on objective measures.[12] This suggests that life expectancy is relatively high, which in combination with a large number of remaining natural teeth in the ageing population, puts a high demand on the dental healthcare systems of many countries.

Reported smoking was considerably lower in the 2017 cohort, and especially so among men (from 56% down to 8%). The use of smokeless tobacco (snuff) is allowed by law in Sweden, and one could suspect that former smokers may switch their smoking habit to snuff. This was, however, not the case as the use of smokeless tobacco also was less frequent in 2017, and again especially so among men (from 14% to 8%). On the other hand, there was about a 40% higher reported frequency of weekly alcohol consumption in 2017 than in 2007, and more so among women where it was 64% higher (Table 2). In a study comparing alcohol consumption in two Swedish cohorts of 75 year olds born in 1901-1902 and 1930 and examined in 1976 and 2006, a 10-fold higher 'at-risk' consumption was observed in women.[13] This trend seems to continue and may pose an increased risk as regards women's health.

An overall better dental status was reported in the 2017 compared to the 2007 cohort. Edentulism was about 5% down (from 7% to 2%), and at only 2% among 75-year-old subjects in 2017 is very low in a global context.[14,15] This figure contrasts starkly with that of the United States in 2011-2016 where the prevalence of edentulism was 13% in 65-74 year olds, and 22.5% in ≥75 year olds.[16] The Swedish dental healthcare system is very different compared to the United States, viz. all inhabitants enjoy free dental care up to the age of 20 years old and after that heavy subsidies apply to adult dental care which includes preventive measures and extensive and costly restorative rehabilitation. This system has been employed for many decades which may explain why Swedes have been able to retain their natural teeth to a greater extent than reported in the United States. Improvement also occurred with regard to chewing efficiency where the proportion of participants who reported 'very good' chewing increased from 55.2% to 60.5%. The better reported chewing efficiency is very likely to be associated with the greater retention of teeth in 2017. This is supported by the finding in the regression analyses where 'All teeth left/missing a single tooth' had the strongest correlation with chewing efficiency (OR 5.3 and 4.0, respectively; Table 6).

Satisfaction with the appearance of their teeth was very high and over 80% responded 'very satisfied/rather satisfied' in both the 2007 and 2017 cohorts. Although not directly comparable to our study because of age differences, it is worth mentioning that among Canadian older adults (40-59 years of age) only 70% were

TABLE 5 Logistic regression model (Forward Conditional Method – final model) for the question as dependent variable at 75 y of age in cohort 2007 and 2017

	2007 Unadjusted			2007 Adjusted			2017 Unadjusted			2017 Adjusted		
Ref. category	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***
Female gender	0.96	0.84-1.1	NS	-	-	-	1.0	0.91-1.2	NS	-	-	-
Born outside Sweden	0.58	0.45-0.75	***	0.62	0.45-0.86	**	0.52	0.40-0.66	***	0.53	0.40-0.71-	***
Living in village or countryside	0.83	0.72-0.95	**	0.83	0.70-0.98	*	0.93	0.82-1.1	NS	-	-	-
Unmarried/ divorced/ widow/ widower	0.69	0.59-0.79	***	0.69	0.57-0.83	***	0.66	0.57-0.76	***	0.78	0.67-0.92	**
High school/ college/ university	2.1	1.8-2.4	***	1.7	1.4-2.0	***	1.6	1.4-1.8	***	1.4	1.19-1.61	***
More than 10 social contacts/wk	1.2	1.1-1.4	**	-	-	NS	1.4	1.3-1.7	***	0.53	0.40-0.71	*
Not feeling healthy	0.49	0.42-0.56	***	0.63	0.52-0.75	***	0.47	0.41-0.55	***	0.66	0.55-0.79	***
Health equal/ worse/much worse than same-aged	0.61	0.52-0.71	***	-	-	NS	0.56	0.48-0.65	***	0.66	0.56-0.79	***
Not using prescribed medicine	1.2	1.1-1.5	**	-	-	NS	1.2	1.0-1.5	*	-	-	NS
No contact with doctor last 3 mo	1.1	0.96-1.3	NS	-	-	-	1.2	1.1-1.4	**	-	-	NS
Smoking - stopped/never smoked	2.0	1.7-2.2	***	2.0	1.7-2.4	***	2.9	2.4-3.6	***	2.5	2.0-3.2	***
Smokeless tobacco - stopped/never used	1.7	1.3-2.3	***	1.5	1.0-2.0	*	1.5	1.1-2.0	*	-	-	NS
Alcohol - one to several times weekly	1.3	1.1-1.4	***	1.2	1.0-1.5	*	1.4	1.2-1.6	***	1.2	1.0-1.4	*
Nagelkerke R^2					*0.102*						*0.076*	

Note: Independent variables are all those presented in Tables 1 and 2 in addition to gender. Dependent variable dichotomised as 1 = *missing rather many teeth/almost no left/edentulous*, 2 = *all teeth left/missing a single tooth*. OR = Odds ratio, CI = Confidence interval for OR.

***$P \leq .001$;

**$.001 < P \leq .01$;

*$.01 < P \leq .05$.

'very satisfied' or 'satisfied' with the appearance of their teeth.[17] The proportion of people who believed that they 'Yes, absolutely' would keep their teeth throughout their whole life was also reported approximately 10% more frequently, from 27.9% in 2007 to 37.2% in 2017. In this regard, the benefits of retaining teeth into older age are numerous and include positive aspects related to dietary habits, quality of life, cognition and maybe even longer life expectancy.[15]

Not unexpectedly, and in line with reduced tooth loss, reported presence of different types of removable prostheses was very low in 2017, ranging from 2% to 6.1%. Numbers of implant retained restorations, porcelain reconstructions and white fillings were higher, while number of gold restorations was lower, in 2017 than in 2007. It can be noted that in 2017 approximately one out of six participants reported that they had an implant (14.6%). This can be compared to Japan where only a little more than 1% of 75-84 year olds had

TABLE 6 Logistic regression model (Forward Conditional Method – final model) for the question 'Can you chew all kinds of food' as dependent variable at 75 y of age in cohort 2007 and 2017

	2007 Unadjusted			2007 Adjusted			2017 Unadjusted			2017 Adjusted		
Ref. category	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***
Female gender	1.1	0.96-1.3	NS	-	-	-	1.2	1.0-1.3	*	1.3	1.1-1.4	**
Born outside Sweden	0.46	0.35-0.59	***	0.55	0.38-0.79	**	0.43	0.34-0.55	***	0.50	0.37-0.67	***
Living in village or countryside	0.82	0.72-0.94	**	-	-	NS	0.88	0.78-0.99	*	-	-	NS
Unmarried/ divorced/ widow/widower	0.77	0.67-0.89	***	-	-	NS	0.73	0.64-0.83	***	0.80	0.69-0.94	**
High school/ college/ university	1.8	1.6-2.1	***	1.3	1.0-1.5	*	1.5	1.3-1.7	***	1.30	1.1-1.5	**
More than 10 social contacts/ wk	1.6	1.4-1.9	***	1.3	1.1-1.6	**	1.4	1.2-1.6	***	-	-	NS
Not feeling healthy	0.41	0.35-0.47	***	0.66	0.53-0.82	***	0.34	0.30-0.39	***	0.57	0.48-0.67	***
Health equal/ worse/much worse than same-aged	0.47	0.40-0.55	***	0.64	0.51-0.79	***	0.39	0.34-0.45	***	0.49	0.42-0.57	***
Not using prescribed medicine	1.3	1.1-1.6	**	-	-	NS	1.4	1.2-1.7	***	-	-	NS
No contact with doctor last 3 mo	1.2	1.1-1.4	**	-	-	NS	1.4	1.2-1.6	***	-	-	NS
Smoking - stopped/never smoked	1.4	1.2-1.6	***	-	-	-	1.5	1.2-1.6	***	-	-	NS
Smokeless tobacco - stopped/never used	1.6	1.2-2.1	**	1.6	1.1-2.4	**	1.2	0.91-1.5	NS	-	-	-
Alcohol - one to several times weekly	1.4	1.3-1.7	***	-	-	NS	1.4	1.2-1.5	***	-	-	NS

(Continues)

TABLE 6 (Continued)

	2007 Unadjusted			2007 Adjusted			2017 Unadjusted			2017 Adjusted		
Ref. category	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***
All teeth left/ missing a single tooth	7.2	6.2-8.4	***	5.3	4.3-6.4	***	5.6	4.8-6.4	***	4.0	3.4-4.7	***
Complete dentures in both jaws - none	3.7	2.7-5.0	***	-	-	NS	4.2	2.7-6.6	***	-	-	NS
Complete dentures in one jaw - none	4.0	3.1-5.2	***	1.5	1.1-2.2	*	3.5	2.6-4.7	***	-	-	NS
Removable partial denture - none	3.9	3.1-5.0	***	1.8	1.3-2.5	***	6.8	5.1-9.1	***	2.8	2.0-4.0	***
Nagelkerke R^2					*0.299*						*0.227*	

Note: Independent variables are all those presented in Tables 1 and 2 in addition to gender. Dependent variable dichotomised as 1 = *Yes, relatively good/not so good/bad*, 2 = *Yes, very good*. OR = Odds ratio, CI = Confidence interval for OR.

***$P \leq .001$;

**$.001 < P \leq .01$;

*$.01 < P \leq .05$.

implants in 2011.[18] Another Japanese study from 2018 on patients receiving home-visit dental care, reported that approximately 3% had received implant therapy.[19] Implant therapy for the older patient is and will continue to be very important in the future but caution has to be exercised because of the many risk factors involved in such treatment.[20]

In the adjusted multivariate analysis, most of the significant variables related to number of remaining teeth are unsurprising and could have plausible explanations (Table 5). For both cohorts, being born outside Sweden, single living, not healthy and smoking were correlated with loss of teeth. In this regard, smoking and impaired general health are known associations with tooth loss, as is living alone, while immigrants have been shown to have reduced number of teeth compared to the native population.[21,22] Interestingly, frequent alcohol consumption was significantly associated with having 'all teeth left/missing a single tooth' both in 2007 and 2017 (OR 1.2 and 1.4, respectively). It is hard to find any logical explanation for this finding but one could speculate about the possible role of socioeconomic factors, viz. that people with many teeth are likely to engage more frequently in activities where such consumption is the norm, and/or they have the economic resources to buy alcohol compared to those with fewer teeth who in general seem to be economically less well-off. That there could be a biological explanation, viz. that alcohol consumption could promote the keeping of teeth (teeth retention) is hard to believe.

Chewing efficiency showed similar associations in the multivariate analysis, that is, impaired health, being born outside Sweden and reported removable partial denture usage correlated with impaired chewing, while a greater number of teeth and higher education were associated with good chewing. The associations between impaired general health, reduced dentition, denture wearing, low education and compromised masticatory performance is no surprise and has been reported on previously.[23,24]

Demographic and health-related differences observed between the two cohorts of 75 year olds reflect remarkable societal changes that have taken place between 2007 and 2017. Improved general health status, less frequent smoking habits and the higher retention of natural teeth mirror a very positive development for the ageing population. The remaining life expectancies for a Swede aged 75 years in 2017 are 11.5 years and 13.3 years for men and women, respectively. Consequently, men will on average reach an age of over 85 and women will live until they are close to 90.[25] This can be compared to a 75-year-old from 50 years ago in 1970 whose remaining lifespan was considerably less than today (men 8.3 years, women 9.6 years).[26] The trend of increasingly longer life spans in Sweden will continue in the future, with the projection being that up to 2070, lifespans will increase in each decade by 1.0 year for women and 1.2 years for men.[26] Further, the old-age dependency ratio (people aged 65 years and above relative to those aged 15-64) within the EU was 29.6% in 2016 and is expected to increase to 51.2% by 2070.[27] This will have far-reaching implications for the possibilities to adequately manage the healthcare needs of the elderly.

The global trend of an increasingly ageing population will not only put high demands on the general health and welfare systems of many countries, but also on oral healthcare systems. The dental profession will have to adapt its undergraduate education and postgraduate training systems, as well as clinical management and preventive strategies to be able to meet the needs and demands of the elderly, generally healthy but also medically comprised, and largely dentate or at least partially dentate section of the population. The approaches on how to effectively manage these challenges deserve further attention by society and the dental community.

5 | CONCLUSIONS

Seventy-five-year-old people in Sweden in 2017 reported much better oral and general health than in their 2007 counterparts. In 2017, 75% had practically all natural teeth present and only 2% were edentulous. This development of an increasingly dentate and partially dentate ageing population will put high demands on the oral healthcare system and will need adapting undergraduate and postgraduate education and management strategies to meet the requirements of the elderly.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

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