



Dental anxiety, concomitant factors and change in prevalence over 50 years

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Objective: To analyse the prevalence of Dental Anxiety (DA) in the general adult population of Sweden, to study concomitant factors of DA and also to compare the prevalence of DA in 1962 with that in 2013. **Method:** The national study for 2013 included 3,500 individuals, randomly selected from the Swedish population. The data sampling was performed as a telephone survey including 38 questions and this report is a selection of those questions with the focus on DA. The national study from 1962 was a face-to-face survey of 1,331 individuals randomly selected from the Swedish population. Both surveys were conducted by the same company. **Results:** In 2013, severe DA was reported in 4.7%, moderate DA in 4.5%, low DA in 9.8% and no DA in 80.9% of the subjects. Most (72.9%) of the subjects who reported severe DA attended dental care regularly. Important predictive factors of DA were age, gender, education, and self-rated poor oral and general health. The analysis showed a decrease in the prevalence of DA between 1962 and 2013, specifically a change towards more individuals reporting no dental anxiety (38.5% vs. 80.9%) but also smaller proportions of individuals having low and high DA (46.4% vs 9.8% and 15.1% vs 9.2%, respectively). **Conclusions:** In this national representative sample of Swedish adults the prevalence of severe DA was 4.7%. The main finding revealed a significant decrease of the prevalence of DA over 50 years.

Key words: adult, cross-sectional, dental anxiety, epidemiology, prevalence, Sweden

Introduction

Dental anxiety (DA) is a public health problem affecting a significant fraction of the population. It is a common problem, which may have consequences for individuals' oral health with pain and poor oral status (Berggren and Meynert, 1984; Schuller *et al.*, 2003). Prevalence of dental anxiety in adults varies from 4% to 30% across studies, countries and cultures (Armfield, 2010; Gatchel *et al.*, 1983; Hill *et al.*, 2013; Milgrom *et al.*, 1988; Morse and Takau, 2004; Vassend, 1993). Differences in cut-off scores, examination methods for DA and study populations may explain this variability. In a review, Smith and Heaton (2003) showed stable DA scores over 50 years in the United States.

The peak prevalence of DA is often shown to occur in early adulthood and declines with greater age, especially after 50 years of age (Hägglin *et al.*, 1996; Hakeberg *et al.*, 1992; Locker *et al.*, 1991). Reports give contradictory results regarding whether socio-economic status impacts on dental anxiety or not (Hakeberg *et al.*, 1992; Locker, 2003; Vassend, 1993). Most of the literature finds a higher prevalence of DA among women than men (Åström *et al.*, 2011), though no gender difference has also been reported (Oosterink *et al.*, 2009). Associations have also been found between DA and non-regular attendance to dental care, poorer oral health and functional impairment (Berggren and Meynert, 1984; Hägglin *et al.*, 1996; Milgrom *et al.*, 1988; Schuller *et al.*, 2003). Several publications have discussed a vicious circle of DA and important concomitant factors that interact over time and eventually escalate the DA levels, as well as a gradient of poor oral

health and social and psychological impairments for the affected individuals (Armfield, 2013b). General and oral health self-care behaviors, except dental attendance, have not been evaluated to the same extent.

More than 50 years have passed since a national survey of DA was performed in Sweden. In 1962, the Swedish Institute of Public Opinion Research (TNS SIFO) performed an interview-based study and analyzed the prevalence of DA in the adult Swedish population (SIFO, 1962). The results of that study indicated a 15.1% prevalence of high DA, moderate DA of 46.4% and no DA of 38.5%. There is a need for a new prevalence study of DA in the adult population in Sweden, to analyse whether there has been a shift in the prevalence of DA in Sweden over time. According to a Health Technology Assessment report there is a need for prevalence studies of the current situation in Sweden (Wide Boman *et al.*, 2012). Have the levels of DA in society changed over time and, if so, what are the distributions by level of DA? Have the gender and age differences changed? This knowledge is needed to understand and assess the influence of dental anxiety at a community level, but also for dental health care planning and for the allocation of resources and education at general and specialist levels.

The aim of this study was to analyse the prevalence of DA in the adult Swedish population and to study concomitant factors to DA, such as socio-economic status, attendance of dental health care, self-reported oral and general health care behaviors. Furthermore, the objective was to compare the prevalence of DA in 1962 and 2013, respectively.

Methods

This cross-sectional observational survey was based on a random national sample of the adult population in Sweden in 2013. The data sampling was performed by a telemarketing company, TNS SIFO, a Swedish company undertaking public opinion and market surveys. SIFO assessed the sample using a telephone survey and was responsible for the randomization. The participants were randomized from the Swedish Personal Address Register (SPAR) in Sweden. SPAR includes all individuals registered as Swedish residents. The data in SPAR is updated daily with data from the Swedish Population Register. When included, individuals with a published fixed or mobile telephone number were asked to participate. There are no data about how common it is to have an unpublished telephone number. Individuals who did not speak and/or understand Swedish were excluded. A total sample of 3,500 individuals, aged ≥ 19 years of age, was interviewed. The participation rate was 49.7%.

A questionnaire was used, including items on demography (education, income, age and gender), self-reported oral and general health, life style (smoking and exercise), oral health-related questions, such as oral health behaviors, dental attendance, self-care behaviors and self-care prevention, and attitude towards oral health problems. There were a total of 38 questions. This report analyzed the variables relating to dental anxiety.

Dental anxiety was assessed using the single-question "Are you anxious about going to the dentist?" with response alternatives: not at all; a little; yes, quite; and yes, very. The responses were considered to reflect no, low, moderate and severe DA respectively for one analysis (model II) but was elsewhere dichotomised into 'no anxiety' for the first two responses and 'dental anxiety' for the last two.

A proxy for socioeconomic status was highest level of education achieved with the response options: elementary school, high school, university studies, university degree and postgraduate degree then categorised the first two of those responses as 'low', 'high' for the last three.

Health and oral health were measured by respondent self-ratings of general and oral health with the responses excellent, very good and, good categorised as 'good' and neither good nor bad and bad, as 'poor'. Similarly responses relating to the importance of good oral health in relation to general well-being categorised as 'not important', not at all and of little importance; as 'important', quite important and very important. A question about satisfaction with teeth aesthetics had the response alternatives: yes, very satisfied, quite satisfied, quite dissatisfied, and very dissatisfied, with the first two being categorised 'good' and the last two as 'poor'.

Oral health behaviors (frequency of tooth-brushing, use of interdental brushes/tooth picks and dental flossing) had the following response alternatives: three times or more daily, twice daily, once daily, several times a week, once a week, less often or never. These variables were dichotomized into twice or more per day and less than twice per day. Dental attendance response alternatives were: twice a year, once a year, once every second year, less often than every second year, just in case of acute symptoms and never, categorised into 'regular' for the

first three of these responses and 'irregular' for the rest.

Two questions measured health behaviors. Physical activity/exercise had the response alternatives: not at all, now and then, once a week, at least twice a week, more frequently than twice a week. These were mapped to less than once a week and once a week or more. Responses regarding daily smoking were: yes; no, but I have been smoking daily; no, I do not smoke/I have never smoked, were divided into 'smoker' for the first response and 'non-smoker' for the others.

Ethical consent to perform the study was obtained from the Regional Ethical Review Board (Reg. no. 801-12).

The cross-sectional study from 1962

Data from the 1962 cross-sectional survey performed by SIFO were used to analyse the prevalence of DA over time and to study both dental attendance and the distribution among men and women in the population suffering from high DA over time. This study was used face-to-face interviews performed by SIFO. A random sample of Swedish adults completed the interview. SIFO used systematic random sampling from the Swedish residents register. A total of 1,331 individuals aged 12 to 75 years were asked to participate. Individuals who did not speak and understand Swedish or suffered from deafness or severe illness were excluded leaving 1,241 participants. In all, 1,071 interviews were performed and included; a participation rate of 86.3%. The 90 adolescents aged 14 years or younger were not asked about dental care. The questions of interest had 970 sets of responses and no information about the missing answers; a useable response rate of 78.1% of those included.

The study from 1962 collected data on dental care visits and demographic variables such as age, gender, place of residence and social class. The part of the survey about dental care included questions about removable dentures, dental attendance, prevalence of DA and impact of DA on dental attendance. The variables of interest were gender, prevalence of DA and dental attendance. 1962 data available are only available from the published report (SIFO, 1962) with no access to the original data at individual level.

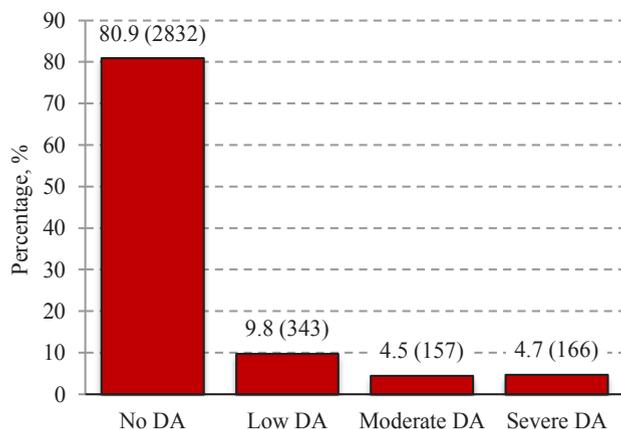
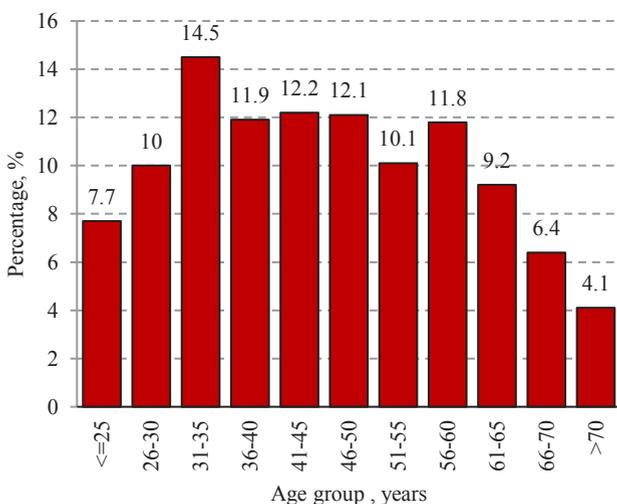
The statistical analysis consisted of descriptive statistics and bivariate and multivariate analyses. T-tests analysed differences between continuous variables and Chi-square and logistic regression were used to analyse categorical dependent variables using the SPSS v21.0 with the level of significance was set at $\alpha=0.05$.

Results

In 2013, severe DA was reported in 4.7% ($n=166$), moderate DA in 4.5% ($n=157$), low DA in 9.8% ($n=343$), and no DA in 80.9% ($n=2,832$) (Figure 1). The sample consisted of 53.1% women and women were proportionally more dentally anxious than men. Distributions by age and gender are shown in Table 1. Figure 2 shows the distribution of dental anxiety by different age groups. The graph reveals increasing DA from young adulthood up to 31-35 years of age, when the DA levels stabilize, while a marked decrease is seen after 60+ years of age.

Table 1. Age and levels of dental anxiety by gender

	Women	Men	Overall
Age (years)			
Mean (SD)	53.9 (17.6)	52.9 (17.4)	53.4 (17.5)
Median	55.0	54.0	55.0
Dental anxiety			
None	75.2%	87.4%	80.9%
Low	12.3%	7.0%	9.8%
Moderate	5.6%	3.2%	4.5%
Severe	6.8%	2.4%	4.7%

**Figure 1.** Prevalence of dental anxiety (DA) in 2013 in Sweden**Figure 2.** Prevalence of high dental anxiety in 2013 by age group

Bivariate analysis reveals the relationship between DA and the included independent variables (Table 2). All potential risk factors of DA were found to be statistically significant, except oral hygiene behaviors, such as tooth-brushing, use of dental floss and the impact of oral health on general wellbeing.

The multivariate logistic analyses used different models, including alternate categorizations of the dependent variable DA. First, the independent variables that showed significant associations with DA in the bivariate analyses were included in the subsequent multivariate model. Second, the first analysis used DA as no DA/low DA versus moderate DA/severe DA (model I). In the following analysis,

DA was categorized as only no DA versus severe DA, excluding the middle groups of DA (model II). Model II evaluated and compared the more extreme groups, thereby emphasizing potential differences more clearly.

For model I, several significant relationships were found between DA and the included covariates. Age, gender, dental attendance, self-reported oral health, satisfaction with dental aesthetics and smoking revealed odds ratios between 1.21 and 2.68. Specifically, gender was the strongest predictor with an OR=2.68. Table 3 shows model II, including the abovementioned independent variables plus education. Generally, higher ORs are seen for all the covariates compared with model I. In the model evaluations, the Nagelkerke test statistic increased from 0.13 to 0.20 for models I and II, respectively.

To ascertain the representativeness of our sample of the Swedish population, comparisons were made between the study sample from 2013 and the population of Sweden in 2013. Data on the Swedish population was obtained from Statistics Sweden, SCB (www.scb.se). The mean age in the sample and in the general population of Sweden was 53.4 and 49.4 years, respectively. In the study sample, 10.8% of the participants were foreign-born, vs. 18.0% in the Sweden population ($\chi^2=122.6$, $p < 0.001$). However, the analysis showed no difference in DA levels between Swedish and foreign-born individuals in the present sample (data not shown). There was a greater proportion of women in the sample than in the Swedish population (53.1% versus 50.5%; $\chi^2=9.6$, $p=0.002$). The analysis also showed that the sample was more highly educated than the general population. The proportion of the sample that reported the highest achieved educational level as elementary school and high school was smaller and the proportion reporting a higher educational level was greater than in the general population (elementary school 18.1% versus 19.7%, high school 40.2% versus 45.8%, and higher educational levels 41.7% versus 34.5%; $\chi^2=80.2$, $p < 0.001$).

In 1962, DA was assessed in three categories: no, low and high DA. In 2013, DA was assessed in four categories: no, low, moderate and severe DA. To be able to compare the 1962 and 2013 data, the categories from 2013 were trichotomized into no DA, and low and high (moderate and severe) DA. A significant difference in DA levels was found between 1962 and 2013 ($p < 0.001$) (Table 4). The fraction reporting no DA has increased while the proportions reporting low and high DA have decreased. Dental attendance has increased among the high DA group ($p < 0.001$). There was no difference in the gender distribution of high DA between 1962 and 2013.

Discussion

This study analyzed data from a nationally representative sample of adult individuals in Sweden concerning dental anxiety and related factors. Moreover, comparisons were made with data from a national random sample studied 50 years ago.

In 2013, the prevalence of severe dental anxiety was 4.7%. Important associated factors predicting DA were female gender, socioeconomic status as captured by low education level, middle-aged individuals, poor dental attendance, poor self-reported oral and general health, and poor general health behaviors.

Table 2. Associations between dental anxiety (DA) and the independent variables displayed as percentages of the sample

	<i>No DA</i>	<i>Low DA</i>	<i>Moderate DA</i>	<i>Severe DA</i>	<i>p value*</i>
Education					
Low	58.3	54.5	54.1	68.9	0.014
High	41.7	45.5	45.9	31.1	
Self-rated oral health					
Poor	24.1	35.0	38.5	51.8	<0.001
Good	75.9	65.0	61.5	48.2	
Self-rated general health					
Poor	13.7	15.5	20.4	23.5	<0.001
Good	86.3	84.5	79.6	76.5	
Dental aesthetics					
Poor	8.8	14.0	20.4	22.3	<0.001
Good	91.2	86.0	79.6	77.7	
Impact of oral health on general wellbeing					
Not important	6.8	6.7	6.6	6.9	NS**
Important	93.2	93.3	93.4	93.1	
Dental attendance					
Irregular	7.7	13.1	12.1	27.1	<0.001
Regular	92.3	86.9	87.9	72.9	
Tooth-brushing					
less than twice daily	7.2	5.2	4.5	4.8	NS
twice daily or more	92.8	94.8	96.5	95.2	
Use of interdental brush/toothpicks					
No	50.7	50.7	48.4	55.4	NS
Yes	49.3	49.3	51.6	44.6	
Use of dental floss					
No	59.3	56.0	61.8	57.8	NS
Yes	40.7	44.0	38.2	42.2	
Smoker					
Yes (including previously)	7.7	9.6	13.4	27.1	<0.001
No	92.3	90.4	86.6	72.9	
Exercise					
once a week or less	23.7	22.4	29.9	31.3	0.040
more than once a week	76.3	77.6	70.1	68.7	

*Chi-square test; **NS, Not Significant

Table 3. Multivariate analysis indicating a correlation between severe dental anxiety and the variables age, gender, education, self-rated oral health, dental aesthetics, dental attendance and smoking

<i>Variable</i>	<i>Category</i>	<i>Referent category</i>	<i>OR</i>	<i>95%CI</i>	<i>p value</i>
Age:	19-30 years	(Ref: 61> years)	1.54	0.86-2.78	0.15
	31-60 years		2.62	1.76-3.89	<0.001
Gender	Women	(Ref: Men)	4.04	2.75-5.95	<0.001
Education	Low education	(Ref: High - more than high school)	1.66	1.15-2.39	0.007
Self-rated oral health	Poor oral health	(Ref: Satisfied with oral health)	2.84	1.98-4.08	<0.001
Dental aesthetics	Poor	(Ref: Satisfied with dental aesthetics)	1.64	1.04-2.59	0.03
Dental attendance	Irregular	(Ref: Regular, 2 years or less)	3.20	2.10-4.88	<0.001
Smoking status	Smoker	(Ref: Non-smoker)	2.92	1.92-4.43	<0.001

Nagelkerke R²=0.20; Hosmer and Lemeshow Test p=0.680; OR, Odds Ratio; CI, Confidence Interval

Table 4. Comparisons between dental anxiety, dental attendance and gender results from 1962 and 2013

	1962 %	2013 %	<i>p</i> <i>value*</i>
Dental Anxiety (DA)			
High	15.1	9.2	<0.001
Low	46.4	9.8	
No	38.5	80.9	
Regular dental attendance among the high DA group, %	41.7	80.2	<0.001
Gender distribution of high DA			
Women	64.0	71.5	0.11
Men	36.0	28.5	

*Chi-square test

Changes over time in the levels of dental anxiety over a period of 50 years specifically revealed one feature, namely a shift in DA towards lower levels in 2013. In addition, the greatest change concerning the decrease in DA, was seen in the categories no and low DA.

The prevalence of severe and high DA corresponds well with earlier results (Hakeberg *et al.*, 1992; Hill *et al.*, 2013; Oosterink *et al.*, 2009; Vassend, 1993). The peak prevalence of high DA occurred between 31 and 35 years of age, was more or less stabilized between 35 and 60 years of age, and decreased with older age. Hakeberg *et al.* reported a peak prevalence of high DA in the same ages and Armfield *et al.* in older ages, but both reported a drop in DA levels with higher ages, after 49 and 64 years, respectively (Armfield *et al.*, 2006; Hakeberg *et al.*, 1992). In 1999, Hägglin *et al.* report a cohort studied over 28 years and the results indicated a decline in DA with age, rather than a cohort effect.

A review from 2003 covering the last 50 years in the US reported a stability in the prevalence of DA (Smith and Heaton, 2003). Studies from Europe have indicated similar results over time (Locker *et al.*, 2001; Maggiri and Locker, 2002; Thomson *et al.*, 2000). In this study, there is a significant result of a reduction in DA over a 50-year period in Sweden, which does not correspond to earlier results. An indication of these results is given by Åström *et al.*, (2011) who reported a decline in DA over a 10-year period among 25-year-olds in Norway. Reported high DA decreased from 11.5% among men versus 23% among women in 1997, to 11.3% and 19.8%, respectively, in 2007, which is a rather small change, albeit seen over a short period of time. Furthermore, those results should be interpreted with caution, given the response rate and the change in the demographic measures. Due to the technological advances and psychological awareness that have developed over the past 50 years in dental treatment, a decrease in DA may be expected. Today's dental care includes several aspects of importance to the quality of the dental service, such as the psychological part of the dental treatment; clinical communication, the patient–dentist relationship, dental fear and anxiety, and patient satisfaction. Another factor that may be important is changes in the population demographic panorama. One such factor is the proportion of foreign-born individuals in 1962 and 2013. There is no information from the 1962 sample, however

in the 2013 sample we found no difference in DA-levels between Swedish- and foreign-born, respectively. Thus, this factor may not influence our results.

Some factors associated with DA in the study from 2013 are found to be in line with the vicious cycle of DA, which has been frequently discussed in the literature. The vicious cycle of DA explains the maintenance of dental fear/anxiety: high levels of DA lead to avoidance of dental attendance, deteriorated oral status and problem-oriented treatment, and, later on, feelings of shame, guilt and/or inferiority, which will reinforce the anxiety/fear (Armfield, 2013b; Berggren and Meynert, 1984; Wide Boman *et al.*, 2010; Ng and Leung, 2008). The literature reports associations between DA and non-regular attendance to dental care, poorer oral health and functional impairment, and some publications also include studies on associations between low SES and DA (Armfield *et al.*, 2006; Åström *et al.*, 2011), showing that low SES could be an indicator of avoidance of dental care.

Similar to our findings, there are a few reports on associations between smoking and anxiety (Pohjola *et al.*, 2013). Smokers tend to be non-attendees of dental care more frequently than non-smokers (Armfield, 2013a). Scheutz and Heidmann (2001) reported an association between non-attendees of dental care and low or no physical activity. These findings tell us about different paths towards the vicious cycle of DA, leading to higher levels of DA.

An interesting finding from this study was that individuals reporting DA also reported oral health as being important for general wellbeing, to the same extent as those who did not report DA. This finding indicates how important oral health is to general wellbeing and to individuals who suffer from DA and perhaps from deteriorated oral health. These individuals need good dental care to manage their somatic as well as psychological suffering.

The response rate of 49.7% is acceptable with this kind of methodology according to recent studies (Dillman *et al.*, 2009; Manfreda *et al.*, 2008). A participation analysis was performed and pointed towards some; however, minor differences between the sample and the general population of Sweden, according to the distribution of men and women, education, foreign-born individuals and age. A single-question item was used to measure DA. Due to the design and for practical reasons, the single-question dental anxiety measure is commonly used in studies with this methodology. How well the single-question item captures DA may be, and has been, discussed several times before, but the single item has been validated in several studies abroad (Armfield, 2011; Viinikangas *et al.*, 2007), and in Sweden (Hägglin *et al.*, 1999), and has been proven correlate with other continuous scales to measure DA. However, the strength of this study was the large and random sample of the general adult population in Sweden.

To conclude, the prevalence of severe dental anxiety among the adult Swedish population was 4.7% in 2013, but although the prevalence of severe DA is still high, the results indicate decreasing DA over a 50-year period. Associations were seen between low SES, irregular dental attendance, determinants of health (self-rated oral and general health, smoking, physical activity) and severe DA. These factors tell us about different paths towards a vicious cycle of DA, leading to higher levels of DA.

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