



UIT

THE ARCTIC
UNIVERSITY
OF NORWAY

Faculty of health sciences / Department of community medicine

Dental Anxiety in Northern Norway

Epidemiologic Assessment of Dental Anxiety in the Troms County – the TOHNN-study

—
Manoel Valcacio Guedes Neto

HEL-3950 Master's thesis in Public Health

May 2017

Main Supervisor: *Birgitta Jönsson, PHD*

Co-supervisor: *Nils Oscarson, PHD and Tordis Trovik, PHD*



Acknowledgements

I would like to thank my main-supervisor Birgitta Jönsson, PHD, researcher at the County Council of Troms, for her immensurable patience, dedication, wisdom and technical knowledge in Public Health Dentistry, and who gave me light through the whole process of making this thesis.

I would also like to thank my co-supervisors. Nils Oscarson, PHD, researcher manager at the County Council of Troms, for giving me access to the data from the TOHNN-study, without which it would not be possible to develop this master thesis, and for the precious insights that were given throughout the study, and Tordis Trovik, PHD, professor at the University of Tromsø, for her memorable lectures in Public Health.

Finally, I would like to thank the staff from the Master in Public Health Program at the University of Tromsø, for organizing and providing all the necessary tools in order to be a better professional. My sincere recognition.

Abstract

Objectives. The aim of this study was to describe the prevalence of dental anxiety (DA) in the Troms county and to investigate the association of DA and variables of socio-economic status, geographic distribution, gender, dental care habits, and oral health status.

Methods. Data from the Tromstannen – Oral health in Northern Norway (TOHNN) study was used. Dental anxiety was assessed with the aid of the Corah's Dental Anxiety Scale (DAS) in a randomly selected sample representative of the population in the Troms county, northern Norway (n=1936). Participants answered a comprehensive questionnaire and went through a clinical examination where decayed teeth (DT) and decayed surfaces (DS) were assessed. The findings were statistically analyzed using the software SPSS, where the person's chi-square test was used for the bivariate analysis and logistic regression analysis was used to examine predictors to DA.

Results. The prevalence of severe dental anxiety among the participant was 9,5% and more women than men were affected (OR=3,053). There was a significance difference in means of DT and DS between DA groups (t-test, $p < 0,001$).

Conclusion. High and severe DA is more prevalent among women, individuals with lower education and lower income and it presents a negative influence in oral health status.

Keywords: Dental anxiety, odontophobia, prevalence.

List of abbreviations

DSM-5 [®]	The Diagnostic and Statistical Manual of Mental Disorders
DF	Dental Fear
DA	Dental Anxiety
DP	Dental Phobia
DAS	Corah's Dental Anxiety Scale
DTE	Direct Traumatic Experiences
IVE	Indirect Vicarious Experiences
VIQ	Verbal Intelligence Quotient
DMFS	Decayed, Missing, Filled Surfaces Index
DMFT	Decayed, Missing, Filled Teeth Index
DS	Decayed Surfaces
DT	Decayed Teeth
TOHNN	Tromstannen – Oral Health in Northern Norway Study
TkNN	Competence Center in Oral Health of Northern Norway

List of Tables

Table 1. Demographic distribution of the sample and levels of anxiety (DAS) in percentage with p-value for the bivariate analysis (Pearson's Chi-Square test)	17
Table 2. Logistic regression between the dependent variables and predictors given in Odds Ratio (OR), confidence intervals (CI) and p-value (Sig).....	18
Table 3. Demographic distribution of the sample and levels of anxiety (DAS) in percentage with p-value for the bivariate analysis (Pearson's Chi-Square test).....	19
Table 4. Logistic regression between the dependent variables and predictors given in Odds Ratio (OR), confidence intervals (CI) and p-value (Sig).....	20
Table 5. Mean of decayed teeth (DT) per category of DA with independent t-test comparing the means.....	21
Table 6. Mean of decayed teeth (DS) per category of DA with independent t-test comparing the means.....	21

List of Figures

Figure 1. The vicious cycle proposed by Berggren	4
Figure 2. Theoretical model of variables used in the study	12
Figure 3. The prevalence of dental anxiety levels in the studied population expressed in number of individuals and proportions.....	15
Figure 4. Distribution of answers of the four questions DAS questionnaire in percentage.....	16

Table of Contents

Acknowledgements	iii
Abstract	v
List of Abbreviations	vii
List of Tables	ix
List of Figures	ix
Table of Contents	xi
1. Introduction	1
1.1 Dental Anxiety (DA), Dental Fear (DF) and Dental Phobia (DP)	1
1.2 Prevalence of DA	2
1.3 Causes of DA	3
1.4 DA and Dental Care Avoidance: The ‘Vicious Cycle’	4
1.5 Instruments to access the levels of DA	5
1.6 DA in Norway	6
1.7 Purpose and Objectives	7
2. Material and Methods	9
2.1 Study participants	9
2.2 Questionnaire	10
2.3 Determining the levels of DA	11
2.4 Questions used to assess the relationship with DA levels	11
2.5 Statistical analysis	13
3. Results	15
3.1 Prevalence of DA in the sample	15
3.2 DA and the dental treatment avoidance related questions and oral hygiene habits	19
3.3 DA and the Decayed Teeth index (DT) and Decayed Surfaces (DS)	21
4. Discussion	23

4.1	The study design	23
4.2	Sample size, selection and potential bias	23
4.3	The reliability of the DAS and other questions from the questionnaire	25
4.4	Statistical analysis	26
4.5	Results	26
5.	Conclusion	31
	References	33
	Appendix 1: Corah's Dental Anxiety Scale (DAS) questionnaire used in the study (in Norwegian).	35
	Appendix 2: Questions used to determine eventual avoidance behavior (in Norwegian).	36

1. Introduction

Dental anxiety is one of the most common type of fear in the developed world (1). Its prevalence reports vary among different regions, but it is believed to affect between 5% and 42% of the population in developed countries (2). Dental anxiety has been associated with several factors linked to oral health impairment such as poor attendance to dental care services, delay of treatment, a greater perceived need of dental treatment, a greater prevalence of dental disease, and a negative influence on quality of life (3).

1.1. Dental Anxiety (DA), Dental Fear (DF) and Dental Phobia (DP)

The term *dental anxiety* has often been used in the scientific literature interchangeably with the term *dental fear*. The Diagnostic and Statistical Manual of Mental Disorders – DSM-5[®] (4) describes fear as the emotional response to real or perceived imminent threat, and anxiety as an anticipation of a future threat. In the DSM-5[®], both states may at some point overlap, but they are different on the premise that fear is associated mostly with escape behaviors and thoughts of immediate danger, while anxiety is associated to a constant state of vigilance, muscle tension and avoidance behaviors of future dangers. According to Beaton et al. (5), the term *dental anxiety* was firstly used by Isador H. Coriat (6). Coriat described dental anxiety as a ‘widely spread form of fear in everyday life’, that through different levels could lead, on its most prominent and exaggerated forms, to an obsessive state of anxiety concerning dental treatment, independently of the nature, that would often result in postponement of appointments which in turn could lead to poorer oral health. *Dental phobia* or *Odontophobia* are coined terms to describe extreme cases of dental anxiety. Classified within the *specific phobias*

branch of Anxiety Disorders on the DSM-5®, *Dental Phobia* was defined by Lauth (7) as ‘an out of proportion fear which will not respond to reason that leads to avoidance of dental treatment’. Thus, in the present study, the terms dental fear (DF) and dental anxiety (DA) are used interchangeably, while the term dental phobia (DP) is used to express only the highest level of anxiety found on the Corah’s Dental Anxiety Scale (DAS), interchangeable with severe dental anxiety (severe DA).

1.2. Prevalence of DA

There is great variability in DA prevalence between countries due to differences in study populations and methods and measurements used (8). Nevertheless, studies suggest that the prevalence of severe DA fluctuates at around 5% of the population in western countries despite enhancements on oral health care over the years (9). In Scandinavia the figures are not much different. In a recent published study which aimed to evaluate the prevalence of DA in the general adult population in Sweden, the authors found that 4.7% reported severe DA, 4.5% moderate, 9.8% low, and 80.9% reported no DA. When comparing the results to previous findings from 1962, the authors found a significant reduction in the prevalence of DA in general, but no significant change in number with severe DA (10). In a study with adults in Norway, using the data from the Trøndelag-94 study, Schuller et al. (9) found the prevalence of severe DA as of 6.6% of the studied population. However, the prevalence of severe dental anxiety can differ from countries and regions. In a study with the adult population in Bulgaria, the percentage of the severe anxiety or phobic group was 11.7%; when gathered with the high anxiety group (total of 29.9% of the sample), the results were considerably higher than in other European and North America countries (11).

1.3. Causes of DA

The development of dental anxiety (DA) is credited to many factors of socio-demographic, behavioral and psychosocial backgrounds. The onset of symptoms occurs in different stages of development, more frequently in childhood and early adulthood, even though it could arise later in life (12). The etiology of DA can be divided into exogenous (external) and endogenous (internal) sources. Direct Traumatic Experiences (DTE) and Indirect Vicarious Experiences (IVE) are listed as the two main exogenous sources (5). The first attributes anxiety to personal traumatic dental events in the past that may linger from childhood into adulthood. It is estimated that half of all cases of DA are attributed to DTE (13). IVE includes anxiety acquired from the influence of role models, which could be understood as family members, peers or the media. This source of anxiety seems to affect children more than adults, as Locker et al. (1999) found association of IVE with dental anxiety exclusively for childhood onsets. Heritability, personality traits and cognitive ability are enlisted as endogenous sources of DA (5). A genetic component for DA was found on a longitudinal study performed with over 2000 twins. The heritability was higher for girls than for boys, with no difference in gender when intensity of fear was evaluated (14). Studies have suggested that introverted and neurotic individuals tend to develop DA more frequently than their counter part of more extroverted and less neurotic individuals (5). In another study, children with better verbal capacity, expressed through the Verbal Intelligence Quotient (VIQ), were found to be less likely to suffer from DA. Despite the fact that the authors found no association for other cognitive indexes evaluated, the results show a link between cognitive ability and DA that needs further investigation (15).

1.4. DA and Dental Care Avoidance: The 'Vicious Cycle'

In 1984, Doctor Ulf Berggren (16, 17) studied the association between dental fear and avoidance behavior. As a conclusion, the author proposed the theory of the 'vicious cycle' where dental fear would lead to dental care avoidance behavior, which would result in neglect of the stomatognathic system over time, poorer oral health and the eventual need for more invasive procedures, which would subsequently increase the levels of dental anxiety (Figure 1).

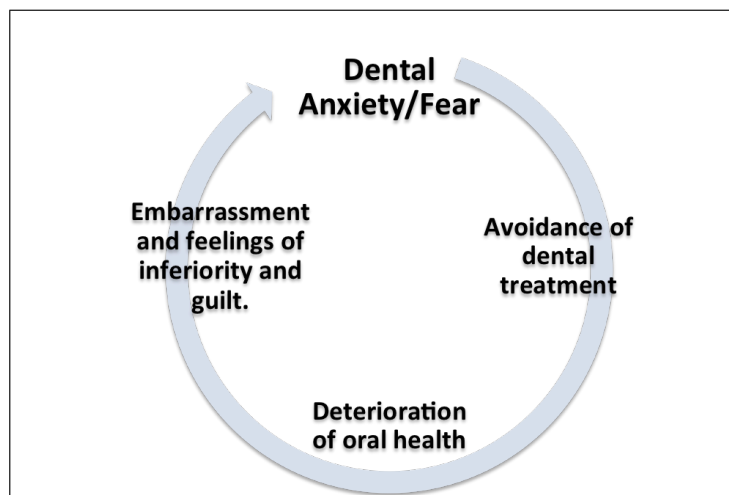


Figure 1. The vicious cycle proposed by Berggren.

This self-perpetuating model has been assessed and supported in whole or partially by several authors (18-20). De Jongh et al. (19) tested the hypothesis that dental treatment avoidance and the fear of negative evaluation were mediated by the deterioration of the oral health. Besides supporting the assumption that avoidance behavior overtime was significantly associated with poorer oral health, the authors suggested that a 'a less healthy dental status' was significantly associated to embarrassment related to dentition and negative social consequences. An alternative

explanation to the avoidance behavior was described by De Jongh et al. (19), and it resembled what was previously proposed by Berggren (16) and Abrahamsson et al. (21): *An exaggerated negative appraisal of patients' own oral status as a driver to missing appointments, where the possibility of needing endodontic treatments, extractions and deep fillings would result in more uncomfortable and painful sessions.*

1.5. Instruments to access the levels of DA

For population and clinical studies, anxiety questionnaires are common instruments used to access dental anxiety levels. There are a number of different self-reporting questionnaires composed of single or multiple items that aim to identify anxious and phobic patients (22). On a review about anxiety and pain measures in Dentistry, Newton & Buck (23) identified a total of 15 instruments used to assess the levels of DA. Among those, the Dental Anxiety Scale (DAS) developed by Norman L. Corah (24) was used in 35 of the 43 studies included in the review. Thus, being the most widely used measure in the literature.

The DAS is composed of four questions approaching different situations in the dental treatment. Each question has five different alternatives to choose that range from 1 (no anxiety) to 5 (extreme anxiety) (24) and the total scores range from 4 to 20. When evaluating the Dental Anxiety Scale in 1978, Corah et al. (25) stated that scores greater than 15 represented a phobic state of anxiety and the average anxiety level in a sample of 1,232 college student was 8.89. Scores from 4 to 8 are classified as no anxiety; from 9 to 12 as moderate anxiety; 13 to 14 as high anxiety and 15 and above as severe anxiety or phobia (11, 26).

When using questionnaires to assess, for example, DA, it is important to ascertain the reliability and validity of the instrument in relation to the studied population (27). In other words, the psychometric properties of the questionnaire such as validity and reliability have to be known in order to assure that the collected data accurately measures the matter of interest (28). A study which evaluated the ability of the DAS to distinguish between fearful and regularly attending patients in a Norwegian population, Kvale, Berg and Raadal (29) found a high reliability of the instrument (Cronbach's alpha indices $> 0,95$). On a more recent study with the Brazilian population, Campos et al. (27) found that the DAS presented adequate internal consistency, and convergent and factorial validity, concluding that the instrument was capable to assess levels of dental anxiety.

1.6. DA in Norway

There are few epidemiological studies assessing the oral health status of the adult population in Norway (30). Fewer are found for the assessment of dental anxiety levels in adults. On a study with military recruits, Wisløff et al. (31) found a discreet but significant negative association between dental anxiety levels, utilization of dental services and the Decayed, Missing, Filled Surfaces Index (DMFS). The influence of DA on oral health status in adults in Norway was also investigated in the Trøndelag study (9). The authors found that individuals with high dental fear presented significantly higher number of decayed teeth (DT) and filled teeth (FT), even though there was no statistically significant association with the Decayed, Missing, Filled Teeth Index (DMFT) as a whole.

Based on the negative consequences that DA can inflict in the population's oral health, summed to the multifactorial nature of the disease's development and the

noted variability of its prevalence in different countries, this research aims to answer the following question: Do people who suffer from Dental Anxiety in the Troms county present an avoidance behavior towards dental treatment and therefore a greater incidence of caries than the ones who do not suffer from Dental Anxiety?

By answering this research question, scientific knowledge will be available for oral health policy makers to enhance treatment for anxious patients and grounds will be provided for further investigation on dental anxiety and fear in northern Norway.

1.7. Purpose and objectives

The purpose of this study was to describe the prevalence of DA in the Troms county and to examine associations between the different levels of DA and socio-economic status, geographic distribution, gender, dental care habits, and oral health status.

Specific aims of this study are:

1. To describe the prevalence of DA in the sample
2. To assess the relationship of the different levels of DA with socio-economic status, geographic distribution and gender
3. To assess the relationship of the different levels of DA with oral health related behaviors and dental treatment avoidance
4. To assess the relationship of the different levels of DA with the Decayed Teeth index and Decayed Surfaces index.

2. Material and methods

Data presented in the present study was from The *Tromstannen* – Oral Health in Northern Norway (TOHNN) study which was a cross-sectional and population-based study performed by researchers at The Public Dental Health Service Competence Centre of Northern Norway (TkNN). Data collected from the study was used to determine the prevalence of DA in the sample to evaluate the association between the different levels of DA and other variables concerning differences in gender, socio-economic status, years of education, dental care habits, dental treatment avoidance and oral health status. The data was collected through a structured questionnaire and an oral clinical examination between October 2013 and November 2014 in the Troms County, Northern Norway. The study was approved by the regional committees for medical and health research ethics of the University of Tromsø (2013/348/REK Nord).

2.1. Study participants

Based on a previously performed power calculation with a 2-sided, 95% confidence interval and a width of 3% with an expected 50% attendance rate, a randomly selected sample of 3,000 individuals was drawn from the population register by Statistics Norway. Out of those, 1,986 agreed to participate in the study (68,3%). The sample was stratified in three different groups in the county: Tromsø (1,380), Southern Troms (1,320) and Northern Troms (300), in order to allow the detection of eventual differences between urban and rural areas. In this thesis only those with one or more teeth are included in the analysis (n=1936).

Participants were primarily contacted by mail with an explanatory letter in Norwegian containing comprehensive information on the study purposes and procedures. Six trained dental health care professionals contacted the potential participants by phone to inquire on the willingness to participate and to give extra information on the study when required. People who declined to participate were asked, if they would like to give the reason to why they chose not to participate. Those who agreed to participate received through mail the questionnaire and a form of written consent. Subsequently, a clinical examination was scheduled free of charge to the participants and a gift card with NOK 150 was given after the examination. Travel expenses were covered when necessary and in some special cases it was prepaid. All participants were automatically included in a lottery of two tablets (iPad) and 20 power toothbrushes.

2.2. Questionnaire

The structured and self-reported questionnaire was composed by 15 pages that included 82 questions which approached topics related to background information, socio-economic status, usage of dental care services, oral-hygiene behaviors, attitude towards oral health, dietary habits, dental anxiety scale, oral-health related quality of life, perceived treatment needs, subjective norms and normative beliefs. The questionnaire was design by the authors (30) using questions previously used in comparable studies and others which were based on the Nord-Trøndelag Health Study (HUNT) (32). The clinical examination included the record of the index for Decayed, Missing, Filled teeth (DMFT), previous dental treatments, dental caries, periodontal and oral hygiene status, temporomandibular disorder, number of supporting zones, height and weight. It was performed by 11 dental teams in 5 dental offices around the county with the support of intra and extra oral radiographs, and clinical photos. All records were registered in a computerized protocol.

2.3. Determining the levels of DA

To assess the levels of dental anxiety the Corah's Dental Anxiety Scale (DAS) was used (33, 34) (Appendix 1). The instrument is composed by 4 questions with answers ranging from not anxious (score of 1) to extremely anxious (score of 5). The questions are described in appendix 1. The participants were primarily gathered in four groups according to the level of anxiety: (1) no anxiety (scored from 4 to 8), (2) moderate anxiety (scores from 9 to 12), (3) high anxiety (scores from 13-14) and (4) severe anxiety (scores from 15 to 20), as previously used by similar studies (26) for determining the prevalence of Dental Anxiety in the studied sample. Furthermore, The DAS scores of the sample were gathered into two groups: (1) no/moderate anxiety (scored from 4 to 12) and (2) high/severe anxiety (scored from 13 to 20). The second arrangement of the scores was performed for the evaluation of the association between the DAS scores and variables of socio-economic status, gender, geographic distribution, oral health habits, avoidance behavior and oral health status.

2.4. Questions used to assess the relationship with DA levels

The groups of DA resulted from the DAS scores were evaluated for association with different variables presented in the questionnaire of the TOHNN study. Figure 2 shows the nature of the variables that were used in the study along with the DA levels. Table 1 shows how the variables age, education, household income and municipality (geographic location) were grouped.

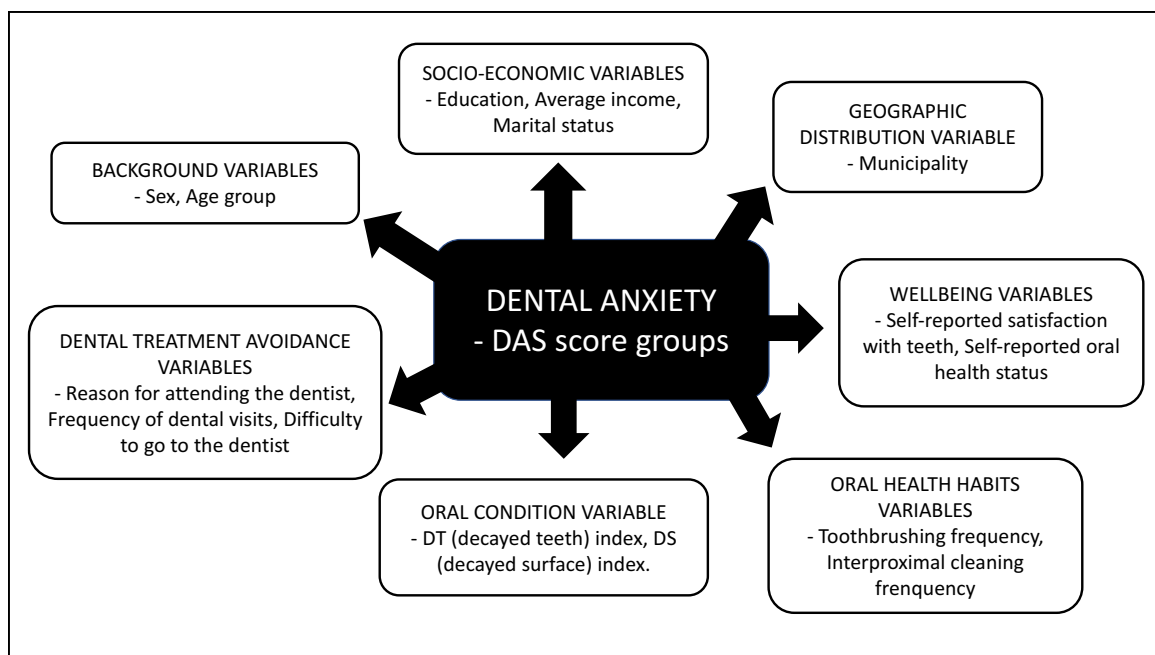


Figure 2. Theoretical model of variables used in the study.

For evaluating the association of possible avoidance behaviors with DA, 3 different questions were used (Appendix 2): The question number #12 on reasons to use dental care services with 3 possible answers, the question #17 on how often they use dental care services with 5 different answers, and the question #18 on the difficulty to visit the dentist with 3 possible answers. Wellbeing was determined by the two questions: one concerning self-perceived satisfaction with their teeth and the other how they perceived their oral health with five possible response alternative from very dissatisfied to very satisfied. Questions concerning the oral health related behaviors comprised how often they brushed their teeth and used devices to clean interdentally.

The oral condition status was assessed by the indices of Decayed Tooth (DT) and Decayed Surfaces (DS). The values for DT are calculated from all teeth with caries

independently if they are restored (filled) or not. The DS index is calculated by the number of surfaces of teeth that presents caries (35).

2.5. Statistical analysis

The Cronbach's Alpha for the DAS questionnaire in the sample was determined using SPSS in order to verify the internal consistency of the instrument. The prevalence of DA in the sample was calculated by dividing the observed number of cases of each level of anxiety determined with the DAS scores by the total sample size. The prevalence was given in proportions. The statistical analysis was conducted using an statistical analysis software (IBM®SPSS®, Version 24, IBM, Armonk, NY) for determining the descriptive statistics, Spearman's correlation coefficients and the logistic regression model of the variables. The independent t-test was used for comparing the means of DT and DS with the DA levels (2). Dental Anxiety was dichotomized as no/moderate anxiety (score less than 13) or high/severe anxiety (score equal or more than 13) for all the statistical assessment of the data except for determining the prevalence. Bivariate association (Pearson's Chi-Square) was checked for eventual association between the variables. When the association was observed and significant ($p < 0,05$), a logistic regression model was used to assess eventual predictors among the independent variables. Missing data was included in the analysis whenever possible and the option "Exclude cases pairwise" was selected in SPSS in order to include any cases that had necessary information for a given analysis (36).

Variables were assessed in groups of similar nature and plausible theoretical association with dental anxiety.

3. Results

3.1. Prevalence of DA in the sample

The Cronbach's Alpha for the DAS questionnaire in the study is 0,92, indicating a high level of internal consistency for the instrument with the specific sample.

Figure 2 shows the prevalence of dental anxiety. Severe DA was found in 4,3% of the sample (N=84), while high DA was found in 5,2% (N=100). The greater majority of the studied population was classified as *no anxiety* (65%, N=1249).

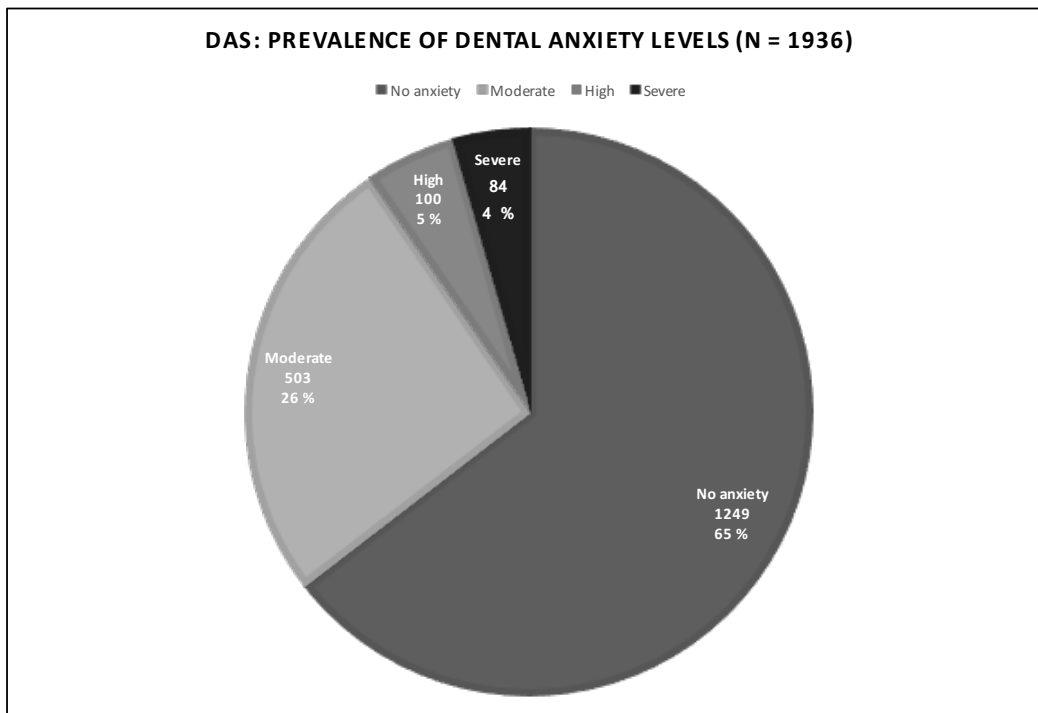


Figure 3. The prevalence of dental anxiety levels in the studied population expressed in number of individuals and proportions.

Figure 3 summarizes the distribution of answers in the sample for the four questions presented by the DAS questionnaires. Question one (which concerns the anxiety feelings of anticipation and expectation for a procedure that should happen the next

day) had the highest prevalence of answers characterized as very and extremely anxious in the sample (N=270 or 14,1%). Question three (which concerns the anxiety feelings while on the dental chair waiting for treatment) had a prevalence of 5,0% for very and extremely anxious (N=95). Question two and four, which deals with the anxiety feelings while in the waiting room and during treatment, presented a prevalence of 3,9% (N=75) and 3,6% (N=69), respectively.

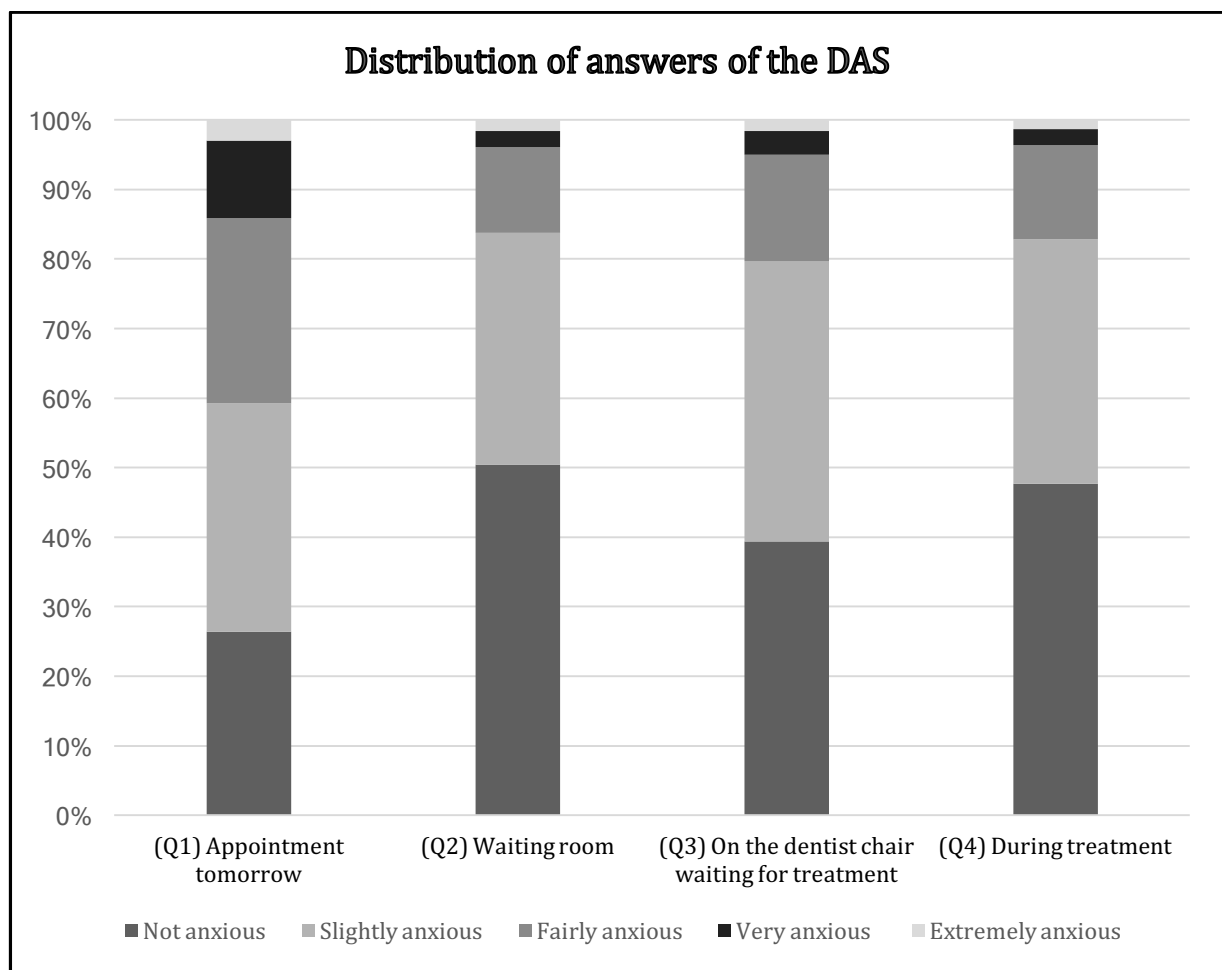


Figure 4. Distribution of answers of the four questions DAS questionnaire in percentage.

Differences between no to moderate anxiety (scores from 4 to 12 of the DAS) and high to severe anxiety (scores from 13 to 20 of the DAS) in regards to demographic

distribution, socioeconomic status, and place of residence are presented within table 1. The bivariate analysis (Pearson's chi-square) showed an association between the levels of anxiety and gender. Women presented greater prevalence in the high/severe anxiety group than men ($p < 0,001$). A statistically significant association was also observed between the two levels of anxiety with age groups ($p < 0,001$), education ($p = 0,014$) and household income ($p = 0,035$).

Table 1. Demographic distribution of the sample and levels of anxiety (DAS) in percentage with p-value for the bivariate analysis (Pearson's Chi-Square test).

	Level of anxiety (n and % of DAS score)				p-value
	N	%	no/mod. Anxiety	High/severe anxiety	
Total	1936	100	1752 (90,5%)	184 (9,5%)	
Gender					< 0,001
Male	948	49	899 (94,9%)	49 (5,1%)	
Female	988	51	853 (86,4%)	135 (13,7%)	
Marital status					0,762
Single	490	25,3	444 (90,6%)	46 (9,4%)	
Partned/married	1318	68,1	1188 (90,1%)	130 (9,9%)	
Missing system	128	6,6	-	-	
Age (years)					< 0,001
20 - 34	464	24	405 (87,3%)	59 (12,8%)	
35 - 49	608	31,4	528 (86,8%)	80 (13,2%)	
50 - 64	556	28,7	518 (93,2%)	38 (6,9%)	
65 - 80	308	15,9	301 (97,7%)	7 (2,3%)	
Education					0,014
Secondary school	283	14,6	258 (91,2%)	25 (8,8%)	
High school	854	44,1	738 (88,4%)	98 (11,7%)	
University	799	41,3	739 (92,5%)	60 (7,5%)	
Household income					0,035
20% lowest (<31.200€)	270	13,9	238 (88,1%)	32 (11,9%)	
Median low (31.300 - 62.400€)	634	32,7	578 (91,2%)	56 (8,9%)	
Median high (62.500 - 93.600€)	660	34,1	520 (88,9%)	65 (11,1%)	
25% highest (>93.700€)	372	19,2	349 (93,9%)	23 (6,2%)	
Municipality (per population)					0,107
> 50.000 (Tromsø)	868	44,8	799 (92%)	69 (8%)	
10.000 - 20.000 (Harstad, Finnsnes)	600	31	536 (89,4%)	64 (10,6%)	
< 10.000 (Målselv, Storslett, smaller municipalities)	467	24,1	416 (89,1%)	51 (10,9%)	
Missing system	1	0,1	-	-	

Logistic regression analysis was performed to identify potential predictors for dental anxiety. The analysis was performed adjusted to all independent variables using the Forced Entry Method (Enter method). The Omnibus Tests of Model Coefficients

presented a significant 'goodness of fit' ($p < 0,001$) with a Chi-square of 100,196. The Hosmer-Lemeshow Test corroborated the 'goodness of fit' of the model with an insignificant p-value ($p = 0,640$). The Cox & Snell and Nagelkerke tests results suggests that between 5,3 to 11,3% of the variability is explained by the set of variables (pseudo Rs of 0,053 and 0,113, respectively). The Odds Ratio (OR) and confidence intervals (CI) can be seen in table 3. Women were found more likely to be classified in the high/severe anxiety group than men. People from 50 to 64 and from 65 to 80 years old were less likely to suffer from high and severe anxiety when compared to the reference group age from 20 to 34 years old. People with university degree were also less likely to be in the high and severe anxiety group than people who only completed secondary school. Furthermore, people part of the 25% highest household income were also less likely to be in the high and severe anxiety group when compared with 20% lowest household income group.

Table 2. Logistic regression between the dependent variable (1=No/Moderate anxiety, 2=High/Severe anxiety) and predictors given in Odds Ratio (OR), confidence intervals (CI) and p-value (Sig.).

* Reference group

	OR	95% CI	p-value
Gender			
* Male			
Female	3,053	2,137 to 4,362	<0,001
Age (years)			
* 20 - 34			
(1) 35 - 49	1,297	0,868 to 1,939	0,205
(2) 50 - 64	0,538	0,337 to 0,858	0,009
(3) 65 - 80	0,167	0,073 to 0,384	<0,001
Education			
* Secondary school			
(1) High school	0,994	0,588 to 1,680	0,981
(2) University	0,556	0,314 to 0,983	0,044
Household income			
* 20% lowest (<31.200€)			
(1) Median low (31.300 - 62.400€)	0,808	0,494 to 1,322	0,397
(2) Median high (62.500 - 93.600€)	0,884	0,537 to 1,457	0,629
(3) 25% highest (>93.700€)	0,485	0,258 to 0,908	0,024

3.2. DA and dental treatment avoidance related questions and oral hygiene habits

The table 3 shows the bivariate analysis (Pearson's chi-square) between anxiety levels and variables concerning oral hygiene habits, satisfaction with oral health, reason and frequency of visits to oral health centers and whether it is difficult or not to visit the dentist or the dental hygienist.

Table 3. Demographic distribution of the sample and levels of anxiety (DAS) in percentage with p-value for the bivariate analysis (Pearson's Chi-Square test).

	Level of anxiety (n and % of DAS score)				p-value
	N	%	no/mod. Anxiety	High/severe anxiety	
Satisfaction with teeth					<0,001
(1) No	292	15,10 %	238 (81,5%)	54 (18,5%)	
(2) Neither/Don't know	681	35,20 %	605 (88,8%)	76 (11,2%)	
(3) Yes	959	49,60 %	905 (94,4%)	54 (5,6%)	
Self-assessment of oral health status					<0,001
(1) poor	253	13,10 %	205 (81,0%)	48 (19,0%)	
(2) Neither/nor	744	38,5%	658 (88,4%)	86 (11,6%)	
(3) Good	934	48,40 %	885 (94,8%)	49 (5,2%)	
Difficulty to go to the dentist					<0,001
(1) Yes/Don't know	335	17,50 %	240 (71,6%)	95 (28,4%)	
(2) No	1538	82,50 %	1500 (94,8%)	83 (5,2%)	
Frequency Attending Dental Health Services					<0,001
(1) Every year	1017	52,90 %	961 (94,5%)	56 (5,5%)	
(2) Every second year	257	13,40 %	239 (93,0%)	18 (7,0%)	
(3) Less often than every two years	216	11,20 %	195 (90,3%)	21 (9,7%)	
(4) Only when having problems	433	22,50 %	347 (80,1%)	86 (19,9%)	
Reason for attendind Dental Health Services					<0,001
(1) Regular check up/recall	1241	64,30 %	1171 (94,4%)	70 (5,6%)	
(2) Only when having problems/pain/lost fillings	390	20,20 %	335 (85,9%)	55 (14,1%)	
(3) Seldom/never attending	298	15,40 %	239 (80,2%)	59 (19,8%)	
Frequency of interproximal cleaning					0,016
(1) Seldom/never	127	6,90 %	108 (85,0%)	19 (15,0%)	
(2) Sometimes	991	53,70 %	889 (89,7%)	102 (10,3%)	
(3) Daily	728	39,40 %	673 (92,4%)	55 (7,6%)	
Toothbrushing frequency					0,913
(1) once a day or less often	537	28,10 %	485 (90,3%)	52 (9,7%)	
(2) Twice a day	1376	71,90 %	1245 (90,5%)	131 (9,5%)	

A significant association was found between the levels of anxiety and all tested variables, except for frequency of toothbrushing (p=0,913).

For the logistic regression model (Table 4), it was included all independent variables that presented a significant association on the chi-square test with the levels of anxiety. It was used an 'Enter method' for the analysis. The model presented a 'goodness of fit' given by the Omnibus test ($p < 0,001$) with a Chi-square value of 156,322 and an insignificant p-value observed for Hosmer and Lemeshow Test ($p = 0,860$). The pseudo Rs presented by the Cox & Snell and Nagelkerke tests suggest that the variables in the model explain between 8,3 to 18,1% of the observed variability of the model.

Table 4. Logistic regression between the dependent variable (1=No/Moderate anxiety, 2=High/Severe anxiety) and predictors given in Odds Ratio (OR), confidence intervals (CI) and p-value (Sig.).

* Reference group

	OR	95% CI	Sig.
Satisfaction with teeth			
* No			
(1) Neither/Don't know	0,732	0,449 to 1,194	0,212
(2) Yes	0,553	0,306 to 1,000	0,050
Self-assessment of oral health status			
* poor			
(1) Neither/nor	0,972	0,582 to 1,623	0,912
(2) Good	0,630	0,330 to 1,203	0,161
Difficulty to go to the dentist			
* No			
Yes/don't know	5,159	3,501 to 7,602	<0,001
Frequency Attending Dental Health Services			
* Every year			
(1) Every second year	1,048	0,567 to 1,938	0,881
(2) Less often than every two years	0,862	0,387 to 1,921	0,716
(3) Only when having problems	1,365	0,636 to 2,928	0,424
Reason for attendind Dental Health Services			
* Regular check up/recall			
(1) Only when having problems/pain/lost fillings	0,907	0,445 to 1,849	0,789
(2) Seldom/never attending	1,263	0,585 to 2,726	0,551
Frequency of interproximal cleaning			
* Seldom/never			
(1) Sometimes	0,823	0,457 to 1,483	0,517
(2) Daily	0,792	0,419 to 1,495	0,471

Difficulty to go to the dentist was the only variable that presented significance in the regression model. Individuals in the high and severe anxiety group find it 5 times

more difficult to go to the dentist than people in the no and moderate anxiety group. The variable satisfaction with teeth presented a borderline p-value of 0,050, where people in the high and severe anxiety group are less satisfied with their teeth than people in the other group.

3.3. DA and the Decayed Teeth Index (DT) and Decayed Surfaces (DS)

The mean of decayed teeth and decayed surfaces between the no/moderate anxiety group and the high/severe anxiety group was significantly different as shown on tables 5 and 6. Individuals in the high/severe anxiety group presented a greater incidence of caries when evaluated by tooth or surfaces. The OR for the DT index was 1,193 (95% CI: 1,113 – 1,279, $p < 0,001$) and to DS index was 1,187 (95% CI: 1,115 – 1,264, $p < 0,001$).

Table 5. Mean of decayed teeth (DT) per category of DA with independent t-test comparing the means.
* Equal variance was not assumed.

	N	DT mean	t-test for equality of Means*		
			Mean Difference	Sig.	95% CI
No/moderate anxiety	1749	1,04	-0,698	<0,001	-1,021 to -0,375
High/severe anxiety	182	1,74			

Table 6. Mean of decayed teeth (DS) per category of DA with independent t-test comparing the means.
* Equal variance was not assumed.

	N	DT mean	t-test for equality of Means*		
			Mean Difference	Sig.	95% CI
No/moderate anxiety	1749	0,71	-0,841	<0,001	-1,226 to -0,455
High/severe anxiety	182	1,55			

4. Discussion

4.1. The study design

A Cross-Sectional design study is suitable to determine the prevalence of cases of a disease in a specific and well defined population (37). This applies to the prevalence of Dental Phobia and different levels of anxiety in the studied sample. The design is also suitable for determining the prevalence of risk-factors and the disease status which could help on the development and improvement of oral health services, policies and planning (37, 38). It presents lower costs and are fairly quick performed studies when compared to study designs such as Cohort and Randomized Control Trials (38). However, cross-sectional designs present considerable limitations. One of them is finding a causal relationship between a risk-factor and a disease. The reason behind it according to Katz, Wild (37) is that the data to exposure to risk-factors and the presence or absence of disease is collected at the same time and a temporal relationship between the two is very difficult to define because it breaks the chronologic path of exposure first and disease after. Therefore, a causal relationship between predictors and the outcome should always be seen with cautious in cross-sectional studies. In the current study, the word “predictor” was always preceded by the word “potential”, which can be understood as the need for further and deeper investigation of the two in search for an eventual causal relationship.

4.2. Sample size, selection and potential bias

A power calculation was performed for defining the necessary size of the sample in order to be able to describe the prevalence of a disease occurring in approximately 10% of the population the sample was drawn from. The calculation assumed a 50% attendance rate based on rates found in different studies performed in Norway (range

from 29 to 64% of attendance rate) (30). The attendance of the TOHNN study was of 68,3%, more than the expected and calculated rate of 50%. The 10% rate used in the power calculation as reference to describe the prevalence of a disease in the real population was drawn from previous studies on the prevalence of advanced periodontitis, which ranges from 8 to 13%. The 10% estimation are larger than the expected prevalence of Dental Phobia in the population which has been suggested in previous studies to be around 5% in western countries, which decreases the chances for external validity of the findings (9). For a 5% prevalence, the sample should be around doubled the size of a 10% prevalence expected. The results should be, therefore, interpreted cautiously.

The selection of the sample was representative and random drawn by the Statistic Norway, presented a well-defined population including rural and urban areas and the validity given by the power calculation minimize the chances for selection bias (39). There was no significant difference on the response rate between participants in urban and rural areas (30). The respondent rate of 68,3%, surpassing the expected 50% minimizes the chances for non-response bias.

The study could, however, be sensible to volunteer bias (39). Since all participants had to go through two different procedures: a questionnaire and a clinical examination, it is possible that people with severe dental anxiety would decline to participate in order to avoid anxiety and fear which the clinical examination could evoke. Thus, participants could mostly be of individuals with lower levels of dental anxiety than would be found in the overall population.

4.3. The reliability of the DAS and other questions from the questionnaire

The Corah's Dental Anxiety Scale (DAS) has been extensively used in the literature (23). It has been considered as detent of good psychometric properties (28), internal consistency (27) and has previously been validated in Norway (29). Nonetheless, the DAS has received criticism for not enquiring on the anxiety generated by local anesthesia injection, which for some authors is a focus point of some patients and major trigger of anxiety episodes (41). In order to overcome those "limitations" a modified version of the DAS, including a fifth question on local anesthesia injection, was developed (41). Furthermore, a scale allowing the comparison of results obtained from the DAS and its modified version (MDAS) was also developed (42).

On a study with a sample drawn from the west part of Norway, the authors compared the DAS with the MDAS and a third instrument for sensitivity, specificity, positive and negative predictive values. The authors concluded that the three instruments presented similar performance and were reliable to be used in a population level for Dental Anxiety estimation (43).

The other questions in the questionnaire that were used in the analysis could be seen as sensible to recall bias as many self-reported health questionnaires due to its "retrospective" and subjective nature (44). Yet, most of the questions used in the present analysis were of related to activities performed in a daily basis such as frequency of toothbrushing, or were based on actual feelings and opinions that do not present a retrospective nature on its formulation e.g. difficulty to go to the dentist, reasons for going to the dentist and opinion on own oral health status. Further, the questionnaire was tested in prior on personal without scientific or dental background for its comprehensiveness (30).

4.4. Statistical Analysis

The bivariate analysis was performed through the Pearson's Chi-Square test between the levels of DA and the other variables in accordance to similar studies found on the literature (12, 18) and due to the categorical nature of the variables. When no association was found for the Chi-Square, the corresponding tested variable was not included in the logistic regression model in order to avoid influences on the odds ratio values of the associated ones. Another reason for not including them was due to the possibility of the independent variables which were not associated to the dependent, be strongly correlated with other independent variables, what could jeopardize the multicollinearity assumption of the regression.

Missing values were not replaced by the mean value and were removed cases list-wise (by default on SPSS) in the logistic regression analysis. The decision was due to the low proportion of missing values in the variables on the study (ranged from 0,1 to 6,6%), while most of the variables presented values for missing data lower than 5%. According to Dong (45) citing Schafer (1999), values equal or lower than 5% of missing data are inconsequential and bias due to missing values should only be expected in studies with considerable sample size for values of missing data exceeding 10%.

4.5. Results

Other Scandinavian countries have found similar prevalence of severe dental anxiety when compared to the 4,3% found for the current study. Severe dental anxiety was found in 4,7% of the sample in Sweden (10), 4,2% in Denmark (46) and 6% in Finland (47). However, differences in methodology, instruments applied to determine the prevalence of DA, the set of different cut-off scores and sample size may produce

variability in the prevalence, making it difficult to compare results between studies (10).

A more accurate comparison of the results could be made between the current study and another study performed in Norway and published in 2003 (9). Both studies used the DAS as instrument to evaluate the prevalence of DA and same cut-off scores. In the current study, high and severe anxiety was found in 9,5% of the sample (scores \geq 13), which was a greater prevalence than the 6,6% found on a study with Norwegian adults using data from the Trøndelag-94 study (9). While women presented a greater prevalence of high and severe DA than men in both studies (13,7% for current study; 10,3% for the study using data from the Trøndelag-94), the estimated prevalence of high and severe DA varied from 2,3 to 13,2% according to age groups in the current study, while it varied from 4 to 9% on the study with data from the Trøndelag-94 (9).

A statistical difference between gender was found in the current study. Women were around 3 times more likely to report high and severe anxiety than men (OR = 3,053 and $p < 0,001$). Higher prevalence of DA among women was also found in other studies (2, 9, 12, 48, 49), and it is consistent to a great number of articles which suggest that women are more likely than men to be diagnosed with anxiety and phobia related problems (12). Chanpong et al. (48) suggests that women are more likely to report anxiety and men are more likely to underreport it due to the “social weakness” linked to assuming a fear or anxiety in society.

Variables of education and household income were used to estimate differences in socioeconomic status. The results found in the current study of high education along with being part of the group with the largest income as presenting a protective factor towards high and severe DA contradict to a previous study performed in Norway and

published in 1993 which found no virtual differences between education and income and DA levels (50). However, on a study evaluation DA and time trends between 1997 and 2007, Åstrøm et al. (12) found that highly educated people were less likely to report DA in 2007, differing from 1997. The authors suggested a change in prevalence of DA through the years, which could justify the different results between early studies and the current study.

No difference was found in the regression between oral hygiene habits and the levels of dental anxiety, corroborating the findings of another study in Norway (9). Individuals in the high and severe DA group were less satisfied with their teeth and found it more difficult to visit the dentist than the no and moderate anxiety group. However, when evaluation the frequency and the reason of dental health system usage, no statistical difference was observed in the regression model of the current study. Those variables were selected to assess an eventual avoidance behavior in the high and severe DA group. Therefore, no difference in attendance was observed using the selected variables and an avoidance behavior could not be observed. That is in contradiction to other findings in the literature (9, 12, 50), which in different degrees suggest high and severe DA as an underlying cause for the avoidance of dental appointments. The differences in results could be due to differences in samples and methodologies between studies. In addition, one important point of the avoidance behavior, which is related to “missing of appointments”, could not be assessed in the current study. Nonetheless, the association between difficulty to go to the dentist and DA levels imply the need for further investigation in avoidance behavior associated with DA in Northern Norway.

Oral status was assessed through the Decayed Surface (DS) and Decayed Teeth (DT) indexes. The results for DT and DS (differences in mean, $p < 0,001$) in the

current study suggest that individuals in the high and severe DA group presented more caries than the no and moderate DA group, which corroborates the findings of previous studies (9, 18, 49). According to Armfield et al. (18), the greater prevalence of DT and DS in the high and severe DA group shows that there are negative clinical consequences of DA. People who are highly and severely anxious to go to the dentist do not only have to deal with the fear and the negative emotional consequences related to it, but they are also more likely to have oral problems, which implies the need of dental professionals to recognize and identify this vulnerable group and to effectively tackle the situation in order to reduce the caries experience.

5. Conclusions

Dental anxiety was more prevalent among women than men, individuals with lower education and with lower household income. The prevalence of caries was greater among participants reporting severe DA showing the negative consequences of DA in oral health. Despite that an “avoidance behavior” could not be found, individuals with high and severe DA were less satisfied with their teeth and found it harder to visit the dental health system. Therefore, identifying DA in a clinical level is recommended in order to develop an individual plan of treatment according to the anxiety level and to reduce the inequalities in oral health resulted from differences in DA levels.

References

1. Kvale G, Berggren U, Milgrom P. Dental fear in adults: a meta-analysis of behavioral interventions. *Community dentistry and oral epidemiology*. 2004;32(4):250-64.
2. Guentsch A, Stier C, Raschke GF, Peisker A, Fahmy MD, Kuepper H, et al. Oral health and dental anxiety in a German practice-based sample. *Clinical Oral Investigations*. 2016:1-6.
3. Vermaire J, Houtem C, Ross J, Schuller A. The burden of disease of dental anxiety: generic and disease-specific quality of life in patients with and without extreme levels of dental anxiety. *European Journal of Oral Sciences*. 2016;124(5):454-8.
4. American Psychiatric A, American Psychiatric A, Force DSMT. *Diagnostic and statistical manual of mental disorders : DSM-5*. 2013.
5. Beaton L, Freeman R, Humphris G. Why are people afraid of the dentist? Observations and explanations. *Medical Principles and Practice*. 2013;23(4):295-301.
6. Coriat IH. Dental anxiety: fear of going to the dentist. *The Psychoanalytic Review (1913-1957)*. 1946;33:365.
7. Lauth H. Dental phobia. *The British Journal of Psychiatry*. 1971;119(549):151-8.
8. Abrahamsson KH. *Dental Fear and Oral Health Behavior: Studies on psychological and psychosocial factors: The Sahlgrenska Academy at Göteborg University*; 2003.
9. Schuller AA, Willumsen T, Holst D. Are there differences in oral health and oral health behavior between individuals with high and low dental fear? *Community Dentistry and Oral Epidemiology*. 2003;31(2):116-21.
10. Svensson L, Hakeberg M, Boman UW. Dental anxiety, concomitant factors and change in prevalence over 50 years. *Community Dent Health*. 2016;33(2):121-6.
11. Kirova DG, Atanasov DT, Lalabonova CK, Janevska S. Dental anxiety in adults in Bulgaria. *Folia medica*. 2010;52(2):49-56.
12. Åstrøm AN, Skaret E, Haugejorden O. Dental anxiety and dental attendance among 25-year-olds in Norway: time trends from 1997 to 2007. *BMC Oral Health*. 2011;11(1):1.
13. Locker D, Liddell A, Dempster L, Shapiro D. Age of onset of dental anxiety. *Journal of dental research*. 1999;78(3):790-6.
14. Ray J, Boman UW, Bodin L, Berggren U, Lichtenstein P, Broberg AG. Heritability of dental fear. *Journal of dental research*. 2010;89(3):297-301.
15. Ek U, Fernell E, Holmberg K, Westerlund J, Dahllöf G. Cognitive ability and dental fear and anxiety. *European journal of oral sciences*. 2013;121(2):117-20.
16. Berggren U. *Dental fear and avoidance: a study of etiology, consequences and treatment*1984.
17. Berggren U, Meynert G. Dental fear and avoidance: causes, symptoms, and consequences. *Journal of the American Dental Association (1939)*. 1984;109(2):247-51.
18. Armfield JM, Stewart JF, Spencer AJ. The vicious cycle of dental fear: exploring the interplay between oral health, service utilization and dental fear. *BMC oral health*. 2007;7(1):1.
19. De Jongh A, Schutjes M, Aartman IH. A test of Berggren's model of dental fear and anxiety. *European journal of oral sciences*. 2011;119(5):361-5.
20. Sohn W, Ismail AI. Regular dental visits and dental anxiety in an adult dentate population. *The Journal of the American Dental Association*. 2005;136(1):58-66.
21. Henning Abrahamsson K, Berggren U, Hakeberg M, Carlsson SG. Phobic avoidance and regular dental care in fearful dental patients: a comparative study. *Acta Odontologica Scandinavica*. 2001;59(5):273-9.
22. Appukuttan DP. Strategies to manage patients with dental anxiety and dental phobia: literature review. *Clinical, cosmetic and investigational dentistry*. 2016;8:35-50.
23. Newton JT, Buck DJ. Anxiety and pain measures in dentistry: a guide to their quality and application. *The Journal of the American Dental Association*. 2000;131(10):1449-57.
24. Corah NL. Development of a dental anxiety scale. *Journal of dental research*. 1969;48(4):596-.
25. Corah NL, Gale EN, Illig SJ. Assessment of a dental anxiety scale. *Journal of the American Dental Association (1939)*. 1978;97(5):816-9.
26. Moore R, Birn H, Kirkegaard E, Brodsgaard I, Scheutz F. Prevalence and characteristics of dental anxiety in Danish adults. *Community Dent Oral Epidemiol*. 1993;21(5):292-6.
27. Campos JADB, Presoto CD, Martins CS, dos Santos Domingos PA, Maroco J. Dental anxiety: prevalence and evaluation of psychometric properties of a scale. *Psychology, Community & Health*. 2013;2(1):19-27.

28. Coolidge T, Hillstead MB, Farjo N, Weinstein P, Coldwell SE. Additional psychometric data for the Spanish Modified Dental Anxiety Scale, and psychometric data for a Spanish version of the Revised Dental Beliefs Survey. *BMC oral health*. 2010;10(1):12.
29. Kvale G, Berg E, Raadal M. The ability of Corah's Dental Anxiety Scale and Spielberger's State Anxiety Inventory to distinguish between fearful and regular Norwegian dental patients. *Acta Odontologica Scandinavica*. 1998;56(2):105-9.
30. Holde GE, Oscarson N, Tillberg A, Marstrander P, Jönsson B. Methods and background characteristics of the TOHNN study: a population-based study of oral health conditions in northern Norway. *International journal of circumpolar health*. 2016;75.
31. Wisløff T, Vassend O, Asmyhr O. Dental anxiety, utilisation of dental services, and DMFS status in Norwegian military recruits. *Community Dental Health*. 1995;12(2):100-3.
32. Krokstad S, Langhammer A, Hveem K, Holmen T, Midthjell K, Stene T, et al. Cohort profile: the HUNT study, Norway. *International journal of epidemiology*. 2013;42(4):968-77.
33. Humphris G, King K. The prevalence of dental anxiety across previous distressing experiences. *Journal of Anxiety Disorders*. 2011;25(2):232-6.
34. Kvale G, Berg E, Nilsen CM, Raadal M, Nielsen GH, Johnsen TB, et al. Validation of the dental fear scale and the dental belief survey in a Norwegian sample. *Community dentistry and oral epidemiology*. 1997;25(2):160-4.
35. Organization WH. Oral health surveys: basic methods: World Health Organization; 2013.
36. Pallant J. SPSS survival manual: McGraw-Hill Education (UK); 2013.
37. Katz DL, Wild D, Elmore JG, Lucan SC. *Jekel's Epidemiology, Biostatistics and Preventive Medicine*: Elsevier Health Sciences; 2013.
38. Bhopal RS. *Concepts of epidemiology: integrating the ideas, theories, principles, and methods of epidemiology*: Oxford University Press; 2016.
39. Sedgwick P. Bias in observational study designs: cross sectional studies. *BMJ: British Medical Journal (Online)*. 2015;350.
40. Henriksen BM. Oral health among the elderly in Norway. A descriptive epidemiological study. *Swedish dental journal Supplement*. 2002(162):1-56.
41. Humphris GM, Dyer TA, Robinson PG. The modified dental anxiety scale: UK general public population norms in 2008 with further psychometrics and effects of age. *BMC oral health*. 2009;9(1):20.
42. Freeman R, Clarke H, Humphris G. Conversion tables for the Corah and Modified Dental Anxiety Scales. *Community dental health*. 2007;24(1):49-54.
43. Haugejorden O, Solveig Klock K. Avoidance of dental visits: the predictive validity of three dental anxiety scales. *Acta Odontologica Scandinavica*. 2000;58(6):255-9.
44. BIAS WIR. Recall bias: a proposal for assessment and control. 1987.
45. Dong Y, Peng C-YJ. *Principled missing data methods for researchers*. SpringerPlus. 2013;2(1):222.
46. Moore R, Birn H, Kirkegaard E, Brødsgaard I, Scheutz F. Prevalence and characteristics of dental anxiety in Danish adults. *Community dentistry and oral epidemiology*. 1993;21(5):292-6.
47. Liinavuori A, Tolvanen M, Pohjola V, Lahti S. Changes in dental fear among Finnish adults: a national survey. *Community dentistry and oral epidemiology*. 2015.
48. Chanpong B, Haas DA, Locker D. Need and demand for sedation or general anesthesia in dentistry: a national survey of the Canadian population. *Anesthesia progress*. 2005;52(1):3-11.
49. Dobros K, Hajto-Bryk J, Wnek A, Zarzecka J, Rzepka D. The level of dental anxiety and dental status in adult patients. *Journal of International Oral Health*. 2014;6(3):11.
50. Vassend O. Anxiety, pain and discomfort associated with dental treatment. *Behaviour Research and Therapy*. 1993;31(7):659-66.

Appendix 1

Corah's Dental Anxiety Scale (DAS) questionnaire used in the study (in Norwegian).

37. Dersom du visste at du skulle til tannlegen i morgen, hva ville du føle? (Angi kun **ett** alternativ)

- Jeg ville se frem til det som en ganske hyggelig opplevelse
- Det ville være det samme for meg, ikke bety noe
- Det ville gjøre meg litt urolig
- Jeg ville bli redd for at det skulle bli ubehagelig og vondt
- Jeg ville bli svært redd med tanke på hva tannlegen kanskje skulle gjøre

Når du venter på tannlegens venteværelse, eller venter på å bli hentet til tannlegen, hvordan føler du deg da? (Angi kun **ett** alternativ)

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

Når du sitter i tannlegestolen og venter på at tannlegen skal begynne behandlingen, hvordan føler du deg da? (Angi kun **ett** alternativ)

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

Tenk deg at du sitter i tannlegestolen og skal få tennene rensset og pusset. Mens du sitter og venter på at tannlegen skal finne instrumentene som brukes til å skrape og pusse med, hvordan føler du deg da? (Angi kun **ett** alternativ)

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

Appendix 2

Questions used to determine eventual avoidance behavior (in Norwegian).

12. Hvordan bruker du tannhelsetjenesten?

- Blir regelmessig innkalt av tannlege eller tannpleier
- Melder meg regelmessig for undersøkelse
- Melder meg når jeg har vondt eller har mistet en fylling
- Bruker ikke å gå til tannlege så ofte

17. Går du regelmessig til tannlege/tannpleie?

- Ja, mer enn en gang i året
- Ja, hvert år
- Ja, hvert annet år
- Ja, med lengre mellomrom enn 2 år
- Nei, bare for akutte problemer

18. Hvis du ikke går regelmessig, hva er den viktigste grunnen til dette? (Angi kun ett alternativ)?

- Har ikke hatt behov for tannbehandling
- Det er lang ventetid hos tannlegen
- Jeg har ikke blitt innkalt
- Avstanden til tannklinikken
- Mangler tannleger/tannpleier
- Økonomiske grunner
- Er ikke interessert
- Jeg er redd eller engstelig for å gå til tannlege/tannpleier
- Anser at det er ikke nødvendig
- Det er ubehagelig
- Annet.....