UiT

THE ARCTIC UNIVERSITY OF NORWAY

Faculty of Health Sciences

Self-reported oral health

A cross sectional study in the municipalities with mixed Sami and Norwegian population in Northern and Mid-Norway

Student: **Anna Teterina**

Supervisor: **professor, Tordis A Trovik**

Master's thesis in public health, May 2018. Tromsø

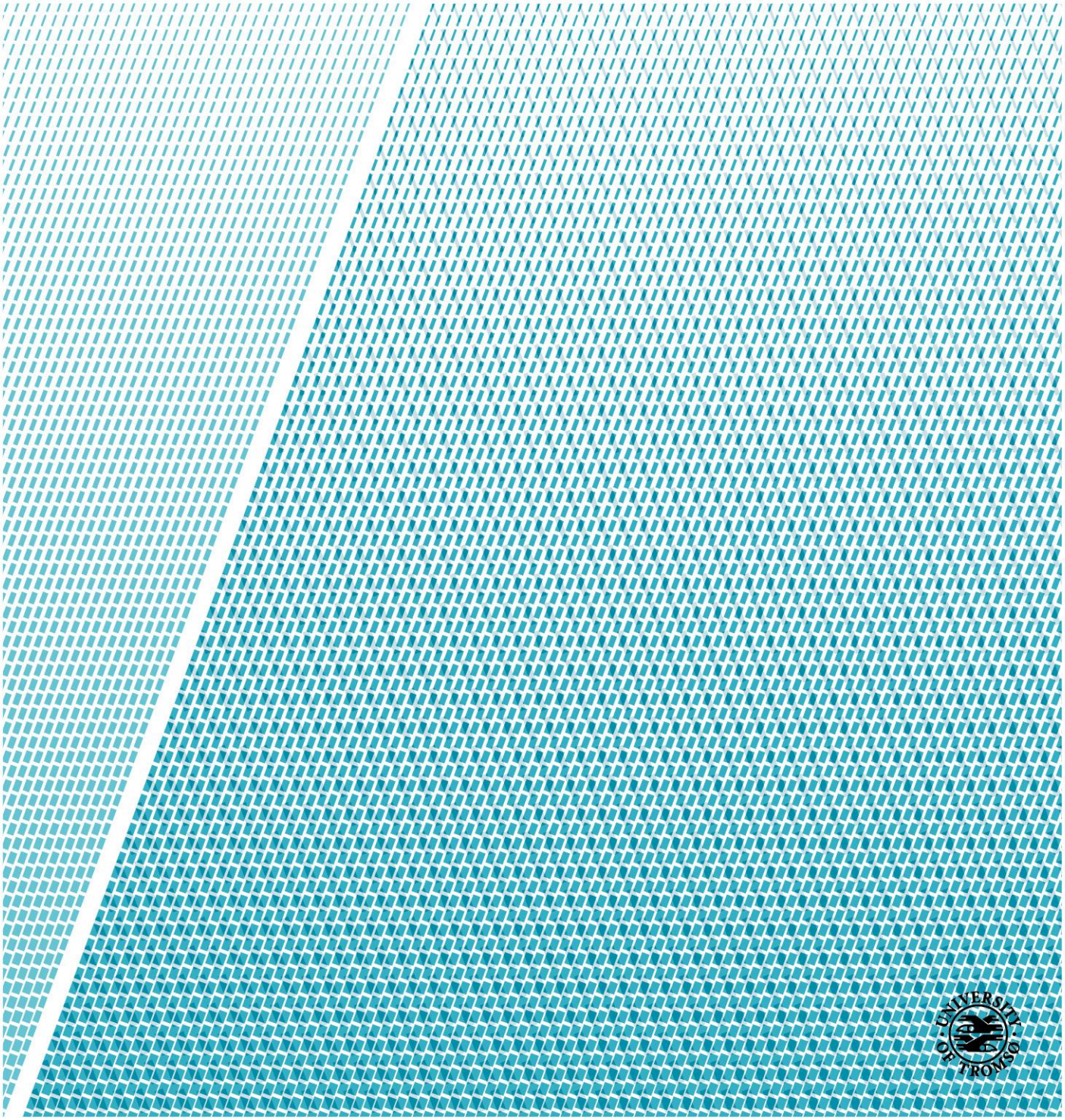


Table of contents:

List of abbreviations:

SROH – self-reported oral health = self-rated oral health = self-perceived oral health

CBS – Central Bureau of Statistics. Norway

CVD – cardio-vascular diseases

DMFT – decayed, missing, filled teeth

DMFS – decayed, missing, filled surfaces

SES – socio-economic status

Acknowledgements:

The SAMINOR 2 questionnaire study has been financed by the Norwegian Ministry of Health and Care Services, the Northern Norway Regional Health Authority, the Regional Research Fund for Northern Norway, the Sami National Centre for Mental Health, The Finnmark Hospital Trust, The Sami Parliament, Finnmark County Council, Troms County Council, and Nordland County Council.

This thesis was performed at the Arctic University of Norway (UiT), the Department of Community Medicine. I want to thank the teachers of the MPH program for sharing their knowledge and inspiration for research. I am especially thankful to my supervisor, professor Tordis A Trovik for the immense help, quick feedback and valuable comments.

I would also like to thank my groupmates for the friendly atmosphere and for having fun with them during our master program. I appreciated that a lot.

I am also thankful to Carolyn Foley, a very kind woman who helped me with language editing.

Thanks a lot to my family for the endless support in everyday life.

Abstract

Background: Detailed data on oral health in the adult population in Northern Norway has been lacking. A number of national studies have reported a north-south gradient in oral health in Norway. Various governmental reports stated that oral health was poorer in Northern Norway, specifically in the municipalities where the proportion of the Sami-population is large. However, no scientific proof of that currently exists. Moreover, no study of self-reported oral health and its determinants has been performed in Northern and Mid-Norway.

Aim: This study sought to investigate different aspects of self-reported oral health in the municipalities in Northern- and Mid-Norway with mixed indigenous and non-indigenous populations and assess behavioural determinants of self-reported oral health.

Materials and Methods: The questionnaire data from the SAMINOR 2 (2012) was used. The study population consisted of 11,325 subjects aged 18-69 years-old living in 25 municipalities in Northern and Mid-Norway. Response rate in the SAMINOR study was 27%. The study sample was described according to demographic and behavioural characteristics, area of residence and prevalence of good SROH. Logistic regression analysis was performed to assess the determinants of poor SROH.

Results: Seventy-three-point five percent of study participants reported good oral health. Daily smokers had a 2.63 times higher odds of reporting poor oral health ($p<0.001$). The participants that brushed their teeth seldom at the age of 10 were 2.59 times more likely to report poor oral health ($p<0.001$). The participants residing in the Sami-majority area had a 36.4% higher risk of reporting poor oral health ($p=0.002$).

Conclusion: The prevalence of good SROH in the study sample was few percent less than the country average. Daily smoking and seldom tooth brushing at the age of 10 were the strongest

predictors of poor SROH. Area of residence was a significant predictor of SROH due to possible structural and geographical differences, and other unique characteristics.

1 Introduction

Oral health in the adult population in Norway has been substantially improved over the past decades (1). Presently, there are fewer edentulous people compared to 30 years ago (2). The proportion of caries free children aged 5 and 12 has significantly increased (3, 4). Norwegian health authorities prioritize equal access to health care services for all inhabitants of Norway (5). Provision of free dental services for children, adolescents and adults with special needs is one of the governmental strategies aiming at the reduction of inequalities in oral health (6). In recent years, social inequalities in oral health have been reduced in absolute numbers and the difference in oral health between the highest income group and the lowest group has decreased (2). However, the disparities in oral health still apparently exist across socio-economic groups and geographical regions of the country (1, 7-9).

1.1 Oral health in Northern and Mid-Norway and Circumpolar areas of other countries

A number of studies suggest that general health is worse in circumpolar areas compared to more southern areas (10-12). However, there is little information about the north-south gradient in oral health. A study on oral health and dental services in the Barents region concluded that people living in this area experienced difficult access to dental services. This was due to lack of dental care personnel and economic constraints compared to those living in more central regions of respective countries (13). The report on oral health in the Inuit people living predominantly in northern Canada showed that they had poorer self-reported oral health, more frequent food avoidance and more frequent oral pain than the southern Canadians (14).

The data on oral health in the adult population in Northern Norway has been lacking. Epidemiological studies on oral health in adults are primarily available from the Trøndelag and Oslo studies (3). Other studies on oral health target a particular population in Norway. For instance, Henriksen et al. analysed the oral health status in elderly people living in the different regions of Norway in 1996-1999. For this age group, they found a clear north-south gradient in oral health. Moreover, the improvement in oral health over the past 25 years was greater in Eastern and Southern Norway compared to Northern Norway (9). The report of the Central Bureau of Statistics (CBS) 2010 revealed the same gradient. People living in Northern Norway reported poorer oral health, fewer planned dental visits and less satisfaction with access to acute dental services than those living in Southern Norway. In Mid-Norway, those living in Trøndelag had worse oral health compared to those living in Southern and Western parts of the country (15).

Historically, there were fewer dentists in Northern-Norway compared to the rest of the country. Educational capacity in Norway was low and dental specialists were mostly recruited from abroad (Scandinavian countries and Germany) (16). Another problem was a high turnover (up to 29%) of dental specialists in 1991-1997. In 1998, one out of four dental clinics in Northern Norway did not have a dentist. One of the reasons was outmigration of dental specialists from the northern counties(16). In 2008, Northern Norway reported the highest number of vacant dentist full-time equivalents in the public dental health service: 31.8, 26.9 and 21.2 percent, in Nordland, Troms and Finnmark, respectively. By 2011, the proportion of vacancies had decreased to 16.9, 14.8, 14.1 percent for the corresponding counties which was still higher than the country average of 6.4 percent (17).

According to the local newspaper, after establishment of dental education in Tromsø, the employment of dentists in Northern Norway increased (18). In 2016, Troms county had the lowest number of inhabitants, 852 per dentist compared to the country's average number of 1,176 (19). It is

difficult to assess the effect of the increased number of dental specialists on oral health in Northern Norway since epidemiological data is limited. The municipality-state reporting system (KOSTRA) is the main source of overall data on oral health in children and adolescents (3). The recent data from KOSTRA showed a substantial improvement of oral health in children aged 5, 12 and 18 years-old living in Northern Norway (20). Although Finnmark county lagged behind the country average, there was a positive parallel trend with the overall positive changes in oral health in Norway (20).

1.2 Oral health in the Sami population in Northern Norway

A report from the Norwegian government (2007) stated that the worst oral health status in both youths and adults coincided with the areas of Northern Norway where the proportion of Sami people was large (21). However, this statement was based on the report by the head of county dental services in Finnmark (21). Clear scientific proof for the statement is absent since no data from population based studies on oral health in Sami people has yet been published (22).

Sami are the indigenous people living in Northern Norway, Sweden, Finland and the Kola Peninsula in the Russian Federation. The majority of the Sami population reside in Northern Norway in co-habitation with Norwegians (23). The Sami people have undergone the policy of "norwegianization" from 1850 to 1980 which aimed to assimilate them into a uniform Norwegian culture (24). As a consequence of the assimilation, many Sami individuals experienced discrimination and stigmatization (25). The Sami lost their original culture and language unequally in different regions of Norway (26). Now, only a small proportion of the Sami-population is engaged in traditional Sami-industries (23). The harsh historical background created ethical challenges in using the ethnicity information in research (27). The total number of persons with

Sami affiliations in Norway is unknown since the National Register does not provide any personal information on ethnicity (28). Sami have their own native language. Ten municipalities in Norway have been included in the Administrative Area for the Sami-language law (29). Nevertheless, only five municipalities (Kautokeino, Karasjok, Nesseby, Tana and Porsanger) have over 50% of Sami-inhabitants according to the SAMINOR 1 data (23). They also have communities that are long-term proponents of the Sami-language, culture and traditional industries (23, 30).

Although official documents claimed that Sami people hesitated to seek health care (31, 32), research has not verified any difference in utilisation of health care services among the Sami compared to the Norwegian population (33). However, Sami-people may have some challenges related to a different native language and culture when seeking health care (34, 35). A recent study revealed that Sami people were less satisfied with health care services, namely, Sami-language skills of health care workers (34). The Norwegian Ministry of Health and Care Services declared lack of epidemiological data on oral health and dental care needs among the Sami population (15). The SAMINOR-2 study obtained the data on self-reported oral health (SROH) in adults living in the municipalities with mixed Sami and Norwegian populations in Northern and Mid-Norway (36).

1.3 Self-reported oral health (SROH)

Self-reported oral health is widely used in research. This measurement is based on the Likert-type 5-point scale and identified by the question: “How would you rate your oral health?” The answers are: excellent, very good, good, fair, poor (37). The measurement is also known as Locker’s global (single-item) oral health self-rating (38). SROH is considered to be a mediator between objective oral health status and quality of life. Therefore, it is consistent with the broad concept of health defined by the WHO (39). Oral health self-rating is based on self-perception rather than mere absence or presence of a disease. For instance, edentulous people may report good

oral health (40). Since SROH reflects perceived needs for dental care, it is particularly useful when planning supply for dental care services. Self-reported data collection is quicker and cheaper than collection of objective data from clinical examination (41). SROH in the adult population in Norway has been assessed in the annual surveys on Health and Living Conditions and data has been published by CBS (15, 42). Several population-based surveys in Norway have data on dental health and particularly SROH: TOHNN (Tromstannen – Oral Health in Northern Norway) (43), Fit Futures 2 (lifestyle and health survey in adolescents in Northern Norway) (44), SAMINOR-2 (study of health and living condition in mixed Sami- and Norwegian population) (36) and the project "Dental health in the North" (45).

1.4 Risk factors for poor oral health.

Oral and general diseases share common risk factors (46). Behavioural factors such as tobacco use, poor hygiene habits and excessive alcohol consumption influence oral health (46, 47). At the same time they are tightly related to the socio-economic factors: income and education (48). Poor lifestyle affects not only clinical symptoms of oral diseases but also oral health related quality of life and consequently SROH (49).

Epidemiological studies suggest a considerable influence of smoking on oral health. Smoking is a risk factor for oral cancer, caries and periodontal disease (49-52). Smoking may also affect quality of life via impaired oral health (53). Severe jaw bone loss, greater depth of periodontal pockets, fewer remaining teeth and poor outcomes of periodontal treatment were significantly associated with daily smoking (54-56). Research found that smokers had higher caries experience than non-smokers (55, 57).

There is little epidemiological research on snuff use (58). Various types of snuff exist

in different countries. For instance, the Swedish snuff (snus) contains a small amount of fermentable carbohydrates and a low level of tobacco-specific nitrosamines (59). The effect of Swedish snuff on oral health is unclear. The majority of studies were focused primarily on the association of Swedish snuff and oral cancer (59).

Most of the studies exploring an association between alcohol consumption and oral health have a cross-sectional study-design. The findings are inconsistent. One study found that alcohol consumption is not associated with poor periodontal health and caries experience in young Finnish adults (60). A study from Denmark found a negative association between alcohol use and the number of missing teeth in middle-aged Danish people (61). Another study found no relationship between alcohol consumption and periodontal outcomes, whereas the association with dental caries was significant (62). A study of life quality reported no impact of alcohol consumption on oral-health related quality of life (63).

Poor oral hygiene has been considered a risk factor for dental caries for a long time. A systematic review investigating the association between frequency of tooth brushing and periodontitis revealed a clear effect of infrequent tooth brushing on severe forms of periodontal disease (64). Another systematic review found an increased incidence of dental caries in those who brushed their teeth less than at least once per day. The increase in incidence was more substantial for deciduous teeth than for permanent teeth. However, it is unclear whether tooth brushing itself affects dental caries occurrence or whether Fluoride as an ingredient in tooth paste has an effect (65).

1.5 Aims:

The primary objective of this thesis is to investigate different aspects of self-reported oral health in the municipalities in Northern and Mid-Norway with mixed indigenous and non-indigenous populations. Another aim is to analyse demographic and behavioural factors associated with self-reported oral health.

Specific objectives:

- To describe prevalence of poor self-reported oral health in the study sample;
- To compare self-reported oral health in the municipalities with high (more than 50%) proportions of Sami population (Sami-majority area) and in the other municipalities in the SAMINOR-2 study;
- To describe smoking, snuffing and alcohol use habits according to demographic characteristics of the study sample;
- To describe dental hygiene habits and attitudes towards oral health and dental hygiene;
- To assess the determinants of self-reported oral health.

2 Materials and Methods

The SAMINOR 2 study is a population-based study on health and living conditions in areas with mixed Sami and Norwegian settlements (36). The first study of Sami and non-Sami population in Norway was conducted in 2003-2004 (SAMINOR-1) (23). Data collection in the SAMINOR 2 study was conducted in 2012 and included two steps: questionnaire-based study and clinical study including a questionnaire (36). This thesis used only the questionnaire-based data from the SAMINOR-2. No information on ethnicity and its distribution was available for the present thesis.

2.1 Target population

Both studies, SAMINOR and SAMINOR 2, were aimed to cover populations of all municipalities in Norway that had more than 5% of their inhabitants reporting at least one Sami-speaking grandparent in the 1970 Census (23, 66). The present thesis used data from the invited population residing in 25 selected municipalities in Mid- and Northern Norway: Trøndelag, Nordland, Troms and Finnmark counties (Fig. 1). In some cases, only selected districts were included, based on the density and distribution of the reported Sami background (36). The following municipalities were included: Sør-Varanger, Nesseby, Tana, Lebesby, Karasjok, Porsanger, Kvalsund, Loppa, Alta, Kautokeino, Kvænagen, Kåfjord, Storfjord, Lyngen, Lavangen, Skånland, Evenes, Narvik (Vassdalen), Tysfjord, Hattfjelldal (Hattfjelldal), Grane (Majavatn), Namskogen (Trones and Furuly), Røyrvik, Snåsa (Vinje) and Røros (Brekken) (36). All inhabitants aged 18-69, registered in the Norwegian National Population Register by 1 December 2011 and selected from the mentioned above areas were eligible for SAMINOR-2 study (36).

2.2 Study sample

Altogether, 43,245 people had received the invitation letter by post. Among those, 1,424 letters were returned due to technical reasons: either the recipient's address was wrong or the recipient had been moved (36). In total, 11,600 people gave an informed consent to participate in the study. Then, the questionnaires were sent out. Fifty percent of the respondents sent the questionnaires back within 2 weeks. The reminders for non-respondents were sent twice: after three weeks and after four months. Average response rate was 27%. It varied from 19.6% to 35.1% across the municipalities (36). In this thesis, 275 subjects were excluded from the statistical analysis due to missing values on self-reported oral health and municipality (figure 2) and 11,325 persons participated in the present study.

2.3 Data collection

Participants could either fill out a paper-questionnaire and return it by post or use a web-based questionnaire and submit it online. The web version of the questionnaire (in Norwegian only) was chosen by 16% of the participants (36). The questionnaires with instructions were written in Norwegian and translated in three relevant Sami-languages (Northern, Lule and Southern). Both types of questionnaires were identical and they were assigned with a unique ID code (36). The questionnaire is available from the SAMINOR study web page (67).

2.4 Self-reported oral health

Participants were asked: How would you rate your oral health? The following alternatives were given: poor; not so good; good; very good.

2.5 Demographic characteristics

Information on gender, year of birth, and municipality of residence was obtained from the National registry. Only five of the SAMINOR municipalities (Kautokeino, Karasjok, Nesseby, Tana and Porsanger) had a definitive Sami majority, as described by Aubert in 1978, and by Lund et al. in 2007*(23, 66)*. The above-mentioned municipalities were situated in Finnmark county in Northern Norway. Seventy-one percent of the respondents in these five municipalities (range 91.2% in Kautokeino - 51.9% in Porsanger) reported at least one Sami identity mark, and had thus been defined as the Sami core area or the Sami majority area (23). The identity marks included i) self-reported Sami family background, and/or ii) Sami as their domestic language in three generations and/or iii) self-perceived Sami ethnicity (23).

Participants reported gross family income per year choosing one of the following income categories: less than 150 000 NOK; 151 000 – 300 000 NOK; 301 000 – 450 000 NOK; 451 000 – 600 000 NOK; 601 000 – 750 000 NOK; 751 000 – 900 000 NOK; more than 900 000 NOK. Educational level was defined by the following question: "How many years of education have you completed?". Participants responded with a number.

2.6 Behavioural characteristics

Smoking status of the participants was defined by the following question: "Do you smoke or have you previously smoked?" The alternative answers were: yes, daily; yes, previously; yes, sometimes; no, never. Information about number of cigarettes per day and the age when a participant started to smoke was obtained. Participants also answered the following question about Swedish snuff (snus) use: "Do you use, or have you previously used Swedish snuff?". The possible answers were: yes, daily; yes, previously; yes, sometimes; no, never. Participants reported the number of snuff portions per day and the age when they started to use it.

The question regarding alcohol consumption was as follows: “How often during the last year have you consumed alcohol?” The answers were: never consumed alcohol; not during the last year; few times during the last year, 1 time per month, 2-3 times per month, 1 times per week, 2-3 times per week, 4-7 times per week.

Dental hygiene habits of the participants were defined by the question: “How often did you brush your teeth as a ten-year-old?” and “How often did your parents check that you had brushed your teeth, when you were 10 years old? The answers were: once a day or more; Sometimes; Seldom or never.

Attitude towards dental hygiene was defined by the following questions: “If you have children under the age of 6 years, how often do you help them to brush their teeth, or check that they have brushed their teeth?” (this variable was coded as “check 6”); “If you have children at the age of 6-12 years, how often do you help them to brush their teeth, or check that they have brushed their teeth?” (this variable was coded as “check 6-12”); “If you have children at the age of 0-12 years, have you had rules for eating chocolate and candy?” (this variable was coded as “candy”). Answers for the first two questions (“check6” and “check 6-12”) were: Often, almost every day; Sometimes; Seldom or never. The answer for the question regarding rules for eating sweets (“candy”) was either “yes” or “no”.

2.7 Ethical perspectives and permissions

All participants of SAMINOR-2 study had signed an informed consent. The data collection and storage was approved by the Norwegian Data Protection Authority (Datatilsynet) (36). Ethical approval for the current project was received from the Regional Committee of Medical and Health Research Ethics (REK) (2015/595-11, and updated August 25th, 2017). The study was registered in

EUTRO-nr: 8030.00108, and Ephorte-nr: 2015/2927-2. The SAMINOR board gave permission to use SAMINOR-2 data on October 10th, 2017.

2.8 Statistical analysis

Statistical Package for the Social Sciences was used (SPSS, Version 24.0, IBM, Somers, New York, NY). The variables had less than 5% of missing values. Missing values on SROH and municipality were excluded from the statistical analysis. SPSS performed pairwise deletion of missing values by default for the other variables when running analyses. Descriptive statistics were provided according to gender due to expected differences in behavioral and demographic characteristics.

The variable SROH was dichotomized for the logistic regression analysis as having value either poor (poor or not so good) or good (good or very good).

The variable age was categorized into three groups: 18-34; 35-50; 51-69. Income was recoded as three categories: low (less than 300 000 NOK per year), middle (300 000 – 600 000 NOK per year) and high (more than 600 000 per year). Number of education years was used as a categorical variable having the following values: “Primary school” (≤ 9 years), “Secondary school” (10-12 years), “Higher education less ≤ 3 years” (13-15 years), “Higher education more than 3 years” (16 and more). The variable “municipality” was recoded into groups: “Sami majority area” and “Sami minority area”. The reason for such division is described above in the section 4.5. The following municipalities were included in “Sami majority area”: Kautokeino, Karasjok, Tana, Porsanger and Nesseby (Figure 1).

The variable “smoking” was narrowed down to the following categories: daily, previously (previously; sometimes) and never. The variable “snuff use” was recoded into three categories: daily, previously (previously; sometimes); never. The variable “alcohol consumption” was recoded

for the statistical analysis as having three categories: never/rarely (never consumed alcohol; not during the last year; few times during the last year); monthly (one time per month; 2-3 times per month); weekly (1 times per week; 2-3 times per week; 4-7 times per week).

The variable "check 6" was recoded as either having the value 1 – "yes" (Often, almost daily) or having the value 0 - "no" (Sometimes; Seldom or never). The variable "check 6-12" was recoded as either having the value 1 – "yes" (often, almost daily; sometimes) or having the value 0 - "no" (Seldom or never). The new variable "Attitude towards dental hygiene" was computed out of three variables: check 6; check 6-12 and candy. It had the value 1, labeled as "positive attitude" if the following condition was satisfied: (check6=1 OR check6-12=1) AND candy=1. Otherwise it had the value 0, denoted as "indifferent attitude".

Five percent level of significance was set. Cross-tables with chi-square test of independence were performed to test the relationship between categorical variables and difference between groups. The distributions of age and years of education were skewed, therefore bootstrapped independent sample t-test was performed to test differences between mean age and mean number of education years in two groups (Sami-majority and Sami-minority area). Logistic regression analysis was performed in order to obtain odds ratios for poor SROH. The following predictors were used for logistic regression analysis: smoking, snuffing, alcohol use, tooth brushing at the age of 10, supervised tooth brushing at the age of 10, attitudes towards oral health and residence area. Regression models were also adjusted for gender, age, gross family income and years of education. Hierarchical entry was used to build the final model (figure 3). Omnibus test was used to check the overall model significance. Nagelkerke r-square was used to check the proportion of variation in SROH that can be explained by variation in the predictors. Multicollinearity was tested.

3 Results

The study sample consisted of 5 014 men and 6 311 women. One-fifth of the sample lived in the Sami majority area (20.2% of the men and 21.3% of the women) and four-fifths in the Sami minority area. Mean age in men was 49.6 (mean age in the Sami majority: 49.7; mean age in the Sami minority: 49.6). Mean age in women was 46.5. (mean age in the Sami majority: 47.3, mean age in the Sami minority: 46.3). There was a statistically significant difference in mean age of men compared to mean age of women ($p<0.001$). Mean number of education years was 12.89 in men and 13.92 in women ($p<0.001$). Men and women reported education differently: 18.5% of men and 12.3% of women had completed only primary school; 30.9% of men and 24.2% of women had secondary education; 25.6% of men and 26.7% of women had higher education ≤ 3 years; 25.0% of men and 36.9% of women reported higher education >3 years. Income distribution was similar in men and women: 13.8% of men and 13.9% of women were in low income group; 35.7% of men and 37.5% of women were in medium income group; 47.5 % of men and 44.7% of women were in high income group.

Table 1 describes demographic characteristics of men and women by residence area in the SAMINOR 2 study. Among men, there was no relationship between age group and residence area ($p=0,654$). The proportion of men in the youngest age group was low in both Sami-majority and Sami-minority area. Mean age of men was similar in two groups ($p=0.789$). There was a relationship between gross family income and living area ($p=0.003$). Education groups were related to living area as well ($p=0.020$). However, mean number of education years among men did not differ in the two groups ($p=0.560$). The differences in income and education of men living in Sami-majority area ware minor compared to those men living in Sami-minority area (Table 1).

Among women, age group, gross family income and education were significantly related to residence area (Table 1). However, difference in percentage points was not substantial. Mean age

was the same among women living in the Sami-majority area as compared to those living in Sami-minority area (p=0.260). Although the difference in mean number of education years was statistically significant (p=0.010), it was not substantial (14.15 years in Sami-majority area and 13.86 in Sami-minority area).

3.1 Smoking

Table 2 describes men and women in the SAMINOR 2 study according to their smoking status. Prevalence of daily smoking was 17.5 % among men and 19.1% among women. Forty-point two percent of males and 35.5% of females were former smokers. Forty-two-point two percent of males and 44.4% females reported that they had never smoked. Reported smoking status was significantly different in three age groups in both genders (p<0,001). The highest proportion of daily smokers was observed in the middle age group (35-50) in men and women. The highest proportion of former smokers was observed in the oldest age group (51-69) in both genders. There was a significant relationship between smoking status and gross family income in both genders (<0.001). Proportions of daily smokers were largest in the low-income group in both men and women. Proportion of never smokers was largest in the high-income group in both genders. Smoking status was significantly related to education in both men and women (p<0.001). The prevalence of daily smoking was lower in higher education groups in both genders. Smoking status was not related to living area in men (p=0.085). At the same time, a significant relationship between smoking and living area was observed in women (p=0.024). However, differences in smoking status of women living in the Sami-minority area was minor compared to those living in the Sami-minority area. The pattern of snuff use was reported significantly different across smoking groups (p<0.001). Among daily snuff users, 61.5% of men and 53.7% of women were former smokers.

Among daily smokers, mean number of cigarettes per day was 13.68 for men and 11.47 for women. Mean number of smoking years was 33.68 among men and 30.18 among women.

3.2 Swedish snuff (snus) use

Prevalence of daily snuff use was 13.5% among men and 2.9% among women (Table 3). Snuff use was significantly related to age groups in both genders ($p<0.001$). The youngest age group reported the highest proportion of daily snuff use in men (25.4%) and women (10.3%). Proportion of never users was highest in the oldest age group in both males and females. Snuff use was significantly related to gross family income in both genders ($p<0.001$). However, there was no apparent trend in snuff use status from the lowest to the highest income group in both genders. Snuff use was significantly associated with education in men($p=0.001$) and women ($p<0.001$). The highest prevalence of daily snuff use was observed in the education group "high, ≤3 years" in both genders. Prevalence of snuff use did not differ substantially across the education groups. Nevertheless, chi-square test was significant. Snuff use was related to residence area in men ($p=0,04$) and in women ($p=0,017$). Proportion of daily snuff users was slightly higher in the Sami-minority area (14.4% of men and 3.3% of women) as compared to the Sami-majority area (10.4% of men and 1.9% 0f women). Among former smoker, 20.5% of men and 4.3% of women used snuff daily. Four-point eight percent of men and 1.3% of women were dual users: used snuff and smoked daily. Mean number of snuff portions per day was approximately 10 among both men and women. Mean duration of daily snuff use was 14.72 for men and 6.17 for women.

3.3 Alcohol use

Prevalence of those who used alcohol rarely or never was 26. 8% among men and 38.0% among women . Prevalence of monthly alcohol use was 37.1% among men and 36.1% among women. Prevalence of weekly alcohol use was 36.1 % among men and 25.9% among women. Alcohol use was significantly related to all of the demographic variables in men and women ($p<0.001$). The highest prevalence of weekly alcohol users was in the oldest age group in both genders. The highest prevalence of never alcohol use was observed in the youngest age group in both men and women. The proportion of respondents who used alcohol weekly was highest in the high-income group and the high education group (higher > 3) in both men and women. The largest proportion of never- or rarely-users was observed in low income group and primary education group in both genders. Alcohol use was significantly associated with living area: those living in the Sami-majority area drank alcohol less frequently than those living in the minority area.

3.4 Tooth brushing habits at the age of 10

Tooth brushing at least once a day at the age of 10 was more prevalent in women (83.1%) than in men (69.9%) (Table 5). Tooth brushing at the age of 10 was significantly related to age group in both men and women ($p<0.001$). The highest proportion of those who reported brushing their own teeth at least once a day at the age of 10 was observed in the youngest age group (18-34). The oldest age group reported the lowest proportion of daily tooth brushing at the age of 10. That was observed for both genders. Tooth brushing at the age of ten was significantly related to family income and education in both genders ($p<0.001$). Those participants who had higher education and higher income reported daily tooth brushing at the age of 10 more frequently. Residence area was also significantly associated with tooth brushing at the age of 10 in both genders ($p<0.001$). Sami-

minority men and women reported daily tooth brushing at the age of 10 more frequently (71.8% and 85.2%, respectively) than those men and women living in the Sami-majority area (62.2% and 75.6%, respectively).

Thirty-two-point seven percent of women and 31.9% of men reported that their parents often (almost daily) helped them with tooth brushing when they were 10 years-old (Table 6). Twenty-nine-point three percent of women and 23% of men reported that their parents had never helped them to brush their teeth or did it seldom. Supervised tooth brushing at the age of 10 was significantly related to all of the demographic variables for both genders ($p<0.001$). Participants in the youngest age group reported daily supervised tooth brushing more frequently than the others. Chi square test was significant for the relationship between supervised tooth brushing at the age of 10 and family income and education. However, no apparent trend was observed across the income groups as well as across the education groups in both genders. There were slightly more respondents of both genders in the Sami-minority area (32.5% of men and 33.7% of women) compared to the Sami-majority area (29.7% of men and 28.7% of women) who reported regular supervised tooth brushing at the age of 10.

3.5 Attitudes towards dental hygiene

To explore the participant's attitude towards dental hygiene, a new variable was constructed based on information of their engagement in their children's dental hygiene habits, and their attitude towards frequency of sweets intake among their children. Table 7 describe the distribution by gender of those who helped their children with tooth brushing and had a rule regarding eating sweets. Table 8 describes the combined variable "attitudes toward dental hygiene". Sixty-two-point six percent of males and 71.3% of females had satisfied the criteria that defined them as people with a positive attitude towards dental hygiene (table 8). Attitude towards dental hygiene was related to

all of the demographic variables ($p<0.001$) except age groups for women (0.065) and residence area for both men and women ($p=0.891$ and $p=0.491$ correspondingly). Prevalence of women that had a positive attitude towards dental hygiene was similar across the age groups (table 8). Participants in the high-income group satisfied the criteria for "positive attitude" more frequently than the others. Proportion of males and females that had positive attitudes toward dental hygiene was increasing from the lowest to the highest education group (table 8).

3.6 Self-reported oral health

The majority of the participants (73.5%) reported good oral health and 26.5% reported poor oral health (table 9). Among men, one-third (31.3) reported poor oral health as compared to one-fifth (22.6%) among women.

Table 9 shows that all risk factors were significantly related to SROH except snuff use for both genders ($p=0.08$ for men and $p=0.154$ for women) and attitude towards dental hygiene for women ($p=0.055$). Table 10 shows the results of multivariate logistic regression analysis. The omnibus test revealed that the overall model was significant ($p<0.001$). According to Nagelkerke statistics, the model could explain 15.8% variation in SROH. Daily smokers were 2.6 times more likely to report poor oral health as compared to never-smokers ($p<0.001$). Former smokers were 1.5 times more likely to report poor oral health than never-smokers ($p<0.001$). Never-tooth brushing at the age of 10 was significantly associated with higher odds of having poor SROH (OR=2.592, $p<0.001$) as compared to daily tooth brushing. Those who brushed their teeth sometimes at the age of 10, had a 76.1% higher probability to report poor oral health (p=0,007). Daily snuff use was associated with poor SROH with an odds ratio of 1.521 ($p=0.006$). Former snuff use was not a significant predictor of poor SROH ($p=0.185$). Those who had never received

help with tooth brushing at the age of 10 had a 50% higher probability of having poor SROH (p=0.001). The participants whose parents helped them to brush their teeth sometimes had a 25.5% higher probability of reporting poor oral health as compared to those who got help with tooth brushing regularly (p=0.029). The participants in the highest income group and those in the medium income group were 48 % and 23% (respectively) less likely to report poor oral health. Higher education was associated with 28.7% lower probability of having poor SROH. Alcohol use was significantly (p=<0.001 and p=0.001) associated with poor SROH, namely, it had a protective effect. Weekly- and monthly-alcohol use decreased the risk of poor SROH by 32% and 29% (respectively) as compared to never-alcohol use. The participants who had positive attitudes towards dental hygiene had a 17% decreased risk of poor SROH (p=0.035) than those having indifferent attitudes. The participants that were living in the Sami-majority area had a 36.4% higher probability of reporting poor SROH than those living in the Sami-minority area (p=0.002). Age group 50-69 years had a lower probability of reporting poor oral health. Men were 22.4% more likely to have poor SROH. In the univariate logistic regression analysis, the strongest predictors that explained more variation in the outcome were tooth brushing at the age of 10 (Nagelkerke R^2=0.056), smoking (Nagelkerke R^2=0.052), education (Nagelkerke R^2=0.050), income (Nagelkerke R^2=0.42) and supervised tooth brushing at the age of 10 (Nagelkerke R^2=0.031).

4 Discussion

More than two thirds of study participants reported good oral health in the present study. The most important predictors of poor self-reported oral health were daily smoking and seldom tooth brushing at the age of 10. The most important confounders, income and education, were strongly associated with the outcome and had a protective effect towards poor SROH.

4.1 Validity of SROH as a measurement of oral health

Many studies on oral health measure only clinical indicators. However, objective measurements do not reflect the impact of oral disease presence on an individual's daily life. Oral health problems such as caries, periodontal disease and tooth loss have a great negative impact on everyday life due to functional impairment, psychological effects and social attitudes towards oral diseases (68). Thus, research on subjective perceptions of oral health can contribute to the improvement of oral health related quality of life, which is important in the modern biopsychosocial concept of health (68-70). Self-rated oral health is a cost-effective, reliable method appropriate for large population-based surveys on a country and global level (41, 71). Self-rating of oral health is also a good complement to the common clinical measurements, as both objective and subjective measurements of oral health can provide a comprehensive picture of oral health status (41).

Single-item self-ratings might be useful for oral health status assessment to the same extent as multi-item measurements (69). Several studies attempted to assess the validity of single-item oral health self-ratings. One study revealed the positive association between clinically assessed and self-reported oral health. This association was observed in several domains: caries, number of missing teeth and periodontal disease (37). Locker et al. analysed factors underlying single-item oral health self-ratings. They found that the oral-health-related quality of life indicators measured using the

Oral Health Impact Profile (OHIP) were the strong predictors of SROH. Functional limitations had specifically large contribution to oral health ratings (69).

4.2 Discussion of the results

Prevalence of good self-reported oral health was 73.5% in the current study. That was somewhat less than the overall prevalence of good SROH of 76% in 2015 in Norway (72) . According to CBS, the lowest prevalence of good SROH was observed in Troms and Nordland county (68 and 70 percent respectively) and prevalence of good SROH in Finnmark was 74% which is not substantially different from the country average of 76% (72). In general, this is in line with findings of the current study, although this thesis does not provide the analysis of SROH by county.

4.2.1 SROH and area of residence

This study found that the participants living in the Sami-majority area were more likely to report poor oral health than those living in the Sami-minority area. There was no substantial difference in demographic variables by living area either in men or in women, although the results were significant (Table 1). Information about ethnicity was not available for the present study. Only geographic areas were compared. To my knowledge, no study on oral health within these geographic areas exists. Thus, it is not possible to compare the results with other studies. One may suggest the possible factors underlying this difference. The report “Health and Care Services to The Sami Population in Northern Norway” stated that the evidence regarding differences in health between Sami and Norwegian populations is insufficient(33). However, the literature suggested that Sami people had a different understanding of disease, health and treatment (32, 33). It would be reasonable to assume that the understanding of oral health, oral disease and consequently oral health

ratings may differ among the Sami people. However, the distribution of Sami-participants in the current study and their understanding of oral health and disease is unknown. The above mentioned report stated also that there was no difference in utilization of health care in the municipalities employing Sami language compared to the other municipalities (33). However, the Sami people were less satisfied with the municipal care services than Norwegians, which might be related to language, cultural challenges and geographic location of health care services (34). It is noteworthy that among dentists in Finnmark in 2008, only one could speak the Sami language (73). To my knowledge, the data on dental service use in the Sami-population has not yet been published. Nevertheless, the current study cannot make any conclusions based on ethnicity since this information was not available for the current study.

The Oral Health Plan for Finnmark county 2014-2017 pointed out that oral health expenditures per inhabitant were higher in Finnmark than in the other counties in Northern Norway and higher than the country average. Clinic structure, geography, recruitment problems and oral health state in local populations contributed to such high expenses (74). There were many small dental clinics distributed throughout Finnmark county: nine clinics had only one dentist; six clinics had two; only four clinics had more than two dentists. Moreover, there were two specialist facilities in Finnmark: Hammerfest and Kirkenes. In addition to the problems with workforce recruitment, stability of employment was also a challenge (74). Young dentists preferred to work in big cities where the job market was larger. Moreover, it was challenging for young dentists to work on their own in remote areas in Finnmark (74). The same document pointed out that there were mostly public dental clinics in Finnmark. These clinics prioritized patients that had rights to receive free dental treatment, whereas those paying for dental services experienced long waiting times and an undersupply of alternative private clinics (74). However, no single factor can explain the difference between the geographic areas. The difference might be observed due to a combined effect of structural, geographical and cultural factors.

4.2.2 Behavioural characteristics of the study sample

Behavioural characteristics of the study sample were generally in line with the national statistics. According to CBS, the prevalence rate of daily smoking was 16% in Norway in 2012 (the same for men and women) (75). There were more smokers among older people as compared to younger people (76). Prevalence of snuff use in Norway was 9 % in 2012 in Norway. Fourteen percent of men and 4% of women used snuff daily (75). Six percent of men and 2 % of women used both snuff and cigarettes (77).There were more daily snuff users among young people in Norway in 2012 compared to old people (76). The present study found the same trend. Other surveys observed only small differences (a few percent) in smoking prevalence in the Sami population compared to the Norwegian population (76, 78, 79). This study found slightly higher smoking rates only in women living in the Sami-majority area compared to the Sami-minority area. However, the present findings cannot be extrapolated on the Sami-population since this study compared only the geographic areas. These findings are rather in line with the fact that smoking prevalence was higher in Finnmark county (where the Sami-majority area is located) compared to Troms, Nordland and Trøndelag in 2012-2016 (76).

A recent study on drinking patterns and mortality from cardiovascular disease in Norway showed that the most frequent drinking pattern among adults is from one time per month to one time per week (50% of study population in average) and those in the high income group used alcohol more often (80). Although the present study used slightly different categories for alcohol intake, similar patterns were observed. The prevalence of regular tooth brushing at least once a day was somewhat lower in the current thesis compared to the national report (15). However, this was in line with the study of adolescents in Troms county in Northern Norway (44). The latter also found that 80% of adolescents received parental control of tooth brushing (44). In current study, lower

frequency of parental control or supervised tooth brushing was observed. However, a slightly different categories for supervised tooth brushing were used.

4.2.3 Behavioural determinants of SROH

This study found that daily smoking and irregular tooth brushing at the age of 10 were the strongest predictors of poor SROH and had the highest effect estimates. A study of mothers' SROH in Australia found an association between smoking status and poor self-rated oral health with an OR of 1.26 (81). Although the effect estimate was substantially lower, this was consistent with the present study. However, the Australian study used slightly different categories for smoking status and the ORs were given for both daily, former, occasional smokers and users of another tobacco types. A recent study from the Netherlands found that daily-smokers had a 49% higher probability of having poor SROH as compared to never-smokers (82), which was also in line with the findings of this thesis.

The study of dental caries in adolescents in Troms county revealed a higher mean DMFT index in those who brushed their teeth once a day or less compared to regular tooth brushing twice a day (44). The study of mothers' oral health from Australia found that those women brushing their teeth once a day or less had a 75% higher probability of reporting poor oral health compared to those brushing their teeth twice a day or more (81). Although the present study analysed brushing habits at the age of 10, the findings of the Australian study were generally consistent with the results of the current study.

The variable "attitude towards dental hygiene" in this thesis combined two questions regarding accountability for children's dental hygiene (rule of eating sweets and help with tooth brushing for children aged <6 and 6-12). Those participants that satisfied the criteria for "positive" attitude towards dental hygiene had less probability of reporting poor oral health, which adds

support to the construct validity of the variable (Table 10). Nevertheless, this is impossible to compare the findings of this thesis with other studies, since no study using the similar variable exists.

To my knowledge there are no studies analysing alcohol consumption as a predictor of SROH. A number of studies have analysed the relationship between alcohol consumption and the number of missing teeth. However, the results are inconsistent (61). A review reported that number of studies found a protective effect of moderate drinking on cardiovascular diseases and J-shaped relationship between CVD-mortality and alcohol consumption (predominantly wine drinking) (83). At the same time, it has been found that even light alcohol consumption increases the risk of certain types of cancer (83). One of the possible reasons for somewhat poorer general health in never-drinkers is that this category of population often incudes former heavy drinkers that had impaired health and therefore such conclusions might be misleading (61, 83). In the current thesis, weekly alcohol consumption had a somewhat protective effect in the logistic regression analysis. However, this finding should be considered with caution due to the above-mentioned reason and the cross-sectional study design. Moreover, the present study has no information on the volume of alcohol intake and the type of alcoholic beverage which also may influence oral health outcomes.

This thesis found a significant association between daily snuff use and a higher risk of reporting poor oral health (Table 10). To my knowledge, there are no studies analysing snuff use as a determinant of self-reported oral health. A number of studies sought to find the association between Swedish snuff use and objective oral health status. The findings were controversial. Hugoson et al. concluded that Swedish snuff is unlikely to be a risk factor for dental caries, because there was no difference in missing teeth and DFS index (decayed/filled tooth surfaces) among snuff users as compared to non-users (58). They did not find any adverse effects of Swedish snuff on periodontal tissue as well (84). Other studies found an association between snuff use and caries prevalence (44, 85). The Directorate of Health reported that Swedish snuff use can be harmful for

oral mucosa and periodontal tissues in the place that is directly in contact with snuff and its compounds (76).

4.2.4 Demographic factors

The current study did not find any trend between age and SROH. Being in the oldest age group was not a significant confounder for poor SROH. At the same time, the middle age group had a lower probability of having poor oral health compared to the youngest age group (table 10). This is in line with the study of SROH in Istanbul adults. This study revealed that older adults were more likely to report good oral health as compared to young adults (86). However, other studies have found that older age is a significant predictor of poor SROH (87, 88). This is logical, that age is inversely associated with an objective state of oral health, since many dental conditions (for example caries or tooth loss) are irreversible. However, it is unclear how age is related to self-ratings of oral health. A study based on self-reported oral health data revealed that the impact of oral health problems decreases with older age (89). The authors emphasized that age as a predictor of oral health related quality of life was mainly investigated in cross-sectional studies, whereas oral health ratings might be dependent on a particular cohort (89). Since SROH is a significant predictor of oral health related quality of life, one can assume that the association between SROH and age might also be cohort-dependent (90). The studies on self-ratings of oral and general health showed that different age groups expressed different reasons why do they rate their health as poor or good (91, 92). This may partly explain the inconsistencies across different studies on SROH.

This thesis has found an association between SROH and such demographic factors as income and education in both univariate and multivariate logistic regression analysis. This is consistent with other studies on self-rated oral health (86, 93). The state report “Personnel and

expenses. Dental health and dental visits" found the same trend: people in the lowest income and education groups had the poorest oral health (15).

Gender was a significant confounder in the logistic regression analysis in the current study (Table 10). Prevalence of good SROH was lower in men than in women. The Survey on Health and Living Conditions conducted in 2015 found the same difference between genders: 74% of men and 79% of women had good self-rated oral health in Norway (72). The study of self-reported oral health from Sweden found no sex-specific differences in oral health (94). The findings of the current study are in line with the study of SROH in Istanbul adults: men were more likely to report poor oral health (86). However, a study from US found the opposite trend. Such discrepancy might be due to unique characteristics of each study population (87).

4.3 Strengths and limitations

One of the strengths of the current study is the large sample size and large geographic area that was covered by SAMINOR 2 study. A large sample size implies more accurate estimates as well as easier detection of outliers. On the other hand, very large sample sizes increase the tendency to reject the null hypotheses making negligible differences significant (95). In this thesis, the mean number of years of education was significantly different in women living in the Sami-majority areas as compared to those living in the Sami-minority areas, but the differences were not substantial (table 1). The same issue was observed in the distribution of income and education in men and women by residence area (Table 1).

The other strength of this study is use of oral health self-rating (SROH) which is the valid measurement associated with oral health-related quality of life. Oral health rating is also a good complement to the objective measurement of oral health status (68, 69).

The main limitation of that study is a low response rate of 27%, specifically in men aged 18-29 (36). Thus, the external validity of the study is questioned. The paper on methodology in the SAMINOR 2 study suggests that such a low response rate and its age pattern is consistent with other population-based studies. A General decline in willingness to participate in questionnaire-based studies was observed in recent years (36). Figure 4 and 5 present age distributions in the Norwegian population (figure 4) and in the SAMINOR 2 study (figure 5). The population in the SAMINOR 2 study was older on average than the Norwegian population. The average age in the Norwegian population was 39.15 in 2011 (96). The average age in the SAMINOR study was 47.92 in the same year. One may argue that older age could contribute to worse SROH. However, this study has not found any trend in probability of reporting poorer oral health with older age. In the present study, the participants reported more years of education than in the national reports. Approximately 10 percent of the Norwegian population (10.2% among men and 8.7 % among women) had higher education more than three years at university and 23% had higher education for 3 years (19% among men and 27% among women) (97). In the current study the proportion of men and especially women that reported higher education more than 3 years is much larger than national numbers from CBS. Thus, the education reports might be biased and related to the low response rate. In addition, the SAMINOR 2 study was intended to be representative of the mixed Sami and Norwegian population. It was difficult to assess representability of the study sample in terms of ethnic distribution due to information on ethnicity of those who did not respond was not available (36). Thus, the results of the present study cannot be extrapolated to the mixed ethnic population of Northern and Mid-Norway.

Other limitations of this study are related to the study design. Recall-bias is inherent to all cross-sectional studies. Participants may not correctly recall some events, especially if an event happened many years ago. For instance, tooth brushing at the age of 10 and help with tooth brushing at the age of 10 are likely to be biased. The validity of some self-reported measurements is

questioned. Self-reports of alcohol consumption might be underestimated by the participants. Smoking is socially stigmatized in the Western society (98), therefore the participants may underreport their smoking habits. Use of snuff is not stigmatized in the Scandinavian countries (99). Therefore), one can expect the participants to report complete information on their snuff use.
The other limitation of the cross-sectional study design is that no causal and no temporal relationship between the variables can be observed.

5 Conclusion

The overall prevalence of good self-reported oral health was more than two-thirds. Residence area was significantly associated with SROH: those living in the Sami-majority area were more likely to report poor oral health. It might be due to structural, geographical and other unique characteristics of this area. Smoking was more prevalent in the oldest age group, low income and low education group, whereas snuff use was more frequent among young people and no trend in snuff use was observed across income and education groups. Weekly alcohol use was more frequent in older age, higher income and education groups. Women reported more frequent tooth brushing at the age of 10 and they satisfied the criteria for positive attitudes towards dental hygiene more frequently than men. The most significant predictors contributing to poor SROH were daily smoking and reports of brushing teeth seldom or never. Other behavioural risk factors such as alcohol use, daily snuff use, supervised tooth brushing at the age of 10 and attitudes towards dental hygiene had moderate association with poor SROH.

For the further research on adults' oral health in Norway, particularly in Northern Norway, it would be reasonable to analyse both SROH and clinical indicators in order to obtain a comprehensive picture of oral health status and its determinants.

6 Reference list:

1. Holst D, Schuller AA. Equality in adults' oral health in Norway. Cohort and cross-sectional results over 33 years. Community dentistry and oral epidemiology. 2011;39(6):488-97.

2. Dorthe Holst IS. Tenner og tannstatus i den voksne befolkning i Norge. DEN NORSKE TANNLEGEFORENINGS TIDENDE NR 3. 2010:194-69.

3. Lyshol HSM, Biehl AM. Tannhelsestatus i Norge. En oppsummering av eksisterende kunnskap. Oslo: Folkehelseinstituttet. Avdeling for helsestatistikk. 2009. Available from: https://www.fhi.no/globalassets/dokumenterfiler/rapporter/2009-og-eldre/rapport-20095-pdf-.pdf

4. Hanna Hånes HSML. Dental Health in Norway - fact sheet. Oslo: Folkehelseinstituttet; 22.06.2010 [updated 18.04.2016]. Available from: https://www.fhi.no/en/mp/dental-health/dental-health-in-norway---fact-shee/#county-differences-in-child-and-adolescent-dental-health.

5. Det offentlige engasjement på tannhelsefeltet. Et godt tilbud til de som trenger det mest Oslo: Statensforvaltningstjeneste; 2005. Available from: https://www.regjeringen.no/contentassets/7607d8cd8dab45259a84229a34933e35/no/pdfs/nou200520050011000dddpdfs.pdf.

6. Dental Health Service Act. Oslo: Sosialdepartementet; 1983. Available from: https://lovdata.no/dokument/NL/lov/1983-06-03-54.

7. Holde GE, Oscarson N, Trovik TA, Tillberg A, Jönsson B. Periodontitis Prevalence and Severity in Adults: A Cross-Sectional Study in Norwegian Circumpolar Communities. Journal of periodontology. 2017;88(10):1012-22.

8. Survey on Health and Living Conditions. Oslo: Central Bureau of Statistics; 2016. Available from: https://www.ssb.no/helse/statistikker/helseforhold/hvert-3-aar/2016-06-20.

9. Henriksen BM, Axéll T, Laake K. Geographic differences in tooth loss and denture-wearing among the elderly in Norway. Community dentistry and oral epidemiology. 2003;31(6):403-11.

10. Veugelers PJ, Yip AM, Mo D, Guernsey J. The north-south gradient in health: analytic applications for public health. Can J Public Health. 2001;92(2):95-8.

11. Mackenbach JP, Cavelaars A, Kunst AE, Groenhof F. Socioeconomic inequalities in cardiovascular disease mortality. An international study. European heart journal. 2000;21(14):1141-51.

12. Rosengren A, Stegmayr B, Johansson I, Huhtasaari F, Wilhelmsen L. Coronary risk factors, diet and vitamins as possible explanatory factors of the Swedish north–south gradient in coronary disease: a comparison between two MONICA centres. Journal of internal medicine. 1999;246(6):577-86.

13. Widström E, Koposova N, Nordengen R, Bergdahl M, Eriksen H, Fabrikant E. Oral health care and dental treatment needs in the Barents region. International journal of circumpolar health. 2010;69(5):486-99.

14. Technical Report on the Inuit Oral Health Survey 2008 – 2009. Ottawa, Ontario; 2011.

15. Trond Ekornrud AJ. Tannhelse. Personell og kostnader, tannhelsetilstand og tannlegebesøk. Oslo: Statistisk sentralbyrå; 2010. Contract No.: Rapporter 2010/29. Available from: https://www.ssb.no/a/publikasjoner/pdf/rapp_201029/rapp_201029.pdf

16. Tannhelsetjenesten. Geografisk fordeling, hensiktsmessig oppgavefordeling og samarbeid mellom offentlig og privat sektor. Oslo: Helsedepartementet. Contract No.: I - 1086 B. Available from: https://www.regjeringen.no/globalassets/upload/kilde/hd/hdk/2003/0027/ddd/pdfv/185723-i-1086_b_tannhelsetjenesten.pdf

17. Tannhelsetjenesten - nøkkeltall (F) etter region, statistikkvariabel og år. Oslo: Tannhelsetjenesten; 2011. Available from: https://www.ssb.no/statbank/table/04920/tableViewLayout1/?rxid=473d317a-af1d-4d15-8f06-f740892b9db4.

18. Fyller hull i tannhelsa. Nordlys. 2013 April 8th 22:00. Available from: https://www.nordlys.no/nyheter/fyller-hull-i-tannhelsa/s/1-79-6594390

19. Antall innbyggere per tannlege. Oslo: Helsedirektoratet, Statistisk Sentralbyrå; 2016 [updated 29.06.2017]. Available from: https://helsenorge.no/Kvalitetsindikatorer/kvalitetsindikatorer-for-tannhelse/antall-innbyggere-per-tannlege#Se-resultater.

20. Tannhelsetjenesten - nøkkeltall (F) etter region, statistikkvariabel og år. Oslo: Statistisk Sentralbyrå; 2001-2011-2017 Available from: https://www.ssb.no/statbank/table/04920/tableViewLayout1/?rxid=473d317a-af1d-4d15-8f06-f740892b9db4.

21. St.meld.nr. 35. Tilgjengelighet, kompetanse og sosial utjevning. Framtidas tannhelsetjenester. 2006-2007. Det kongelige helse- og omsorgsdepartement; 2006-2007. NOU 2005: 11. Available from: https://www.regjeringen.no/globalassets/upload/hod/vedlegg/stm_nr35.pdf.

22. Magritt Brustad THL. Tannhelse i samisk befolkning i Finnmark. Den norske tannlegeforenings tidende. 2015. 125: 966—70

23. Lund E, Melhus M, Hansen KL, Nystad T, Broderstad AR, Selmer R, et al. Population based study of health and living conditions in areas with both Sami and Norwegian populations-the SAMINOR study. International journal of circumpolar health. 2007;66(2):113-28.

24. Minde H. Assimilation of the Sami–Implementation and Consequences1. Acto Borealia. 2003;20(2):121-46.

25. Blix BH, Hamran T, Normann HK. Struggles of being and becoming: A dialogical narrative analysis of the life stories of Sami elderly. Journal of aging studies. 2013;27(3):264-75.

26. Sárgon S. Konsekvenser av statens fornorskningspolitikk-med fokus på tapt skolegang under andre verdenskrig: Universitetet i Tromsø; 2007.

27. Stordahl V, Tørres G, Møllersen S, Eira-Åhren I-M. Ethical guidelines for Sami research: the issue that disappeared from the Norwegian Sami Parliament's agenda? International journal of circumpolar health. 2015;74(1):27024.

28. Gaski M, Melhus M, Deraas TS, Førde OH. Use of health care in the main area of Sami habitation in Norway: Catching up with national expenditure rates. 2011.

29. Samelovens språkregler og forvaltningsområdet for samisk språk. Oslo: Kommunal- og moderniseringsdepartementet; [updated 12.08.14]. Available from: https://www.regjeringen.no/no/tema/urfolk-og-minoriteter/samepolitikk/samiske-sprak/samelovens-sprakregler-og-forvaltningsom/id633281/.

30. Hansen KL. Ethnic discrimination and health: the relationship between experienced ethnic discrimination and multiple health domains in Norway's rural Sami population. International journal of circumpolar health. 2015;74(1):25125.

31. NORGES OFFENTLIGE UTREDNINGER. Plan for helse- og sosialtjenester til den samiske befolkning i Norge. Oslo: Sosial- og helsedepartementet; 1995. NOU 1995:6

32. St.meld. nr. 47 (2008−2009) Samhandlingsreformen. Rett behandling − på rett sted − til rett tid. In: omsorgsdepartementet H-o, editor. Oslo: Helse- og omsorgsdepartementet; 2009.

33. Blix BH. Helse-og omsorgstjenester til den samiske befolkningen i Norge–En oppsummering av kunnskap. Senter for omsorgsforskning; 2016. Available from: https://brage.bibsys.no/xmlui/handle/11250/2414949

34. Nystad T, Melhus M, Lund E. Samisktalende er mindre fornøyd med legetjenestene. 2006. Tidsskrift for Den norske legeforening; 2006. 126, s. 738-40.

35. Norum J, Olsen A, Småstuen M, Nieder C, Broderstad AR. Health consumption in Sami-speaking municipalities with regard to cancer and radiotherapy. International journal of circumpolar health. 2011;70(3):319-28.

36. Brustad M, Hansen KL, Broderstad AR, Hansen S, Melhus M. A population-based study on health and living conditions in areas with mixed Sami and Norwegian settlements–the SAMINOR 2 questionnaire study. International journal of circumpolar health. 2014;73(1):23147.

37. Thomson W, Mejia G, Broadbent J, Poulton R. Construct validity of Locker's global oral health item. Journal of dental research. 2012;91(11):1038-42.

38. Locker D, Gibson B. Discrepancies between self-ratings of and satisfaction with oral health in two older adult populations. Community dentistry and oral epidemiology. 2005;33(4):280-8.

39. Abelsen B. What a difference a place makes: dental attendance and self-rated oral health among adults in three counties in Norway. Health & place. 2008;14(4):829-40.

40. Dorthe Holst ISoJG. Den Norske Tannlegeforenings Tidende. 2005.

41. Pinelli C, Loffredo LdCM. Reproducibility and validity of self-perceived oral health conditions. Clinical oral investigations. 2007;11(4):431-7.

42. Norske spørreundersøkelser. Levekårsundersøkelser Levekårsundersøkelsen EU-SILC: NSD Norsk Senter for Forskningsdata; Available from: http://www.nsd.uib.no/nsddata/serier/levekaarundersokelser.html.

43. 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(1):30169.

44. Jacobsen ID, Eriksen HM, Espelid I, Schmalfuss A, Ullbro C, Crossner C-G. Prevalence of dental caries among 16-year-olds in Troms County, Northern Norway. Swedish dental journal. 2016;40(2):191-201.

45. Tannhelse i Nord. En undersøkelse i regi av Universitetet i Tromsø. Available from: https://site.uit.no/tannhelseinord/om-undersokelsen/hva-innebaerer-det-a-delta/.

46. Tsakos G, Quiñonez C. A sober look at the links between oral and general health. BMJ Publishing Group Ltd; 2013.

47. Petersen PE. Tobacco and oral health-the role of the World Health Organization. Oral Health and Preventive Dentistry. 2003;1(4):309-16.

48. Petersen PE. Sociobehavioural risk factors in dental caries–international perspectives. Community dentistry and oral epidemiology. 2005;33(4):274-9.

49. Petersen PE. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century–the approach of the WHO Global Oral Health Programme. Community Dentistry and oral epidemiology. 2003;31(s1):3-24.

50. Kinane DF, Peterson M, Stathopoulou PG. Environmental and other modifying factors of the periodontal diseases. Periodontology 2000. 2006;40(1):107-19.

51. Mashberg A, Boffetta P, Winkelman R, Garfinkel L. Tobacco smoking, alcohol drinking, and cancer of the oral cavity and oropharynx among US veterans. Cancer. 1993;72(4):1369-75.

52. Winn DM. Tobacco use and oral disease. Journal of dental education. 2001;65(4):306-12.

53. Allam E, Zhang W, Zheng C, Gregory RL, Windsor LJ. Smoking and oral health. Cigarette Smoke Toxicity: Linking Individual Chemicals to Human Diseases. 2011:257-80.

54. Bergström J. Periodontitis and smoking: an evidence-based appraisal. Journal of Evidence-Based Dental Practice. 2006;6(1):33-41.

55. Axelsson P, Paulartder J, Lindhe J. Relationship between smoking and dental status in 35-, 50-, 65-, and 75-year-old individuals. Journal of clinical periodontology. 1998;25(4):297-305.

56. Haffajee A, Socransky S. Relationship of cigarette smoking to attachment level profiles. Journal of Clinical Periodontology. 2001;28(4):283-95.

57. Jette AM, Feldman HA, Tennstedt SL. Tobacco use: a modifiable risk factor for dental disease among the elderly. American Journal of Public Health. 1993;83(9):1271-6.

58. Hugoson A, Hellqvist L, Rolandsson M, Birkhed D. Dental caries in relation to smoking and the use of Swedish snus: epidemiological studies covering 20 years (1983–2003). Acta Odontologica Scandinavica. 2012;70(4):289-96.

59. Foulds J, Ramstrom L, Burke M, Fagerström K. Effect of smokeless tobacco (snus) on smoking and public health in Sweden. Tobacco control. 2003;12(4):349-59.

60. Tanner T, Päkkilä J, Karjalainen K, Kämppi A, Järvelin MR, Patinen P, et al. Smoking, alcohol use, socioeconomic background and oral health among young Finnish adults. Community dentistry and oral epidemiology. 2015;43(5):406-14.

61. Morse DE, Avlund K, Christensen LB, Fiehn N-E, Molbo D, Holmstrup P, et al. Smoking and drinking as risk indicators for tooth loss in middle-aged Danes. Journal of aging and health. 2014;26(1):54-71.

62. Jansson L. Association between alcohol consumption and dental health. Journal of clinical periodontology. 2008;35(5):379-84.

63. Maida CA, Marcus M, Spolsky VW, Wang Y, Liu H. Socio-behavioral predictors of self-reported oral health-related quality of life. Quality of Life Research. 2013;22(3):559-66.

64. Zimmermann H, Zimmermann N, Hagenfeld D, Veile A, Kim TS, Becher H. Is frequency of tooth brushing a risk factor for periodontitis? A systematic review and meta-analysis. Community dentistry and oral epidemiology. 2015;43(2):116-27.

65. Kumar S, Tadakamadla J, Johnson N. Effect of toothbrushing frequency on incidence and increment of dental caries: a systematic review and meta-analysis. Journal of dental research. 2016;95(11):1230-6.

66. Båk'te VA. Den samiske befolkning i Nord-Norge: Statistisk sentralbyrå:[i kommisjon H. Aschehoug]; 1978.

67. SAMINOR 2. Spørreskjema. Tromsø: Senter for samisk helseforskning; 2012. Available from: https://uit.no/Content/425448/SAMINOR2_1_Spørreskjema_Norsk.pdf.

68. Luchi CA, Peres KG, Bastos JL, Peres MA. Inequalities in self-rated oral health in adults. Revista de saude publica. 2013;47(4):740-51.

69. Locker D, Wexler E, Jokovic A. What Do Older Adults' Global Self-ratings of Oral Health Measure? Journal of public health dentistry. 2005;65(3):146-52.

70. Engel GL. From biomedical to biopsychosocial: Being scientific in the human domain. Psychosomatics. 1997;38(6):521-8.

71. Lawal FB. Global self-rating of oral health as summary tool for oral health evaluation in low-resource settings. Journal of International Society of Preventive & Community Dentistry. 2015;5(Suppl 1):S1.

72. Survey on Health and Living Condition 2015. Oslo: Den Norske Tannlegeforening; 2016. Available from: https://www.ssb.no/helse/statistikker/helseforhold/hvert-3-aar/2016-06-20.

73. Dyvi EB. I landets nordligste fylke. Nor Tannlegeforen Tid. 2008. 118: 386—9

74. Tannhelseplan for Finnmark fylkeskommune 2014 - 2017. Vadsø: Finnmark fylkeskommune; 2014. Available from: https://www.ffk.no/_f/p10/ib8321807-8a8c-41a0-9cf7-2a45fc2766c4/tannhelseplan-for-finnmark-fylkeskommune-2014-2017.pdf

75. Smoking habits in Norway. Oslo: Statistics Central Bureau; 2017. [updated 18.01.2018]. Available from: https://www.ssb.no/royk.

76. Liv Grøtvedt KEL, Leif Edvard Aarø, Rolv Skjærven, Stein Emil Vollset. Smoking and snus use in Norway. Oslo: Norwegian Istitute of Public Health; 2016 [updated 26.09.17. Available from: https://www.fhi.no/en/op/hin/risk--protective-factors/royking-og-snusbruk-i-noreg/#about-tobacco-and-nicotine-.

77. Tobacco use in all age groups 16-74 year-old 2013-2015. Oslo: Norwegian Institute of Public Health; 2016 [updated 26.09.17]. Available from: https://www.fhi.no/globalassets/bilder/folkehelserapporten/fhr_figur1c_tobakk_16-74_260617.jpg

78. Eriksen AM, Hansen KL, Javo C, Schei B. Emotional, physical and sexual violence among Sami and non-Sami populations in Norway: the SAMINOR 2 questionnaire study. Scandinavian journal of public health. 2015;43(6):588-96.

79. Eliassen B-M, Graff-Iversen S, Braaten T, Melhus M, Broderstad AR. Prevalence of self-reported myocardial infarction in Sami and non-Sami populations: the SAMINOR study. International journal of circumpolar health. 2015;74(1):24424.

80. Degerud E, Ariansen I, Ystrom E, Graff-Iversen S, Høiseth G, Mørland J, et al. Life course socioeconomic position, alcohol drinking patterns in midlife, and cardiovascular mortality: Analysis of Norwegian population-based health surveys. PLoS medicine. 2018;15(1):e1002476.

81. Ha DH, Spencer AJ, Thomson WM, Scott JA, Do LG. Commonality of Risk Factors for Mothers' Poor Oral Health and General Health: Baseline Analysis of a Population-Based Birth Cohort Study. Maternal and child health journal. 2018;22(4):617-25.

82. Duijster D, Oude Groeniger J, van der Heijden GJ, van Lenthe FJ. Material, behavioural, cultural and psychosocial factors in the explanation of socioeconomic inequalities in oral health. European journal of public health. 2017.

83. Artero A, Artero A, Tarín JJ, Cano A. The impact of moderate wine consumption on health. Maturitas. 2015;80(1):3-13.

84. Hugoson A, Rolandsson M. Periodontal disease in relation to smoking and the use of Swedish snus: epidemiological studies covering 20 years (1983–2003). Journal of clinical periodontology. 2011;38(9):809-16.

85. Holmén A, Strömberg U, Magnusson K, Twetman S. Tobacco use and caries risk among adolescents–a longitudinal study in Sweden. BMC oral health. 2013;13(1):31.

86. Peker K. The Determinants of Self–Rated Oral Health in Istanbul Adults. Oral Health Care-Pediatric, Research, Epidemiology and Clinical Practices: InTech; 2012.

87. Reisine S, Bailit H. Clinical oral health status and adultperceptions of oral health. Social Science & Medicine Part A: Medical Psychology & Medical Sociology. 1980;14(6):597-605.

88. Okunseri C, Yang M, Gonzalez C, LeMay W, Iacopino AM. Hmong adults self-rated oral health: a pilot study. Journal of immigrant and minority health. 2008;10(1):81.

89. Steele JG, Sanders AE, Slade GD, Allen PF, Lahti S, Nuttall N, et al. How do age and tooth loss affect oral health impacts and quality of life? A study comparing two national samples. Community dentistry and oral epidemiology. 2004;32(2):107-14.

90. Locker D, Clarke M, Payne B. Self-perceived oral health status, psychological well-being, and life satisfaction in an older adult population. Journal of dental research. 2000;79(4):970-5.

91. Locker D, Maggirias J, Wexler E. What Frames of Reference Underlie Self-Ratings of Oral Health? Journal of public health dentistry. 2009;69(2):78-89.

92. Kaplan G, Baron-Epel O. What lies behind the subjective evaluation of health status? Social science & medicine. 2003;56(8):1669-76.

93. Pattussi MP, Peres KG, Boing AF, Peres MA, Da Costa JSD. Self-rated oral health and associated factors in Brazilian elders. Community dentistry and oral epidemiology. 2010;38(4):348-59.

94. Wamala S, Merlo J, Boström G. Inequity in access to dental care services explains current socioeconomic disparities in oral health: the Swedish National Surveys of Public Health 2004–2005. Journal of Epidemiology & Community Health. 2006;60(12):1027-33.

95. Kaplan RM, Chambers DA, Glasgow RE. Big data and large sample size: a cautionary note on the potential for bias. Clinical and translational science. 2014;7(4):342-6.

96. Average age in Norway in 2000-2018. Oslo: Central Bureau of Statistics; 2018. Available from: http://www.kommuneprofilen.no/Profil/Befolkning/DinRegion/bef_alder_region.aspx

97. Befolkningens utdanningsnivå. Oslo: Statistisk Sentralbyrå: 2016. Available from: https://www.ssb.no/utniv/

98. Graham H. Smoking, stigma and social class. Journal of Social Policy. 2012;41(1):83-99.

99. Lund M, Lund KE, Halkjelsvik T. Contrasting smokers' and snus users' perceptions of personal tobacco behavior in Norway. nicotine & tobacco research. 2014;16(12):1577-85.

7 Appendix 1: Figures

Figure 1. Municipalities in SAMINOR 2 study

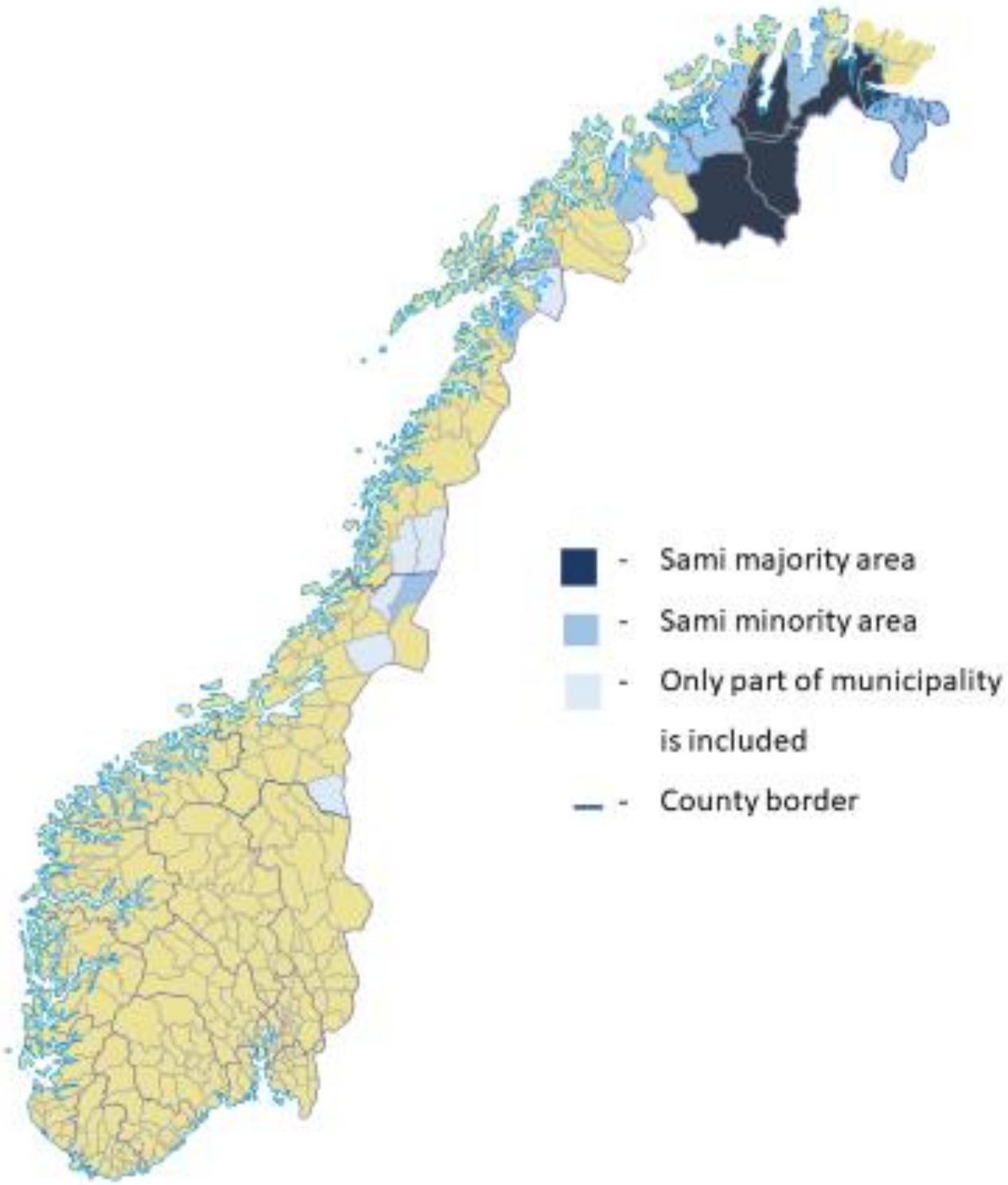


Figure 2. Flow chart of inclusion in the study of self-reported oral health.

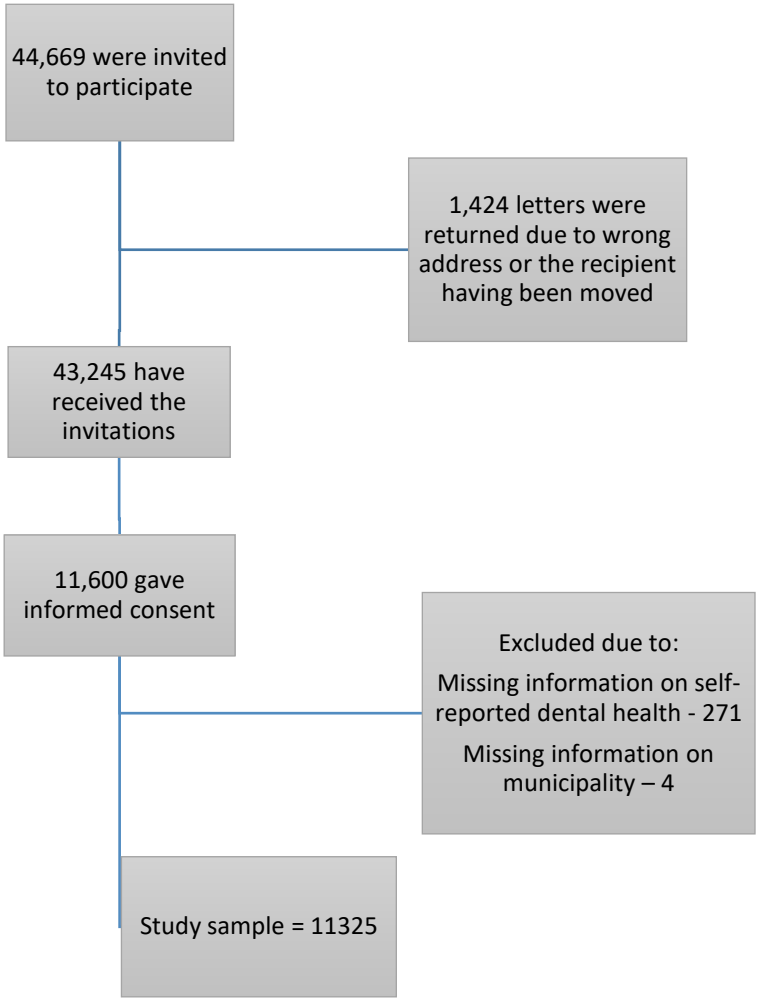


Figure 3. Hierarchical method of entry in the logistic regression model

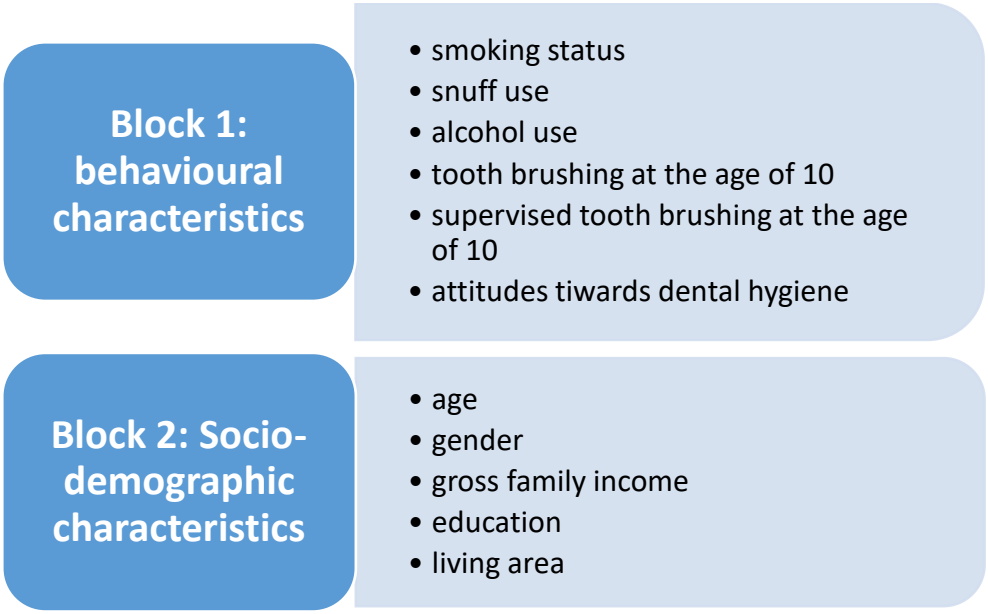
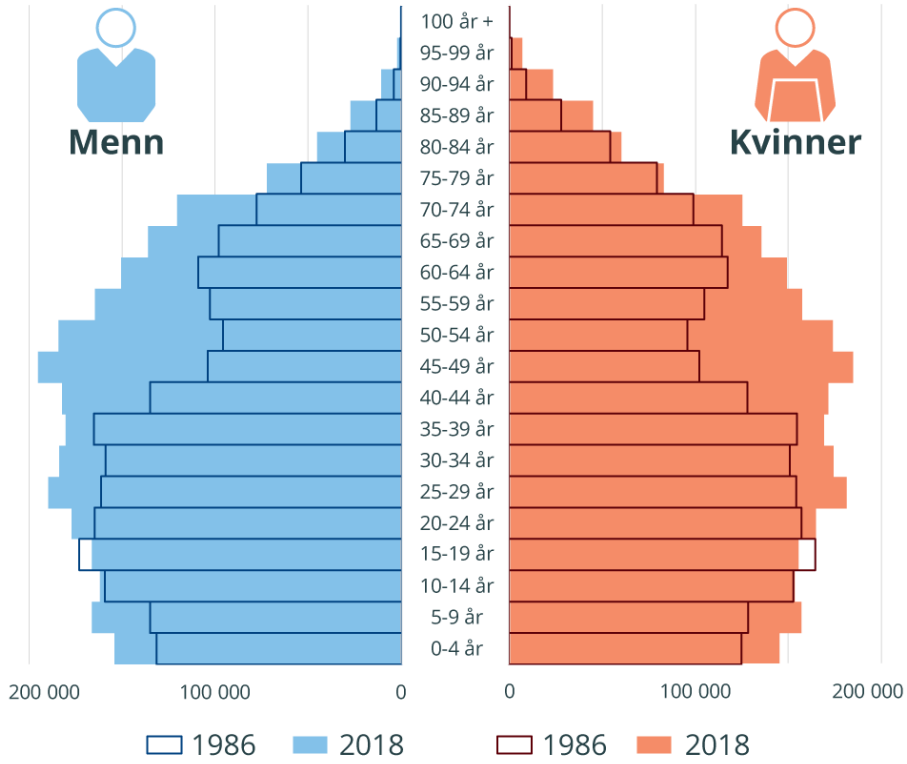
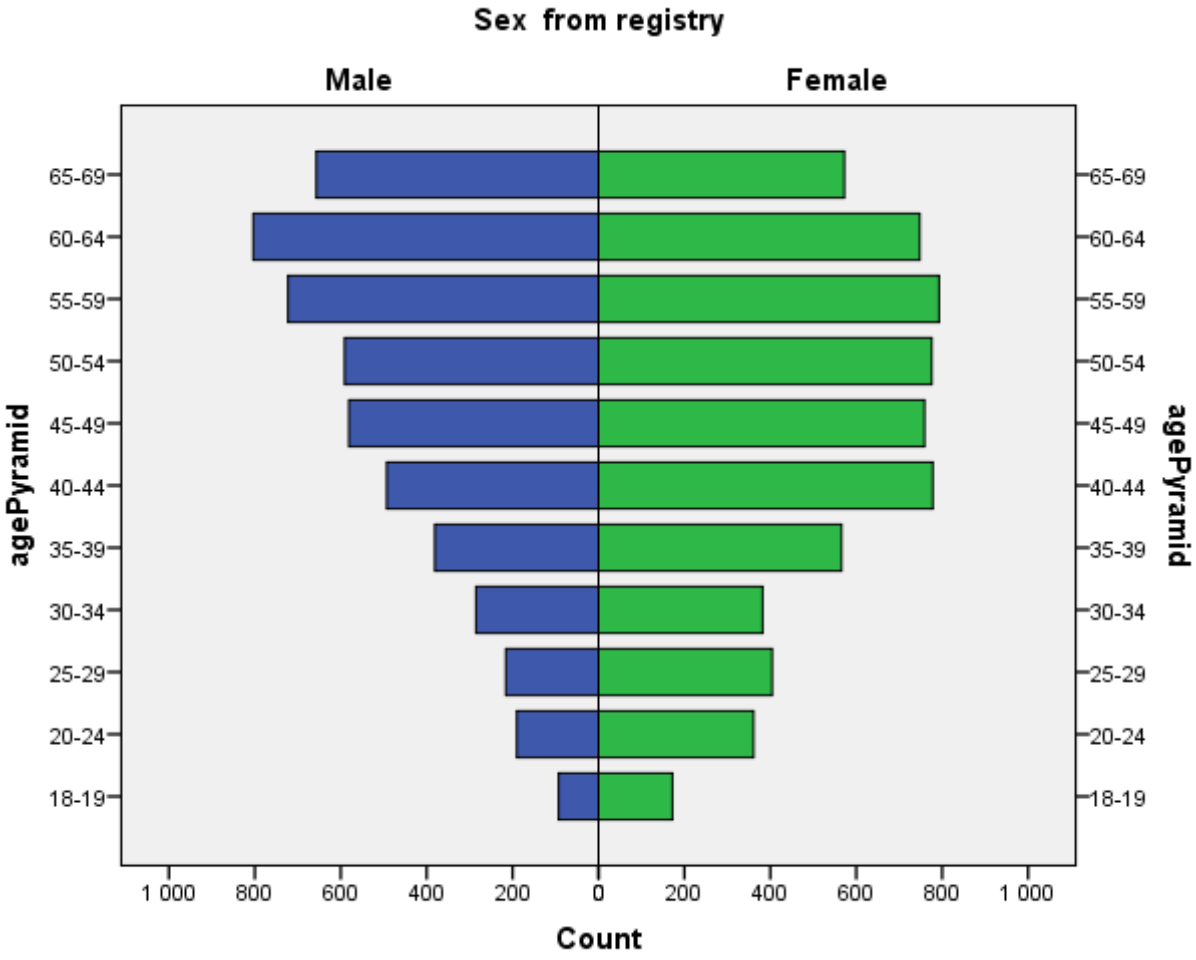


Figure 4. Age distribution in Norwegian population by gender



Source: The Central Bureau of Statistics. Norway. Available from: https://www.ssb.no/befolkning/faktaside/befolkningen

Figure 5. Age distribution in the SAMINOR 2 study by gender



8 Appendix 2: Tables

Table 1. **Demographic characteristics of men and women by residence area in the SAMINOR 2 study.**

	Men					Women				
	Sami majority area		Sami minority area			Sami majority area		Sami minority area		
	n=1015	%/CI	n=3999	%/CI	p-value	n=1347	%/CI	n=4964	%/CI	p-value
Age group					0.654[a]					0.010[a]
18-34	159	15.7	625	15.6		273	20.3	1046	21.3	
35-49	283	27.9	1172	29.3		410	30.4	1693	34.1	
50-69	573	56.5	2202	55.1		664	49.3	2225	44.8	
Gross family income					0.003[a]					<0.001[a]
Low	167	17.0	526	13.5		200	15.6	679	14.2	
Medium	374	38.2	1417	36.5		557	43.3	1812	37.9	
High	439	44.8	1944	50.0		528	41.1	2296	48.0	
Education					0.020[a]					0.001[a]
Primary school	217	21.7	694	17.6		173	13.1	590	12.0	
Secondary school	304	30.4	1222	31.1		299	22.7	1206	24.6	
Higher ≤ 3 years	251	25.1	1013	25.7		310	23.5	1348	27.5	
Higher >3 years	228	22.8	1006	25.6		538	40.8	1756	35.8	
Mean age	49.74	[48.94;50.63]	49.62	[49.22;50.05]	0.789[b]	47.29	[46.56;47.97]	46.36	[46.00;46.76]	0.260[b]
Mean number of education years	12.68	[12.41;12.92]	12.95	[12.84;13.07]	0.560[b]	14.15	[13.93;14.37]	13.86	[13.75;13.97]	0.011[b]

a Pearson's chi-square test
b Independent sample t-test
Subgroups may not be total due to missing values

Table 2. **Characteristics of men and women by smoking status in the SAMINOR 2 study. Subgroups may not be total due to missing values.**

	Men							Women						
	daily smokers		former smokers		never smokers		p-value	daily smokers		former smokers		never smokers		p-value
	n=844	%/SD	n=1947	%	n=2045	%		n=1165	%/SD	n=2241	%	n=2705	%	
Age group							<0.001[a]							<0.001[a]
18-34	81	10.6	225	29.5	458	59.9		178	14.0	360	28.3	736	57.8	
35-50	274	19.1	476	33.2	683	47.7		456	22.1	681	33.0	928	44.9	
51-69	500	18.6	1264	47.0	926	34.4		546	19.2	1215	42.8	1077	37.9	
Gross family income							<0.001[a]							<0.001[a]
low	189	28.8	257	38.0	230	34.0		217	25.3	270	31.5	371	43.2	
medium	353	20.1	718	40.9	683	38.9		475	20.3	881	37.7	980	42.0	
high	292	12.5	939	40.2	1107	47.3		438	15.8	1039	37.5	1293	46.7	
Education							<0.001[a]							<0.001[a]
primary school	215	24.0	420	46.9	261	29.1		177	23.6	308	41.1	264	35.2	
secondary school	297	20.0	651	43.8	539	36.2		408	27.4	577	38.8	502	33.8	
higher ≤3	204	16.5	452	36.5	583	47.1		298	18.3	574	35.2	759	46.5	
higher >3	128	10.5	424	34.9	662	54.5		282	12.6	782	34.8	1180	52.6	
Residence area							0.085[a]							0.024[a]
Sami minority	660	16.9	1588	40.7	1654	42.4		894	18.4	1785	36.7	2180	44.9	
Sami majority	195	19.8	377	38.3	413	41.9		286	21.7	471	35.7	561	42.6	
Snuff use							<0.001[a]							<0.001[a]
Daily snuff users	41	6.3	401	61.5	210	32.2		15	8.5	95	53.7	67	37.9	
Former snuff users	165	23.9	339	49.2	185	26.9		114	31.8	141	39.3	104	29.0	
Never snuff users	643	18.3	1214	34.7	1644	47.0		1044	18.9	1992	36.0	2501	45.2	
Mean N of cigarettes per day	13.68	7.067						11.47	5.666					
Mean N of years of smoking	33.68	11.98						30.18	11.68					

a Pearson's chi-square test ; * Only for daily smokers

Table 3. **Characteristics of men and women by snuff use in the SAMINOR 2 study.** Subgroups may not be total due to missing values.

	Men							Women						
	Daily snuff users		Former snuff users		Never snuff users			Daily snuff users		Former snuff users		Never snuff users		
	n=658	%/SD	n=693	%	n=3505	%	p-value	n=182	%/SD	n=360	%	n=5547	%	p-value
age group							<0.001[a]							<0.001[a]
18-34	193	25.4	153	20.1	415	54.5		131	10.3	205	16.1	941	73.7	
35-50	250	17.5	262	18.3	918	64.2		38	1.9	108	5.3	1902	92.9	
51-69	215	8.1	278	10.4	2172	81.5		13	0.5	47	1.7	2704	97.8	
Gross family income							<0.001[a]							<0.001[a]
low	75	11.2	117	17.4	480	71.4		45	5.4	61	7.3	734	87.4	
medium	205	11.8	218	12.6	131	75.6		64	2.8	122	5.3	2110	91.9	
high	362	15.5	343	14.7	1626	69.8		66	2.4	161	5.9	2522	91.7	
Education							0.001[a]							<0.001[a]
primary school	97	10.9	107	12.1	682	77.0		13	1.8	29	4.0	683	94.2	
secondary school	198	13.4	196	13.3	1082	73.3		32	2.2	60	4.1	1369	93.7	
higher ≤3	195	15.8	196	15.9	844	68.3		73	4.5	142	8.8	1395	86.6	
higher >3	164	13.6	187	15.5	859	71.0		62	2.8	128	5.7	2039	91.5	
Residence area							0.04[a]							0.017[a]
Sami minority	557	14.4	541	13.9	2783	71.7		157	3.3	292	6.1	4341	90.6	
Sami majority	101	10.4	152	15.6	722	74.1		25	1.9	68	5.2	1206	92.8	
Smoking status							<0.001[a]							<0.001[a]
Daily	41	4.8	165	19.4	643	75.7		15	1.3	114	9.7	1044	89.0	
Former	401	20.5	339	17.3	1214	62.1		95	4.3	141	6.3	1992	89.4	
Never	210	10.3	185	9.1	1644	80.6		67	2.5	104	3.9	2501	93.6	
Mean N of snuff portions per day*	10.11	5.82						10.6	6.15					
Mean N of years of snuff use	14.72	12.49						6.17	8.36					

a Pearson's chi-square test

* Only for daily snuff users

Table 4. **Characteristics of men and women by alcohol use in the SAMINOR 2 study.**

	Men							women						
	Never/rarely		Monthly		Weekly			Newer/rarely		Monthly		Weekly		
	n=1331	%	n=1847	%	n=1795	%	p-value	n=2373	%	n=2258	%	n=1619	%	p-value
Age group							<0.001[a]							<0.001[a]
18-34	227	29.2	368	47.4	182	23.4		543	41.5	582	44.5	184	14.1	
35-50	364	25.1	557	38.5	527	36.4		787	37.7	778	37.2	525	25.1	
50-69	740	26.9	922	33.6	1086	39.5		1043	36.6	898	31.5	910	31.9	
Gross family income							<0.001[a]							<0.001[a]
low	289	42.5	220	32.4	171	25.1		442	51.0	293	33.8	131	15.1	
medium	555	31.3	672	37.9	548	30.9		979	41.6	859	36.5	514	21.9	
high	433	18.2	903	38.0	1038	43.7		850	30.3	1022	36.4	934	33.3	
Education							<0.001[a]							<0.001[a]
primary school	337	37.4	329	36.6	234	26.0		401	53.4	236	31.4	114	15.2	
secondary school	424	28.1	564	37.4	521	34.5		607	40.7	549	36.8	337	22.6	
higher ≤3	286	22.8	524	41.8	445	35.5		606	36.9	634	38.6	401	24.4	
higher>3	251	20.4	406	33.0	575	46.7		717	31.4	814	35.7	751	32.9	
Residence area							<0.001[a]							<0.001[a]
Sami minority	1034	26.1	1445	36.5	1485	37.5		1783	36.3	1778	36.2	1355	27.6	
Sami majority	297	29.4	402	39.8	310	30.7		590	44.2	480	36.0	264	19.8	

a Pearson's chi-square test; Subgroups may not be total due to missing values

Table 5. **Characteristics of men and women by tooth brushing habits at the age of 10 in the SAMINOR 2 study.**

	Men							Women						
	Once a day or more		Sometimes		Seldom or never			Once a day		Sometimes		Seldom or never		
	n=3450	%	n=1222	%	n=263	%	p-value	n=5161	%	n=902	%	n=145	%	p-value
age group							<0.001[a]							<0.001[a]
18-34	694	89.5	65	8.4	16	2.1		1227	93.8	71	5.4	10	0.8	
35-50	1226	85.1	190	13.2	24	1.7		1846	88.6	214	10.3	23	1.1	
51-69	1530	56.3	967	35.6	223	8.2		2088	74.1	617	21.9	112	4.0	
Gross family income							<0.001[a]							<0.001[a]
low	404	59.8	209	30.9	63	9.3		664	77.3	155	18.0	40	4.7	
medium	1143	64.8	507	28.7	115	6.5		1881	80.3	395	16.9	66	2.8	
high	1819	77.0	464	19.7	78	3.3		2447	87.7	311	11.1	33	1.2	
Education							<0.001[a]							<0.001[a]
primary school	447	50.5	355	40.1	83	9.4		485	65.5	216	29.2	39	5.3	
secondary school	1012	67.3	410	27.3	81	5.4		1166	79.0	264	17.9	46	3.1	
higher ≤3	948	75.7	248	19.8	56	4.5		1428	87.3	179	10.9	29	1.8	
higher >3	997	81.4	191	15.6	37	3.0		2014	88.5	233	10.2	29	1.3	
Residence area							<0.001[a]							<0.001[a]
Sami minority	2833	71.8	930	23.6	180	4.6		1783	36.3	1778	36.2	1355	27.6	
Sami majority	617	62.2	292	29.4	83	8.4		590	44.2	480	36.6	264	19.8	

[a] Pearson's chi-square test

Subgroups may not be total due to missing values

Table 6. **Characteristics of men and women by supervised tooth brushing at the age of 10 in the SAMINOR 2 study.**

	Men							Women						
	Once a day or more		Sometimes		Seldom or never			Once a day or more		Sometimes		Seldom or never		
	n=1554	%	n=2193	%	n=1116	%	p-value	n=2005	%	n=2337	%	n=1801	%	p-value
age group							<0.001[a]							<0.001[a]
18-34	456	59.2	236	30.6	78	10.1		755	58.0	395	30.4	151	11.6	
35-50	585	40.9	626	48.3	219	15.3		644	31.2	812	39.3	611	29.6	
51-69	513	19.3	1331	50.0	819	30.8		606	21.8	1130	40.7	1039	37.4	
Gross family income							<0.001[a]							<0.001[a]
low	184	28.0	280	42.6	194	29.5		295	34.7	280	33.0	274	32.3	
medium	510	29.3	793	45.5	438	25.2		687	29.7	907	39.2	721	31.1	
high	815	34.8	1073	45.8	453	19.4		946	34.1	1079	38.9	748	27.0	
Education							<0.001[a]							<0.001[a]
primary school	179	20.7	387	44.7	299	34.6		146	20.1	290	39.9	290	39.9	
secondary school	438	29.5	714	48.1	331	22.3		411	28.1	571	39.1	479	32.8	
higher ≤ 3	448	36.1	563	45.4	230	18.5		617	38.0	605	37.3	401	24.7	
higher >3	471	38.9	501	41.3	240	19.8		808	35.8	843	37.4	606	26.8	
Residence area							<0.001[a]							<0.001[a]
Sami minority	1263	32.5	1796	46.2	825	21.2		1628	33.7	1877	38.9	1326	27.4	
Sami majority	291	29.7	397	40.6	291	29.7		377	28.7	460	35.1	475	36.2	

a Pearson's chi-square test

Subgroups may not be total due to missing values

Table 7. **Distribution of attitudes towards dental hygiene by gender in SAMINOR 2 study. N=3168**

	men		women		p
	n	%	n	%	
Help with tooth brushing for children aged <6 (Check 6)					<0.001
Often, almost daily	1107	76.0	1541	89.9	
Sometimes	197	13.5	104	9.5	
Seldom or never	150	10.3	69	4.0	
Help with tooth brushing for children aged 6-12 (Check 6-12)					<0.001
often, almost daily	824	54.1	1221	65.6	
sometimes	500	32.8	532	28.6	
seldom or never	200	13.1	107	5.8	
Having a rule of eating sweets (Candy)					<0.001
yes	1148	66.4	1582	72.8	
no	580	33.6	592	27.2	

a Pearson's chi-square test

Subgroups may not be total due to missing values

Table 8. **Characteristics of men and women by attitudes toward dental hygiene in the SAMINOR 2 study.**

	Men					Women				
	positive		indifferent			positive		indifferent		
	n=1054	%	n=629	%	p-value	n=1529	%	n=613	%	p-value
age groups					<0.001[a]					0.065[a]
18-34	176	65.7	92	34.3		368	70.1	157	29.9	
35-50	604	65.8	314	34.2		901	73.2	330	26.8	
51-69	274	55.1	223	44.9		260	67.4	126	32.6	
Gross family income					<0.001[a]					<0.001[a]
Low	79	52.0	73	48.0		122	57.8	89	42.2	
Medium	294	57.0	222	43.0		503	70.4	211	29.6	
High	666	67.8	317	32.2		853	74.6	290	25.4	
Education					<0.001[a]					<0.001[a]
Primary school	141	51.8	131	48.2		144	64.6	79	35.4	
Secondary school	292	59.5	199	40.5		270	65.4	143	34.6	
Higher ≤3	285	63.5	164	36.5		412	70.9	169	29.1	
Higher >3	327	72.2	126	27.8		685	76.1	215	23.9	
Residence area					0.891[a]					0.491[a]
Sami minority	845	62.5	506	37.5		1217	71.0	496	29.0	
Sami majority	209	63.0	123	37.0		312	72.7	117	27.3	

a Pearson's chi-square test
Subgroups may not be total due to missing values

Table 9. **Characteristics of men and women by SROH in the SAMINOR 2 study.**

	Men					Women				
	Good		Poor			Good		Poor		
	n=3442	68.7%	n=1572	31.3%	p-value	n=4886	77.4%	n=1426	22.6%	p-value
Age group					<0.001					<0.001
18-34	577	73.6	207	26.4		1083	82.1	236	17.9	
35-50	1116	76.7	339	23.3		1720	81.8	383	18.2	
51-69	1749	63.0	1026	37.0		2082	72.1	807	27.9	
Gross family income					<0.001					<0.001
Low	356	51.4	337	48.6		586	66.7	293	33.3	
Medium	1149	64.2	642	35.8		1768	74.6	601	25.4	
High	1853	77.8	530	22.2		2366	83.8	458	16.2	
Education					<0.001					<0.001
primary school	481	52.8	430	47.2		474	62.1	289	37.9	
secondary school	1020	66.8	506	33.2		1106	73.5	399	26.5	
higher ≤3	921	72.9	343	27.1		1324	79.9	334	20.1	
higher >3	972	78.8	262	21.2		1920	83.7	374	16.3	
Residence area					<0.001					<0.001
Sami minority	2822	70.6	1177	29.4		3931	79.2	1033	20.8	
Sami majority	620	61.1	395	38.9		954	70.8	393	29.2	
Smoking status					<0.001					<0.001
Daily	420	49.1	435	50.9		777	65.8	403	34.2	
Former	1288	65.5	677	34.5		1730	76.7	526	23.3	
Never	1660	80.3	407	19.7		2278	83.2	463	16.9	
Snuff use					0.08					0.154
Daily	472	71.7	186	28.3		148	81.3	34	18.7	
former	456	65.8	237	34.2		290	80.6	70	19.4	
Never	2426	69.2	1079	30.8		4282	77.3	1265	22.8	
Alcohol use					<0.001					<0.001

never/rarely	825	62.0	506	38.0		1740	73.3	633	26.7	
Monthly	1311	71.0	536	29.0		1793	79.4	465	20.6	
Weekly	1285	71.6	510	28.4		1317	81.3	302	18.7	
toothbrushing at the age of 10					<0.001					<0.001
Yes	2585	74.9	865	25.1		4177	80.9	984	19.1	
No	813	54.7	672	45.3		641	61.2	406	38.8	
Supervised toothbrushing at the age of 10					<0.001					<0.001
Yes	1202	77.3	352	22.7		1678	83.7	327	16.3	
No	2153	65.1	1156	34.9		3087	74.6	1051	25.4	
Attitudes towards dental hygiene**					<0.001					0.055
positive	794	75.3	260	24.7		1208	79.0	321	21.0	
indifferent	408	64.9	221	35.1		461	75.2	152	24.8	

a Pearson's chi-square test
Subgroups may not be total due to missing values

* Only for daily smokers

**analysis is based on a subsample of 3825 subjects

Table 10. Crude and adjusted odds ratios (OR) for poor SROH. The results are adjusted for age, gender (women-2; men-1), income, education, residence area (Sami majority-1; Sami minority-0), smoking, alcohol use, snuffing, tooth brushing at the age of 10, supervised tooth brushing at the age of 10 and attitudes towards dental hygiene.

	Crude OR	p-value	CI	adjusted OR	p-value	CI
Age categories						
18-34	1			1		
35-50	0.954	0.487	[0,836;1,087]	0.721	0.003	[0.579;0.897]
50-69	1.793	<0.001	[1,637;2,077]	0.995	0.972	[0.767;1.292]
Gender	0.639	<0.001	[0,588;0,695]	0.776	0.007	[0.645;0.933]
Gross family income						
low	1			1		
medium	0.637	<0.001	[0,565;0,719]	0.770	0.058	[0.588;1.009]
high	0.350	<0.001	[0,310;0,396]	0.520	<0.001	[0.370;0.727]
Education						
Primary school	1			1		
Secondary school	0.565	<0.001	[0,499;0,640]	1.013	0.921	[0.783;1.311]
Higher ≤3	0.401	<0.001	[0,352;0,456]	0.755	0.042	[0.576,0.990]
Higher >3	0.292	<0.001	[0,257;0,332]	0.713	0.015	[0.542;0.937]
Residence area	1.530	<0.001	[1,387;1,687]	1.364	0.002	[1.121;1.661]
Smoking						
Never	1			1		
Former	1.804	<0.001	[1,634;1,993]	1.491	<0.001	[1.231;1.807]
Daily	3.169	<0.001	[2,825;3,554]	2.633	<0.001	[2.108; 3.290]
Alcohol use						
Never/rarely	1			1		
Monthly	0.726	<0.001	[0,657;0,802]	0.709	<0.001	[0.585; 0.859]
Weekly	0.703	<0.001	[0,633;0,781]	0.680	0.001	[0.546; 0.848]
Snuff use						
Never	1			1		
Former	1.015	0.852	[0,865;1,193]	1.199	0.185	[0.917;1.568]
Daily	1.178	0.023	[1,023;1,356]	1.521	0.006	[1.130;2.047]
Tooth brushing at the age of 10						
Once a day or more	1			1		
Sometimes	2.532	<0.001	[2,532;2,290]	1.761	<0.001	[1.402;2.213]
Seldom/never	3.841	<0.001	[3,841;3,142]	2.592	<0.001	[1.628;4.126]
Supervised tooth brushing at the age of 10						
Often (Almost daily)	1			1		
Sometimes	1.457	<0.001	[1,309;1,621]	1.255	0.029	[0.023;1.539]
Seldom/never	2.382	<0.001	[2,128;2,666]	1.500	0.001	[1.182;1.904]
Attitudes towards dental hygiene	0.791	0.166	[0,568;1.102]	0.830	0.035	[0.698;0.987]