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Department of Clinical Dentistry
Faculty of Health Sciences

The association between children's oral health and parents' socioeconomic position in Northern Norway

Jeanett Kraukle Thomassen and Beate Larsen
Supervisor: Lina Stangvaltaite-Mouhat
Co-supervisor: Lars-Inge Byrkjeflot
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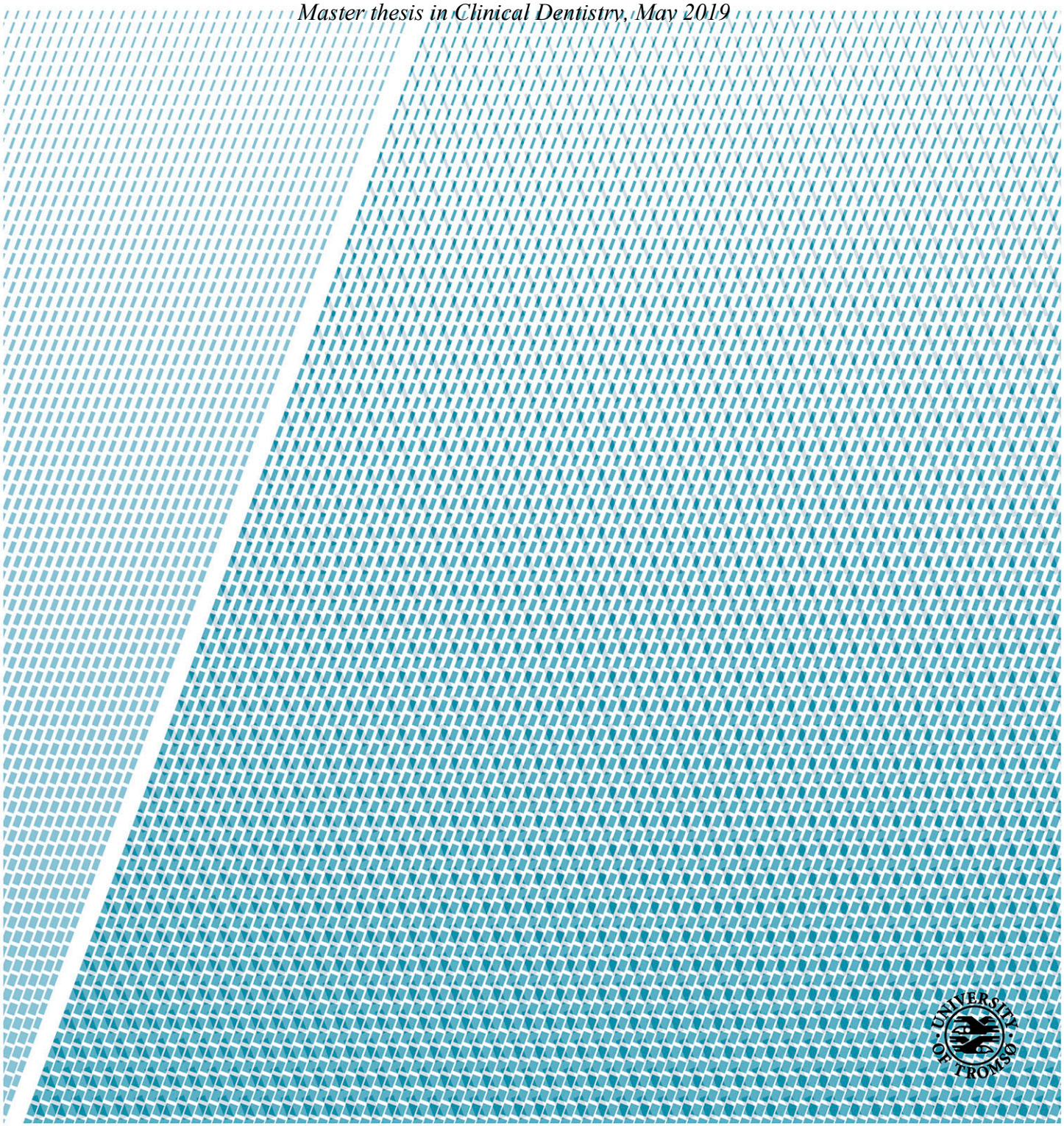

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This master thesis has been written by Jeanett and Beate. Jeanett was the one who prepared the envelopes for delivering and sending, while Beate filled in the data from the questionnaires in a SPSS file. Most of the analysis and writing has been done together.

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Abstract

Background: Dental caries is the most common chronic disease in children. In Norway there are government sponsored programs that give all children (0-18 years) free public dental treatment. This program seems to reduce the social gap in oral health compared to countries where dental treatment is paid out-of-pocket. There are indications that not all children in Norway benefit equally good from this program.

Aims: The first aim of this thesis was to assess caries experience expressed as DMFT/dmft index among children in Northern Norway (Tromsø, Storslett and Mosjøen). The second aim was to investigate the association between children´s oral health and their parents´ socioeconomic position (SEP).

Materials and method: This was a cross sectional study, that included 140 children and their parents. The children in the study were between 5 and 12 years old. The sample was recruited at University Dental Clinic in Tromsø (82, 30%), public dental clinic in Storslett (19, 76%) and public dental clinic in Mosjøen (39, 83%). Data was collected using a structured questionnaire asking about the child's gender, age, living area, number of people in the household, how long the child has lived in Norway, who the child lives with, last dental visit and the reason for the visit, rating of the child's oral health, frequency of tooth brushing, help with tooth brushing, use of dental cleaning products, chronic diseases, medication, intake of sugar, parents´ age/education/occupation, household income and residence. DMFT/dmft value was measured on a routinely dental examination by a dentist or a dental hygienist.

Results: The total mean caries experience was higher among older children. It was lowest for children at 5 years old (0,1 (0,4)) compared to children at 6-, 7-, 8,- 9, 11- and 12 years old ((0,4 (1,0)), (0,3 (0,7)), (0,5 (1,0)), (0,5 (0,7)), (0,6 (1,2)), (1,1 (2,0)) and (1,0 (1,4)), respectively). This difference was not statistically significance.

The odds for a child to have DMFT≥1 decrease by 0,8 with each 50000NOK higher income (p=0,058).

Children with a father that only had completed primary school/ high school education had 10,4 times higher odds to have DMFT≥1 (adjusted OR: 10,435; 95% CI1,461-74,513).

Conclusions: According to multivariable binary logistic regression analysis, having a father with low education was associated with DMFT≥1 of the child. Even in a rich country like Norway, social inequalities in oral health based on father's education and income already at the age of 5-12 years could be observed. More studies are needed in order to investigate social inequalities among children in Northern Norway.

Keywords: child, oral health, parents' socioeconomic position, DMFT, questionnaire, northern Norway

1. Introduction

1.1 What is dental caries?

Dental caries is a localized chemical dissolution of the tooth surface by acidic byproducts from bacterial fermentation of dietary carbohydrates. A dental carious lesion is related to a shift in the microbiological activity of the biofilm on the tooth surface, where an imbalance in the equilibrium between mineralization and demineralization of the tooth has developed (1, 2).

1.2 Contributing factors for dental caries

Many factors can have significant impact on the development of dental caries. Oral environmental factors play an important role when it comes to the composition of the saliva, the salivary flow, buffer capacity, the ion composition in saliva (Ca^{2+} and PO_4^{2+}) and the pH of dental plaque (3-5). Personal factors have also been proved to affect the development of dental caries. This include knowledge, attitudes, oral health literacy, behavior (oral hygiene, snacking, frequency of sugar intake, how often one visits the dentist and use of tobacco), general health, medication and ethnicity (3-8). Socioeconomic indicators, which include education, occupation, income and household have also an impact on the development of dental caries (9-11).

1.3 Prevalence of dental caries worldwide

Although dental caries is preventable, it is the most prevalent chronic disease in both children and adults (12). In 2015 it was included in the Global Burden of Disease Study and ranked as the 1st most prevalent condition for decayed permanent teeth (2.3 billion people) and 12th most prevalent condition for decayed deciduous teeth (560 million children) (13). There is estimated that approximately 44% of all people around the world have untreated dental caries. This includes primary and permanent teeth (14).

1.4 The arrangement of the dental health care system in the Nordic countries

Norway, Sweden, Finland and Denmark have many similarities in the structure of the dental health care system. The common similarities are free dental care for all children offered in the public dental service (15).

1.5 Situation in Norway

Norway is a relatively rich country with a well-developed oral health care system. The law: "Lov om tannhelsetjenesten", that was introduced 01.01.1984, states that all children are entitled to receive free public dental care (16). The Public Dental Service provides free-of-charge, regular and outreach dental service to all children and adolescents 0-18 years of age (16, 17). Regularly means often enough to maintain a satisfactory dental/oral health, and outreach offer means that the dental service should provide notice and follow-up if the patient is not meeting.

The number of children with no caries experience has increased since the law was introduced. In 1985 there were about 49,6% children with no caries experience at the age of 5 years and 18,9% children at the age of 12 years, compared to 2017 where there were 81% children with no caries experience at the age of 5 years and 60% children at the age of 12 years (18-20). During this period there has also been a noticeable decrease in the difference of the DMFT values among children in the Northern and Southern part of Norway (18).

In Norway there are two guidelines that are in use in the dental practice: the guideline "God Klinisk Praksis i tannhelsetjenesten - En veileder i bruk av faglig skjønn ved nødvendig tannbehandling" that was introduced in 2011 and the guideline "Nasjonal faglig retningslinje for tannhelsetjenester til barn og unge 0-20 år" that was introduced in 2018. The aims of these guidelines were to reduce inequalities in oral health between people with different socioeconomic position (SEP), increase the competence about oral health among practitioners, increase the availability of dental service overall and prevent oral diseases (21, 22).

1.6 The association between children´s oral health and parents´ SEP

There are several indicators for SEP, but the most used are: education, income, occupation and household conditions (23, 24). Findings from studies have shown that there is an association between SEP and oral health among adults (25). There are for example evidence that poor oral health, like dental caries, periodontal disease or oral cancer is related to low SEP among adults (25-27). Several studies have also tried to investigate the association between SEP and children's oral health (9, 28, 29). A study from Lithuania showed that parents with low SEP had lower attention to their child's dental care (30). An American study investigated the relation between parents´ SEP and beverage consumption among children. Findings from this study could partially explain the caries experience. Children from a low

SEP family background had a higher beverage consumption and higher caries experience compared to children from a high SEP family (31). A Swedish study published in 2019 showed that SEP was a more strongly related risk of caries experience compared to age and gender (32).

1.7 The association between children's oral health and parents´ SEP in Norway

To our knowledge there is only one study performed in Norway investigating how parents´ SEP influence children's oral health. This study showed an association between caries prevalence and parent-related factors like education, national origin, oral health behaviors and attitudes (6). To our knowledge there are no study investigating how parents´ SEP influences their child's oral health in the Northern Norway. More studies are therefore needed.

2. Aims

The first aim is to assess caries experience among children in Northern Norway (Tromsø, Storslett and Mosjøen). The second aim is to investigate the association between children's oral health and their parents´ SEP.

3. Material and Method

3.1 Sample

This study had a cross-sectional design. The sample was collected during the period from April to December 2018.

All children between 5 and 12 years old (all children that turned 5 years and the ones that were 12 years were eligible for this study), who were attending follow-up or treatment at the University Dental Clinic (UDC), Sonjatun Dental Clinic in Storslett (SDC) and Mosjøen Dental Clinic (MDC), and their parents were invited to participate in this study. The total sample size was calculated based on how many children there are in the age group of 5-12 year old that lived in Tromsø, Storslett and Mosjøen (SSB) and an online calculator (33) with 95% CI and margin of error at 5%. It was calculated that 270 respondents were needed to represent Northern Norway if 20% refused to participate. Out of total 343 invited children, 143 responded (41% response rate). This consisted of the response rates: 84 (31%)

participants from UDC, 19 (76%) participants from SDC and 40 (85%) participants from MDC. Out of them, 3 responders were excluded from the analyses due to no access to their dental journal (OPUS).

3.2 Questionnaire

In Tromsø, a questionnaire was sent with the invitation for regular examination. In the same envelope, there was also an invitation letter explaining the purpose of the study and an informed consent. In Storslett and Mosjøen this was delivered at the clinic after the clinical examination. The envelopes that were delivered out at SDC and MDC, were prepaid to ensure a higher response rate. The questionnaire consisted of 21 questions. Out of them 10 questions were extracted from WHO "Oral Health Surveys Basic Methods" (34), while 11 were based on other studies and guidelines. The questionnaire was first made in English and then translated into Norwegian.

3.2.1 Outcome variable

Measured oral health was assessed according to the DMFT index, which was collected in a routinely dental examination. *DT* stands for decayed teeth and describes tooth surfaces that are cavitated and have to be treated, which includes caries degree 3-5 according to UiO/UiT classification. *MT* describes number of missing teeth due to caries and *FT* describes number of filled teeth. All the dental clinics that participated in this study used OPUS (OPUS Dental Planmeca oy, version 7.1), which is an oral health journal system. This system measures the DMFT value according to the information typed in during a dental examination. This allowed the examiner to extract the DMFT value directly from the system, without any need for further calculation.

The DMFT value was based on a clinical examination and BiteWing radiographs (BW) when indicated. Whether it is an indication to take an BW depends on the need for further information to make a diagnose (35). If there is suspected approximal caries or bone loss, or if one wants to follow-up an earlier caries lesion, BW is also indicated. The DMFT value was collected by approximately 36 dental students at UDC, three dental hygienists at SDC and two dental hygienists at MDT. At UDC, the DMFT value was extracted by the master students, while the dental hygienist extracted the DMFT values at SDT and MDT. When a patient had a mixed dentition, the DMFT values for the primary (dmft) and the permanent (DMFT) dentition were added together and used as one DMFT value. This value was then

dichotomized into: DMFT=0 and DMFT≥1. These groups were used in the statistical analysis.

3.2.2 Socio-economic position indicators

The information about SEP indicators was collected from the questionnaire. The parents´ SEP included questions related to the parents' education, occupation, income and household tenure.

The question about the parents´ education was obtained from WHO "Oral Health Surveys Basic Methods" (34). The parents' education was based on the question: "What level of education have you/your partner completed?" The participants could choose between: 1) *Primary school*, 2) *High school* and 3) *College/university*. The categories were dichotomized into: 1) *Primary school and high school* and 2) *College/university*. College/university was used as the reference group in the binary logistic regression analysis. Based on an American study that found a correlation between parents´ health-risk lifestyles on adolescents and gender symmetry (fathers´ health risk lifestyle affected only boys and mothers´ health risk lifestyle affected only girls) (36), the parents´ education were divided into mother´s and father´s education. By using the informed consent, the parents' education was sorted into mother's and father's education. When only one parent had signed the informed consent, it was assumed that the parent that answered the questionnaire was "you" and the other was "your partner". When both parents had signed the informed consent, it was assumed that the first was "you" and the second was "your partner".

The questions about parents´ occupation, income and household were based on other studies that showed an association between SEP indicators and dental caries in children (9, 10) and a study of optimal indicators of SEP for health research (23).

The question regarding the parents´ occupation was based on "What is your/your partner's occupation?". The participants were asked to fill in their occupation. The parents´ occupation were also here divided into the mother's and the father's occupation based on the informed consent (the same method as education).

The parents´ professions were categorized according to "Standard for Occupational Classification" published on SSB (37). This classification is based on an International

Standard for Occupational Classification from ILO 2008 - International Standard Classification of Occupations - ISCO 08. By using this categorization, occupations will fall into the following categories:

0. Military professions and unspecified
1. Leaders
2. Academic professions
3. College
4. Office
5. Sales and service professions
6. Farmers, fishermen, etc.
7. Craftsmen
8. Process and machine operators, transportation workers, etc.
9. Cleaners, assistants, etc.

The categories were categorized into: 1) *Academic professions and college*, 2) *Leaders, office, sales and service professions* and 3) *Farmers, fishermen, craftsmen, process and machine operators, transportation workers, cleaners and assistants*. Academic professions and college were used as the reference group in the binary logistic regression analysis.

The household income was based on the question: "How big is the household´s yearly income?" The participant could write the amount on a line. The total household income was divided by the number of persons living in the household to get an income per person (one unit is one NOK). Based on this value, it was made a new value that represent every 50000 NOK, which was used in the statistical analysis as a continuous variable.

The information about household tenure was dichotomized: 1) *Homeowner* and 2) *Housing cooperatives and rented.* These categories were used in the statistical analysis. Homeowner was used as the reference group in the binary logistic regression analysis.

3.2.3 Demographic characteristics

Demographic characteristics were collected from the questionnaire. Three questions about the child's and parents´ demographic characteristics were obtained from WHO "Oral Health Surveys Basic Methods" (34). This included gender (boy/girl), age and living area (urban/periurban/rural). The question, "How many years has the child lived in Norway?" is

based on a Danish study that found major inequalities in dental health between children from families with non-Danish background and Danish background. Children with non-Danish background had worse dental health compared to children with Danish background (38). Age and the if the child has lived abroad were recorded as a continuous variable and was in this form used in the statistical analysis.

The question that asked about who the child lives with had following answer options: 1) *Both parent*s, 2) *Mother,* 3) *Father*, 4) *Mother and stepfather,* 5) *Father and stepmother,* and 6) *Others.* Due to a small sample size the answers were categorized into four groups: 1) *Both parent*s, 2) *Mother or father*, 3) *Mother and stepfather or father and stepmother,* and 4) *Others.* Both parents was used as the reference group in the binary logistic regression analysis.

3.2.4 Oral health behavior

The questions about how often the child brush his/her teeth and which oral hygiene products the child use to clean his/her teeth were obtained from WHO "Oral Health Surveys Basic Methods" (34). The question about how often the child gets help with tooth brushing was based on national guidelines from Helsedirektoratet (21). Information about the child's oral hygiene was collected by use of following questions: "How often does your child brush his/her teeth, "How often does your child get help to brush his/her teeth", "Does your child use any of the following daily: toothpaste with fluoride, toothpaste without fluoride, toothpicks, dental floss, mouthwash, fluoride tablets, others (what?)". The answers for the tooth brushing and help with tooth brushing frequency were first categorized into: 1) *Not every day*, 2) *Once a day* 3) *Twice a day* and 4) *More than twice a day*. In the statistical analysis the answers were dichotomized into 1) *Brushing two times a day or more*, 2) *Brushing 1 time a day or less*. Brushing two times a day or more was used as the reference group in the binary logistic regression analysis. The answers regarding oral hygiene products were dichotomized into: 1) "*Very good*" - fluoride toothpaste, interdental cleaning *and* fluoride substitutes, 2) "*Good*" - fluoride toothpaste, interdental cleaning *or* fluoride substitutes (this included also those who answered only fluoride toothpaste), 3) "*Bad*" - toothpaste without fluoride and/or interdental cleaning. "Very good" – fluoride toothpaste, interdental cleaning and fluoride substitutes was used as the reference group in the binary logistic regression analysis.

When it comes to collecting information about the child's sugar intake frequency, the following question from WHO "Oral Health Surveys Basic Methods" was used: "How often does your child eat/drink any of the following: 1) *Cookies/cakes/buns*, 2) *Ice cream*, 3) *Sugar-containing cereals*, 4) *Chocolate milk*, 5) J*am or honey*, 6) *Candy*, 7) *Juice/concentrated juice (containing sugar)*, 8) *Soda (containing sugar)* and 9) *Sugar-containing hot drinks (coffee, tea, hot chocolate) (34)*. The parents could encircle around one of the following frequencies: 1) *Never*, 2) *Several times a month*, 3) *Once a week,* 4) *Several times a week*, 5) *Every day* and 6) *Several times a day.* The recorded score was categorized into three different groups: 1) *Low intake of sugar* (9-18 points), 2) *An average intake of sugar* (19-36 points) and 3) *High intake of sugar* (37-54 points). Low intake of sugar was used as the reference group in the binary logistic regression analysis. Each tick in the questionnaire is equal to one point, so the lowest score was 9 points and the highest 54 points.

3.2.5 General health

As known, diseases and medications may have an impact on the oral health. A disease like asthma may for example promote dental caries (39). Medications may also promote dental caries if it contains sugar or gives xerostomia (40, 41). The questions about disease and medication were based on the studies that show a correlation between diseases/medications and dental caries/lesions (40, 42-44). Information regarding the child's general health, were collected by use of the following questions: "Does your child have any chronic disease?" and "Does your child use any medications regularly (if yes, which)?" The participant could choose between the two options: 1*) Yes* and 2) *No*. If yes, the participant had a line to write which chronic disease. No were used as the reference group in the binary logistic regression analysis.

3.2.6 Last dental visit

Both questions about the last dental visit were obtained from WHO "Oral Health Surveys Basic Methods" (34). The last dental visit at the dental clinic was perceived by following question: "How long is it since your child last visited the dental clinic?" The participants could choose between: 1) *Lesser than 6 months*, 2) *6-12 months*, 3) *More than 1 year, but lesser than 2 years*, 4) *2 years or more, but lesser than 3 years*, 5) *3 years or more* and 6) *Has never been summoned.*

The reason for the last visit at the dental clinic was based on the following question: "What was the reason of your child's last visit at the dental clinic?" The participant could choose between four different options which then were dichotomized into: 1) *Regular dental check up* and 2) *Treatment/don't remember*, which included treatment, follow up, pain or problems in the mouth.

3.3 Ethics

The study was performed in compliance with Good Clinical Practice and the Declaration of Helsinki. The ethics approval was obtained from the Regional Ethical Committee in Northern Norway (reference number 2017/1643/REK nord).

Prior to signing an informed consent form, all participants in Tromsø were introduced to the research in written form. In SDC and MDC they were introduced orally and in written form. A comprehensive information letter was provided that included the following:

- an invitation to participate in the study voluntarily and ensuring of anonymity,
- the explanation of the research aim, research design, procedures to be carried out by the investigator, the expected duration of the individual's participation, any foreseeable risks or discomfort, benefits, confidentiality,
- withdrawal procedure from the research,
- contact details of the investigators in case of any questions before and during the research.

A sufficient amount of time (at least 24 hours) was provided to decide if one wanted to participate in the study or not. The decision should only be made after ascertaining that participants and/or their parents had an adequate understanding about this study. An informed consent had to be signed if they wanted to participate.

3.4 Statistics

Statistical analysis was performed in Statistical Package for the Social Science (SPSS, Version 25 IBM, Somers, New York, NY). Kruskal-Wallis test was used to find if there was any statistical significance difference between DMFT values and different age groups. Univariable binary logistic regression analysis was used to find any associations between the SEP indicators and co-variables, and the DMFT values in order to find crude odds ratios (OR). The co-variables that resulted in $p \geq 0,1$in the univariable binary logistic regression

analyses were adjusted for in a multivariable binary logistic regression analysis in order to find adjusted OR for SEP indicators and DMFT values. The analysis was performed with DMFT as the dependent variable and the co-variables as independent variables.

Nagelkerke R^2 was used to investigate how much the outcome was explained by the SEP-indicators and co-variables in a multivariable binary logistic regression analysis (45). Hosmer and Lemeshow test were recorded for a multivariable binary logistic regression analysis, as is an index that describes how well the model fits the data. This is often based on the correspondence between the data predicted by the model and the data that actually were collected (45). The level of significance was set at p=0,05 and 95% CI.

4. Results

The response rate in UDC, SDC and MDC were: 31% (n=84), 76% (n=19) and 85% (n=40). After excluding questionnaires where the DMFT values were missing, the final study sample consisted of 30% (n=82) UDC, 76% (n=19) SDC and 83% (n=39) MDC (Table 1). In total there were 70 girls and 70 boys who participated in this study rendering a response rate of 41% (n=140) (Tables 1, 2).

The mean DMFT value for the study population was 0,35. The lowest caries prevalence (DMFT≥1**)** and experience was seen in children at 5 years old (5%, 0,4) compared to 6-, 7-, 8-, 9-, 10-, 11- and 12- year olds ((18%, 1,0), (25%, 0,7), (27%, 1,0), (37,5%, 0,7), (25%, 1,2), (37,5%, 2,0), (45,5%, 1,4), respectively) (Tables 2,3). According to Kruskal-Wallis test none of the age groups were statistically significantly different from each other in terms of DMFT value (p=0,163).

Table 1. Sample size and response rate

	UDC	SDC	MDC	Total
Number of respondents	82	19	39	140
Number of	271	25	47	343

invitations sent				
Response rate	30%	76%	83%	41%

Table 2. The number of responders divided into different age groups and the caries experience (mean DMFT (SD)) in different age groups and gender

DMFT/dmft responders																
The number of participants separated in different age groups	*20 (14,3%)*		*11 (7,9%)*		*32 (22,9%)*		*22 (15,7%)*		*8 (5,7%)*		*20 (14,3%)*		*16 (11,4%)*		*11 (7,9%)*	
	5 year		*6 year*		*7 year*		*8 year*		*9 year*		*10 year*		*11 year*		*12 year*	
Number (Boys/ Girls)	*13*	*7*	*7*	*4*	*14*	*18*	*12*	*10*	*2*	*6*	*8*	*12*	*10*	*6*	*4*	*7*
Mean DMFT (SD)	*0,0 (0,0)*	*0,2 (0,7)*	*0,0 (0,0)*	*1,2 (1,5)*	*0,7 (0,9)*	*0,1 (0,3)*	*0,6 (1,0)*	*0,5 (1,0)*	*0,0 (0,0)*	*0,6 (0,8)*	*0,5 (1,4)*	*0,6 (1,2)*	*1,4 (2,5)*	*0,6 (1,2)*	*1,0 (1,4)*	*1,0 (1,5)*
Total mean DMFT (SD) boys and girls added together	*0,1 (0,4)*		*0,4 (1,0)*		*0,3 (0,7)*		*0,5 (1,0)*		*0,5 (0,7)*		*0,6 (1,2)*		*1,1 (2,0)*		*1,0 (1,4)*	

Table 3. The number (%) of participants who had no caries experience (DMFT=0) and the number (%) who had caries experience (DMFT ≥1) stratified by age group

Age	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*Total*
DMFT= 0	*19 (95%)*	*9 (82%)*	*24 (75%)*	*16 (73%)*	*5 (62,5%)*	*15 (75%)*	*10 (62,5%)*	*6 (54,5%)*	*104 (74,3%)*
DMFT≥1	*1 (5%)*	*2 (18%)*	*8 (25%)*	*6 (27%)*	*3 (37,5%)*	*5 (25%)*	*6 (37,5%)*	*5 (45,5%)*	*36 (25,7%)*
Total	*20*	*11*	*32*	*22*	*8*	*20*	*16*	*11*	*140 (100%)*

Table 4. Characteristics of the participants

	5 years	***6 years***	***7 years***	***8 years***	***9 years***	***10 years***	***11 years***	***12 years***	***TOTAL***
Outcome variables:									
Rating of the child's oral health									
Better	*0*	*3*	*6*	*3*	*1*	*3*	*2*	*0*	*18 (12,68%)*
At the same level	*20*	*7*	*28*	*19*	*8*	*18*	*13*	*10*	*123 (86,62%)*
Worse	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1 (0,70%)*
Socioeconomic position indicators:									
Mother's education									
Primary school	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*2 (1,46%)*
High school	*2*	*3*	*8*	*5*	*3*	*8*	*4*	*3*	*36 (26,28%)*
University/college	*16*	*7*	*25*	*17*	*6*	*12*	*9*	*7*	*99(72,26%)*
Father education									
Primary school	*0*	*0*	*2*	*0*	*0*	*0*	*1*	*0*	*3 (2,42%)*
High school	*5*	*4*	*14*	*8*	*1*	*6*	*6*	*7*	*51 (41,13%)*
University/college	*14*	*4*	*15*	*13*	*5*	*11*	*6*	*2*	*70 (56,45%)*
Mother occupation									
0. Military professions and	*1*	*2*	*3*	*1*	*2*	*1*	*1*	*1*	*12 (8,39%)*

unspecified									
1. Leaders	*2*	*1*	*0*	*0*	*0*	*1*	*1*	*1*	*6 (4,2%)*
2. Academic professions	*10*	*5*	*13*	*12*	*4*	*4*	*4*	*5*	*57 (39,86%)*
3. College	*2*	*1*	*10*	*2*	*0*	*3*	*3*	*0*	*21 (14,69%)*
4. Office	*0*	*0*	*1*	*1*	*0*	*2*	*2*	*0*	*6 (4,2%)*
5. Sales and service professions	*4*	*0*	*6*	*5*	*1*	*1*	*1*	*3*	*21 (14,69%)*
6. Farmers, fishermen, etc.	*0*	*0*	*0*	*1*	*1*	*0*	*0*	*0*	*2 (1,4%)*
7. Craftsmen	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
8. Process and machine operators, transportation workers, etc.	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
9. Cleaners, assistants, etc.	*0*	*2*	*1*	*0*	*9*	*3*	*3*	*0*	*18 (12,59%)*
Father's occupation									
0. Military professions and unspecified	*0*	*1*	*3*	*0*	*0*	*0*	*1*	*3*	*8 (6,30%)*
1. Leaders	*2*	*1*	*2*	*2*	*1*	*4*	*1*	*1*	*14 (11,02%)*
2. Academic professions	*8*	*2*	*10*	*8*	*2*	*3*	*1*	*1*	*35 (27,56%)*
3. College	*3*	*1*	*1*	*5*	*1*	*3*	*3*	*0*	*17 (13,38%)*
4. Office	*1*	*0*	*1*	*0*	*0*	*0*	*2*	*0*	*4 (3,15%)*
5. Sales and service professions	*3*	*1*	*3*	*2*	*0*	*1*	*1*	*2*	*13 (10,24%)*
6. Farmers, fishermen, etc.	*1*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*3 (2,36%)*
7. Craftsmen	*1*	*2*	*8*	*4*	*1*	*5*	*2*	*0*	*23 (18,11%)*
8. Process and machine operators, transportation workers, etc.	*0*	*1*	*3*	*0*	*0*	*0*	*3*	*1*	*8 (6,30%)*
9. Cleaners, assistants, etc.	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*1*	*2 (1,57%)*
Demographic characteristics:									
Gender									
Boy	*13*	*7*	*14*	*12*	*2*	*8*	*10*	*4*	*70 (50%)*
Girl	*7*	*4*	*18*	*10*	*6*	*12*	*6*	*7*	*70 (50%)*
Who the child lives with									
Both parents	*18*	*8*	*31*	*19*	*6*	*17*	*15*	*9*	*123 (86,01%)*
Mother	*2*	*2*	*1*	*2*	*2*	*3*	*1*	*2*	*15 (10,49%)*
Mother and stepfather	*0*	*1*	*2*	*1*	*1*	*0*	*0*	*0*	*5 (3,5%)*

How long has the child lived in Norway									
0,5	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1 (0,70%)*
1	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1 (0,70%)*
4	*2*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*3 (2,10%)*
5	*17*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*19 (13,29%)*
6	*0*	*9*	*1*	*0*	*0*	*0*	*0*	*0*	*10 (7,0%)*
7	*0*	*0*	*32*	*2*	*0*	*0*	*0*	*0*	*34 (23,78%)*
8	*0*	*0*	*0*	*19*	*0*	*0*	*0*	*0*	*19 (13,29%)*
9	*0*	*0*	*0*	*0*	*9*	*0*	*0*	*0*	*9 (6,29%)*
9,5	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*1 (0,70%)*
10	*0*	*0*	*0*	*0*	*0*	*19*	*1*	*0*	*20 (13,99%)*
11	*0*	*0*	*0*	*0*	*0*	*0*	*15*	*2*	*17 (11,89%)*
12	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*9*	*9 (6,29%)*
Residence									
Town	*19*	*5*	*26*	*16*	*5*	*15*	*12*	*8*	*106 (75,17%)*
Village	*1*	*4*	*1*	*2*	*3*	*3*	*0*	*3*	*17 (12,1%)*
Rural	*0*	*1*	*6*	*4*	*1*	*3*	*3*	*0*	*18 (12,7%)*
Number of people in the household									
2	*0*	*2*	*0*	*1*	*1*	*1*	*2*	*0*	*7 (5,34%)*
3	*3*	*3*	*6*	*0*	*0*	*2*	*2*	*1*	*17 (13%)*
4	*12*	*3*	*21*	*2*	*2*	*12*	*6*	*7*	*65 (49,62%)*
5	*4*	*3*	*3*	*5*	*5*	*3*	*6*	*3*	*32 (24,42%)*
6	*1*	*0*	*3*	*5*	*1*	*0*	*0*	*0*	*10 (7,63%)*
Oral health behavior:									
Frequency of tooth brushing									
2 or more times daily	*9*	*8*	*23*	*17*	*5*	*15*	*13*	*9*	*99 (69,72%)*
1 or less times daily	*11*	*2*	*11*	*5*	*4*	*6*	*2*	*2*	*43 (30,28%)*
Help with tooth brushing									
2 or more times daily	*4*	*3*	*10*	*5*	*0*	*0*	*0*	*0*	*22 (15,49%)*
1 or less daily	*16*	*7*	*24*	*17*	*9*	*21*	*15*	*11*	*120 (84,51%)*
Dental cleaning products									
Very good	*0*	*1*	*1*	*1*	*0*	*3*	*0*	*3*	*9 (6,38%)*
Good	*18*	*8*	*33*	*21*	*9*	*17*	*14*	*8*	*128 (90,14%)*

Bad	*1*	*1*	*0*	*0*	*0*	*0*	*2*	*0*	*4 (2,82%)*
Intake of sugar									
Low	*6*	*2*	*4*	*4*	*1*	*3*	*2*	*3*	*25 (18,38%)*
Average	*13*	*9*	*26*	*18*	*7*	*16*	*14*	*8*	*111 (81,62%)*
General health:									
Disease									
Yes	*2*	*0*	*5*	*1*	*0*	*1*	*3*	*3*	*15 (10,64%)*
No	*18*	*10*	*28*	*21*	*9*	*20*	*12*	*8*	*126 (89,36%)*
Medications									
Yes	*2*	*1*	*5*	*3*	*0*	*1*	*1*	*3*	*16 (11,27%)*
No	*18*	*9*	*29*	*19*	*9*	*20*	*14*	*8*	*126 (88,73%*
Last dental visit:									
Last visit									
Less than 6 months	*1*	*3*	*7*	*5*	*2*	*9*	*4*	*4*	*35 (24,82%)*
6-12 months	*4*	*4*	*16*	*10*	*4*	*8*	*5*	*5*	*56 (39,72%)*
More than 1 year, but less than 2 year	*9*	*3*	*11*	*7*	*3*	*3*	*6*	*2*	*44 (31,21%)*
2 year or more, but less than 3 year	*5*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*6 (4,25%)*
Reason for the visit									
Regular examination	*17*	*7*	*26*	*17*	*7*	*12*	*13*	*7*	*106 (75,18%)*
Treatment/follow-up	*0*	*2*	*5*	*4*	*2*	*7*	*0*	*2*	*22 (15,60%)*
Pain or problems with teeth, gingiva or mouth	*2*	*1*	*2*	*1*	*0*	*1*	*2*	*2*	*11 (7,80%)*
Don't know/don't remember	*1*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*2 (1,42%)*

Univariable binary logistic regression analysis

Age and if the child has lived abroad showed a significant association with the child's DMFT value. The child had 1,3 times higher odds to have DMFT≥1 (crude OR: 1,268 95% CI 1,057-1,520) by the child gets one year older. Children that have lived abroad had 1,2 times higher odds to have DMFT≥1 (crude OR: 1,236 95% CI 1,039-1,470) compared to the children that have lived their whole life in Norway (Table 5). The odds for a child to have DMFT≥1

decrease by 0,8 with each 50000NOK higher income (had marginal statistical significance p=0,058).

Multivariable binary logistic regression analysis

In the univariable binary logistic regression analysis age, if the child has lived abroad and household income showed a significant association with the child's DMFT. These three associations lost their significance in the multivariable binary logistic regression analysis.

Children with a father that only had completed primary school/ high school education had 10,4 times higher odds to have DMFT≥1 (crude OR: 2,215 95% CI 0,967-5,076 and adjusted OR: 10,435 95% CI 1,461-74,513). Nagelkerke R^2 was recorded and 0,242% of the variation in the outcome was explained by the model. The Hosmer and Lemeshow gives a p-value of 0,266 (Table 5).

Table 5. Association between children' DMFT values and their parents' socioeconomic (SEP) indicators according to univariable and multivariable binary logistic regression analyses among 5-12-year-olds in Northern Norway. The association between the co-variables and DMFT are also included. The number of participants varies in each analysis due to missing data.

Characteristic		**Crude OR (95% CI)**	**Adjusted OR (95%CI)**
Socioeconomic position indicators:			
Mother's education	*University/college*	*1*	*1*
	Primary school/High school	*1,380 (0,592-3,214)*	*0,403 (0,057-2,849)*
Father's education	*University/college*	*1*	*1*
	Primary school/High school	*2,215 (0,967-5,076)*	*10,435 (1,461-74,513)*
Mother's	*Academic professions,*	*1*	*1*

occupation	*college.*		
	Leaders, office, sales and service professions	*1,482 (0,598-3,676)*	*1,290 (0,215-7,726)*
	Military professions, farmers, fishermen, craftsmen, process and machine operators, transportation workers, cleaners, assistants, etc.	*2,281 (0,813-6,393)*	*1,371 (0,163-11,515)*
Father's occupation	*Academic professions, college.*	*1*	*1*
	Leaders, office, sales and service professions	*1,145 (0,368-3,567)*	*0,116 (0,012-1,145)*
	Military professions, farmers, fishermen, craftsmen, process and machine operators, transportation workers, cleaners, assistants, etc.	*2,172 (0,857-5,504)*	*0,281 (0,037-2,148)*
Income per 50000 NOK		*0,786 (0,613-1,008)*	*0,804 (0,599-1,080)*

Household tenure	*Homeowner* *Housing cooperatives and rented*	*1* *0,383 (0,106-1,381)*	*1* *0,129 (0,011-1,504)*
Demographic characteristics:			
Gender	*Girl* *Boy*	*1* *0,861 (0,403-1,839)*	
Age		*1,268 (1,057-1,520)*	*1,586 (0,773-3,254)*
Residence	*Town* *Village* *Rural*	*1* *0,395 (0,085-1,844)* *2,369 (0,845-6,640)*	
Has the child lived abroad		*1,236 (1,039-1,470)*	*0,720 (0,375-1,383)*
Number of people in the household		*1,142 (0,774-1,685)*	
Lives with	*Both parents* *Mother/father* *Mother and stepfather/ father and stepmother*	*1* *1,044 (0,310-3,519)* *0,718 (0,077-6,669)*	
Mother's age		*1,034 (0,964-1,109)*	
Father's age		*1,016 (0,950-1,086)*	
Oral health behavior:			
Frequency of tooth brushing	*2 times daily or more* *1 time daily or less*	*1* *0,449 (0,179-1.127)*	

Help with tooth brushing	*Help 2 times daily or more* *Help 1 times daily or less*	*1* *1,140 (0,385-3,373)*	
Dental cleaning products	*Very good (fluoride toothpaste+interdental cleaning+fluoride supplements)* *Good fluoride toothpaste+interdental cleaning or fluoride supplements)* *Bad (toothpaste without fluoride and/or interdental cleaning)*	*1* *0,412 (0,104-1,632)* *0,417 (0,030-5,708)*	
Intake of sugar	*Low* *High*	*1* *1,081 (0.393-2,978)*	
General health:			
Disease	*No* *Yes*	*1* *0,836 (0,217-3,227)*	
Medication	*No* *Yes*	*1* *0,689 (0,183-2,597)*	
Last dental visit:			
Last visit	*Lesser than 6 months* *6-12 months*	*1* *1,466 (0,571-3,765)*	

	More than 1 year, lesser than 2 years *2 years or more, but lesser than 3 years*	*0,450 (0,143-1,424)* *0,556 (0,057-5,422)*	
Reason for the visit	*Routine examination of teeth* *Treatment* *Pain* *Don't know/don't remember*	*1* *0,968 (0,323-2,899)* *2,743 (0,769-9,784)* *3,292 (0,198-54,631)*	
Nagelkerke R2			*0,242*

5. Discussion

The first aim in this study was to assess the caries experience among children in Northern Norway (Tromsø, Storslett and Mosjøen). In general, the caries experience was quite low.

The second aim was to investigate the association between children´s oral health and their parents´ SEP. It was found that children with a father that only had completed primary school/ high school education had 10,4 times higher odds to have DMFT≥1 (crude OR: 2,215; 95% CI 0,967-5,076 and adjusted OR: 10,435; 95% CI 1,461-74,513). Univariable binary logistic regression analysis also showed that the child's age and if the child has lived abroad were associated with having DMFT≥1. The p-value 0,058 also indicate that there is a marginal association between children's DMFT and household income.

5.1 Methodical considerations

5.1.1 Study design

In this study it was used a cross sectional design, which gave information about how the situation looked at the point of investigation (the prevalence of DMFT/dmft) and the association between caries experience and related factors (SEP and co-factors). This means that a patient may have an earlier caries experience in the primary dentition (dmft) that cannot be measured in the permanent dentition (DMFT), because of exfoliation of the primary teeth. In this manner the patient's cumulative caries experience cannot be seen. In a cross sectional

study the causality cannot be established because the exposure and effect is measured at the same time (46).

5.1.2 Participation and generalizability

It was necessary to invite 324 respondents, because we expected that 20% (54) would refuse to participate. This would give us 270 participants that we needed. In total 271 questionnaires were sent out in Tromsø and 72 were administered in person at SDC and MDC. The total response rate was 41% with the highest response rate seen at MDC (83%), followed by SDC (76%) and SDC (30%). This means that the highest response rate was from the external clinics. A conceivable reason for this may be explained by the way the patient got the questionnaire. In Tromsø the questionnaires were sent by mail to the patient, and the patient had to deliver the questionnaire in the reception if they wanted to participate. At SDC and MDC the questionnaires were hand delivered to the patient, and the patient could send in the questionnaire if he/she wanted to participate in the study. It has been shown that the response rate in epidemiological studies may increase if the questionnaire is delivered by hand (47, 48).

A limitation of this study is that the needed number of participants was not reached, which could result in the introduction of type 2 error. Type 2 errors may result when there is thought that there is no relation between children's oral health and parents SEP, but in reality there is (45).

Our sample size consisted of 140 participants, while 270 was the number calculated needed to be representative for Northern Norway. Because we failed to recruit 270 participants, the population seems to be non-representative, and the generalization of the observations from this study to other children at the same age living in Northern Norway may be limited. In other words, the generalizability tells something about the observations in the study may be applied to other populations, locations, situations and times (45), which is difficult in this study, because the response rate was lower compared to what was needed.

A limitation of this study is that it might be that only those who felt confident on the topic answered the questionnaire, which may result in a more positive outcome. This may increase the risk for introduction of self-selection bias, which means that the sampling is not random (2, 49). This is related to the difference between those who answered and not.

5.1.3 Measurement of the DMFT value

In this study, the DMFT was chosen as an indicator of oral health among children. There exist also other indexes that describe dental caries (for example: ICDAS), but DMFT is the most widely used index in statistical data (for example SSB and "Norgeshelsa statistikkbank") and other scientific studies about oral health. In this study caries experience is measured according to DMFT, which may be a strength because it makes it easier to compare results from this study to other studies.

At the UDC, the DMFT values were collected directly from "Th. data" in OPUS, and the dmft values were collected manually from the diagnostic picture in OPUS. Patients with mixed dentition got two different values, one that represents the deciduous dentition (dmft) and one that represents the permanent dentition (DMFT) which in the analysis were added together. At SDC and MDC the DMFT values were only collected from "Th. data" in OPUS, which means that only the DMFT values from the permanent dentition were available. Since the dmft values from Nordreisa and Mosjøen were not available, it was not possible to compare the oral health in children with only deciduous teeth. The outcome may also be more positive at SDC and MDC compared to SDC because the dmft values were not included. This may reduce the internal validity, which indicates how well an instrument measure what is intended to measure or investigate (45).

In this study, there were several different dental workers and students that have evaluated children's oral health. The DMFT values were collected by dental students at the UDC. At SDC and MDC it was collected by dental hygienists. Since no one in this study was calibrated to diagnose and differentiate between a sound tooth surface, a non-cavitated and a cavitated lesion, the caries lesions may have been considered differently. This might introduce detection bias (misclassification bias in outcome) (2), which means that a patient may have been evaluated to have a higher or lower DMFT value depending on which dental health worker that has considered the child's oral health. This may reduce the internal validity.

The DMFT values were categorized into DMFT=0 and DMFT≥1. It is possible that this categorization makes less differences between those who have caries and those who have not. The categorization makes it impossible to differentiate between different grades of caries experience. Education was categorized into primary school/high school and university/college. Also, this categorization is equalizing the answers. It is impossible to

distinguish between the highest and lowest degree of education. In the categorization of DMFT and education, it can be introduced a misclassification bias in the outcome (2).

5.1.4 Questionnaire

Out of 21 questions, 10 of the questions from the questionnaire was obtained directly from WHO "Oral Health Surveys Basic Methods" (34) and translated into Norwegian, while 11 were drafted by the researchers. Questions retrieved from WHO "Oral Health Surveys Basic Methods" (34) are often used in other studies (gold standard questions), which makes it easy to compare results from this study to other studies. The validity of the drafted questions should always be established. The validity says something about the amount of systematic or build-in error in the questionnaire. This could be established by use of a panel of experts that consider the questions based on the theoretical construct, which tells how well the theoretical construct represents the question. It is also possible to establish the validity of the questions by use of a field test. This type of test says something about how well a given measure relates to one or more external criterion, which is based on empirical constructs. There are two forms of empirical construct validity: criterion-related validity and construct validity. In this study the drafted questions were based on other studies and it is therefore possible to use hypothesis-testing validity, which is a subgroup of construct validity. If there is evidence that support the hypothesis (what is intended to be measured), it is possible to conclude that there exist a construct validity. Since the drafted questions were based on studies with evidence, it is possible to conclude that there exists a construct validity (50).

As mentioned, the questionnaire consisted of 21 questions, where 10 of the questions obtained from WHO "Oral Health Surveys Basic Methods" were translated into Norwegian, while 11 drafted by the researchers, and translated into Norwegian. The translation from English to Norwegian might have introduced translation bias, and therefore compromise internal validity of these questions (2, 51, 52). No backwards translation from Norwegian to English by an independent bi-lingual person was performed. To test the reliability of the translated questionnaire, it is possible to do a test-retest. It can be accomplished if one delivers the same questionnaire at two different times, and then calculate a correlation coefficient to see how reliable the result is (46). The correlation coefficient lies between 0 and 1, where 0 represent no reliability and 1 represent perfect reliability (53). A reliable result should be approximately 0,7. A test-retest was not done because of limited time. One questionnaire was delivered in English after the parents wish. A possible weakness may be that the questions in English can

be interpreted differently than in Norwegian and therefore provide potential failure. However, because this only included one questionnaire, it would not have a big impact on the results.

Findings show that sensitive questions like age, health, behavior, household income, sexual orientation, marital status often may introduce bias (49). If participants are aware of their child's unhealthy behavior, low brushing frequency, low or no use of fluoride, interdental cleaning or fluoride supplements, high intake of sugar, they may be prone to report an incorrect answer which results in response bias (54). This may have an impact on the answers, as they are contributing factors for development of dental caries, which may result in less difference among the children. In other cases, it might be that the parent has misinterpreted the question or forgot the answer and therefore just guessed what they thought was the correct answer. This may introduce recall bias (55).

When evaluating the questionnaire, the parents age, education and occupation were sorted based on who signed the informed consent or who signed first or second. If only one parent had signed the informed consent, we automatically assumed that the second parent was the opposite gender. This method may lead to misclassification bias, because of the increasing number of homosexual parents (56). We will never know if the parent that did not answer is the opposite or the same gender. In the multivariable binary logistic regression analysis, there was found an association between the father's education and the child's DMFT. According the increasing number of homosexual parents, there might have been introduced bias in relation between father's education and children's DMFT, which may weaken the conclusion of this study. It could be that the way the questionnaire was analyzed might give too few mothers or fathers if the child actually has parents that are homosexual. This might also introduce bias in the outcome of occupation, which in this study was not significant related to the child's DMFT.

When evaluating the questionnaire, parents' occupation was divided into different categories. A weakness of such a classification might be that it introduces misclassification bias in exposure if the parents' occupation is categorized incorrectly. Some occupations that were stated in the questionnaire were impossible to categorize due to the lack of information about the occupation or lack of affiliation in any of the groups. Such groups were categorized into group 0.

5.2 Discussion of the results

Higher prevalence (DMFT ≥1) of caries was observed among older children (Table 3). Among children at the age of 5 years, the caries prevalence was 5%, compared to children at 12 years where the caries prevalence was 45,5%. Among 5-year olds the prevalence of children with no caries experience was 95%. This differs from statistics retrieved from "Norgeshelsa statistikkbank" (20), where both Troms, Nordland and the whole of Norway are slight above 80%. At the age of 12 years, our result is almost similar to the statistics (20). In this study the prevalence of children with no caries experience was 54,5%, compared to the whole Norway, Troms and Nordland where the prevalence of children with no caries experience was 60%. The big gap between children at 5 years old in this study and "Norgeshelsa statistikkbank" (20) can be explained by low response rate. A low response may increase the risk for self-selection bias, which may give a more positive outcome.

There are not many new studies regarding caries experience and prevalence among the other Scandinavian countries. A study from Finland showed that 39,2% of the 5 year olds and 26,1% of the 12 year olds had no caries experience in 2009 (57), while a study from Sweden showed that 75% of the 6 year olds had no caries experience in 2016 (58). When comparing Finland and Sweden with this study, both Finland and Sweden have higher caries prevalence. Despite this difference in caries prevalence, it is important to remember when this study is done and that it may have changed to a lower caries prevalence (57). WHO have released a document called "Global goals for oral health 2020" that have some set goals for oral health 2020. One of them is to increase the proportion of caries free 6-year-olds in the world to 80% (59, 60). In this study 82% of the 6-year olds had no caries experience, and the 2020 goal are therefore reached. If comparing children at 5 years old from Finland (39,2%) (57) and children at 6 years old from Sweden (75%) (58) this goal is not reached.

The total mean caries experience (DMFT (SD)) was higher among older children. It was lowest for children at 5 years old (0,1 (0,4)) compared to children at 6-, 7-, 8,- 9, 11- and 12 years old (0,4 (1,0)), (0,3 (0,7)), (0,5 (1,0)), (0,5 (0,7)), (0,6 (1,2)), (1,1(2,0)) and (1,0 (1,4)), respectively). There is no pattern in the distribution of the total mean caries experience as the value gets higher from 5 (0,1 (0,4)) to 6 (0,4 (1,0)) years old, but gets lower from 6 (0,4 (1,0)) to 7 (0,3 (0,7)) years old. The highest total mean caries experience was found in children at 11 (1,1 (2,0)) years old, but is lower among children at 12 (1,0 (1,4)) years old. There are found no studies that have the same system. At the age of 5, 6 and 9 years old, the total mean caries

experience for boys was 0,0, while the girls had the following values of 0,2 (0,7), 1,2 (1,5) and 0,6 (0,8). The highest total mean caries experience was seen among 11 year olds (1,1 (2,0)), where it was 1,4 (2,5) for boys and 0,6 (1,2) for girls. In the "Global goals for oral health 2020", WHO also has a goal to reduce the DMFT at age 12 years to a maximum of 1,5 (59, 60). The total mean caries experience for the 12 year olds in our sample was 1,0 (1,4), and is therefore reached (59, 60).

The association between DMFT and SEP indicators were assessed cross sectionally. According to multivariable binary logistic regression analysis only one SEP indicator, father's education, was statistic significantly associated with child's DMFT score (OR=10,435 95% CI 1,461-74,513). Children with a father that only had completed primary school/ high school education had 10,4 times higher odds to have DMFT ≥1. The older the child gets and if the child has lived abroad were associated with having DMFT≥1 based on the univariable binary logistic regression analysis. These findings were additional findings of the binary logistic regression analysis and not findings related to our aims. These finding were significant only in the univariable analysis.

According to univariable binary logistic regression analysis, age (crude OR: 1,268 95% CI 1,057-1,520) and if the child has lived abroad (crude OR: 1,236 95% CI 1,039-1,470) were statistically significantly associated with DMFT ≥1. These findings are in line with another studies from Scandinavia, where an association between the child's oral health and foreign ethnic background was found (6, 8, 38). A child with foreign ethnic background had worse oral health compared to a child with Scandinavian background. There was for example performed a study in Denmark that found a significant association between dental health and if the child come from a family with Danish background or a non-Danish background (38). The children from a non-Danish background had as much as four times higher caries experience than them with Danish background. A study performed in Akershus in Norway showed an association between caries experience and parent-relating factors like education, national origin, oral health behavior and attitudes. It showed that a child having one or both parents of non-western origin was associated with higher risk of having caries experience (OR=4,8). A study that was a part of the cross-national survey on health behavior in school-aged children indicated that different oral health behavior between European countries, Israel, Canada and USA contributed to the variance in caries experience. This study compared data on frequency of tooth brushing, consumption of sweets, soft drinks, fruits and vegetables (61).

It is imaginable that if a Norwegian child that has lived abroad, may have been influenced by another culture with other oral health behaviors and therefore have another caries experience compared to children that have not lived abroad.

From the univariable binary logistic regression analysis there was found a marginal significant association between children's DMFT and the household income (p=0,058). The result is in line with other studies where higher parents income are associated with better oral health of the child (9, 29). A study performed in Italy showed higher caries prevalence in children with a low household income (OR = 9.9; 95% CI 5.1-20.1) (29). In a systematic review, there was found that more than half of the studies, children with high income parents were at lower risk for dental caries (9).

The SEP indicator, father's education, was statistic significantly associated with child's DMFT score (adjusted OR: 10,435 95% CI 1,461-74,513). The father's role and involvement in the family varies depending on the family's cultural background (62). Even though the family economic contributions have become more equalized among mother and father in Norway during the years, the father has still the most impact to the family economy around the world. A study found that father's education and income were predictors for father's engagement and involvement around the child. A good father-child interaction will give the child a better outcome and promote the child's well-being (62).

There was not found any studies investigating the association between the child's oral health and only fathers education, but there are findings from studies that show an association between the child's oral health and parents education (6, 9, 10, 30). This is comparable with the result from this study where the risk to have DMFT≥1 increase if the father only has completed primary school/high school. Fathers education was the only SEP indicator that was associated with the child's DMFT. However, the categorization of education varies in these studies. In Lithuania there was performed a study that investigated the role of parental education and socioeconomic status relation to dental caries prevention among the child. In this study education were divided into two groups: 1) college or higher educated, and 2) included parents with an incomplete secondary, secondary, vocational school, etc. education. The study performed in Akershus in Norway that showed an association between caries experience and parent-relating factors, found that having both parents (OR=3.0 95% CI 1,6-5,6) or one parent (OR=2.1 95% CI 1,1-4,0) with low education level was associated with

higher chance for having caries experience in the 5-year-olds. In that study, high education was defined by more than 12 years at school, while low education was 12 year or less at school (6).

It is imaginable that the introduction of the law "Lov om tannhelsetjenesten" and the guideline "God Klinisk Praksis i tannhelsetjenesten - En veileder i bruk av faglig skjønn ved nødvendig tannbehandling" have decreased the caries experience and equalized the differences between children from different SEP families.

6. Conclusion

This cross-sectional study assessed the caries experience among children in Northern Norway. Children at the age of 5 years old (5%, 0,4) had lower prevalence (DMFT≥1) and caries experience compared to children at 6-, 7-, 8-, 9- 10-, 11- and 12 years old ((18%, 1,0), (25%, 0,7), (27%, 1,0), (37,5%, 0,7), (25%, 1,2), (37,5%, 2,0) and (45,5%, 1,4), respectively).

The older the child gets and if the child has lived abroad were associated with having DMFT≥1 based on the univariable binary logistic regression analysis. These findings were additional findings of the binary logistic regression analysis and not findings related to our aims. There was also found a marginal statistical significant association between the child's DMFT and household income.

From the multivariable binary logistic regression analysis, a child with a father that only had finished primary school/high school was associated with having DMFT≥1.

Even though the introduction of the laws and guidelines have decreased the caries experience in Northern Norway, the result show us that more studies are needed to investigate inequalities among children in Northern Norway. Considered a small sample size in our study, there is a need of studies with bigger study samples investigating the association between parents´ SEP and children's oral health.

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Appendix

Appendix I

Spørreskjema

Spørreskjema nr. ……..

DMFT ……

Under finner du en rekke spørsmål, med svaralternativ. Vennligst sett ring rundt eller kryss av for riktig svar.

Vær vennlig og **lever** spørreskjemaet i **resepsjonen** ved oppmøte på tannklinikken.

1. Barnets kjønn

Gutt 1

Jente 2

2. Hvor mange år er barnet i 2018?

____ *År*

3. Bosted?

By 1

Tettsted 2

Landlig 3

4. Hvor mange personer er dere i husholdningen?

____*(Antall personer)*

5. Hvor lenge har barnet bodd i Norge?

_____ *År*

6. Hvem bor barnet sammen med?

Begge foreldre 1

Mor 2

Far 3

Mor og stefar 4

Far og stemor 5

Andre 6

7. Hvor lang tid er det siden barnet ditt sist besøkte tannklinikken?

Mindre enn 6 måneder 1

6-12 måneder 2

Mer enn 1 år, men mindre enn 2 år 3

2 år eller mer, men mindre enn 3 år 4

3 år eller mer 5

Har aldri vært innkalt til tannklinikk 6

8. Hva var årsaken til ditt barns siste besøk på tannklinikken?

Rutinemessig undersøkelse av tenner 1

Behandling/oppfølging 2

Smerter eller problemer med tenner, tannkjøtt eller munn 3

Jeg vet ikke/husker ikke 4

9. Hvordan tror du ditt barns tannhelse er sammenlignet med barn på samme alder?

Bedre 1

På samme nivå 2

Dårligere 3

10. Hvor ofte børster barnet ditt sine tenner?

Ikke hver dag 1

En gang om dagen 2

To ganger om dagen 3

Mer enn to ganger om dagen 4

11. Hvor ofte hjelper du eller andre voksne barnet ditt å børste tennene?

Ikke hver dag 1

En gang om dagen 2

To ganger om dagen 3

Mer enn to ganger om dagen 4

12. Bruker barnet ditt noe av følgende daglig?

Tannkrem med fluor *1*

Tannkrem uten fluor *2*

Tannpirkere *3*

Tanntråd *4*

Munnskyll *5*

Fluortabletter *6*

Annet *7*

Hvis annet, spesifiser _____

13. Har barnet noen kroniske sykdommer (f.eks: hjertesykdommer, diabetes, astma)?

Ja *1*

Nei *2*

*Hvis JA, hvilken?*_____

14. Bruker barnet noe medisiner regelmessig?

Ja *1*

Nei 2

15. Hvor ofte spiser/drikker barnet ditt følgende?

	Flere ganger om dagen 6	Hver dag 5	Flere ganger i uka 4	En gang i uka 3	Flere ganger måneden 2	Aldri 1
A. Kjeks, kaker, boller						
B. Iskrem						
C. Sukker-holdige frokost-blandinger						

(cornflakes, honni
corn, weetos)

D. Sjokolade
melk

E. Syltetøy
eller
honning

F. Godteri

G. Juice
/saft (sukkerholdig)

H. Brus
(sukkerholdig)

I. Sukkerholdig
varm drikke
(kaffe, te, kakao)

16. Hvor gammel er du/partneren din?

Din alder	*Din partners alder*
___	___

17. Hvilken utdanning har du/din partner fullført?

	Du	Din partner
Grunnskole	*1*	*1*
Videregående	*2*	*2*
Høyskole/universitet	*3*	*3*

18. Ditt yrke?

_____

19. Din partners yrke?

_____

20. Hvor stor er husholdningens årlige bruttoinntekt?

Ca. _____ Kr pr. år

21. Bosituasjon

Selveier	*1*
Borettslag	*2*
Leietaker	*3*