Stomatologija, Baltic Dental and Maxillofacial Journal, 15:3-11, 2013

Caries prevalence and determinants among 12-year-olds in North-West Russia and Northern Norway

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SUMMARY

Objectives. To assess oral health and oral health associated factors in 12-year-olds and to establish determinants explaining variation in oral health among children representing two areas in the Barents region – Arkhangelsk in North-West Russia and Tromsø in Northern Norway.

Methods. The samples consisted of Russian (N=590) and Norwegian (N=264) 12-year-olds and their parents selected according to stratified one-stage cluster design. The study included clinical examination (children) and self-reports (children and parents). The child's oral health was recorded under field conditions. Statistical analyses were conducted on pooled samples of subjects.

Results. The mean DMFT/S-scores were 3.0/4.4 for the Russian and 1.2/1.5 for the Norwegian children ($p<0.001$). In multiple logistic regressions, country of origin (OR=3.8) and filling obtained during last dental visit (OR=5.0) were showing the strongest association with child's dental caries ($\chi^2=87$; $p<0.001$). Among parent's variables showing the strongest association with child's dental caries were country of origin (OR=2.4) and oral health problems during the past two years (OR=1.8) ($\chi^2=60$; $p<0.001$).

Conclusions. Dental caries prevalence was higher among the Russian than the Norwegian children. The overall regression models were significant for both the child and parental variables. The results indicate different impact on child's oral health from children and parental determinants.

Key words: Barents region, dental caries, determinants, children.

INTRODUCTION

One of the most significant time-trends observed in studies assessing oral health conditions is the remarkable decrease in the prevalence of dental caries, in particular among children and adolescents during the past decades (1-3). Studies conducted to assess oral health status of various European populations demonstrate that this is a predominant trend especially for the western part of Europe (1, 4-7). Regarding children and adolescents, low prevalence of dental caries is a common characteristic for the Nordic countries – Norway, Sweden, Denmark and Finland (8-10), countries that in a global context are characterized as affluent societies with well-developed health care and educational systems and with the most fundamental prerequisites for health available for most citizens. This situation is different from the eastern part of Europe (4, 11) and Russia where dental caries remains a common disease among children with a prevalence of 73% and 82% among 12- and 15-year olds respectively (12).

In spite of the enormous natural resources in North-West Russia, the negative demographic trends inherited from the post-Soviet period persist contrary to improving living standards in the more central parts of Russia. Moreover, the recent positive development in economy has neither exerted a major positive influence in demography nor improved health care in this region. As a result, general- and oral health has not improved in the Russian part of the Barents Euro-Arctic Region (BEAR) compared

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Table 1. Caries status at tooth- and surface level in 12-year-olds from Tromsø, Norway and Arkhangelsk, Russia

DMFT/S	Teeth			Surfaces		
	Norway Mean (SD)	Russia Mean (SD)	p-value	Norway Mean (SD)	Russia Mean (SD)	p-value
Decayed	0.4 (0.8)	1.3 (1.6)	<.001	0.4 (0.9)	1.8 (2.4)	<.001
Missing	0.00 (0)	0.02 (0.1)	n.s.	0.00 (0)	0.09 (0.1)	n.s.
Filled	0.8 (1.4)	1.7 (1.7)	<.001	1.1 (1.7)	2.6 (3.0)	< .001
Total	**1.2 (1.7)**	**3.0 (2.3)**	**<.001**	**1.5 (2.1)**	**4.4 (4.1)**	**<.001**

Table 2. Proportions of 12-year-olds from Tromsø, Norway and Arkhangelsk, Russia responding unfavourably on the studied determinants

Variable	Norway (%) n=124	Russia (%) n=514	Cohen's h (p)
Family economy (below average)	20.2	25.0	0.11 (n.s.)
Family status (not living with both mother and father)	32.3	41.5	0.19 (n.s.)
General health, self-evaluated (moderate/bad)	4.1	25.2	0.64 (<.001)
Oral health, self-evaluated (bad)	9.2	12.7	0.10 (n.s.)
Tooth brushing frequency (≤ than once pr. day)	24.4	45.3	0.44 (<.001)
Last dental attendance (more than one year ago)	8.2	28.4	0.54 (<.001)
Dental fear (nervous, afraid)	14.2	51.7	0.83 (<.001)
Breakfast habits (irregular)	13.9	17.5	0.10 (n.s.)
Lunch habits (irregular)	35.5	21.6	0.31 (<.01)
Dinner habits (irregular)	9.8	14.3	0.14 (n.s.)
Money spent on sweets (> 4 euro pr. week)	44.7	26.5	0.38 (<.001)
Sports activities (irregular/never)	10.7	27.6	0.44 (<.001)
Time spent on PC/TV (> than 2 hours pr. day)	30.3	38.3	0.17 (n.s.)
Filling obtained at last visit to dentist (yes)	24.8	49.2	0.51 (<.001)
Weight status (over- or underweight)	21.8	43.9	0.48 (<.001)
Oral hygiene (OHI-S > 0.6)	17.2	29.1	0.28 (<.01)

Table 3. Proportions of parent's participants from Tromsø, Norway and Arkhangelsk, Russia responding unfavourably on the studied determinants

Variable	Norway (%) n=124	Russia (%) n=514	Cohen's h (p)
Education (< than 12 years)	31.0	41.8	0.23 (<.05)
Oral health, self-evaluated (moderate/bad)	19.8	70.7	1.08 (<.001)
Evaluation of child's oral health (moderate/bad)	8.6	65.8	1.30 (<.001)
Last dental attendance (more than one year ago)	40.9	30.7	0.21 (n.s.)
Oral problems last 2 years (yes)	36.8	73.3	0.75 (<.001)
Adequate help obtained during last visit to dentist (no)	6.0	38.3	0.84 (<.001)
Satisfaction with school dental service (dissatisfied)	31.3	64.7	0.68 (<.001)
Child's eating habits (no control)	7.8	13.8	0.20 (n.s.)
Reminding child about oral hygiene (no)	45.2	37.5	0.16 (n.s.)
Number of teeth (< than 25 teeth)	9.0	12.8	0,13 (n.s.)

to the situation in the Nordic parts of this region (13-15).

Traditionally, biological and dietary factors have been considered as the major determinants for dental caries in a bio-medical context (16-17). Gradually, a broader framework has emerged emphasizing the additional importance of socio-economic, constitutional, behavioural and attitude-related factors including inferior oral hygiene and inappropriate eating habits (18-19). In addition, parental education, place of origin and non-western parents (20-21) has been shown to be of importance regarding prevalence of caries.

Assuming that individual, cultural and economic factors as well as the oral health care system might explain differences in oral health in a region, we found it appropriate to study determinants of child's oral health in a cross-cultural context. The above-mentioned factors might be of relevance both for detecting individuals being at risk for oral diseases and for improving dental care.

Accordingly, the aim of the present study was to assess oral health and oral health associated factors in 12-year-old children representing two areas in the Barents Euro-Arctic Region – Arkhangelsk in North-West Russia and Tromsø in Northern Norway. We

also aimed at exploring the association between dental caries and possible determinants explaining variation in oral health.

MATERIAL AND METHODS

Study population and sampling procedure

The target populations were approximately 5000 in Arkhangelsk and 815 in Tromsø in 2009. Power calculation was originally based on the detected difference in caries prevalence in Arkhangelsk (12) and Tromsø (22) with 90% power (β=0.10) and precision of 0.05 (α=0.05) yielding a sample size of approximately 300 from Arkhangelsk and 50 from Tromsø. However, in order to allow for multivariate analyses and due to an expected higher number of non-attenders in Tromsø than in Arkhangelsk (23), the final samples were 590 Russian and 264 Norwegian 12-year-olds.

Children were selected from 15 of a total of 56 schools in Arkhangelsk and 7 schools of a total of 20 in Tromsø, proportionally representing different districts of both cities. The sampling was performed according to stratified one-stage cluster design, in which the first stage of sampling occurred at school class level as the primary sampling units. Subsequently, all pupils in the appropriate age group were included in the study. This procedure was chosen in order to secure representativity because a random sampling of 12-year-olds in the Arkhangelsk region was considered difficult due to lack of updated local statistics (13). Only subjects obtaining a written consent from their parents were included in the study, which yielded 514 12-year-olds from Russia (87% attendance rate) and 124 subjects from Norway (47% attendance rate). Mothers constituted a majority among responding parents, 90% in Arkhangelsk and 86% in Tromsø.

Assessment

The study included clinical examination (children) and self-reports (children and parents).

Clinical examination

The clinical investigation was performed using caries assessment based on the DMFT/S index system according to the criteria of the World Health

Table 4. Distribution of caries experience and no caries in 12-year-olds according to socio-economic and clinical characteristics and association with selected child's variables *(Continued on the next page)*

Variable		DMFT=0	DMFT>0			DMFT>0		
	n	n (%)	n (%)	χ^2	p	OR	95% CI	p
Country of origin								
Russia	514	113 (22%)	401 (78%)	44.0	<.001	3.7	2.4-5.5	<.001
Norway (ref)	124	64 (52%)	60 (48%)					
Gender								
Boy	311	83 (27%)	228 (73%)	0.1	>.05	1.1	0.7-1.5	>.05
Girl (ref)	322	94 (29%)	228 (71%)					
Family economy								
Below average	156	39 (25%)	117 (75%)	0.3	>.05	1.2	0.7-1.7	>.05
Average/good (ref)	472	131 (28%)	341 (72%)					
Family status								
Not living with both mother and father	248	63 (25%)	185 (75%)	0.7	>.05	1.2	0.8-1.7	>.05
Mother and father (ref)	375	107 (28%)	268 (72%)					
General health (self-evaluated)								
Moderate/bad	128	23 (18%)	105 (82%)	7.4	<.01	2.0	1.2-3.2	<.01
Good/very good (ref)	486	146 (30%)	340 (70%)					
Oral health (self-evaluated)								
Bad	52	7 (14%)	45 (86%)	4.7	<.01	2.0	1.0-4.5	<.05
Good (ref)	388	107 (28%)	281 (72%)					
Tooth brushing frequency								
≤ once pr. day	249	54 (17%)	195 (83%)	7.2	<.01	1.7	1.1-2.4	<.01
> once pr. day (ref)	365	115 (31%)	250 (69%)					
Fluoride rinse								
Irregular/never	339	104 (31%)	235 (69%)	0.1	>.05	0.9	0.6-1.7	>.05
Regular (ref)	62	19 (31%)	43 (69%)					
Last dental attendance								
> than one year ago	459	127 (28%)	332 (72%)	0.01	>.05	0.9	0.6-1.5	>.05
≤ than one year ago (ref)	146	41 (28%)	105 (72%)					

Organisation (24) and level of oral hygiene using the Simplified Oral Hygiene Index (OHI-S) (25).

Caries registration was conducted with surface as the unit of measurement. Two trained and calibrated examiners examined the children in the classroom or nurse's office of the schools by using sterile disposable instrument kit (mouth mirror and probe) and gloves under optimal artificial light. The usual infection-control protocols were followed. Dental caries was diagnosed at the caries into dentine threshold (D3), using a visual method without radiography or compressed air. Surfaces were given a code according to status: decayed (D), missing (M) and filled (F) and the DMFT/S indexes were calculated. The data were registered on individual charts. The inter-examiner reproducibility was tested and the kappa-value found to be 0.85. Intra-examiner reproducibility tests were not performed due to restrictions expressed by the Regional Ethical Committee of Northern Norway in Tromsø.

Oral hygiene registration was conducted with use of the Simplified Oral Hygiene Index – OHI-S (25) for categorizing children into three levels of oral hygiene (poor, moderate and good). The OHI-S comprised the debris index and the calculus index with the criteria for classifying debris from 0 for no debris or stain present to 3 for soft debris covering most of the teeth. The criteria for classifying calculus vary from 0 for no calculus present to 3 for heaviest calculus covering most of the teeth. The average score for debris and calculus index are calculated and combined to obtain the Simplified Oral Hygiene Index.

Table 4. Distribution of caries experience and no caries in 12-year-olds according to socio-economic and clinical characteristics and association with selected child's variables *(Continued from previous page)*

Variable		DMFT=0	DMFT>0			DMFT>0		
	n	n (%)	n (%)	χ^2	p	OR	95% CI	p
Dental fear								
Nervous, afraid	266	57 (21%)	209 (79%)	9.4	.001	1.8	1.2-2.6	<.01
Relaxed (ref)	330	108 (33%)	222 (67%)					
Breakfast habits								
Irregular	99	25 (25%)	4 (75%)	0.3	>.05	1.2	0.7-1.9	>.05
Regular (ref)	516	144 (28%)	372 (72%)					
Lunch habits								
Irregular	148	53 (36%)	95 (64%)	7,1	<.01	0.6	0.4-0.9	<.01
Regular (ref)	459	113 (25%)	346 (75%)					
Dinner habits								
Irregular	79	21 (27%)	58 (73%)	0.6	>.05	1.1	0.6-1.8	>.05
Regular (ref)	532	146 (27%)	386 (73%)					
Money spent on sweets								
> 4 euro pr. week	184	50 (27%)	134 (73%)	0.1	>.05	1.1	0.7-1.5	>.05
≤ 4 euro pr. week (ref)	419	117 (28%)	302 (72%)					
Sport activities								
Irregular/never	145	35 (24%)	110 (76%)	1.2	<.05	1.3	0.8-1.9	>.05
Regular (ref)	459	132 (29%)	327 (71%)					
Time spent on PC/TV								
≥ 2 hours pr. day	220	112 (29%)	273 (71%)	1.2	>.05	1.2	0.8-1.8	>.05
< 2 hours pr. day (ref)	385	55 (25%)	16 (75%)					
Filling obtained at last visit to dentist								
Yes	264	40 (9%)	224 (91%)	36.0	<.001	3.4	2.2-5.0	<.001
No (ref)	333	124 (37%)	209 (63%)					
Weight status								
Over- or underweight	251	70 (28%)	181 (72%)	0.1	>.05	0.9	0.7-1.4	>.05
Normal (ref)	369	100 (27%)	269 (73%)					
Oral hygiene								
OHI-S > 0.6	158	28 (18%)	130 (82%)	3.8	<.05	1.6	1.0-2.5	<.05
OHI-S ≤ 0.6 (ref)	437	111 (25%)	326 (75%)					

Self-report

Socio-demographic and behavioral variables related to oral health conditions were collected from both parents and children using questionnaires constructed for the purpose. Tables 2-5 indicate the questions included in the questionnaires. The background variables collected from the parents were information about education, oral health conditions, evaluation of child's oral health, dental attendance, oral health problems last 2 years, adequate help obtained during last visit to dentist, satisfaction with oral care provided by the school dental service, child's eating habits, child's oral hygiene,

number of own teeth and their own dental care habits. From the children, information on family status and economy, eating habits, general and dental health, own dental care habits as well as information on leisure activities were also collected. The questionnaires were constructed primarily based on similar forms used in the Oslo-investigations (5) (parents) and World Health Survey (children) (26) and adapted to local conditions. Mothers responded more often than fathers, the rest of parent's self-reports were filled out by fathers and by other caretakers (grandparents, aunts/uncles). As no systematic differences were found in answers between mothers, fathers and others in any of the studied variables, the answers were therefore grouped and named "parent".

The questionnaires were translated from English into both Norwegian and Russian by two independent interpreters (27). A different interpreter made back translations (27), which were compared with the originals and identified and corrected inconsistencies. The questions were validated during the pre-study session at a public dental clinic in Tromsø and in the pilot study (23).

The study was approved by the Ethical Committee of the Northern State Medical University, Arkhangelsk, Russia and by the Regional Committee for Medical Research Ethics of Northern Norway, Tromsø. Permissions were also given by the Regional Department of Education in Arkhangelsk as well as by the participating schools in Russia and Norway.

Data analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS 19.0). To test whether there were differences between Norway and Russia on the mean number of decayed, missing and filled teeth as well as the total DMFT/S-scores, t-tests were used. Pearson's chi square analysis was implemented to test whether Norway and Russia differed regarding various determinants. Most of the determinants were measured on an ordinal scale with 2-5 categories. All of these were recoded into dichotomous variables based on a clinical evaluation (i.e., favourable/unfavourable to dental health) before testing for differences. The differences in proportions of favourable/unfavourable conditions were measured by Cohen's h. According to the convention used by Cohen, the thresholds of 0.2, 0.5 and 0.8 were used to define small, moderate and large effect (28).

When exploring the associations between the DMFT-scores and various determinants, we first dichotomised the DMFT-scores in DMFT=0 and DMFT>0 (no caries experience/caries experience). Calculation of low intra-class correlations and low design effect verified the relevance of using regular logistic regression analyses in the statistical evaluation of the results. A binary logistic regression analysis, with dental caries as an outcome variable (1/0),

Table 5. Distribution of caries experience and no caries in 12-year-olds according to socioeconomic and clinical characteristics and association with selected parent's variables *(Continued on the next page)*

Variable		DMFT=0	DMFT>0			DMFT>0		
	n	n (%)	n (%)	χ^2	p	OR	95% CI	p
Country of origin								
Russia	514	113 (22%)	401 (78%)	44.0	<.001	3.7	2.4-5.5	<.001
Norway (ref)	124	64 (52%)	60 (48%)					
Education								
<12 years	252	7 (26%)	20 (74%)	2.6	>.05	1.4	0.9-1.9	>.05
≥12 years (ref)	380	116 (31%)	264 (69%)					
Oral health (self-evaluated)								
Moderate/bad	389	90 (23%)	299 (77%)	12.0	<.001	1.8	1.3-2.6	<.001
Good/very good (ref)	244	87 (36%)	157 (64%)					
Evaluation of child's oral health								
Poor	351	69 (20%)	292 (80%)	28.0	<.001	2.6	1.8-3.7	<.001
Good, very good (ref)	282	109 (39%)	173 (61%)					
Last dental attendance								
Less than one year ago	242	67 (28%)	175 (72%)	0.1	>.05	0.9	0.7-1.4	>.05
Less than one year ago (ref)	380	104 (27%)	276 (73%)					
Oral problems last 2 years								
Yes	403	86 (21%)	317 (79%)	23.0	<.001	2.4	1.7-3.5	<.001
No (ref)	204	81 (40%)	123 (60%)					
Adequate help obtained during last visit to dentist								
No	203	40 (20%)	163 (80%)	9.0	<.001	1.9	1.2-2.8	<.01

was conducted separately for each variable in order to determine the associations between child's and parents' self-reported oral health-related factors and the child's dental caries status according to the results of the clinical investigation. Odds ratios (OR), 95% confidence intervals (CI) and p-values were calculated. Child's and parent's variables showing statistically significant associations with the DMFT-variable were further included in multiple logistic regression analyses in order to establish the overall significance of the models for child's and parent's variables regarding child's dental caries.

RESULTS

The mean DMFT/S-scores among children were higher in the Russian than in the Norwegian sample, 3.0/4.4 (SD 2.3/4.1) versus 1.2/1.5 (SD 1.7/2.1) respectively. Considering the different components of the index system, the DT/S-part showed the greatest difference in absolute figures, DT/S 1.3/1.8 for the Russian – versus 0.4/0.4 for the Norwegian participants (Table 1). Among the Norwegian participants, 52% were without caries (DMFT=0) while only 16% caries-free individuals were detected among the Russian children.

The proportions of individuals scoring unfavourably on the various items included in the investigation are presented in Table 2 (children) and Table 3 (parents). The Russian participants demonstrated higher frequencies of unfavourable scores for most of the items at statistically significant level.

The distribution of boys and girls in Norway and Russia was equal (results not shown). The largest differences were found for self-evaluated oral health and dental fear (children) (Table 2) and parental evaluation of their child's oral health and parents' own oral health and having had oral health problems (Table 3). About 1/3 of the adults did not visit a dentist on a regular basis with only minor differences between Russian and Norwegian participants (Table 3). The prevalence of adults who were unsatisfied with the school dental service was higher in Russia (65%) than in Norway (31%) (Table 3).

Table 5. Distribution of caries experience and no caries in 12-year-olds according to socioeconomic and clinical characteristics and association with selected parent's variables *(Continued from previous page)*

Variable		DMFT=0	DMFT>0			DMFT>0		
	n	n (%)	n (%)	χ^2	p	OR	95% CI	p
Yes (ref)	421	132 (31%)	289 (69%)					
Satisfaction with school dental service								
Dissatisfied	366	84 (23%)	282 (77%)	10.7	<.001	1.8	1.3-2.6	<.001
Satisfied (ref)	258	90 (35%)	168 (65%)					
Child's eating habits								
No control	79	24 (30%)	55 (70%)	0.3	>.05	0.9	0.5-1.5	>.05
Control (ref)	546	149 (27%)	397 (73%)					
Money regularly spent on sweets								
Yes	261	68 (26%)	193 (74%)	1.2	>.05	1.2	0.9-1.7	>.05
No (ref)	362	109 (30%)	253 (70%)					
Reminding child about oral hygiene								
No	243	79 (33%)	164 (67%)	3.8	<.05	0.7	0.5-1.0	<.05
Yes (ref)	383	97 (25%)	286 (75%)					
Society's responsibility for child's oral health								
No	26	9 (35%)	17 (65%)	0.7	> .05	0.7	0.3-1.6	>.05
Yes (ref)	571	155 (27%)	416 (73%)					
Number of teeth								
< 25 teeth	69	21 (30%)	48 (70%)	0.2	>.05	0.8	0.4-1.5	>.05
≥ 25 teeth (ref)	506	141 (28%)	365 (72%)					

About one half of both the child's and parent's independent variables showed statistically significant associations with dental caries ($p<0.05$) (Tables 4 and 5). The child's variables that showed the strongest association with dental caries were country of origin and filling obtained at last dental visit. Gender, family status, family economy judged by the children, money spent on sweets and weight status did not show a statistically significant association with the DMFT-scores (Table 4).

Among parent's variables that showed the strongest and statistically significant associations with the child's dental caries were country of origin, evaluating both own- and the child's oral health as bad and oral health problems in the past (Table 5).

The multiple logistic regression analysis implemented with child's variables entered into the regression model presenting the following variables with the strongest association with dental caries: Russia as country of origin (OR=3.8) and filling obtained during last visit to dentist (OR=5.0) (Table 6). The model passed the Pearson chi-squared goodness of fit test (χ^2=87; p<0.001).

The multiple logistic regression analysis implemented with parental variables entered into the regression model showed that the strongest parental predictors of child´s dental caries were country of origin (OR=2.4) and oral health problems during the past two years (OR=1.8) (Table 7). The model passed the Pearson chi-squared goodness of fit test (χ^2 =60; p<0.001). The number of significant variables from the bivariate analyses (Tables 4 and 5) was thus substantially reduced when tested in a multivariate design (Tables 6 and 7).

DISCUSSION

The present study is part of a large project investigating various aspects of oral health among children in the Barents Euro-Arctic Region. The prevalence of non-attenders was much higher among the Norwegian than the Russian participants, 53% versus 13%. This indicates that at least among the Norwegians, a dropout analysis would have been relevant. However, this was not accepted by the Regional Ethical Committee in Tromsø based on protection of personal integrity and privacy.

The study was conducted on a sample of 12-year-old children in the two regions characterized by different levels of dental caries. Findings from the present study confirmed the previously obtained trends from the pilot study (23) where the main finding was a substantial difference in DMFT/S-scores for the Russian participants (DMFT/S=3.3/5.9) versus the Norwegians (DMFT/S=0.5/0.6) (23).

The results from the present study demonstrate that the caries prevalence among Russian 12-year-olds was higher than for the Norwegian counterpart. Caries statistics from Arkhangelsk (12) and Tromsø (22) as reported in 2009 showed that accordingly 16% and 52% of the 12-year-olds were without caries experience (DMFT=0). This is thus identical to the prevalence found in the present investigation, indicating no selection bias.

Country of origin also appears as the overall strongest associated factor with bad oral health. This is reflected by the distribution of favourable/unfavourable scores for the different independent variables, where the Russian sample presents with higher prevalence of unfavourable scores on most of them; life conditions appeared to be less favourable in North-West Russia than in Northern Norway. Tooth brushing habits were found to be less regular and dental fear more pronounced among Russian than Norwegian participants and dissatisfaction with the child's dental health service was more pronounced in Russia indicating inferior quality of this service. This might partly explain the difference in caries prevalence. Our earlier study (13) clearly showed that there were considerably poorer

Table 6. The multiple logistic regression analysis implemented with child's variables as independent variables and dental caries as dependent variable

Variable	OR	DMFT>0 95% CI	p
Country of origin (Russia)	3.8	2.1-6.8	<0.001
General health, self-evaluated (moderate/bad)	0.9	0.4-1.9	n.s.
Oral health, self-evaluated (bad)	1.7	0.6-4.7	n.s.
Tooth brushing frequency (less than once pr. day)	1.5	0.8-2.6	n.s.
Dental fear (fear, tension before visit)	0.9	0.5-1.8	n.s.
Lunch habits (irregular)	0.6	0.3-1.0	n.s.
Filling obtained at last visit to dentist (yes)	5.0	2.7-9.8	<0.001
Oral hygiene (OHI-S > 0.6)	1.4	0.8-2.6	n.s.

Nagelkerke R^2=0.29, χ^2=29; df=8; p<0.001.

Table 7. The multiple logistic regression analysis implemented with parent's variables as independent variables and dental caries as dependent variable

Variable	OR	DMFT>0 95% CI	p
Country of origin (Russia)	2.4	1.4-4.1	<0.001
Oral health, self-evaluated (moderate/bad)	0.8	0.5-1.3	n.s.
Evaluation of child's oral health (moderate/bad)	1.5	0.9-2.4	n.s.
Satisfaction with school dental service (dissatisfied)	1.1	0.7-1.6	n.s.
Oral problems last two years (yes)	1.8	1.1-2.8	<0.05
Help obtained during last visit to dentist (no)	1.2	0.8-1.9	n.s.

Nagelkerke R^2=0.14, χ^2=14; df=8; p<0.001.

resources in the oral health care provision system, which also explains many of the differences in child's and parents' experiences of dental care (13).

The bivariate analyses indicated that many of the child's and parent's variables introduced showed a statistically significant association with dental caries prevalence with nationality as the most pronounced. Dental fear and parental oral health and oral health attitudes are factors found to be statistically highly significantly associated with the DMFT-scores in the present investigation. This supports findings from other oral health studies (29-31). Many of the other associations presented as a result of the study were somewhat expected based on existing knowledge of caries etiology (32). However, it was not expected to find that among the child variables, money spent on sweets and physical activity/weight status did not show a statistically significant association with DMFT-scores.

The multiple logistic regression analyses established the country of origin as the most dominating determinant. Surprisingly, neither parental education nor family situation were found to be associated with child's dental caries. This is in contrast to previous studies indicating the role of these socio-economic determinants in child's dental caries (33-34). Results thus have to be interpreted with caution until the same findings are established in other studies.

Except for the country of origin and the child's variable of filling obtained during last visit to dentist, the parental variable of oral health problems in the past was also among the variables significantly associated with child's dental caries as documented in the multiple regression analysis. This is consistent with previous studies demonstrating the association between parent's factors and child's dental caries (20-21). A consistent finding was also that the overall regression models were significant for both the child's and parent's variables.

Finally, the impact of many of the statistically significant variables selected from the bivariate analyses became insignificant when controlling for co-variance with country of origin as the most dominating. This is because many of the selected determinants are strongly interrelated, an observation also reported from other oral health studies (5, 20). Due to the dominating impact of country of origin, multiple regression analyses were also performed both on pooled samples and on the Russian and Norwegian samples independently excluding country of origin as a variable. Only minor changes in the outcome were found. This supports the observation of no significant interactions between country of origin and other independent variables. The observed co-variance among the independent variables leading to a substantial reduction from the bivariate to the multivariate analyses may indicate randomness in the association between many of the independent variables and DMFT-scores, complying with theories of dynamic complexity (35).

The work has its strength in providing comparative data on prevalence of dental caries and factors associated with poor oral health among children from selected areas in the Barents region. The study has particular shown that dental caries is common among children in the Barents region and that it is associated with oral health outcomes. However, a cross-sectional design documents associations with minor possibility of disclosing causal relationships. Furthermore, sampling from only two urban areas and not including Northern Sweden and Northern Finland also limits the opportunities for generalization to the whole Barents region.

CONSLUSIONS

Dental caries prevalence was higher among the Russian than the Norwegian children. The overall regression models were significant for both the child and parental variables. The results indicate different impact on child's oral health from children and parental determinants.

ACKNOWLEDGEMENTS

The support obtained from the Savings Bank of Northern Norway Research Fund is greatly appreciated. We would also like to thank Mrs. Weidemann (Tromsø, Norway) for her valuable help in data collection for this study.

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Received: 12 08 2012
Accepted for publishing: 22 03 2013