

# Oral Health-Related Quality of Life Among 12-Year-Olds in Northern Norway and North-West Russia

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## Abstract

**Aims:** To assess self-perceived oral health-related quality of life (OHRQoL) in 12-year-olds living in two areas in the Barents region: North-West Russia (Arkhangelsk) and Northern Norway (Tromsø).

**Methods:** Sampling was performed according to a stratified cluster design and consisted of 590 Russian and 264 Norwegian 12-year-olds and their parents. After written consent from their parents, 514 Russian (87% attendance) and 124 Norwegian (47% attendance) children entered the study. The study included clinical examination (children) and questionnaires (children and parents). Dental caries and the aesthetic dental appearance were recorded under field conditions. Self-reports on background variables and oral health-related quality of life questions (CPQ11-14) were completed in classroom settings by children and at home by parents.

**Results:** OHRQoL was found to vary depending on country of origin, with higher scores of CPQ11-14 domains among 12-year-olds from Russia. OHRQoL was found to be associated with dental caries, with higher scores among 12-year-olds with caries. Inferior emotional and social well-being were established as having the strongest association with quality of life. Dental caries showed an independent effect on OHRQoL scores, but this effect disappeared when controlling for background variables, with country of origin, family economy, parental education and aesthetic appearance as the most influential ( $R^2=0.14$ ).

**Conclusions:** Norwegian 12-year-olds had better oral health and OHRQoL than their Russian counterparts. The impact of dental caries on OHRQoL was weak and aesthetic dental appearance and socio-economic determinants were found to be more important, probably reflecting the great differences in the standards of living between Northern Norway and North-West Russia.

*Key Words:* Oral Health, Dental Caries, Quality of Life, 12-Year-Olds, Barents Region

## Introduction

The concept of "quality of life" as related to health status has attracted increasing interest over the last decades [1]. Indeed, traditional methods alone might be inadequate in assessing oral health and unable to provide a real description of oral health condition, bringing serious consequences for both children and their parents [2]. Oral health-related quality of life (OHRQoL) is not a directly measurable condition, but represents the interplay of many factors such as health status, age, gender and general standard of living and is dependent on the per-

ception of the individual [3]. Thus, oral health-related quality of life and health status represent two different constructs; the former putting the greatest emphasis on mental and psychosocial aspects whereas health status is more closely related to physical functioning [4,5]. In an attempt to measure dimensions of health-related quality of life, a variety of index systems have been developed [4]. In this context, OHRQoL has attracted increasing interest [5-12]. An extensive review of existing instruments for measuring OHRQoL was published by Skaret *et al.* in 2003 [13].

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The northern parts of Norway, Sweden, Finland and North-West Russia, named the Barents Euro-Arctic Region (BEAR), constitute Europe's largest region for inter-regional cooperation. Both climate and living conditions are harsh in this region and general and oral health conditions and health services are inferior compared with more central regions of the respective countries [14]. However, in a global context the parts belonging to Norway, Sweden and Finland are characterised by well-organised health care and educational systems and with fundamental prerequisites for health (peace, housing, education, food and material resources) available to most citizens. On the other hand, Russia has undergone dramatic socio-economic, political, and ideological changes during the past 20 years [15-19] and general and oral health have not improved to the same extent in the Russian part of the BEAR region as in the Nordic parts [14,20].

Assuming that both individual, cultural and socio-economic factors as well as the oral health care system may explain differences in oral health, perception of oral health and oral health-related quality of life, it was considered of interest to study school children's perceived oral health-related quality of life in a cross-cultural context; that is, in the Russian and Norwegian parts of the Barents region. Results from both a pilot study [21] and a more extensive follow-up study [22] indicated that the oral health conditions of North-West Russian 12-year-olds were inferior to their Norwegian counterparts (*Figure 1*). The results further indicated a possible association between oral health and self-perceived oral health-related quality of life in this age cohort [21]. In addition to the oral health status per se, cultural and socio-economic conditions such as unstable family conditions [23] and family economy [24-26] might have an impact. Aesthetic dental appearance is also found to be associated with oral health-related quality of life [9,27].

The pilot study on caries prevalence in the Barents region [21] found an overall higher frequency of dissatisfaction related to standard of living and quality of life-aspects in general among the Russian compared to the Norwegian participants. It was therefore considered of interest to investigate whether or not oral health had an independent effect on self-perceived oral health-related quality of life in the Barents region or whether it is influenced by the socio-demographic, behavioural and clinical factors.

## Aim

The aim of the present investigation was to study the self-perceived oral health-related quality of life in 12-year-olds from two selected cities in the Barents region, Arkhangelsk in North-West Russia and Tromsø in Northern Norway.

## Methods

### Study population and sampling procedure

The target populations were approximately 5000 in Arkhangelsk and 815 in Tromsø. A power calculation was originally based on the detected difference in caries prevalence in Arkhangelsk [28] and Tromsø [29] with 90% power ( $\beta=0.10$ ) and precision of 0.05 ( $\alpha=0.05$ ), yielding a sample size of approximately 300 from Arkhangelsk and 50 from Tromsø. However, in order to allow for multivariate analyses, unknown variation in quality of life and an expected higher number of non-attenders in Tromsø than in Arkhangelsk [21], 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 to recruit due to lack of updated local statistics [14]. 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, respectively.

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

### Self-report

Information on oral health-related quality of life was collected using the Child Oral Health Quality of Life Questionnaire (COHQLoQ) applying the 37 items version of the Child Perception Questionnaire (CPQ11-14) developed by Jokovic *et al.* (2002) [8].

In the CPQ11-14, the questions are grouped in four main domains: oral symptoms (6 items), functional limitations (9 items), emotional well-being (9 items) and social well-being (13 items). The response format ranges from 0 (best) to 4 (worst) conditions [8,30]. Average scores from the questions listed under each domain were used as composite scores for the different domains. The internal consistency coefficients (Chronbach's alpha) were 0.61 for oral symptoms, 0.67 for functional limitations, 0.88 for emotional well-being and 0.83 for social well-being.

Socio-demographic and behavioural variables related to oral health conditions were collected from both parents and children [21,22]. In the present study, results from a clinical examination and self-reports of oral health-related quality of life evaluated by the children (8) are presented both independently and also controlled for the impact of background variables. These background variables comprise information about parental education (mother), oral health conditions, satisfaction with oral care provided by the school dental service, and their own dental care habits as reported by the parents. For the children, information on family conditions and economy, eating habits, general and dental health as well as information on leisure activities was collected. The questionnaires for adults were constructed primarily on similar forms to those used in the Oslo-investigations on 35-year-olds [31] whereas the World Health Survey [32] was used for children. Prior to the main study, a pilot study was conducted in order to validate the questionnaires and to improve their practical usefulness for fieldwork. Any inconsistencies were then corrected to improve the content of the self-reports.

The questionnaires had been translated from English into Norwegian and Russian by two independent interpreters, following established guidelines, including independent back translations [33].

### Clinical examination

The clinical investigation included caries assessment using the DMFT/S index system [34]. 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. Standard infection-control protocols were followed. Dental

caries was diagnosed at the caries into dentine (D3) threshold, using a visual method without radiography or compressed air. Surfaces were given a code according to status: decayed (D), missing (M) and filled (F) then the DMFT/S indices were calculated. The data were registered on individual charts.

Two paediatric dentists carried out the clinical examination. 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 in Tromsø.

Self-evaluation of aesthetic dental appearance was performed by asking the participants to rank the appearance of their front teeth according to a pre-produced set of pictures from ideal alignment (score 1) to severely crowded front teeth (score 10) using the Index of Orthodontic Treatment Need (IOTN) [35]. Before initiating the study, clinical calibration and training sessions, and validation of the questionnaires were performed at a public dental clinic in Tromsø.

Data were analysed using statistical software (Statistical Package for Social Sciences version 19.0; SPSS Inc, Chicago, USA). Differences between Norway and Russia in dental caries rates (DMFT) and the oral health-related quality of life domains (CPQ11-14) (*Table 1*) were analysed by Student's *t*-test. Distributions of scores on self-perceived oral health (*Figure 1*) and impact of self-perceived oral health on own life (*Figure 2*) were estimated by Pearson's chi-square test. Frequency analysis was conducted to estimate the prevalence of scores on various items of the CPQ11-14 domains (*Table 2*). Differences in self-perceived aesthetic dental appearance (*Figure 3*) and oral health-related quality of life scores related to prevalence of dental caries (*Table 3*) were analysed by Student's *t*-test. Correlation analysis was implemented to estimate the relationships between the CPQ11-14 domains and dental caries rates (*Table 4*).

As no significant interactions were revealed between country of origin and the various determinants included, a multiple regression model for final evaluation of the importance of dental caries on quality of life, controlling for the impact of background variables (*Table 5*), was performed on a pooled sample. A two-step multiple regression analysis was run. At the beginning all background factors collected in the main study [22] were introduced, including aesthetic dental appearance, in

**Table 1.** Descriptive statistics for oral health-related quality of life (CPQ11-14 domains) and DMFT/S scores among 12-year-olds from Tromsø (Norway) (n=124) and Arkhangelsk (Russia) (n=514)

Caries scores	Tromsø			Arkhangelsk			P-value
	Mean (SD)	Min. score	Max. score	Mean (SD)	Min. score	Max. score	
DMFT	1.2 (1.7)	0	9	3.0 (2.3)	0	14	<0.001
DMFS	1.5 (2.1)	0	9	4.4 (4.1)	0	28	<0.001
<b>CPQ11-14 domains</b>							
Oral symptoms	4.8 (2.7)	0	14	4.6 (2.9)	0	18	NS
Functional limitations	1.6 (2.1)	0	9	4.6 (3.7)	0	20	<0.001
Disturbed emotional well-being	1.8 (3.1)	0	15	5.1 (4.9)	0	23	<0.001
Disturbed social well-being	2.1 (2.5)	0	17	5.4 (6.1)	0	32	<0.001
Overall CPQ score	9.9 (6.9)	0	34	19.5 (14)	0	85	<0.001

Higher CPQ11-14 scores indicate inferior condition.

NS = not significant

order to establish their influence on the OHRQoL. Variables showing a statistically significant association with OHRQoL-scores were further included in the multiple regression analysis, first without DMFT-score (Step 1) and finally entering the caries score (Step 2) (Table 5).

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. Permission to perform the survey was also obtained from the Regional Department of Education in Arkhangelsk, school authorities in Tromsø and the schools included in Russia and Norway. The analysis of reasons for non-attendance was not accepted by the Regional Committee for Medical Research Ethics of Northern Norway.

## Results

The substantial difference in dental caries occurrence between 12-year-olds from Arkhangelsk and Tromsø (Table 1) has been documented in our earlier studies [21,22]. This finding also corresponds with the self-perceived oral health showing the Russian participants to be less satisfied than the Norwegian (Figure 1). One half of the Norwegian participants reported their oral health to be excellent/very good compared to 12% of the Russian participants ( $P<0.001$ ). However, there was no statistically significant difference in the estimated impact of self-perceived oral health on OHRQoL (Figure 2) ( $P>0.05$ ).

When considering the oral health-related qual-

ity of life in detail, based on the CPQ11-14 index [7,8], where the higher scores were for the worse OHRQoL, the Russian 12-year-olds scored significantly higher on all of the CPQ11-14 domains except for oral symptoms (Table 1). In addition, the Russian children also had worse results, for most of the items included in CPQ11-14 questionnaire, especially in the domains of functional limitations, disturbed emotional well-being and social well-being, than the Norwegians (Table 2).

As for associations between dental caries status dichotomised in DMFT=0/DMFT>0 and the various oral health-related quality of life domains for a pooled sample of subjects, all domains, except oral symptoms, showed a statistically significant association with the caries incidence (Table 3).

Assessing relationships between oral health-related quality of life, dental caries and self-evaluated aesthetic dental appearance (the aesthetic component of the IOTN) [35], the scores were found to be positively correlated with reduced emotional ( $P<0.01$ ) and social well-being ( $P<0.01$ ) and with total CPQ-scores ( $P<0.01$ ). These three OHRQoL domains were also found to be positively correlated with the DMFT index at a statistically significant level ( $P<0.05$ ). In both cases, the associations between the studied variables were weak and varied from 0.08 to 0.13 (Table 4).

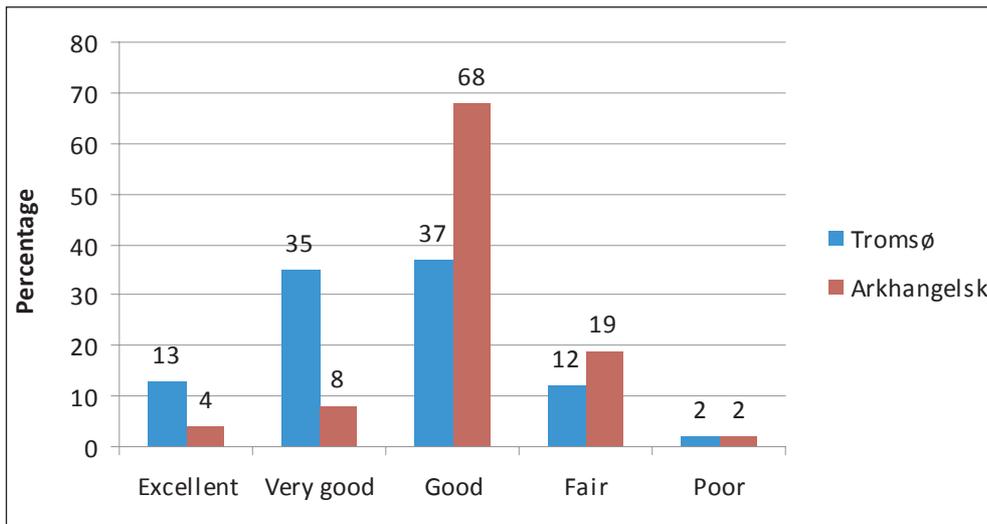
Ranking of self-evaluated aesthetic dental appearance showed no significant differences between the Russian and Norwegian participants and 79% of the participants indicated either ideal alignment or only minor deviations (IOTN scale 1-3) with no difference between groups (Figure 3).

**Table 2.** Percentage of the study population (children) in relation to CPQ11-14 items among 12-year-olds from Norway (n=124) and Russia (n=514)

CPQ11-14 domains	CPQ11-14 item	Tromsø		Arkhangelsk	
		n	%	n	%
Oral symptoms	Pain in teeth, lips, jaws or mouth	59	(48%)	311	(55%)
	Bleeding gums	77	(63%)	251	(45%)
	Sores in mouth	73	(60%)	212	(38%)
	Bad breath	68	(56%)	332	(59%)
	Food stuck in or between teeth	103	(84%)	457	(81%)
	Food stuck in the top of mouth	16	(13%)	68	(12%)
Functional limitations	Breathing through mouth	20	(17%)	414	(74%)
	Taken longer than others to eat a meal	11	(9%)	240	(43%)
	Had trouble sleeping	10	(8%)	175	(31%)
	Difficult to chew food	23	(19%)	151	(27%)
	Difficult to open mouth wide	13	(11%)	78	(14%)
	Difficult to say words	18	(15%)	139	(25%)
	Difficult to eat food you like	14	(11%)	93	(16%)
	Difficult to drink with a straw	2	(2%)	19	(3%)
	Difficult to drink/eat hot/cold foods	25	(22%)	277	(49%)
Disturbed emotional well-being	Irritable or frustrated	26	(21%)	225	(40%)
	Unsure of self	23	(19%)	276	(49%)
	Shy or embarrassed	32	(26%)	283	(50%)
	Concerned what others think	40	(32%)	213	(38%)
	Worried not as good-looking as others	23	(19%)	256	(45%)
	Been upset	10	(8%)	279	(50%)
	Feel nervous or afraid	13	(11%)	257	(54%)
	Worried not as healthy as others	18	(15%)	200	(35%)
Disturbed social well-being	Worried being different from others	11	(9%)	177	(32%)
	Missed school due to treatment	79	(65%)	116	(21%)
	Hard paying attention at school	8	(14%)	154	(28%)
	Difficulty with doing homework	5	(4%)	173	(31%)
	Not wanting to speak loud at class	6	(4%)	129	(23%)
	Avoid taking part in activities	3	(2%)	103	(18%)
	Not wanting to talk to other children	3	(3%)	129	(23%)
	Avoid smiling, laughing	24	(20%)	137	(24%)
	Difficulty playing musical wind instruments	2	(2%)	60	(11%)
	Not wanting to spend time with children	1	(1%)	119	(22%)
	Arguments with children or family	8	(7%)	266	(48%)
	Teased	4	(3%)	228	(41%)
	Feel left out by others	0	(0%)	143	(26%)
	Children asking about teeth, lips, jaws, mouth	42	(34%)	102	(28%)

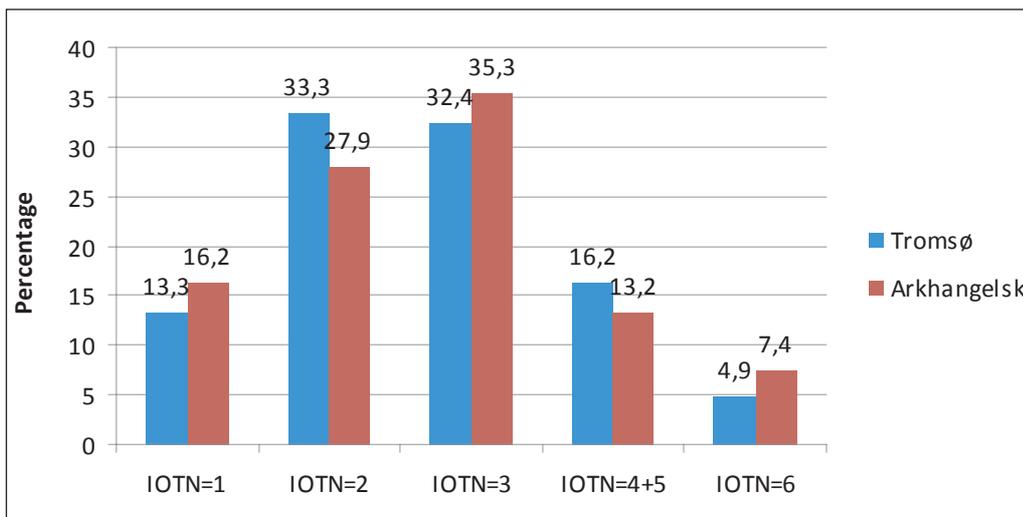
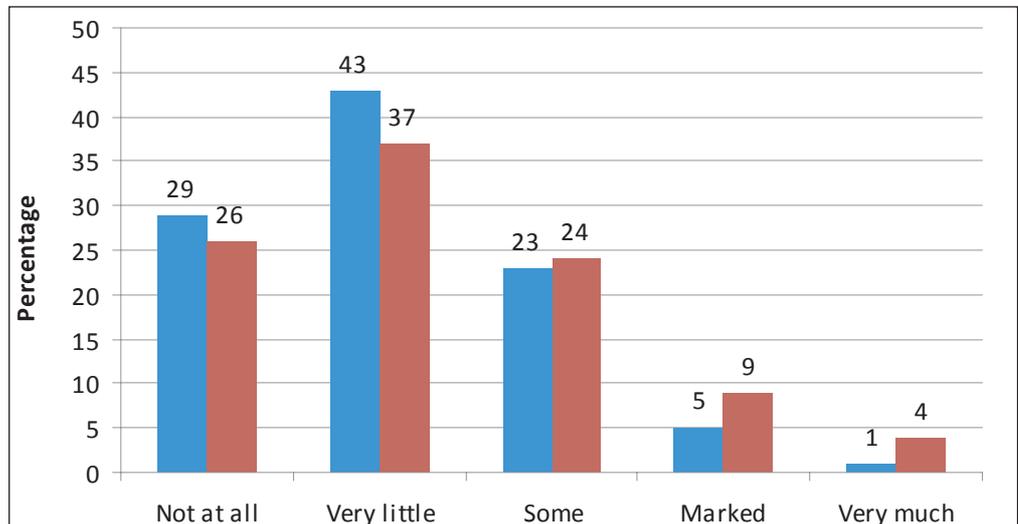
These results indicate an impact of dental caries on oral health-related quality of life among 12-year-olds in the BEAR region (Table 3). Background factors such as country of origin, gender, aesthetic appearance level of parental education, family economy and family situation may have a possible impact on self-perceived oral

health-related quality of life [12,24-27] and act as confounders. In addition, as no significant interactions were revealed between country of origin and the various factors included in the study, multiple regression was performed on a pooled sample [22]. A two-step multiple regression analysis introducing these variables at first step and thus controlling for



**Figure 1.** Self-perceived oral health on a scale from excellent (score 1) to poor (score 10) among Norwegian and Russian 12-year-olds.

**Figure 2.** Estimated impact of self-perceived oral health on oral health-related quality of life among 12-year-old Norwegian and Russian children.



**Figure 3.** Self-evaluated aesthetic dental appearance according to the IOTN index measuring self-perceived appearance of the front teeth.

its relationship with the CPQ11-14 scores was therefore performed. The DMFT index was entered to the model in the second step. Results from the first step, not including caries scores, showed that

country of origin, aesthetic appearance, level of parental education and family economy had a statistically significant association with the CPQ11-14 scores ( $R^2=0.14$ ,  $F=13.31$ ,  $P<0.001$ ). When adding

**Table 3.** CPQ11-14 domain scores related to caries occurrence (DMFT) grouped in four different domains and overall score

CPQ11-14 domains	DMFT = 0			DMFT >0			P-value
	Mean (SD)	Min. score	Max. score	Mean (SD)	Min. score	Max. score	
Oral symptoms	4.9 (2.9)	0	18	4.6 (2.9)	0	15	NS
Functional limitations	3.7 (3.5)	0	16	4.3 (3.7)	0	20	<0.05
Disturbed emotional well-being	3.4 (4.4)	0	19	4.8 (4.9)	0	23	<0.05
Disturbed social well-being	4.1 (5.1)	0	24	5.1 (5.9)	0	32	<0.05
Overall CPQ score	15.8 (12.1)	0	68	18.6 (14.2)	0	85	<0.05

Higher CPQ11-14 scores indicate inferior condition.  
NS = not significant

**Table 4.** Relationships presented as correlation coefficients between oral health-related quality of life domains (CPQ11-14), aesthetic dental appearance (IOTN-score) and dental caries prevalence (DMFT-score)

CPQ11-14 domains	IOTN score	DMFT score
Oral symptoms	0.05	0.04
Functional limitations	0.05	0.05
Emotional well-being	0.12 **	0.08*
Social well-being	0.13 **	0.09*
Overall CPQ score	0.12 **	0.09*

\*  $P < 0.05$ , \*\*  $P < 0.01$ .

the DMFT index values into the regression equation, the  $\beta$  coefficients for the control variables changed slightly, but the  $R^2$  remained unchanged at 0.14 (Table 5).

### Discussion

The aim of the present study was to investigate to what extent oral health in general and dental caries in particular represented factors of importance regarding self-perceived oral health-related quality of life among 12-year-olds in the Barents region. The study was performed in two areas with quite diverse socio-cultural and economic conditions, Arkhangelsk in North-West Russia and Tromsø in Northern Norway [14]. A statistically significant difference between the Russian and Norwegian participants regarding prevalence of dental caries had previously been documented in a pilot study [21] and was confirmed in the present study [22]. Self-perceived oral health was consistent with this difference. However, no difference was found regarding the impact of oral health on self-perceived quality of life, indicating that this dimension

**Table 5.** Association between caries experience (DMFT) and oral health-related quality of life scores (CPQ11-14) controlling for selected factors in a multiple regression equation model

Variable name	$\beta$ -value	P-value
Country of origin (Russia)†‡	8.403	<0.001
Gender (male) †	-1.804	NS
Aesthetic dental appearance (high score)†	2.566	<0.05
Level of parental education (less than 12 y)‡	2.743	<0.05
Family economy (bad) †	5.475	<0.001
Social support (bad family situation) †	-1.588	NS
DMFT index (>0) †	0.306	NS

† child variable, ‡ parental variable.

NS = not significant

was relative and not directly related to the oral health conditions per se. When investigating this result in more detail, it appeared that the Russian participants scored higher on most of the domains included in the CPQ scores and that the scores were related to prevalence of dental caries. The findings concerning the established highest differences regarding CPQ11-14 domains of disturbed emotional and social well-being probably reflected the situation of children at the age of 12 years as being more vulnerable psychologically than physically to different health conditions. It had been previously suggested that adolescents aged 19 years are more capable of handling life situations, including oral health care, than younger children [36].

Previous studies have repeatedly shown that inferior OHRQoL is related to different socio-behavioural conditions [4-6]. In this study, the frequency distribution of scores for CPQ11-14 domains showed that the Russian 12-year-olds were more frequently limited functionally as well as disturbed emotionally and socially than the Norwegian ones. This probably reflected an overall

inferior quality of the standard of life in North-West Russia compared to Northern Norway [21,22,37], which correlated with the prevalence of dental caries.

Self-evaluation of the dental aesthetic appearance of their front teeth showed only minor differences between the groups. In addition, the aesthetic dental appearance only correlated significantly with the emotional and social domains of the CPQ and with the overall CPQ score, supporting the suggestion that the possession of malocclusion more frequently interferes with a person's emotional and social well-being than oral health in general [38]. The established correlations were found to be very weak, a finding in line with a study of Mandall *et al.* (2005) [39], and should thus be interpreted with caution.

Another interesting finding in our study was that, when analysing the impact of caries prevalence in a multiple regression model, the impact of dental caries disappeared. This indicated that the bivariate associations found were mainly due to different factors related primarily to socio-economical confounders like country of origin (Russia), bad family economy and low level of parental education but also to the clinical variable of aesthetic dental appearance. Previous studies have found that socio-economic status, including family wealth [24,26] and aesthetic dental appearance [27], are important for self-perceived oral health-related quality of life, supporting the findings of the current study. It is possible that people living in areas where the oral health conditions are worse among all population groups and also access to oral health care more difficult than in other parts of the country [14] get used to the prevailing circumstances and do not complain or find the impact of oral health status on their quality of life so great. Instead of studying oral health-related quality of life as an isolated phenomenon, it could be interesting to measure the extent of the dental component in comparison with general diseases and other domains influencing the quality of life.

In summary, the study showed that although the prevalence of dental caries was relatively high,

especially among the Russian 12-year-olds, it showed a rather weak impact on self-perceived oral health-related quality of life. The findings indicate that greater awareness of the importance of good oral health is needed in these geographical areas.

## Conclusions

Norwegian 12-year-olds had better oral health and OHRQoL than their Russian counterparts. The impact of dental caries on OHRQoL was weak and aesthetic dental appearance and socio-economic determinants were found to be more important, probably reflecting the great differences in the standards of living between Northern Norway and North-West Russia.

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## Contributions of each author

- NK designed the study, in collaboration with the co-authors, performed the clinical investigation and collected the survey data, performed data analysis in collaboration with RK, and was responsible for the writing of the paper.
- HME was partly responsible for the design of the study and the writing of the paper.
- EW was partly responsible for the design of the study and the writing of the paper.
- ME contributed to the design of the study, the psychological part of data evaluation and the writing.
- AO supported data collection in Arkhangelsk.
- RK supported data analysis and the writing of the paper.

## Statement of conflict of interest

As far as the authors are aware, there are no conflicts of interest.

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