Changes in oral health-related quality of life according to public oral health procedures in parents of young children from the FinnBrain Birth Cohort Study

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Abstract

Objectives: The aim was to evaluate the association between public oral healthcare procedures and change in oral health-related quality of life (OHRQoL) over four years among parents in the FinnBrain Cohort Study, comparing those who did not visit public oral healthcare.

Methods: Study used data on parents of young children from the FinnBrain Birth Cohort Study (www.finnbrain.fi) and healthcare centers' national patient data register. OHRQoL was measured with the 14-item Oral Health Impact Profile (OHIP-14). Of those who had answered the OHIP-14 questionnaire at gestational week (gw) 34 and 4-year time points (n=1552), 589 had visited a public oral healthcare service. OHIP-14 severity score, two thresholds of prevalence and their changes were evaluated according to gender and public oral healthcare visits (Mann-Whitney U test, χ^2 test, Wilcoxon signed ranks test). Correlations between treatment procedures and OHRQoL were evaluated among those who had visited public oral healthcare service. Association between OHRQoL and its change with different treatment procedures were evaluated by using Spearman correlation coefficients.

Results: OHRQoL did not change for the majority of parents, regardless of visiting public oral healthcare service, or if they received oral healthcare treatment or only preventive procedures. Change in OHRQoL and treatment procedures showed a weak association. OHRQoL worsened most for those receiving treatment in four or more procedure groups. Changes in OHRQoL were not clinically meaningful.

Conclusions: Oral healthcare procedures seem to have a limited impact on OHRQoL changes among parents of young children.

Key words: healthcare, health-related quality of life, parents, cohort study, longitudinal study, oral health, Oral Health Impact Profile

Introduction

One purpose of oral healthcare services is to improve oral health related quality of life (OHRQoL)[1, 2], especially among those with greatest need. Mostly cross-sectional studies have shown that those affected by the most common oral diseases such as caries, periodontitis, and missing teeth, have poorer OHRQoL[3-6.] In longitudinal studies with follow-up times from one day to three years, oral healthcare procedures related to periodontology, cariology, endodontics, prosthetics, stomatognathic physiology (without surgery) and xerostomia have shown to improve OHRQoL[7-13], although others on supportive periodontal treatment procedures demonstrated no effect on OHRQoL[14, 15]. Treatment of severe forms of malocclusions has shown to improve OHRQoL up to the level of the Finnish population after 3 to 8 years of treatment[16, 17].

Many of the previous studies have been conducted in specialised care, hospitals, or university clinics. This limits generalizability to the general population. Yet, information at a population level is important for planning oral healthcare services and directing resources to those who need them most, especially when treatment is subsidized by public funds. Since 2002, the entire Finnish population has been entitled to use subsidized public oral health care services with nationally fixed out-of-pocket fees for adults, and free for those under 18 years. The care covers a wide range of oral healthcare procedures according to the uniform criteria used for access also to non-emergency treatment[18]. To date, however, there have been no studies reporting whether the oral healthcare procedures provided in public oral healthcare services improve patient OHRQoL in the general population over the long-term.

The aims of the study were to examine (1) whether public oral healthcare procedures were associated with changes in OHRQoL among parents of the FinnBrain Cohort Study from the third trimester of the pregnancy up to four years. (2) compare changes in OHRQoL between those that did and did not visit public oral healthcare services. The study hypothesis was that public oral healthcare procedures would lead to an improvement in OHRQoL.

Methods

The study was a secondary analysis of data from the multidisciplinary FinnBrain Birth Cohort Study (www.finnbrain.fi) on the effects of environment and genes on child brain development and health[19]. Participants in the South-Western Hospital District and the Åland Islands in Finland were recruited during 2011-2015 after ultrasonography appointments, which are offered free of charge, for every pregnant mother in Finland by municipal maternity clinics during the first trimester of the pregnancy. The coverage of these appointments attended by mothers is nearly 100%[19, 20]. The ethical clearance for the FinnBrain Birth Cohort Study was obtained from the

Intermunicipal Hospital District of Southwest Finland on 14.6.2011 and all participants provided signed informed consent. After birth, cohort families have been followed up regularly[19]. The study used data from pregnancy to the point when the participating child was four years old.

All mothers-to-be (n = 5790) and fathers or other partners (later called fathers) who participated in the appointment with the mother were informed about the study. Mothers were asked to invite fathers, who did not attend the ultrasound appointment, to participate the study. From these potential participants, 3808 mothers and 2624 fathers expecting 3837 babies (twins included) decided to participate at the first stage. The flowchart of allocated and analysed participants is presented in Figure 1.

OHRQoL was measured using the reliable and valid Finnish translation of the 14-item Oral Health Impact Profile (OHIP-14) questionnaire[21, 22] at two time points i.e., gestational week 34 (gw34) and when the child was 4-year-old (4yr). The respondents reported the frequency of each impact during the previous month on a 5-point scale ranging from 0 (never) to 4 (very often). For participants with one or two missing OHIP-14 values (owing to a non-response or answering don´t know) the missing values were replaced with the sample mean computed from the non-missing responses to OHIP-14 in the relevant time-point. Those with more than two missing OHIP-14 values were not included in the analysis. OHIP severity score was calculated as the sum of the ordinal responses with a range of 0–56, a lower score indicating better overall OHRQoL. The prevalence was determined as the percentage of participants who reported at least one OHIP-14 impact at two thresholds, occasionally, fairly often, or very often (OFoVo), and fairly often or very often (FoVo). Lower prevalences indicating better OHRQoL. Change in OFoVo prevalence was categorized into improvement, no change, and worsening. The change in severity was determined by subtracting the severity at gw34 from severity at 4yr, increased scores indicating deterioration in OHRQoL.

Data on oral healthcare procedures between gw34 and 4yr were obtained from the public healthcare centers' national patient data register maintained by the Finnish Institute for Health and Welfare. Procedures were categorized based on the national oral healthcare area codes used in the Finnish public oral healthcare sector. The categories were examination and treatment plan, preventive oral healthcare, radiological examinations, periodontology, cariology, endodontics, prosthetics, surgery, stomatognathic physiology, orthodontics, and anesthetics. Examination, preventive oral healthcare such as health advice e.g., tobacco, alcohol, oral self-care teaching, topical fluoride application and radiological examination codes were categorized as preventive procedures and other procedure codes as treatment procedures. Codes related to appointment type or anesthetics were excluded, the latter as they were assumed to be related to other procedures. The

participants were divided into two groups according to the oral healthcare procedures they had, those with only preventive procedures and those with any procedures, including preventive ones.

Information concerning the parents' age at childbirth was obtained from the Finnish Medical Birth Register, and education with self-report questions at gw34[19]. Education was divided into three levels: low (high school/vocational < 12 years), medium (polytechnics) and high (university degree or comparable).

Descriptive statistics were calculated for age, education, OHIP-14 severity score, and severity change, OFoVo and FoVo prevalences, OFoVo change and oral healthcare procedures according to gender and visiting public oral healthcare. Differences between the genders and those who visited at least once between gw34 and 4yr or did not visit public oral healthcare service were evaluated using the Mann-Whitney U test and χ^2 test. Statistical significance of the changes in severity scores were evaluated using the Wilcoxon signed rank test. Association between severity and its change, and number of oral healthcare procedures according to procedure types, were evaluated using Spearman correlation coefficients. Analyses were conducted using IBM SPSS Statistics 29.

Results

The distribution of participants by gender, age, education and oral health-related quality of life, is presented in Table 1. Of the parents 1140 mothers (42.8 %) and 476 fathers (17.9 %) had visited public oral healthcare services between gw34 and the 4yr. Of those who answered the OHIP-14 questionnaire at gw34 and 4yr, 41.8% of the mothers and 30.2% of the fathers had visited public oral healthcare. Mothers who did not visit public oral healthcare were older than those who did ($p = 0.005$). Fathers who did not visit public oral healthcare had lower levels of education than did mothers in the same group ($p < 0.001$). During pregnancy women had better severity scores but poorer OFoVo prevalence than fathers had. By 4yr, these differences between parents were smaller. For those who visited public oral healthcare, severity remained the same more often than improved or worsened. Both groups had similar change in severity. For most OFoVo prevalence did not change, and when it changed it worsened more often than improved. A similar trend was observed among those who did not visit public oral healthcare.

Information about the number of procedures and OHRQoL by treatment type and number of treatment types per participants is presented in Table 2. Among those who received only preventive procedures, the mean number of procedures was 2.4 (range = 1–7) and their mean severity score change was not statistically significant (increased by 0.16, $p = 0.871$) during the

study. The standardised response means (SRM) for the orthodontic treatment procedures was -0.44 and for the other treatment procedure group the SRM ranged from 0.04 to 0.31, indicating that the change in OHRQoL was not clinically relevant. The participants receiving treatment procedures had also preventive procedures (mean 3.41, range 0–25), increasing the mean number for all procedures to 8.57 (range 1–83). Their mean severity score increased by 0.59 ($p < 0.001$) implying worsened OHRQoL. The corresponding change for the total group was 0.57 ($p = 0.130$), respectively. Participants most often received treatment for dental caries or periodontal disease. OHRQoL worsened in those who had any treatment procedures, and of the procedure groups in those who had cariological, endodontic, periodontal or stomatognathic physiology procedures. OHRQoL tended to improve only with orthodontics procedures. OHRQoL worsened most for those with treatment procedures from four or more different procedure groups. The change was statistically significant if there were treatment procedures in one or two procedure groups.

The correlations between the number of procedures and OHRQoL are presented in Table 3. Numbers of procedures were more often associated with severity at the 4yr than at the baseline, but the correlations were very weak. The only statistically significant, but weak positive correlation between the change in OHRQoL and number of procedures, was found in those who had only preventive procedures indicating worsened OHRQoL with more treatment procedures.

Discussion

For most participants OHRQoL did not change and when changed it tended to worsen rather than improve, regardless of if participants had used public oral healthcare services or not. OHRQoL worsened the most in those who received four or more treatment procedures. The association between OHRQoL change and procedures was weak in every procedure group. The study hypothesis that OHRQoL would be improved over the 4yr follow-up period due to the oral healthcare procedures was rejected.

The strength of this study was a longer follow-up period compared to previous studies, as many previous studies have studied the impact of procedures on OHRQoL change mainly from one day to three years.[7-11, 14, 15]. In addition, a reliable and valid OHRQoL measurement tool[21], which has been used also in other OHRQoL studies [16, 17, 21, 23-24], was used which means that the findings are comparable on a national level. The FinnBrain Birth Cohort sample has been shown to represent the general population in the geographic area[19], including both mothers and fathers from various socio-economic backgrounds. However, the study has limitations. The data on oral procedures was limited to only those who visited public oral healthcare and there was no data available of the procedures for those who had not visited public oral healthcare services but who

had responded to the OHIP-14 questionnaire at both time points. The data described only the procedures taken, not the professionally assessed treatment need. The study could not identify those who came for examination but not for the needed treatment or those who visited private oral healthcare or both public and private oral healthcare services. The sample represented a limited age group in a specific life situation with young children. Young parents with low education levels were likely to have dropped out of the FinnBrain study[19], which could cause bias in interpreting the findings.

The use of oral healthcare services has increased in Finland in the 2010s[25]. During years 2011–2019 11–14% of 20–35 years old South-Western inhabitants visited private oral healthcare services[26]. At the same time, 20–28% of the 30–39 years old Finnish citizens visited private oral healthcare services. Those with the lowest level of education in Finland, had fewest visits to oral healthcare checkups.[25] In the study, the highest level of education was found among mothers and lowest level among fathers who did not visit public oral healthcare. This suggests that mothers who did not visit public oral healthcare may have visited private oral healthcare, while fathers likely did not visit any oral healthcare services. Over 40% of participants visited public oral healthcare during the study which may be due to the Finnish Government Decree on maternity and child health clinic services. According to the decree, local authorities shall provide at least one evaluation of oral health and need for care assessment for families expecting their first baby.[27] Oral healthcare procedures were more strongly associated with OHRQoL at the 4yr than at baseline, indicating that those with more procedures had poorer OHRQoL than those with less procedures. The effect of the number of treatment procedures on OHRQoL change was not clinically meaningful[28].The identified treatment needs during visits may have affected the OHRQoL.

Better OHRQoL has been shown to lead to regular use of oral healthcare services and regular service use may lead to better subjective oral health experience. At baseline OHRQoL was higher compared to that of the Finnish population of a similar age in 2011.[24] Most of the Finnish population of the same age as the participants have not been diagnosed with cavities or other oral healthcare needs[29]. The participants were likely to have a similar situation, and thus, they might have perceived their OHRQoL as good. This is one potential explanation for why the association between oral healthcare procedures and OHRQoL was found to be weak. Additionally, oral health problems can be asymptomatic for a long time; it may be that asymptomatic assess their OHRQoL better than those who experience symptoms from oral health problems.

In Finland, public oral healthcare procedures are carried out based strictly on the assessed need for treatment, as the system is funded by public tax revenue. Treatment procedures, except orthodontics, tended to worsen OHRQoL although the changes were significant only for

prosthetic and surgical procedures. These findings differ from previous findings which were based on shorter follow-up periods[7-11, 14, 15]. Oral diseases requiring treatment were possibly treated mainly with simple procedures like simple fillings or scaling, which may have very minor or no effect on OHRQoL. On the other hand, some procedures, such as tooth extraction, may have led to greater decline in OHRQoL. Those who had orthodontic procedures had an improvement in OHRQoL, but the change in OHRQoL was not statistically significant. The improvement was likely due to treatment of severe malocclusions in adulthood, which have shown to improve OHRQoL[16, 17].

In conclusion, considering the study limitations, public oral healthcare procedures had a limited impact on OHRQoL among parents of young children in the FinnBrain Birth Cohort Study. Instead, OHRQoL worsened rather than improved during t the study period. The changes in OHRQoL were not clinically meaningful. The changes in OHRQoL may be due to many factors not measured in the current secondary analysis. Further research is needed to identify which factors beyond oral health care could influence OHRQoL among parents of young children.

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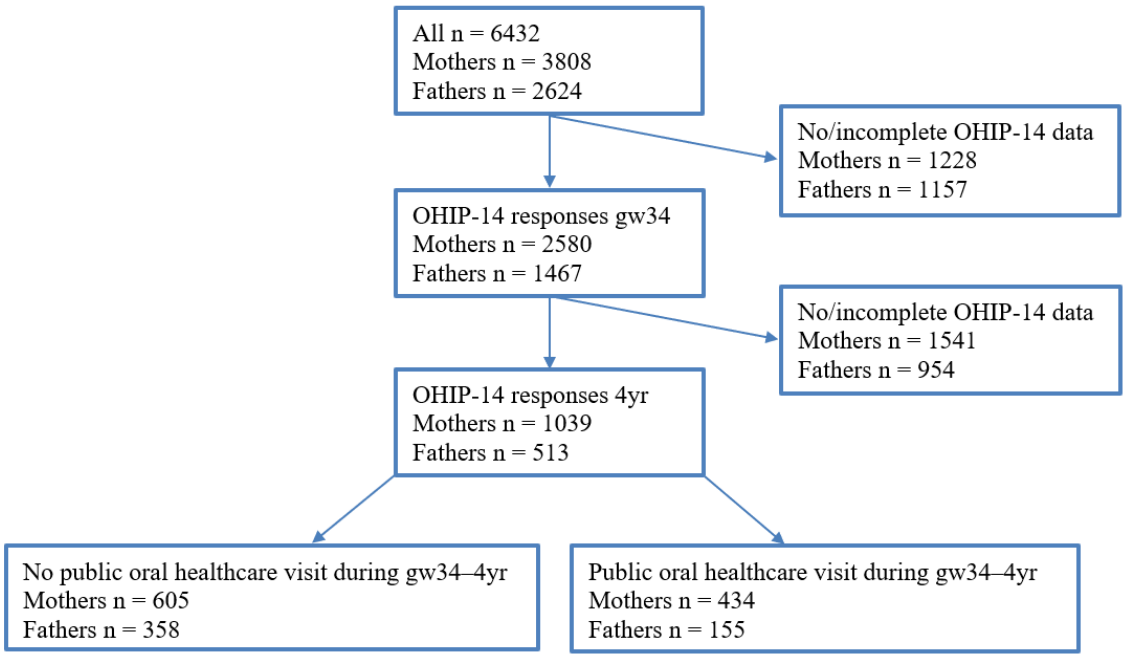

Figure 1. Flowchart of the participants during the study.

OHIP–14 = Oral Health Impact Profile 14

gw34 = gestational week 34

4yr = 4–year time point

Table 1. Descriptive statistics of age, education, gender, Oral Health Impact Profile severity score, the percentage of participants reporting at least one impact occasionally, fairly often or very often, percentage of participants reporting at least one impact fairly often or very often, change in the Oral Health Impact Profile severity score and change in prevalence of the percentage of participants who reported at least one impact occasionally, fairly often, or very often, and the number of participants in preventive and treatment procedure groups.

		Visit to public oral healthcare				No visits to public oral healthcare			
		All	Mothers	Fathers	p	All	Mothers	Fathers	p
N		589	434	155		963	605	358	
Age	Mean (Range)	31.3 (18–54)	30.7 (18– 45)	33.1 (21–51)	<0.001	32.0 (18–54)	31.4 (18–42)	33.0 (22–54)	<0.001
Education (1 missing)	Low, n (%)	172 (29.2)	123 (28.4)	49 (31.6)	0.084	278 (30.8)	155 (27.4)	123 (36.6)	<0.001
	Medium, n (%)	187 (31.7)	130 (30.0)	57 (36.8)		255 (28.3)	154 (27.2)	101 (30.1)	
	High, n (%)	229 (38.9)	180 (41.6)	49 (31.6)		369 (40.9)	257 (45.4)	112 (33.3)	
OHIP-14 gw34	Severity score, mean (SD)	1.79 (3.9)	1.56 (3.0)	2.43 (5.5)	0.072	1.58 (3.5)	1.46 (3.4)	1.79 (3.5)	0.136
	OFoVo prevalence, n (%)	118 (20.0)	89 (20.5)	29 (18.7)	0.631	174 (18.1)	112 (18.5)	62 (17.3)	0.642
	FoVo prevalence, n (%)	17 (2.9)	8 (1.8)	9 (5.8)	0.011	40 (4.2)	24 (4.0)	16 (4.5)	0.706
OHIP-14 4yr	Severity score, mean (SD)	2.35 (4.2)	2.29 (3.9)	2.50 (5.1)	0.844	2.15 (3.9)	2.18 (4.1)	2.11 (3.6)	0.954
	OFoVo prevalence, n (%)	168 (28.5)	125 (28.8)	43 (27.7)	0.802	249 (25.9)	159 (26.3)	90 (25.1)	0.696
	FoVo prevalence, n (%)	39 (6.6)	29 (6.7)	10 (6.5)	0.921	55 (5.7)	38 (6.3)	17 (4.7)	0.322
Change in	Severity score, mean (SD)	0.56 (4.4)	0.73 (3.8)	0.07 (5.6)	0.191	0.57 (4.4)	0.72 (4.7)	0.32 (3.9)	0.335
Change in OFoVo prevalence	Improvement, n (%)	51 (8.7)	40 (9.2)	11 (7.1)	<0.001	93 (9.7)	65 (10.7)	28 (7.8)	0.130
	No change, n (%)	437 (74.2)	318 (73.3)	119 (76.8)		702 (72.9)	428 (70.8)	274 (76.6)	
	Worsening, n (%)	101 (17.1)	76 (17.5)	25 (16.1)		168 (17.4)	112 (18.5)	56 (15.6)	
Groups	Only preventive procedures [a], n (%)	49 (8.3)	39 (9.0)	10 (6.5)	0.327				
	Treatment procedures [b], n (%)	540 (91.7)	395 (91.0)	145 (93.5)					

OHIP-14 = Oral Health Impact Profile 14
gw34 = gestational week 34
4yr = 4-year time point 4.4
OFoVo prevalence = percentage of participants who reported at least one OHIP-14 impact Occasionally, Fairly often, Very often
FoVo prevalence = percentage of participants who reported at least one OHIP-14 impact Fairly often, Very often
Severity score = sum of the ordinal OHIP-14 responses with a range of 0–56, a lower score indicating better overall OHRQoL

p = p-value for Mann-Whitney U test for discrete and $\chi 2$ test for categorical variables
a Preventive procedures = examinations, preventive oral healthcare, radiological examinations
b Treatment procedures = cariological, endodontic, periodontal, prosthetic, stomatognathic physiology, orthodontic and surgical procedures

Table 2. Mean number of oral healthcare procedures and mean Oral Health Impact Profile severity scores by treatment type, and number of treatment types per participant, as well as standardised response means by treatment type.

		Number of procedures	OHIP-14 severity score, mean (SD)			
	n (%)	Mean (range)	gw34	4yr	change	SRM
Any treatment procedures [a]	540 (91.7)	5.16 (1–58)	1.80 (3.9)	2.39 (4.3)	*0.59 (4.5)	0.13
Cariology procedures	354 (60.1)	2.54 (1–21)	1.84 (4.1)	2.69 (4.7)	*0.85 (4.7)	0.18
Endodontics procedures	68 (11.5)	2.66 (1–13)	3.04 (5.6)	3.96 (4.6)	*0.91 (7.0)	0.13
Periodontology procedures	380 (64.5)	1.63 (1–6)	1.67 (3.4)	2.22 (4.0)	*0.55 (4.5)	0.12
Prosthetics procedures	7 (1.2)	2.29 (1–5)	2.71 (3.1)	3.57 (4.2)	0.86 (2.8)	0.31
Stomatognathic physiology procedures	59 (10.0)	1.53 (1–7)	1.78 (3.3)	2.86 (3.8)	*1.08 (4.1)	0.26
Orthodontics procedures	9 (1.5)	3.44 (1–21)	5.78 (9.5)	2.78 (3.5)	–3.00 (6.8)	-0.44
Surgery procedures	122 (20.7)	1.69 (1–5)	2.81 (4.8)	3.07 (4.7)	0.26 (6.1)	0.04
Number of treatment procedure types/participant						
1	229 (38.9)	2.17 (1–18)	1.62 (4.0)	2.20 (4.6)	*0.58 (3.7)	
2	195 (33.1)	5.25 (2–23)	1.54 (3.3)	2.04 (3.5)	*0.50 (4.1)	
3	86 (14.6)	8.24 (3–20)	1.99 (4.0)	2.49 (4.1)	0.50 (5.0)	
4+	30 (5.1)	18.57 (8–58)	4.37 (6.2)	5.87 (5.6)	1.50 (8.6)	

OHIP-14 = Oral Health Impact Profile 14
gw34 = gestational week 34
4yr = 4-year time point
Severity score = sum of the ordinal OHIP-14 responses with a range of 0–56, a lower score indicating better overall OHRQoL
a Treatment procedures = cariological, endodontic, periodontal, prosthetic, stomatognathic physiology, orthodontic and surgical procedures
* Statistically significant change, Wilcoxon signed-rank test
SRM = standardised response means

Table 3. The Spearman correlation coefficients between the number of different oral healthcare procedures and Oral Health Impact Profile severity score.

	OHIP-14 severity		
Procedures	gw34	4yr	change
Among all (n = 589)			
All procedures (treatment and preventive)	*0.104	***0.183	0.071
Preventive procedures	0.054	***0.154	*0.105
Treatment procedures	**0.127	***0.169	0.034
Among those with only preventive procedures (n = 49)			
Preventive procedures	0.093	0.199	0.094
Among those with treatment procedures (n = 540)			
All procedures (treatment and preventive)	**0.125	***0.182	0.057
Preventive procedures	0.061	***0.152	*0.102
Treatment procedures	***0.157	***0.169	0.012
Cariology procedures	0.064	**0.135	0.078
Endodontics procedures	*0.099	***0.179	0.059
Periodontology procedures	-0.025	-0.045	-0.048
Prosthetics procedures	0.063	0.067	-0.005
Stomatognathic physiology procedures	-0.010	0.080	0.048
Orthodontics procedures	0.074	0.024	-0.079
Surgery procedures	***0.149	**0.108	-0.035

OHIP-14 = Oral Health Impact Profile 14
Severity score = sum of the ordinal OHIP-14 responses with a range of 0–56, a lower score indicating better overall OHRQoL
gw34 = gestational week 34
4yr = 4-year time point
*, p<0,05; **, p<0,01; ***, p<0,001
Preventive procedures = examinations, preventive oral health care, radiological examinations
Treatment procedures = cariological, endodontic, periodontal, prosthetic, stomatognathic physiology, orthodontic and surgical procedures