

Oral Health-Related Quality of Life and Caries Experience of Hong Kong Preschool Children

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Keywords:	Quality of life, Child, Oral health, early childhood caries, Dental caries
Abstract:	<p>Oral Health-Related Quality of Life and Caries Experience of Hong Kong Preschool Children</p> <p>Objective: The study aimed to investigate the association between oral health-related quality of life (OHRQoL) and caries experience of Hong Kong preschool children. Methods: Parents or primary caretakers of Hong Kong preschool children were invited to complete a self-administered dental health questionnaire. The study children were examined in their kindergartens. The decayed, missing and filled teeth (dmft) index was used for documenting the caries status. The questionnaire included the Chinese Early Childhood Oral Health Impact Scale (ECOHIS), parents and children's socio-demographic backgrounds. Logistic regression analysis was used to determine the association between the OHRQoL and caries experience of preschool children.</p> <p>Results: A total of 434 preschool children were invited. Among these, 336(77.4%) received dental examination and returned a parental questionnaire. The mean (SD) age of the study children was 4.7(0.3) years. Among them, 236 caregivers (70.2%) reported an OHRQoL impact (ECOHIS score>0) for at least one item. Their mean(SD) ECOHIS score was 5.8(6.2). Caries prevalence (dmft>0) was 36.9% and their mean(SD) dmft score was 1.7(3.2). In the final logistic regression model, children with higher caries experience had a significantly higher chance to have poorer OHRQoL (OR=1.20, 95% CI: 1.07-1.35, p=0.002), whereas children's sex, parent's education levels and the respondent's relationship to the child were not associated with OHRQoL (p>0.05).</p> <p>Conclusion: Caries experience is associated with lower OHRQoL of Hong Kong preschool children.</p>

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37 According to the American Academy of Pediatric Dentistry, early childhood caries
38 (ECC) is defined as the presence of one or more decayed (noncavitated or cavitated
39 lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a
40 child under the age of six [1]. Dental caries in primary teeth was reported as the 12th
41 most frequent condition, affecting approximately 560 million young children globally
42 [2]. In Hong Kong, approximately half (55%) of the preschool children had decayed
43 teeth and almost all (93%) of them were unrestored or left untreated [3]. Comparing
44 to the previous surveys [4], there was no significant improvement of caries status
45 among Hong Kong preschool children in the past decades [5]. To monitor the severity
46 and distribution of caries experience, several epidemiological dental surveys were
47 conducted. However, clinical outcome measures such as the decayed, missing and
48 filled teeth (dmft index) represent only one physical aspect and do not reflect the
49 impact of dental caries on psychological and social aspects of the affected children
50 [6].

51

52 Following the World Health Organisation (WHO)'s definition, 'health' is a stage of
53 complete well-being and not just the absence of disease [7]. The significance of
54 evaluating patients' perceptions lies in the need for planning and allocating resources
55 to promote health and eradicate diseases [8]. Oral health-related quality of life
56 (OHRQoL) is described as the impact of dental problems that are vital to persons and
57 patients, affecting their perception and self-esteem [9]. Several OHRQoL tools in
58 assessing patient-based outcomes and patients' needs have been verified to be valid

59 and reliable [10]. Nevertheless, young children usually lack the ability to think
60 abstractly, which is the basis of health perceptions. Thus, parents or primary
61 caretakers are considered to be their representatives in observing and describing the
62 impacts and consequences of any health problem. The Early Childhood Oral Health
63 Impact Scale (ECOHIS) is a parental proxy measure in assessing the impact of oral
64 diseases and dental treatment experiences on the quality of life of young children [11].
65 Recently, the Chinese ECOHIS showed high validity and reliability [12].

66

67 As the last community-wide oral health survey on OHRQoL and dental caries in
68 preschool children was conducted for more than seven years in Hong Kong [13]
69 (Pubmed searched on October 15, 2018), updated patient-based outcomes are valuable
70 for planning and implementing preschool oral health care programs. It is unknown if
71 socio-economic status and other effect modifiers may influence the impacts of ECC
72 on quality of life of affected children.

73

74 The aim of the study was to investigate the association between caries experience and
75 OHRQoL of preschool children and to investigate other risk factors associated with
76 their OHRQoL.

77

78 **Methods**

79 The present study received ethics approval from the Institutional Review Board of the
80 University of Hong Kong/Hospital Authority Hong Kong West Cluster (UW 17-414).
81 This study was performed in full accordance with ethical principles, including the
82 World Medical Association Declaration of Helsinki. An invitation letter describing

83 the purpose and procedures of the study was submitted to the parents of the preschool
84 children. Written parental consent was obtained prior to implementing the study.
85 Preschool children whose parents or caretakers had the ability to write and read in
86 Chinese were eligible to participate in the study. Exclusion criteria were preschool
87 children who had major systemic illnesses or refused the dental examination. All
88 participating children were examined in their kindergartens. The present study was
89 carried out from November 2017 to April 2018.

90

91 *Study population and sample size calculation*

92 A non-probability sampling was adopted. We purposely selected six kindergartens
93 that had not participated in any research study and were located in different districts
94 from the list of participating kindergartens in the dental outreach service funded by
95 The University of Hong Kong in 2017-18. The G*Power 3.1.9.2 software (University
96 of Düsseldorf, Germany) was used to estimate the sample size. A previous study
97 showed that the prevalence of showing any impact on OHRQoL (ECOHIS score>0)
98 among Hong Kong preschool children was approximately 70% [13]. Ratio of children
99 having ECOHIS score=0 to those having ECOHIS score>0 was anticipated to be at
100 0.3/0.7, with the 80% power (type II error set as 0.2), and the two-sided test at the
101 0.05 statistical significance level. It was estimated that 75% of the children with caries
102 experience would show the impact on their OHRQoL (ECOHIS score > 0) and the
103 least odds ratio to be detected was set as 2.5 [14]. Thus, at least 323 children in total
104 (225 children having ECOHIS score > 0 and 98 children having ECOHIS=0) were
105 required. With the estimated 80% participation rate, at least 404 children would need
106 to be invited.

107 *Questionnaire survey*

108 A self-administered questionnaire was submitted to the parents of the study children.
109 The questionnaires were completed at home before their children had received dental
110 examination. Thus, during the time of completing questionnaire, the respondents had
111 not been informed about their children's caries status. This questionnaire featured two
112 parts: 1) child and parents' demographic background including child's sex and age,
113 mother and father's educational attainment, relationship of respondent to the child; 2)
114 the Chinese ECOHIS [12] which contains two sections as follows.

115 1) Child impact section (CIS)

116 1.1 child symptoms – one item (toothache or oral pain)

117 1.2 child function – four items (having difficulty in eating, drinking, pronouncing
118 and missing schools)

119 1.3 child psychology – two items (trouble sleeping and frustrated/irritable)

120 1.4 self-image/social interaction – two items (avoiding smiling and talking with
121 others)

122 2) Family impact section (FIS)

123 2.1 parental distress – two items (upset and guilty)

124 2.2 family function – two items (taken day off and affecting family economy)

125 The response scores of the ECOHIS were as follows: score 0 = never; score 1 =
126 hardly ever; score 2 = occasionally; score 3 = often; score 4 = very often; and score 5
127 = don't know. The score for each individual domain, section and in total were
128 computed as a summation of the response scores. The response of 'don't know' was
129 recorded as missing. The sum ECOHIS score ranges from zero up to 52. Lower
130 ECOHIS scores indicated lower impact on the quality of life of the study child and
131 his/her family.

132

133 *Clinical examination*

134 Dental examinations were conducted in classrooms. A single examiner (DD) had been
135 trained and was supervised by ECML and CCH who were specialists in dental public
136 health. The examiner adopted visual inspection using the aid of WHO Community
137 Periodontal Index (CPI) dental probes and disposable mirrors (MirrorLite, Kudos
138 Crown Limited, Hong Kong) connected with an illuminated intra-oral handle. Clinical
139 data were recorded onto a paper sheet by a research assistant. The decayed, missing,
140 and filled teeth (dmft) index was adopted for documenting the caries experience. A
141 tooth was noted as decayed (dt) when dentine caries was present. A tooth was noted
142 as filled (ft) when a permanent filling without caries was present, whereas missing
143 (mt) was recorded when a tooth was extracted due to dental caries. In the present
144 study, dental caries was diagnosed at the cavitation level based on the WHO criteria
145 [15]. Consequences of untreated caries were diagnosed using the four codes of the
146 modified pufa index [16]: 'p' was noted when pulpal involvement was present; 'u' was
147 recorded if there was an ulceration; 'f' was recorded if fistulae was present; and 'a'
148 was noted when an abscess was present. Duplicate dental examinations on
149 approximately 10% of the participants were conducted on the same day of the dental
150 examination to evaluate intra-examiner reliability of caries assessment. Between the
151 duplicated examinations, at least 30 other children were examined so that the
152 examiner did not memorize the first recording.

153

154 *Statistical analysis*

155 Data were cleaned and proofread before being transferred to a computer database
156 using SPSS 24.0 for Windows (IBM, New York, USA) for storage and processing.
157 Cohen's Kappa statistics was adopted to assess the intra-examiner reliability
158 regarding the caries diagnosis. Chi-square test was used to investigate the
159 relationships between categorical variables and the impact on OHRQoL. Multiple
160 logistic regression analysis was used to determine the child factors (sex, age, dmft,
161 modified pufa) and parental factors (father's education level, mother's education level
162 and respondent's relationship to a child) associated with ECOHIS. The dependent
163 variable was the impact of OHRQoL (having at least one OHRQoL impact or
164 ECOHIS score>0). Regarding the independent variables, caries prevalence and
165 modified pufa were continuous variables in model A and they were categorized as
166 dichotomous variables (yes/no) in model B, whereas the others were dichotomous
167 variables. The backward stepwise procedure was performed until all variables in the
168 final model were statistically significant ($p<0.05$). The level of statistical significance
169 was set at 0.05.

170

171 Results

172 In total, 434 children attending the second year of six selected kindergartens were
173 invited. Prior to the study implementation, 398 children (91.7%) provided written
174 informed consent. Thirty-six children were absent on the examination day. Therefore,
175 362 children received the dental examination. Among these, 10 children who did not
176 return their questionnaires and 16 children who missed more than 2 items of ECOHIS
177 were excluded. No significant difference was observed regarding the caries
178 prevalence of those 26 children who did not return the questionnaire or missed more
179 than two items of ECOHIS, compared to those who answered properly the instrument

180 (Chi-square test, $p=0.185$). For those 16 children who missed more than 2 items of
181 ECOHIS, no significant difference was found between their demographic background
182 (age, gender, respondent and parents' education) and their caries prevalence ($p>0.05$),
183 compared to those remaining in the study. Thus, 336(77.4%) were included in the
184 study. Among these, eight missing values were detected. Missing imputation was
185 performed using the mean of the remaining items of the ECOHIS in each child.
186 Among the participants, 169 children (50.3%) were boys. The mean age(SD) of the
187 participants was 4.7(0.3) years. Children and parents' demographic background and
188 clinical characteristics are shown in Table 1. Among them, 124 children (36.9%) had
189 caries experience ($dmft>0$). Their mean(SD) number of dmft, decayed teeth (dt) and
190 filled teeth (ft) were 1.6(3.2), 1.6(3.0), and 0.1(0.6), respectively. None of the study
191 children had missing teeth due to caries. Nearly all of the decayed teeth were
192 unrestored: the dt component accounted for 98.5% of the dmft index. Regarding the
193 intra-examiner reliability, the Kappa statistics for caries diagnosis was 0.95. The
194 prevalence of negative consequences from untreated caries (modified pufa score >0)
195 was 3.3%. Their mean(SD) modified pufa was 0.1(0.5) with the range from zero up to
196 seven. Most of the respondents (86%) were mothers. Around half of the mothers
197 (44.3%) and the fathers (43.4%) attained secondary education.

198

199 The frequency of ECOHIS responses (%) are shown in Table 2. In the child section,
200 the most frequently reported items were 'difficulty pronouncing any words' (51.2%)
201 and 'had difficulty in eating' (44.0%). Parental distress including 'been upset'
202 (46.5%) and 'felt guilty' (41.1%) were the most commonly reported items in the
203 family section. Overall, the ECOHIS scores ranged from zero up to 39 in the present
204 study, and 235 caregivers (70.2%) reported an OHRQoL impact (score >0) for at least

205 one ECOHIS item. However, the magnitude of impacts was low, with the mean(SD)
206 score being 5.8(6.2) out of 52. Their mean(SD) ECOHIS in the child and family
207 sections were 3.8(4.3) and 2.0(2.6), respectively. Frequency and mean (SD) of
208 ECOHIS responses in each item of children with and without caries experience are
209 shown in Table 3. Their mean(SD) ECOHIS of children with caries experience and
210 without caries experience were 7.4(7.1) and 4.8(5.5), respectively.

211

212 Bivariate analysis of various factors related to the overall impacts, child impacts and
213 family impacts are displayed in Table 4. 79% of the children who had caries
214 experience reported an OHRQoL impact. The dt and caries experience (dmft) were
215 statistically associated with the ECOHIS of the CIS, PIS and the overall section (Chi-
216 square test, $p < 0.05$), whereas other factors were not. For the PIS, child's sex was
217 associated with the family impact (Chi-square test, $p = 0.049$). Table 5 shows the
218 results of the final logistic regression model of significant factors associated with
219 ECOHIS > 0 in the CIS, FIS, and the overall (child and family) section. After
220 adjusting for the father's and mother's education attainment, relationship of
221 respondent to a child, child's sex and age, and consequences of untreated dental caries
222 (modified pufa), caries experience (dmft score) was the only significant variable
223 affecting OHRQoL of children and families (overall ECOHIS > 0) (OR = 1.20, CI:
224 1.07-1.35, $p = 0.002$). Results of Hosmer and Lemeshow test ($p = 0.732$) implied
225 goodness of fit with $p > 0.05$. For the PIS, parents having a son were 1.63 times more
226 likely to have a higher negative impact on their OHRQoL, compared with those
227 having a daughter (CI: 1.04-2.56, $p = 0.032$). When using caries experience as a
228 categorical variable (yes/no) instead of continuous variable (dmft score), children

229 with caries experience were 2.02 times as likely to have a negative impact on their
230 OHRQoL, compared with those without caries experience (CI: 1.20-3.39, p = 0.008).

231

232 Discussion

233

234 Quality of life has crucial implications for health research and practice [10].
235 Subjective oral health status should be complemented when assessing oral health
236 statuses and perceived needs in a community [8]. The present results indicate that the
237 overall oral health impacts were not high (5 out of 52), although the majority (70%) of
238 the parents reported an OHRQoL impact (ECOHIS score>0) for at least one item. In
239 the current study, parents reported slightly higher OHRoL impacts, compared to the
240 previous population-based survey [13]. This may be due to the fact that the children in
241 the present study were older (4.7 years) and had higher caries prevalence (36.9%)
242 compared to those younger (3.9 years) having lower caries prevalence (19.9%) in the
243 previous study [13].

244

245 Regarding the association between OHRQoL and dental caries, the chances of having
246 negative impacts were observed among children with higher caries experience. For
247 every one unit increase in dmft score, the chance of having an impact on child's
248 OHRQoL was 1.2 times as likely. This is in agreement with the studies conducted in
249 different geographical areas such as in Brazil [17], France [18], and Trinidad [14].
250 Caries statuses of the Hong Kong preschool children have not been improved in the
251 last decade. Up to date, no third-party payment coverage or government subsidized
252 dental care services exists for preschool children in Hong Kong [19]. Our results
253 corroborate the evidence that untreated caries has ramifications not just for oral health

254 but also for general health of the affected children [20, 21]. The burden of ECC and
255 its impacts beyond the clinical aspects suggests the need of addressing specific
256 strategies to improve dental health in childhood. Effective evidenced-based
257 approaches including supervised toothbrushing program with fluoridated toothpaste
258 and topical fluoride treatment in a school setting should be established to improve the
259 oral health of Hong Kong preschool children [5].

260

261 In the current study, the most frequently reported domains were symptoms and
262 functional limitations, whereas the domains of child self-image and social interaction
263 were least frequently reported. These results are consistent with those in the previous
264 studies [17, 18]. Thus, pain relief and functional improvement should be primary
265 treatment goals for managing tooth decay in young children. In the current situation
266 where most of the cavities are untreated, simple and cost-effective approaches such as
267 silver diamine fluoride therapy may be beneficial in preventing and controlling
268 disease progression [22]. Although no missing tooth due to caries (mt) was recorded,
269 difficulty pronouncing any words was the prevalent OHRQoL impact rated by
270 parents. Possibly, this may be related to non-caries related reasons such as
271 malocclusion or previous traumatic dental injury. Although the results of Hosmer-
272 Lemeshow test implied goodness of fit with $p > 0.05$, other unmeasured oral conditions
273 being associated with OHRQoL impact should be further explored. In the family
274 section, guilty and upset feeling by the parents were the most frequently reported
275 impacts, which were similar to the results of the previous studies [18, 20]. Within the
276 same ethnic group, Chinese parents in Hong Kong had higher distress than those in
277 Mainland China, although their children's caries statuses were similar [23]. The

278 distinction of parental responses may be due to different social and economic
279 development between two areas.

280

281 Socioeconomic status has been found to be one of the risk factors associated with
282 dental caries [24]. In addition, children from low social classes had worse OHRQoL
283 after adjusting for potentially confounding factors [25]. Conflicting findings were
284 published [26]. In the present study, no association between socioeconomic status and
285 OHRQoL was observed. Although mothers and fathers were allowed to be proxies in
286 the present study, most (86%) of them were mothers. The depth of their awareness
287 and agreement in child's oral health between proxies may be different. Following the
288 results of multivariate logistic regression analysis, relationship of respondent to child
289 (either mother or others) had no effect on child's OHRQoL. Interestingly, association
290 between the child's gender and parental distress was observed. Parents having a boy
291 had higher negative family impacts than those having a girl, even after adjustment.
292 This may be due to the patrilineal culture. Gender values in Chinese sociocultural
293 contexts were associated with the functionality of family in several aspects including
294 child-rearing [27]. This may lead to higher parental expectation and social pressure
295 when parenting a boy. The parent-child relationship is complex and individualized
296 [28]. Social and behavioural factors influencing child oral health should be further
297 studied.

298 Strengths of this study include the adoption of a validated OHRQoL measure, good
299 intra-reliability of dental examination, acceptable participation rates and sufficient
300 sample size. Several study limitations should be addressed. The reliability of the
301 parents' answers was not assessed. In addition, the study children were selected
302 following a non-probability sampling method. Caries prevalence (36.9%) of the study

303 children aged 4 was lower than that (43.1%) of the same age group in the recent
304 territory-wide oral health survey [29]. Nevertheless, the profile of demographic
305 background (parental educational attainment) in the present study was similar to that
306 of Hong Kong population having attended the secondary level (47.3%) and higher
307 education (32.7%), respectively [30]. Due to the sampling bias from non-probability
308 sampling, we cautiously make inferences from these study samples to the general
309 population. In addition, this was a cross-sectional study; the exposure (dental caries),
310 outcome (ECOHIS) and other confounding factors are simultaneously evaluated.
311 Thus, there is no evidence regarding a temporal relationship between dental caries and
312 OHRQoL. Recall bias also possibly influenced the caregivers' responses. The
313 adoption of parent proxy may not be ideal, but satisfactory and reasonable given the
314 linguistic and cognitive aspects of early childhood [31]. A well-designed prospective
315 study using the representative samples is required to provide more information
316 regarding the causal effect of dental caries on OHRQoL of the affected children and
317 their families.

318 Dental caries in primary teeth may be a potential health problem, reverberating
319 beyond its clinical sign and symptom. Increasing one decayed primary tooth has a
320 significantly negative impact on OHRQoL of the affected children and families.
321 However, the magnitude of the perceived impact on OHRQoL was low in Hong
322 Kong. Attention should be paid on a broader policy level by increasing knowledge
323 and awareness as well as improving access to oral care for preschool children, thus
324 improving quality of life of preschool children.

325 In summary, caries experience of the preschool children is significantly associated
326 with the negative family and child experiences, contributing to lowered OHRQoL,
327 regardless to their socioeconomic status.

328

329 **Conflict of interest**

330 All authors declare no conflict of interest.

331

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335

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Table 1 Parent and child's characteristics in the study (n =336)

Parent and child's characteristics	Frequency	Percentage
Parent's demographics		
Relationship of the respondent to the child		
Mother	289	86.0
Other family member	47	14.0
Mother's education level		
Up to junior secondary school	88	26.2
Secondary school	149	44.3
Post-secondary school/ University	99	29.5
Father's education level		
Up to junior secondary school	89	26.5
Secondary school	146	43.4
Post-secondary school/ University	101	30.1
Child's demographics and caries status		
Sex		
Male	169	50.3
Female	167	49.7
Age (year)		
4	264	78.6
5	72	21.4
Decayed teeth (dt)		
dt = 0	213	63.4
dt \geq 1	123	36.6
Missing teeth (mt)		
mt = 0	336	100
mt \geq 1	0	0
Filled teeth (ft)		
ft = 0	323	96.1
ft \geq 1	13	3.9
Decayed, missing or filled teeth (dmft)		
dmft = 0	212	63.1
dmft \geq 1	124	36.9
Oral conditions of untreated caries (Modified pufa)		
Modified pufa = 0	325	96.7
Modified pufa \geq 1	11	3.3

Table 2 Frequency and mean (SD) and of ECOHIS responses in each item (n =336)

Impact	ECOHIS response, n(%)					Mean (SD)
	Never	Hardly ever	Occasio -nally	Often	Very often	
Child impact section						
How often has your child because of dental problems or the need for dental treatments?						
Child Symptom						
a) had pain in the teeth, mouth or jaws?	201(59.8)	102(30.4)	28(8.3)	4(1.2)	1(0.3)	0.5(0.7)
Child Function						
b) had difficulty drinking beverages?	211(62.8)	107(31.8)	16(4.8)	2(0.6)	0(0)	0.4(0.6)
c) had difficulty eating some foods?	188(56.0)	103(30.7)	37(11.0)	6(1.8)	2(0.6)	0.6(0.8)
d) had difficulty pronouncing words?	164(48.8)	93(27.7)	66(19.6)	9(2.7)	4(1.2)	0.8(0.9)
e) missed preschool, day care?	274(81.5)	59(17.6)	2(0.6)	1(0.3)	0(0)	0.2(0.4)
Child Psychology						
f) had trouble sleeping?	250(74.4)	71(21.1)	12(3.6)	2(0.6)	1(0.3)	0.3(0.6)
g) been irritable or frustrated?	216(64.3)	97(28.9)	19(5.7)	2(0.6)	2(0.6)	0.4(0.7)
Self-image and social interaction						
h) avoided smiling or laughing?	259(77.1)	69(20.5)	7(2.1)	1(0.3)	0(0)	0.3(0.5)
i) avoided talking with other children?	260(77.4)	72(21.4)	3(0.9)	1(0.3)	0(0)	0.2(0.5)
Family impact section						
How often have you or another family member because of your child's dental problems or treatment?						
Parental distress						
j) been upset?	183(54.5)	105(31.3)	39(11.6)	8(2.4)	1(0.3)	0.6(0.8)
k) felt guilty?	198(58.9)	89(26.5)	38(11.3)	7(2.1)	4(1.2)	0.6(0.9)
Family function						
l) had to take hours or days off work?	239(71.1)	81(24.1)	12(3.6)	3(0.9)	1(0.3)	0.4(0.6)
m) had the family's economic situation affected?	234(69.6)	83(24.7)	15(4.5)	3(0.9)	1(0.3)	0.4(0.6)

Table 3 Frequency and mean (SD) and of ECOHIS responses in each item of children with caries experience (n=124) and children without caries experience (n=212)

Impact	ECOHIS response, n(%)					Mean (SD)
	Never	Hardly ever	Occasionally	Often	Very often	
Children with caries experience (n=124)						
Child impact section						
Child Symptom						
a) had pain in the teeth, mouth or jaws?	59(47.6)	44(35.5)	16(12.9)	4(3.2)	1(0.8)	0.7(0.9)
Child Function						
b) had difficulty drinking beverages?	65(52.4)	46(37.1)	12(9.7)	1(0.8)	0(0)	0.6(0.7)
c) had difficulty eating some foods?	58(46.8)	47(37.9)	17(13.7)	2(1.6)	0(0)	0.7(0.8)
d) had difficulty pronouncing words?	57(46)	39(31.5)	24(19.4)	3(2.4)	1(0.8)	0.8(0.9)
e) missed preschool, day care?	92(74.2)	29(23.4)	2(1.6)	1(0.8)	0(0)	0.3(0.5)
Child Psychology						
f) had trouble sleeping?	81(65.3)	38(30.6)	4(3.2)	1(0.8)	0(0)	0.4(0.6)
g) been irritable or frustrated?	74(59.7)	45(36.3)	4(3.2)	1(0.8)	0(0)	0.5(0.6)
Self-image and social interaction						
h) avoided smiling or laughing?	86(69.4)	34(27.4)	3(2.4)	1(0.8)	0(0)	0.4(0.6)
i) avoided talking with other children?	88(71)	34(27.4)	1(0.8)	1(0.8)	0(0)	0.3(0.5)
Family impact section						
Parental distress						
j) been upset?	56(45.2)	42(33.9)	18(14.5)	7(5.6)	1(0.8)	0.8(0.9)
k) felt guilty?	54(43.5)	43(34.7)	19(15.3)	5(4)	3(2.4)	0.9(1.0)
Family function						
l) had to take hours or days off work?	73(58.9)	40(32.3)	8(6.5)	2(1.6)	1(0.8)	0.5(0.8)
m) affected family's economic situation?	73(58.9)	40(32.3)	8(6.5)	2(1.6)	1(0.8)	0.5(0.8)
Children without caries experience (n=212)						
Child impact section						
Child Symptom						
a) had pain in the teeth, mouth or jaws?	142(67)	58(27.4)	12(5.7)	0(0)	0(0)	0.4(0.6)
Child Function						
b) had difficulty drinking beverages?	146(68.9)	61(28.8)	4(1.9)	1(0.5)	0(0)	0.3(0.5)
c) had difficulty eating some foods?	130(61.3)	56(26.4)	20(9.4)	4(1.9)	2(0.9)	0.6(0.8)
d) had difficulty pronouncing words?	107(50.5)	54(25.5)	42(19.8)	6(2.8)	3(1.4)	0.8(1.0)
e) missed preschool, day care?	182(85.8)	30(14.2)	0(0)	0(0)	0(0)	0.1(0.3)
Child Psychology						
f) had trouble sleeping?	169(79.7)	33(15.6)	8(3.8)	1(0.5)	1(0.5)	0.3(0.6)
g) been irritable or frustrated?	142(67)	52(24.5)	15(7.1)	1(0.5)	2(0.9)	0.4(0.7)
Self-image and social interaction						
h) avoided smiling or laughing?	173(81.6)	35(16.5)	4(1.9)	0(0)	0(0)	0.2(0.4)
i) avoided talking with other children?	172(81.1)	38(17.9)	2(0.9)	0(0)	0(0)	0.2(0.4)
Family impact section						
Parental distress						
j) been upset?	127(59.9)	63(29.7)	21(9.9)	1(0.5)	0(0)	0.5(0.7)
k) felt guilty?	144(67.9)	46(21.7)	19(9)	2(0.9)	1(0.5)	0.4(0.7)
Family function						
l) had to take hours or days off work?	166(78.3)	41(19.3)	4(1.9)	1(0.5)	0(0)	0.3(0.5)
m) affected family's economic situation?	161(75.9)	43(20.3)	7(3.3)	1(0.5)	0(0)	0.3(0.5)

Table 4. Bivariate analysis of various factors related to ECOHIS (child and family impacts), child impacts and parent impacts

	% of child impacts (CIS score>0)	% of family impacts (FIS score>0)	% of overall impact (ECOHIS > 0)
Parent demographics			
Relationship to the child			
Mother	64.0% (185/289)	48.1% (139/289)	70.2% (203/289)
Other family member	66.0% (31/47)	46.8% (22/47)	70.2% (33/47)
Mother's education level			
Lower secondary school or lower	60.2% (53/88)	50.0% (44/88)	65.9% (58/88)
Secondary school	71.1% (106/149)	47.0% (70/149)	75.2% (112/149)
Post-secondary school/ University	57.6% (57/99)	47.5% (47/99)	66.7% (66/99)
Father's education level			
Lower secondary school or lower	64.0% (57/89)	47.2% (42/89)	68.5% (61/89)
Secondary school	65.8% (96/146)	48.6% (71/146)	70.5% (103/146)
Post-secondary school/ University	62.4% (63/101)	47.5% (48/101)	71.3% (72/101)
Child demographics and caries status			
Sex			
Male	67.5% (114/169)	53.3% (90/169)	73.4% (124/169)
Female	61.1% (102/167)	42.5% (71/167)	67.1% (112/167)
Age (years)			
4	68.2% (180/264)	62.9% (166/264)	46.2% (122/264)
5	77.8% (56/72)	69.4% (50/72)	54.2% (39/72)
Decayed teeth (dt)			
	*	**	**
dt = 0	59.6% (127/213)	40.8% (87/213)	65.3% (139/213)
dt ≥ 1	72.4% (89/123)	60.2% (74/123)	78.9% (97/123)
Missing teeth (mt)			
mt = 0	64.3% (216/336)	47.9% (161/336)	70.2% (236/336)
mt > 1	NA	NA	NA
Filled teeth (ft)			
ft = 0	64.4% (208/323)	47.1% (152/323)	70.3% (227/323)
ft ≥ 1	61.5% (8/13)	69.2% (9/13)	69.2% (9/13)
Decayed, missing or filled teeth (dmft)			
	*	***	**
dmft = 0	59.9% (127/212)	40.6% (86/212)	65.1% (138/212)
dmft ≥ 1	71.8% (89/124)	60.5% (75/124)	79% (98/124)
Modified pufa			
Modified pufa = 0	69.5% (226/325)	63.4% (206/325)	47.4% (154/325)
Modified pufa ≥ 1	90.9% (10/11)	90.9% (10/11)	63.6% (7/11)

CIS, Child impact section; FIS, Family impact section; NA, not applicable; pufa, oral conditions of untreated caries

Chi-square test, *p<0.05, **p<0.01, ***p<0.001

Table 5. Final model of logistic regression of ECOHIS

	Odds ratio	95% CI	p value
<i>Model A: Caries experience(dmft score) and modified pufa -continuous variables</i>			
Child impacts ^a			
dmft score	1.18	1.07-1.31	0.001
Family impacts ^b			
dmft score	1.23	1.12-1.35	<0.001
Child's sex			0.032
female*			
male	1.63	1.04-2.56	
Overall (Child+Parent) impacts ^a			
dmft score	1.20	1.07-1.35	0.002
<i>Model B: Caries experience and modified pufa (yes/no)-categorical variables</i>			
Child impacts ^a			
Caries experience (yes/no*)	1.70	1.06-2.75	0.029
Family impacts ^b			
Caries experience (yes/no*)	2.30	1.46-3.63	<0.001
Child's sex			
female*			
male	1.61	1.03-2.50	0.035
Overall (Child+Parent) impacts ^a			
Caries experience (yes/no*)	2.02	1.21-3.39	0.008

*Reference group; CI, Confident interval

^a Excluded variables: relationship of respondent to a child, education level of mother and father, child's sex and age, modified pufa

^b Excluded variables: relationship of respondent to the child, education level of mother and father, child's age, modified pufa