Contextual and individual determinants of oral health-related quality of life among five-year-old children: a multilevel analysis

By Monalisa Gomes

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Background: Contextual factors may influence oral health-related quality of life (OHRQoL) in children. The aim of the present study was to evaluate the influence of individual and contextual determinants of OHRQoL based on the perceptions of children. **Methods:** A cross-sectional study was conducted with a representative sample of 769 five-year-old children from public and private preschools in a city in the countryside of northeast Brazil. Parents/caregivers answered questionnaires addressing psychological aspects, sociodemographic data and aspects of the child's oral health. The children answered the child version of the Scale of Oral Health Outcomes for five-year-old children and were submitted to oral examinations. Variables related to the context were obtained from the schools and official municipal publications. Unadjusted and adjusted multilevel Poisson regression models were used to investigate associations between variables. **Results:** In the adjusted analysis, parent's/caregiver's schooling, household income, parent's/caregiver's age, a history of dental pain, dental caries and its consequences and traumatic dental injury were considered individual determinants of OHRQoL according to the children's self-reports. After the incorporation of the contextual determinants, the association between parent's/caregiver's schooling and OHRQoL lost its significance. Type of school was the context variable that remained associated with OHRQoL. **Discussion:** Besides the clinical and sociodemographic individual characteristics, characteristics of the school environment in which the child studies are associated with self-reported impacts on OHRQoL.

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30 children's self-reports. After the incorporation of the contextual determinants, the association

31 between parent's/caregiver's schooling and OHRQoL lost its significance. Type of school was
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33 **Discussion:** Besides the clinical and sociodemographic individual characteristics, characteristics
34 of the school environment in which the child studies are associated with self-reported impacts on
35 OHRQoL.

36

37 **Introduction**

38

39   The oral health status of preschool children has been the object of diverse studies due to
40 the high prevalence of oral problems in this age group, such as dental caries, traumatic dental
41 injury (TDI) and malocclusion (Kramer et al., 2013; Gomes et al., 2014). Moreover, these
42 conditions can cause impacts on oral health-related quality of life (OHRQoL) among children
43 and their families (Kramer et al., 2013; Gomes et al., 2014; Abanto et al., 2014). Psychological
44 aspects of parents/caregivers, such as sense of coherence (SOC) and locus of control (LOC), may
45 also be related to oral health problems and OHRQoL (Bonanato et al., 2009a; Khatri, Acharya &
46 Srinivasan, 2014; Gururatama, Baker & Robinson, 2014; Fernandes et al., 2017; Nunes &
47 Perosa, 2017).

48   OHRQoL is a multidimensional concept that reflects functional, psychological and social
49 aspects (Tsakos et al., 2012). Most studies involving preschool children have evaluated
50 OHRQoL using two previously validated questionnaires. The Early Childhood Oral Health
51 Impact Scale (ECOHIS) was the first questionnaire to emerge for the evaluation of OHRQoL
52 among children aged two to five years and their families based on the reports of
53 parents/caregivers (Pahel, Rozier & Slade, 2007). More recently, the Scale of Oral Health
54 Outcomes for 5-year-old children (SOHO-5) was developed for the evaluation of the OHRQoL
55 of five-year-olds (Tsakos et al., 2012; Abanto et al., 2013a), which considers the perceptions of
56 parents/caregivers as well as the perceptions of children (self-report). A previous study reports
57 that this questionnaire has good psychometric properties and a good correlation is found between
58 the two versions (parental and child) (Abanto et al., 2013b). Thus, this scale enables a better
59 evaluation of the impact of oral health conditions on the OHRQoL of five-year-old children.

60   Previous investigations conducted with preschool children have demonstrated the impact
61 of dental caries, TDI and malocclusion on the OHRQoL of children (Wong et al., 2011; Kramer

62 et al., 2013; Gomes et al., 2014; Abanto et al., 2014; Onoriobe et al., 2014; Arrow et al., 2015;
63 Guedes et al., 2014; Perazzo et al., 2017b; Abanto et al., 2018). Most studies focused on the
64 evaluation of the characteristics of the children and their families for the determination of
65 OHRQoL (Wong et al., 2011; Kramer et al., 2013; Gomes et al., 2014; Abanto et al., 2014;
66 Onoriobe et al., 2014; Arrow et al., 2015; Perazzo et al., 2017b; Abanto et al., 2018). However, it
67 is possible to find explanations for the impact on OHRQoL not only in individual characteristics,
68 but also in contextual characteristics. Only one study that evaluated the impact of both individual
69 and contextual factors on the OHRQoL of preschool children was found (Guedes et al., 2014).
70 The study investigated the perceptions of parents using the ECOHIS and found that unfavorable
71 social conditions have a negative impact on the reports of parents/caregivers regarding the
72 OHRQoL of children, but no investigation was performed on the impact of the school
73 environment, which exerts considerable influence in this phase of the one's life as well as on the
74 OHRQoL of children (Guedes et al., 2014). While studies evaluating contextual aspects of
75 OHRQoL have involved different age groups (Turrell et al., 2007; Alwadi et al., 2017; Bomfim
76 et al., 2017), no previous studies have evaluated the influence of individual and contextual
77 factors on the self-reports of five-year-old children regarding OHRQoL. Thus, there is a need for
78 a clearer understanding of the impact of oral conditions based on the self-reports of children.
79   Contextual factors seem to be strongly associated with different oral health outcomes
80 (Fernández et al., 2015; Piovesan et al., 2017) and the study of these factors is undoubtedly
81 important to the planning of services as well as the investigation of health inequalities (Petersen
82 & Kwan, 2011). The school setting is important to the intellectual development of children and
83 also exerts an influence on health behaviors. Moreover, there is a relationship between economic
84 status and the type of preschool a child attends (Piovesan et al., 2017). Thus, understanding these
85 contextual disparities could be the basis for directed interventions and health policies. The use of
86 statistical methods for a multilevel analysis assists in better data treatment because the findings
87 begin to demonstrate a hierarchical structure (Diez-Roux, 2000).
88   Thus, the aim of the present study was to evaluate the influence of individual and
89 contextual determinants on OHRQoL according to the perceptions of five-year-old children.
90
91 **Materials and Methods**
92

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93 Sample and study design

94   *The paper is based on a previously published doctoral thesis (Gomes, 2017).* The present

95 study was conducted at public and private preschools between August and December 2015 in the

96 city of Campina Grande, which is located in northeast Brazil, with approximately 400,000

97 inhabitants.

98   The sample was selected using a complex two-stage (preschools and children)

99 probabilistic sampling method. Two hundred sixty-three preschools (129 public and 134 private)

100 were registered with the Ministry of Education. The city is divided into six administrative

101 districts and preschools were randomly selected proportional to the total number in each district.

102 Twenty-eight private and 20 public preschools were selected. In the second stage, five-year-old

103 children enrolled in these preschools were randomly selected using a simple lottery procedure.

104   The sample size was calculated considering a 5% margin of error, 95% confidence

105 interval and a 1.6 design effect to account for the change in the precision of the estimates due to

106 the two-stage sampling process. Moreover, a 50% prevalence of the negative impact on

107 OHRQoL was used to maximize the sample size and enhance statistical power of the results. The

108 minimum sample was determined to be 615 children. This value was increased to compensate for

109 possible dropouts estimated at 20% resulting in a sample of 769 five-year-old children.

110

111 Eligibility criteria

112   Children aged five years attending public and private preschools were included in the

113 study. Those with a systemic adverse health conditions according to the reports of

114 parents/caregivers, those with permanent teeth and those having been submitted to orthodontic

115 treatment were excluded from the study.

116

117 Calibration exercises

118   Two researchers who performed the data collection and an experienced specialist in the

119 field participated in this phase. The researchers first evaluated photographs of oral conditions and

120 group discussions were held. In the clinical phase, 40 children were randomly selected from a

121 preschool that did not participate in the main study. These children were examined twice. The

122 first examination was used for the calculation of inter-examiner agreement (Kappa statistic)

123 between the researchers and the experienced specialist [K= 0.89-0.90 for dental caries; K= 0.90-

124 1.00 for the pufa index (consequences of untreated dental caries); K= 0.88-0.90 for TDI; K=
125 0.86-0.91 for malocclusion and K= 0.68-0.73 for tooth wear]. After a seven-day interval, the
126 same children were examined a second time for the calculation of intra-examiner agreement [K=
127 0.87-1.00 for dental caries; K= 1.00 for the pufa index; K= 0.82-0.87 for TDI; K= 0.94-1.00 for
128 malocclusion and K= 0.81-1.00 for tooth wear]. The Kappa coefficients demonstrated good
129 reliability for the clinical examinations, as coefficients between 0.61 and 0.80 are considered
130 good and those between 0.81 and 1.00 are considered very good (Altman, 2006).
131
132 Data collection
133   Data collection was performed at the previously selected preschools following contact
134 with the principals of each preschool to explain the study and dynamics of the data collection
135 process. Parents/caregivers were then asked to participate in a meeting at their child's preschool
136 for clarifications regarding the objectives of the study and obtain written consent for the
137 examination of the children. At the same meeting, the parents/caregivers were asked to fill out
138 the questionnaires. The children answered the SOHO-5 questionnaire prior to the clinical exams.
139 After the questionnaires were collected, the children were examined for the assessment of the
140 oral conditions.
141
142 *Individual determinants*
143 *Individual sociodemographic variables:* To obtain an individual profile of each child/family, the
144 following sociodemographic data were collected: child's sex, parent's/caregiver's schooling,
145 parent's/caregiver's age (in years), household income (analyzed based on the Brazilian monthly
146 minimum wage, which was equivalent to U$280 at the time of the data collection) and whether
147 the child had siblings.
148 *Oral health-related variables.* Some aspects of the children's oral health were collected from the
149 parents/caregivers. A history of dental pain was recorded if this symptom was reported/observed
150 at least once in the child's life. Visit to the dentist was recorded if this occurred sometime in the
151 child's life, independently of the reason. Tooth brushing frequency was investigated and
152 dichotomized as < 2 times a day or ≥ 2 times a day.
153 *Sense of coherence.* The SOC of the parents/caregivers was measured using the Sense of
154 Coherence Scale (SOC-13), employing the version validated in Brazil for use on mothers of

155   preschool children (Bonanato et al., 2009b). This questionnaire has 13 items, each with five
156   response options that assist in evaluating the components that compose SOC: comprehensibility,
157   manageability and meaningfulness. The total ranges from 13 to 69 points, with higher scores
158   indicative of a stronger SOC and greater capacity to cope with stress. For the purposes of
159   statistical analysis, the score was dichotomized by the median, as performed in a previous study
160   (Bonanato et al., 2009a). Scores below the median were considered indicative of a weak SOC
161   and scores above the median were indicative of a strong SOC.

162   *Locus of control.* The LOC of the parents/caregivers was evaluated using the Multidimensional
163   Health Locus of Control (version validated in Brazil) (Nunes & Perosa, 2017), which has 18
164   items distributed among three subdivisions (internal/external/chance) for the evaluation of the
165   respondent's perception of who or what determines health/illness events: the individual
166   himself/herself (internal) or other forces (external/chance). Each item has five response options
167   (1 = fully agree; 2 = agree in part; 3 = neither agree nor disagree; 4 = disagree in part; 5 = fully
168   disagree). The scores of the items on each subscale are totaled and can range from 6 to 30 points,
169   with higher scores on the subscale indicating a lower degree of each factor (internal and
170   external/chance). An internal LOC is considered when the lowest score is on the subscale of
171   internal factors and an external LOC is considered when the lowest score is on the subscale of
172   external or chance factors.

173   *Clinical examination.* The clinical examinations were performed at the preschools in the knee-to-
174   knee position. The children were first given a kit with a toothbrush, toothpaste and dental floss
175   and then performed oral hygiene under the supervision of the researchers. The examiners used
176   individual protective equipment and a head lamp (Petzl Zoom head lamp; Petzl America,
177   Clearfield, UT, USA). A sterilized mouth mirror (PRISMA, São Paulo, SP, Brazil), sterilized
178   Williams probe (WHO-621; Trinity, Campo Mourão, PR, Brazil) and gauze were used. The
179   clinical examinations were performed using criteria established in the literature. After the
180   examination, a fluoride varnish (Duraphat® - 5% NaF) was applied to the teeth and the
181   researchers sent a letter to the parents/caregivers informing them of their child's oral health
182   status.

183   Dental caries was evaluated using the International Caries Detection and Assessment
184   System (ICDAS-II) (Ismail et al., 2007). The score ranges from 0 to 6. Code 0 refers to a sound
185   tooth. Code 1 refers to a white spot detected after drying the teeth with compressed air. Code 2

186   refers to a white spot diagnosed following drying of the teeth with gauze. Codes 3 to 6 are used

187   for increasing degrees of cavitated lesions. In the present study, the children were classified in

188   three dental caries categories coded as follows: absent (ICDAS code 0); white spot (children with

189   caries only in the initial stage [ICDAS code 2]); and cavitated lesion (children with at least one

190   cavitated tooth [ICDAS code 3 to 6]). Code 1 is not used in epidemiological studies since the

191   teeth are dried with gauze in such studies rather than compressed air.

192   Caries activity was also evaluated. Enamel lesions were recorded as active using the

193   following criteria: lesion is whitish/yellowish; lesion is chalky (lack of luster); lesion may or may

194   not be cavitated; lesion feels rough upon probing; probing may or may not encounter cavity.

195   Dentin lesions were recorded as active using the following criteria: lesion may appear as shadow

196   below intact, but de-mineralized enamel; if cavity extends into dentin, dentin appears

197   yellowish/brownish; dentin soft upon probing (Pitts, 2009).

198   The pufa index was used to evaluate the consequences of untreated dental caries in the

199   children (Monse et al., 2010): visible pulpal involvement (p), ulceration (u) caused by dislocated

200   tooth fragments, fistula (f) and abscess (a). In the present study, this variable was dichotomized

201   as absent (no consequences of untreated caries) or present (one or more teeth with some

202   consequence of untreated caries).

203   The determination of TDI was based on the criteria established by the literature in enamel

204   fracture, enamel + dentin fracture, complicated crown fracture, luxation (lateral, intrusive and

205   extrusive) and avulsion (Andreasen, Andreasen & Andersson, 2007). Discoloration stemming

206   from trauma was also investigated. This variable was dichotomized as absent or present (one or

207   more teeth diagnosed with some type of TDI or discoloration stemming from a trauma).

208   For the evaluation of malocclusion, the following types were investigated: increased

209   overbite (> 2 mm), increased overjet (> 2 mm), anterior open bite, anterior crossbite and

210   posterior crossbite (Foster & Hamilton, 1969). Malocclusion was recorded as present when a

211   child exhibited at least one of these conditions.

212   The children were also submitted to a clinical examination for the determination of tooth

213   wear due to attrition. This type of tooth wear is associated with functional and parafunctional

214   habits, such as chewing and bruxism (clenching and/or grinding the teeth). Attrition generally

215   occurs on occlusal, incisal or palatal surfaces on maxillary teeth or vestibular surfaces on

216   mandibular teeth, presenting as a small polished area on the tip of a cusp, in the region around

217   the cusp or on the incisal angles. This oral condition was diagnosed in the presence of wear on

218   the incisal surfaces of the anterior teeth and/or occlusal surfaces of the posterior teeth.

219

220   *Contextual determinants*

221   *Contextual variables.* Four variables were investigated for the evaluation of the contextual

222   aspects of OHRQoL: type of preschool (public or private), number of children in the preschool

223   (school size), mean monthly income of the neighborhood in which the preschool was located and

224   number of oral health teams in the administrative district in which the school was located.

225   Information on the mean income of the neighborhood was obtained from the Brazilian Institute

226   of Geography and Statistics in the city and the number of oral health teams in the administrative

227   districts was obtained from the Ministry of Health in the city. Data on the preschools were

228   recorded during the first visit to each preschool.

229

230   *Outcome*

231   *Oral health-related quality of life:* Quality of life was evaluated using the Scale of Oral Health

232   Outcomes for 5-year-old children (SOHO-5), which is a validated questionnaire in Brazil for the

233   evaluation of the impact of oral problems on the OHRQoL of children aged five years (Tsakos et

234   al., 2012; Abanto et al., 2013a) and is divided into two versions: child version and parental

235   version. As the aim of the present study was to evaluate self-reports of children with regard to

236   OHRQoL, only the child version of the SOHO-5 was considered. The questionnaire addresses

237   difficulty eating, difficulty speaking, difficulty playing, difficulty sleeping, the avoidance of

238   smiling due to pain, the avoidance of smiling due to appearance and difficulty drinking. The

239   answers are scored on a three-point scale (no = 0, a little = 1 and a lot = 2). To facilitate the

240   child's responses, a self-explanatory drawing for each type of answer was used. The sum of all

241   answers is used for the final score, which ranges from 0 to 14 points on the child version of the

242   questionnaire.

243

244   Statistical analysis

245   Descriptive statistics were used for the characterization of the sample. Unadjusted and

246   adjusted multilevel Poisson regression models were created to describe associations between the

247   outcomes and predictors. The sum of the scores on the SOHO-5 was considered for the

248 evaluation of OHRQoL. Multilevel Poisson regression analysis involved a fixed effects model
249 with random intercepts to evaluate associations between mean total SOHO-5 (dependent
250 variable) and both individual and contextual covariates (independents variables). The sum of all
251 answers ranges from 0 to 14 points on the child version of the questionnaire. This strategy
252 enabled the estimation of rate ratios (RR) between comparison groups and respective 95%
253 confidence intervals (CI).

254   In the first step, an unconditional (null) model was used to estimate the variability in the
255 data before the individual and contextual characteristics were taken into account (Diez-Roux,
256 2000). Individual and contextual variables that achieved a p-value < 0.20 in the univariate
257 multilevel Poisson regression analysis were incorporated into the multiple model and those with
258 a p-value < 0.05 in the adjusted analysis remained in the model. Interactions between individual
259 covariates and contextual variables in the model were tested and those with statistical
260 significance ($p < 0.05$) were incorporated into the final model. The models were also tested for
261 multicollinearity and no collinearity was found between the individual and contextual factors
262 (variance inflation factor < 2, tolerance statistic > 0.6 and correlation coefficients < 0.5 between
263 all possible combinations of variables). The goodness-of-fit of the models was calculated based
264 on deviance values (-2 log likelihood).

265   Statistical analyses were performed using the Statistical Package for the Social Sciences
266 (SPSS for Windows, version 19.0, SPSS Inc., Chicago, IL, USA) and Hierarchical Linear and
267 Nonlinear Modeling (HLM 6.06 statistical package). SPSS was used for the descriptive analyses
268 and to create two databases using individual and contextual variables. These data bases were
269 then used in the HLM 6.06 statistical package to perform multilevel analyses.

270

271 Ethical aspects

272   This study received approval from the Human Research Ethics Committee of the State
273 University of Paraíba (38937714.0.0000.5187) and was conducted in compliance with the
274 guidelines stipulated in the Declaration of Helsinki. All legal guardians signed as statement of
275 informed consent prior to the data collection process.

276

277 **Results**

278

279   A total of 769 pairs of children and parents/caregivers participated in the study. The male

280   sex accounted for 52.4% of the sample, 30.0% of the parents/caregivers had eight years of

281   schooling or less and the majority of the children (65.7%) had siblings. Regarding characteristics

282   related to oral health, the majority of children who attended public preschools had cavitated

283   lesions (78.2%), consequences of untreated dental caries (23.5%) and a history of dental pain

284   (37.0%). In contrast, TDI (52.9%), malocclusion (57.7%) and tooth wear (77.9%) were more

285   prevalent among the children attending private preschools (Table 1).

286   Table 2 displays the results of the multilevel Poisson regression analysis. Significant

287   associations   were   found   in   the   univariate   analysis   for   the   following   variables:

288   parent's/caregiver's schooling (RR= 1.31; 95%CI: 1.15-1.49), household income (RR= 0.93;

289   95%CI: 0.91-0.96), parent's/caregiver's age (RR= 1.01; 95%CI: 1.01-1.02), being an only child

290   (RR= 0.87; 95%CI: 0.78-0.97), history of dental pain (RR= 1.69; 95%CI: 1.52-1.88), white spot

291   (RR= 1.39; 95%CI: 1.12-1.72), cavitated lesion (RR= 1.69; 95%CI: 1.37-2.08), caries activity

292   (RR= 1.98; 95%CI: 1.62-2.42), consequence of untreated dental caries (RR= 1.51; 95%CI: 1.33-

293   1.71), TDI (RR= 1.19; 95%CI: 1.08-1.31), tooth wear (RR= 1.13; 95%CI: 1.01-1.27) and type of

294   preschool (RR= 2.10; 95%CI: 1.64-2.70).

295   After adjusting for the individual and contextual variables, household income (RR= 0.86;

296   95%CI: 0.82-0.91), parent's/caregiver's age (RR= 1.01; 95%CI: 1.01-1.02), history of dental

297   pain (RR= 1.55; 95%CI: 1.37-1.76), white spot (RR= 1.45; 95%CI: 1.14-1.85), cavitated lesion

298   (RR= 1.43; 95%CI: 1.13-1.82), consequence of untreated dental caries (RR= 1.22; 95%CI: 1.06-

299   1.40) and TDI (RR= 1.20; 95%CI: 1.08-1.33) were identified as individual determinants of a

300   negative impact on the OHRQoL of the children based on self-reports. After the incorporation of

301   the contextual variables (type of preschool), parent's/caregiver's schooling lost its statistical

302   significance. The influence of the type of preschool is demonstrated on the contextual level, as

303   children who attended public preschools reported a greater impact on OHRQoL (RR= 1.95;

304   95%CI: 1.51-2.54). There   was   no   collinearity   between   individual   and   contextual   factors

305   (variance inflation factor < 2, tolerance statistic > 0.6 and correlation coefficients < 0.5 between

306   all   possible   combinations   of   variables).   On   the   other   hand,   type   of   preschool   demonstrated

307   significant   interactions   with   parent's/caregiver's   schooling   [RR   1.40   (1.03-1.89)],   household

308   income   [RR   0.79   (0.69-0.90)]   and   parent's/caregiver's   age   [RR   1.02   (1.01-1.03)].   Therefore,

309   these interaction terms were retained in the final model for adjustment.

310

Discussion

312

313   This study was conducted to evaluate the influence of individual and contextual
314   determinants on OHRQoL based on self-reports by children. To the best of our knowledge, this
315   is the first study with this objective. The main findings demonstrate that individual
316   socioeconomic factors and clinical conditions exert an influence on this perception. In the final
317   model, OHRQoL was associated with household income, parent's/caregiver's age, a history of
318   dental pain, dental caries, consequences of untreated dental caries and TDI. However, the results
319   provide evidence that the social context also exerts an influence on OHRQoL, such as the social
320   environment of the school at which children study. Children who attended public schools
321   demonstrated greater impact on OHRQoL than those who attended private schools.

322   Clinical conditions, such as dental caries and its consequences (pulpal involvement,
323   ulceration, fistula and abscess) and TDI were associated with OHRQoL according to self-reports
324   by the children, even after adjusting for contextual variables. Previous studies have also
325   demonstrated such associations, reporting that these conditions may be related to impairments
326   with regard to functional, esthetic and social aspects (Kramer et al., 2013; Gomes et al., 2014;
327   Abanto et al., 2014; Guedes et al., 2014; Perazzo et al., 2017b; Abanto et al., 2018). It is also
328   possible that these relationships were due to the associated symptoms. A history of dental pain
329   was associated with OHRQoL, which is in agreement with data from previous studies involving
330   this age group (Clementino et al., 2015). However, white spots were also associated with
331   OHRQoL. It is possible that children with white spots on their anterior teeth may perceive a
332   negative esthetic effect. This finding is also described in a previous study, although no such
333   association was found in the perception of parents/caregivers (Perazzo et al., 2017b). This may
334   demonstrate that parents/caregivers perceive oral problems in small children only in the presence
335   of pain, which underscores the importance of studies that also evaluate children's perceptions to
336   gain a better understanding of OHRQoL in young children. Moreover, malocclusion was not
337   associated with the children's perceptions regarding OHRQoL, which may reflect the absence of
338   symptoms with this type of oral problem as well as the greater prevalence of mild malocclusions,
339   which would not result in a negative perception on the part of the children regarding oral
340   esthetics.

341   Parent's/caregiver's schooling, household income and parent's/caregiver's age were
342   individual determinants of OHRQoL according to self-reports by the children. However, after
343   adjusting for contextual variables, only household income and parent's/caregiver's age remained
344   in the final model. This finding is in agreement with data reported in previous study, which
345   found that a lower income and younger age of parents/caregivers exerted a greater impact on
346   OHRQoL (Guedes et al., 2014). Individuals with a lower income have less access to health
347   services and information and younger parents/caregivers generally have less experience with
348   regard to health care (Martins-Júnior et al., 2011). However, the influence of these individual
349   factors should be considered with caution, as such factors had a significant interaction with the
350   contextual variable in the model, demonstrating that the effect on OHRQoL was different for
351   children who attended public and private schools. Moreover, type of preschool seems to have a
352   greater influence on the oral health of children than parent's/caregiver's schooling.

353   Type of preschool was the contextual variable that remained in the final model. Children
354   attending public preschools reported worse OHRQoL, which may demonstrate a lower
355   socioeconomic status of the family. In Brazil, most children and adolescents who study at public
356   schools are from underprivileged families that live in areas of social deprivation and do not have
357   the financial resources to afford a private school (Piovesan et al., 2011). Besides this individual
358   socioeconomic issue, public and private preschools in Brazil have very distinct characteristics,
359   which may explain the results of the present study. A previous study involving preschool
360   children demonstrated that those who find themselves in an unfavorable social context also have
361   poorer OHRQoL according to the reports of parents/caregivers (Guedes et al., 2014). It is
362   possible that the other contextual variables analyzed were not associated because they
363   demonstrated a division with a geographical element (such as mean income of the
364   neighborhood), since individuals with different socioeconomic statuses often reside in the same
365   area. Thus, the influence of characteristics related to type of school on the OHRQoL of children
366   should be explored further in future studies.

367   Schools are considered important settings for the promotion of health in children
368   (Piovesan et al., 2011), since children spend a large part of their time in such environments.
369   Thus, schools could be used for measures designed to improve health, self-esteem and healthy
370   behaviors in children (Fernández et al., 2015). Indeed, the present study demonstrates that the
371   school setting could be a good option for the planning of preventive strategies directed at oral

372   problems and, consequently, reduce the negative impact on OHRQoL. It is possible that some
373   schools, besides having children with a better economic status, also develop activities that stress
374   the importance of health care. In a study involving children aged one to five years, children
375   whose mothers had a greater participation in their children's schools were more likely to make
376   use of oral health services (Piovesan et al., 2017). Thus, health programs for children should
377   consider the school environment. Oral health programs can assist in the implementation of
378   preventive measures, such as healthy behaviors.

379   With regard to psychological aspects of the parents/caregivers, neither SOC nor LOC was
380   associated with OHRQoL. SOC is the capacity to adapt to stress, which may be reflected in the
381   oral health of individuals and their children (Bonanato et al., 2009b). Mothers with a low SOC
382   (little capacity to adapt to stressful situations) tend to have children with more caries (Bonanato
383   et al., 2009a) and take their children to the dentist less often (Perazzo et al. 2017a). LOC is the
384   perception one has regarding who or what controls events in life (the individual himself/herself
385   or others) (Nunes & Perosa, 2017). Individuals who believe that they have a greater influence
386   over their own lives (internal locus) tend to have more positive attitudes regarding health. These
387   findings may be due to the fact that OHRQoL was evaluated based on the children's perceptions.
388   Previous studies involving preschool children report an association between a strong SOC on the
389   part of parents and a better OHRQoL according to the perceptions of parents/caregivers (Khatri,
390   Acharya & Srinivasan, 2014; Fernandes et al., 2017). Another study reports a relationship
391   between the LOC and OHRQoL, but involved students aged 11 to 14 years (Gururatana, Baker
392   & Robinson, 2014). Thus, these aspects need to be explored further. The present results
393   demonstrate that socioeconomic and clinical factors are more important to the evaluation of
394   OHRQoL based on the perceptions of children.

395   The cross-sectional design can be considered a limitation of the present study due to the
396   inability to evaluate causality. However, studies with this type of design are important for
397   estimating the prevalence of events in a representative sample of the population. Moreover,
398   cross-sectional studies provide useful data for the planning of public health policies. As a
399   representative sample and validated questionnaires were employed, the results can be
400   extrapolated to the population of Brazilian five-year-old preschoolers. Further studies are needed
401   to evaluate the longitudinal aspects of the associations found herein.

402

403 **Conclusion**

404

405   Type of preschool was identified as a contextual determinant in this study. Moreover,

406 children with a history of dental pain, caries and its consequences and TDI who belonged to

407 families with a lower income and whose parents/caregivers were younger reported poorer

408 OHRQoL.

409

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Table 1(on next page)

Individual and contextual characteristics of sample.

1   Table 1. Individual and contextual characteristics of sample.

Variable	Type of preschool	
	Public	Private
	n(%) / mean (SD)	
Individual Level		
Sex		
Female	136(45.6)	230(48.8)
Male	162(54.4)	241(51.2)
Parent's/caregiver's schooling*		
≤ 8 years of study	184(62.2)	46(9.8)
> 8 years of study	112(37.8)	424(90.2)
Monthly household income*	774.71(456.39)	2587.29(3108.16)
Parent's/caregiver's age*	32.63(8.98)	32.69(7.00)
Only child*		
No	228(77.6)	273(58.2)
Yes	66(22.4)	196(41.8)
History of dental pain*		
No	184(63.0)	392(84.5)
Yes	108(37.0)	72(15.5)
Dental caries		
Absent	10(3.4)	57(12.1)
White spot	55(18.5)	195(41.4)
Cavitated lesion	233(78.2)	219(46.5)

Consequence of untreated dental caries (visible pulpal involvement, ulceration, fistula and/or abscess)		
Absent	228(76.5)	435(92.4)
Present	70(23.5)	36(7.6)
TDI		
Absent	141(47.3)	222(47.1)
Present	157(52.7)	249(52.9)
Malocclusion*		
Absent	126(42.4)	199(42.3)
Present	171(57.6)	272(57.7)
Tooth wear		
Absent	68(22.8)	104(22.1)
Present	230(77.2)	367(77.9)
Sense of coherence		
Weak	168(56.4)	153(32.5)
Strong	130(43.6)	318(67.5)
Locus of control*		
Internal	171(58.2)	349(74.3)
External	123(41.8)	121(25.7)
Contextual Level		
Mean monthly income of neighborhood	1074.77(500.97)	996.19(454.38)
Number of oral health teams	7.97(1.03)	9.55(2.40)

Number of children in preschool	80.86(53.74)	124.63(116.18)

2   * Sample less than 769 due to the failure of some interviewees to provide this information or

3   impossibility of performing the clinical examination.

4

Table 2(on next page)

Unadjusted and adjusted assessment of the association between overall SOHO-5 scores and both individual and contextual variables.

1   Table 2. Unadjusted and adjusted assessment of the association between overall SOHO-5 scores

2   and both individual and contextual variables.

Variable	SOHO-5		
	Scores mean (SD)	Crude* RR (95% CI)	Adjusted** RR (95% CI)
Individual Level			
Sex			
Female	2.20(3.22)	0.92(0.84-1.01)	-
Male	2.53(3.45)	1.00	-
Parent's/caregiver's schooling			
≤ 8 years of study	3.53(4.03)	**1.31(1.15-1.49)**	0.95(0.81-1.12)
> 8 years of study	1.88(2.88)	**1.00**	1.00
Household income (MMW)	-	**0.93(0.91-0.96)**	**0.86(0.82-0.91)**
Parent's/caregiver's age	-	**1.01(1.01-1.02)**	**1.01(1.01-1.02)**
Only child			
Yes	1.87(2.97)	**0.87(0.78-0.97)**	-
No	2.61(3.47)	**1.00**	-
Use of dental services			
Yes	2.25(3.22)	1.02(0.93-1.13)	-
No	2.47(3.45)	1.00	-
Tooth brushing frequency			
< Twice a day	2.90(3.47)	1.09(0.94-1.26)	-
≥ Twice a day	2.32(3.34)	1.00	-

History of dental pain			
Yes	3.77(3.88)	**1.69(1.52-1.88)**	**1.55(1.37-1.76)**
No	1.92(3.01)	**1.00**	1.00
Dental caries			
Absent	1.22(2.04)	**1.00**	1.00
White spot	1.84(2.87)	**1.39(1.12-1.72)**	**1.45(1.14-1.85)**
Cavitated lesion	2.84(3.66)	**1.69(1.37-2.08)**	**1.43(1.13-1.82)**
Caries activity			
Active	2.68(3.53)	**1.98(1.62-2.42)**	-
Inactive	1.18(2.31)	**1.00**	-
Consequence of untreated caries (visible pulpal involvement, ulceration, fistula and/or abscess)			
Absent	2.15(3.22)	**1.00**	1.00
Present	3.79(3.79)	**1.51(1.33-1.71)**	**1.22(1.06-1.40)**
TDI			
Absent	2.05(3.25)	**1.00**	1.00
Present	2.67(3.41)	**1.19(1.08-1.31)**	**1.20(1.09-1.33)**
Malocclusion			
Absent	2.31(3.29)	1.00	-
Present	2.42(3.40)	1.02(0.92-1.12)	-
Tooth wear			
Absent	2.22(3.42)	**1.00**	-

Present	2.42(3.33)	**1.13(1.01-1.27)**	-
Sense of coherence			
Weak	2.76(3.56)	1.00	-
Strong	2.10(3.16)	0.94(0.85-1.04)	-
Locus of control			
Internal	2.21(3.19)	0.94(0.85-1.04)	-
External	2.70(3.63)	1.00	-
Contextual Level			
Type of school			
Public	3.54(4.05)	**2.10(1.64-2.70)**	**1.95(1.51-2.54)**
Private	1.63(2.56)	**1.00**	**1.00**
Mean monthly income of neighborhood	-	0.99(0.99-1.00)	-
Number of oral health teams	-	0.96(0.88-1.04)	-
Number of children in preschool	-	0.99(0.99-1.00)	-

3 *Univariate multilevel Poisson regression models **Multiple multilevel Poisson regression

4 model adjusted by individual and contextual variables presented in table as well as following

5 interactions: "parent's/caregiver's schooling and type of preschool" [RR 1.40 (1.03-1.89)],

6 "household income and type of preschool" [RR 0.79 (0.69-0.90)] and "parent's/caregiver's age

7 and type of preschool" [RR 1.02 (1.01-1.03)].

8 MMW = Brazilian monthly minimum wage (equivalent to U$280 at time of data collection)

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12

Contextual and individual determinants of oral health-related quality of life among five-year-old children: a multilevel analysis