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Effect of neighborhood and individual social capital in early childhood on oral health-related quality of life: a 7-year cohort study

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Abstract

Objective Social capital incorporates both contextual and individual levels of interactions and influences health. The aim of this study was to assess the influence of neighborhood and individual social capital on oral health-related quality of life (OHRQoL) of children.

Methods This 7-year cohort study was conducted with 639 children (1–5 years) who had been evaluated initially with a survey administered in 2010. OHRQoL was assessed using the Brazilian version of the Child Perception Questionnaire (CPQ8-10) in the follow-up. Contextual variables related to social capital were collected during the baseline and included the presence of social class associations, workers' associations, and cultural community centers. Individual variables included individual social networks, socioeconomic variables, and oral health measures (dental caries and overjet). A multilevel Poisson regression model was used to investigate the influence of individual and contextual characteristics on OHRQoL. With this approach, we calculated incidence rate ratio (IRR) and 95% confidence intervals (95% CI).

Results From the 639 preschoolers examined at baseline, a total of 449 children were re-evaluated after 7 years (70.3% response rate). Children who lived in areas with social class associations at baseline reported better OHRQoL in the follow-up (IRR 0.79; 95% CI 0.67–0.93). Regarding individual variables, low socioeconomic status, poor clinical conditions, and weak social networks were also associated with higher overall CPQ8-10 scores.

Conclusions High levels of individual and neighborhood social capital in early childhood positively influenced children's OHRQoL. This finding is important in planning public health policies to improve children's health and well-being.

Keywords Children · Cohort study · Epidemiology · Quality of life · Social capital

Introduction

Motivated by a broader conception of the health and disease process, studies on inequalities in oral health have adopted a new perspective, where health outcomes are patient-oriented, for example, focusing on oral health-related quality of life (OHRQoL) [1, 2]. In this context, OHRQoL has been widely advocated as an adjunct to clinical parameters in planning public health policies and in evaluating oral health strategies [3]. The OHRQoL is described as a multidimensional construct and refers to the impact of oral health conditions on the daily functioning and well-being of individuals [4]. Thus, the OHRQoL is an important outcome that results from an interaction between oral health conditions and general health, social, and contextual factors [4].

In this sense, it has been suggested that a broad range of social determinants influence oral health and OHRQoL [3, 5]. Among these factors is social capital, which is considered a social determinant with an important influence on health [6]. Social capital comprises social resources that evolve in accessible social networks and social structures characterized by mutual trust [7–10]. These social resources facilitate

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access to various returns, which might benefit both the individual and the collective [9, 10]. In this context, social capital can be understood as a resource accessible to people through participation in various types of social networks, allowing for the achievement of certain objectives, returns, or benefits that would not be achieved in the absence of this characteristic capital [7–10].

Previous studies have evaluated the relationship between contextual and social factors, self-perception oral health, and OHRQoL in different age groups [1, 11–14]. According to these findings, it was demonstrated that the social network into which the individual is inserted provides social support, and this is related to self-reported health status, since health behavior is associated with having good social networks [11, 12, 15]. Moreover, individuals residing in neighborhoods with low social capital experience the worst levels of oral diseases and the greatest impacts on OHRQoL [11, 12]. Although such findings provide useful information, most of the studies in question have a cross-sectional design, which prevents hypotheses of causality. In this regard, there is still a need for more specific studies to understand more deeply the influence of contextual and social determinants and their cumulative effect on OHRQoL.

Longitudinal studies addressing the cumulative effect of low socioeconomic status and social capital over the course of childhood are important for the implementation of oral health promotion strategies, because these problems and their consequences do not manifest only in childhood, and may persist throughout life [16]. The aim of this study was to assess the influence of neighborhood and individual social factors on children's OHRQoL. We hypothesized that children who live in neighborhoods with high social capital and whose parents have high levels of individual social networks are more likely to report better OHRQoL.

Methods

This study is reported according to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

Study design and participants

This is a cohort study with 7 years of follow-up. The first assessment was undertaken in 2010 in Santa Maria, a southern city in Brazil. In 2010, the city had an estimated population of 263,403, which included 27,520 children under 6 years. A sample group was selected from among all children who attended health centers in the municipality on the National Children's Vaccination Day. The sampling points were 15 health centers randomly selected from different neighborhoods of the city. Each health center is responsible for vaccinating children living in that area. A total of 639 children aged 1 to 5 years were examined for the assessment of their oral health status. At this examination, caregivers answered a semi-structured questionnaire regarding sociodemographic characteristics and social networks. Full details about the methodology used in the epidemiological survey are published elsewhere [17].

For the sample size calculation, we considered a standard error of 5%, 95% confidence level, and taking a prevalence of 56.1% of children with high mean CPQ8-10 scores in the exposed group (high vulnerability) and 38.8% in the unexposed group (low vulnerability) [18]. The ratio of unexposed to exposed was 2:1, with a design effect of 1.2, and a statistical power of 80%. Considering possible losses, 30% was added to the sample size. The minimum sample size required was 472 children. As this study was part of a large survey that investigated other outcomes, a sample larger than necessary was included. The inclusion criteria were that all participants were children aged 1–5 years who attended health centers in the municipality on the National Children's Vaccination Day. The exclusion criteria comprised of children with any degree of mental or physical disability.

Follow-up assessment

After 7 years, all children who participated in the initial epidemiological survey were invited to participate in a further assessment. During the follow-up survey, children answered a questionnaire to evaluate OHRQoL. Data on demographic and socioeconomic variables and oral health measures were also obtained. Data collection was carried out from January 2017 to March 2018. Some search strategies were adopted in order to trace the greatest possible number of children for this follow-up. First, these children were accessed through telephone calls to their parents for purposes of updating the data and scheduling the child evaluations. In addition, some children were located through the acquisition of student enrolment listings from the city's public schools. After updating addresses and receiving authorization from the caregivers, the children were evaluated in their schools and residences.

Oral health-related quality of life

The Brazilian version of the Child Perception Questionnaire (CPQ8-10) was used to assess the children's OHRQoL—the outcome of this study [19, 20]. Children answered the questionnaire in the follow-up through a face-to-face interview conducted by previously trained interviewers. The CPQ8-10 comprises 25 questions organized into 4 domains: oral symptoms (5 questions), functional limitations (5 questions), emotional well-being (5 questions), and social well-being (10 questions). Answers were measured on a 5-point Likert

scale, ranging from 0 to 4. The mean CPQ8-10 scores were calculated from overall scores ranging from 0 to 100, with higher overall scores indicating poorer OHRQoL.

Neighborhood and individual social capital

The independent variables were social support and social networks and were obtained at baseline. Individual social capital was assessed by the levels of social networks in which parents took part, using the two questions: "In the past 12 months, have you attended a volunteer group?" and "Do you participate in any group related to your child's school activities?" and the following possible responses: 0 = no and 1 = yes. These questions were answered by caregivers through face-to-face interviews conducted by trained interviewers. These are commonly used indicators in the social capital literature and in the Brazilian population [2, 11]. In this context, it has been demonstrated that social relationships surrounding the individual, as well as the groups of people they have contact with or participate with in some way, can be considered as a proxy of social capital [21].

The neighborhood social capital was defined by geographic area through the neighborhood in which the child was living, in order to assess the contextual-level influences in OHRQoL. Three community-related variables were obtained: the presence of social class associations, workers' associations, and cultural community centers. These covariates have previously been used as proxies for a community social network [15] and are theoretically related to social capital and social cohesion, resulting in positive or negative impacts within a collective environment, independent of individual social networks [22, 23]. The total number of social class associations, workers' associations, and cultural community centers were counted within each of the 15 neighborhoods. These context-indicating variables were dichotomized for analysis, as being either present or absent. This information was obtained from local government, in the form of official municipal publications.

Covariates

Some potential confounders of the association were collected during the baseline and included: sex (male or female), maternal education, household income, household crowding, dental attendance, and oral health measures. Maternal education was collected in terms of the number of years of study and was dichotomized as being either 8 or more years of schooling or less than 8 years of schooling (incomplete primary education). Household income was a sum of all forms of income in month (salary, wages, pensions, cash transfer program, and rental income). It was collected in Reais (Brazilian currency—R$3.75 was equivalent to US$1.00 approximately) and transformed in quartiles for each assessment: Q1 (Lowest): < R$500.00, Q2: R$500.00 to < R$900.00, Q3: R$900.00 to < R$1500.00; and Q4 (Highest): R$1500+. Household crowding was evaluated through the ratio of the number of people to the number of rooms in the house (except the bathroom) and transformed in quartiles for analysis. Children were also classified according to their use of dental services in the previous 6 months as (0) visited the dentist for routine appointment or check-up, (1) visited the dentist for toothache, and (2) did not visit the dentist. The data were collected through a semi-structured questionnaire answered by parents or guardians during the baseline assessment.

Clinical variables were assessed at baseline by calibrated examiners and international criteria standardized by the World Health Organization for oral health surveys was used for all dental examinations [24]. Oral health measures were administered at health centers in dental chairs with conventional illumination, using a plane dental mirror and periodontal probes (CPI; "ball point"). For the survey, 15 examiners selected after the training and calibration procedures conducted the assessments. The prevalence of untreated caries was recorded as a non-zero D/d component in the decayed, missed, or filled teeth indexes—DMFT/dmft indexes. The variable "incidence of untreated dental caries" was created from the difference between baseline and follow-up number of cavitetated lesion. The maxillary overjet was evaluated in millimeters and dichotomized as present (≥ 3 mm) and absent (< 3 mm). Inter- and intra-examiner agreement (weighted kappa) for the oral measures were higher than 0.8.

Statistical analyses

Data analysis was performed using STATA 14 (StataCorp. 2014. Stata Statistical Software: Release 14.1. College Station, TX: StataCorp LP). The differences between the participants and non-participants were evaluated through the Chi-square test. The OHRQoL overall score was the main dependent variable. Descriptive analysis described individual and contextual characteristics of the sample in the baseline (T1) and follow-up (T2). The variation of overall CPQ8-10 scores at follow-up according to characteristics at baseline was also estimated.

Adjusted multilevel Poisson regression models were used to assess the association between neighborhood and individual social capital and OHRQoL. The multilevel structure of analysis considered individuals (level 1) nested into 15 neighborhoods (level 2). Multilevel models provide the estimation of contextual effects of neighborhood-level variables by accounting for spatial clustering of individuals within areas [25]. The multilevel model used the scheme of fixed effect with random intercept. The results are presented as

incidence rate ratio (IRR) and its respective 95% confidence interval (95% CI).

Our statistical models were tested according to a theoretical model presented in Fig. 1. Three models were described. Model 1 ("empty model"), an unconditional model, estimated the proportion of variance for each level before the incremental introduction of the contextual and individual independent variables; Model 2 ("contextual") included contextual variables; and Model 3 ("full") comprised of Model 2 plus individual sociodemographic variables and clinical oral health measures. Variables with P value < 0.20 in the unadjusted analysis were considered for the multivariable models. In all models, the quality of fit was measured using deviance (-2 log likelihood) and the median incidence rate ratio (MIRR). Statistically significant changes in the fitting of the models were assessed using the likelihood ratio.

Ethical issues

This cohort study was approved by the Committee for Ethics in Research of School of Dentistry, Federal University of Santa Maria (Protocol Number 54257216.1.0000.5346) and the participants' parents signed a consent form.

Results

From the 639 preschoolers assessed at baseline, a total of 449 children were re-evaluated at 7-year follow-up (a 70.3% response rate). The mean age of children evaluated at baseline and follow-up was 2.8 (standard deviation; 1.4) and 10.0 (standard deviation; 1.4) years, respectively. The reasons for losses in participant numbers at follow-up included refusal to take part in the study ($n = 9$) and inability to locate the original children ($n = 181$). Comparing the participants with the non-participants, there were no statistical differences for sex ($P = 0.28$), age ($P = 0.18$), and maternal education ($P = 0.35$). The re-examined children were from significantly lower-income families than the non-participants ($P < 0.05$); however, we performed sensitivity analysis using the Monte Carlo simulation and verified that this difference did not influence our results.

Distributions of individual and contextual characteristics of the sample are presented in Table 1. We observed that 49.6% and 51% of the individuals were girls at baseline and follow-up, respectively. In relation to household income, most of the participants were in the lower quartiles at the time of both assessments. Regarding maternal education, most mothers had more than 8 years of schooling. The prevalence of untreated dental caries in T1 and T2 was 28.8% and 28.3%, respectively.

Table 2 presents the distribution of overall CPQ8-10 scores at follow-up according to individual and contextual characteristics at baseline. The mean overall CPQ8-10 score in the sample was 10.57 (SD 10.36). The children with higher overall CPQ8-10 scores were girls, had lower socioeconomic status, and had visited the dentist for toothache within the past 6 months. Moreover, children whose parents were members of volunteer networks and were involved in school activities reported a better OHRQoL. The presence of social class associations and workers' associations in the neighborhood was related to lower scores in CPQ8-10.

Unadjusted associations between contextual and individual variables and overall CPQ8-10 scores are shown in Table 3. There were statistically significant differences for individual and neighborhood (social class association), social capital variables, and CPQ8-10 scores. Furthermore, the overall CPQ8-10 scores were significantly higher among

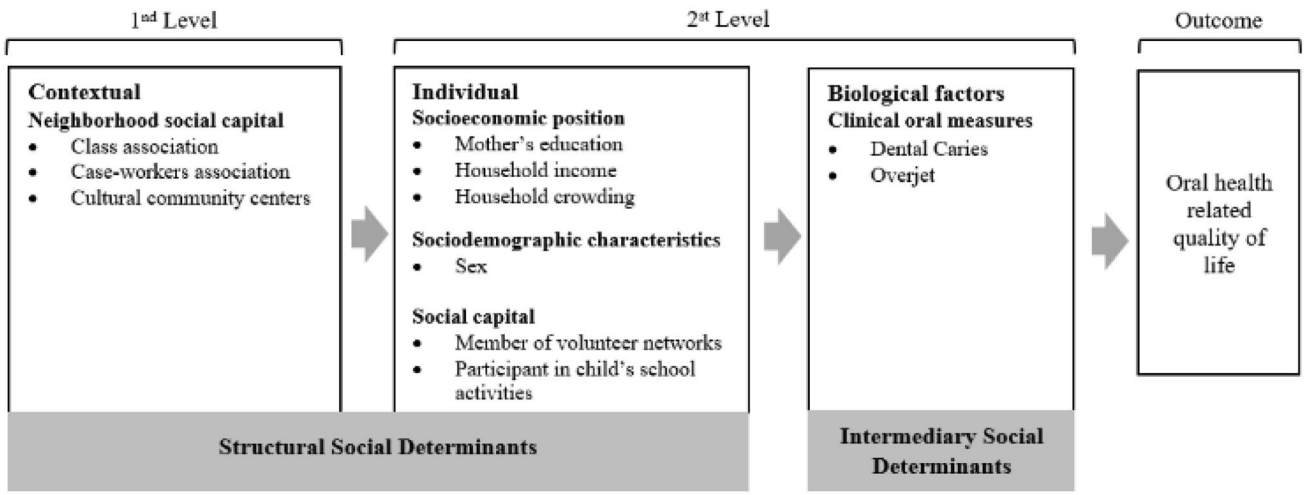

Fig. 1 Theoretical model for the study of contextual and individual determinants of OHRQoL in children, adapted from WHO [26]

Table 1 Contextual and individual characteristics of the participants at the baseline (T1) and at 7-year follow-up (T2)

Variables	Baseline (T1)[a] (*n* = 639) *n* (%)	Follow-up (T2)[b] (*n* = 449) *n* (%)
Contextual-level variables		
Social class association		
Absent	393 (61.6)	277 (61.7)
Present	245 (38.4)	172 (38.3)
Workers association		
Absent	413 (64.7)	284 (63.3)
Present	225 (35.3)	165 (36.7)
Cultural community centers		
Absent	365 (57.2)	265 (59.0)
Present	273 (42.8)	184 (41.0)
Individual-level variables		
Sex		
Boys	322 (50.4)	220 (49.0)
Girls	317 (49.6)	229 (51.0)
Maternal education		
≥ 8 years of formal education	357 (56.5)	246 (55.3)
< 8 years of forma education	275 (43.5)	199 (44.7)
Household income in R$[c]		
Lowest (1st quartile)	137 (22.8)	94 (22.1)
Medium lowest (2nd quartile)	172 (28.6)	129 (30.3)
Medium highest (3rd quartile)	170 (28.2)	128 (30.1)
Highest (4th quartile)	123 (20.4)	75 (17.6)
Household crowding in people/room		
Lowest (1st quartile)	221 (35.0)	147 (33.0)
Medium lowest (2nd quartile)	214 (33.9)	158 (35.4)
Medium highest (3rd quartile)	53 (8.4)	34 (7.6)
Highest (4th quartile)	143 (22.7)	107 (24.0)
Dental attendance		
Check-up/routine	94 (14.9)	63 (14.2)
Toothache	40 (6.35)	30 (6.8)
No visit	496 (78.7)	349 (79.0)
Member of volunteer networks		
Yes	97 (15.3)	74 (16.6)
No	538 (84.7)	372 (83.4)
Parental involvement at school activities		
Yes	248 (39.3)	178 (40.1)
No	383 (60.7)	266 (59.9)
Untrated Dental caries		
Without	455 (71.2)	322 (71.7)
With	184 (28.8)	127 (28.3)
Maxillary overjet		
≤ 3 mm	405 (86.5)	292 (87.7)
> 3 mm	63 (13.5)	41 (12.3)

[a]T1, baseline

[b]T2, 7-year follow-up

[c]R$, Real (R$3.75 it was equivalent to US$1.00 approximately)

Table 2 Sample distribution of overall CPQ8-10 scores according to individual and contextual characteristics at baseline

Variables	CPQ8-10 follow-up (T2)[a] Mean (SD)[b]
Contextual-level variables	
Social class association	
Absent	11.9 (11.8)
Present	8.4 (7.0)
Workers association	
Absent	11.5 (11.2)
Present	9.0 (8.5)
Cultural community centers	
Absent	10.5 (10.0)
Present	10.6 (10.8)
Individual-level variables	
Sex	
Boys	10.0 (10.2)
Girls	11.1 (10.5)
Maternal education	
≥ 8 years of formal education	9.4 (9.3)
< 8 years of formal education	11.8 (11.1)
Household income in R$[c]	
Lowest (1st quartile)	13.3 (13.8)
Medium lowest (2nd quartile)	10.6 (10.8)
Medium highest (3rd quartile)	8.8 (7.6)
Highest (4th quartile)	8.3 (7.2)
Household crowding in people/room	
Lowest (1st quartile)	9.0 (9.2)
Medium lowest (2nd quartile)	11.2 (10.7)
Medium highest (3rd quartile)	12.6 (15.1)
Highest (4th quartile)	11.2 (9.5)
Dental attendance	
Check-up/routine	8.7 (8.4)
Toothache	11.9 (10.2)
No visit	10.9 (10.7)
Member of volunteer networks	
Yes	9.9 (9.5)
No	10.7 (10.6)
Parental involvement at school activities	
Yes	9.2 (9.3)
No	11.5 (11.0)
Incidence of untreated dental caries	
Without	9.8 (10.0)
With	13.1 (11.3)
Maxillary overjet	
≤ 3 mm	10.6 (10.5)
> 3 mm	12.4 (13.5)

[a]T2, 7-year follow-up

[b]SD, standard deviation

[c]R$, Real (R$3.75 it was equivalent to US$1.00 approximately)

Table 3 Unadjusted association between contextual and individual variables at baseline (T1) and overall CPQ8-10 scores at 7-year follow-up (T2), determined using multilevel Poisson regression

Variables	IRR[a] (95% CI)[b]	*P* value
Contextual variables (neighborhood)		
Social class association		$P<0.01$
Absent	1	
Present	0.72 (0.59–0.89)	
Workers association		$P=0.10$
Absent	1	
Present	0.81 (0.63–1.03)	
Cultural community centers		$P=0.90$
Absent	1	
Present	0.98 (0.75–1.28)	
Individual variables (child)		
Sex		$P<0.01$
Boys	1	
Girls	1.08 (1.02–1.14)	
Maternal education		$P<0.001$
≥ 8 years of formal education	1	
< 8 years of formal education	1.18 (1.11–1.25)	
Household income in R$[c]		$P<0.001$
Lowest (1st quartile)	1	
Medium lowest (2nd quartile)	0.75 (0.69–0.81)	
Medium highest (3rd quartile)	0.65 (0.60–0.71)	
Highest (4th quartile)	0.62 (0.56–0.68)	
Household crowding in people/room		$P<0.001$
Lowest (1st quartile)	1	
Medium lowest (2nd quartile)	1.19 (1.11–1.28)	
Medium highest (3rd quartile)	1.31 (1.17–1.46)	
Highest (4th quartile)	1.17 (1.08–1.28)	
Dental attendance		$P<0.001$
Check-up/routine	1	
Toothache	1.26 (1.10–1.45)	
No visit	1.21 (1.10–1.32)	
Member of volunteer networks		$P<0.01$
Yes	1	
No	1.14 (1.05–1.23)	
Parental involvement at school activities		$P<0.001$
Yes	1	
No	1.26 (1.18–1.34)	
Incidence of untreated dental caries		$P<0.001$
Without	1	
With	1.36 (1.27–1.44)	
Maxillary overjet		$P<0.01$
≤ 3 mm	1	
> 3 mm	1.15 (1.04–1.27)	

[a]IRR, incidence rate ratio

[b]CI, confidence interval

[c]R$, Real (R$3.75 it was equivalent to US$1.00 approximately)

quartiles with household crowding, low household income, and lower maternal education. Incidence of caries lesions and presence of accentuated overjet was also associated with poor OHRQoL.

Table 4 shows the results of adjusted multilevel Poisson regression analyses. In the final model (Model 3), sex (girls), low household income, high household crowding, dental attendance (toothache or no visit), incidence of dental caries, and presence of accentuated overjet at baseline were associated with higher overall CPQ8-10 scores at the follow-up. In relation to the individual social capital, children whose parents were not involved in school activities presented worse OHRQoL (IRR 1.23; 95% CI 1.14–1.34). The influence of neighborhood social capital covariates could be noted at the contextual level, as those who lived in areas with social class associations during the baseline reported better OHRQoL at the follow-up (IRR 0.79; 95% CI 0.67–0.93).

Discussion

The present findings support the hypothesis that individual and neighborhood social capital in early childhood influence the OHRQoL throughout childhood. Children who lived in areas with social class associations and whose parents were involved in school activities, reported better OHRQoL at follow-up. Our results also suggest that being a female of lower socioeconomic status and seeing a dentist due to toothache and accentuated overjet are related to poor OHRQoL in children. Recent studies have reported that psychosocial factors are related to children's OHRQoL. However, the individual and contextual effects of social capital on children's OHRQoL longitudinally had not yet been explored.

The presence of social class associations in neighborhoods positively influenced children's OHRQoL. The presence of social class associations has been described as a proxy for the degree of social networks, being theoretically related to social capital and social cohesion [23]. A high social capital community is characterized by the existence of associations and active citizens, and leads to a positive social environment which is characterized by trust and social cohesion among individuals [22]. It has been suggested that living in a high social capital neighborhood can be beneficial even for individuals with poor social connections [22]. In this sense, collective social capital can influence health through psychosocial processes, behavior pathways, access to health services, and development of supportive public policy [27].

Communities with a high degree of cohesion are hypothesized to experience lower levels of psychosocial stress through access to social support, as well as via feelings of safety, belonging, and coping [27, 28]. Moreover, these communities are more successful in uniting for the best interest

Table 4 Adjusted association of contextual and individual variables at baseline (T1) with overall CPQ8-10 scores at 7-year follow-up (T2), determined using multilevel Poisson regression

Variables	Model 1[a] ("empty") IRR[d] (95% CI)[e]	Model 2[b] ("contextual") IRR (95% CI)	Model 3[c] ("full") IRR (95% CI)
Fixed component			
Intercept	9.82 (8.63–11.18)	11.95 (10.31–13.84)	7.90 (6.35–9.83)
Contextual variables (neighborhood)			
Social class association			
Absent		1.0	1.0
Present		0.71 (0.59–0.86)**	0.79 (0.67–0.93)**
Workers association			
Absent		1.0	1.0
Present		0.83 (0.69-1.00)	0.79 (0.78–0.93)
Cultural community centers			
Absent		1.0	–
Present		1.07 (0.88–1.29)	
Individual variables (child)			
Sex			
Boys			1.0
Girls			1.08 (1.01–1.16)*
Household income in R$[f]			
Lowest (1st quartile)			1.0
Medium lowest (2nd quartile)			0.78 (0.71–0.85)***
Medium highest (3rd quartile)			0.64 (0.58–0.71)***
Highest (4th quartile)			0.66 (0.58–0.75)***
Household crowding in people/room			
Lowest (1st quartile)			1.0
Medium lowest (2nd quartile)			1.15 (1.05–1.25)**
Medium highest (3rd quartile)			1.34 (1.67–1.55)***
Highest (4th quartile)			1.09 (0.98–1.20)
Dental attendance			
Check-up/routine			1.0
Toothache			1.42 (1.18–1.70)***
No visit			1.19 (1.05–1.34)**
Parental involvement at school activities			
Yes			1.0
No			1.23 (1.14–1.34)***
Incidence of untreated dental caries			
Without			1.0
With			1.41 (1.31–1.52)***
Maxillary overjet			
≤ 3 mm			1.0
> 3 mm			1.25 (1.13–1.38)***
Random component			
Deviance = (− 2 log likelihood)	5085.58	5074.38	3414.15
MIRR[g]	1.27	1.17	1.13

*P value < 0.05; **P value < 0.01; ***P value < 0.001

[a]Model 1: empty model, represents unconditional model

[b]Model 2: mutually adjusted for contextual variables

[c]Model 3: fully adjusted for contextual, individual, and oral health variables

[d]IRR, incidence rate ratio

[e]CI, confidence interval

[f]R$, Real (R$3.75 it was equivalent to US$1.00 approximately)

[g]MIRR, median incidence rate ratio

of the neighborhood and influencing political decisions in health, and might be better able to lobby for access to high-quality health and social services [29]. Besides that, high levels of social capital in local communities can influence health through the spread of healthy norms and are most likely to support health-enhancing behaviors [29]. Thus, it is demonstrated that the social network into which the individual is inserted provides social support, and this is related to self-reported health status, since health behavior is associated with good social networks [11, 15].

In relation to the individual social capital, our results showed that children whose parents were not involved in school activities reported worse OHRQoL. In this study, the level of social networks was used as a proxy of individual social capital. A possible explanation for our findings is that social relationships surrounding the individual or some form of participation in groups provide various forms of social support that may influence health by functioning as 'buffering factors' for stress, as well as providing feelings of coherence and meaningfulness [29, 30]. Moreover, individuals in a social network are subject to the influence of normative dental health behaviors and also can access material resources and services, such as job opportunities and healthcare [27, 29].

Furthermore, social networks are distinguished into "horizontal" egalitarian relationships and "vertical" hierarchical relationships [9, 31]. Horizontal networks are considered the capital that denotes to cooperative and trusting relations between members of a network who see themselves as similar ("bonding") or that they are not alike in some way with respect to socio-demographics or social identity ("bridging") [31]. The vertical or linking social capital consists of vertical ties between people in different formal or institutionalized power hierarchies [31]. In this context, parental involvement in school activities can be considered as a type of vertical social capital, showing the relationship between school–institution and parents–children. The importance of linking social capital is that the nature and extent of respectful and trusting ties to representatives of formal institutions has a major impact on people's welfare and health [10]. Studies in the field of education have demonstrated positive effects of parental school involvement on academic outcomes [32]. Thus, greater parental involvement in schools can be linked to promoting the health and well-being of children, as well as their subjective perceptions.

Our findings demonstrated that household crowding and low household income negatively impacted the children's OHRQoL in accordance with previous studies [12, 33–35]. We considered household income and household crowding as proxies to individual socioeconomic status [36]. A possible explanation for this is that individuals with low socioeconomic status are more susceptible to general and oral health risk factors, which may generate negative impacts on the functional, psychological, and social dimensions of quality of life [1, 4, 37]. Moreover, socioeconomic barriers are related to decreased seeking of services, and the combination of perceived need for treatment and absence of resources for seeking health professionals can negatively influence healthy habits and coping behavior, generating discontent and discomfort [38–40].

Clinical oral health measures were also associated with OHRQoL among children in our study. Children with incidence of dental caries and accentuated overjet, who either did not visit a dentist or visited a dentist due to toothache, had worse OHRQoL. Previous studies have also demonstrated the negative impacts of dental caries on OHRQoL [18, 41, 42]. Children with dental caries are more likely to experience pain and impaired chewing [41, 42]. In addition, they can be more concerned about their oral health, which may negatively impact on their quality of life [41]. Consistent with our results, studies have shown that unaesthetic occlusal traits may induce unfavorable social responses among children, impairing the social interaction and psychological well-being of the individuals, which then reflects in their OHRQoL [43, 44]. Children who reported toothache visited a dentist with higher frequency than those who sought the dentist for preventive reasons [45]. Moreover, toothache affects the physical status of children, as well as their psychological well-being and social interactions, thus negatively affecting the OHRQoL [46].

The main limitation of this study is that social capital was measured by indirect indicators of social cohesion, social networks, and social support, which may not provide a full view of social capital. However, both theory and measurement of social capital are still evolving, and inconsistencies have been reported in its definition and measurement, which has been a source of discussion [29]. Notwithstanding, we used the same social capital indicators described in previous studies [11, 15]. Furthermore, introduction of new concepts in science often gives rise to resistance and criticism [10].

This study also has strengths. It is a long-term cohort study with a large cohort retention rate of 70.3% after 7 years, indicating the external validity of our findings. In addition, this study is a longitudinal assessment of the influence of social factors in OHRQoL during a transition stage in children's lives, which provides evidence for the development of broad oral health promotion with this age group. This knowledge is important in planning public health policies to improve the health and well-being of children and it may give policymakers useful insights into the importance of community, and the social relations at the individual, community, and societal level, aimed at reducing the impact of inequality on OHRQoL.

Conclusion

Our findings indicated that individual and neighborhood social capital influenced the OHRQoL. Children of low socioeconomic status and with low individual and neighborhood social capital have a worse OHRQoL.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the Human Research Ethics Committee of the Federal University of Santa Maria (protocol number 54257216.1.0000.5346), Brazil.

Informed consent Informed consent was obtained from all individual participants included in the study.

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