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## **Pathways between social capital and oral health from childhood to adolescence**

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**Abstract**

This study aimed to evaluate the theoretical pathways by which social capital can influence dental caries and oral health-related quality of life (OHRQoL) of children over time. This 10-year prospective cohort started in 2010 with a sample of 639 preschoolers aged 1-5 years from the southern Brazil. Community and individual social capital were assessed at baseline through the presence of formal institutions in the neighbourhood and social networks, respectively. In the 10-year follow-up, the individual social capital was evaluated by social trust and social networks. Dental caries was measured by the International Caries Detection and Assessment System (ICDAS), and the short version of the Child Perception Questionnaire (CPQ 11-14) was used to assess OHRQoL. Demographic, socioeconomic, behavioural (frequency of toothbrushing and use of dental services), and psychosocial (sense of coherence) characteristics were also assessed. Structural equation modelling was used to evaluate the associations between variables over time. About 429 children were reassessed at 10-years follow-up (67.1% cohort retention rate). High community social capital at baseline directly predicted lower occurrence of dental caries and better OHRQoL after 10 years. Social capital at community level also indirectly predicted lower occurrence of dental caries through sense of coherence, frequency of toothbrushing, and use of dental services. Individual social capital at follow-up was indirectly linked to OHRQoL via the psychosocial pathway (sense of coherence). Community-level social capital was associated with dental caries and OHRQoL over time. The relationship between individual social capital and oral health was mediated through the psychosocial pathway.

## **Introduction**

The majority of oral diseases are preventable conditions that affect billions of people worldwide with a high economic impact on the societies, reflecting the persistence of widespread socioeconomic inequalities (Peres et al. 2019). Of them, dental caries is still considered a remarkable public health problem, especially during childhood and adolescence (Wright 2018). In addition to the economic impact, dental caries and other oral health conditions can also causes several consequences for the individuals' well-being and quality of life (Rauber et al. 2020).

Oral health is multifaceted and continuously influenced by the values and attitudes of people and communities, and reflects the physiological, social, and psychological attributes essential to the quality of life (Glick et al. 2016). Thus, assessment of oral health should incorporate patient-reported outcomes measures (PROMs). Oral health-related quality of life (OHRQoL) reflects people's comfort when eating, sleeping, engaging in social interactions, and their satisfaction with their oral health (Group 1995). In this context, oral health emerges as a positive concept that is interconnected with the available personal and social resources to the individuals, such as social capital (Rouxel et al. 2015).

Social capital can be defined as social resources evolving accessible social networks or social structures that are characterized by mutual trust, which facilitate access to various instrumental or expressive returns that can benefit the individual and the collective (Putnam 1993; Rostila 2011). The role of social capital on oral health conditions has been investigated. Individuals with higher levels of social capital had lower levels of dental caries and gingivitis (Fontanini et al. 2015; Ferreira et al. 2021), and reported better self-perception of health and OHRQoL (Knorst et al. 2019; do Amaral Júnior et al. 2021).

Some hypothetical pathways have been developed to explain the link between social capital and oral health (Kawachi and Berkman 2000). The different mechanisms by which social capital influence oral health include the psychosocial, behavioural, and use of health services pathways (Rouxel et al. 2015). The psychosocial pathway acknowledges that social capital exerts a protective effect on oral health via buffering the impact of stress, through enhancing the feelings of belonging, coping, resilience, and sense of coherence (Rouxel et al. 2015). The behavioural and use of dental service pathways suggest that social capital can impact oral health through the dissemination of healthy habits, such as oral hygiene or the search for dental care (Rouxel et al. 2015). However, to the best of our knowledge, no previous study has evaluated the influence of social capital on oral health from childhood to adolescence neither assessed the possible mediators of such relationship. The longitudinal assessment of oral health

outcomes during the transition from childhood to adolescence provides the opportunity to enhance the understanding on the determinants and causal paths of the health-disease process during such crucial period of biopsychosocial development.

This study aimed to explore the pathways by which individual and community social capital can influence the dental caries and OHRQoL from childhood to adolescence. We hypothesized that high individual and community social capital at baseline would directly predict lower dental caries and better OHRQoL at 10-year follow-up. Moreover, indirect effects of individual and community social capital at baseline on dental caries and OHRQoL at 10-year follow-up via psychosocial, behavioral, and use of oral health services pathways were also hypothesized.

## **Methods**

This study is reported according to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines (von Elm et al. 2008). The Strobe checklist and detailed methodology are available in the Appendix file.

### *Study design and sampling process*

This study was a 10-year prospective cohort study involving preschool children from Santa Maria, a southern city in Brazil. The cohort study involved the baseline and 3 follow-up assessments in the years 2012 (2 years), 2017 (7 years), and 2020 (10 years). The present study included baseline data in 2010 (T1) and followed up data in 2017 (T2) and 2020 (T3). The research protocol was approved by the Research Ethics Committee of the Federal University of Santa Maria (protocol CAAE 11765419.1.0000.5346). All participants agreed to participate and the caregivers signed an informed consent form.

A systematic probabilistic sample was selected involving all children aged from 1 to 5 years-old who attended primary healthcare units in the municipality on the National Children's Vaccination Day in 2010. Children with any physical or mental disabilities were not included. The primary sampling units included all 15 health care centres in the city that had dental chairs. Further details on the methodology used in T1 have already been published elsewhere (Piovesan et al. 2013).

The sample size calculation of the present study considered a standard error of 5%, confidence level of 95%, minimum effect size of 0.2 (Fontanini et al. 2015), two latent variables, 13 observed variables, and statistical power of 80% for structural equation modelling

(SEM) analysis. Considering a design effect of 1.2 and adding 30% for possible anticipated losses, the minimum required sample size was 335 children.

#### *Follow-up assessment*

All participants of the baseline examination were invited for a further assessment after 7 (T2) and 10 years (T3). Children's age ranged from 8 to 12 years at T2 and 11 to 15 years at T3. Follow-up data collection at T2 was carried out from January 2017 to March 2018. Follow-up data collection at T3 started in November 2019, which was interrupted in March 2020 due to the COVID-19 pandemic. Thereafter, with all appropriate measures, the continuation of this stage took place between October 2020 and January 2021. Follow-up data collections occurred through school visits as well as home visits which were arranged via telephone, Facebook or WhatsApp.

#### *Data collection and variables*

Data were collected through self-administered questionnaires, interviews, and oral examinations in all waves of the study.

Dental caries was evaluated at T1, T2 and T3 using the diagnostic criteria of the International Caries Detection and Assessment System (ICDAS) (Ismail et al. 2007). The dental exams were performed using a plain dental mirror (Golgran, São Caetano, Brazil) and CPI "ball point" periodontal probes (Golgran, São Caetano, Brazil). The examiners were previously trained and calibrated (Kappa coefficients ranged from 0.70 to 0.96). For the purpose of analysis, dental caries was assessed according to the number of teeth with the presence of untreated dental caries (ICDAS codes 3, 5 or 6).

OHRQoL was assessed using the most appropriate instrument in each period of evaluation considering the participant's age. At T1, OHRQoL was evaluated using the Brazilian version of the Early Childhood Oral Health Impact Scale (ECOHIS), applied to children's parents or guardians (Scarpelli et al. 2011). At T3, the adolescents completed the reduced Brazilian version of the Child Perceptions Questionnaire 11-14 (CPQ11-14) (Torres et al. 2009). Both questionnaires evaluate questions throughout a Likert scale. Posteriorly, the scores are added, and the higher the score, the worse the OHRQoL.

Individual social capital at T1 was measured through social networks of the participants' parents through the religious practice, participation in volunteer groups and in child's school activities. Individual social capital at T3 was evaluated according to adolescents' social networks and social trust. Community social capital at T1 was assessed according to the

presence of community cultural centres, number of dental workers and the number of churches in the neighbourhood where the participant lived at the baseline. The information of the neighbourhoods was obtained from the local council. The social capital variables were valid measures commonly used as indicators according to previous literature (Paxton 1999; Chor et al 2001; Aida et al. 2008; Ferreira et al. 2021).

The possible mediators between social capital and oral health measures were evaluated according to the theoretical explanatory pathways (Rouxel et al. 2015). Sense of coherence (SOC) was evaluated at T3 to represent aspects of the psychosocial pathway, and the adolescents answered the short version of the 13-item sense of coherence scale (SOC-13) (Antonovsky 1987; Menegazzo et al. 2020). The items are followed by a 5-point Likert scale and are added to calculate the final score. Higher scores represent a higher SOC. Frequency of dental visits and frequency of toothbrushing were assessed at T2 and T3 and used to evaluate use of dental services and health behaviours pathways, respectively. Use of dental services was assessed according to the methodology proposed by the WHO for oral health surveys, using the following question: "In the last year (12 months), how many times have you been to the dentist?" (WHO 2013). Frequency of toothbrushing was measured according to the number of times the individuals brushed their teeth daily. These measures were used as count variables.

Demographic data, including sex (girls or boys) and skin colour, and socioeconomic status were also measured at T1 and T3 as covariates. Skin colour was evaluated using the criteria established by the Brazilian Institute of Geography and Statistics (IBGE) (IBGE 2010) and dichotomized into whites and non-whites. Family income in the previous month was used to measure socioeconomic status (Galobardes et al. 2007), which was collected in Brazilian Real (US\$1.00 is equivalent to R\$5.4 approximately) and categorized into income quartiles.

### *Statistical analysis*

The data were analyzed using the STATA 14 program. Descriptive analysis of the characteristics of the sample at T1, T2 and T3 was performed. Data between individuals who were assessed at follow-ups and dropouts, and between individuals at T3 evaluated before and during the COVID-19 pandemic were compared using the Chi-square test and the *t*-test. Analyses were conducted considering the sampling weights ('svy' command).

Structural equation modelling (SEM) was used to assess the associations of individual and community social capital with dental caries and OHRQoL over time. The theoretical model used in this study was based on the conceptual framework of the Commission on Social Determinants of Health (Solar and Irwin 2010) and on the model proposed by Rouxel (Rouxel

et al. 2015) where the pathways by which individual and community social capital can affect oral health are hypothesized (Supplementary Figure 1).

Confirmatory factor analysis (CFA) was used to assess the measurement model for latent variables (individual and community social capital at T1). In the next step, structural equation modelling (SEM) assessed the magnitude of the direct and indirect relationships between latent and observed variables according to the theoretical model. The Maximum Likelihood with Missing Values (MLMV) estimation method was used in CFA and SEM analysis. The goodness-of-fit was measured using Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI). The RMSEA value  $<0.05$  and CFI and TLI  $>0.90$  denotes an adequate model fit (Kline 2010). The results are present using standard coefficients ( $\beta$ ), standard errors (SE) and p-values.

## Results

Of the 639 children assessed at baseline, a total of 449 (a 70.3% cohort retention rate) and 429 (a 67.1% cohort retention rate) were re-evaluated at 7 and 10-year follow-up, respectively. The reasons for losses in follow-ups included the inability to find the individual, move to another city, and refusal to participate in the follow-up data collection. There were no significant differences in sample characteristics between followed individuals and dropouts for characteristics such as sex ( $p=0.227$ ), household income ( $p=0.109$ ), social capital variables ( $p>0.05$ ), dental caries ( $p=0.737$ ), and OHRQoL ( $p=0.486$ ), nor between individuals evaluated at T3 before and during the COVID-19 pandemic ( $p>0.05$ ). Regarding the main outcomes of this study, the mean number of teeth with untreated dental caries was 0.9 (SE 0.1), and the mean overall CPQ11-14 scores were 11.1 (SE 0.6) at T3 (Table 1).

Supplementary table 1 presents the measurement model assessed using CFA, which included two latent variables. Table 2 shows the standardized coefficients between variables in the full and parsimonious SEM models. Both models presented good fit values.

Figure 1 displays the significant pathways of the parsimonious model. Greater community social capital at T1 directly predicted lower untreated dental caries ( $\beta = -0.12$ ) and better OHRQoL ( $\beta = -0.10$ ) after 10-years. Individual social capital at T1 was not associated with oral health outcomes over time. Social trust at T3 was directly linked to untreated dental caries at T3 ( $\beta = -0.13$ ). Higher levels of untreated dental caries (T3), greater frequency of dental visits in the last year (T3), lower frequency of toothbrushing (T3), and lower SOC (T3) directly predicted poor OHRQoL at T3.



Table 3 presents the total, direct and indirect effects between social capital variables, untreated dental caries and OHRQoL. High social capital at T1 indirectly predicted lower untreated dental caries via sense of coherence at T3, frequency of toothbrushing at T2 and T3, and use of dental services at T2 and T3 ( $\beta = -0.52$ ). Social capital variables at T1 had no significant indirect effects on OHRQoL at T3, only direct. Social trust ( $\beta = 0.85$ ) and social networks ( $\beta = -1.20$ ) at T3 indirectly predicted OHRQoL at T3 through the SOC.

## **Discussion**

This study explored the different pathways on the relationship of community and individual social capital with dental caries and OHRQoL from childhood to adolescence using a theoretical framework. Our findings partially confirmed the pre-established hypotheses. High community social capital at baseline was a relevant determinant of lower occurrence of untreated dental caries and better OHRQoL after 10 years. Moreover, different pathways on the influence of community social capital on lower occurrence of untreated dental caries were identified. The hypotheses of the direct and indirect effects of individual social capital at T1 on oral health conditions over time were not confirmed. However, individual social capital at T3 was indirectly associated with OHRQoL at T3 through the aspect of the psychosocial pathway reflected by SOC.

High levels of social capital at the community level in early childhood directly impacted on the lower occurrence of dental caries and in better OHRQoL after 10 years. In our study, social networks and social support at the community level were used as indicators to represent the latent variable of community social capital. The neighbourhood characteristics used to assess social capital in this study, including the number of workers, health service providers (Aida et al. 2008; Kowitt et al. 2015), and religious temples (Ferreira et al. 2021), can be considered valid measures since they have been associated with community social capital (Brunner and Marmot 2006; Solar and Irwin 2010; Rostila et al. 2011). Thus, a community with high social capital is composed of different formal institutions and active citizens, leading to a social environment characterized by higher levels of mutual trust and social cohesion (Brunner and Marmot 2006; Solar and Irwin 2010; Rouxel et al. 2015). A possible explanation for this finding is that communities with high levels of social capital are considered positive environments where healthy habits are disseminated and supported, and there is greater access to dental services. In addition, neighbourhood-level social capital can buffer the harmful effects of stress acting as a protective factor due to higher social support between residents (Kawachi

and Berkman 2000). Thus, community social factors can predict better oral health outcomes for residents, such as dental caries and OHRQoL.

The impact of community social capital on dental caries over time was also mediated by psychosocial (SOC), behavioural (frequency of toothbrushing), and use of dental services (frequency of use of dental services) pathways. Previous evidence supports the abovementioned relationships in dental research (Mathur et al. 2015; Kumar et al. 2016; Tomazoni et al. 2019; Ha et al. 2020). The behavioural pathway acknowledges that social capital can influence health behaviours through norms, informal social control, peer influence, and dissemination of knowledge (Kawachi and Berkman 2000; Rouxel et al 2015). Furthermore, high levels of social capital may promote the adoption of favourable oral health-related behaviors, such as a higher frequency of toothbrushing, which is considered to be a protective factor for dental caries (Kumar et al. 2016). The psychosocial pathway considers that high levels of social capital exert a protective influence on health by mitigating the stress consequences through enhancing the feelings of support, security, and belonging (Kawachi and Berkman 2000). Thus, social capital may positively impact on people's natural coping strategies and sense of coherence, that have also been related to the occurrence of dental caries (Tomazoni et al 2019). The use of dental services pathway can be supported because dwellers of communities with higher levels of social capital are more engaged and more successful in (Rouxel et al 2015), which has also been associated with dental caries (Hashim et al. 2006).

Individual social capital at baseline was not associated with oral health outcomes over time. This finding might be explained because the levels of individual social capital may shift over time, and variations also occur according to gender and personal experiences (Sisson 2007). Nevertheless, individual social capital at baseline was assessed through parents, which may not impact on their children's lives after a long period of time. In this context, social capital at the community level showed a greater impact on oral health over time than the individual-level social capital. Structural neighbourhood conditions, such as income, social capital, and social cohesion, are closely interconnected and less likely to change in the short term (McDonald and Mair; 2010). Thus, the present findings confirmed that structural aspects tend to have a cumulative impact on one's health from childhood to adolescence, regardless the exposure to individual risk factors.

Individual-level characteristics and oral health outcomes were indirectly associated when such relationship was assessed using concurrent measures notwithstanding. Our findings showed that individual social capital variables at follow-up were indirectly linked to dental OHRQoL through SOC (psychosocial pathway). SOC can be defined as a global orientation

that allows people to manage stress more effectively, identify their internal and external environments and find solutions for their health (Kowitt et al 2015). It has been suggested that SOC interacts with a person's natural coping style and social support. Thus, the extent of networks and social trust can influence the development of a strong or weak SOC (Gupta et al. 2015) mainly in adolescence. Previous evidence in dental research has been shown that individuals with high SOC have better OHRQoL (Baker et al. 2020), particularly in terms of how much a person is able to cope with poor health. Therefore, accordantly with our results, higher levels of social networks and social trust during adolescence can positively impact on OHRQoL through SOC.

This study has some limitations that should be acknowledged. First, the indicators of social capital used in this study may not fully represent the construct. However, the social capital indicators adopted in this study have been widely used and are considered valid measures according to previous studies (Paxton 1999; Aida et al. 2008; Rostila 2011). Second, some adolescents were evaluated in the follow-up before and others during the COVID-19 pandemic, which can introduce some response bias (Brondani et al. 2021). However, sensitivity analyzes showed that this concern might not affected our findings. Another findings limitation is the low Cronbach's alpha found for the latent variable of individual social capital. However, important aspects such as the standardized coefficient and the Kaiser-Meyer-Olkin (KMO) test demonstrated acceptable values for the maintenance of this factor (Kline 2011). Finally, few variables were chosen to represent the theoretical pathways between social capital and oral health. Thus, other psychosocial variables (such as fear/anxiety, oral health values, beliefs, attitudes) or behavioural factors (such as diet, smoking, alcohol use), that were out of the scope of this study that could act as indirect mediators in the above-mentioned relationship should be examined in future research. Furthermore, the pathway use of dental services was assessed by self-report from caregivers, which may be subject to information bias.

This is a long-term prospective cohort study with a cohort retention rate of 67.1% after 10 years, indicating the validity of our findings. Moreover, this study represents a longitudinal examination of the theoretical pathways between social factors and oral health outcomes during the transition from childhood to adolescence. This transition period is characterized by many changes and adaptative processes that can increase the susceptibility to risk factors which may remain throughout the life span.

Our findings showed that social capital at the community level had a strong and direct impact on dental caries and OHRQoL from childhood to adolescence. Individuals who lived in communities with high social capital at baseline presented lower levels of untreated dental

caries and better OHRQoL after 10 years. The impact of community social capital on dental caries over time was also mediated by psychosocial, behavioural, and use of dental services pathways. In addition, individual social capital indicators at follow-up indirectly influenced untreated dental caries and OHRQoL through the psychosocial pathway.

### **Findings implications for policy, practice, education and research**

Our findings provide evidence for the development and evaluation of oral health promotion actions focusing on distal factors with the aim to reduce the impact of social inequalities on oral health in children and adolescents. Therefore, interventions aiming to improve social networks and trust among individuals may improve their oral health. Furthermore, incentive for implementation of formal institutions in neighbourhoods may also be relevant for the oral health promotion of their residents. Interventions focusing on enhancing sense of coherence may also be relevant, since this seems a relevant psychosocial predictor and mediator of oral health during childhood and adolescence.

### **Study highlights**

- Social capital at the community level exerts a stronger impact on oral health outcomes from childhood to adolescence;
- The association between individual social capital and oral health outcomes was mediated especially through the psychosocial pathway.

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### **Declaration of competing interest**

The authors declare that they have no conflict of interest.

### **Authors contributions**

Ms Knorst designed the study, designed the data collection instruments, collected data, carried out the analyses, drafted and revised the manuscript. Ms Brondani designed the study, collected data and revised the manuscript. Dr Vettore and Dr Hesse conceptualized and designed the study and critically reviewed the manuscript. Dr Mendes and Dr Ardenghi conceptualized and

designed the study, coordinated and supervised data collection and critically reviewed the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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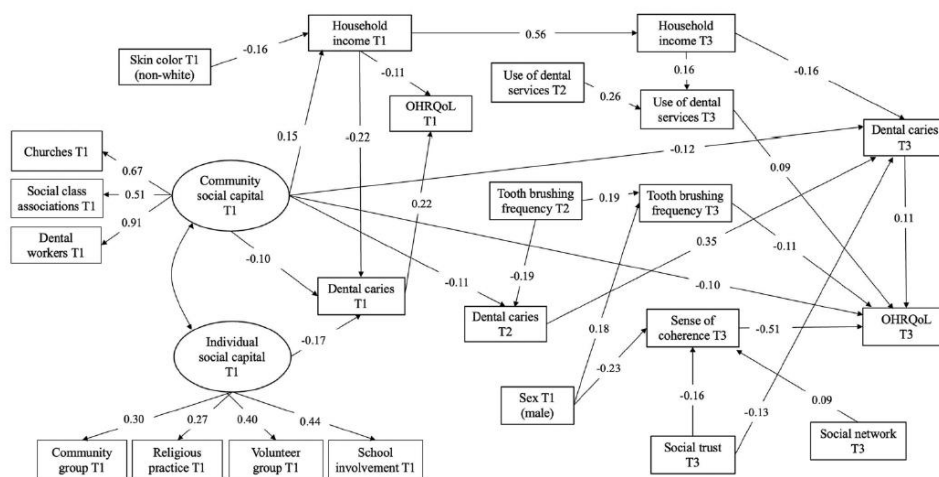


Figure 1. Significant pathways of the final structural model among social capital variables and oral health conditions over time



Table 1. Sociodemographic, psychosocial, behavioural characteristics, and oral health measures at baseline (T1) and at the follow-ups (T2 and T3) of the participants followed over the 10-year cohort.

Variables	Children followed over 10 years	
	N = 429*	p-value <sup>†</sup>
<b>Baseline - 2010 (T1)</b>		
<i>Sociodemographic variables</i>		
Sex [n (%)]		0.227
Girls	209 (49.8)	
Boys	220 (50.2)	
Skin colour [n (%)]		0.158
White	330 (74.3)	
Non-white	99 (25.7)	
Household income in R\$ [n (%)]		0.109
Quartile 1 Lowest	90 (17.2)	
Quartile 2	117 (34.4)	
Quartile 3	125 (30.9)	
Quartile 4 Highest	74 (17.6)	
<i>Individual social capital</i>		
Frequency of religious meeting attendance [n (%)]		0.161
At least once a month	248 (58.7)	
Less than once a month or never	181 (41.3)	
Member of volunteer group [n (%)]		0.626
Yes	74 (21.0)	
No	353 (79.0)	
Member of community group [n (%)]		0.104
Yes	72 (17.6)	
No	354 (82.4)	
School involvement [n (%)]		0.352
Yes	172 (40.6)	
No	252 (59.4)	
<i>Community social capital</i>		
Number of churches [mean (SE)]	2.9 (0.1)	0.195
Number of dental workers [mean (SE)]	11.6 (1.4)	0.709
Number of social class associations [mean (SE)]	0.7 (0.1)	0.338
<i>Psychosocial variable</i>		
OHRQoL [mean (SE)]	2.5 (0.3)	0.486
<i>Oral health variable</i>		
Dental caries [mean (SE)]	6.1 (0.4)	0.737
<b>Follow-up - 2017 (T2)</b>		
<i>Behavioral variables</i>		
Daily frequency of tooth brushing [mean (SE)]	2.1 (0.1)	0.473
Dental visits in the last year [mean (SE)]	0.5 (0.1)	0.491
<i>Oral health variable</i>		
Untreated dental caries [mean (SE)]	2.7 (0.2)	0.390
<b>Follow-up - 2020 (T3)</b>		
<i>Socioeconomic variable</i>		

Household income in R\$ [n (%)]		0.300
Quartile 1 Lowest	110 (29.2)	
Quartile 2	79 (23.4)	
Quartile 3	108 (25.4)	
Quartile 4 Highest	77 (21.9)	
<i>Individual social capital</i>		
Social network [n (%)]		0.279
Yes	126 (31.4)	
No	303 (68.6)	
Social trust [n (%)]		0.119
Yes	202 (48.7)	
No	223 (51.3)	
<i>Psychosocial and behavioral variables</i>		
Sense of coherence - SOC-13 [mean (SE)]	36.3 (0.6)	0.202
OHRQoL [mean (SE)]	11.1 (0.6)	0.821
Daily frequency of tooth brushing [mean (SE)]	2.3 (0.1)	0.001
Dental visits in the last year [mean (SE)]	1.2 (0.1)	0.574
<i>Oral health variable</i>		
Untreated dental caries [mean (SE)]	0.9 (0.1)	0.050

\*Taking into account the sampling weights; Values lower than 429 due to missing data [household income T1 (n=406 and T3 (n=374), member of volunteer group T1 (n=427), member of community group T1 (n=426), school involvement T1 (n=424) and social trust T3 (n=425)]. †p-value refers to the comparison between participants in the follow-up and dropouts, and between individuals evaluated before and during the COVID-19 pandemic; R\$, Brazilian Real (US\$1.00 is equivalent to R\$5.4 approximately); SE, standard error; OHRQoL, oral health-related quality of life.

Table 2. Standardized effects among the variables of social capital and oral health conditions in the initial and final structural model

Pathway to	Full model		Parsimonious model	
	$\beta$ (SE)	p-value	$\beta$ (SE)	p-value
<b>OHRQoL (T3)</b>				
Community social capital (T1)	-0.10 (0.04)	<0.05	-0.10 (0.04)	<b>&lt;0.05</b>
Individual social capital (T1)	0.06 (0.07)	0.309	0.06 (0.07)	0.309
OHRQoL (T1)	0.00 (0.04)	0.844	0.00 (0.04)	0.844
Skin colour (T1)	-0.04 (0.04)	0.231	-0.04 (0.04)	0.231
Dental visits in the last year (T2)	0.02 (0.04)	0.645	0.02 (0.04)	0.645
Frequency of tooth brushing (T2)	-0.02 (0.04)	0.596	-0.02 (0.04)	0.596
Household income (T3)	-0.09 (0.05)	0.071	-0.09 (0.05)	0.071
Social network (T3)	-0.01 (0.04)	0.679	-0.01 (0.04)	0.679
Social trust (T3)	-0.01 (0.04)	0.731	-0.01 (0.04)	0.731
Untreated dental caries (T3)	0.11 (0.04)	<0.01	0.11 (0.04)	<b>&lt;0.01</b>
Dental visits in the last year (T3)	0.09 (0.04)	<0.05	0.09 (0.04)	<b>&lt;0.05</b>
Frequency of tooth brushing (T3)	-0.11 (0.04)	<0.01	-0.11 (0.04)	<b>&lt;0.01</b>
Sense of coherence (T3)	-0.51 (0.03)	<0.01	-0.51 (0.03)	<b>&lt;0.01</b>
<b>Untreated dental caries (T3)</b>				
Community social capital (T1)	-0.12 (0.05)	<0.05	-0.12 (0.05)	<b>&lt;0.05</b>
Individual social capital (T1)	-0.10 (0.07)	0.163	-0.10 (0.07)	0.163
Untreated dental caries (T1)	0.04 (0.04)	0.285	0.04 (0.04)	0.285
Sex (T1)	-0.06 (0.04)	0.133	-0.06 (0.04)	0.133
Skin colour (T1)	-0.03 (0.04)	0.498	-	
Dental visits in the last year (T2)	-0.03 (0.04)	0.524	-0.03 (0.04)	0.524
Frequency of tooth brushing (T2)	-0.17 (0.04)	0.719	-0.17 (0.04)	0.719
Untreated dental caries (T2)	0.35 (0.04)	<0.01	0.35 (0.04)	<b>&lt;0.01</b>
Household income (T3)	-0.16 (0.05)	<0.01	-0.16 (0.05)	<b>&lt;0.01</b>
Social network (T3)	0.02 (0.04)	0.625	0.02 (0.04)	0.625
Social trust (T3)	-0.13 (0.04)	<0.05	-0.13 (0.04)	<b>&lt;0.05</b>
Dental visits in the last year (T3)	-0.02 (0.04)	0.533	-0.02 (0.04)	0.533
Frequency of toothbrushing (T3)	0.04 (0.04)	0.377	0.04 (0.04)	0.377
Sense of coherence (T3)	0.00 (0.04)	0.836	0.00 (0.04)	0.836
<b>Sense of coherence (T3)</b>				
Community social capital (T1)	-0.07 (0.05)	0.124	-0.07 (0.05)	0.129
Individual social capital (T1)	0.06 (0.06)	0.444	0.06 (0.04)	0.403
Sex (T1)	-0.23 (0.04)	<0.01	-0.23 (0.04)	<b>&lt;0.01</b>
Household income (T3)	0.06 (0.04)	0.214	0.06 (0.05)	0.192
Social network (T3)	0.09 (0.04)	<0.05	0.09 (0.04)	<b>&lt;0.05</b>
Social trust (T3)	-0.16 (0.04)	<0.01	-0.16 (0.04)	<b>&lt;0.01</b>
<b>Dental visits during the last year (T3)</b>				
Community social capital (T1)	0.06 (0.04)	0.169	0.09 (0.05)	0.07
Individual social capital (T1)	-0.09 (0.07)	0.245	-0.14 (0.07)	0.05
Sex (T1)	0.05 (0.04)	0.217	0.07 (0.04)	0.12
Dental visits during the last year (T2)	0.26 (0.04)	<0.01	0.26 (0.04)	<b>&lt;0.01</b>
Household income (T3)	0.14 (0.05)	<0.05	0.16 (0.05)	<b>&lt;0.05</b>
Social network (T3)	-0.03 (0.04)	0.489	-0.02 (0.04)	0.59
Social trust (T3)	-0.02 (0.04)	0.984	-	
<b>Frequency of toothbrushing (T3)</b>				
Community social capital (T1)	-0.03 (0.05)	0.557	-0.00 (0.05)	0.498

Individual social capital (T1)	0.10 (0.07)	0.157	0.06 (0.07)	0.224
Sex (T1)	0.17 (0.04)	<0.05	0.18 (0.04)	<0.05
Frequency of toothbrushing (T2)	0.19 (0.04)	<0.01	0.19 (0.04)	<0.01
Household income (T3)	0.08 (0.05)	0.125	0.10 (0.05)	<0.05
Social network (T3)	-0.03 (0.04)	0.880	-	
Social trust (T3)	0.01 (0.04)	0.413	-	
<b>Social network (T3)</b>				
Household income (T3)	0.04 (0.05)	0.361	-	
Sex (T1)	-0.02 (0.04)	0.595	-	
Individual social capital (T1)	0.03 (0.07)	0.632	0.01 (0.07)	0.951
<b>Social trust (T3)</b>				
Social network (T3)	-0.04 (0.04)	0.410	-	
Household income (T3)	-0.12 (0.05)	<0.05	-0.12 (0.05)	<0.01
Sex (T1)	0.06 (0.04)	0.159	0.06 (0.04)	0.156
Individual social capital (T1)	0.05 (0.07)	0.474	0.05 (0.07)	0.484
<b>Household income (T3)</b>				
Household income (T1)	0.57 (0.03)	<0.01	0.57 (0.03)	<0.01
<b>Dental visits during the last year (T2)</b>				
Community social capital (T1)	0.03 (0.05)	0.437	0.03 (0.05)	0.437
Individual social capital (T1)	-0.16 (0.08)	0.050	-0.16 (0.08)	0.050
Household income (T1)	0.12 (0.05)	<0.05	0.12 (0.05)	<0.05
Sex (T1)	0.13 (0.04)	<0.01	0.13 (0.04)	<0.01
<b>Frequency of toothbrushing (T2)</b>				
Community social capital (T1)	-0.00 (0.05)	0.851	-0.00 (0.05)	0.851
Individual social capital (T1)	0.01 (0.08)	0.983	0.01 (0.08)	0.983
Household income (T1)	0.08 (0.05)	0.133	0.08 (0.05)	0.133
Sex (T1)	0.05 (0.04)	0.239	0.05 (0.04)	0.239
<b>Untreated dental caries (T2)</b>				
Community social capital (T1)	-0.11 (0.05)	<0.05	-0.11 (0.05)	<0.05
Individual social capital (T1)	-0.01 (0.08)	0.904	-0.01 (0.08)	0.904
Household income (T1)	-0.12 (0.05)	<0.05	-0.12 (0.05)	<0.05
Untreated dental caries (T1)	0.01 (0.04)	0.803	0.01 (0.04)	0.803
Frequency of toothbrushing (T2)	-0.19 (0.04)	<0.01	-0.19 (0.04)	<0.01
<b>Household income (T1)</b>				
Skin colour (T1)	-0.16 (0.03)	<0.01	-0.16 (0.03)	<0.01
Community social capital (T1)	0.15 (0.04)	<0.01	0.15 (0.04)	<0.01
Individual social capital (T1)	-0.29 (0.06)	<0.01	-0.29 (0.06)	<0.01
<b>Untreated dental caries (T1)</b>				
Household income (T1)	-0.22 (0.04)	<0.01	-0.22 (0.04)	<0.01
Sex (T1)	-0.05 (0.03)	0.188	-	
Community social capital (T1)	-0.10 (0.04)	<0.05	-0.10 (0.07)	<0.05
Individual social capital (T1)	-0.17 (0.07)	<0.05	-0.17 (0.07)	<0.05
<b>OHRQoL (T1)</b>				
Household income (T1)	-0.11 (0.05)	<0.05	-0.11 (0.05)	<0.05
Untreated dental caries (T1)	0.22 (0.04)	<0.01	0.22 (0.04)	<0.01
Sex (T1)	-0.01 (0.04)	0.921	-	
Community social capital (T1)	-0.04 (0.05)	0.331	-0.04 (0.05)	0.331
Individual social capital (T1)	-0.12 (0.08)	0.123	-0.12 (0.08)	0.123
<b>Model Fit</b>				
RMSEA (90% CI)	0.02 (0.01-0.03)		0.02 (0.01-0.03)	

CFI	0.94	0.95
TLI	0.92	0.93

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T1, baseline; T2, follow-up 2017; T3, follow-up 2020;  $\beta$ , beta coefficient; SE, standard error; OHRQoL, oral health-related quality of life; RMSEA, Root Mean Square Error of Approximation; CI, Confidence interval; CFI, Comparative Fit Index; TLI, Tucker-Lewis Index.

Table 3. Standardized coefficients of the direct, indirect and total effects of the social capital variables on dental caries and OHRQoL at baseline and follow-ups

<b>Pathways from...</b>	<b>Direct effects</b>	<b>Indirect effects</b>	<b>Total effects</b>
Community social capital (T1) to untreated dental caries (T1)	-0.15*		-0.20*
Via household income (T1)		-0.05*	
Community social capital (T1) to untreated dental caries (T3)	-0.84*		-1.36*
Via frequency of toothbrushing (T2 and T3) -> Via use of dental services (T2 and T3) -> Via sense of coherence (T3)		-0.52*	
Individual social capital (T1) to untreated dental caries (T1)	-0.13		-0.08
Via household income (T1)		0.05	
From ISC (T1) to untreated dental caries (T3)	-0.38		-0.25
Via frequency of toothbrushing (T2 and T3) -> Via use of dental services (T2 and T3) -> Via sense of coherence (T3)		0.13	
Community social capital (T1) to OHRQoL (T1)	-0.62		-1.26
Via household income (T1) -> Untreated dental caries (T3)		-0.64*	
Community social capital (T1) to OHRQoL (T3)	-2.15*		-2.60*
Via frequency of toothbrushing (T2 and T3) -> Via use of dental services (T2 and T3) -> Via sense of coherence (T3)		-0.45	
Individual social capital (T1) to OHRQoL (T1)	-0.85		-0.78
Via household income (T1) -> Untreated dental caries (T3)		0.07	
Individual social capital (T1) to OHRQoL (T3)	0.14		0.41
Via sense of coherence (T3)		-0.55	
Social trust (T3) to untreated dental caries (T3)	-0.44*		-0.45*
Via sense of coherence (T3)		-0.01	
Social trust (T2) to OHRQoL (T3)	-0.18		0.66
Via sense of coherence (T3)		0.85*	
Social network (T3) to untreated dental caries (T3)	0.13		0.14
Via sense of coherence (T3)		0.01	
Social network (T3) to OHRQoL (T3)	-0.40		-1.60
Via sense of coherence (T3)		-1.20*	

T1, baseline; T2, follow-up 2017; T3, follow-up 2020; OHRQoL, oral health-related quality of life; \*p<0.05