

Original Research

Factors Associated with Dental Caries Prevalence Among Socially Vulnerable Children

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Abstract: The aim of this study was to evaluate the association between socioeconomic factors and the oral health status (OHS) of children in socially vulnerable situations assisted by a prominent nongovernmental organization in Fortaleza, Ceará state, Brazil. This is a cross-sectional observational study with a quantitative approach. One hundred children aged 5 to 6 years were included. Data collection took place in two stages in the first half of 2023: 1) parents or guardians answered a questionnaire, provided socioeconomic and demographic information, as well as details on access to dental care; 2) clinical oral examinations were performed on the children. Data were statistically analyzed using SPSS 27.0 software, and the following tests were applied: Kolmogorov-Smirnov, Pearson's chi-square, and Spearman's correlation, with a significance level at $p < 0.05$. Most children ($n = 71$, 71%) had dental caries. Only access to running water showed a statistically significant difference ($p = 0.005$) in relation to the level of dental pain. Correlations were tested through multiple linear regression analysis, revealing that the number of rooms in the home ($p = 0.023$) and family income ($p = 0.022$) were predictors of the DMFT index. Access to running water ($p = 0.001$) and the DMFT index ($p = 0.010$) were predictors of the level of pain. Children in situations of social vulnerability have a higher prevalence of dental caries associated with socioeconomic factors. It is essential that continuous strategies for promotion and prevention in oral public health be renewed to monitor children's development and growth.

Keywords: Child health; Oral health; Social Vulnerability.



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1. Introduction

Brazil has a long-standing history of social inequality and poverty, which has led to a significant number of people living in social vulnerability. These circumstances predispose to several diseases and other conditions hindering access to healthcare, especially in large cities, where primary healthcare coverage is still insufficient [1, 2]. The interplay between environmental, cultural, social and economic determinants and conditions, both individually and collectively, represents multiple categories of vulnerability. These factors can either support or undermine the balance in the health-disease process, affecting

the development and progression of early childhood caries (ECC), from birth to 6 years of age [3, 4].

ECC is an opportunistic, acute, and multifactorial disease that affects multiple primary teeth, often sparing only the lower incisors, which are anatomically positioned near the outlet of salivary gland ducts [5, 6]. The advanced stage of ECC is clinically characterized by the destruction of the tooth structure due to extensive demineralization of the enamel, dentin, and root cementum [7]. In addition to the problems observed in the oral cavity, ECC affects child growth and development by triggering poor nutrition, school absenteeism, and social phobia. Therefore, ECC has become a critical health concern in developing countries [8, 9].

Standardized assessment protocols have been in place since 1960 to enhance the validity and reliability data on dental caries (DC). Notwithstanding its limitations [10], the decayed, missing, and filled teeth (DMFT) index, measured in five-year-olds, is one of the most widely used indices [11]. In Brazil, this index stands at 2.43, with highest prevalence of the decayed component, and 27% for children aged 18 to 36 months have at least one caries-affected tooth in their primary dentition [12]. Changes have been proposed throughout the implementation of the Brazilian Public Health System (SUS), encompassing the organization and delivery of oral health services, particularly through the Brazilian National Policy for Oral Health (PNSB). It was introduced in 2004 with the aim of reducing DC rates, among other objectives [4, 13, 14]. More than 20 years later, with the recent inclusion of this social tool as a field of action under the Statutory Health Law [15], questions have arisen about the effectiveness of the efforts undertaken to improve the OHS of Brazilian children.

The study worked with the hypothesis that children in situations of social vulnerability have a higher prevalence of ECC due to socioeconomic factors such as low family income and education of those responsible. Accordingly, the present study examines the correlation between ECC and socioeconomic factors, which may contribute to the formulation of new strategies for individual and collective actions involving children and their caregivers [16].

The aim of this study is to assess the association between socioeconomic factors and OHS of socially vulnerable children from a leading nongovernmental organization in Fortaleza, state of Ceará, Brazil.

2. Method

This was an observational cross-sectional study with a quantitative approach. This study was conducted at the Institute of Early Childhood and Development (IPREDE), located in Fortaleza, state of Ceará, Brazil. This nongovernmental organization, founded in 1980, aims to prevent and fight malnutrition and provide treatment to improve the development of socially vulnerable children aged 0 to 6 years. In 2022, approximately 1,350 children were treated every month, one-third of whom benefit from semiannual collective oral interventions such as educational activities, supervised tooth brushing, and fluoride application, planned and conducted by dental students from the University of Fortaleza (UNIFOR) as part of their internship activities.

This study followed the ethical principles outlined in Resolution no. 466/12 and was approved by the Research Ethics Committee of Universidade de Fortaleza (CEP/UNIFOR), protocol no. 5.829.559. The legal guardians of the children included in the study signed an informed consent form (ICF). The sampling technique used was convenience sampling, in which those responsible for the children who agreed to participate in the study were included in this investigation. The sample included 100 male and female children aged 5 and 6 years treated at the institute at the time. Children diagnosed with autism spectrum disorder (ASD) were excluded from the analysis.

The Data were collected in the first half of 2023. Based on a list of participants attended at the institute, each legal guardian was invited directly and personally to participate. Data collection consisted of two stages: 1) questionnaire applied to legal guardians

to collect information on socioeconomic and demographic variables and access to dental care and 2) clinical oral examination of children. Calibration by the researchers occurred using images of teeth with caries lesions at different stages of progression. The SB Brasil 2020 Project was used because it is one of the references in epidemiology in Oral Health in the country. The questionnaire contained different sections: general information (gender, ethnicity and age); socioeconomic origin of the family; early childhood education; odontogram (total number of decayed teeth) and treatment needs.

The oral examination was performed in a room designated for dental treatment, and the oral cavity was observed directly under natural lighting for the identification of carious lesions and for decisions about the need for dental treatment. For the examination, both the examiner and the child sat facing each other and the legal guardian stood next to them. Disposable wooden spatulas and biosafety equipment were used, including latex gloves, disposable gowns, caps, mask, and goggles.

After the collection of this information, the variables were statistically analyzed using the Statistical Package for Social Science for Windows (SPSS) software, version 27.0. The Kolmogorov-Smirnov test was used to check the normality of quantitative variables. Socioeconomic variables were dichotomized according to their mean values for Pearson's chi-square test, which verified the distribution of the socioeconomic variables as to the presence or absence of dental caries and dental pain. Thereafter, Spearman's correlation test was employed to assess the association of socioeconomic factors with DMFT indices and level of dental pain. Significant correlations were included in the multiple linear regression to identify the predictive factors of the DMFT index and level of dental pain. The confidence interval used was 95%, and the level of statistical significance was calculated at $p < 0.05$.

Risks were minimized by placing the participants in separate rooms, thus preventing any discomfort. Moreover, playful approaches were utilized, respecting the cultural backgrounds of everyone. The study allowed gaining better knowledge of ECC prevalence, outlining future collective strategies for health prevention, promotion, and recovery at the investigated institution.

3. Results

One hundred children aged 5 and 6 years, accompanied by their respective legal guardians, participated in this study. Table 1 shows the distribution of children with and without dental caries according to the assessed socioeconomic factors, indicating that 71 (71%) had dental caries (DC). No statistically significant differences were found between children with or without DC regarding the number of household members ($p = 0.336$), number of rooms in the household ($p = 0.062$), number of actively employed individuals ($p = 0.330$), receipt of the "Bolsa Família" (Family Stipend) benefit ($p = 0.321$), or access to piped water ($p = 0.492$).

Table 1. Association between the presence of dental caries and socioeconomic and household variables in children from a vulnerable population. Fortaleza, Brazil, 2024.

	Dental caries		X ²	p*
	Yes (n = 71)	No (n = 29)		
Household members				
≤5	53 (73.6%) ^a	19 (26.4%) ^a	0.851	0.336
>5	18 (64.3%) ^a	10 (35.7%) ^a		
Number of rooms				
≤2	64 (74.4%) ^a	22 (25.6%) ^a	3.487	0.062
>2	7 (50%) ^a	7 (50%) ^a		

Actively employed individuals				
≤4	34 (66.7%) ^a	17 (33.3%) ^a	0.949	0.330
>4	37 (75.5%) ^a	12 (24.5%) ^a		
"Bolsa família"				
Yes	55 (68.8%) ^a	25 (31.3%) ^a	0.983	0.321
No	16 (80%) ^a	4 (20%) ^a		
Piped water				
Yes	66 (70.2%) ^a	28 (29.8%) ^a	0.472	0.492
No	5 (83.3%) ^a	1 (16.7%) ^a		

*Pearson's chi-square test (p<0.005).

Table 2 shows the distribution of children with and without dental pain, highlighting that most children (n = 68, 68%) do not feel pain. No statistically significant differences were observed in the distribution of children with or without dental pain regarding the number of residents in the household (p = 0.330), number of rooms in the household (p = 0.361), number of employed workers (p = 0.571) or receipt of the Bolsa Família benefit (p = 0.830). Only access to running water showed a statistically significant difference (p = 0.005), with 71.3% of the sample not having dental pain.

Table 2. Association between the presence of dental pain and socioeconomic and household variables in children from a vulnerable population. Fortaleza, Brazil, 2024.

	Dental pain		X ²	p*
	Yes (n = 32)	No (n = 68)		
Household members				
≤5	21 (29.2%) ^a	51 (70.8%) ^a	0.949	0.330
>5	11 (39.3%) ^a	17 (60%) ^a		
Number of rooms				
≤2	29 (33.7%) ^a	57 (66.3%) ^a	0.836	0.361
>2	3 (21.4%) ^a	11 (78.6%) ^a		
Actively employed individuals				
≤4	15 (29.4%) ^a	36 (70.6%) ^a	0.320	0.571
>4	17 (34.7%) ^a	32 (65.3%) ^a		
“Bolsa família”				
Yes	26 (35.5%) ^a	54 (67.5%) ^a	0.046	0.830
No	6 (30%) ^a	14 (70%) ^a		
Piped water				
Yes	27 (28.7%) ^a	67 (71.3%) ^b	7.730	0.005*
No	5 (83.3%) ^a	1 (16.7%) ^b		

*Pearson's chi-square test (p<0.005)

The correlation matrix (Table 3) shows that the number of rooms in the household (p = 0.002; r=-0.310) and income in Brazilian reais (p = 0.001; r=-0.317) had an inversely proportional correlation with the DMFT index. In other words, the fewer rooms in the household or the lower the household income, the higher the DMFT index. An inversely proportional correlation was noted for the level of dental pain and access to piped water (p =

0.002; $r = -0.310$). In other words, the lesser the access to piped water, the higher the levels of dental pain, whereas the DMFT index ($p < 0.001$; $r = 0.412$) had a directly proportional correlation, indicating that the higher the index, the higher the level of dental pain. Significant correlations were tested using multiple linear regression, which showed that the number of rooms in the household ($p = 0.023$) and income in Brazilian reais ($p = 0.022$) are predictors of the DMFT index. Access to piped water ($p = 0.001$) and the DMFT index ($p = 0.010$) were predictive factors for the level of dental pain.

Table 3. Matrix of socioeconomic factors showing the DMFT index and the level of dental pain of the assessed children. Fortaleza, Brazil, 2024.

	DMFT		Level of dental pain	
	p	r	p	r
Household members	0.430	-0.080	0.245	0.117
Rooms	0.002*	-0.310	0.924	-0.010
Household goods	0.464	0.74	0.731	0.035
Piped water	0.125	-0.154	0.002*	-0.310
"Bolsa família"	0.480	-0.071	0.816	0.024
Income in reais	0.001*	-0.317	0.870	-0.017
DMFT	-	-	<0.001*	0.412
Mother's years of schooling	0.812	-0.024	0.656	-0.045
Literate child	0.951	-0.006	0.282	0.109
Child attending school	0.226	0.122	0.435	0.079

*Spearman's correlation test ($p < 0.05$).

4. Discussion

The present study examined the correlation between the prevalence of ECC and sociodemographic factors in a socially vulnerable population from Fortaleza, in the state of Ceará, Brazil. It was observed that DC is still a concern in this population, given that most of the participants (72%) had carious lesions, indicating that this condition is still a preoccupation in some regions and has become a public health problem. These data corroborate the study by Araujo, Pinheiro and Vilar [20], in which the authors observed that children in a condition of social vulnerability in the municipality of Crato, state of Ceará, presented a high prevalence of dental caries in 92.31% of their sample of 52 participants.

Similar results were reported in the study by Diniz et al. [4], extended in the same location with a sample of 363 participants. The investigation highlighted a high prevalence of caries in children (126; 35.6%), in addition to a significant proportion of individuals who had never been to a dentist (295; 81.3%) and who had never reported dental pain (299; 82). Interventions are needed for better planning of prevention strategies that consider the social, demographic, and epidemiological profiles of the population [4].

Painful symptoms were present in only 32 (32%) children. Nevertheless, ECC progression is still a serious problem. Lack of proper treatment leads to disease progression and eventually causes pain, affecting the normal function of the stomatognathic system (e.g., chewing), thereby contributing to malnutrition, poorer school performance, and problems with social interactions [16]. Primary dentition is extremely important because of its role in speech, swallowing, chewing, and aesthetics. Moreover, primary dentition preserves space for the permanent teeth. Therefore, primary teeth prevent tooth movements, preserve the perimeter of the dental arch, and reduce the likelihood of malocclusion [17].

The present study also demonstrated that socioeconomic factors could affect OHS in early childhood because the 55 children (68.8%) who had carious lesions were beneficiaries of welfare programs such as “Bolsa Família” which are only available to low-income families. Hence, social and economic factors, owing to the lack of information about healthcare, can be a hindrance to oral health assistance and education for this population [18]. Socioeconomic inequality has a direct impact on oral health during early childhood, and the northern and northeastern Brazilian regions, which are economically underprivileged, are the most widely affected, as evidenced by the latest epidemiological survey conducted by SB-Brazil 2010. In this study, the decayed component of the DMFT index in 5-year-olds was higher in the northeastern (2.55) and northern (3.04) regions, surpassing the national average (1.95) [14, 18].

In line with that, an inherent relationship exists between children from low-income families and worse oral health-related quality of life. This scenario can be explained by the fact that their families belong to lower social classes, which often do not have access to information that could improve healthcare, consequently leading to worse outcomes in terms of well-being and oral health. In addition, there is a persistent correlation between oral health and socioeconomic factors within the family environment. Thus, parents’ social, economic, and cultural backgrounds have a significant impact on their children’s oral health. Although this study considered maternal education in the analysis, no statistically significant associations with dental caries or pain were found. However, it was noted that education is a factor that can influence both knowledge about oral hygiene and access to health services, possibly affecting DMFT and pain levels [19].

Furthermore, children from lower social classes can have limited access to dental care, including the public healthcare system, which is often overcrowded and has huge waiting lists. This could have negative consequences for children, such as social exclusion, low self-esteem, and poorer school performance [20]. The close relationship between parents’ education and their children’s oral health, showing that the higher the level of parental education, the lower the total score on the early childhood oral health impact scale (ECOHIS), which means that children would have fewer oral health problems [21].

The findings of the present study for the DMFT index and children’s school performance and illiteracy are significant, clearly evidencing the connection between oral health and schooling. This connection is complex because of the various factors associated with poor schooling, such as unawareness about the importance of oral healthcare, limited access to healthcare, and delayed diagnosis of oral diseases, thereby worsening dental problems in this population. Moreover, some individuals with both poorer schooling and literacy could encounter linguistic barriers when interacting with healthcare providers, underscoring the need for these professionals to overcome such barriers and adopt a simplified approach and dialogue in order to provide individuals with autonomy and empowerment so that they can deal with their health condition [21, 22].

In the social and educational contexts, it is important to consider the correlation between oral health and variables such as income, schooling, and number of children. This correlation stems from the heterogeneous nature of oral health in Brazil, which is marked by differences between social groups and regions. As a result, the risks of severe dental conditions are greater in socially vulnerable populations [23, 24]. It has also been evidenced that children’s primary caregivers, for the most part, have not finished elementary education. Therefore, socioeconomically underprivileged children with DC and whose parents perceived their OHS as regular/poor had a higher incidence of tooth surfaces with untreated DC. This factor is also related to parents’ lack of commitment to routine dental visits at appropriate intervals.²⁵ In the present study, this was shown by the fact that 55% of 71 children with carious lesions had access to welfare programs such as “Bolsa Família,” i.e., they were from low-income families.

To mitigate oral health problems, the Brazilian National Policy for Oral Health (PNSB), popularly known as “Brasil Sorridente”, was implemented in 2004, and it is currently a benchmark for health recovery and disease prevention. In early childhood, the

aim of the program is to stop the progression of DC and prevent its associated complications. Therefore, PNSB focuses on monitoring the OHS of the Brazilian population to steer services and actions in the field. Nonetheless, between 2003 and 2010, the program had little influence and failed to significantly change oral health indicators [26, 27].

ECC can result in school dropout¹⁷ because it is related to caries activity in childhood and during the emergence of permanent dentition, affecting the children's and their families' quality of life. Immediate and long-term consequences may ensue, such as impaired learning and school dropout. In addition, DC can predispose to negative social behavior, and the affected children often become susceptible to bullying by their peers [28]. Therefore, healthcare attention helps prevent oral health problems, safeguarding the oral health of children younger than 3 years, reducing the prevalence of DC both during early childhood and beyond. Offering guidance to mothers during pregnancy to encourage healthy habits is crucial. In addition, multidisciplinary efforts are indispensable, using socioeducational strategies collectively to enhance the engagement of children and their caregivers, leading to more effective health prevention and maintenance [20].

Schools that implement health promotion strategies have lower prevalence of DC and dental trauma and they are consequently associated with better OHS. It is therefore extremely important that family members serve as role models and help their children develop good oral hygiene habits, thus promoting and maintaining their children's health, mainly in early years, given that children in the age range of 0 to 3 years rely heavily on their caregivers for the establishment of oral hygiene habits [29]. Furthermore, family members play a key role regarding sugar intake habits, a triggering factor for DC. It may be inferred that family members play a pivotal role in shaping their children's dietary preferences, thus influencing the development of dental complications [30, 31].

A limitation of this study is that the epidemiological survey was conducted in a single institution that provides healthcare to children in early childhood. Nevertheless, this is one of the largest institutions in the state of Ceará that treats this population, and the profile of the participants is representative of diverse areas within the municipality of origin.

5. Conclusion

The children evaluated in this study had a higher prevalence of IPC in vulnerable conditions, which may be associated with socioeconomic factors, such as education and income, especially in regions of high vulnerability. Furthermore, the level of pain was influenced by the lack of access to running water and the DMFT index, with a direct impact on SSB. Therefore, it is crucial to promote long-term public strategies for health promotion and prevention, starting with prenatal dental care, helping caregivers instill appropriate care habits, and continuing through school support, to support the full development and growth of children. Furthermore, there is an urgent need to carry out potential future research to suggest an intrinsic relationship between socioeconomic factors and oral health in early childhood.

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