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Association of socioeconomic and educational indicators with dental caries among 12-year-old students living in a capital city in southern Brazil

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ABSTRACT

OBJECTIVE: The objectives of this study were to determine the prevalence of dental caries in a population of 12-year-old schoolchildren in the city of Curitiba and to evaluate the association between dental caries and socioeconomic and educational variables.

METHODS: Data were obtained from a socioeconomic and educational questionnaire assessment and a clinical examination to determine the index of decayed, missing, and filled teeth (DMF-T). A total of 451 children were examined, and the data obtained were analyzed using SPSS 14.0 and Stata programs.

RESULTS: The prevalence of caries was 22.2%, with a mean DMF-T of 0.37 (±0.90). Schoolchildren in public schools showed a higher mean DMF-T (0.39±0.93) and were 3.98 times more likely to develop caries compared to students from private schools. With regard to socioeconomic factors, the prevalence of dental caries in children in class C was 3.51 times greater than that in children in class A, i.e., 251% greater. There was also an association between low maternal education and an increase in the prevalence of dental caries in children.

CONCLUSION: In this study, dental caries is directly associated with low socioeconomic and cultural indicators of children's families.

Keywords: epidemiology; oral health; pediatric dentistry.

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Associação de indicadores socioeconômicos e educacionais com cárie dentária em estudantes de 12 anos de idade em uma capital do sul do Brasil

RESUMO

OBJETIVO: Os objetivos deste estudo foram determinar a prevalência de cárie dentária em uma população de escolares de 12 anos de idade residentes na cidade de Curitiba e avaliar a associação entre esta doença e variáveis socioeconômicas e culturais.

METODOLOGIA: Os dados foram obtidos de um questionário socioeconômico e educacional e também por meio de um exame clínico que determinou o índice de dentes cariados, perdidos ou restaurados (CPO-D). Foram examinadas 451 crianças e os dados obtidos foram analisados usando os programas SPSS 14.0 e STATA.

RESULTADOS: A prevalência de cárie dentária foi de 22,2%, com média de CPO-D de 0,37 (±0,90). O CPO-D de crianças de escolas públicas foi maior (0,39±0,93) do que o CPO-D de crianças de escolas privadas. A chance de crianças de escolas públicas desenvolver cáries é 3,98 vezes maior do que crianças de escolas privadas. No que diz respeito aos fatores socioeconômicos, a prevalência de cárie dentária nas crianças da classe C foi 3,51 vezes maior do que em crianças da classe A, isto é, 251% maior. Também houve associação entre baixa alfabetização maternal e aumento da prevalência de cárie dentária nas crianças.

CONCLUSÃO: Neste estudo, a cárie dentária está diretamente associada com baixos indicadores socioeconômicos e culturais das famílias das crianças.

Palavras-chave: epidemiologia; saúde bucal; odontopediatria.

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INTRODUCTION

Dental caries is a multifactorial disease and has a high prevalence in children and adolescents. Acidogenic buccal microbiota and consumption of fermentable carbohydrates are among the determinants that contribute to the development of the disease [1, 2]. However, modifying factors such as geographical location and socioeconomic and cultural conditions of an individual or family contributes decisively to the occurrence and progression of the disease in the population [3, 4, 5]. The idea that the socioeconomic conditions of an individual and his or her family are directly related to worsening of oral health is not new once poor financial conditions expose the family to risk factors such as consumption of cheaper and cariogenic foods and inability to acquire toothbrushes and dentifrices. In addition, these constraints make it difficult to access dental treatments [6]. In addition to the social factors, there seems to be a direct association between the school category in which the child studies and its geographic location and the increased prevalence of decayed, lost or restored teeth [4, 5, 7].

With the aim of improving oral health and reducing dental caries, the World Health Organization (WHO) Oral Health Program proposed that studies or epidemiological surveys be carried out every 5 to 10 years to measure the prevalence of dental caries. Such surveys are indispensable about planning and implementation of collective and individual preventive and assistance actions at the municipal, state, and federal levels [8]. From the data collected in the survey, health actions can be planned and executed. In addition, comparisons of prevalences across different time periods and geographical areas can be made [9].

In Brazil, the National Oral Health Survey revealed a decrease in the number of decayed teeth in the 12-year-old population due to the implementation of health actions directed at the population [7, 10]. Despite the decline in the prevalence of the disease, there are groups of children with high index of decayed teeth. Curiously, these groups reside in areas of greater social and economic vulnerability [5, 11, 12]. In Curitiba, previous epidemiological studies that evaluated the oral conditions of school-aged children revealed that the prevalence of decayed teeth was 48.7%, [13] but there is little information available regarding the oral health status of 12-year-old schoolchildren living in different neighborhoods of the city of Curitiba. There are also gaps in knowledge about the prevalence and incidence of dental caries in children attending public and private schools in the city.

Thus, the objectives of this study were to determine, through a cross-sectional epidemiological study, the prevalence of dental caries in the population of 12-year-old children attending private and public schools in the city of Curitiba and to evaluate the association between dental caries and the socioeconomic variables of the families.

METHODS

Ethical aspects

We included in the sample all children aged 12 years who were duly enrolled in the schools, were residents in the city of Curitiba, and whose parents or guardians signed the informed consent form (TCLE), which was previously approved by the Research Ethics Committee of Universidade Positivo (Protocol 1,184,196).

Study Design

This was a cross-sectional study using a representative sample of 12-year-old schoolchildren living in the city of Curitiba, Paraná, Brazil. The city of Curitiba has 9 health districts in its administrative division, and it has a total population of 126 077 schoolchildren aged 10 to 14 years [14]. To represent the entire population of schoolchildren in this age group, schools were randomly drawn considering the proportion of 12-year-old schoolchildren attending public and private schools in the 9 health districts. After the lottery, invitation letters were sent to schools. If the school accepted the invitation, it was enrolled in the study.

The sample size was calculated considering a level of significance of 95%, an admissible error of 5%, and a dental caries prevalence of 50% in this population. This yielded a total 383 children. This was increased by approximately 20% to minimize losses, so the final sample size was 450 12-year-old schoolchildren. At the time of the examination, non-collaborating children and children with orthodontic or orthopedic braces or without prior authorization of the person in charge were excluded from the survey.

Data collection

Data collection included a socioeconomic questionnaire sent to the parents and/or guardians along with the informed consent form. The questions included were about the socioeconomic and educational variables of interest: family income, number of residents in the household, parental education, type of dwelling, number of rooms in the house, and objects present at home, as well as questions about the parents' perception of their child's oral health. After the receipt of parental/guardian authorization and the questionnaire, the schools were visited for oral examinations.

For the evaluation of dental caries, the index for decayed, missing, filled teeth in permanent teeth (DMF-T) was used according to World Health Organization criteria [15]. Four scorer-assisted examiners were pre-calibrated through a previous study that included discussion of evaluation criteria and clinical examinations. Calibration was confirmed by means of reviews in approximately 10% of the sample, and the Kappa index revealed an inter- and intra-examiner concordance greater than 0.80.

Statistical analysis

The DMF-T index was used as the dependent variable. Independent variables were the category of school, gender,

parental schooling, number of residents in the house, type of dwelling, rooms in the house, and economic classification.

The data were tabulated, and statistical analyses were performed using the programs SPSS 14.0 (Statistical Package for the Social Sciences for Windows®, SPSS Inc., Chicago, IL, US) and Stata (Stata Corporation, College Station, Tex., US). Descriptive analyses, associations and mean DMF-T of independent variables were performed using the chi-square test and the prevalence ratio (PR) with a significance level of $p \leq 0.05$. The associations were tested with respect to the dichotomized DMF-T frequencies: DMF-T=0 and DMF-T>1.

RESULTS

Approximately 1154 invitations and informed consent forms were distributed, and the rate of response was 47.83%; thus, 501 students were willing to participate in clinical exams. However, 51 did not meet the inclusion criteria and were excluded. The number of participants obtained was still representative of the population of all health districts in the city of Curitiba. Of the total number of participating schoolchildren, 92.4% were from public schools and 7.6% from private schools; 53.8% were male (n=242) and 46.2% were female (n=208). The prevalence of caries in the school-age population was 22.2%, and the mean DMF-T index was 0.37 (±0.90), with a predominance of the restored component (72%).

Table 1 presents the mean of dental caries in permanent dentition according to socioeconomic, educational, and context variables. The students in public schools had a higher mean DMF-T index (0.39±0.93) than those in private schools (0.03±0.17). In addition, the variables low maternal education, low family income, greater number of residents in the house, type of housing, and sanitary district were associated with a greater prevalence of dental caries in the population of 12-year-old children.

Table 1. Relationship between the average DMF-T index and the analyzed variables.

		Mean DMF-T	Min-Max	p value
Type of School	Private	0.03	0-01	0.01
	Public	0.39	0-05	
Gender	Female	0.32	0-03	0.421
	Male	0.40	0-05	
House residents	Up to 4	0.37	0-05	0.683
	5 to 10 residents	042	0-04	
Maternal education	Up to 8 years	0.40	0-05	0.307
	> to 8 years	0.17	0-02	
Paternal education	Up to 8 years	0.37	0-05	0.418
	> to 8 years	0.23	0-02	
Type of home	Own	0.40	0-05	0.943
	Leased	0.36	0-04	
	Assigned	0.38	0-05	
Rooms in the house	Above 5 rooms	0.40	0-05	0.579
	Up to 4 rooms	0.27	0-03	
Ranking Brazilian Economic	A	0.03	0-01	0.079
	B	0.34	0-04	
	C	0.37	0-05	
Sanitary district	Matriz	0.04	0-01	0.120
	Boa vista	0.47	0-04	
	Portão	0.15	0-01	
	Santa felicidade	0.61	0-05	
	Bairro Novo	0.23	0-02	
	Pinheirinho	0.16	0-03	
	Boqueirão	0.45	0-03	
	CIC	0.34	0-03	
	Cajuru	0.31	0-05	

** Mann-Whitney and Kruskal-Wallis Test. Level of significance of 0.05.

Table 2. Non-adjusted DMF-T association with independent variables, chi-square test, significance level p≤0.05.

		DMF-T (n%)			Prevalence Ratio (95% CI)	p value
		Caries ≥ 1	Caries = 0	Total		
Type of School	Private	83 (20)	333(8)	416	3.98 (0.9-16.9)	0.044
	Public	2 (5.9)	32 (94.1)	34	1 (1)	
Gender	Female	37 (17.8)	171 (82.2)	208	1 (1)	0.580
	Male	48 (19.8)	194 (80.2)	242	1.14 (0.7-1.8)	
House residents	Up to 4	22 (21.6)	81 (78.4)	102	1.04 (0.5-1.8)	0.870
	5 a 10 residents	44 (20.6)	170 (79.4)	214	1 (1)	
Maternal education	Up to 8 years	36 (16.3)	206 (79.2)	260	1.34 (0.5-3.1)	0.496
	> to 8 years	7(16.3)	36 (83.7)	61	1 (1)	
Paternal education	Up to 8 years	53 (20.9)	201 (79.1)	254	1.45 (0.4-4.3)	0.509
	> to 8 years	4 (15.4)	22 (84.6)	26	1 (1)	
Type of home	Own	8 (19)	34 (81)	42	0.89 (0.3-2.0)	0.966
	Leased	18 (20.7)	69 (79.3)	87	0.98 (0.5-1.2)	
	Assigned	39 (20.9)	140 (79.1)	187	1 (1)	
Rooms in the house	Above 5 rooms	14 (20.3)	55 (79.7)	69	0.97 (0.5-1.8)	0.946
	Up to 4 rooms	50 (20.7)	192 (79.3)	242	1 (1)	
Ranking Brazilian Economic	A	62 (20.1)	247 (79.9)	309	3.51 (0.8-15.1)	0.201
	B	21 (18.9)	90 (81.1)	111	3.26 (0.7-14.8)	
	C	2 (6.7)	28 (93.3)	30	1 (1)	

Table 2 shows the unadjusted analysis of the association between socioeconomic and educational factors on one hand and the DMF-T index on the other. Only the school category variable was associated with the caries index (P=0.044). With respect to the school category, schoolchildren in public schools were 3.98 times more likely to develop dental caries (RP 3.98, 0.93-16.97). In relation to the economic classification the majority of the population evaluated belonged to class C, and they were 3.51 times more likely to develop dental caries (PR 3.51, 0.81-15.15) when compared to class A (PR 3.26; 0.72-14.80). The value of PR=1 was the reference variable in relation to the development of dental caries.

DISCUSSION

This cross-sectional population study evaluated the association between dental caries and socioeconomic and educational factors in 12-year-old children in a capital city of southern Brazil, and it confirmed an association between the category of schools in which the child studies and maternal and family income on one hand and the risk of developing dental caries in children on the other hand.

Although the epidemiological picture of Brazil with respect to oral health is still unfavorable and some indicators revealed by the latest national survey of oral health show that the country needs health promotion actions directed to certain populations. In Curitiba, the prevalence of dental caries has decreased significantly. This value was 1.53 in 2010 [7], which was already below the national average (2.07). Surprisingly, now it is far below that observed previously for the population in the same age group (DMF-T=0.37; 95% CI, 0.28-0.45).

This improvement is thought to be due to the adequacy of the adopted public health policies, both by the municipal government and by the state and federal governments, which guarantee investment in basic health care [16]. It is also due to the great financial incentive given by the federal government from the year 2000 to include teams from the Family Health Program (PSF). This changed the perspective of the basic care model, and allowed the population to have access to dental services [17]. This improvement was made possible because the O component of the DMF-T index, that is, restored teeth, was 3.6 times larger than the number of decayed teeth and 12.3 times larger than the number of teeth. However, there is still a significant difference in DMF-T between children in public and private schools (0.39±0.93 and 0.03±0.17, respectively). In this sense, at the municipal level, the adoption of the model proposed by Martins et al. [18] that considers the management and provision dimensions could be used to identify the vulnerabilities and direct the actions of the managers.

The considerable fall in the DMF-T index observed in this research can also be explained by intersectoral practices of education and prevention that have been developed for some years by oral health teams. These practices have produced positive effects, and they are influencing the improvement of the oral health of the population. Several of these actions were developed in a school environment, such as the development of healthy canteens that caused important dietary changes in

children and adolescents [6, 19, 20]. In addition, an important factor that should be considered is that the addition of play activities focused on prevention, education, and hygiene in the school environment are extremely beneficial; when they are incorporated collectively for children, they help the child to change behavior at this stage of life, making the process of education in oral health favorable [21, 22, 23].

The age group of 12 years is considered ideal by the WHO for the global monitoring of oral health because children show permanent dentition by this age, and it facilitates the capture of the sample. It is used for comparisons within the same country or between countries, and it is therefore an important indicator for monitoring the increase or decrease of dental caries [24]. At this stage of life, the child, almost an adolescent, still depends on the information and care provided by his family, especially his or her mother. In this sense, maternal schooling seems to be associated with the general health of children, including oral health [11, 12, 13, 25]. This was confirmed in this study since children whose mothers had less than eight years of schooling had a 1.34 higher prevalence of dental caries compared to children whose mothers studied for more than eight years (P=0.496); this was also shown by the average DMF-T of 0.40 in children whose mothers had less study time compared to 0.26 in children whose mothers had higher literacy.

With regard to the family income, studies indicate that there is an association between the development of oral diseases and low family income [5, 26]. It is thought that the decrease in family income causes financial resources to be directed to needs other than dental needs. In the population analyzed in this study, it was found that children belonging to class C, according to the Brazilian economic classification, had a 3.51 (95% CI, 0.81-15.15) higher chance of having a decayed tooth compared to children in classes A and B. Thus, low income is a vulnerability factor for the development of oral problems. This outcome was also found in a study conducted in the United States, where a multivariate analysis showed a relationship between social factors, such as low family income, maternal education, and ethnicity with children's oral health, indicating that the lower the socioeconomic power, the less the family makes use of dental services, hence increasing the susceptibility to poor oral health [27].

Diseases that affect large portions of the population are a reflection of the organization of population groups [28]. With regard to tooth decay, it is not different. The results show that boys have a higher risk of developing dental caries than girls (P=0.580). In this sense, it seems that the perception of self-care is higher in girls, who seek dental treatment more frequently, and not only when there is pain or discomfort [8, 29]. This can also be attributed to the model of the society structure in which boys, following the examples of parents or men of the family, care little about their own health. Folayan et al. [30] have shown that males generally neglect oral hygiene.

Oliveira et al. [11] showed that, in the city of Goiânia, the chance of developing dental caries is higher in children who study in public schools than in private schools. This situation was also observed in this study; children attending public schools had a greater chance of developing dental caries (RP: 3.98, 0.93-16.97).

Finally, this cross-sectional research study in a 12-year-old school population suggests that the schools and municipal dental care network are fulfilling their role in oral health education, and they are providing to citizens access to services when necessary. Therefore, we believed that full and permanent support or the schools by implementation of educational activities through the public network can reduce the inequities in relation to oral health. However, it is also essential that the family nucleus, especially mothers, receive more information about dental care so as to develop autonomy in ensuring self-care for their children.

CONCLUSION

Within the limitations of this research, we conclude that there has been an improvement in oral health indicators because the prevalence of dental caries in the population of 12-year-old schoolchildren in the city of Curitiba has decreased significantly. However, there seems to be a direct relationship between dental caries, although low, with the category of school in which the child studies and maternal schooling.

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