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Original Article

Socioeconomic, Familiar and Clinical Variables associated to Caries increment in Schoolchildren Participating in a Dental Health Program

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Abstract

Objective: To evaluate socioeconomic, familiar and clinical risk variables associated to caries increment in the children's permanent dentition from seven to 10 years participating in a dental health program. **Material and Methods:** A sample of 301 children from nine public schools participated in the 'Always Smiling Program' took part in this study. They were evaluated for dental caries through dmft and DMF-T indexes along 2 years, and their parents completed a socio-environmental questionnaire containing questions on their income, education and family environment. Survival analysis using Kaplan-Meier method was used to evaluate the effect of the independent variables on caries increment. **Results:** We verified that socio-environmental variables were not associated with caries increment, while children with experience in primary dentition were 1.5 times more likely to develop caries in permanent dentition compared to those who did not have this experience. **Conclusion:** Schoolchildren presenting dental caries in primary dentition on baseline had higher risk of developing caries in permanent dentition and this variable should be taken in consideration by managers of dental health programs when prioritizing groups with higher care needs.

Keywords: Dental Caries; Risk Assessment; Survival Analysis.

Introduction

Although several studies have demonstrated a decrease in prevalence and severity of dental caries not only in Brazil but worldwide, it is still a major public health problem, affecting mainly low socioeconomic populations [1,2].

Dental caries is a multifactorial disease, determined and shaped by socioeconomic, cultural and behavioral factors, and affects the quality of life of children and adolescents in functional, social and emotional aspects [3-8]. Thus, the social condition of the children and their family, ethnicity, family income, education level of parents, overcrowded housing and difficult to access health services may predispose this population to a greater risk of developing caries [4,9-11].

Among the clinical variables, previous caries experience is considered an important risk predictor for the future development of the disease [12-14] and, thus, it should be included in models that assess risk factors for caries in children.

Although some studies investigated the impact of environmental and clinical variables in caries increment in children, the age of the subjects usually selected was considered by the World Health Organization as indices ages for conducting epidemiological surveys, that is, five and 12 years [14-16]. However, some researchers used children between six to seven years in order to evaluate these characteristics [17-19]. However, few studies evaluated the impact of socio-demographic and family variables on caries increment in children in the age of caries from seven to 10 years.

Thus, the aim of this study was to identify socio-demographic, family and clinical risk factors associated with caries increment in permanent teeth of children participating of a dental care program.

Material and Methods

The project was approved by the Ethics Research Committee of Piracicaba Dental School, University of Campinas, n. 111/2010.

This longitudinal study began in 2011, based on epidemiological survey conducted with schoolchildren at the Always Smiling Program (PSS, in Portuguese) [11]. This Program provides dental care to nine schools located on the periphery of Piracicaba, São Paulo, and in 2011 there were 1411 schoolchildren from seven to 10 years old (from 3rd to 5th grade of elementary school). Of these, 856 students were enrolled in 3rd and 4th grade of elementary school and were invited to this longitudinal study. Due to lack of parental consent, moving to another school or withdrawal from the PSS, the study lost 555 students. Thus, the initial sample had 301 schoolchildren who were monitored for two years. The children selected for the study were initially examined in 2011 (baseline) and after 12 and 24 months (2013).

The experience and the caries increment were evaluated in primary and permanent dentition using the dmft indices (decayed, extracted, filled deciduous teeth) and DMF-T (decayed, missing and filled permanent teeth), according to the codes and criteria of the World Health Organization [15]

and with the use of artificial light, dental mirror and ballpoint-type probe, in the courtyard of the schools.

Prior to data collection, practical and theoretical activities were carried out in calibration exercises. The intra-examiner reliability was assessed using the kappa statistics until reaching a good percentage agreement (Kappa above 0.85) [20]. In addition, a questionnaire [7,10] containing questions on socioeconomic characteristics (family income, parental education, own house, government aid, parents occupation) and the family environment (number of people living in the house, if the child lives with both biological parents, who takes care of the child outside school hours) was sent to the parents at baseline. The dichotomization of the questionnaire variables followed the research protocol of previous study [11].

For statistical analysis, we used the survival analysis to assess the significant variables that impacted on caries increment over time due to the fact that some permanent teeth already had caries lesions at baseline and due to the short monitoring period (2 years). Thus, we considered differences in the exposure time of each individual to the risk of caries in the permanent teeth. Thus, we selected the survival analysis, which considers the censored data (in this study case the censored data were about children who completed the study time showing no caries). We estimated the time required to increase the DMF-T index by the Kaplan-Meier method, in order to test the effect of the independent variables (socioeconomic, family environment and previous caries experience in the primary dentition) in caries incidence in permanent teeth after 2 years.

We observed the average survival time (average time until the child presents increase in DMF-T index) and the total proportion of survival (proportion of children without DMF-T index increasing over the two years) and we applied the logrank test in order to compare the curves.

The variables considered significant by the logrank test were submitted to the Cox bivariate analysis. Those with $p \leq 0.05$ value were then submitted to the final Cox model adjusted. For this study, we considered a failure when the children showed caries increment; we considered censored when they reached the end of the study (2013) without presenting caries increment. We performed the analysis using the SAS software (Cary, NC, USA). The level of statistical significance was $p<0.05$.

Results

During the two-year monitoring, from the sample of 301 schoolchildren we lost 12.6%. Therefore, the final sample consisted of 263 children, among them 46% male and 54% female.

With regard to socioeconomic variables, 68.4% of families had an income of ≤ 2 minimum wages and the majority of fathers (41.7%) and mothers (54.3%) studied for less than eight years. Regarding the family environment, in 2011, 67.8% of children lived with both biological parents and 46% stayed with other people when they were not at school (Table 1).

With respect to caries experience in deciduous teeth, 50.6% of the children were assessed in dmft>0 in 2011. The dmft index average at baseline was 1.38 (SD=1.88) and the DMF-T index was

0.17 (SD=0.57). After 2 years of monitoring (2013), the index dmft average decreased to 0.39 (SD=0.97) and the DMF-T index increased to 1.07 (SD=1.4)

Regarding survival analysis, the synthesis of failures (children with increase in DMF-T) and censored observations (children who did not present increase in DMF-T index over the period) are shown in Table 1.

As shown in Table 1, a total of 78 (58.65%) children with previous caries experience in deciduous teeth in the beginning of the study showed an increase of DMF-T index compared with 58 (44.61%) children who had no previous caries experience in the initial examination (baseline).

Table 1. Synthesis of failures and censored observations in permanent teeth, according to the independent variables.

Variable	Number of children	Failures	Censored
Gender			
Female	142 (54.00%)	81 (57.05%)	61 (42.95%)
Male	121 (46.00%)	55 (45.45%)	66 (54.55%)
Age			
7 to 8 years	200 (76.05%)	99 (49.50%)	101 (50.50%)
9 to 10 years	63 (23.95%)	37 (58.73%)	26 (41.27%)
Previous experience with caries in deciduous teeth (dmft>0)			
No experience	130 (49.43%)	58 (44.61%)	72 (55.39%)
With experience	133 (50.57%)	78 (58.65%)	55 (41.35%)
Family income			
Up to two minimum wages	180 (68.44%)	99 (55.00%)	81 (45.00%)
Higher or equal to two minimum wages	83 (31.56%)	37 (44.58%)	46 (55.42%)
Number of people in the same residence			
Less or equal to 4 people	193 (73.38%)	95 (49.22%)	98 (50.78%)
More than 4 people	70 (26.62%)	41 (58.57%)	29 (41.43%)
Mother's education			
Less or equal to 8 years of study	143 (54.37%)	71 (49.65%)	72 (50.35%)
Higher than 8 years of study	120 (45.63%)	65 (54.17%)	55 (45.83%)
The child lives with			
Both biological parents	178 (67.68%)	91 (51.12%)	87 (48.88%)
Only with the father, only with the mother, other	85 (32.32%)	45 (52.94%)	40 (47.06%)
Parents' perception regarding children's oral hygiene			
Moderate, poor	212 (80.61%)	111 (52.36%)	101 (47.64%)
Excellent, very good, good	51 (19.39%)	25 (49.02%)	26 (50.98%)
When the child is not at school they stay with			
Father and/or mother	142 (53.99%)	78 (54.93%)	64 (45.07%)
Other	121 (46.01%)	58 (47.93%)	63 (52.07%)

Table 2 presents the average lifetime, estimates for the third time (year of 2013) of the survival function obtained by the Kaplan-Meier estimator and by the p-value for the *logrank tests*.

Table 2. Kaplan-Meier estimates, average lifetime and significance of the logrank tests for permanent teeth data according to the independent variables.

Variable	Number of patients	Average lifetime (standard error)	S(3): Probability of an observation to survive time t=3 (standard error)	p-Value
Gender				
Female	142 (54.00%)	2.46 (0.0586)	0.430 (0.0415)	0.0443
Male	121 (46.00%)	2.62 (0.0576)	0.545 (0.0453)	
Age				
7 to 8 years	200 (76.05%)	2.57 (0.0477)	0.505 (0.0354)	0.145
9 to 10 years	63 (23.95%)	2.41 (0.0829)	0.413 (0.0620)	

Previous experience with caries in deciduous teeth (dmft>0)				
No experience	130 (49.43%)	2.65 (0.0507)	0.554 (0.0436)	0.0087
With experience	133 (50.57%)	2.41 (0.0639)	0.414 (0.0427)	
Family income				
Up to two minimum wages	180 (68.44%)	2.46 (0.0517)	0.450 (0.0371)	0.0522
Higher or equal to two minimum wages	83 (31.56%)	2.70 (0.0654)	0.554 (0.0546)	
Number of people in the same residence				
Less or equal to 4 people	193 (73.38%)	2.55 (0.0485)	0.508 (0.0360)	0.193
More than 4 people	70 (26.62%)	2.47 (0.0801)	0.414 (0.0589)	
Mother's education				
Less or equal to 8 years of study	143 (54.37%)	2.55 (0.0566)	0.503 (0.0418)	0.505
Higher than 8 years of study	120 (45.63%)	2.52 (0.0612)	0.458 (0.0455)	
The child lives with				
Both biological parents	178 (67.68%)	2.56 (0.0502)	0.489 (0.0375)	0.661
Only with the father, only with the mother, other	85 (32.32%)	2.48 (0.0737)	0.471 (0.0541)	
Parents' perception regarding children's oral hygiene				
Moderate, poor	212 (80.61%)	2.54 (0.0454)	0.476 (0.0343)	0.802
Excellent, very good, good.	51 (19.39%)	2.51 (0.1014)	0.510 (0.0700)	
When the child is not at school they stay with				
Father and/or mother	142 (53.99%)	2.49 (0.0604)	0.451 (0.0418)	0.21
Other	121 (46.01%)	2.59 (0.0556)	0.521 (0.0454)	

Table 3 shows Cox's proportional hazards model, considering only the variables that showed differences between the survival curves (significant *logrank* test).

Table 3 - Cox's model results for children's gender, previous caries experience in deciduous teeth and family income variables.

Variable	Estimate	Standard error	Z	p-Value
Gender	-0.3001	0.1752	-1.713	0.0867
Exp. caries	0.4045	0.1737	2.329	0.0198
Income	-0.3055	0.1934	-1.580	0.1141

Table 4 shows final Cox model adjusted, which considers only the previous caries experience variable in primary dentition at baseline (only significant variable in Cox model of Table 3).

Table 4. Cox regression model for previous caries experience.

Variable	Estimate	Standard error	Z	p-Value	Hazard ratio
Exp. caries	0.3953	0.1735	2.278	0.0227	1.4848

According to the results presented in Table 4, we observed that the risk for caries increment in permanent teeth among children with previous caries experience in primary dentition was approximately 1.5 times higher than those without previous caries experience.

Discussion

The results of this study provide important contributions to the public health research and planning, since, unlike what was observed so far in survival studies, we used in the model

environmental variables along with clinical caries experience. Through survival analysis we could determine that aspects related to the previous disease had greater impact than the environmental characteristics.

When assessing caries increment in children participating in the dental care program we observed that even exposed to a similar pattern of educational and preventive activities, some of them were 1.5 time more likely to risk of developing caries in permanent teeth due to previous caries experience in primary dentition.

The children were from outlying schools located in neighborhoods of greater social exclusion and, therefore, from families of lower socioeconomic level [11]. In a previous study [14] conducted in public schools in the same city (Piracicaba/SP) with five year-old children at baseline, only the previous caries experience in primary dentition variable remained in the final model. Moreover, we observed that the children with dmft>0 showed relative risk 2.133 times higher than those with dmft=0 at baseline, corroborating this study findings.

In a research conducted in Mexico with 452 children from six to nine years old, monitored for two years, the authors found that those with caries in primary dentition at baseline (dmft>0) were at a risk 2.71 times higher of developing caries in permanent teeth than those who did not have the disease at baseline [13]. The same fact was observed in a study conducted in China [18]. During the two-year monitoring with children from six to seven years, it was found that those who had caries in primary dentition had 2.1 times greater risk of developing caries in permanent teeth over the two years of monitoring. The relative risk of developing caries lesions in permanent teeth of children with caries in primary dentition was 2.4 in a study developed in the Netherlands, with children at the average age of 7.5 years [21].

Therefore, we observed a worldwide trend in the results of studies on caries risk starting at the age of five, that is, caries experience in primary dentition is a good predictor for caries development in permanent teeth. However, the predictive value may be higher or lower depending on the socioeconomic and environmental characteristics of the studied population.

In this study, the lower risk found for the caries experience in primary dentition variable compared to other studies may be due to several factors, among them, that the children in the study were participants in a dental care program that conducted educational-preventive and curative activities with the schoolchildren, and they were from economically disadvantaged classes, which made the sample a little more homogeneous. We found that only 8.7% of the caries-free children developed new lesions, contrary to those who have had previous caries experience.

Dental care programs aimed at schoolchildren can promote better access to preventive and curative actions of children and adolescents, a reality not often found in the rest of the country [22]. The Always Smiling Program is recognized for its prevention and rehabilitation actions, reducing social inequities in health, since it promotes access of children in need of oral health care and dental treatments of quality, regardless of financial availability, time and mobility of the people responsible for them [11,23].

However, among the relevant results of this study, it is worth noting that even including social determinants of health in the model (socioeconomic and environmental factors), previous caries experience was the most important predictive factor for future experience. Thus, this fact leads us to reflect on the importance of health-promoting actions also to children of pre-school age, in day care centers or preschools, or in the family environment [24-26]. However, in this study, we should consider that the absence of influence of environmental factors may have occurred because the study sample has socioeconomic characteristics and similar family environment [11], influencing the ability of statistical analysis to identify differences. In the opposite situation, other studies in the literature found associations between socioeconomic variables as predictors of dental caries in children [27-29].

Finally, the results should be viewed with caution, since it is a homogeneous sample, with low-profile of oral diseases and monitored for two years by a preventive-curative program, which may have impacted with low caries incidence found.

Conclusion

We conclude that socio-environmental and family variables were not associated with risk factors for caries increment over 2 years in children from seven to 10 years. However, these children with previous caries experience in primary dentition had a higher risk of developing caries lesions in permanent teeth in the period studied.

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