Socio-behavioral factors influence prevalence and severity of dental caries in children with primary dentition

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Abstract: The aim of this study was to analyze the influence of socio-behavioral variables on the prevalence and severity of dental caries in 4- to 6-year-old children. A cross-sectional study was performed on a sample of 1993 children enrolled in 58 public preschools from Araçatuba City, São Paulo State, Brazil, during 2010. The exams were made using the decayed, missing, and filled teeth index (World Health Organization methodology) and detection criteria for non-cavitated lesions. A tested, self-administered questionnaire was sent to parents to obtain information about their socio-behavioral characteristics. Standardization was performed to verify concordance among examiners (kappa = 0.84). The prevalence of cavitated caries lesions was 41.2% (821), and the prevalence of both, cavitated and non-cavitated caries lesions, was 43.9% (875). The means ± standard deviations of the decayed, missing, and filled teeth index for children aged 4, 5, and 6 years were 1.18 ± 2.45, 1.65 ± 2.67, and 1.73 ± 2.77, respectively. Caries were significantly more prevalent in children from families with low incomes and low educational levels. The presence of dental caries was associated with access to dental services ($p < 0.05$). The associations between both, cavitated and non-cavitated dental caries lesions, and the frequency of oral hygiene were statistically significant. The prevalence of dental caries in preschoolers was strongly associated with factors related to the children's parents. Therefore, information about parents' socio-economic status, behaviors, and attitudes in relation to oral health should be considered when planning prevention and educational programs for the oral health of preschool children.

Descriptors: Dental Caries; Child, Preschool; Epidemiology.

Declaration of Interests: The authors certify that they have no commercial or associative interest that represents a conflict of interest in connection with the manuscript.

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Submitted: Apr 18, 2012
Accepted for publication: Aug 28, 2012
Last revision: Sep 10, 2012

Introduction

In recent decades, there have been considerable improvements in the oral health of preschoolers in many developed countries.[1] However, dental caries still affect a considerable proportion of children. Recent studies have shown that dental caries have decreased in Latin America and the Caribbean.[2] In Brazil, there was a 17% decrease in dental caries from 2003 to 2010, and the decayed, missing, and filled teeth index (dmft index) for 5-year-old children decreased from 2.80 to 2.30.[3]

Concomitantly with caries decreasing, there was a growing polarization in its distribution.[4] In some areas, the dmft index increased and was concentrated in small parts of the population. The strong polarization in

disease distribution, even among young children, indicates that a considerable proportion of this group does not receive benefits from traditional prevention programs.[5]

Caries experience in primary dentition is considered the strongest predictor of caries in permanent dentition.[6] Therefore, mapping patterns of oral health in young children and studying the risk factors for caries and their distribution are essential for the new panorama of dental caries, allowing to understand the caries behavior and the best ways to control and prevent it.

The number of children with caries located in the enamel alone, without cavitation, has been increasing and has been noted not only by general dentists, but also by epidemiologists and health service planners.[7,8] The inclusion of both types of caries lesions (cavitated and non-cavitated) in epidemiological research can improve study sensibility, mainly in populations with a low prevalence of caries. In these populations, non-cavitated caries lesions show a slow progression pattern and are observed principally in early stages.[9,10]

Caries epidemiology also involves the study of variables that can influence its occurrence and severity, including social, demographic, and behavioral factors, such as ethnicity, family income, parents' educational level, knowledge and beliefs of them and oral hygiene habits. Cross-sectional studies have shown the complex interaction among these factors and caries in preschoolers.[11] However, few studies have considered the inclusion of non-cavitated caries lesions in deciduous teeth. Therefore, the aim of this study was to evaluate the influence of socio-behavioral variables on the prevalence and severity of dental caries in children aged 4 to 6 years old.

Methodology

Study design

A cross-sectional, epidemiological study was performed in 4- to 6-year-old male and female children who lived in Araçatuba during 2010. Araçatuba is a city in São Paulo state, Brazil, with 181,618 inhabitants. The income *per capita* is approximately US$7,355.00/year, the child mortality rate is 10.29/100, and the Human Development Index is 0.848. Since 1972, the city has added 0.6 to 0.8 mg/l fluoride to the public water supply.

The sample consisted of children from 4 to 6 years old, who were enrolled in the 58 public preschools in Araçatuba during 2010 (n = 3,697). Exclusion criteria were:

- children whose parents did not authorize exams,
- children who had authorization but did not cooperate during exam, and
- children who were not present on the three dates scheduled for exams.

The final sample consisted of 1,993 (53.9%) children. All included children underwent a clinical evaluation, and their parents answered the questionnaire.

Questionnaire

A tested, semi-structured, self-administered questionnaire and a written consent form were sent to parents/responsible adults. The questionnaire included variables related to the parents' socio-economic and educational levels, food habits, children's oral hygiene habits, access to dental services, and reasons for consultation. All questionnaire items were evaluated by a panel of five dentists with research interests and expertise in clinical exams, and a pilot study was performed that confirmed its adequacy.

Clinical exams

Clinical exams were performed by 5 teams composed of one examiner and one assistant. Diagnostic criteria for dental caries followed the World Health Organization (WHO) recommendation, using a CPI probe (WHO) and a number 5 plane oral mirror under natural light.[12] When necessary, before the clinical exam, it was used to gaze at and to clean the tooth surface.

The dmft index was calculated, and non-cavitated lesions were registered according to criteria recommended by the Workshop on Diagnosing and Reporting ECC for Research Purposes.[13] Rampant caries were recorded when the child had one or more smooth surfaces that were cavitated, missing, or filled in the primary maxillary anterior teeth.

Rampant caries were also recorded when the dmft index was ≥ 5 for 4-year-old children or when the dmft index was ≥ 6 for 5- and 6-year-old children.[13]

Standardization of diagnosis

All examiners were trained prior to the study. The calibration process consisted of a theoretical phase that involved studying indicators and trials, and a practice phase that involved performing exams and discussions using the consensus technique.[12] The kappa test for dmft evaluation was applied to verify concordance among inter-examiners, and a mean value of 0.842 was obtained. No calibration was performed for the assessment of non-cavited caries lesions, and this is a limitation of this study. As all examiners have clinical experience and were previously trained, concordance among intra-examiners was not assessed.

Data analysis

Data analysis was performed using BioEstat version 5.3 (Instituto Mamirauá, Manaus, BR)[14] and Epi-Info version 3.5.1 (Centers for Disease Control and Prevention, Atlanta, USA)[15] software.

The dependent variables were presence of dental caries, rampant caries, and dental caries including non-cavitated lesions. The chi-squared test or Fisher's test at a 5% level of significance was used to verify the association of dependent and independent variables (parents' education level, monthly family income, access to dental services, and frequency of tooth hygiene). The data were expressed as the mean ± standard deviation. A multivariate analysis was performed using logistic regression (STATA software, version 10, StataCorp LP, College Station, USA). The variables that had shown statistical significance were entered into the model, and the results were expressed as an odds ratio (OR) with a 95% confidence interval (CI).

Ethical aspects

This study was approved by the Ethical Committee on Research with Humans of the Araçatuba Dental School - Unesp, process number 1577-2010. Children were examined only when they had a written consent form signed by their parents or responsible adults.

Results

A total of 1,993 children were examined, of which 984 (49.4%) were boys and 1,009 (50.6%) were girls. A total of 821 (41.2%) children had dental caries, and when non-cavitated lesions were included, the total was 875 (43.9%) children. The mean dmft index was 1.53 ± 2.63. Rampant caries were observed in 16.2% (323) of children.

In Table 1, the children were subdivided by age (4, 5, and 6 years) to define the characteristics of each age group. The mean dmft index increased with increasing age. There was a higher prevalence of rampant caries among older children, and a higher prevalence of children free of caries among

Table 1 - Caries experience of children according to age.

	4 years	5 years	6 years	Total
	n (%)	n (%)	n (%)	n
Number of children	607 (30.4%)	748 (37.5%)	638 (32.0%)	1993
Boys	302 (49.8%)	369 (49.3%)	313 (49.1%)	984
Girls	305 (50.2%)	379 (50.7%)	325 (50.9%)	1009
Caries	198 (32.6%)	334 (44.7%)	289 (45.3%)	821
Free of caries	409 (67.4%)	414 (55.3%)	349 (54.7%)	1172
Rampant caries	81 (13.3%)	133 (17.8%)	109 (17.1%)	323
Caries including non-cavitated lesions	221 (36.4%)	349 (46.7%)	305 (47.8%)	875
Non-cavitated lesions	47 (7.7%)	53 (7.1%)	39 (6.11%)	139
Dmft index (mean ± sd)	1.18 ± 2.45	1.65 ± 2.67	1.73 ± 2.77	1.53 ± 2.63

Table 2 - Number and percentage of children with caries according to parents' educational level, family income, and behavioral variables.

	n	Caries	Rampant caries	Caries, including non-cavitated lesions
		n (%)	n (%)	n (%)
Parents' educational level				
Illiterate	48	31 (64.6)	14 (29.2)	32 (66.7)
Elementary school	402	191 (47.5)	76 (18.9)	198 (49.3)
High school	1060	413 (39.0)	164 (15.5)	441 (41.6)
University	188	68 (36.2)	21 (11.2)	72 (38.3)
p-values		$p < 0.001$	$p < 0.0073$	$p < 0.001$
Income				
< 1 minimum wage	166	84 (50.6)	38 (22.9)	90 (54.2)
1–1.9 minimum wages	822	366 (44.5)	153 (18.6)	379 (46.1)
2–2.9 minimum wages	404	163 (40.3)	57 (14.1)	181 (44.8)
3 or more minimum wages	340	106 (31.2)	36 (10.6)	117 (34.4)
p-values		$p < 0.001$	$p < 0.001$	$p < 0.001$
Access to dental services				
Yes	1211	552 (45.6)	223 (18.4)	583 (48.1)
No	777	265 (34.1)	99 (12.7)	288 (37.1)
p-values		$p < 0.001$	$p < 0.001$	$p < 0.001$
Hygiene frequency				
0 or once/day	199	91 (45.7)	37 (18.6)	99 (49.7)
twice or more times/day	1686	676 (40.1)	263 (15.6)	719 (42.6)
p-values		0.126	0.2748	0.05

younger children (Table 1).

Table 2 shows the relationships among caries experience and parents' educational level, family income, and behavioral variables. Caries, rampant caries, and caries including non-cavitated lesions were significantly more prevalent in families with a lower educational level and lower monthly income. Caries, rampant caries, and caries including non-cavitated lesions were significantly more prevalent in children that had access to dental services than in those without access. Children that practiced dental hygiene two or more times per day had less caries than those who did not practice dental hygiene or practiced once per day. This association was statistically significant only when non-cavitated lesions were included (Table 2). Multivariate analysis confirmed that low educational level, low family income, and access to dental services were independently associated with the presence of caries, rampant caries, and caries including non-cavitated lesions. Children who did not practice dental hygiene or who practiced once *per* day had a tendency to have more caries, when non-cavitated lesions were included (Table 3).

Among all affected children, only 2.7% (53) had a dmft index ≥ 10 (Figure 1). The decayed component contributed most to the dmft index value, with percentages of 89%, 82%, and 78% for children aged 4, 5, and 6 years, respectively (Figure 2).

Discussion

This study analyzed the prevalence of dental caries and its relationship with socio-behavioral factors. The analysis also included non-cavitated lesions in the diagnostic criteria, and demonstrated a tendency in the association between hygiene frequency and dental caries. Therefore, children who had their teeth cleaned two or more times per day

Table 3 - Multivariate analysis for the presence of caries.

	Caries	Rampant caries	Caries, including non-cavitated lesions
	OR, 95% CI	OR, 95% CI	OR, 95% CI
Low parents' educational level	1.27, 1.07–1.50	1.36, 1.09–1.70	1.26, 1.07–1.49
Low family income	1.27, 1.13–1.44	1.36, 1.15–1.60	1.23, 1.09–1.39
Access to dental services	1.74, 1.38–2.18	1.69, 1.24–2.31	1.74, 1.39–2.17
Hygiene frequency	1.29, 0.91–1.84	1.26, 0.80–1.98	1.39, 0.98–1.98

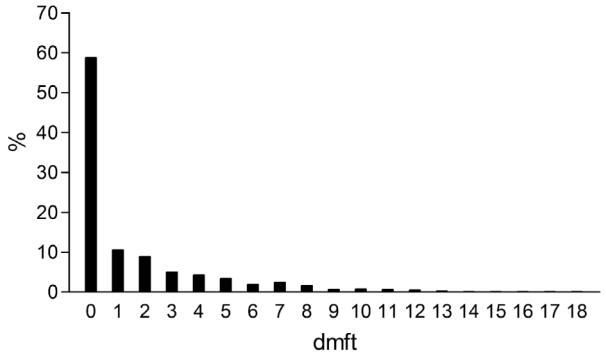

Figure 1 - Percentage distribution of children according to the dmft index.

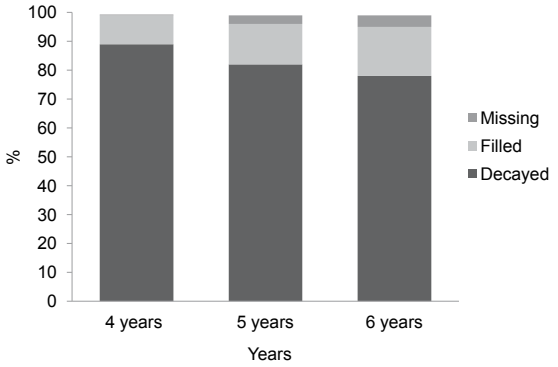

Figure 2 - Percentage distribution of decayed, missing and filled teeth in the dmft index, according to age.

had a tendency of lower caries prevalence than those who had their teeth cleaned only once per day or none. In previous studies in some European countries, parental help during tooth brushing and the frequency of oral hygiene were considered the most significant determinants for childhood caries.[16,17] However, no relationship between these variables was noted in an American study.[18]

The dmft and decayed, missing, and filled surfaces (dmfs) indexes are universally accepted, and allow epidemiological data to be compared from different studies around the world. By including the diagnosis of caries in enamel without cavitation, the new criteria could lead to better preventive dental services. Collecting data on both cavitated and non-cavitated lesions would provide additional knowledge about caries progression in deciduous teeth and during early childhood.[13,19]

Comparing the results of this study with those of a previous study performed in the same city in 1998, a decrease in caries prevalence was observed. The mean dmft index values found in the present study for children aged 4, 5, and 6 were 1.18, 1.65, and 1.72, respectively, and were lower than those found in 1998 (1.53, 2.28, and 2.27 for children aged 4, 5, and 6, respectively).[20] There was a 13.13% increase in number of caries-free children when our results (55.30%) were compared with the results from 1998 (42.17%).[20]

Our results showed a similar percentage of caries-free children in comparison to those of previous international studies from the United Kingdom (rate of 60.0%)[21] and Norway (rate of 66.0%).[22] Nevertheless, the level of caries-free children did not meet the goal established by the WHO/FDI for 2010 that 90% of children should be free of caries at age 5 and 6 years. It is important to note that studies must be compared with caution because there are variations in the diagnostic criteria and in the selection of indices used to evaluate the disease in this age group.

The results showed that only 2.7% (53) of affected children had a dmft index ≥ 10. Among the 1993 children, 16.2% (323) had rampant caries with high dmft index values. These children represent a significant group that requires dental treatment, being the group of epidemiological polarization. This

fact indicates that a considerable proportion of this group did not receive any benefits from traditional preventive programs.[23]

In the dmft index, the main component responsible for the values was the decayed component, which represented 89% at 4 years, 82% at 5 years, and 78% at 6 years. This result may indicate that these preschoolers had no access to dental services.

This study demonstrates that children who already had access to dental treatments were those who showed experience with caries, rampant caries, and caries including non-cavitated lesions. This finding indicates that, when using dental services in Brazil, people have an old view of oral diseases that is associated with the treatment of dental caries through its sequelae, the cavity, rather than considering preventive aspects.

The present study confirmed the association between caries and socio-economic characteristics. Epidemiological studies have clearly reported that there is an increase in the risks of early childhood caries associated with socio-economic characteristics, including low income and low educational level.[24,25] These associations are likely because low-income families have material, social, and financial disadvantages that compromise their ability to care for themselves and their children. These families face difficulties in obtaining professional care in health services and do not identify dental problems through preventative care during the early stages of their disease. They have a poor nutritional status, less access to early diagnosis, fewer therapeutic resources, and worse disease prognoses.[25] All of these factors lead to a decreased resistance to disease, including oral diseases.[26]

This study highlights the importance of prevention to combat dental caries. Prevention programs should target specific groups; however, the best strategy depends on several factors, including cultural, economic, and geographic factors. Some strategies include the use of fluoride, chlorhexidine, sealant and xylitol, behavioral changes, social programs, and cultural modification. The most suitable strategy depends on local factors.[27] The early identification of high-risk groups and the approaching of behavioral aspects in preventive and educational programs on oral health should be encouraged.[28]

Conclusion

Caries prevalence in the primary dentition of children was associated with parental factors, including parents' socio-economic status, behaviors, and attitudes related to oral health. These factors should be considered when planning preventive and educational programs about oral health for children in this age group.

Acknowledgement

The authors acknowledge the São Paulo Research Foundation - FAPESP for financial support.

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