

# Dental caries associated factors in 12 year-old schoolchildren from a municipality in the state of São Paulo, Brazil

Fatores associados à cárie dentária em escolares aos 12 anos em um município do estado de São Paulo, Brasil

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## ABSTRACT

### Objective

To analyze the possible association between dental caries, fluorosis and the need for treatment in 12 year-old schoolchildren and the socioeconomic conditions of parents/guardians in the city of Franca, in the state of São Paulo.

### Methods

A random sample of schoolchildren aged 12 was obtained from the school records in Franca, using a systematic random technique. The epidemiological survey was carried out by a single calibrated examiner, on 258 public and private schoolchildren in order to obtain the prevalence of dental caries, the need for treatment and the severity of dental fluorosis. Parents/guardians were also interviewed to assess their socioeconomic conditions (education and per capita income). We used multiple correlation analysis to investigate associations between category variables.

### Results

It was possible to identify two distinct groups, with associations between the variables: the first group, represented by schoolchildren with average prevalence of caries, need for treatment, low level of parental education and income; and a second group represented by schoolchildren with low prevalence of caries, no need for treatment, high parental education and income. The two dimensions explained approximately 35% of total inertia. The factors within each group are related.

### Conclusion

High income and parental education are associated with the low prevalence of dental caries but there is no association with dental fluorosis.

**Indexing terms:** Dental caries. Dental fluorosis. DMF index. Epidemiology. Oral health. Socioeconomic factors.

## RESUMO

### Objetivo

Analisar as possíveis associações entre cárie dentária, fluorose e necessidade de tratamento de escolares aos 12 anos de idade e fatores sócio-econômicos dos pais ou responsáveis, no Município de Franca, São Paulo.

### Métodos

Foi obtida uma amostra probabilística, através da técnica de sorteio ponderado de estabelecimentos de ensino do cadastro das escolas do município de Franca, cujos elementos amostrais foram identificados através da técnica casual sistemática. Os exames epidemiológicos foram realizados em 258 escolares de unidades de ensino público e privados, por um único examinador calibrado, para obtenção da prevalência de cárie, necessidade de tratamento e severidade da fluorose dental. Foram também realizadas entrevistas com os pais ou responsáveis para avaliação sócio econômica (escolaridade e renda familiar). Com base nesses dados foi realizada uma análise de correspondência múltipla para a busca das associações entre variáveis categóricas. Foi obtida uma amostra probabilística, através da técnica de sorteio ponderado de estabelecimentos de ensino do cadastro das escolas do município de Franca, cujos elementos amostrais foram identificados através da técnica casual sistemática. Os exames epidemiológicos foram realizados em 258 escolares de unidades de ensino público e privados, por um único examinador calibrado, para obtenção da prevalência de cárie, necessidade de tratamento e severidade da fluorose dental. Foram também realizadas entrevistas com os pais ou responsáveis para avaliação sócio econômica (escolaridade e renda familiar). Com base nesses dados foi realizada uma análise de correspondência múltipla para a busca das associações entre variáveis categóricas.

### Resultados

A análise permitiu identificar dois grupos discrepantes, os quais possuem associações entre as variáveis: Grupo 1, escolares com prevalência média de cárie, baixa escolaridade dos pais, com necessidade de tratamento e baixa renda familiar; e Grupo 2, escolares com prevalência baixa de cárie, alta escolaridade dos pais, sem necessidade de tratamento e renda familiar média. As duas dimensões explicaram 35% aproximadamente da inércia total. Os fatores dentro de cada grupo estão associados.

### Conclusão

A escolaridade e renda alta dos pais ou responsáveis estão associadas à baixa prevalência de cárie dentária e não há associação com a fluorose dentária.

**Termos de indexação:** Cárie dentária. Fluorose dentária. Índice CPO. Epidemiologia. Saúde bucal. Fatores socioeconômicos.

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## **INTRODUCTION**

Over the years, dental caries has been regarded as the primary problem in the field of social dentistry. This stems from its frequency, the seriousness of the damage caused, the possibility of effective action, the per capita cost of treatment and the level of interest of the public at large<sup>1</sup>.

Moreover, dental caries may have an adverse effect on the quality of life of a large number of people, causing pain and infection. Without proper treatment, it could even produce or aggravate other common illnesses as well as increase the financial burden on the health services<sup>2</sup>.

In the 1970s, studies considered dental caries to be a “democratic” disease affecting all classes of society indiscriminately<sup>3</sup>. The predominance was noted of components relating to the need for treatment in the least privileged layers of society, while in the population that enjoyed higher levels of income, with greater access to dental services, a predominance of already performed treatment was observed.

With the decline in the prevalence of caries disease, which occurred globally as from the end of the 70s and early 80s, this picture began to change. The epidemiological surveys subsequently carried out already demonstrate inequality of caries experience between the classes<sup>4</sup>. The experience of caries was reduced as a whole but there are still groups of individuals that present a large number of dental surfaces experiencing caries<sup>5</sup>. These people usually belong to the lower income strata of the population. The lower purchasing power involves a set of factors that relate to access to health services, level of education, lifestyle, conditions of hygiene, housing and access to products, amongst others<sup>6</sup>.

Significant transformations in living conditions occurred in particular regions of the globe in the 20th century. These changes are linked to the models of social and economic development engendered in each region. In many regions, there was wider access to treated water, growth in education and in services networks and an increase in income with better housing conditions and food. A variety of aspects, separately or in combination, have contributed to the transformations in the health conditions of human populations, changing both the population structure and the patterns of morbi-mortality<sup>7</sup>.

By describing and comparing the trends of manifestation of dental caries observed in each country, or even within one municipality, as is the case of this study, it allows us to explore connections between the rates of

occurrence of this disease over the course of time and more general aspects linked to industrialization, human development, socioeconomic conditions and, consequently, to contribute to the refinement of social policies<sup>8</sup>.

## **METHODS**

The reference population for the study comprised schoolchildren of 12 years of age from the municipality of Franca, in 2004. The city, with approximately 304,000 inhabitants, is situated in the northwestern region of the state of São Paulo, in Brazil. A total of 98% of households enjoy a system of treated, fluorinated water (0.7 to 1 ppm)<sup>9</sup>.

The study was approved by the Ethics in Research Committee at the University of Franca (filing no. 010/02B).

The study presents a prevalence study with a cross-sectional, observational design. For the probability sample<sup>10</sup>, as the basis for calculating sample size, the variable “attack of dental caries” was adopted, measured via the CPO-D (better known as DMF-T in English-speaking countries) index (2.8) produced in Franca in 1998<sup>11</sup>, considering a level of significance of 95%, a design effect equal to 2 and assuming a loss of 20%. The sampling units were drawn using the systematic sampling technique and the sampling elements were identified by applying systematic random sampling.

The epidemiological examinations of oral health condition were carried out on 256 schoolchildren by a calibrated dental surgeon using the codes and criteria advocated by the WHO<sup>12</sup>, and CPO\_D index data were obtained, classified as Low (CPOD\_B), with values between 0 and 3, Medium (CPOD\_M), with values between 4 and 8 and High (CPOD\_A), being greater than 8; the level of fluorosis, classified as Normal (FLU\_N), Questionable (FLU\_Q) and Light (FLU\_L); and the need for treatment classified as Needs Treatment (TRAT\_nece) or Does Not Need Treatment (TRAT\_ñ nece).

The socioeconomic evaluation was obtained by means of interviews in which the oral healthcare questionnaire<sup>13</sup> was used in which the variables included here were: level of education of parents/guardians and family income.

Level of education, represented by the number of years of study of the parents/guardians interviewed, was obtained based on the grade to which the individual was currently studying or had studied, taking into account the last grade completed and passed. The following categories

were used: Low (ESC\_0-4), parents/guardians with 0 to 4 years of study; Medium (ESC\_5-8), between 5 and 8 years of study; and High (ESC\_+9), 9 or more years of study.

The value used for monthly family income was the sum of the monthly earnings of all the components of the Family Unit. Income was designated by minimum salary. Monthly family income was classified as low income (RENDA\_B), where income was between 0 and 4 minimum salaries; high income (RENDA\_A), income greater than or equal to 8 minimum salaries; and average income (RENDA\_M), between 4 and 8 minimum salaries.

The checking of intra-examiner agreement, Kappa coefficient, was obtained from the practice of examining, in duplicate, 10% of the epidemiological examination sample<sup>14</sup>.

Multiple correspondence factor analysis (MCA) was employed to investigate the existence of an association between the category variables<sup>15</sup> studied based on the table X'X, known as the Burt Table, which contains all frequencies related to the intersection of all categories of response from the records obtained. X is the original data matrix (Table 1). The line points and/or column resulting from the association between the variables in table X are displayed in two-dimensional maps called perceptual maps which facilitate the viewing of relationships that exist between the variables. The quality of the perceptual maps is measured by the values of inertia retained in each eigenvalue responsible for the generation of the individual dimensions. The analyses were processed using the software application Statistica® version 7.

Table 1. Burt's frequency table.

	FLU_N	FLU_Q	FLU_L	CPOD_B	CPOD_M	CPOD_A	TRAT_nece	TRAT_ñ nece	ESC_0-4	ESC_5-8	ESC_+9	RENDA_B	RENDA_M	RENDA_A
FLU_N	85	0	0	57	17	11	36	49	21	37	27	67	11	7
FLU_Q	0	17	0	13	3	1	8	9	7	7	3	13	3	1
FLU_L	0	0	42	31	10	1	23	19	13	21	8	33	4	5
CPOD_B	57	13	31	101	0	0	67	34	23	47	31	77	13	11
CPOD_M	17	3	10	0	30	0	0	30	13	14	3	26	4	0
CPOD_A	11	1	1	0	0	13	0	13	5	4	4	10	1	2
TRAT_nece	36	8	23	67	0	0	67	0	15	30	22	49	9	9
TRAT_ñ nece	49	9	19	34	30	13	0	77	26	35	16	64	9	4
ESC_0-4	21	7	13	23	13	5	15	26	41	0	0	38	3	0
ESC_5-8	37	7	21	47	14	4	30	35	0	65	0	51	9	5
ESC_+9	27	3	8	31	3	4	22	16	0	0	38	24	6	8
RENDA_B	67	13	33	77	26	10	49	64	38	51	24	113	0	0
RENDA_M	11	3	4	13	4	1	9	9	3	9	6	0	18	0
RENDA_A	7	1	5	11	0	2	9	4	0	5	8	0	0	13

## RESULTS

Of the 300 schoolchildren drawn out, an epidemiological exam was performed on 256 of them, representing 85.33% of schoolchildren drawn and a loss of 14.67%.

The intra-examiner agreement percentages obtained in the epidemiological examination of the dental caries condition was 99% and the Kappa Coefficient was 0.98.

The average CPOD in the 12 year-old index was 1.69 (ranging from 1.41 to 1.96), confidence interval of 95% for the population average. The percentage of schoolchildren without caries was 46.06% and the prevalence of caries in the studied population was classified as "low".

Interviews were carried out with the parents/guardians of 144 of the schoolchildren taking part in the study. The average age of the parents/guardians was 40 (sd = 7.42), 90% being between 30 and 50 years-old. The average number of years of schooling of the parents/guardians was 6.9; 17.4% were still studying. Approximately 78.47% of interviewees had an average family income of between 1 and 4 minimum salaries; 12.5% between 4 and 7; and 9.2% had income of 8 or more minimum salaries.

Figure 1 shows the graphical representation of the MCA in a two-dimensional plane. A clear division can be noted into two groups of variables, guided by the distance between the points that represent the category variables.

In Figure 1, a pseudo diagonal was constructed passing through the center of dimensions 1 and 2 and RENDA\_A. By projecting the points on the perceptual map on to this diagonal, two contrasting groups can be observed, as follows: GROUP 1 (CPOD\_M, ESCO\_0-4, TRAT\_nece and RENDA\_B) and GROUP 2 (RENDA\_A, ESC\_+9, TRAT\_ñ nece, RENDA\_M and CPO\_B). The factors within each group are connected. The most extreme factors (most inert) possess greater discriminatory power (RENDA\_A, CPOD\_M, CPOD\_A). The two dimensions corresponded approximately to 35% of the total inertia contained in the original data. Although the value seems low, it was possible to explain the associations between factors.

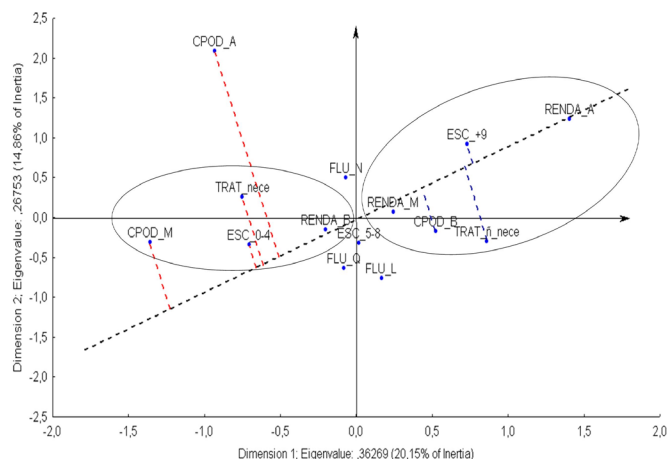


Figure 1. Analysis of the multiple correspondence for the category variables.

## DISCUSSION

Epidemiological studies<sup>16-17</sup> have obtained percentages of overall intra-examiner agreement and a Kappa index similar to those observed in this study, values which are considered by Landis & Kock<sup>18</sup> to be a near perfect agreement, which demonstrates a high degree of reproducibility in relation to the CPOD and affords a guarantee of statistical reliability to the results.

The prevalence of caries is low in 12 year-old schoolchildren in the municipality of Franca, similar to that in other cities in Brazil<sup>17</sup> and comparable to that found in industrialized countries; a continuing decline in caries has been observed; in 1998<sup>11</sup>, the average CPOD was 2.8. According to Pine et al.<sup>19</sup>, the decline in the prevalence of caries has been accompanied by changes that have occurred in the pattern and distribution of the disease.

The decline in the prevalence of dental caries amongst children and adolescents has been reported in various studies<sup>19-20</sup>; however individuals in this age range still display high caries values; this is known as the polarization phenomenon. There needs to be, therefore, a honing of oral healthcare strategies aimed at these groups<sup>19</sup>.

The uneven distribution of dental caries can be seen even in countries with a low prevalence of caries, whose CPOD values are considered by the WHO to be very low (CPOD at 12 years of age  $\leq 1.2$ )<sup>21</sup>. In addition, studies have been finding significant associations between social, economic, behavioral and environmental variables and the experience of caries, in socially deprived individuals and areas<sup>22-23</sup>.

These differences are being well reported by various authors and they characterize significant inequality in health that requires the attention of the authorities and adequate public health intervention<sup>8</sup>.

The association between socio-economic drivers and the presence of dental caries<sup>6,16,24-25</sup>, amongst others, has shown that the worst conditions of oral health cannot be divorced, in particular, from the disparity in incomes and the level of schooling, factors which are indicative of social levels<sup>25-26</sup>.

Taking into consideration the socioeconomic aspects, in a study conducted with schoolchildren of 7, 12 and 14 years of age in the city of Ceuta (Spain), the prevalence of caries in schoolchildren of a low socio-economic level and with the father unemployed, was 1.8 times greater than in schoolchildren with working parents<sup>16</sup>. For Peres et al.<sup>25</sup>, family income was the most relevant socioeconomic factor. Children whose family income was less than 5 minimum salaries were 4.18 times more likely to present with a high severity of caries when compared to those who had a family income above 5 minimum salaries. In the population studied in the municipality of Franca (in the state of São Paulo), we found a greater correspondence between high family incomes and levels of schooling of parents/guardians and low prevalence of caries.

However, in a study carried out with 1,000 schoolchildren in Porto Alegre, a local association was observed between schoolchildren with more than four affected surfaces and parents who did not complete primary education. Schoolchildren without caries were locally associated with parents who had completed higher education, as observed in the present study.

Moreover, for Pine et al.<sup>26</sup>, in a large-scale study conducted in Europe, North America, Africa and Asia, the level of understanding and the attitudes of parents in relation to their own oral health and that of their children is associated with the chances of their children developing caries.

The present study, as with that by Meneghim et al.<sup>27</sup>, on evaluating the relationship between socioeconomic classification and the prevalence of caries and dental fluorosis in Piracicaba, São Paulo, Brazil, only found, with regard to socioeconomic class, a statistically significant association with dental caries.

In a more recent study, also conducted in the municipality of Piracicaba, Pereira et al.<sup>26</sup> concluded that socioeconomic variables are only associated with a greater prevalence of the disease at an individual level.

The decline in the prevalence of caries in Franca could also be associated with the use of fluorides, bearing in mind that 98% of households in the municipality have access to treated, fluoridated water<sup>28</sup>.

Peres et al.<sup>29</sup>, comparing the indices of caries in districts with treated, fluoridated water, in Brazil, with those of districts that do not have this resource, concluded that the fluoridated water was related to an improvement in the indices of caries and, accordingly, it is considered to be an effective strategy for the control of the disease.

According to Balbani et al.<sup>16</sup>, upon analyzing the relationships between dental caries and socio-economic factors in the Brazilian state of Paraná, it was noted that the higher the percentage of households connected to the fluoridated water system, the lower the CPO-D values in the municipalities; in this regard, the importance of this benefit was underscored, not only as a resource for the reduction of levels of caries, but also to soften the impact of socioeconomic inequalities on the prevalence of dental caries.

For Maltz & Barbachan<sup>6</sup>, however, there are few studies that discuss the relationship of prevalence of fluorosis and socioeconomic levels and these generally present conflicting results. In theory, as fluorosis is the result of the combined effects of diverse sources of fluorine, the population with greater access to fluoridated products could present with a higher prevalence of fluorosis, irrespective of socioeconomic levels and the level of schooling of parents, as observed in this study. Similar results were reported by other authors<sup>16-17,30</sup>, who attribute to this measure, the ability to substantially reduce the negative impact of socioeconomic equality on the prevalence of dental caries, even though, notwithstanding, they are not able to neutralize them.

## CONCLUSION

Advanced levels of education and high incomes of parents/guardians are associated with a low prevalence of dental caries and the absence of required treatment; however no association was found with dental fluorosis.

The population in this study presented a low level of dental caries, however, inequalities can be observed and they are associated with socioeconomic conditions; this requires the attention of the authorities and adequate public health strategies.

We would emphasize the need for complementary studies to check for the presence of correlation in areas with greater social privation that exist in the municipality.

## Collaborators

SF MESTRINER, MA MORRAYE, AP AGUILA and W MESTRINER JÚNIOR took part in all stages of the preparation

of the article. AS FERRAUDO participated in the statistical analysis, interpretation of data and the composition of the article.

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