

Dental Needs and Socioeconomic Status Associated with Utilization of Dental Services in the Presence of Dental Pain: A Case-Control Study in Children

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Aims: To identify the effect of unmet dental treatment needs and socioeconomic and sociodemographic variables on the patterns of dental visits in the presence of dental pain in 6- to 12-year-old Mexican schoolchildren. **Methods:** A case-control study included 379 patients that had a dental visit because of dental pain in the 12 months preceding this study and 1,137 controls. Mothers and/or guardians supplied sociodemographic, socioeconomic, and oral health-related information through a questionnaire. The profiles of unmet dental needs and of oral hygiene were ascertained by means of a standardized dental examination administered to participating children. Odds ratios (OR) and 95% confidence intervals (CIs) were calculated with logistic regression. **Results:** Higher unmet dental needs and lack of health insurance were associated with the experience of dental visits because of dental pain in the preceding 12 months. Boys who attended public schools had a 70% (95% CI = 1.29 to 2.23) higher probability of having had a dental visit in which dental pain was one of the main reasons for attendance, compared to boys attending private schools. The effect for girls was only 28% (95% CI = 1.10 to 1.50) higher for girls attending a public school, compared to girls attending private schools. Older children had a higher occurrence of dental visits because of dental pain than younger children. **Conclusions:** While higher unmet dental needs and lack of health insurance were strong predictors of having had dental visits because of dental pain in the preceding 12 months, some socioeconomic variables and sociodemographic variables modified these relationships. J OROFAC PAIN 2010;24:279–286

Key words: case-control study, dental caries, dental pain, Mexico, socioeconomic status, treatment needs, utilization of health services

Oral health is a part of overall health in children. According to studies in many parts of the world, oral illnesses and conditions have an adverse effect on diverse aspects of the quality of life of children.^{1,2} Dental caries is considered a public-health problem in Mexico, and is often identified as one of the unmet oral health needs among Mexican schoolchildren.^{3,4} This situation mimics the overall profile of dental caries in many parts of the world, and is the most common cause of dental pain among children and adolescents.^{2,5,6} According to reports from diverse countries, the prevalence of dental pain among children and adolescents ranges from 5% to 33%⁷ and, among adults, it is between 12% and 40%.⁸ In the case of specific countries, it has been found that a high percentage (70%) of 8- to 10-year-old children in

South Africa reported dental pain during the 2 months prior to the study.⁹ Nomura et al⁵ reported a dental pain prevalence of 33.7% in Brazilian 12- to 13-year-old adolescents, while in 11- to 12-year-old Thai children, the prevalence was 25.1%.¹⁰ In Uganda, dental pain prevalence during the month prior to the survey was estimated at 36.5% in children aged 5 to 7 years and 12 years.¹¹ In Sri Lanka, 31% of 8-year-old children had suffered dental pain during the 2 months prior to the survey.⁶ While differences in research methodology as well as in the reference time used for the estimations contributed to the wide range of prevalences among diverse studies, they largely substantiate the unfortunate fact that many children affected by dental caries suffer from the all too common sequel of pain.

Dental health care may be divided into two general types of attention: curative and/or rehabilitative and preventive services. Different factors determine their use. The utilization of curative and/or rehabilitative services by children and adolescents is often driven by the presence of pain, for example, in Trinidad and Tobago, a high percentage (74%) of dental emergencies among children and adolescents under 16 years of age was related to dental caries. This situation is more common in people of low socioeconomic status.¹² Other studies have generally confirmed these trends in countries as dissimilar as the United States¹³ and Kenya.¹⁴ The key question would be to identify the variables (across settings and situations) that delay timely use of dental services, and that are associated with pain.¹⁵

The present study was carried out in Mexico, where the health-care system is a mixed, fragmented system composed of public services and social security efforts supplied by public institutions, third party payment systems, and private carriers.¹⁶ Employment status, geographic location, and socioeconomic status are the three main variables governing the degree of sophistication of health services available and, in some cases, the extent of overlap across systems for a given person. The social security system has five main institutions: the Instituto Mexicano del Seguro Social (IMSS), which insures workers in the private sector; the Instituto de Seguridad y Servicios Sociales para los Trabajadores del Estado (ISSSTE), which insures workers employed by the various levels of government; the health system supported by the one oil company in the country; and the health systems caring for the army and navy. The latter three systems are more sophisticated than those of IMSS and ISSSTE, both in terms of diversity of services and extent of benefits. A more recent development

is a voluntary public insurance plan encompassing the bulk of nonmandatory, nonemployment-related health services.

The private health-care system is usually a fee-for-service type of payment. About 3% of the overall population has a private medical insurance plan. Cost and quality of the private health-care system is highly heterogeneous and poorly regulated. In 2002, about 49% of the overall population had no insurance (neither public nor private); IMSS insured 40% of the remaining population.^{17,18} The ratio of public to private expenditure varies markedly between states and across populations served by different subsystems.

Dental diseases are assumed to be a public-health problem in Mexico due to their high prevalence and incidence, and they appear to impact the disadvantaged and poor unequally. While dental health care falls by default within the purview of the activities of the Ministry of Health, as well as specifically within the social security system, only a fraction of the treatment variety and burden of clinical services are in fact available through these large systems. Therefore, even patients who have some sort of dental insurance plan might end up seeking private dental care from independent practitioners, incurring out-of-pocket expenditures, or forgoing dental care even when it is needed, eg, because of pain.¹⁹

Even though several studies have focused on identifying the factors associated with the prevalence and severity of pain of dental origin, few of them have characterized the factors associated with the actual dental visit taking place, when pain is one component of the clinical picture. This gap in knowledge weakens the understanding of the relative impact that different variables have on dental health-care utilization because of pain. The objective of the present study was to identify the effect of unmet dental treatment needs and socioeconomic and sociodemographic variables on the patterns of dental visits in the presence of dental pain in 6- to 12-year-old Mexican schoolchildren.

Materials and Methods

The undertaking of this study adhered to the ethical regulations stipulated by the academic organization where data collection and analysis took place, including the signing of an informed consent form.

Design and Study Population

Data used in the present study are part of a more comprehensive research project about oral health in schoolchildren that live in Navolato, a city located in the state of Sinaloa, northern Mexico. More detailed information about the methodology employed has been published elsewhere.^{20,21}

A case-control study was performed in 6- to 12-year-old schoolchildren attending elementary schools. According to the academic census, the original population was 3,547 schoolchildren. After health and educational systems authorized the study, mothers/guardians were invited to participate. The response rate was 87% (n = 3,086). Some children were excluded from the study (n = 38) because they were (1) younger than 6 or older than 12 years of age, (2) had a congenital oral condition, such as cleft lip or palate, or (3) had fixed orthodontic appliances.

Selection of Cases and Controls

Cases. Schoolchildren who visited the dentist at least once during the 12 months prior to the study, and this visit was because they had dental pain, were defined as cases. Questions used to identify cases were: "Have you received any dental care during the last year?" People who responded affirmatively were asked: "What was the main reason for your last visit to the dentist?" All responses that included "dental pain" led to those children being classified as cases (379 schoolchildren).

Controls. From the children population census database, three controls were randomly selected for each case by using STATA 8.2. To attain an age distribution in the controls similar to the overall school population, the selection of controls was made without replacement with proportional probabilities to the number of individuals in each age group (proportional to size probabilities sampling).

Variables of the Study and Data Collection

A questionnaire targeting the schoolchildren's mother and/or guardian (for cases and controls) was used to collect sociodemographic and socioeconomic variables as well as those related to oral health behaviors. The independent variables included in the analysis were age, sex, tooth-brushing frequency, parents' ages, as well as a series of socioeconomic status variables, such as having health insurance and what type, owning a car, family size, and the maximum level of educational

attainment and the occupation of both parents (or any parent present).

Children were clinically examined by three standardized dental examiners ($\kappa > 0.85$) following the World Health Organization's caries criteria²² supplemented by the d_1 lesions from the Pitts classification.²³ A pilot study was performed prior to collecting clinical data to standardize dental examiners in the criteria used. Children participating in the pilot study were not part of the final study population.

Clinical variables were included to measure oral hygiene and caries experience on schoolchildren. The "plaque" component from the Simplified Oral Hygiene Index (SOHI) was the first clinical variable. There were six dental surfaces examined per child in total. The hygiene variable was categorized into three groups, according to the score obtained: (0) was "good," between 0.0 and 1.0; (1) was "moderate," between 1.1 and 1.5; and (2) was "poor," between 1.6 and 3.0.

A variable connoting unmet oral health needs quantified the number of untreated caries lesions in both dentitions. Unmet oral health needs are a larger concept, but for the purposes of the present study, this concept was used as related specifically to untreated carious lesions. The categories for decayed teeth were: (0) "low," between 0 and 3 teeth affected; (1) "moderate," between 4 and 6; (2) "high," between 7 and 9; and (3) "very high," more than 9.

Statistical Analysis

To assemble a variable estimating socioeconomic status, diverse correlated variables were combined using principal components analysis (polychoric correlation)²⁴: schooling and occupation of any parent(s) of record. These variables have been used as proxies to determine the socioeconomic status of children or adolescents in health studies in Mexico.^{3,4,20,25-27} The first component was able to explain 60% of the socioeconomic status variability; the new variable was categorized into tertiles, with the first tertile representing the lowest and the third one the highest socioeconomic status.

For univariate analyses, central tendency and dispersion measures were calculated for the continuous variables, and frequencies and percentages for the categorical variables. The Mann-Whitney *U* test and chi-square test were employed for the bivariate analyses, as well as simple logistic regression. Dental pain was used as an independent variable for the multivariate analysis, and odds ratios (OR) with 95% confidence intervals (CIs) were

Table 1 Distribution of Sociodemographic, Socioeconomic, and Behavioral Characteristics of the Case and Control Children

Variable	Controls n = 1,137	Cases n = 379
Children's age (y)	9.01 ± 1.77	8.65 ± 1.60
Fathers' age (y)	37.56 ± 6.42	37.08 ± 6.45
Mothers' age (y)	34.39 ± 5.68	34.04 ± 5.43
Permanent teeth	13.54 ± 6.37	15.19 ± 6.98
Primary teeth	10.12 ± 5.46	8.74 ± 5.82
Sex		
Boys	529 (46.5)	158 (41.7)
Girls	608 (53.5)	221 (58.3)
Tooth-brushing frequency		
< 7 times/week	510 (44.9)	160 (42.2)
≥ 7 times/week	627 (55.1)	219 (57.8)
Age when tooth brushing started		
> 2 years old	856 (75.5)	304 (80.2)
≤ 2 years old	277 (24.5)	75 (19.8)
Oral hygiene (SOHI)		
Good (0.0–1.0)	675 (59.4)	219 (57.8)
Moderate (1.1–1.5)	349 (30.7)	112 (29.5)
Poor (1.6–3.0)	113 (9.9)	48 (12.7)
Soft drink consumption		
At least one a day	986 (89.2)	332 (88.3)
More than one a day	120 (10.8)	44 (11.7)
Type of school		
Private	193 (17.0)	41 (10.8)
Public	944 (83.0)	338 (89.2)
Family size*		
< 2 children	443 (39.0)	122 (32.2)
≥ 2 children	694 (61.0)	257 (67.8)
Type of health insurance		
Public insurance	779 (68.6)	230 (60.7)
Without insurance	182 (16.1)	82 (21.6)
Private insurance	174 (15.3)	67 (17.7)
Household owned a car		
No	531 (46.8)	199 (52.5)
Yes	603 (53.2)	180 (47.5)
Socioeconomic status		
Low	375 (33.1)	142 (37.5)
Middle	376 (33.1)	116 (30.6)
High	383 (33.8)	121 (31.9)
Unmet dental caries needs [†]		
Low	268 (23.6)	50 (13.2)
Moderate	327 (28.7)	110 (29.0)
High	325 (28.6)	125 (33.0)
Very high	217 (19.1)	94 (24.8)

*Determined as children in the family, [†]Determined as presence of untreated caries. Percent of total numbers are shown in parentheses.

calculated in nonconditional logistic regression analyses. Variables that showed an association at a *P* value < .20 were included in the multivariate model, to control for potential confounding. Using the Box-Tidwell test, the authors tested whether each year's increase in the *logit* of the dependent variable was constant. The Variance Inflation

Factor test was used to analyze and, if necessary, to avoid multicollinearity between independent variables. After fixing the main effects, interactions of interest were tested; those that showed *P* < .15 were included in the final multivariate model. For both bivariate and multivariate analyses, the CIs were calculated using robust standard errors with clusters at school level.²⁸ STATA 8.2 software was used for the analyses.

Results

Basic Results

A total of 379 schoolchildren were classified as cases (children that used dental services when dental pain was one of the reasons, prompting at least one dental visit in the past 12 months) and 1,137 as controls. Table 1 shows the distribution of parents and children for cases and controls. Table 2 shows the crude ORs and 95% CIs of use of dental services. Mean age of parents was not statistically different between cases and controls, but age of children was older among the controls. The proportion of females was also higher among the cases, as well as having poorer oral hygiene, being more likely to attend public schools, belonging to a larger-sized family, not having health insurance, and having higher unmet dental needs. The age that tooth brushing started, owning a car in the family, and socioeconomic status were variables also considered in the final multivariate model (*P* < .20).

Multivariate Results

Table 3 shows the results of the multivariable adjusted logistic regression. The model showed an adequate goodness of fit with a Pearson $\chi^2=141.31$ (*P* = .909), indicating that observed probabilities were similar to estimated probabilities. This model had five main effects and one interaction. Unmet dental caries needs had a stronger effect on dental services associated with dental pain: school children with moderate needs, high needs, and very high needs had higher probabilities of having sought dental care associated with pain than school children with low unmet dental caries needs. Children lacking health insurance had 33% higher probability of having sought dental care associated with pain than children with health insurance (private or public). Older school children had 52% increased probabilities of having sought dental care associated with pain than younger children. Finally, an interaction in the

Table 2 Bivariate Logistic Regression Analyses on Utilization of Dental Services When Dental Pain was Cited as One of the Leading Reasons for Seeking Dental Care

Variable	OR (95% CI)	P value
Children's age		
6 to 9 years	1*	
10 to 12 years	1.55 (1.24–1.92)	.000
Sex		
Boys	1*	
Girls	1.22 (1.06–1.40)	.006
Tooth brushing frequency		
< 7 times/week	1*	
≥ 7 times/week	1.11 (0.87–1.42)	.387
Age when tooth brushing started		
> 2 years old	1*	
≤ 2 years old	0.76 (0.56–1.04)	.087
Oral hygiene (SOHI)		
Good/moderate (0.0 – 1.5)	1*	
Deficient (1.6 – 3.0)	1.31 (1.03–1.68)	.031
Soft drink consumption		
At least one a day	1*	
More than one a day	1.09 (0.66–1.81)	.741
Type of school		
Private	1*	
Public	1.69 (1.48–1.92)	.000
Family size*		
< 2 children	1*	
≥ 2 children	1.34 (1.02–1.77)	.034
Type of health insurance		
Public insurance	1*	
Without insurance	1.53 (1.20–1.94)	.001
Private insurance	1.30 (0.96–1.77)	.087
Household owned a car		
No	1*	
Yes	0.80 (0.63–1.01)	.057
Socioeconomic status		
Low	1.21 (0.99–1.49)	.063
Middle/high	1*	
Unmet dental caries needs [†]		
Low	1*	
Moderate	1.80 (1.12–2.91)	.016
High	2.06 (1.36–3.13)	.001
Very high	2.32 (1.38–3.92)	.002

Note: 95% CIs estimated with robust standard errors (school clustering).
*Reference category, [†]Score test for trend of odds: $P < .0001$.

model showed that the effect of seeking dental service associated with pain was different across sexes. Boys who attended public schools had 70% higher probability of having had a dental visit in which dental pain was one of the main reasons for attendance, compared to boys attending private schools. The effect for girls was only 28% higher for girls attending a public school, compared to girls attending private schools.

Table 3 Multivariate Analyses of Logistic Regression on Utilization of Dental Services When Dental Pain was Cited as One of the Leading Reasons for Seeking Dental Care

Variable	Coefficient	OR (95% CI)	P value
Children's age			
6 to 9 years		1*	
10 to 12 years	0.4207	1.52 (1.20–1.93)	.001
Sex (A)			
Boys		1*	
Girls	0.4144	1.51 (1.28–1.79)	.000
Type of school (B)			
Private		1*	
Public	0.5297	1.70 (1.29–2.23)	.000
Type of health insurance			
Public insurance		1*	
Without insurance	0.2844	1.33 (1.01–1.74)	.039
Private insurance		1*	
Unmet dental caries needs			
Low		1*	
Moderate	0.5262	1.69 (1.07–2.68)	.025
High	0.6612	1.94 (1.29–2.91)	.002
Very high	0.8173	2.26 (1.36–2.76)	.002
Interaction (A) (B)	–0.2781		.010
Effect of attending public school among boys	0.5297	1.70 (1.29–2.23)	.000
Effect of attending public school among girls	0.2517	1.28 (1.10–1.50)	.001

*Reference category; model adjusted for variables in the Table, as well as family size and socioeconomic status; 95% CIs estimated with robust standard errors (school clustering); goodness of fit test: Pearson $\chi^2(165) = 141.31$; $P = .9091$; specification error test: estimator $P = .040$; estimator² = 0.658.

Discussion

Pain is an important component (sometimes the only manifestation) of a variety of illness processes, thus becoming a priority issue in clinical practice.²⁹ From an oral health perspective, some authors consider dental pain as one of the most severe types of pain³⁰ and one of the main reasons for the public to seek professional dental services.³¹ Having difficulty eating, sleeping, attending school, and playing are the main consequences for children.³²

This study showed that diverse variables had an effect on the probability of seeking dental services because of pain of dental origin. To better explain these variables, it is necessary to summarize some of the basic features outlined above of the dental care delivery system in the country. In Mexico, dental services are offered through the public system managed by the Ministry of Health but also by the private sector, which is usually restricted to those segments of the population with greater ability to pay for care at point-of-service.²⁸ The public health-care system covers only a small portion of the treatment demand and, thus, in many instances the public has to pay out-of-pocket for the clinical services needed. This feature is a financial barrier in access to care for those segments of the population with fewer financial resources.^{19,25} If we consider that the specific position of a person within the socioeconomic gradient is closely associated with morbidity, it may be inferred that such a “social health gradient” is a conglomerate of factors whereby the inequities affecting the distribution of health conditions are related to the inequities of social status. However, the exact mechanism by which socioeconomic position is related to both health status and perceived need to seek and access health services is not clear. To improve understanding of this complex phenomenon, it is important to take into consideration the multidimensional construct of socioeconomic status, which covers different circumstances (social and financial). These circumstances can be measured using different indicators.³³ Although in the present study the indicator variable of socioeconomic status did not remain significant in the multivariate model, two other variables related to socioeconomic position did: having publicly-funded health insurance and the type of school attended (public or private). Prior studies in adults have shown that people from a low socioeconomic status are less likely to seek professional care when suffering dental pain.³¹ The results of the present study suggested the opposite, since low socioeconomic status schoolchildren had a higher probability of having had dental care associated with dental pain. These results are consistent with studies investigating dental pain^{5,6,12,34} and use of dental care in other less developed countries and/or settings. Pain was often one of the components of the clinical picture. In the Mexican environment, this specific association may be due to the fact that children with lower socioeconomic status have more unmet dental needs,^{3,4} which at one stage or another of the carious processes become associated with pain. It

is reasonable to assume that children with a higher socioeconomic status might have fewer dental health needs as a consequence of using preventive services—and/or using them more regularly—on account of having fewer economic barriers. But given the characteristics and limitations of the present study, it is impossible to offer a definitive answer to this speculation.

Although the socioeconomic variable “attending a public school” had an effect on dental services because of pain, this effect depended on the sex of the child. This is the first study on dental pain that shows the effect of a variable of socioeconomic status modified by a sociodemographic variable. In general, females have more numerous health needs,^{3,4} higher prevalence of dental pain,³⁵ and use dental services more frequently²⁶ compared to males. Conversely, the present study found that boys had higher OR than girls if they attended public schools.

Age was also a factor in this child population: older children were more likely to have had dental services than younger children. The simple fact that teeth had been exposed to environmental insults for a longer period of time in the mouths of older children may indirectly increase the probability of having a more advanced stage in the continuum of dental disease.^{3,4,20} Not uncommonly, studies have observed that young people report dental pain more frequently than adults, but the reasons for seeking care vary.³⁵ It can be speculated that adults tolerate a more severe degree of dental pain than children within a similar socioeconomic status and/or defer treatment for longer because of financial constraints.

The unmet dental needs variable had a substantial effect on dental services associated with pain. The present study showed that children with higher unmet needs (specifically, untreated dental caries) had a different pattern of dental visits associated with dental pain than children with other profiles of dental needs. Past studies on children have found that dental pain is reported because of advanced caries and higher unmet dental needs among children,^{2,5,6} to the point of dental caries being the main reason for attendance at pediatric emergency room clinics.¹²⁻¹⁴ The role of high unmet treatment needs and pain generally coincides with reports derived from adult populations.³⁵

The present study had some inherent design limitations. First, it was not able to identify the exact origin of the dental pain, and while it seems somewhat safe to ascribe pain to dental caries in this population group, other causes may be implicated to a lesser extent (eg, trauma). Despite the fact that

dental caries and its consequences have been identified as one of the main causes of dental pain, it is not possible to ensure that this link existed throughout every subject in this study. On the other hand, not every case of dental pain might have been included in the analysis, since it was possible that not all the children with dental pain had received care from a dentist. The authors have recently shown from national data in Mexico that about 50% of people who self-reported a dental problem did not seek dental care.²⁸ Because the dental examination was carried out after the occurrence of the dental visit associated with dental pain, the present study might have underestimated the number of, and the severity of decay in, carious teeth. If some of these teeth were treated during the prior, recent dental visit, the effect of the unmet dental needs would be underestimated and the real effect can be assumed to be higher. Finally, the study population is representative of that age group in a midsize city in northern Mexico, but no further inferences at the national or regional levels can be made.

Despite these limitations, the present study suggested that unmet dental needs are predictors of dental services associated with dental pain among Mexican schoolchildren from 6 to 12 years of age. Some indicators of socioeconomic status (such as having health insurance, whether public or private insurance, and the type of school attended [public or private]) were also related to the occurrence of dental services associated with dental pain. To the authors' knowledge, this is the first time that type of school (a socioeconomic status variable in the Mexican environment) had an effect over use of dental services associated with dental pain, and was subsequently modified by the child's sex. Even in an emerging economy such as Mexico, finding that the more economically successful segments in societies manage to reduce their risk of ill health hardly contributes new knowledge to the mechanics of health disparities. On the one hand, the present information should help to focus in greater detail those strategies aimed at reducing unmet oral health needs among schoolchildren and, therefore, ameliorate current inequalities in dental health status. Future studies need to identify why people in these age and socioeconomic groups do not use dental services despite having pain of dental origin. On the other hand, corroborating that social determinants of poor oral health exist along clearly delimited sociodemographic gradients is a reminder that health promotion should begin by addressing environmental, socioeconomic, developmental, and lifestyle components that are con-

ducive to worsening health outcomes. The present results carry the risk of being used to support arguments for merely more dentists and better access to reparative treatment, while neglecting the importance of real risk factors such as poverty, poor education and health customs, and limited access to healthy dietary patterns. From an operational perspective, future interventions should attempt to identify culturally acceptable, economically viable, and clinically sound programs that address the challenges of pursuing overall oral health promotion.

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