Social Context and Dental Pain in Adults of Colombian Ethnic Minority Groups: A Multilevel Cross-Sectional Study

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Aims: To estimate the effect of social context on dental pain in adults of Colombian ethnic minority groups (CEGs). **Methods:** Information from 34,843 participants was used. A multilevel model was constructed that had ethnic groups (ie, CEGs and non-CEGs) at level 1 and Colombian states at level 2. Contextual variables included gross domestic product (GDP), Human Development Index (HDI), and Unmet Basic Needs Index (UBNI). **Results:** Dental pain was observed in 12.3% of 6,440 CEGs. In an unadjusted logistic regression model, dental pain was associated with being a CEG (odds ratio [95% confidence interval], 1.34 [1.22–1.46]; $P = .0001$). This association remained significant after adjusting for possible confounding variables. An unconditional multilevel analysis showed that the variance in dental pain was statistically significant at the ethnic group level ($\beta = 0.047 \pm 0.015$; $P = .0009$) and at the state level ($\beta = 0.038 \pm 0.019$; $P = .02$) and that the variation between ethnic groups was higher than the variation between states (55% vs 45%, respectively). In a multivariate model, the variance in dental pain was also statistically significant at the ethnic group level ($\beta = 0.029 \pm 0.012$; $P = .007$) and the state level ($\beta = 0.042 \pm .019$; $P = .01$), but the variation between states was higher (40% vs 60%). The results of multilevel multivariate analyses showed that dental pain was associated with increasing age ($\beta = 0.009 \pm 0.001$; $P = .0001$), lower education level ($\beta = 0.302 \pm 0.103$; $P = .0001$), female sex ($\beta = 0.031 \pm 0.069$; $P = .003$), GDP ($\beta = 5.136 \pm 2.009$; $P = .002$) and HDI ($\beta = 6.862 \pm 5.550$; $P = .004$); however, UBNI was not associated with dental pain. **Conclusion:** The variance in dental pain was higher between states than between ethnic groups in the multivariate multilevel model. Dental pain in CEGs was associated with contextual and individual factors. Considering contextual factors, GDP and HDI may play a major role in dental pain prevalence. *J Oral Facial Pain Headache 2016;30:21–26. doi: 10.11607/ofph.1524*

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Pain presents clinical, social, and economic difficulties, and estimations of its frequency vary from 8% to more than 60% among different populations.[1] Oral pain is a common sign of several diseases affecting the facial and oral tissues; in the United States, for example, oral pain is estimated to occur in 22% of adults aged 18 years or older.[2] Additionally, an increase in oral pain over a 10-year period, concurrent with social and demographic changes, has been observed in Sweden.[3]

Dental pain reflected in pain involving innervated dental tissues is usually a result of dental caries.[4] Conditions such as erosion and trauma can also cause dental pain.[3,4] Some objectives of the Global Goals for Oral Health 2020, developed jointly by the World Health Organization, the FDI World Dental Federation, and the International Association for Dental Research, include decreasing dental pain and decreasing absence from employment because of oral and craniofacial health problems.[5]

Studying a self-described health condition is a conventional approach for estimating the prevalence of sickness in people and is an option for evaluating dental pain in large population studies.[6–10]

Racial and ethnic inequalities in dental health exist,[11,12] and important racial and ethnic disparities have been demonstrated.[13–15] Inequalities have been attributed to a complex system of communal, emotional, and organizational features.[16] Nevertheless, these variations could be genetic or caused by contextual confounders[17]; consequently, inappropriate treatments have been observed in minority groups.[18,19]

Colombia is a multicultural, multiethnic, and multilingual country. Approximately 6 million (14.1%) Colombians belong to ethnic minority groups, and five ethnic groups have been differentiated: Afro-descendant (10.5%), Indigenous (3.4%), Raizal (0.08%), Palenquero (0.07%), and Romani (0.01%). Colombia also has persons of Native American, African, and European genetic ancestry, many of whom are descendants of immigrants brought by the slave trade and European settlement and indigenous Native American populations.[20]

Individual features do not sufficiently account for the occurrence and distribution of illness among a population.[21] The application of a multilevel analysis includes the estimation of contextual characteristics and their interactions with oral health.[22,23,24] Three multilevel studies have been published on the social determinants of dental pain,[6–8] all of which have been performed in Brazil. However, none of these studies reported whether individual- or contextual-level factors explain variability in dental pain. Therefore, the aim of the present study was to use a multilevel methodology to estimate the effect of community context on dental pain in adults of Colombian ethnic minority groups (CEGs).

Materials and Methods

Record Sources

Records were obtained from the 2007 National Public Health Survey in Colombia.[25] This survey was directed by the Colombian Ministry of Social Protection, including the 32 states of Colombia and Bogotá, the capital district. A multiple stage–stratified sampling method was used, in which the last-stage units were family households. Records were gathered by interviewing one adult from each household between January 2007 and April 2008. Detailed descriptions of this methodology have been published previously.[26] For the current study, data from 34,843 adults aged 18 years or older were used.

Information regarding ethnic origin was collected by asking the question, "Which of the following ethnic groups do you belong to?" The question offered five options for response: "Indigenous," "Romani," "Raizal," "Palenquero," or "Afro-descendant." In the general survey, a large number of respondents did not respond to this question because only 14% of Colombians belong to ethnic minority groups.[20] For that reason, another classification ("rest of the population") was included in the present study. For the following analyses, this group will be the reference unit.

In accordance with previous studies,[6–8] dental pain was investigated by asking the question: "Have you had a toothache during the last month?" The response options were "yes" or "no."

Contextual information was obtained from diverse databases of the National Demographic Census. Data on the health of the population were collected from the Colombian Ministry of Health.

Because this research used secondary data obtained from many available data series, it did not necessitate informed consent; however, informed authorization was obtained for the 2007 National Public Health Survey (no. 519–2008) by the Ministry of Social Protection of the Colombian government.

Statistical Analyses

The normal distribution of quantitative variables was confirmed using a Kolmogorov-Smirnov test. Chi-square tests were used for qualitative variables, and an independent t test was applied to define the statistically significant differences between groups (participants who reported their ethnic background vs participants from the rest of the population). The discriminative value of dental pain for CEGs was analyzed using logistic regression; first crudely and then adjusting for possible confounding variables such as sex (male, female), age (in years), and education level (with college education, without college education, high school, elementary school, or no education). Adjusted odds ratios (ORs) were presented with 95% confidence intervals (CIs) for each variable. The model assumptions were proven. P values < .05 were considered statistically significant. These analyses were performed using SPSS statistical software (version 18.0; SPSS).

Subsequently, the effect of diverse factors on the dependent variable (dental pain) was studied using multilevel models. A two-level random intercept regression model was composed, with ethnic groups at level 1 and Colombian states at level 2 (32 states and Bogotá). A variance model (null model) was created using dental pain as the dependent variable but without adding explanatory variables. The null model was applied to estimate the complete variability in dental pain and to attribute it to levels 1 and 2. Then, sequences of explanatory variables were integrated (covariate model). This additional phase permitted the inspection of the association between each covariate and the dependent variable. This methodology has been used previously by the present study's research team.[26]

The explanatory variables at level 1 were sex (male or female), age (in years), and education level (without a college education or with college education). The explanatory variables at level 2 were gross domestic product (GDP; the summative amount of production equivalent to the total of the gross values of all resident institutional units involved in production by region or state), Human Development Index (HDI; the arithmetic mean of the indicator's income, education, and longevity, with equal weights), and Unmet Basic Needs Index (UBNI; the access to a dwelling that guarantees a minimum housing standard [construction materials and overcrowding], the presence of fundamental hygienic facilities in the residence, the access to elementary education, and the economic means to obtain minimum consumption levels).

The model assumptions were tested (independence of the observations was conditional on the explanatory variables and uncorrelated residual errors). The Multilevel Models Project Institute of Education statistical package was used for multilevel analysis (version 2.16, MLwiN).

Results

This multilevel cross-sectional study included 34,843 persons in 32 Colombian states and Bogotá.

Fifty-seven percent of the participants were women. A small proportion of participants had received a college education (8.2%). The mean age of the participants was 39.4 years. In addition, 18.5% of the participants reported their ethnic group. Dental pain was observed in 10% of the total sample and in 12.3% of CEGs.

Dental pain varied greatly by Colombian state, with findings ranging from 5.8% to 15.7%. The values for GDP, HDI, and UBNI represent better socioeconomic conditions in Bogotá (Table 1).

Table 2 depicts the sociodemographic characteristics and the dental pain of CEGs. Significant differences were observed between CEGs and the rest of the participants for dental pain; elementary and high school education; and GDP, HDI, and UBNI values. Variables were less favorable for CEGs.

A statistical analysis was performed to test differences between ethnic groups related to dental pain; the results did not show heterogeneity (chi-square test; $P = .82$). Additionally, no association was found between GDP, HDI, and UBNI ($P = .7$, $P = .5$, $P = .9$, respectively); consequently, the collinearity was excluded.

Table 1 Percentage of Dental Pain, Percentage of CEGs, and Contextual Variables of 32 Colombian States and Bogotá[a] (n = 34,843)

Location	Dental pain (%)	CEGs n (%)	GDP	HDI	UBNI
32 Colombian states	10.3	5,853 (16.8)	0.65	0.75	24.7
Bogotá[a]	10.1	587 (1.7)	0.75	0.83	6.6
Total	10	6,440 (18.5)	0.70	0.78	19.3

[a]The capital district.
CEGs = Colombians of ethnic minority groups; GDP = gross domestic product; HDI = Human Development Index; UBNI = Unmet Basic Needs Index.

Table 2 Comparison of Sociodemographic Characteristics and Dental Pain of CEGs (n = 6,440) vs Those in the Rest of the Sample (n = 28,403)

Parameter	CEGs	Rest of the sample	P value
Mean age (y) ± SD	39.5 ± 14	39.1 ± 13	.08
Sex (%)			
Female	51.5	58	.1
Male	48.5	42	.1
Education level (%)			
Without studies or elementary school	48.9	45	.03
High school	43.4	46.7	.04
College education	7.7	8.3	.5
Dental pain (%)	12.3	10	.04
GDP	0.63	0.70	.0001
HDI	0.75	0.78	.0001
UBNI	32	20.7	.0001

CEGs = Colombians of ethnic minority groups; GDP = gross domestic product; HDI = Human Development Index; UBNI = Unmet Basic Needs Index.

The unadjusted logistic regression model showed that dental pain was associated with being a CEG (OR [95% CI], 1.34 [1.22–1.46]; $P = .0001$). This association remained significant after adjusting for possible confounders (Table 3). Increased age, sex, and elementary and high school education were statistically significant. Moreover, the OR of reporting dental pain was 16% lower among male participants than among female participants (OR [95% CI], 0.84 [0.78–0.91]; $P = .001$).

To analyze the social contextual effects on dental pain in CEGs, all data series were studied with multilevel regression (Table 4). A total of 32 Colombian states and Bogotá and 6,440 CEGs were incorporated in the multilevel evaluation. Model one revealed that the variance in dental pain was statistically significant at level 1 and level 2 (Table 4). The variation between states (45%) was smaller than that between ethnic groups (55%). Regression estimations and examination of significance for all ethnic and contextual features were likewise achieved (model two). Regression analysis for covariates is shown in Table 5. After controls were applied, state-level variance was still significant at level 1 and level 2; it is important to note that the variation in the ethnic group level was smaller (40%) than the variation

Table 3 Logistic Regression Analysis of Dental Pain in CEGs

Variable	Adjusted model[a] OR (95% CI)	P value
Ethnic minority	1.34 (1.22–1.46)	.0001
Age (y)	1.01 (1.007–1.013)	.0001
Sex (male)	0.84 (0.78–0.91)	.0001
Education level	1.17 (1.1–1.25)	.0001

[a]Adjusted for age, sex, and education level.
CEGs = Colombians of ethnic minority groups; CI = confidence interval; OR = odds ratio.

Table 4 Multilevel Logistic Regression Model Estimating the Relative Contribution of Individual and Contextual Parameters to the Variability in Dental Pain of Adults Living in 32 Colombian States and Bogotá[a] (n = 6,440)

Intercept	Empty model β ± SE	P value	Multivariate model β ± SE	P value
Variance	2.193 ± 0.054	.0001	2.045 ± 0.064	.0001
State (level 2)	0.038 ± 0.019	.02	0.042 ± 0.019	.01
Ethnic group (level 1)	0.047 ± 0.015	.0009	0.029 ± 0.012	.007
Total variance	0.085		0.071	

[a]The capital district.
SE = standard error.

Table 5 Multilevel Multivariate Logistic Regression Model Assessing the Significance of Ethnic and State Parameters on the Variability in Dental Pain of Adults Living in 32 Colombian States and Bogotá[a] (n = 6,440)

Parameter	Dental pain (β ± SE)	P value
Ethnic group (level 1)		
Age	0.009 ± 0.001	.0001
Sex	0.031 ± 0.069	.003
Education level	0.302 ± 0.103	.0001
State (level 2)		
GDP	5.136 ± 2.009	.002
HDI	6.862 ± 5.550	.004
UBNI	0.010 ± 0.011	.9

[a]The capital district.
SE = standard error; GDP = gross domestic product; HDI = Human Development Index; UBNI = Unmet Basic Needs Index.

between states (60%). Each level 1 variable had a statistically significant association with dental pain. Low GDP and HDI values at level 2 were associated with dental pain, but UBNI was not.

Discussion

This study analyzed the effect of social context on dental pain in CEGs. The applied hierarchical analysis considered features from the contextual level as being intermediaries to the complete complex of personal determination.[26]

Because the validity of self-reported dental pain data has been confirmed previously,[6–8] the present study asked about dental pain by using one dichotomous question. Self-reported information is adequate for studying oral health.[27,28] In addition, data on dental pain in multilevel studies have also been collected by using a questionnaire administered to adolescents[6,7] and adults[8] in Brazil. In this study, 12.3% of CEGs described dental pain; comparable numbers have been reported in previous studies.[8,9]

In the current investigation, the variables of dental pain, elementary education, high school education, GDP, HDI, and UBNI were less favorable in CEGs compared with the rest of the study sample. These findings are consistent with the report that low financial status and fewer educational opportunities were significant risk factors for toothache pain in 724 participants in the Florida Dental Care Study.[9] Additionally, in a study of older adults, participants who were black described more social impact on the expression of pain.[10]

Ecologic and population factors may have a larger effect than personal characteristics on risk factors related to the occurrence and progress of illness in ethnic minority subgroups.[18,19] Policymakers, public health officials, and other health care providers need to understand how social factors may contribute to racial and ethnic disparities in oral health.[29]

In the current study, dental pain was associated with being a CEG, and the variables of increased age and elementary and high school education were statistically significant. Moreover, the OR of reporting dental pain was 16% lower among male participants than among female participants. The prevalence of self-documented temporomandibular and muscular syndromes has been reported to increase in Hispanic and black females up to 60 years of age and remain higher in these participants than in white participants.[14] Additionally, Constante et al[30] reported a greater incidence of dental pain among black participants in an observational investigation in Brazil. These results emphasize the importance of prevention and timely intervention for racial, ethnic, and socioeconomic minorities to prevent oral health disparities in later life.[11] Some authors also reported dental pain differences in relation to sex.[9,31] Social, cultural, and environmental factors may predispose women to report health problems more frequently than men.[32]

In the current investigation, disparities associated with pain were observed between states and Bogotá. A comparable result has been found in Brazil.[6] Sufficient funds for oral health could alleviate these disparities.

Although smoking habits were not addressed in the current investigation, some authors have reported that persons who smoke have a higher risk of reporting pain.[30,33] Nevertheless, the frequency of smoking in Colombia is low compared with other countries in Latin America (Colombia, 12.8%; Brazil, 21.6%; Mexico, 24.8%; Argentina, 29.4%; Uruguay, 30.7%; Chile, 45.4%),[34,35] and this behavior may not have influenced the occurrence of dental pain in this research. Smokers have more accumulation of plaque and saliva, altering the enamel that protects the teeth during remineralization.[36]

The present results indicate that contextual features influence dental pain. Community effects have also been found for dental pain according to some reports[6–8,37]; nevertheless, these studies did not report if variability in dental pain was associated with personal or contextual factors.

In the current study, increased dental pain was associated with low GDP and HDI values in CEGs. The World Health Survey conducted in 70 nations confirmed that for people in countries with advanced GDP, health disparities are lower.[36,38] In contrast, a higher HDI was substantially associated with dental pain in teenagers from Brazil after controlling for sex, skin color or race, and income,[7] which showed that contextual and personal variables were probable causes.[39]

The strengths of this investigation include national representative data and the use of multilevel models; therefore, it was reasonable to use this data to investigate the effects of personal and community characteristics on dental pain. Additionally, markers of contextual growth were analyzed.[37] However, a weakness of this investigation was its cross-sectional design. This design did not allow for an exploration of causality. In addition, the outcome variable analyzed in this study was self-reported.

Conclusions

The variance in dental pain was higher between Colombian states than between ethnic groups in the multivariate multilevel model. Dental pain in CEGs was associated with contextual and individual factors. Considering contextual factors, GDP and HDI may play a major role in dental pain prevalence; consequently, these results have important implications for dental public health.

Acknowledgments

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