Neighborhood Social Capital and Dental Injuries in Brazilian Adolescents

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Objectives. Evidence suggests that communities with higher levels of social capital have better health, but this association has not been explored specifically in relation to dental injury. We investigated the association between social capital and dental injury.

Methods. We conducted a multilevel study assessed individual and neighborhood effects on dental injury of 1302 14- to 15-year-old adolescents in 39 schools of Distrito Federal, Brazil. Children underwent a dental examination and, with their parents, answered a questionnaire about their local environments. Our data analysis used logistic multilevel modeling of students and neighborhood (the latter defined by catchment areas of schools).

Results. The prevalence of dental injury was significantly lower in neighborhoods with higher levels of social capital, especially among boys. After control for individual and neighborhood variables, the adjusted odds ratio for a 1-unit increase in the standardized social capital index was 0.55 (95% confidence interval = 0.37, 0.81; $P = .002$) among boys.

Conclusions. Social capital may explain inequalities in rates of dental injury, especially among boys. (*Am J Public Health.* 2006;96:1462–1468. doi:10.2105/AJPH.2005.066159)

Despite methodological inconsistencies, recent evidence suggests that social capital, the norms and networks that enable people to act collectively, may have an important influence on health. People in societies with higher levels of social capital live longer, have lower premature mortality rates, are less violent, and have lower levels of self-perception of poor health.[1] However, there are very few studies of the effects of social capital on injury. One study investigating accidental injury and several other causes of mortality in 39 US states found that mortality rates from injury were higher in states with higher mistrust, lack of fairness, and low perceived helpfulness between community members.[2] However, the estimated regression coefficients for social capital were substantially attenuated and became nonsignificant after the introduction of an area-level poverty variable to the statistical model.

Using dental injury as a measure for general injury, Moyses[3] reported that a 3-item social cohesion index, as measured by a community's participation in health and social care conferences, the community's associations with other communities, and the presence of local health committees, was not significantly associated with dental injury, but an index of supportive policies, policies that support implementation of public day care centers, healthy food projects in schools, and adequate community dwellings, was. Others have assessed the relations between the prevalence of dental injury and supportive health-promoting school environments that may be an indirect measure of area-level social capital.[4,5] After adjusting for gender, time at school, and household income, Moyses et al.[4] predicted that a 5% decrease in the percentage of children with dental injury would be expected in supportive compared with nonsupportive schools. Similarly, Malikaew et al.[5] found significantly lower rates of dental injury in supportive compared with nonsupportive schools in Thailand after taking into account a contextual variable of physical environment and some individual-level variables (odds ratio=0.68; 95% confidence interval [CI]=0.49, 0.93).

Very little is known about area-level determinants of dental injury, and the current literature is only indirectly related to social capital theory. Therefore, we investigated the influence of contextual and individual risk factors associated with dental injury.

We hypothesized that the prevalence of dental injury was lower in neighborhoods with higher social capital levels. Dental injuries have long-lasting impacts on oral health–related quality of life and are seldom treated in most countries, making the presence of these types of injuries a good measure for dental health. Further, dental health and general health share many of the same determinants, so the same forces that normally cause body injuries also cause dental injuries. Neighborhoods with higher levels of social capital will have better social networks and environments that produce less dental injury because the conditions that would produce the trauma are not or are less present.

Several factors justify this study: it introduces a social perspective to explain dental injury, a subject mostly investigated in terms of individual risk factors such as gender, age, tooth overjet, lip coverage, and obesity[6]; the use of neighborhood factors is a subject that has not been fully explored in other studies. The association between social capital and dental injury also has been chosen because of the potential benefit of social capital in improving these injury rates. Furthermore, if disparities in dental injury can be explained by disparities in social capital, then injury reductions might be achieved by changes in policy.

METHODS

The research was conducted in 2 cities (Taguatinga and Ceilândia) of the Distrito Federal, Brazil. They were chosen for logistic reasons: proximity and size (they are large and therefore socially diverse). Data were collected at student and neighborhood levels. At the student level, data were collected by clinical examination and self-administered questionnaires. Data at the neighborhood level (defined by catchment areas of schools) were collected from parents with self-administered questionnaires brought home by their children. Other

neighborhood variables were calculated from census data.

A pilot study of 131 children and their parents from 10 schools assessed validity and reliability of the study instruments and obtained reliable estimators for sample size calculations. The required sample size, calculated with dental caries as the outcome, because it required the largest sample size of any of the outcomes of interest, was estimated as 1000 adolescents in 40 schools (20 schools per city and 25 students per school). The sample was increased to allow for nonresponse. A total of 1500 adolescents in 40 selected schools were invited to participate in the study. For dental injury, the sample size provided, at the 5% level, 88% ability to detect an 11% difference between high and low social capital areas. This calculation was based on pilot study data indicating a 30.2% prevalence of dental injury in low social capital areas and 19% in high social capital areas, as well as an intraclass correlation coefficient of 0.032.[7]

The population studied consisted of 14- and 15-year-old adolescents attending urban public (state-funded) schools in Distrito Federal. This age group was chosen because all permanent teeth, except third molars, have erupted and have been in place for 2 to 8 years in this demographic; thus, the cumulative effect of dental injury can be observed.[8] In addition, it is assumed that this age group is mature enough to complete the questionnaire, and it is one of the last age groups in which a valid sample can be obtained from the educational system. According to official statistics, 3% of children of this age did not attend school in Distrito Federal.[9] Children from public schools were chosen because there are no catchment area criteria for enrolling in private schools; consequently, private school students do not reside in clearly defined areas around their schools.

The 2-stage sampling method consisted of taking a random sample of first-stage units (schools), then taking a random sample of second-stage units within each school (students). Private, rural, and special schools (for children with disabilities and learning difficulties) were excluded, as were schools with less than 25 eligible children. The total number of 14- and 15-year-old adolescents in Taguatinga and Ceilândia was 25 628 in 2002; of these, 16% were from private schools, 2.4% were from rural schools, and less than 1% were from small schools.[9]

Digital maps of each enumeration district (the smallest unit of census information provided, averaging 3000 households and 1000 people) were obtained from the Brazilian Institute of Geography and Statistics.[10] The catchment areas of schools were mapped, aggregating the corresponding enumeration districts. The mean numbers of enumeration districts, households, and population per catchment area were 16.7 (SD=7.4), 3535 (SD=1557), and 13 158 (5908), respectively. Adolescents not living in the enumeration districts within the catchment area of their school were excluded.

Data collection was carried out over 8 months in 2002. Dental injury to anterior teeth (the 4 upper and 4 lower incisors) was defined as fractures and avulsions caused by physical contact and were measured using sterilized mouth mirrors and periodontal probes (WHO-621; World Health Organization, Campo Mourão, Brazil), according to criteria used in the United Kingdom[11] and reported by Cortes et al.[8,12] Examinations were carried out by 1 examiner (MPP) at schools. Intraexaminer diagnostic consistency was assessed by duplicate examinations on 5.5% of participants using the κ statistic on a tooth-by-tooth basis.

There are no agreed-upon standard criteria to measure social capital. We defined the term as the norms and networks that enable people to act collectively.[13] A 30-item social capital index (available as a supplement to the online version of this article) was created by the authors on the basis of commonly used themes in social capital literature[14–16] and was refined on the basis of findings from the pilot study. Five dimensions, confirmed using principal component analysis, comprised social capital: social trust, social control, empowerment, neighborhood security, and political efficacy. Social trust refers to people's perception of trust, connectedness, and solidarity in their neighborhood. Analysis of perceptions of community social control assesses whether neighbors would intervene in situations in which children were engaging in delinquent behavior.[14] Empowerment was defined as social actions taken by neighbors to improve their neighborhood. Political efficacy referred to people's perceptions of the political system and politicians.[16] Finally, because the members of less violent communities have more income equality and there is more trust between community members,[17] the conceptual framework included people's perception of security in the area as a component of social capital.

The social capital variable was created as follows[14]: negative items were reverse-coded so that all items ranged from low to high social capital. Because of differences in contribution of items to each social capital subscale, raw scores of items were weighted according to their respective value in the rotated component matrix of the principal component analysis (a table of items and dimensions comprising the social capital index is available from the authors). Unweighted analysis produced similar results. Weighted values for each item were then added up according to their subscale. Because of differing numbers of items comprising each subscale, the final scores of each subscale were standardized to create z scores (mean=0; SD=1), so that the subscales were comparable and could be summed up to form the social capital variable. This information was based on answers to the parents' questionnaire (n=816), and the mean scores for each catchment area were used as secondary-level variables.

Data from the Brazilian Census 2000[7] were used to create the Poverty Gap Index[18] and an infrastructure variable. The poverty variable was calculated with the software POVCAL (World Bank, Washington, DC), which permits the calculation of poverty data from grouped data. Income data was obtained from the 2000 Census. The index is expressed as the proportion of the poverty line and increases as income drops further below the poverty line, thus giving a good indication of the depth of poverty. The nonpoor are counted as having a zero poverty gap. In other words, it indicates how much money would have to be transferred to the poor to bring their incomes up to the poverty line. The poverty threshold for Brazil in July 2000, US$78 per month (the equivalent of 1 Brazilian minimal wage [the minimum wage Brazilian workers can earn monthly]), was used for calculation of the index.[19]

The Institute of Geography and Statistics also provides detailed digital maps for each

enumeration district.[10] These maps served as a basis for assessing the infrastructure of each catchment area. The infrastructure was assessed in terms of rates of leisure time; religious establishments; security, educational, and health facilities; and philanthropic and social organizations per 10 000 inhabitants in the neighborhoods.

The individual variables included in the models were age (14 or 15 years of age), lip coverage (whether the teeth were ordinarily covered by the lips when child was sitting and at rest),[20] occlusal overjet of anterior teeth (the horizontal relation of the incisors when the teeth are in centric occlusion measured as the distance from the labial–incisal edge of the most prominent upper/lower incisor to the labial surface of the corresponding lower/upper incisor),[21] and overweight/obesity (determined by body mass index).[22] These variables have been shown to be associated with dental injury. Lip coverage and overjet are anatomical features that protect anterior teeth from impact, and it has been argued that obese children are less agile, and, thus, are more prone to accidents that cause dental injury.[23–25]

In addition, a standard socioeconomic classification commonly employed in Brazil[26] was used that takes into account the number of domestic assets, servants, cars, and level of education of the head of household. A set of points was assigned to these indicators, and a final score defined the socioeconomic groups: A (highest) through E (lowest). Because of the small number of observations in classes A and E, data were categorized into high, middle, and low. The binary outcome of presence or absence of dental injury was defined. Multilevel logistic models were used to account for the clustering of individuals within areas. A total of 651 boys and 605 girls, with complete data on all variables, were included in the main analyses. The following sequence of models were fitted to assess the influence of individual and area-level confounding variables on the association between social capital and dental injury: model 1—unadjusted effect of the social capital variable; model 2—the effect of social capital was adjusted for other contextual variables; model 3—the effect of social capital was adjusted for individual-level risk factors; and model 4—the effect of social capital was adjusted for both neighborhood and individual-level variables. Analyses were carried out separately for boys and girls because of possible interaction between social capital and gender.

The statistical analysis was carried out using SPSS version 10.1 (SPSS Inc, Chicago, Ill) and MLwiN version 1.10 (Centre for Multilevel Modelling, University of Bristol, Bristol, UK) programs.

TABLE 1—Distribution of Dental Injuries in Brazilian Adolescents (N = 1302), by Gender, Reported Causes, and Place of Occurrence: Distrito Federal, Brazil, 2002

	Dental Injuries		
	Boys, n (%)	Girls, n (%)	Total, n (%)
Reported place of occurrence of dental injury			
Home	48 (38.1)	45 (53.6)	93 (44.3)
Street/walkway	41 (32.5)	15 (17.9)	56 (26.7)
School	14 (11.1)	7 (8.3)	21 (10.0)
Other places	11 (8.7)	10 (11.9)	21 (10.0)
Don't know	12 (9.5)	7 (8.3)	19 (9.0)
Total	126 (100.0)	84 (100.0)	210 (100. 0)
Reported cause of dental injury			
Playing	60 (47.6)	41 (48.8)	101 (48.1)
Sports	23 (18.3)	5 (6.0)	28 (13.3)
Teeth misuse	8 (6.3)	11 (13.1)	19 (9.0)
Violence	8 (6.3)	4 (4.8)	12 (5.7)
Other causes	15 (11.9)	16 (19.0)	31 (14.8)
Don't know	12 (9.5)	7 (8.3)	19 (9.0)
Total	126 (100)	84 (100)	210 (100)

RESULTS

Kappa values were more than 0.92, indicating that there was almost perfect consistency of results for the examiner in duplicate examinations of dental injury.[27] A total of 39 schools took part, but because some schools had the same catchment area, or there was a significant overlap, only 37 neighborhoods were considered. One school refused to participate. The response rate was 86.8% for student and 62.7% for parent questionnaires. Parent nonresponders were significantly more likely to be from higher social classes and higher levels of education compared with responders. There was no significant social capital–associated variation in response rates.

Of the 1302 adolescents in the study, 681 (52.3%) were boys and 621 (47.7%) were girls. More than 86% (n=1125) of adolescents had lived in the Distrito Federal for 10 or more years. Dental injuries were present in 13.5% (95% CI=10.8, 16.2%) of girls and 18.5% (95% CI=15.6, 21.4%) of boys. The most common place for the injury to occur was at home. Boys received more dental injuries in streets/walkways than did girls. The main reported causes were playing; boys, more than girls, reported playing and sports as causes of injury (Table 1).

The standardized social capital index varied among neighborhoods for boys (mean=0.09; SD=0.63; interquartile range=0.29–0.40; range=−1.45–1.97), and girls (mean=0.04; SD=0.63; interquartile range=0.29–0.30; range=−1.45–1.97) (Table 2). The mean rate of organizations per 10 000 (infrastructure variable) and the mean poverty gap index were 6.6 (SD=5.8) and 7.0 (SD=2.3), respectively. The crude odds ratio of dental injury for 1 unit increase in the social capital index was 0.64 (95% CI=0.46, 0.89; *P*=.008) among boys (Table 2). This relation remained independent of both individual and area-level variables (Table 3, model 4). For this model, the predicted prevalence of a dental injury in 14-year-old boys living in the lowest social capital area, from a middle social class, with normal overjet, adequate

TABLE 2—Distribution and Multilevel Logistic Regression for the Unadjusted Associations Between Traumatic Dental Injuries and Individual and Area Variables, by Gender: Distrito Federal, Brazil, 2002

	Prevalence of Dental Injuries, n (%)	Mean (SD)	OR (95% CI)	*P*
		Boys, individual level		
Age				
14 years	61 (18.8)		Reference	
15 years	65 (18.3)		0.95 (0.64, 1.42)	.815
Incisal Overjet				
≤3 mm	95 (17.2)		Reference	
>3 mm	31 (23.8)		1.53 (0.86, 2.44)	.074
Lip coverage				
Adequate	95 (17.2)		Reference	
Inadequate	31 (23.8)		1.29 (0.86, 1.93)	.218
BMI				
Not overweight	76 (17.1)		Reference	
Overweight	50 (21.1)		1.26 (0.74, 2.16)	.388
Social class[a]				
High	42 (19.1)		1	
Middle	54 (18.1)		0.94 (0.60, 1.48)	.803
Low	25 (18.7)		0.99 (0.57, 1.75)	1.00
		Boys, area level		
Social capital		0.07 (0.6)	0.64 (0.46, 0.89)	.008
Infrastructure		6.9 (5.7)	0.97 (0.93, 1.01)	.085
Poverty gap		7.0 (2.3)	0.96 (0.88, 1.05)	.364
		Girls, individual level		
Age				
14 years	38 (11.6)		Reference	
15 years	46 (15.6)		1.42 (0.89, 2.25)	.140
Incisal overjet				
≤3 mm	65 (12.3)		Reference	
>3 mm	19 (20.4)		1.83 (1.04, 3.22)	.038
Lip coverage				
Adequate	65 (12.3)		Reference	
Inadequate	19 (20.4)		0.84 (0.52, 1.35)	.463
BMI				
Not overweight	54 (14.3)		Reference	
Overweight	30 (12.3)		1.02 (0.52, 1.87)	.944
Social class[a]				
High	27 (14.9)		Reference	
Middle	32 (12.0)		0.78 (0.45, 1.35)	.377
Low	25 (15.9)		1.08 (0.60, 1.95)	.799
Girls, area level				
Social capital		0.04 (0.6)	0.91 (0.63, 1.32)	.627
Infrastructure		6.5 (5.0)	0.95 (0.90, 1.00)	.058
Poverty gap		6.8 (2.3)	1.05 (0.95, 1.16)	.362

Note. OR = odds ratio; CI = confidence interval; BMI = body mass index.
[a] Classified according to criteria proposed by the Brazilian National Association of Research Institutes.[26]

lip coverage, nonoverweight, and from an area with moderate (mean) poverty and infrastructure was 30.1%. The predicted prevalence among similar boys living in the area with the highest social capital level was 5.3%.

There was no significant association between social capital and dental injury in girls (Tables 2 and 4). Poverty level was not statistically associated with dental injury in either boys or girls. Although the associations did not reach the conventional levels of statistical significance, there was a tendency for areas with a more favorable infrastructure to have fewer dental injuries (Table 2).

At the individual level, no statistically significant associations were found between dental injury and social class in unadjusted and adjusted models. Dental injury remained associated with overjet in both genders after adjusting for all other individual and contextual factors (Tables 2–4). The total between-area variation in dental injury was relatively small (between-area variance=0.08 among boys), but most of the variation was explained by social capital.

DISCUSSION

The hypothesis tested was that a higher prevalence of traumatic dental injury was associated with low social capital. This hypothesis was partially supported by the study's findings. Dental injury among boys were significantly lower in areas with higher social capital levels, but the same was not true for girls. This introduces a further dimension of the effect of context on dental injury; namely, gender differences as a function of environment. A study of schools in Thailand also found that the association between dental injury and supportive school environment was stronger among boys than among girls.[5]

Although there may be an important school factor associated with dental injury, in the present study, only 10% of all injury occurred in the school environment. This suggests that the contribution of school environment to the overall prevalence of dental injury was relatively small. The possibility of confounding outcomes with school environment cannot be ruled out, as it is possible that more supportive schools are found in higher social capital areas.

TABLE 3—Odds Ratios (ORs) and 95% Confidence Intervals (CIs) of the Fixed Parameters From Multilevel Logistic Regression Models for Traumatic Dental Injuries Among Boys (N = 651): Distrito Federal, Brazil, 2002

Fixed Parameters	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Individual				
15 years of age	...	...	0.98 (0.66, 1.48)	0.93 (0.61, 1.40)
Overjet > 3 mm	...	...	1.52 (0.97, 2.44)	1.63 (1.00, 2.66)*
Lip inadequate	...	...	1.23 (0.82, 1.86)	1.19 (0.79, 1.79)
BMI, overweight	...	...	1.35 (0.78, 2.34)	1.34 (0.77, 2.32)
Middle social class	...	...	0.86 (0.55, 1.35)	0.95 (0.59, 1.52
Low social class	...	...	0.97 (0.54, 1.72)	1.19 (0.66, 2.14)
Area				
Social capital	0.64 (0.46, 0.89)*	0.58 (0.40, 0.84)*	0.62 (0.44, 0.86)*	0.55 (0.32, 0.81)*
Infrastructure	...	0.97 (0.93, 1.01)	...	0.97 (0.93, 1.01)
Poverty gap	...	0.90 (0.81, 1.00)	...	0.90 (0.81, 1.00)

Note. BMI = body mass index. Reference categories are as in Table 2. Model 1 = social capital; Model 2 = M1 + contextual factors; Model 3 = M1 + individual risk factors; Model 4 = M1 + contextual factors + individual risk factors.
*$P \leq .05$.

TABLE 4—Odds Ratios (ORs) and 95% Confidence Intervals (CIs) of the Fixed Parameters From Multilevel Logistic Regression Models for Traumatic Dental Injuries in Girls (N = 605): Distrito Federal, Brazil, 2002

Fixed Parameters	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Individual				
15 years of age	...	...	0.69 (0.43, 1.11)	0.69 (0.43, 1.11)
Overjet > 3 mm	...	...	2.01 (1.13, 3.60)*	1.82 (1.02, 3.25)*
Lip inadequate	...	...	1.19 (0.73, 1.95)	1.17 (0.72, 1.91)
BMI, overweight	...	...	1.00 (0.54, 1.84)	1.02 (0.55, 1.84)
Middle social class	...	...	0.74 (0.42, 1.31)	0.68 (0.38, 1.20)
Low social class	...	...	0.96 (0.52, 1.77)	0.92 (0.49, 1.73)
Area				
Social capital	0.90 (0.63, 1.31)	0.94 (0.61, 1.45)	0.90 (0.60, 1.32)	0.97 (0.63, 1.49)
Infrastructure	...	0.95 (0.90, 1.01)	...	0.95 (0.90, 1.01)
Poverty gap	...	1.04 (0.92, 1.17)	...	1.03 (0.91, 1.16)

Note. BMI = body mass index. Reference categories are as in Table 2. Model 1 = social capital; Model 2 = M1 + contextual factors; Model 3 = M1 + individual risk factors; Model 4 = M1 + contextual factors + individual risk factors.
*$P \leq .05$.

Stress and behavior problems may also have a role in dental injury. Despite small sample sizes, both a case–control study and a prospective study reported significant associations between emotionally stressful states, as measured by catecholamines, and presence of dentofacial injury[28,29]; a higher number of boys than girls exhibited increased levels of catecholamines, which correlated with a higher rate of injury among boys. Risky behaviors are also more common among males than among females. In a meta-analysis of 150 studies, males were greater risk-takers than were females.[30] Corroborating the findings in this study, the prevalence of dental injury was higher among boys than among girls. More boys than girls reported playing and sports as the main causes for dental injury. The effect of social capital was also stronger among boys than among girls, suggesting that risk-taking behaviors among boys vary more by social environment.

The mechanisms by which social capital affects health are not yet fully understood.[31] Social capital and social networks could improve community health by alleviating stress levels caused by emotional and behavior problems,[32] which may play an important role in health in general and dental injury in particular. Evidence that the areas with low social capital may be associated with higher stress levels comes from cross-sectional studies showing that low neighborhood cohesion is associated with higher levels of depression and anxiety.[33] A series of mental health problems in children, ranging from posttraumatic stress disorder to anxiety, have been associated with chronic exposure to community violence.[34,35] In this study, boys may have been more influenced by environment. Almost one third of all injury among boys occurred in public streets or pathways, whereas in girls they occurred mostly at home, suggesting that environment type influenced the genders differently.

Another explanation of the effects of social capital on prevalence of dental injury is that cohesive communities exert more control over deviant behaviors.[14] Social capital could reduce child psychosocial adjustment difficulties in 2 ways: by positive parenting and by lowering neighborhood violence. Family levels of social capital have been associated with a significant reduction in involvement with delinquents and misbehavior.[36] Antisocial behavior and youth delinquency are more common among boys than in girls.[37,38] Also, mothers whose parents provided them with high levels of factors enhancing social capital were more successful in positive parenting behaviors, which resulted in lower levels of psychosocial adjustment problems in their children.[39]

Childhood psychosocial difficulties have been linked to triggering injury in general and dental injury in particular. Children with behavioral problems are more likely to be excitable, risk-taking, and reckless, increasing their chance of getting into situations that result in injury. Behavioral and emotional risk factors have been linked to major and minor

unintentional injury in general.[40] This association has also been reported for dental injury in particular.[41] Social capital could then provide further benefits for children, as neighborhoods with high levels of parental resources are typically less dangerous, lessening the link between violence and child psychosocial adjustment problems.[39]

Incisal tooth overjet was the only individual-level anatomical variable that remained statistically associated with dental injury in both genders after adjusting for all variables. This corroborates the findings of a systematic review that found that children with a larger incisal overjet were approximately 2 times more at risk of dental injury to anterior teeth than those with normal overjet.[21]

Although there was a tendency for the infrastructure variable in this study to be associated with dental injury in girls and boys, the lack of a stronger association may be because of the intrinsic fragility of this indicator, which pooled different aspects of areas of residence. Independent effects of each place or organization, of which this indicator is composed, might have been obscured.

Appropriately defining neighborhoods has been a methodological limitation of much of the research attempting to examine how neighborhood characteristics affect an individual's health.[42] One limitation of the present study is that the boundaries of a neighborhood, such as the limits of the catchment areas, may not coincide with perceived boundaries. People tend to perceive their neighborhood as comprising their own street, with perhaps 1 or 2 adjacent streets.[34] The sizes of neighborhoods in this study were relatively small (average population=13 128; SD=5908). On the one hand, it means that information about the shared environments of the perceived neighborhoods was representative of the areas surveyed because of within-area homogeneity. To some extent, this validates the social capital perception of the area. On the other hand, it may have led to relative socioeconomic homogeneity between the neighborhoods, resulting in the observed low between-area variation. The poverty level of the whole study area was relatively low. Relatively few families in the study were in high and low social classes, and only children from public schools were included. Public schools are considered a proxy for low socioeconomic status, both in Brazil[43,44] and in other Latin American countries.[45]

Kappa values for the oral exams indicated almost perfect consistency of the examiner and reproducibility of the data. With regard to nonclinical data, the overall response rate for students was very good. For the parents' questionnaires, the response rate was lower (63%; n=816), and varied considerably between neighborhoods (33%–86%), but response rate did not vary systematically with social capital score or with the area measures of infrastructure and poverty gap. Therefore, it is unlikely that the association seen between social capital score and dental injury is an artifact of response rate. Furthermore, if there was a systematic bias that was responsible for the association, there is no reason why it would be present only among boys. Nonresponders may have a different perception of the neighborhood compared with responders. Areas with lower response rates have a less precise measure of neighborhood characteristics, which was not accounted for in our analyses. In addition, characterizing the neighborhood on the basis of individual perceptions may potentially misrepresent their share in social capital.[46] However, our sample was representative of the overall population of students from public schools, and the correlations between schooling (in years of education) and mean income (in Brazilian real) of the head of the household in the population (census data) and in our sample were $r=0.79$ and 0.68 ($P<.0001$), respectively.

We used a multilevel approach in study design and data analysis. It has been argued that the debate on the linkages between individual health and contextual factors, such as social capital, cannot be addressed adequately without adopting an explicitly multilevel approach.[47]

Our index showed sufficient reliability and validity. Cronbach α coefficient for all scales was above 0.7, except the empowerment scale (a table of items and dimensions comprising the social capital index is available from the author). Furthermore, the coefficient did not increase significantly when any specific item was omitted.[48] The index also showed good construct validity, confirmed by principal components analysis, and concurrent validity with the "collective efficacy" index[14] produced a correlation coefficient equal to 0.71 ($P<.001$). The internal consistency was also sufficient; the corrected item-total correlation (i.e., the correlation of each item with the total score) produced only 2 values (in the empowerment scale) under the minimum recommended value of 0.3.

Ours was one of the first studies in which the central goal was to investigate the benefits of social capital on oral health. The relationship between social capital and dental injuries was demonstrated, but no causal inferences should be made. Cross-sectional studies are limited to identifying associations rather than causal relationships. Thus, ideally, this relationship should be addressed by means of a prospective study, in which social capital and dental injury are measured repeatedly. Future studies would also benefit from a larger sample size to obtain more precise estimates of the associations with area-level variables and greater heterogeneity between clusters.

Use of social capital should not be viewed as the only solution for all health problems, and should not be applied uncritically. The effect of social capital on health has to be considered in the context of social and political environments.[49] These contexts are essential for shaping public health policies and institutions. ■

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Contributors

M. P. Pattussi originated the study, carried out fieldwork, analyzed the data, and wrote the article. R. Hardy helped in the design of the study and provided statistical support. A. Sheiham helped to conceptualize ideas and supervised the study. All authors interpreted findings and revised drafts of the article.

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Human Participant Protection

The protocol of this research was approved by regional education and health authorities and by the bioethics committee of the University of Brasilia and of the Ministry of Health of Brazil.

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