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Correlation between socioeconomic indicators and traumatic dental injuries: a qualitative critical literature review

Cristiane B. Bendo, Ana C. Scarpelli, Miriam Pimenta Parreira Vale, Patrícia Maria Pereira Araújo Zarzar

Department of Pediatric Dentistry and Orthodontics, Faculty of Dentistry, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

Correspondence to: Ana C. Scarpelli, Rua Buenos Aires 436/201, Belo Horizonte, Minas Gerais CEP 30315-570, Brazil
Tel.: +55 31 3225 4360
Fax: +55 31 3489 8111
e-mail: anascarp@yahoo.com.br

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Abstract – *Background/Aim*: Traumatic dental injuries are widespread and have become a serious dental public health problem in childhood. Despite its importance, very few studies have correlated the prevalence of permanent tooth injury and socioeconomic indicators. The aim of the present study was to evaluate just such a correlation. *Materials and Methods*: Electronic searches were performed in the following bibliographical databases: Brazilian Bibliography of Dentistry, Scientific Electronic Library Online, Latin American and Caribbean Health Sciences, The Cochrane Library, ISI Web of Knowledge, International Database for Medical Literature and PubMed Central. Reference lists from articles that fulfilled the inclusion criteria in this review were searched for additional relevant articles. The Brazilian Coordination of Higher Education Personnel Improvement Theses Databank was also included. Selection and analysis of the articles were performed independently by two authors of the present literature review. *Results*: A total of 21 of 98 articles were eligible for inclusion in the review. However, only nine articles performed all the methodology criteria analyzed. Seven of the surveys were carried out in Brazil and two in Thailand. The age of children was 9–14 years. Statistically significant associations between permanent tooth injuries and high economic status were found in four studies. *Conclusion*: There were few studies correlating traumatic injuries in permanent teeth and socioeconomic indicators and the majority found no such association. It is suggested that the association between traumatic dental injuries and socioeconomic factors may be related to the indicators used, considering differences in their individual components. Furthermore, the heterogeneity of the methodologies hinders the comparison of the studies.

Traumatic dental injuries are widespread and have become a serious dental public health problem in childhood (1). The prevalence of permanent tooth injury varies in different populations and at different ages (2–5). A literature search identified Brazilian studies reporting a prevalence of permanent tooth injuries ranging from 10% (Recife) (3) to 58% (Blumenau) (4). In European countries, studies carried out on schoolchildren found a prevalence of 17.4% in Spain (6), 34.4% in England (7) and 44.2% in UK (8). The prevalence of traumatic injuries in permanent teeth is lower in Canadian schoolchildren (11.4%) (9), whereas the prevalence among Thai children is 35% (10, 11). Cortes et al. (5) found that the prevalence of traumatic injuries in permanent teeth increased from 8% at 9 years of age to 16% at 14 years of age (Belo Horizonte, Brazil). These differences in prevalence can be explained by differences in the diagnostic criteria of traumatic dental injury employed as well as differences in age of the population and location where the study was carried out (3, 12). A cohort study carried out in Brazil found that the incidence of further cases of traumatic dental injury was 11.44:1000 permanent incisors and an individual who had previously suffered traumatic dental injury had a 4.85-fold greater chance of suffering further episodes of traumatic dental injury (13). Regarding gender, boys experience more injuries than girls (2–5, 7, 10, 12, 14–16).

The causes of traumatic dental injuries are well known. The main reported causes of anterior permanent tooth injuries are falls, collisions with people or inanimate objects, traffic accidents, sports and violence (2–5, 12). Predisposing factors include inadequate lip coverage and increased incisal overjet of the teeth (3, 5, 12, 17).

There are a small number of studies that correlate the prevalence of permanent tooth injury and socioeconomic indicators. Among such studies, this correlation is not clear and results are conflicting (4, 5, 14). A higher prevalence of traumatic injury in permanent teeth has been reported among British adolescents from low socioeconomic groups compared to those from middle and upper socioeconomic groups (7). In contrast, studies

carried out in Brazil report a higher prevalence among high socioeconomic groups (5, 13).

The purpose of the present review was to investigate the correlation between traumatic injuries in permanent teeth and socioeconomic indicators.

Materials and methods

For the identification of studies either included in or considered for this review, a search strategy was developed for all electronic databases searched using keywords from the Medical Subject Headings list. The inclusion criteria for study selection were: articles that correlate traumatic dental injuries in permanent teeth and socioeconomic indicators; and subjects between 6 and 20 years of age. Electronic searches were performed in the following databases: Brazilian Bibliography of Dentistry (BBO), Scientific Electronic Library online (SciELO), Latin American and Caribbean Health Sciences (LILACS), The Cochrane Library, ISI Web of Knowledge, International Database for Medical Literature (MEDLINE) and PubMed Central (from the inception of the databases until April 2008). Reference lists from articles that fulfilled the inclusion criteria in this review were searched for additional relevant articles. Data from theses registered in the database of the Brazilian Coordination of Higher Education Personnel Improvement (CAPES) were also included. All potentially relevant studies in any language, publication year and study design were assessed. The following keywords and their combinations were used to carry out the search: traumatic dental injuries, dental trauma, tooth injuries, permanent incisors, permanent tooth, social class, socioeconomic, children, adolescent, child and teenager.

The baseline searches were carried out by two of the authors of the present review. The selection of papers based on the title, keywords and abstract as well as decisions regarding eligibility were carried out independently and in duplicate by the same authors. The full text of every article considered for inclusion was obtained. If the information relevant to the inclusion criteria was not available in the abstract or if the title was relevant but the abstract was not available, the full text of the report was obtained. All information and data recording was performed independently by each author.

In the next step, two review authors assessed the quality of all studies included, using criteria from a standardized form. The data extracted included study design, mention of sample size calculation, sample size, age/age range, population features, reported sampling framework, mention of examiners' training and calibration, data collection methodology, diagnostic criteria for traumatic dental injuries and socioeconomic indicators. The studies that fulfilled the established criteria were considered in the final analysis. Any disagreements regarding the data collected independently by each author were resolved through discussions between the authors founded on a theoretical basis in order to establish a consensus. The analysis was not masked with regard to the authors or results (Fig. 1).

Results

The electronic searches yielded a total of 154 articles. However, as the periodicals were found in different electronic databases, some articles were listed more than once. Records were checked on the basis of the title, keywords and abstract. Duplicates of articles were excluded ($n = 56$). All potentially relevant records were noted ($n = 98$).

Considering the 98 abstracts from the articles, a total of 53 articles were excluded: 28 studies that did not evaluate the correlation between traumatic injuries in permanent teeth and socioeconomic indicators (inadequate theme) and 25 because of the inadequate age of the subjects. Thus, 45 of the 98 reports were analyzed in their full text. Twenty-four of these 45 full-text articles were excluded at the end of the analyses for the same reasons: 16 that did not evaluate the correlation between traumatic injuries in permanent teeth and socioeconomic indicators and eight because of the inadequate age of the subjects. This left 21 studies remaining for further detailed consideration. Each study was analyzed according the established methodological criteria. Considering the nine pre-established criteria (study design, mention of sample size calculation, sample size, population features, reported sampling framework, mention of examiners' training and calibration, data collection methodology, diagnostic criteria for traumatic dental injuries, socioeconomic indicators), only three criteria (mention of sample size calculation, mention of examiners' training and calibration and diagnostic criteria for traumatic dental injuries) were not fulfilled by all 21 articles. A total of 12 studies did not fulfill all the methodological criteria (6–9, 12, 14, 15, 17–21).

A total of nine studies performed all the methodological criteria proposed by the review authors (Table 1). Seven studies were carried out in Brazilian cities (Jaraguá do Sul, Recife, Belo Horizonte, Blumenau, Cianorte, Biguaçu) (2–5, 13, 16, 22). The other two were carried out in Thailand (10, 11). All the studies (2–5, 10, 11, 13, 16, 22) fulfilled the criteria of mentioning examiner training and calibration. For the diagnosis of traumatic dental injury, four studies used the Children's Dental Health Survey criteria (23), another four studies used the adapted Children's Dental Health Survey criteria (23, 24) and one used Andreasen's criteria (25).

Regarding socioeconomic indicators, one study adopted the Brazilian Economic Classification Criteria (ABA-ABIPEME) (5), which separates the population into economic classes and estimates buying power, as measured by the quantity of products each family can afford; four used a parent's level of education, income and employment status; two used mother's level of education; one adopted the type of school (private or public); and another adopted the social and physical environment of the school.

Cortes et al. (5) found a significant association between permanent tooth injuries and socioeconomic indicators through simple logistic regression analysis ($P < 0.001$). The results of multiple logistic regression

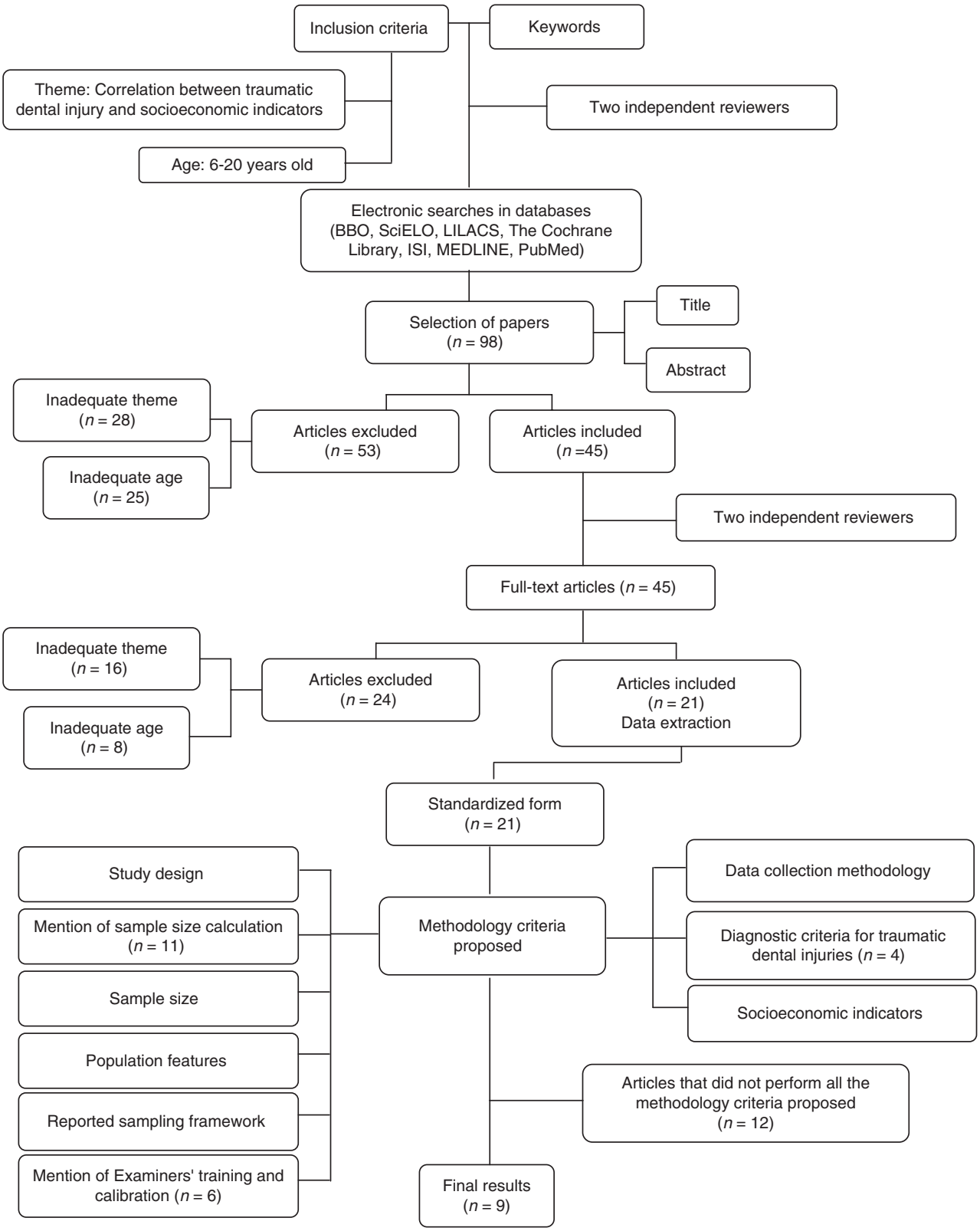

Fig. 1. Illustration of the methodology employed.

confirmed the significant associations found after adjusting for overjet, lip coverage, gender and age. Adjusted results revealed that children with high socioeconomic indicators were 1.4-fold (95% CI = 1.15–1.79) more likely to present with a dental injury than children with low socioeconomic indicators.

Table 1. Studies that have correlated traumatic dental injuries and socioeconomic indicators: methodological analysis

References	Study design	Mention of sample size calculation	Sample size	Age (years)/age range	Population features	Reported sampling framework	Data collection methodology	Diagnostic criteria for traumatic dental injuries	Socioeconomic indicators	Results
Marcenes et al. (2)	Cross-sectional survey	Yes	476	12	Brazilian schoolchildren	Primary schools (public and private)	Clinical examination and interview	The Children's Dental Health Survey criteria (23)	Parent's level of education and income, employment status	No significant association was found
Soriano et al. (3)	Cross-sectional survey	Yes	1046	12	Brazilian schoolchildren	Primary schools (public and private)	Clinical examination	Andreasen's criteria (25)	Type of school (public and private)	No significant association was found
Marcenes et al. (4)	Cross-sectional survey	Yes	652	12	Brazilian schoolchildren	Primary schools (public and private)	Clinical examination and interview	The Children's Dental Health Survey criteria (23)	Family income, parent's level of education and employment status	No significant association was found
Cortes et al. (5)	Cross-sectional survey	Yes	3702	9–14	Brazilian schoolchildren	Primary schools (public and private)	Clinical examination and interview	The Children's Dental Health Survey adapted criteria (24)	The ABA-ABIPEME criterion (Brazil) (30)	A significant association was found
Malikaew et al. (10)	Cross-sectional survey	Yes	2725	11–13	Thai schoolchildren	Primary schools	Clinical examination and interview	The Children's Dental Health Survey criteria adapted by Cortes (24)	Employment status of parents, education status of parents and family income	A significant association was found
Malikaew et al. (11)	Cross-sectional survey	Yes	2725	12	Thai schoolchildren	Primary schools (public and private)	Clinical examinations Interviews	The Children's Dental Health Survey criteria adapted by Cortes (24)	School social and physical environment	A significant association between traumatic dental injuries and social environments was found. No significant association between traumatic dental injuries and physical environments was found
Ramos-Jorge et al. (13)	Cohort study	Not applicable	306	11–13	Brazilian schoolchildren	Primary schools	Clinical examinations Interviews	The Children's Dental Health Survey criteria (23)	Mother's level of education	A significant association was found
Nicolau et al. (16)	Cross-sectional survey	Yes	652	13	Brazilian adolescents	Primary schools (public and private)	Clinical examinations Interviews	The Children's Dental Health Survey criteria (23)	Family income and parent's level of education	No significant association was found
Traebert et al. (22)	Cross-sectional survey	Yes	2260	11–13	Brazilian schoolchildren	Private and public schools	Clinical examination Questionnaire	The Children's Dental Health Survey adapted criteria (23)	Mother's level of education	No significant association was found

A prospective cohort study carried out by Ramos-Jorge et al. (13) found a significant association between mother's schooling and the occurrence of further cases of traumatic injuries in permanent teeth. Children whose mothers had more than 4 year of study were more likely to undergo new episodes of dental trauma than children whose mothers had less years of schooling ($P < 0.001$).

Malikaew et al. (11) found that Thai children attending schools with a more supportive social environment were likely to have a significantly lower risk of traumatic injury in permanent teeth than those attending schools with a less supportive social environment ($P = 0.004$). However, this study found no significant association between traumatic injury in permanent teeth and the physical environment of the schools ($P = 0.52$).

Another study carried out by Malikaew et al. (10) with Thai schoolchildren found a significant association between traumatic injury in permanent teeth and socioeconomic conditions. The occurrence of dental trauma increased when parents had a lower educational status and income or when they were unemployed ($P < 0.001$). The other five studies (2–4, 16, 22) found no significant association between traumatic injury in permanent teeth and socioeconomic indicators.

Discussion

The most remarkable problem regarding dental traumatology and socioeconomic indicators is the wide range of existing classifications and criteria adopted in reports, even those within the same country. Traumatic dental injury can be assessed under different perspectives and based on a wide variety of factors, such as etiology, anatomy, pathology and treatment, depending on the classification criteria (26) [e.g. the Children's Dental Health Survey Criteria (23), Andreasen's criteria (25), WHO criteria (27), Ellis' criteria modified by Holland et al. (28), Sgan-Cohen et al. (29)]. Regarding socioeconomic indicators (e.g. Parent's level of education and income, employment status of parents, type and location of school, family composition and government social support, physical environment, residential property values, ABA-ABIPEME, Spanish Epidemiological Society criteria, ACORN, modified Kuppuswamy scale, Jaman index) (2, 8, 9, 11, 15, 30–34), there is considerable variety in the components used for their determination. Thus, some indicators become more complex, as they consider the association of various components, thereby expressing the socioeconomic status of the target population of the study in a more realistic manner (11, 20). Differences in the individual components of each socioeconomic indicator are determinant factors in their quality and complexity. This considerable heterogeneity among classification criteria for traumatic dental injury and socioeconomic indicators hinders comparisons between studies. Furthermore, the present literature review reveals that there are a very small number of articles published on the issue.

Analyzing the articles selected, the four studies that found an association between traumatic dental injuries and socioeconomic indicators were carried out in Brazil and all used a similar criterion for dental trauma (The Children's Dental Health Survey Criteria). However, the index used to measure the socioeconomic indicators was different in each study. One used the Brazilian Economic Classification Criteria (ABA-ABIPEME), which is employed as the standard of segmentation of the population into economic classes. Classification is composed of five levels (A–E), for which A is the highest and E the lowest. The other studies considered social indicators such as employment/education status of parents and social/physical school environment. These differences in socioeconomic criteria hinder the analysis of results.

Traumatic dental injury is a result of a variety of factors. Regarding possible risk factors, a number of studies have found an association between evident overjet and inadequate lip coverage and the occurrence of traumatic injuries in permanent teeth (3, 5, 12, 13, 17, 18). Child behavior is another important factor related to traumatic dental injury. The fact that boys suffer more traumatic injuries in permanent teeth than girls (3–5, 12, 14–16, 18, 22) is explained by behavior, as boys practice more dangerous activities and sports than girls.

An additional interesting finding of our systematic search was the fact that the higher risk of permanent tooth injuries among children in higher socioeconomic groups in developing countries such as Brazil (5, 13) may be related to greater ownership of bicycles, access to swimming pools, skateboarding, roller-skating and horseback riding than those from low socioeconomic groups (5). Furthermore, in developing countries, even children from affluent families tend to play in unsafe environments. Conversely, children from affluent families in developed countries tend to play in safer environments than those from less affluent families (4).

The findings of several studies suggest that the occurrence of traumatic dental injury is a result of the interaction between individual socioeconomic indicators, physical/environmental characteristics and sanitary conditions (11, 22). A recent study has suggested that social environments with better levels of supervision by staff members, safety topics in the school curriculum, participation of parents at school meetings, community activities at school as well as lower rates of violence, absenteeism and punishment have a protective effect on the occurrence of traumatic dental injury. However, the physical environment had less effect than the social environment on the level of traumatic dental injuries. This may be explained by the relatively good physical environment of all schools in the study (11). Consequently, if an individual having suffered traumatic dental injury continues living in the same environment, with the same oral and psychosocial characteristics, such as socioeconomic level and behavior, this individual would have a greater chance of suffering a further episode of traumatic dental injury than an individual in better conditions (13). This outcome proves the importance of social measures in preventing the occurrence of traumatic dental injuries and decreasing the prevalence of traumatic dental injuries. The adoption of health and safety policies as well as improvements in the physical environment are likely to have a positive impact in dental trauma (10, 11, 13).

There is no consensus in the literature regarding the association between the occurrence of traumatic injury in

permanent teeth and socioeconomic indicators and the majority of the studies analyzed found no such association. It is suggested that the association between traumatic dental injuries and socioeconomic factors may be related to the indicators used, considering differences in their individual components.

The heterogeneity of the methodologies and the small number of published articles hinders the comparison of the studies. Consequently, it is essential to standardize methodologies for the classification of traumatic dental injuries and socioeconomic indicators in order to achieve a better comparison of results. Socioeconomic indicators with a greater number of individual components need to be developed in order to enable the obtainment of results that are closer to the reality of the population.

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