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Traumatic dental injury among 12-year-old South Brazilian schoolchildren: prevalence, severity, and risk indicators

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Abstract – An increasing prevalence of traumatic dental injury (TDI) has been reported in the last few decades. The aim of this study was to assess the prevalence and severity of TDI and its association with socio-demographics and physical characteristics in the anterior permanent teeth of 12-year-old Brazilian schoolchildren. A cross-sectional study was carried out in a population-based sample of 1528 subjects attending 33 public and nine private schools (response rate of 83.17%). A single calibrated examiner performed the clinical examinations at the schools and recorded the TDI index (Children's Dental Health Survey criteria), overjet and lip coverage. Height and weight were measured to calculate the body mass index (BMI). Parents/legal guardians answered a questionnaire containing socio-demographic questions. The relationships among TDI, socio-demographic variables and physical characteristics were assessed by survey Poisson regression models. The prevalence of TDI was 34.79% (mild trauma = 24.37%; severe trauma = 10.43%). Male schoolchildren (RR = 1.41, 95% CI = 1.23–1.61, $P = 0.002$) and schoolchildren from low socioeconomic status (RR = 1.32, 95% CI = 1.07–1.64, $P = 0.021$) were more likely to present at least one tooth with TDI, whereas students attending 7th grade (advanced students) were less likely to experience TDI (RR = 0.59, 95% CI = 0.43–0.82, $P = 0.012$). Regarding the severity analysis, students of mid-high (RR = 1.46, 95% CI = 1.09–1.94, $P = 0.022$), mid-low (RR = 1.68, 95% CI = 1.01–2.77, $P = 0.045$) and low (RR = 1.78, 95% CI = 1.11–2.85, $P = 0.027$) socioeconomic status were more likely to have mild trauma when compared with schoolchildren of high socioeconomic status. No significant association between severe trauma and socioeconomic status was observed. In conclusion, this study showed a high prevalence of TDI in 12-year-old Brazilian schoolchildren. Socio-demographic data and school achievement were associated with TDI.

Traumatic dental injury (TDI) in children and adolescents has been extensively studied over the last few decades, with recent studies reporting prevalence rates ranging from 6% to 25% in different populations (1–6). In Brazil, the prevalence varies widely, ranging from 10% to 58% (7–10). The possible explanations for this variation include differences in places/environments, diagnostic criteria and methods of examination.

Several risk factors/indicators for TDI have been studied; however, few are well established in the literature. Studies have consistently shown that male individuals have a higher chance of TDI than female individuals (5, 8, 9). Other demographic characteristics, such as race, have been little investigated, and only one publication could be found in the literature, and this study did not find an association (3). Socioeconomic status has been associated with several oral diseases and conditions, such as dental caries (11), periodontal diseases (12), tooth loss (13), and oral cancer (14). Nevertheless, the association between TDI and socioeconomic indicators remains unclear (8, 9, 15–18). Although some researchers have reported that schoolchildren with lower socioeconomic status are more likely to suffer TDI (10, 19–21), others have shown an inverse correlation, with wealthier children having a higher risk of TDI (7, 8). A recent review concluded that there are few studies correlating TDI in permanent teeth with socioeconomic indicators and that the majority found no such association (15).

Among physical factors, increased overjet has been consistently associated with TDI (22), whereas inadequate lip coverage has not been consistently associated with TDI (7, 23). The childhood obesity epidemic has received increased attention worldwide, and some studies have assessed the relationship between obesity and TDI with inconsistent results (9, 24).

The aims of this study were to assess the prevalence and severity of TDI in the anterior permanent teeth of 12-year-old Brazilian schoolchildren and to assess the associations among TDI, socio-demographic data and physical characteristics.

Subjects and methods

Study design

This study used a cross-sectional design and was carried out in Porto Alegre, southern Brazil, from September 2009 to December 2010. The target population was schoolchildren aged 12 years old who were attending public and private schools.

Sample size calculation

Sample size was calculated based on TDI prevalence estimates for a similar schoolchildren population in Southern Brazil (8). A sample size of 1331 was calculated to be necessary to estimate a prevalence of 60% with a precision level of $\pm 3\%$ for the 95% confidence interval. A design effect of 30% and a non-response error of 40% were added to the sample size, and a final sample size of 1837 was estimated.

Sampling strategy and sample characteristics

A multistage probability sampling strategy was used. The primary sampling unit consisted of five geographical areas organized according to the municipal water fluoridation system. Within each area, the schools were randomly selected proportional to the number of private and public schools (42 schools: 33 public and nine private). Schoolchildren born in 1997 or 1998 were then randomly selected proportional to the number of schoolchildren in each school. A total of 1528 schoolchildren were examined, yielding a response rate of 83.17%.

Data collection

A questionnaire containing questions on demographic and socioeconomic characteristics was sent to parents/legal guardians of each selected student. The questionnaire gathered information on demographic and socioeconomic characteristics, such as gender, skin color, mother's and father's education, socioeconomic status (using the standard Brazilian economic classifications) (25), and numbers of rooms and people living in the house. Information on the school year that the student was attending was recorded. Information regarding location, cause, and age of TDI was gathered using specific questions.

Clinical examination was performed at the schools with the students in a supine position, using artificial light, a clinical mirror, a periodontal probe (Williams no. 23, Golgran, São Paulo, Brazil) and gauze. The instruments were properly packed and sterilized. TDI was recorded according to the Children's Dental Health Survey criteria (26): (0) no trauma, (1) enamel fracture alone, (2) enamel-dentine fracture, (3) fracture with pulp exposure, (4) sign of pulp involvement, but without sign of fracture, (5) missing tooth because of TDI, and (6) other types of TDI. Overjet was measured as the distance, in millimeters, between the buccal surface of the more prominent upper central incisor and the corresponding lower incisor, with the millimetric probe positioned parallel to the occlusal plane. Overjet was a negative value in patients with anterior crossbites and 0 in cases of top bite. Lip coverage was visually assessed and scored as adequate (lips form an anterior seal when the mandible is in a physiological rest position) or inadequate (lips do not form an anterior seal under the same condition, and the incisors remain apparent) (27).

Anthropometric data were gathered to allow the calculation of body mass index (BMI). Participants were weighed using a digital scale, and two readings were made. A third assessment was taken if a difference >0.3 kg was observed between measurements (24). The mean of the two closest measurements was used to calculate BMI. The schoolchildren wore light clothing and no shoes. Height was measured to the nearest full centimeter using inelastic metric tape attached to a flat wall with no footer (28).

Measurement reproducibility

A single calibrated examiner (NDT) performed all measurements. Before the beginning of the study, calibration of the TDI index was performed by the repeated assessment of 30 photographs. During the survey, repeated examinations were conducted on 5% of the sample. The minimal time interval between examinations was 2 days. The median Cohen's kappa value was 0.80 (range 0.72–0.88).

Ethical considerations

This study was approved by the Federal University of Rio Grande do Sul Research Ethics Committee (299/08) and by the Municipal Health Department of Porto Alegre Research Ethics Committee (process no. 001.049155.08.3/register no. 288). A written letter explaining the study aims and procedures and inviting families to participate was sent in advance to the selected schoolchildren's households. All participants and their parents/legal guardians signed free informed consent.

Non-response analysis

Of the 337 and 1500 schoolchildren who were selected from private and public schools, 76 and 233 did not participate, yielding response rates of 77.44% and 84.46%, respectively. Telephone contact was established with 176 parents/legal guardians of the non-respondents. Of those children, 26% reported no interest because of previous access to dental care, 27% of schoolchildren refused to participate, 24% did not return the informed consent or questionnaire, and 4% showed concern about biosecurity or refused to answer socioeconomic questions. Nineteen percent of students were not available at school during the normal survey schedule.

A random sample of non-respondents was selected, and demographic and socioeconomic data were obtained for 80 schoolchildren. Among those students, 44% were girls, and 56% were boys; 77% were white, and 23% were non-white; 21% had high socioeconomic status, 31% had mid-high status, 46% had mid-low status, and 2% had low socioeconomic status. Regarding parents' educations, 42% had only attended elementary school, 41% had attended high school, and 17% had attended a university. Given the discrepancies in some of the demographic and socioeconomic features between the study participants and non-respondents, a weighted variable based on information provided by the Primary Education School Census of 2010 (29) was used in the statistical analysis to minimize the non-responses.

Data analysis

Prevalence was defined as the percentage of schoolchildren having any TDI score. TDI severity was categorized into no trauma (all teeth having scores 0), mild trauma (≥1 tooth with a scores 1), or severe trauma (≥1 tooth with scores 2, 3, 4, 5, or 6).

Socioeconomic status used cutoff points proposed by the standard Brazilian economic classification, and households were classified into low (≤13 points), mid-low (≥14 to ≤22 points), mid-high (≥23 to ≤28 points), and high (≥29 points) status, following the data distribution. Student school year was categorized into regular (5th and 6th grades), late (4th grade or earlier), and advanced (7th grade). Household crowding was calculated as the number of persons per room, and it was categorized into low (≤0.6 persons/room), medium (> 0.6 to ≤1 persons/room), and high crowding (> 1 person/room). BMI was calculated using the standard formula and was categorized according to gender-specific cutoff points for this age group (28).

Data analysis was performed using STATA software (Stata 11.1 for Mac; Stata Corporation, College Station, TX, USA) and survey commands took into account the survey design, including clustering, weighting, and robust variance estimations. A weight variable was therefore used to adjust for the potential bias in the population estimates (30). The sample weight was adjusted for the probability of selection and population distribution according to gender, school type, and city area. Probability of selection was calculated by dividing the population size by the number of individuals sampled in each area. This procedure also permitted the achievement of the expansion weight. The distribution of the population (poststratification) was calculated using the Primary Education School Census (29). The sample and the population were divided into various subgroups according to gender, school type, and city area. The final sample weighted variable was calculated by multiplying the base weight by the poststratification adjustment. Pairwise comparisons for demographic, socioeconomic, and physical factors were carried out using the Wald test. The chosen level of statistical significance was 5%.

The association of TDI prevalence and severity with the independent variables was assessed using survey Poisson regression models. The preliminary analysis was carried out using a univariable model, and variables showing associations with $P < 0.25$ were selected for the multivariable analysis. Confounding and effect modifications were assessed. Variables were considered confounders if a change of 30% or more in other variables in the model was observed. Effect modification was assessed by including interaction terms in the multivariable models. No statistically significant interactions were observed. The contribution of each variable to the model was assessed by means of the Wald statistic. Because no association between TDI and schoolchildren late at school was observed in the multivariable model ($P = 0.20$), the variable school year was dichotomized into regular/late and advanced.

Results

Table 1 shows the prevalence and severity of TDI by demographic, socioeconomic, and physical characteristics. The overall prevalence of TDI was 34.79%. Considering the severity of TDI, 24.37% of individuals had mild trauma (enamel fracture alone), and 10.43% had severe trauma, including cases of enamel-dentine fracture without pulp involvement (9.43%), enamel-dentine fracture with pulp involvement (0.52%), tooth loss (0.11%), and other types of trauma, such as trauma in periodontal tissue (0.37%). The majority of affected individuals had one (62.95%) or two teeth (27.68%) with TDI. Upper incisors were the most affected teeth, whereas canines were the least affected. The average number of traumatized teeth was 0.52 (standard error = 0.02).

The majority of individuals who had suffered TDI did not remember the cause (53.64%), location (53.66%), or age (61.67%) of the incident. The most common cause of injury was falls (15.46%), followed by sports (11.08%), collision against objects or people (10.60%), violence and traffic accidents (0.70% and 0.54%, respectively), and other causes 7.98%. TDI occurred at home in 22.32% of cases, at school in 8.52% of cases and elsewhere in 15.50% of cases. Regarding age, there was an even distribution of episodes of TDI in all ages (6–12 years old), with a slight predominance in ages 10 and 11 years old.

In the univariable analysis, several factors were significantly associated with the occurrence of TDI, including gender, socioeconomic status, parents' educations, school year, and household crowding. After adjusting for the other factors in the multivariable analysis, male individuals (RR = 1.41, $P = 0.002$) and schoolchildren with low socioeconomic status (RR = 1.32, $P = 0.021$) were more likely to present at least one tooth with TDI. In contrast, students attending 7th grade (advanced students) were less likely (RR = 0.59, $P = 0.012$) to have TDI than students in the 6th grade or below (Table 2).

The effect of socioeconomic status on TDI severity is shown in Table 3. Mild TDI was significantly associated with lower socioeconomic status. After adjusting for gender and school year, students of low socioeconomic status were 78% more likely to have mild TDI than those of high socioeconomic status. In contrast, no statistically significant associations were observed between severe TDI and socioeconomic status.

Table 1. Frequency distribution, prevalence and severity of traumatic dental injury by demographic, socioeconomic, and physical characteristics in 12-year-old schoolchildren in Porto Alegre, Brazil

		Prevalence[2]		Severity[3] %		
Variable	*n* (%)	% (SE)	*P*	Mild	Severe	*P*
Gender						
Female	758 (49.61)	28.6 (2.07)	ref.	20.5	8.1	0.001
Male	770 (50.39)	40.8 (1.26)	0.000	28.1	12.7	
Skin color						
White	1065 (69.70)	32.9 (1.90)	ref.	23.3	9.6	0.069
Non-white	463 (30.30)	39.4 (1.78)	0.054	26.9	12.5	
Socioeconomic status						
High	141 (9.23)	26.5 (2.16)	ref.	14.1	12.4	0.109
Mid-high	358 (23.43)	33.2 (2.95)	0.089	21.9	11.3	
Mid-low	871 (57.00)	36.8 (0.01)	0.025	26.7	10.1	
Low	158 (10.34)	37.5 (0.01)	0.007	29.9	7.6	
Mother's education[1]						
Elementary school	789 (51.87)	38.1 (2.00)	ref.	27.8	10.3	0.193
High school	516 (33.93)	32.6 (2.83)	0.232	22.7	9.9	
University	216 (14.20)	29.6 (1.52)	0.039	17.5	12.1	
Father's education[1]						
Elementary school	788 (55.22)	37.9 (1.41)	ref.	27.1	10.8	0.021
High school	436 (30.55)	31.2 (1.63)	0.015	22.2	9.0	
University	203 (14.23)	29.9 (2.00)	0.010	17.5	12.4	
School						
Private	261 (17.08)	31.6 (0.92)	ref.	18.6	13.0	0.084
Public	1267 (82.92)	35.7 (1.77)	0.082	26.0	9.7	
School year						
Regular/late (6th or below)	1480 (96.86)	35.4 (1.58)	ref.	25.1	10.3	0.135
Advanced (7th)	48 (3.14)	18.4 (1.71)	0.000	5.9	12.5	
Crowding						
Low	351 (22.97)	29.7 (2.43)	ref.	19.4	10.3	0.088
Medium	827 (54.12)	34.8 (1.31)	0.061	24.2	10.6	
High	350 (22.91)	41.1 (2.26)	0.024	30.9	10.2	
Overjet[1]						
0–5 mm	1320 (86.90)	33.7 (1.64)	ref.	24.1	9.6	0.267
6+ mm	199 (13.10)	40.8 (5.48)	0.284	26.5	14.3	
Lip coverage						
Adequate	1004 (65.71)	32.9 (1.93)	ref.	23.6	9.3	0.305
Inadequate	524 (34.29)	38.6 (2.59)	0.147	25.8	12.8	
BMI						
Underweight	12 (0.79)	37.4 (11.17)	0.868	37.4	0.0	0.248
Normal	1114 (72.91)	35.5 (1.74)	ref.	23.9	11.6	
Overweight	268 (17.54)	33.2 (2.96)	0.734	24.8	8.4	
Obese	134 (8.77)	31.6 (3.62)	0.594	26.0	5.6	
Total	1528 (100.00)	34.8 (1.58)		24.4	10.4	

BMI, body mass index; ref., reference category; SE, standard error.
[1]Missing data.
[2]Wald test.
[3]Chi-square test.

Discussion

This study was carried out to assess the prevalence, severity, and risk indicators of TDI in the anterior permanent teeth of 12-year-old South Brazilian schoolchildren. We found a high prevalence of mild trauma, whereas severe trauma was infrequent. The presence of TDI was significantly associated with gender, socioeconomic status, and school year. Mild trauma was associated with socioeconomic status in a direct manner. In contrast, no statistically significant associations were observed between severe TDI and socioeconomic status.

The prevalence of TDI in this population was approximately 35%, which is higher than in the US/Europe/Africa but similar/lower than elsewhere (1–6). The heterogeneity of the prevalence rates might be explained, at least in part, by differences in diagnostic criteria and methods of examination (10, 15, 23, 31). In this study, the fact that students were in a supine position, the use of artificial light, and tooth drying may have increased the sensitivity of the examination. It is also important to acknowledge that other population and societal factors may have had an impact on the epidemiology of TDI.

Several studies have shown significant differences in the occurrence of TDI between genders, and a higher prevalence in boys has been consistently found (5, 8, 9, 32). The present survey is in agreement with these

Table 2. Prevalence of traumatic dental injury by demographic, socioeconomic, and physical characteristics in 12-year-old schoolchildren in Porto Alegre, Brazil (Poisson regression)

	Univariable			Multivariable		
Variable	RR	95% CI	*P*	RR	95% CI	*P*
Gender						
Female	1.00			1.00		
Male	1.42	1.24–1.63	0.002	1.41	1.23–1.61	0.002
Skin color						
White	1.00					
Non-white	1.19	0.99–1.44	0.057			
Socioeconomic status						
High	1.00			1.00		
Mid-high	1.25	0.95–1.64	0.083	1.21	0.90–1.62	0.142
Mid-low	1.38	1.04–1.83	0.031	1.31	0.99–1.74	0.051
Low	1.41	1.14–1.74	0.010	1.32	1.07–1.64	0.021
Mother's education						
Elementary school	1.00					
High school	0.85	0.62–1.17	0.242			
University	0.77	0.61–0.97	0.038			
Father's education						
Elementary school	1.00					
High school	0.82	0.71–0.94	0.017			
University	0.78	0.67–0.92	0.015			
School						
Private	1.00					
Public	1.12	0.98–1.29	0.074			
School year						
Regular/late (6th or below)	1.00			1.00		
Advanced (7th grade)	0.52	0.40–0.66	0.002	0.59	0.43–0.82	0.012
Crowding						
Low	1.00					
Medium	1.17	0.97–1.40	0.078			
High	1.38	1.05–1.81	0.028			
Overjet						
0–5 mm	1.00					
6+ mm	1.21	0.81–1.80	0.254			
Lip coverage						
Adequate	1.00					
Inadequate	1.17	0.91–1.50	0.142			
BMI						
Underweight	1.05	0.48–2.30	0.865			
Normal	1.00					
Overweight	0.93	0.71–1.21	0.509			
Obese	0.89	0.62–1.26	0.412			

BMI, body mass index; RR, rate ratio; CI, confidence interval.

studies, with boys having a 41% higher likelihood of TDI than girls. Adjustment for other factors (socioeconomic status and school year) in the multivariable model did not affect the magnitude of this association, strengthening the role of gender in the occurrence of TDI. Boys frequently engage in contact sports and intense/competitive activities, which increase the risk for accidents (5, 33–35).

Several variables have been used as proxies to try to capture the effect of children and adolescents' socioeconomic status on TDI, including school type (public or private) (10, 18, 19, 23), parents' educations (9, 17), income (8, 9, 19), socioeconomic status (6, 36), and housing conditions (21). We have used a comprehensive set of variables to assess this relationship, and all variables showed significant or borderline significant associations with TDI in the univariable analyses. Schoolchildren with mid-low and low socioeconomic status who were living in situations of high household crowding were more likely to suffer TDI, whereas those individuals with parents having higher educations were less likely to experience TDI. School type was borderline significantly associated with TDI, with public school students having a greater chance of having TDI. After adjustment for gender and school year, schoolchildren with mid-low and low socioeconomic status were around 50% more likely to suffer TDI than schoolchildren with high socioeconomic status. This finding may be explained by the lifestyle of this population, which is more likely to live in unsafe environments (15) and is less socially secure (19). Regarding severity analysis, there was a tendency of students from higher socioeconomic status toward having severe TDI. In the multivariable analysis, mild TDI was significantly associated with mid-

Table 3. Effect of socioeconomic status on severity of traumatic dental injury in 12-year-old schoolchildren in Porto Alegre, Brazil (Poisson regression)

	Univariable						Multivariable[1]					
	Mild			Severe			Mild			Severe		
	RR	95% CI	*P*	RR	95% CI	*P*	RR	95% CI	*P*	RR	95% CI	*P*
Socioeconomic status												
High	1.00			1.00			1.00			1.00		
Mid-high	1.53	1.20–1.95	0.008	0.99	0.54–1.81	0.994	1.46	1.09–1.94	0.022	0.94	0.52–1.71	0.814
Mid-low	1.84	1.05–3.25	0.039	0.95	0.52–1.74	0.844	1.68	1.01–2.77	0.045	0.85	0.47–1.53	0.504
Low	2.01	1.22–3.29	0.017	0.74	0.35–1.58	0.342	1.78	1.11–2.85	0.027	0.64	0.33–1.22	0.132

RR, rate ratio; CI, confidence interval.
[1]Estimates are adjusted for gender and school year.

high (RR = 1.46, $P = 0.022$), mid-low (RR = 1.68, $P = 0.045$), and low (RR = 1.78, $P = 0.027$) socioeconomic status, whereas severe TDI was not significantly correlated to socioeconomic status. Some studies have shown no association between TDI and socioeconomic status (2, 5, 32, 37). Among those that found such associations, the majority observed a higher prevalence of TDI in individuals with lower socioeconomic status (10, 19–21, 38), as was found in this study. It has been suggested that developing countries present an inverse association (more TDI in individuals with higher socioeconomic status) (8, 15). However, this study does not support this hypothesis, nor do other surveys conducted in developing countries (10, 38).

In this study, we found an inverse correlation between TDI and students who were ahead of their class. Students in 7th grade were 41% less likely to have TDI than students in the 6th grade or below. This association remained significant after adjusting for gender and socioeconomic status, indicating an independent effect on TDI. The rationale for this protective effect is unclear; nevertheless, it is likely to be related to the behavioral characteristics of these students. No association between TDI and being late at school (4th grade or earlier) was observed in this study.

Conflicting results have been observed with regard to the role of physical characteristics on TDI occurrence. A tendency toward a higher chance of TDI was observed in students with inadequate lip coverage; however, this association never reached statistical significance. This finding is in contrast to several reports that showed a protective effect of adequate lip coverage on TDI (8, 21, 24, 39). Similarly, most studies have shown an increased risk of TDI in children with increased overjets. A meta-analysis assessing 11 articles found a significant relationship between an overjet >3 mm and TDI (22). In this study, no significant association was observed between TDI and overjet. Recently, the association between obesity and TDI has gained greater attention because of the increase in childhood obesity. In this study, no significant association was found between BMI and TDI, and this finding is in agreement with another study carried out in Brazil (10). In contrast, two earlier studies showed that overweight students were more affected by TDI (9, 24).

In conclusion, this study showed a high prevalence of TDI in 12-year-old Brazilian schoolchildren. Gender, socioeconomic status, and school achievement were associated with TDI.

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Conflict of interest statement

We, Nailê Damé Teixeira, Luana Severo Alves, Cristiano Susin, and Marisa Maltz, declare that we have no proprietary, financial, professional, or other personal interest of any nature or kind in any product, service, and/or company that could be construed as influencing the position presented in, or the review of, the manuscript 'Traumatic dental injury among 12-year-old South Brazilian schoolchildren: Prevalence, severity and risk indicators'.

References

1. Altun C, Ozen B, Esenlik E, Guven G, Gurbuz T, Acikel C et al. Traumatic injuries to permanent teeth in Turkish children, Ankara. Dent Traumatol 2009;25:309–13.
2. David J, Astrom AN, Wang NJ. Factors associated with traumatic dental injuries among 12-year-old schoolchildren in South India. Dent Traumatol 2009;25:500–5.
3. Kaste LM, Gift HC, Bhat M, Swango PA. Prevalence of incisor trauma in persons 6–50 years of age: United States, 1988–1991. J Dent Res 1996;75 Spec No:696–705.
4. Navabazam A, Farahani SS. Prevalence of traumatic injuries to maxillary permanent teeth in 9- to 14-year-old school children in Yazd, Iran. Dent Traumatol 2010;26:154–7.
5. Naidoo S, Sheiham A, Tsakos G. Traumatic dental injuries of permanent incisors in 11- to 13-year-old South African schoolchildren. Dental Traumatol 2009;25:224–8.
6. Locker D. Prevalence of traumatic dental injury in grade 8 children in six Ontario communities. Can J Public Health 2005;96:73–6.
7. Cortes MI, Marcenes W, Sheiham A. Prevalence and correlates of traumatic injuries to the permanent teeth of schoolchildren

aged 9–14 years in Belo Horizonte, Brazil. Dent Traumatol 2001;17:22–6.
8. Marcenes W, Zabot NE, Traebert J. Socio-economic correlates of traumatic injuries to the permanent incisors in schoolchildren aged 12 years in Blumenau, Brazil. Dent Traumatol 2001;17:222–6.
9. Nicolau B, Marcenes W, Sheiham A. Prevalence, causes and correlates of traumatic dental injuries among 13-year-olds in Brazil. Dent Traumatol 2001;17:213–7.
10. Soriano EP, Caldas- AF Jr, Carvalho MVD, Amorim-Filho HA. Prevalence and risk factors related to traumatic dental injuries in Brazilian schoolchildren. Dent Traumatol 2007;23:232–40.
11. Maltz M, Barbachan e Silva B. [Relationship among caries, gingivitis and fluorosis and socioeconomic status of schoolchildren]. Rev Saude Publica 2001;35:170–6.
12. Susin C, Haas AN, Valle PM, Oppermann RV, Albandar JM. Prevalence and risk indicators for chronic periodontitis in adolescents and young adults in South Brazil. J Clin Periodontol 2011;38:326–33.
13. Susin C, Haas AN, Opermann RV, Albandar JM. Tooth loss in a young population from South Brazil. J Public Health Dent 2006;66:110–5.
14. Warnakulasuriya S. Significant oral cancer risk associated with low socioeconomic status. Evid Based Dent 2009;10:4–5.
15. Bendo CB, Scarpelli AC, Vale MP, Araújo Zarzar PM. Correlation between socioeconomic indicators and traumatic dental injuries: a qualitative critical literature review. Dent Traumatol 2009;25:420–5.
16. Glendor U. Aetiology and risk factors related to traumatic dental injuries – a review of the literature. Dent Traumatol 2009;25:19–31.
17. Fakhruddin KS, Lawrence HP, Kenny DJ, Locker D. Impact of treated and untreated dental injuries on the quality of life of Ontario schoolchildren. Dent Traumatol 2008;24:309–13.
18. Sgan-Cohen HD, Megnagi G, Jacobi Y. Dental trauma and its association with anatomic, behavioral, and social variables among fifth and sixth grade schoolchildren in Jerusalem. Community Dent Oral Epidemiol 2005;33:174–80.
19. Artun J, Al-Azemi R. Social and behavioral risk factors for maxillary incisor trauma in an adolescent Arab population. Dent Traumatol 2009;25:589–93.
20. Malikaew P, Watt RG, Sheiham A. Associations between school environments and childhood traumatic dental injuries. Oral Health Prev Dent 2003;1:255–66.
21. Marcenes W, Murray S. Social deprivation and traumatic dental injuries among 14-year-old schoolchildren in Newham, London. Dental Traumatol 2001;17:17–21.
22. Nguyen QV, Bezemer PD, Habets L, Prahl-Andersen B. A systematic review of the relationship between overjet size and traumatic dental injuries. Eur J Orthod 1999;21:503–15.
23. Soriano EP, Caldas- AF Jr, Goes PSA. Risk factors related to traumatic dental injuries in Brazilian schoolchildren. Dental Traumato 2004;20:246–50.
24. Petti S, Cairella G, Tarsitani G. Childhood obesity: a risk factor for traumatic injuries to anterior teeth. Endod Dent Traumatol 1997;13:285–8.
25. ABEP. Standard Brazilian economic classifications. Brazil. 2009. http://www.abep.org/novo/CMS/Utils/FileGenerate.ashx?id = 12 [accessed on 15 March 2011].
26. O'brien M. Children's dental health in the united kingdom 1993. Report of dental survey, office of population censuses and surveys. London: Her Majesty's Stationary Office; 1994.
27. Jackson D. Lip positions and incisor relationships. Br Dent J 1962;112:147–58.
28. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. Br Med J 2000;320:1240–3.
29. National Institute of Educational Studies. Primary education school census. Brazil: Min of Education; 2010.
30. Korn B, Graubard E. Analysis of health surveys. New York: John Wiley and Sons; 1999.
31. Glendor U. Epidemiology of traumatic dental injuries – a 12 year review of the literature. Dent Traumatol 2008;24:603–11.
32. Nicolau B, Marcenes W, Sheiham A. The relationship between traumatic dental injuries and adolescents' development along the life course. Community Dent Oral Epidemiol 2003;31:306–13.
33. Marcenes W, al Beiruti N, Tayfour D, Issa S. Epidemiology of traumatic injuries to the permanent incisors of 9–12-year-old schoolchildren in Damascus, Syria. Endod Dent Traumatol 1999;15:117–23.
34. Marcenes W, Alessi ON, Traebert J. Causes and prevalence of traumatic injuries to the permanent incisors of schoolchildren aged 12 years in Jaragua do Sul, Brazil. Int Dent J 2000;50:87–92.
35. Kahabuka FK, Mugonzibwa EA. Risk factors for injuries to maxillary permanent incisors and upper lip among schoolchildren in Dar es Salaam, Tanzania. Int J Paediatr Dent 2009;19:148–54.
36. Jamani KD, Fayyad MA. Prevalence of traumatized permanent incisors in Jordanian children, according to age, sex and socioeconomic class. Odontostomatol Trop 1991;14:17–20.
37. Fakhruddin SK, Lawrence HP, Kenny DJ, Locker D. Etiology and environment of dental injuries in 12- to 14-year-old Ontario schoolchildren. Dental Traumatol 2008;24:305–8.
38. Ramos-Jorge ML, Peres MA, Traebert J, Ghisi CZ, Paiva SM, Pordeus IA et al. Incidence of dental trauma among adolescents: a prospective cohort study. Dental Traumatol 2008;24:159–63.
39. Traebert J, Bittencourt DD, Peres KG, Peres MA, Lacerda JT, Marcenes W. Aetiology and rates of treatment of traumatic dental injuries among 12-year-old school children in a town in Southern Brazil. Dental Traumatol 2006;22:173–8.