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# Exploring factors associated with traumatic dental injuries in preschool children: a Poisson regression analysis

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**Abstract** – *Objective*: This cross-sectional study aimed to investigate the factors associated with dental trauma in preschool children using Poisson regression analysis with robust variance. *Subjects and methods*: The study population comprised 888 children aged 3- to 5-year-old attending public nurseries in Canoas, southern Brazil. Questionnaires assessing information related to the independent variables (age, gender, race, mother's educational level and family income) were completed by the parents. Clinical examinations were carried out by five trained examiners in order to assess traumatic dental injuries (TDI) according to Andreasen's classification. One of the five examiners was calibrated to assess orthodontic characteristics (open bite and overjet). Multivariable Poisson regression analysis with robust variance was used to determine the factors associated with dental trauma as well as the strengths of association. Traditional logistic regression was also performed in order to compare the estimates obtained by both methods of statistical analysis. *Results*: 36.4% (323/888) of the children suffered dental trauma and there was no difference in prevalence rates from 3 to 5 years of age. Poisson regression analysis showed that the probability of the outcome was almost 30% higher for children whose mothers had more than 8 years of education (Prevalence Ratio = 1.28; 95% CI = 1.03–1.60) and 63% higher for children with an overjet greater than 2 mm (Prevalence Ratio = 1.63; 95% CI = 1.31–2.03). Odds ratios clearly overestimated the size of the effect when compared with prevalence ratios. *Conclusions*: These findings indicate the need for preventive orientation regarding TDI, in order to educate parents and caregivers about supervising infants, particularly those with increased overjet and whose mothers have a higher level of education. Poisson regression with robust variance represents a better alternative than logistic regression to estimate the risk of dental trauma in preschool children.

Traumatic dental injuries (TDI) in preschool children represent a public health problem due to their high prevalence, to their impact on the children's quality of life, and to the high costs associated with their treatment (1, 2). The implementation of policies aimed at preventing TDI should be based on data derived from research studies of high methodological quality, which allow a comprehensive understanding of the condition.

Findings of studies designed to assess the occurrence of TDI in the permanent dentition cannot be directly extrapolated to preschool children, since it is likely that the web of causality, including both biological and socioeconomic factors, will behave in a different manner in this population (3, 4). For example, while some orthodontic characteristics are clearly associated with TDI in adolescents, there is no evidence of such a relationship in preschool children (5–9). The association between socioeconomic indicators and TDI is also inconsistent in the published literature and needs to be further investigated. Clarification of these questions could contribute to establishing a baseline for future preventive interventions and for the management of trauma in preschool children.

Over recent decades, risk factors associated with several different conditions have been identified by means of multivariate analysis techniques, such as logistic regression. However, the use of odds ratio in cross-sectional studies designed to assess frequent outcomes, such as dental trauma, can cause an overestimation of the prevalence ratio, which is the measure of

choice in such studies (10, 11). In this sense, Poisson regression with robust variance seems to represent a better alternative for obtaining measures that are both more appropriate and easier to interpret (10).

The aim of this study was to investigate, by means of Poisson regression with robust variance, the association between TDI and demographic, orthodontic, and socioeconomic variables in preschool children from Canoas, a municipality in southern Brazil.

## Methods

### Subjects and study design

This cross-sectional study is part of a major study which investigated the oral conditions of children attending public nurseries (0–6 years old) in the municipality of Canoas, southern Brazil. Prevalence rates of dental trauma, gingivitis, dental caries and dental anomalies in this population have been published previously (12–15).

The study sample comprised 888 children aged 3–5 years. Sample size was calculated based on the following parameters: a 95% confidence interval (95% CI), a power of 80%, and an odds ratio of 1.85 between exposed (severe overjet) and unexposed (without severe overjet) children (6). These parameters resulted in a minimum sample size of 420 children, which was increased by 30% for the multivariate analysis. The final sample size required ($n = 566$) was compatible with the total number of children who met the inclusion criteria ($n = 888$), namely, age between 3 and 5 years and complete deciduous dentition. The exclusion criteria were presence of one or more erupted permanent teeth and ongoing or past orthodontic treatment.

### Questionnaire

A self-administered questionnaire assessing demographic data (age, gender, and race) and socioeconomic data (mother's educational level and family income) was completed by the children's parents at the nurseries. Data regarding the distribution of TDI according to gender and age in the whole sample have been published previously (12); nevertheless, these variables were kept in the initial model as possible confounders. Trained investigators were available to provide assistance to parents who were unable to read or write. Race was classified as white or non-white (16). Family income and mother's educational level were obtained as quantitative variables. Family income was defined as the sum of the monthly wages of all economically active members of the family (in local currency), divided by the Brazilian minimum wage (about US$ 150.00). The variable was then stratified into tertiles (1st tertile: $<2$ minimum wages; 2nd tertile: 2–3.5; and 3rd tertile: $>3.5$ minimum wages). Mother's educational level was recorded in years of schooling. This variable was stratified into three categories: $<4$ years, i.e., mothers who had not completed the first half of primary/elementary education; 4–8 years, i.e., mothers who had completed or were attending the second half of primary/elementary education; and $>8$ years, i.e., mothers who had completed or were attending secondary or higher education.

### Clinical examination

Dental examinations were conducted at the nurseries by five experienced clinicians. Examinations were carried out under natural light, with the children lying on ordinary desks facing a window. First, their teeth were cleaned and dried with gauze. Visual and digital examinations were carried out with the help of a tongue depressor. Traumatic injuries were recorded as described by Andreasen (17), and included crown discoloration, enamel fracture, enamel-dentine fracture with or without pulp exposure, subluxation, lateral luxation, intrusive luxation, extrusive luxation, and avulsion. Quality control measures included the training and calibration of examiners prior to the beginning of the study in order to ensure consistency in examination techniques and in the diagnosis of dental injury, as follows: two dental examinations were conducted with a 10-day interval in 20 children aged 1–5 years. Kappa values for intra and inter-examiner agreement for dental trauma ranged from 0.85 to 0.94 and from 0.82 to 0.90, respectively.

One of the five examiners was calibrated for the assessment of orthodontic characteristics (kappa = 0.81). Occlusion was assessed with the teeth in centric occlusion. The following parameters were recorded using standard, previously published definitions: (i) incisor overjet, measured as the distance between the palatal surface of the most protruded maxillary incisor and the labial surface of the corresponding mandibular incisor, later categorized into normal ($\leq$2.0 mm) and increased ($>2.0$ mm) (18–20); and (ii) presence of anterior open bite, defined as lack of vertical overlap of the incisors in the occlusal position (4, 21).

### Statistical analysis

Statistical analyses were performed using SPSS (SPSS Inc., Chicago, IL, USA). Unadjusted and adjusted prevalence ratios of dental trauma were estimated using Poisson regression analysis with robust variance. First, the prevalence ratios and 95% CI of each variable were estimated separately. Then, multivariate modeling was performed starting with all independent variables and confounders available for dental trauma, using backward elimination when the Wald *P*-value was higher than 0.05. Interactions were evaluated by Wald tests in the final model. Logistic regression was also performed to compare the estimates obtained with both models.

### Ethical aspects

This study was approved by the Ethics Committee at Universidade Luterana do Brasil (ULBRA), Canoas, Brazil. All the procedures involved in the study, as well as possible discomforts and risks were fully explained to the children and their parents or guardians. Free, informed consent was obtained from all participants prior to the investigation.

## Results

This study population included 469 (52.8%) boys and 419 girls (47.2%); 305 (34.3%) were 3-year olds, 323 (36.4%) were 4-year olds, and 260 (29.3%) were 5-year olds. Most of the children were white (81%). Mothers' educational level varied from 1 to 17 years of schooling, with one-third of the mothers having $<4$ years of schooling. Family income was low for most families: 33% had an income of $<2$ minimum wages. Finally, most children (61%) presented increased overjet ($>2$ mm), and open bite was present in 38% of the sample.

Of the 888 children examined, 36.4% (323) showed dental trauma. Results of the univariate logistic regression and Poisson regression analyses are shown in Table 1. Both methods identified the same variables as significantly associated with TDI: mother's educational level and overjet. However, point estimates as well as CI obtained by logistic regression were clearly overestimated. No association was found in the univariate analysis between dental trauma and gender, age, race, family income, or open bite.

Table 2 presents the final multivariate model for the occurrence of dental trauma. Poisson regression analysis with robust variance showed that the probability of TDI was almost 30% higher for children whose mothers had spent $>8$ years in education (PR = 1.28; 95% CI 1.03–1.60) than for children whose mothers had received $<4$ years of education. Furthermore, the probability of presenting TDI was 63% higher for children with an overjet $>2$ mm (PR = 1.63; 95% CI 1.31–2.03) than for children with an overjet $\leq 2$ mm. Although the same variables remained in the final logistic regression model, the odds ratios and CI were again strongly overestimated. The odds of TDI was almost 50% higher in children whose mothers had $>8$ years of schooling (OR = 1.48; 95% CI 1.04–2.11) and more than two-fold higher in children with an overjet $>2$ mm (OR = 2.09; 95% CI 1.52–2.88). On an average, CI were 44% narrower using Poisson regression with robust variance when compared with logistic regression. No statistically significant interactions were found between the variables assessed.

Many questionnaires were incomplete, mainly with respect to maternal education. In order to assess the influence of these losses, the prevalence of TDI was compared between children with and without a complete questionnaire, and no difference was found (Chi-squared test, $P = 0.149$).

## Discussion

The main result of the present study was the association between increased overjet and TDI, which suggests that, in young children, overjet is an important predisposing factor for injuries to primary incisors. The plausibility of such association, based on an increased exposure of protruded teeth to traumatic injuries, and the strength found for this association, suggest a significant relationship of causality between both variables. While increased overjet had already been described as a risk factor for TDI in the permanent dentition (5–9), data available for the deciduous dentition have so far been inconclusive. Although the conflictive results reported may reflect variations in behavioral and environmental susceptibilities, methodological characteristics are perhaps what best explains the difference between studies reporting a relationship between increased overjet and TDI in the deciduous dentition (22, 23) and those not identifying such a relationship (24, 25). The power of this study, characterized by its adequate sample size, as well as the multivariate analysis employed, reinforce the probability that the results observed have not occurred by chance or as an effect of confounding.

Although orthodontic treatment of increased overjet has been recommended to prevent TDI in mixed and permanent dentition, treatment of the deciduous dentition has only been suggested for patients with markedly increased overjet (26). The confirmation that overjet is a risk factor for TDI in the deciduous dentition suggests that the indications for early orthodontic therapy should be reassessed. Furthermore, this finding could contribute to the identification of groups who should receive special guidance on general traumatic injury prevention measures. Guidance on avoiding non-nutritive sucking habits, which is a factor related to increased overjet in the deciduous dentition, may also contribute to reducing the occurrence of this outcome (27–29). We did not assess the variable lip coverage in this study because it is collinear with overjet and also because overjet apparently offers greater possibilities of prevention and treatment (8).

Our observation that anterior open bite was not associated with TDI differs from the results reported by Oliveira et al. (4), who also investigated Brazilian children. The inclusion of children aged 0–3 years in that study possibly explains, at least in part, the differences observed. Nevertheless, further research is warranted to elucidate the role of open bite, a common condition in primary teeth, in the occurrence of TDI.

Race has been extensively used in the medical and public health literature to measure social differences in health outcomes (16, 30), with ethnic minorities tending to experience more adversities and diseases (2). However, the relationship between TDI and race/ethnicity is still obscure, and no association was found in the present study either. In Latin American countries, miscegenation plays a significant role in terms of social and populational characteristics, which makes it difficult to identify ethnicities at greater risk for a given outcome (16, 30). Similar prevalence rates of TDI were also reported in different race/ethnicity categories in the USA (31).

Another relevant finding of this study was the increased occurrence of TDI among children whose mothers had higher education. Mothers' educational level is a widely used indicator of socioeconomic status (SES), and previous investigations carried out in developed countries (7, 32) have demonstrated that children with lower SES present higher rates of dental injuries. On the other hand, studies carried out in developing countries (6, 33), including findings obtained with preschool children from southern Brazil (34), have shown a reverse association: children with higher SES

*Table 1.* Crude odds ratios (OR) (obtained by unadjusted logistic regression) and prevalence ratios (PR) (obtained by unadjusted Poisson regression with robust variance) and respective 95% confidence intervals (95% CI) in the analysis of the factors associated with TDI in preschool children

| | | With trauma | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Variables | *N*[1] | *n* (%) | OR | (95% CI) | *P*-values | PR | (95% CI) | *P*-values |
| Gender | | | | | | | | |
| Male | 469 | 180 (38.4) | 1.20 | (0.91–1.58) | 0.189 | 1.12 | (0.94–1.34) | 0.190 |
| Female | 419 | 143 (34.1) | 1.00 | | | 1.00 | | |
| Age (years) | | | | | | | | |
| 3 | 305 | 112 (36.7) | 1.00 | | | 1.00 | | |
| 4 | 323 | 126 (39.0) | 1.10 | (0.80–1.52) | 0.555 | 1.06 | (0.87–1.30) | 0.555 |
| 5 | 260 | 85 (32.7) | 0.84 | (0.59–1.19) | 0.317 | 0.89 | (0.71–1.12) | 0.318 |
| Race | | | | | | | | |
| White | 719 | 266 (37.0) | 1.13 | (0.79–1.61) | 0.489 | 1.08 | (0.86–1.37) | 0.495 |
| Non-white | 167 | 57 (34.1) | 1.00 | | | 1.00 | | |
| Maternal education (in years) | | | | | | | | |
| <4 | 299 | 92 (30.8) | 1.00 | | | 1.00 | | |
| 4–8 | 204 | 76 (37.3) | 1.34 | (0.92–1.94) | 0.130 | 1.21 | (0.95–1.55) | 0.128 |
| >8 | 272 | 107 (39.3) | 1.46 | (1.03–2.06) | 0.032 | 1.28 | (1.02–1.60) | 0.032 |
| Family income (minimum wages) | | | | | | | | |
| <2.0 | 276 | 96 (34.8) | 1.00 | | | 1.00 | | |
| 2.0–3.5 | 302 | 105 (34.8) | 1.00 | (0.71–1.41) | 0.997 | 1.00 | (0.80–1.25) | 0.997 |
| >3.5 | 260 | 99 (38.1) | 1.15 | (0.81–1.64) | 0.428 | 1.09 | (0.87–1.37) | 0.428 |
| Overjet | | | | | | | | |
| >2 mm | 546 | 228 (41.8) | 1.86 | (1.39–2.50) | <0.001 | 1.50 | (1.23–1.83) | <0.001 |
| ≤2 mm | 342 | 95 (27.8) | 1.00 | | | 1.00 | | |
| Open bite | | | | | | | | |
| Yes | 338 | 125 (37.0) | 1.04 | (0.79–1.38) | 0.768 | 1.03 | (0.86–1.23) | 0.767 |
| No | 550 | 198 (36.0) | 1.00 | | | 1.00 | | |

[1]The total (*n* = 888) was smaller for race (*n* = 886), family income (*n* = 838) and maternal education (*n* = 775).

*Table 2.* Final model using multivariate logistic regression and Poisson regression with robust variance: adjusted odds ratios (OR) and prevalence ratios (PR) of the associations between TDI and mother's education and overjet

| Variables | OR[1] | (95% CI) | *P*-values | PR[1] | (95% CI) | *P*-values |
|---|---|---|---|---|---|---|
| Mother's education (in years) | | | | | | |
| <4 | 1.00 | | | 1.00 | | |
| 4–8 | 1.34 | (0.92–1.96) | 0.124 | 1.21 | (0.95–1.60) | 0.129 |
| >8 | 1.48 | (1.04–2.11) | 0.027 | 1.28 | (1.03–1.60) | 0.027 |
| Overjet | | | | | | |
| >2 mm | 2.09 | (1.52–2.88) | <0.001 | 1.63 | (1.31–2.03) | <0.001 |
| ≤2 mm | 1.00 | | | 1.00 | | |

[1]Adjusted for the other variable in the model.

tend to present higher frequencies of dental trauma, which is in line with our findings. The increased risk of dental injuries among higher SES adolescents in developing countries may be related to the greater access that this population has to high-risk conditions in unsafe environments (6). Nevertheless, family income, which is a variable directly related to the acquisition of goods and property, was not associated with the occurrence of TDI in our study. In younger children, general and dental trauma appears to be closely related to the home environment (35). It is possible that mothers with higher levels of education are more involved in activities other than taking care of their children at home, determining less physical proximity (34).

One peculiarity of this study was the use of two statistical models to identify factors associated with TDI in preschool children and to quantify the strength of such association. Poisson regression with robust variance was chosen based on the high frequency of TDI in our sample. Studies on TDI have described frequencies over 20%; under such circumstances, the odds ratio (measure obtained by logistic regression) can strongly overestimate the risk ratio (10, 11, 36). In the present study, adjusted prevalence ratio and odds ratio for overjet were 1.63 and 2.09, respectively. In other words, interpreting the odds ratio as a relative risk suggests an increase in the risk of TDI in exposed children of more than 100% compared with a more likely true increase of 63%. The clinical relevance of this difference is that logistic regression would significantly overestimate the quantitative impact of overjet on TDI. More accurate estimates may have a positive influence on policy decision-making processes, contributing to identify more cost-effective interventions (37).

Additionally, the precise definition of odds – the number of those who experience the outcome divided by the number of those who do not – is not easy for clinicians and often causes problems (36). Even more difficult to understand is the odds ratio, which is the ratio of the odds in the two groups of interest (37). In contrast, the prevalence ratio (measure obtained by Poisson regression) simply tells us how much the risk is increased from an initial level: a prevalence ratio of 2 shows that the initial risk has been increased two-fold (37).

Some aspects of our methodology merit discussion. The loss of information as a result of incomplete questionnaires was fairly high, especially in relation to mother's education. However, since no difference was found in the prevalence of TDI between children with complete and those with incomplete questionnaires, we strongly believe that this limitation did not affect the study findings or conclusions. Another factor that should be highlighted is that cross-sectional studies have an inherent limitation in defining causal associations between an exposure and a disease. Nevertheless, the factors identified in this study as associated with trauma – increased overjet and mother's educational level – possibly preceded the outcome, and therefore cannot be considered to represent reverse causality.

In conclusion, our results suggest that programs should be implemented early in childhood in order to motivate parents and caregivers to supervise infants, particularly those with increased overjet and whose mothers have a higher level of education. These findings reinforce the need for preschool- and community-based programs to improve safety in the first years, including guidance to improve the home environment and to reduce home hazards (34, 35). Further research is necessary to evaluate the role of digital sucking in overjet relationships and to find out whether early orthodontic treatment of increased overjet could contribute to preventing TDI in this age group. Furthermore, Poisson regression with robust variance proved to be a better analysis model to estimate the risk of TDI in preschool children when compared with logistic regression.

## References


1. Ramos-Jorge ML, Bosco VL, Peres MA, Nunes AC. The impact of treatment of dental trauma on the quality of life of adolescents – a case-control study in southern Brazil. Dent Traumatol 2007;23:114–9.
2. Glendor U. Epidemiology of traumatic dental injuries-a 12 year review of the literature. Dent Traumatol 2008;24: 603–11.
3. Nicolau B, Marcenes W, Sheiham A. The relationship between traumatic injuries and adolescents development along the life course. Community Dent Oral Epidemiol 2003;31: 306–13.
4. Oliveira LB, Marcenes W, Ardenghi TM, Sheiham A, Bönecker M. Traumatic dental injuries and associated factors among Brazilian preschool children. Dent Traumatol 2007;23: 76–81.
5. Nguyen QV, Bezemer PD, Habets L, Pral-Andersen B. A systematic review of the relationship between overjet size and traumatic dental injuries. Eur J Orthod 1999;21:503–15.
6. Cortes MIS, Marcenes W, Sheiham A. Prevalence and correlates of traumatic injuries to the permanent teeth of school-children aged 9–14 years in Belo Horizonte, Brazil. Dent Traumatol 2001;17:22–6.
7. Marcenes W, Murray S. Social deprivation and traumatic dental injuries among 14-year-old schoolchildren in Newham, London. Dent Traumatol 2001;17:17–21.
8. Artun J, Behbehani F, Al-Jame B, Kerosuo H. Incisor trauma in an adolescent Arab population: prevalence, severity, and occlusal risk factors. Am J Orthod Dentofac Orthop 2005;128:347–52.
9. Glendor U. Aetiology and risk factors related to traumatic dental injuries – a review of the literature. Dental Traumatol 2009;25:19–31.
10. Barros AJ, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. BMC Med Res Methodol 2003;3:21.
11. Thompson ML, Myers JE, Kriebel D. Prevalence odds ratio or prevalence ratio in the analysis of cross sectional data: what is to be done? Occup Environ Med 1998;55:272–7.
12. Kramer PF, Zembruski C, Ferreira SH, Feldens CA. Traumatic dental injuries in Brazilian preschool children. Dental Traumatol 2003;19:299–303.
13. Feldens EG, Kramer PF, Feldens CA, Ferreira SH. Distribution of plaque and gingivitis and associated factors in 3- to 5-year-old Brazilian children. J Dent Child (Chic) 2006;73:4–10.
14. Ferreira SH, Beria JU, Kramer PF, Feldens EG, Feldens CA. Dental caries in 0-to-5-year-old Brazilian children: prevalence, severity, and associated factors. Int J Paediatr Dent 2007;17:289–96.
15. Kramer PF, Feldens CA, Ferreira SH, Spiguel MH, Feldens EG. Dental anomalies and associated factors in 2- to 5-year-old Brazilian children. Int J Paediatr Dent 2008;18:434–40.
16. Travassos C, Williams DR. The concept and measurements of race and their relationship to public health: a review focused on Brazil and the United States. Cad Saude Publica 2004;20:660–79.
17. Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. Copenhagen: Munksgaard; 1994.
18. Foster TD, Hamilton MC. Occlusion in the primary dentition study of children at 2 to 3 years of age. Brit Dent J 1969;21: 76–9.
19. Otuyemi OD, Sote EO, Isiekwe MC, Jones SP. Occlusal relationships and spacing or crowding of teeth in the dentitions of 3-4-year-old Nigerian children. Int J Paediatr Dent 1997;7:155–60.
20. Grabowski R, Stahl F, Gaebel M, Kundt G. Relationship between occlusal findings and orofacial myofunctional status in primary and mixed dentition. J Orofac Orthop 2007;68:26–37.
21. Jones ML, Mourino AP, Bowden TA. Evaluation of occlusion, trauma, and dental anomalies in African–American children of metropolitan Headstart programs. J Clin Pediatr Dent 1993;18:51–4.
22. Fergusson FS, Ripa LW. Prevalence and type of traumatic injuries to the anterior teeth of preschool children. J Pedod 1979;4:3–8.
23. Robson F, Ramos-Jorge ML, Bendo CB, Vale MP, Paiva SM, Pordeus IA. Prevalence and determining factors of traumatic injuries to primary teeth in preschool children. Dent Traumatol 2009;25:118–22.
24. Garcia-Godoy F, Sanchez JR, Sanchez RR. Proclination of teeth and its relationship with traumatic injuries in preschool and school children. J Pedod 1982;6:114–9.
25. Al-Majed I, Murray JJ, Maguire A. Prevalence of dental trauma in 5–6 and 12–14-year old boys in Riyadh, Saudi Arabia. Dent Traumatol 2001;17:153–8.

26. Schopf P. Indication for and frequency of early orthodontic therapy or interceptive measures. J Orofac Orthop 2003;64:186–200.
27. Nanda RS, Khan I, Anand R. Effect of oral habits on the occlusion in preschool children. J Dent Child 1972;39:449–52.
28. Ravn JJ. Sucking habits and occlusion in 3-year-old children. Scand J Dent Res 1976;84:204–9.
29. Moss SJ, Maccaro H. Examination, evaluation and behavior management following injury to primary incisors. N Y State Dent J 1985;51:87–92.
30. Lovell PA, Wood CH. Skin color, racial identity and life chances in Brazil. Lat Am Perspect 1998;25:90–109.
31. Kaste LM, Gift HC, Bhat M, Swango PA. Prevalence of incisor trauma in persons 6 to 50 years of age: United States. 1988–1991. J Dent Res 1996;75:696–705.
32. Lalloo R. Risk factors for major injuries to the face and teeth. Dent Traumatol 2003;19:12–4.
33. Jamani KD, Fayyad MA. Prevalence of traumatized permanent incisors in Jordanian children. Odontostomatol Trop 1991;14: 17–20.
34. Feldens CA, Kramer PF, Vidal SG, Faraco Junior IM, Vítolo MR. Traumatic dental injuries in the first year of life and associated factors in Brazilian infants. J Dent Child (Chic) 2008;75:7–13.
35. Drachler ML, Carvalho Leite JC, Marshall T, Almaleh CMAH, Feldens CA, Vitolo MR. Effects of the home environment on unintentional domestic injuries and related health care attendance in infants. Acta Paediatr 2007;96:1169–73.
36. Kirkwood BR, Sterne JAC. Essential medical statistics, 2nd edn. Oxford: Blackwell Science; 2003.
37. Davies HTO, Crombie IK, Tavakoli M. When can odds ratios mislead? BMJ 1998;316:989–91.