Prevalence and Causes of Traumatic Dental Injuries in Ghanaian Preschoolers in Accra Metropolis, Ghana.

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ABSTRACT

Objective: The purpose of this study was to investigate the prevalence, etiology, place of injury, and pattern of distribution of traumatic dental injuries to primary anterior teeth in Ghanaian preschoolers aged 2-5 years.

Methods: In this cross-sectional study, multistage sampling technique was used to sample 346 preschoolers – 176 boys and 170 girls from 10 primary schools within the Accra Metropolis of Ghana. Approval from the University of Ghana Ethical Committee and school authorities, as well as consents from parents were obtained before the study commenced. Intra-oral examination of primary dentition was conducted on all study participants from April to July 2018.

The children were clinically examined using WHO diagnostic criteria modified by Andreasen and Andreasen. STATA/SE 17.0 was used to analyze the dataset. At the 95% significance level, Pearson's Chi Square and Fisher's Exact tests were conducted to ascertain whether there are statistically significant differences in proportions of certain clinical parameters of traumatized anterior primary teeth by sex of the study participants.

Results: The prevalence of traumatic dental injuries amongst Ghanaian preschoolers was 7.2%. The largest proportion of traumatic dental injuries were seen amongst those who were 3 years old (29.48%), whilst the least proportion of injuries occurred amongst the 2-year-old (17.91%) category. There was no significant difference in proportion of traumatic dental injuries between boys and girls.

Uncomplicated crown fracture was the commonest type of dental injury (64.71 %) whilst complicated crown fracture was the least (8.82 %). Moreover, primary anterior teeth in the upper right quadrants sustained more traumatic injuries (52.94 %) compared to those in the upper left quadrants (47.06 %), though there was no statistically significant difference in proportion of site of injury between boys and girls. No traumatized primary mandibular canines and incisors were recorded. Fall (84%) was the commonest cause of dental trauma and (72%) of the injuries occurred at home. All the Ghanaian preschoolers examined, who had sustained dental injuries, have never been to the dentist.

Conclusion: The prevalence of traumatic dental injuries in Ghanaian preschoolers was 7.2%. Uncomplicated crown fractures were most common whilst the 3-year-old children sustained the most traumatic injuries to the upper primary incisor teeth. Non-treatment of all traumatized teeth among the studied population calls for concern. Specific dental public health interventions and policies are needed to create awareness on the importance of early treatment of fractured teeth to prevent potential complications.

Key words: Dental injuries, epidemiology, primary dentition, Ghanaian preschoolers

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INTRODUCTION

Traumatic Dental Injuries (TDIs) is one of the commonly encountered dental emergencies in paediatric dentistry practice. TDIs are public dental health problems worldwide and can occur throughout life.[1] Trauma to the oral region occurs frequently and comprises 5% of all injuries for which people seek treatment.[2] Compared to the vast number of publications of traumatic dental injuries amongst school-aged children, similar injuries amongst preschoolers are relatively under-studied.

Nonetheless, studies have demonstrated that about one-third of these preschoolers suffer traumatic dental injuries.[3,4] A prevalence between (7.0-42%) has been reported for the primary dentition.[5] In preschool children – with injuries to the head being the most common – oral injuries make up as much as 17% of all bodily injuries, in contrast to later in life when injuries to hands and feet are the most common.[1]

The incidence and prevalence of dental trauma in preschool children varies widely for various countries and among different age groups studied.[2-4] The wide range in reported prevalence of TDIs in the primary dentition is likely due to variation in the studied populations and sample characteristics, study design, injury diagnosis and classification.[6] Children in preschool ages have a first peak of dental injuries between the age of 2 and 4.[3-8] Highest number of TDIs had been reported amongst 2- to 3-year-olds,[9-11] while some studies showed that dental injury occur more frequently amongst 4- to 5-year-old children.[12,13,14]

These injuries occur in a period when children at these ages are still learning to walk or beginning to grasp the skills of running which increases the risk of falling due to their lack of coordination and experience.[7,15,16] However, there is universal agreement that trauma occurs as a result of psychomotor underdevelopment and poor motor skills which do not allow the child to perform precise and safe movements.[17,18.]

More boys have been reported to suffer TDI than girls in primary dentition.[5,12, 19,20] The reason could be because boys are more involved in aggressive play and sports. Other studies have reported that there was no preponderance of either sex.[7,14,21]Recent publications indicate that there is no statistically significant difference in the proportion of dental injuries between the genders.[22,23,24] There are conflicting literatures regarding which of the two genders incurred the greater proportion of traumatic dental injuries.

The maxillary central incisor has been reported to be the most vulnerable tooth to TDI,[3,4,5,6,10,11,12,17,19] and this is probably because of its prominent location.[1–24] Household income and overjet, absence of lip coverage, intellectual disability, epilepsy and socioeconomic conditions are among the predisposing factors to trauma.[4,17,25,26,27]

Reported studies showed that enamel fracture was the commonest type of injury in primary dentitions.[5,9,28] There are also studies indicating that subluxation and luxation injuries were the commonest.[29,30] Injury involving one tooth was common.[5,31] Falls are the most common cause of dental trauma in the primary dentition[5,28] and most injuries occurred at home.[28,32,33]

A possible complication of traumatic dental injury in primary dentition is that the development of the permanent tooth germ can be affected, and the effect may be seen several years later when the permanent tooth erupts. In the permanent dentition, the most severe cases of dental injuries may affect the surrounding alveolar bone structure and may lead to tooth loss.[34]

Epidemiological studies on traumatic primary dentition had been documented in literature[1-34] but with very few publications on African children.[11,12,13,14,21,35] In Ghana, there was no reported studies on dental trauma in preschoolers. The only reported study was on paediatric maxillofacial fractures.[36]

The objective of this study was to bridge-up the gap in literature and to examine the prevalence of dental injuries and describe their distribution according to type, etiological factors, place of injury, and classification of such injuries amongst preschoolers in the Accra Metropolis of Ghana.

METHODOLOGY:

In this cross-sectional study, multistage sampling technique was used to sample 346 preschoolers – 176 boys and 170 girls from 10 primary schools within the Accra Metropolis of Ghana. Approval from the University of Ghana Ethical Committee and school authorities, as well as consents from parents were obtained before the study commenced. Intra-oral examination of primary dentition was conducted on all study participants from April to July 2018. The examiners were calibrated before the screening exercise and Cohen's Kappa score of 0.7 was used. Using WHO diagnostic criteria, the children were examined in their classrooms under natural lighting

with the aid of mouth mirror.[36,37] Infection control was maintained throughout the study by making use of a pack of sterile instrument per participant during examination. Children who had dental trauma were referred to the Dental Clinic at the University of Ghana School of Medicine and Dentistry, Korle-Bu for treatment. The information provided about the dental injury by the children during the screening exercise in the schools were confirmed by the parents in the clinic.

Root fractures were not recorded as no radiograph was taken. STATA/SE 17.0 was used to analyze the dataset. At the 95% significance level, Pearson's Chi Square and Fisher's Exact tests were conducted to ascertain whether there are statistically significant differences in proportions of certain clinical parameters of traumatized anterior primary teeth by sex of the study participants.

RESULTS:

The sampled population had a total of 346 preschoolers: 176 boys and 170 girls between the ages of 2-5 years. Table 1 shows the demographic distribution of all the 346 study participants sampled for this study. Children who were 3 years old recorded the largest proportion (29.48 %) of various traumatic dental injuries, whilst those who were 2 years old recorded the least proportion (17.91 %). Of the three hundred and forty-six Ghanaian preschoolers within the Accra Metropolis screened, twenty-five of them had various traumatic dental injuries, giving a prevalence of 7.2 %. The mean age of this subset of the population was (3.60 ± 0.91) years.

Table 2 illustrates the distribution of dental injuries across the four age categories (2-,3-,4- and 5 years) between boys and girls. In this subset, it is also seen that preschoolers who were 3 years old recorded the highest proportion of traumatic dental injuries (44.00 %) whilst the lowest proportion was seen in children who were 2 years old (8.00 %).Fisher's Exact test was conducted to ascertain whether there is any statistically significant difference in proportion of anterior traumatic injury across the various age categories by gender and no significance was found [Fisher's Exact test, p-value = 0.999].

Table 3 shows the commonest site of dental trauma was the maxillary arch, and the maxillary central incisors (91.2 %) were the teeth most traumatized. Traumatic dental injuries to the upper primary canine were not found in any of the study participants. Fisher's Exact test was conducted to check if there is any statistically significant difference in proportion of the tooth type (FDI classification) injured by gender of study participants and no significance was found [Fisher's Exact test, p-value = 0.912]. Lower anterior primary teeth, the incisors and canines were clinically not found to have been traumatized in the study participant.

Table 4 shows that trauma to anterior teeth in the upper right maxilla were in greater proportion (52.94 %) compared to those at the upper left side (47.06 %), though no statistically significant difference in proportions were found between boys and girls [Pearson Chi-Square test, p-value = 0.064].

Table 5 shows the distributions of the number of primary upper anterior teeth injured by gender of the study participants. It was observed that Ghanain preschoolers mostly sustained traumatic dental injuries (TDIs) to just a single tooth (72.00 %) whilst concomitant injuries to three primary teeth were the least (8.00 %). Using Fisher's Exact test, no statistically significant difference in proportions of the number of primary teeth traumatized was found between boys and girls [Fisher's Exact test, p-value = 0.813].

Table 6 shows the distributions of the types of traumatic dental injuries (TDIs) detected amongst study participants by sex. It was found that uncomplicated crown fractures were most predominant (64.71 %), followed by avulsion injuries (26.47 %) and then complicated crown fractures (8.82 %). Likewise, using Fisher's Exact test, no statistically significant difference in proportions of the types of traumatic dental injuries was found between boys and girls [Fisher's Exact test, p-value = 0.999]

Table 7 shows the distributions of the etiological types of traumatic dental injuries, and places of occurrence of these injuries by the gender of study participants. Three etiological types of TDIs were identified in the study population – fall, sports and fight/assaults. Road traffic accidents and bicycle accidents did not contribute to the dental injuries seen amongst the study participants. Injuries resulting from falls constituted the largest proportion (84.00 %) whilst injuries resulting from fight/assaults constituted the least (4.00 %)

Using Fisher's Exact test, no statistically significant difference in proportions of etiological types of traumatic dental injuries were found between boys and girls [Fisher's Exact test, p-value = 0.999]. Most of the dental injuries occurred at home (72.00 %) whilst relatively few occurred at school (24.00 %). The least proportion of these injuries however occurred on the street (7.69 %), which makes sense since children around the ages of 2-5 are mostly not left unattended to by the roadside. Once again, using Fisher's Exact test, no statistically significant difference in proportions of place of occurrence of traumatic dental injuries were found between boys and girls [Fisher's Exact test, p-value = 0.504].

Table 1. Demographic Distribution of Study Participants (Ghanaian Preschoolers)

Age (Years)	Frequency Boys n (%)	Frequency Girls n (%)	Total Number n (%)
2	32 (18.18 %)	30 (17.65 %)	62 (17.91 %)
3	50 (28.41 %)	52 (30.59 %)	102 (29.48 %)
4	48 (27.27 %)	45 (26.47 %)	93 (26.88 %)
5	46 (26.14 %)	43 (25.09 %)	89 (25.73 %)
Total	**176**	**170**	**346**

Table 2. Age and Gender Distribution of Study Participants (Ghanaian Preschoolers) of Traumatized Anterior Primary Teeth

Age (Years)	Number of Boys n (%)	Number of Girls n (%)	Total Number of Children n (%)
2	1 (7.14 %)	1 (9.09 %)	2 (8.00 %)
3	6 (48.85 %)	5 (45.45 %)	11 (44.00 %)
4	4 (28.57 %)	3 (27.27 %)	7 (28.00 %)
5	3 (15.44 %)	2 (18.19 %)	5 (20.00 %)
Total	**14**	**11**	**25**

Fisher's Exact test, p-value = 0.999, Mean Age ± SD = (3.60 ± 0.91

Table 3. Distribution of Traumatized Anterior Primary Teeth of Study Participants by Gender

Injured Tooth Type* (FDI Notation)	Injured Teeth in Boys n (%)	Injured Teeth in Girls n (%)	Total Number of Injured Teeth n (%)
51	11 (50.00 %)	5 (41.67 %)	16 (47.06 %)
52	1 (4.55 %)	1 (8.33 %)	2 (5.88 %)
53	0 (0.00 %)	0 (0.00 %)	0 (0.00 %)
61	9 (40.90 %)	6 (50.0 %)	15 (44.12 %)
62	1 (4.55 %)	0 (0.00 %)	1 (2.94 %)
63	0 (0.00 %)	0 (0.00 %)	0 (0.00 %)
Total	**22**	**12**	**34**

Fisher's Exact test, p-value = 0.912

*Tooth Type 71-75 and 81-85 (FDI Notation) not analyzed. Lower anterior teeth were not traumatized amongst the study participants.

Table 4. Site of Traumatized Upper Anterior Primary Teeth of Study Participants by Gender

Site of Injured Tooth	Number Observed Boys n (%)	Number Observed Girls n (%)	Total Number n (%)
Upper Right Anterior of Maxilla	12 (54.54 %)	6 (50.00 %)	18(52.94 %)
Upper Left Anterior of Maxilla	10 (45.46 %)	6 (50.00 %)	16 (47.06 %)
Total	**22**	**12**	**34**

Pearson Chi-Square test, p-value = 0.064

Table 5. Gender Distribution of Study Participants by Number of Injured Teeth

Number of Injured Teeth	Frequency Boys n (%)	Frequency Girls n (%)	Total Number n (%)
1	10 (76.92 %)	8 (66.67 %)	18 (72.00 %)
2	2 (15.38 %)	3 (25.00 %)	5 (20.00 %)
3	1 (7.70 %)	1 (8.33 %)	2 (8.00 %)
Total	**13**	**12**	**25**

Fisher's Exact test, p-value = 0.813

Table 6. Distribution of Tooth Trauma Type Amongst Study Participants by Sex

Trauma Type of Tooth	Number Observed Boys n (%)	Number Observed Girls n (%)	Total Number n (%)
Uncomplicated Crown Fracture	12 (63.16 %)	10 (66.67 %)	22 (64.71 %)
Complicated Crown Fracture	2 (10.53 %)	1 (6.67 %)	3 (8.82 %)
Avulsion	5 (26.32 %)	4 (26.67 %)	9 (26.47 %)
Total	**19**	**15**	**34**

Fisher's Exact test, p-value = 0.999

Table 7. Gender Distribution of Traumatic Dental Injuries by Etiology and Place of Occurrence Amongst Study Participants

Etiology of Traumatic Dental Injury	Frequency Boys n (%)	Frequency Girls n (%)	Total Frequency n (%)
Fall	10 (76.92 %)	11 (91.67 %)	21 (84.00 %)
Sports	2 (15.38 %)	1 (8.33 %)	3 (12.00 %)
Fight or Assault	1 (7.69 %)	0 (0.00 %)	1 (4.00 %)
Road Traffic Accident	0 (0.00 %)	0 (0.00 %)	0 (0.00 %)
Bicycle accident	0 (0.00 %)	0 (0.00 %)	0 (0.00 %)
Total Fischer's Exact test p-value = 0.999	**13**	**12**	**25**
Place of Occurrence of Injury			
Home	10 (76.92 %)	8 (66.67 %)	18 (72.00 %)
School	2 (15.38 %)	4 (33.33 %)	6 (24.00 %)
Street	1 (7.69 %)	0 (0.00 %)	1 (4 %)
Total	**13**	**12**	**25**

Fisher's Exact test, p-value = 0.504

DISCUSSIONS

The prevalence of traumatic dental injuries for Ghanaian preschool children aged between 2-5 years in this cross-sectional study was found to be 7.2%. Trauma to primary dentition is a common occurrence with a prevalence of (7.0-42.0%) in preschool children.[2-24] Reasons for this difference in the reported prevalence can be explained by fact that different researchers adopted different diagnostic criteria, screening procedure including sample size, age group under investigation, and screening locations.[5]

The prevalence of TDIs in this study was not in agreement with reported studies in Brazilian (36.8%) and Cuban (34.2%) preschoolers.[3,6] This prevalence

was low when compared with reported studies among African preschoolers in Nigeria, South Africa and Tanzania.[11,12,13, 14,21,35] The findings in this study is important because it could serve as a baseline literature for Accra Metropolis preschoolers in future studies.

The most common age group in which injury occurs in primary teeth is between the age of 2-4 years.[3,5,6,7,8.] The highest number of TDIs had been reported in 2- to 3-year-olds,[9,10,11] and this was similar to the findings in this report. This study showed that the highest injury occurred in the 3-year-old children, although this could be because the highest number of children seen in this study were 3-year-olds. Adekoya-Sofowora et al.[11] reported that the largest proportion of dental injuries was found in 3-year-old Nigerian children which is similar to the findings in this study conducted in Accra, Ghana.[38] Injuries to the dentition of infants are infrequent during the first year of life because an infants' teeth do not start erupting until the child is 6 months of age, and infants are limited in their ability to move about within their environment.

There is no consensus among researchers regarding the most common type of trauma in the primary dentition. Some reported studies showed that uncomplicated crown fractures are more commonly encountered in preschoolers especially enamel fracture,[5,9,28] whilst other researchers reported luxation injuries as the commonest injury in primary dentition [29,30] Most of the later studies were hospital-based studies conducted in the emergency room where there was possible increase in the chance of reporting more severe injuries. This study showed that uncomplicated crown fractures were the most common injury, and this agrees with previously reported studies.[5,9,28.]

Luxation injury was not found in the participants. This is not in support of reported studies[29,30] which showed luxation as the commonest type of injury in primary dentition. The possible explanation for the high prevalence of uncomplicated crown fractures in this study was that luxation injuries in the primary dentition tend to heal spontaneously without treatment[39] and may have gone unnoticed by parents or undiagnosed by clinicians.

The general agreement in the literature was that boys suffer injuries to their teeth more often than girls.[5,6,12,19,20] For example, Skaare et al. (2005) reported that Norwegian boys outnumbered girls within all age groups, and this difference in proportions of TDIs by gender was statistically significant.[40] On the other hand, Carvalho et al.[41] reported that younger age group, and girls showed higher rates than boys.[41] Majority of studies showed that there were no significant differences between males and females in their susceptibility to traumatic dental injuries.[6,7,14,21]

Considering all clinical parameters – age, number of teeth injured, site of the dental injuries, types of tooth injuries, teeth involved, and places of occurrence of these injuries amongst Ghanaian preschoolers also shows a similar result of no significant difference in proportions of these indices by gender of the study participants. This may reflect the change in habits in Ghana from outdoor play which involved running and a lot of risk to injuries, indoor games, watching television and playing computer games with a lower risk for traumatic dental injuries. This may also explain the low prevalence of injuries in this study as compared to most studies conducted two decades earlier.[11, 12, 13, 14, 21, 35]

Some studies reported that falls were the most common cause of TDIs in primary dentition [5,28] and this study agrees with these previous studies that falls accounted for 84.00 % of the cause of dental injuries within the sampled population. This might be because children from 2 years start to walk and run thus resulting in frequent falls.

As demonstrated by other authors, most traumatic dental injuries occurred at home[28,32,33,42] and this study also shows that majority of the injuries amongst the preschoolers occurred at home (72.00 %). In recent times, children tend to be more indoor bound during play and there is current evidence that young children are exposed to an abundance of home activities that include watching television, using the computer and playing video games.[43]

In this study, maxillary teeth were more frequently traumatized than mandibular primary teeth. In fact, no traumatized mandibular primary incisors was recorded and all the primary canines were not also traumatized. This agreed with previous studies that the tooth most vulnerable to dental traumatic injuries is the maxillary central incisor.[3,4,5,6,11,12,17,19] This probably relates to vulnerable position of the maxillary central incisors. In addition, these teeth are frequently protruded and may have inadequate lip coverage.[44] Similarly, as it was observed in previous studies,[5,31,38,] this study also showed that Ghanaian preschoolers sustained the most injuries to only a single tooth (72.00 %).

Interestingly, all the traumatized teeth in Ghanaian preschoolers who participated in this study were not treated and all these children had never visited the dentist. This calls for the introduction of population-specific dental public health interventions, education, and effective policies in all kindergartens, nursery and primary schools across Ghana. Untreated fractured teeth is a common occurrence in African children.[13,14] Parental lack of dental awareness and the barriers of availability, accessibility, acceptability and affordability of dental treatment could be the major reasons why fractured teeth are mostly found untreated amongst African children. The authors[13,14] recommend that dental treatment should be made affordable or preferably free for children.

Some strengths of this study include the application of multistage sampling technique which ensured that the population sampled for this study is a true representation of the larger population of preschoolers across the population of Accra, Ghana. Randomization in the selection of study participants minimized selection bias and strengthened internal validity. Also, the dental surgeons who conducted the screening exercises were subjected to refresher training and calibration exercises.

The authors consider this a crucial step in this cross-sectional epidemiological study, and the Kappa test calculated on a tooth-by-tooth basis is the appropriate means to assessing congruency between examiners for dental traumatic injuries. This minimized measurement bias among the dentists who conducted the intra-oral screening of the study participants.

The authors admit that this current study had some weaknesses too. There are currently 16 regions in Ghana and the determinants of oral healthcare may vary from one region to the other. For example, it is well known that residents of the Accra Metropolis relatively have easier access to dentists and dental facilities compared to those in the other regions. Any attempt to ascertain the prevalence of traumatic dental injuries in Ghanaian preschoolers should have involved representative samples from each of the 16 regions of Ghana. Though the findings of this study – which was conducted only in Accra (the capital city of Ghana) – has internal validity, projecting it unto the entire population of Ghanaian preschoolers may lack external validity due to the nuances in the determinants of oral healthcare across all the 16 regions of Ghana.

Moreover, it's of great concern that the relatively low prevalence of TDIs among Ghanaian preschoolers might have accounted for the lack of statistical significance of all the clinical parameters of traumatized teeth examined in this study. Of the 346 study participants initially recruited using multistage sampling technique, only 25 of them had TDIs. Future studies should, therefore, aim at sampling more prospective participants to examine if there might be statistically significant differences in the computed p-values for Chi-Square distribution and Fisher's Exact tests.

CONCLUSIONS:

In this study, the prevalence of traumatic dental injuries amongst Ghanaian preschoolers was 7.2% and most of these injuries went untreated, predisposing these children to various abnormalities in the development of the succeeding permanent dentitions and the dental arch in general. There is, therefore, the urgent need for dental public health education, interventions and policies across the Ghanaian population to raise awareness of the importance of early treatment of fractured teeth.

CONFLICT OF INTEREST

None declared.

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