

# Age-Related Pattern of Dental Trauma in a Nigerian Tertiary Health Institution

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## ABSTRACT

**Objective:** To evaluate the pattern of traumatic dental injuries among children, adolescents, and adults. **Material and Methods:** This was a cross-sectional analytic study of children and adults who presented with dental trauma. Data utilized for this study were sociodemographic characteristics, history of the traumatic incident, presenting complaints, traumatized teeth and classification of the traumatized tissues using Ellis and Davey's classification. **Results:** A total of 163 participants with 307 traumatized teeth were included in the study. The participants' age ranged from 2 years to 75 years, with a mean age of  $25.36 \pm 15.4$  years. Children <10 years were the least represented (14.7%), adolescents 10-19 years accounted for 23.9%, young adults 20 to 40 years were the most represented (44.8%) and older adults >40 years (16.6%). A higher proportion of the study participants were female 83 (50.9%) and the most prevalent complaint was broken teeth (57.1%) The most prevalent aetiology of the trauma documented was fall (36.2%). The most prevalent injury type was extended crown fracture with noticeable dentinal involvement without pulp exposure. There was a statistically significant association between injury type, aetiology and age group. **Conclusion:** Traumatic dental injuries affect children, adolescents and adults alike. The central incisors were the most vulnerable teeth across all age groups. Age was significantly associated with the etiology of dental trauma and injury type.

**Keywords:** Tooth Injuries; Tooth Fractures; Tooth Avulsion; Age Groups.

## Introduction

Dental trauma has been widely reported in children and adults; it accounts for a high proportion of dental emergencies at oral health facilities and is a significant public health burden [1-3]. The prevalence of dental trauma in children in Nigeria ranges from 10-30%, with a male preponderance [4,5], while that for adults was reported to be about 7% [6].

Dental trauma has been shown to be associated with some risk factors, which could be anatomic or socio-behavioral [7]. The anatomic factors that have been consistently recorded are maxillary overjet [7-14] and lip coverage [7-11,15]. Maxillary overjet >5mm has been reported to tend to traumatic dental injuries [15,16]. Other anatomic factors reported are Class II sagittal skeletal pattern [17] and Class II malocclusions [14]. Gender was reported as a socio-behavioral factor, with the male gender showing a higher tendency for traumatic dental injuries [7,10,11,15-18].

Various etiologic factors exist for dental trauma, which tends to vary with the patient's age. For preschool children, falls have been mostly implicated and non-accidental injuries; for school-aged children, sports, physical activities and fights; in adolescents and young adults, sports, assaults, road traffic accidents, alcohol misuse/abuse; for older adults, assault and road traffic accidents, domestic violence and for the elderly falls are the most common etiology [6,15,19,20]. Uncomplicated dental trauma (enamel fractures, enamel and dentine fractures and tooth discolorations) accounts for approximately two-thirds of diagnosed trauma [15,21,22].

It has been demonstrated that the most frequently traumatized teeth are the maxillary central incisors [7,14-17]. This may be related to their conspicuous location in the maxillary arch. Untreated dental trauma has a negative impact on the quality of life [23], especially among those with visible signs of trauma such as fracture, discoloration or tooth loss. This impact is particularly common in children. Usually, the emotional and social well-being domains are the most negatively impacted [24].

Managing dental trauma poses a challenge to both the patient, caregiver and dentist, and its never the same after the event [25] as the procedures carry their own risks, diagnostic uncertainties and the potential for long-term follow up without the inclusion of the financial burden and time spent meeting dental appointments. Most studies report findings either in children or adults, but this study aims to compare the patterns seen in both children and adults to allow for the identification of suitable preventive measures to tackle the problem and appropriate treatment modalities. The aim of this study is to report and compare the distributions and patterns of traumatic dental injuries and types among children, adolescents, and adults and to analyze the prevalence and distribution of these injuries.

## Material and Methods

### Study Design and Population

This was a cross-sectional analytic study. The population consisted of patients who had dental trauma and presented to the dental centre of the University of Benin Teaching Hospital for management.

### Sample Size Calculation

To make the study reliable, the sample size was determined using the following formula:  $n = (Z^2 pq) / d^2$ ; Where  $n$  = The desired sample size if population size is more than 10000;  $z$  = The standard normal deviate usually set at 1.96 corresponding to the 95% confidence level;  $p$  = The proportion in the target population estimated to have a particular characteristic; and  $q = 1 - p$  and  $d$  = degree of accuracy desired set at

0.05. Using 11.4% as  $p$ , which was determined in a Nigerian study [26] and a marginal error of 5% with a 95% confidence level. The calculated sample size was 155. A 10% attrition rate was added, bringing the sample size to 170. A convenience sampling technique was used to recruit participants.

### Study Sample

Composed by consecutive patients with dental trauma who presented to the paediatric dental clinic and the restorative clinic. Adults ( $\geq 18$  years) who had the presenting traumatic episode during childhood were excluded from the study.

### Variables Measured/Recorded

Data for the study was obtained by the use of an interviewer-administered questionnaire. The data retrieved information on the sociodemographic characteristics of the participants in the form of age, gender, highest level of education and occupation where applicable; history of the traumatic incident (when and how), presenting complaints, traumatized teeth

### Dental Trauma System Used

The Ellis and Davey's classification [27] was used to classifying dental trauma: Class I - simple crown fracture with plain enamel involvement; Class II - extended crown fracture with noticeable dentinal involvement without pulp exposure; Class III - extended crown fracture with noticeable dentinal involvement with pulp exposure; Class IV- teeth that have lost their vitality, with or without loss of crown tissues; Class V - traumatically avulsed tooth; Class VI - root fracture with or without the loss of crown tissues; Class VII - tooth luxation without crown or root fracture; Class VIII - cervical crown fracture; Class IX- traumatic injuries of primary teeth.

### Ethical Consideration

Ethical approval was obtained from the Ethics and Research committee of the College of Medical Sciences, University of Benin, prior to the commencement of this study (Protocol no. ADM/E22/A/VOL.VII/1352). In addition, informed consent was obtained from all adult participants, parents/ legal guardians of child participants, while assent was also sought from children 8 years and above.

### Statistical Analyses

For analysis, the participants were grouped into children <10 years, adolescents 10-19 years, young adults 20 to 40 years and older adults >40 years [28]. All data retrieved were screened for completeness and entered into IBM SPSS statistics for windows version 26.0 (IBM Corp. Armonk, NY, USA). Data analysis was done using descriptive statistics. Association between variables was determined using Chi-square tests, and  $p < 0.05$  was considered statistically significant.

## Results

A total of 170 questionnaires were filled and returned; however, 7 were not properly filled. Therefore, 163 participants' records with 307 traumatized teeth were used for the study. The participants' age ranged from 2 years to 75 years, with a mean age of  $25.36 \pm 15.4$  years.

A higher proportion of the study participants were female (50.9%) and the remaining 49.1% were males giving a male-female ratio of 1:1.04. Young adults (20 to 40 years old) were the most represented, making up 44.8% of the study population, followed by adolescents (10 to 19 years old) accounting for 23.9%, while children less than 10 years of age were the least represented (14.7%). The highest level of education most represented was the tertiary level of education (50.9%), followed by secondary (30.1%), while the least represented (2.5%) was no formal education (Table 1).

**Table 1. Demographic characteristics of the participants.**

Variables	N	%	95% Confidence Interval
<b>Gender</b>			
Male	80	49.1	41.7-57.7
Female	83	50.9	42.3-58.3
<b>Age group</b>			
Children	24	14.7	9.8-20.2
Adolescents	39	23.9	17.8-30.7
Young Adult	73	44.8	37.4-52.8
Older Adults	27	16.6	10.4-22.7
<b>Highest level of Education</b>			
No formal education	4	2.5	0.6-4.9
Nursery/Primary	27	16.6	11.0-22.1
Secondary	49	30.1	23.3-36.8
Tertiary	83	50.9	42.9-58.3

A higher proportion of adolescents were males (56.4%), there was an equal proportion of both genders among the children less than 10 years of age, while a higher proportion of young adults and adults were females, but this was not statistically significant (Table 2).

**Table 2. Age distribution across gender of the participants.**

Age Group	Gender		Total N (%)	p-value
	Male N (%)	Female N (%)		
Children	12 (50.0)	12 (50.0)	24 (100.0)	0.65
Adolescents	22 (56.4)	17 (43.6)	39 (100.0)	
Young Adults	35 (47.9)	38 (52.1)	73 (100.0)	
Adults	11 (40.7)	16 (59.3)	27 (100.0)	
Total	80 (49.1)	83 (50.9)	163 (100.0)	

The most prevalent complaint was broken teeth (57.1%), followed by pain (19.0%), while the least reported complaints were mobile teeth (4.9%) and swelling (2.5%). The most prevalent aetiology of the trauma was fall (36.2%), followed by interpersonal violence (14.7%), while the least was sporting activities (4.3%) and family violence (3.1%). A higher proportion (38.0%) of the participants presented within 7 days of the traumatic incident, 33.7% presented after 60 days, and 6.7% presented between 31 and 60 days after the traumatic incident (Table 3).

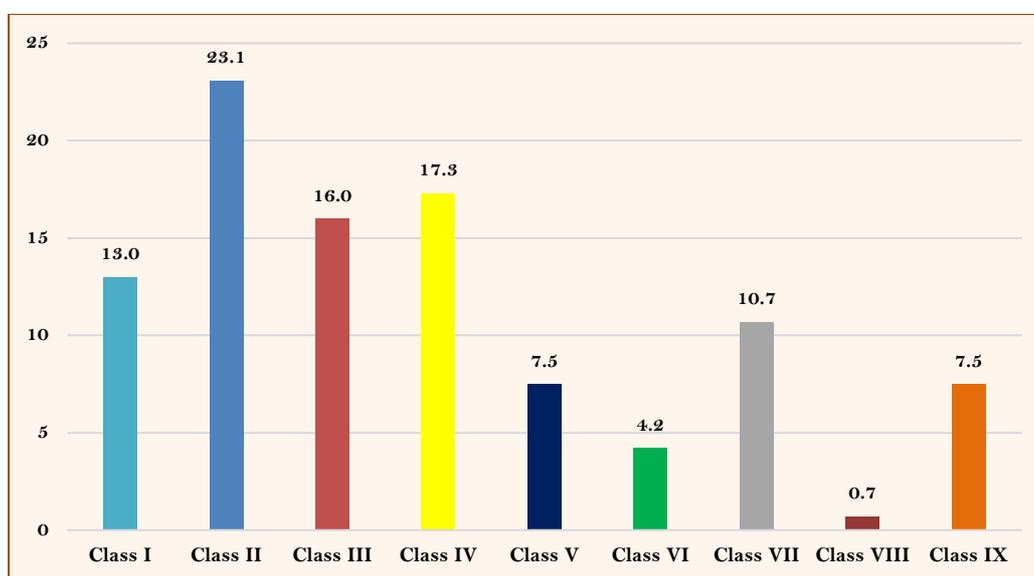
**Table 3. Presenting complaint, aetiology of trauma and time between traumatic incident and presentation among the participants.**

Variables	N	%	95% Confidence Interval
<b>Complaint</b>			
Pain	31	19.0	13.5-25.2
Broken teeth	93	57.1	49.7-64.4
Swelling	4	2.5	0.6-4.9
Mobile teeth	8	4.9	1.8-8.0

Tooth sensitivity	7	4.3	1.8-7.4
Missing teeth	11	6.7	3.1-10.4
Discolored teeth	9	5.5	2.5-9.2
<b>Aetiology</b>			
Playground activities	22	13.5	8.6-19.0
Interpersonal violence	24	14.7	9.8-20.2
Fall	59	36.2	28.8-44.2
Road traffic accident	15	9.2	4.9-14.1
Eating hard food	21	12.9	8.0-18.4
Domestic accident	10	6.1	2.5-9.8
Family violence	5	3.1	0.6-6.1
Sporting activities	7	4.3	1.2-8.0
<b>Time of presentation</b>			
Within 7 days	62	38.0	30.7-45.4
8-30 days	35	21.5	15.3-28.2
31-60 days	11	6.7	3.1-10.4
>60 days	55	33.7	26.4-41.1

More than half (51.5%) of the participants had multiple teeth traumatized while the remaining 48.5% had only a single tooth traumatized. The most frequently traumatized teeth were the central incisors (79.5%), followed by the lateral incisors (18.9%) and canines (1.6%). Both arches were implicated in 9.2% of cases, while the maxillary arch was involved in 84.0% of cases.

The most prevalent injury type recorded was Class II (extended crown fracture with noticeable dentinal involvement without pulp exposure), accounting for 23.1% of the cases, followed by Class IV (teeth that have lost their vitality, with or without loss of crown tissues) and Class III (extended crown fracture with noticeable dentinal involvement with pulp exposure) which made up 17.3% and 16.0% of cases respectively. The least recorded injury (0.7%) was Class VIII (cervical crown fracture) (Figure 1).



**Figure 1. Distribution of Injury using Ellis and Davey's classification.**

There was a statistically significant association between the type of trauma and the age group of the participants ( $p < 0.0001$ ). Class I; simple crown fracture with plain enamel involvement, class II; extended crown fracture with noticeable dentinal involvement without pulp exposure, class III; extended crown fracture with noticeable dentinal involvement with pulp exposure and class V; the traumatically avulsed tooth was most prevalent in young adult accounting for 60.0%, 60.6%, 49.0% and 65.2% respectively. Class IV injuries, teeth

that have lost their vitality, with or without loss of crown tissues and Class VII injuries, tooth luxation without crown or root fracture, were most prevalent in adolescents (54.7% and 48.5%). Class VI - root fracture with or without the loss of crown tissues had equal representation (46.2%) in young adult and older adults. Similarly, class VIII had equal representation (50.0%) in young adults and older adults. All the class IX injuries (traumatic injuries of primary teeth) occurred in children (Figure 2).

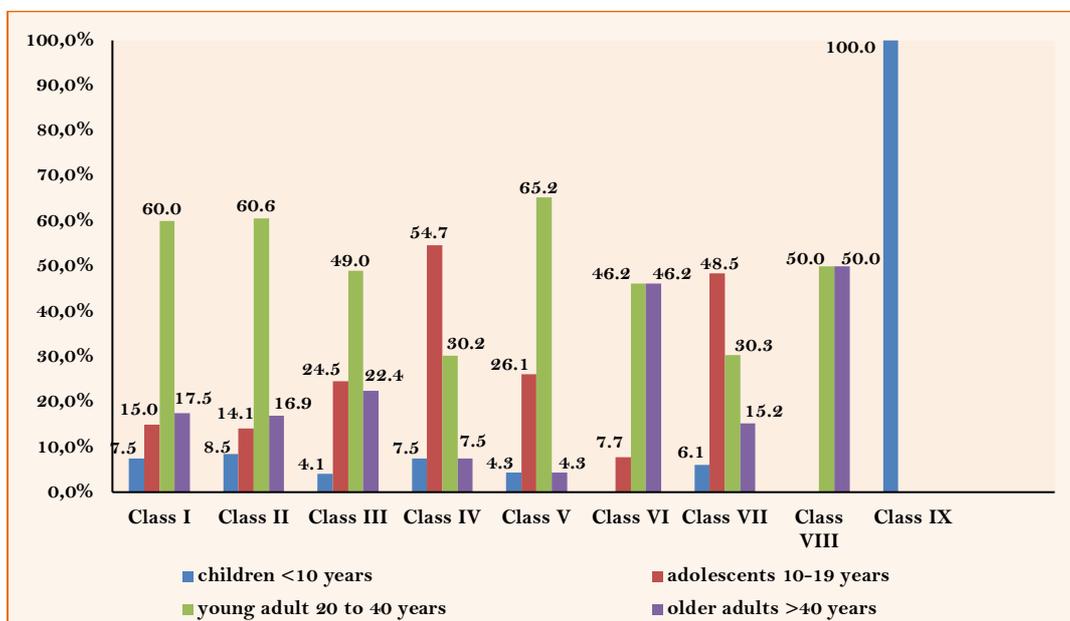


Figure 2. Association between injury type and age group (p<0.0001).

There was a reduction in the proportion of participants presenting with broken teeth with increasing age and an increase in the proportion of participants presenting with pain with increasing age. In addition, there was a statistically significant association between the age group and presenting complaint (p=0.01) (Table 4).

Table 4. Association between the age of the participants and presenting complaint

Age Group	Presenting Complaint							Total N (%)
	Pain	Broken Teeth	Swelling	Mobile Teeth	Sensitivity	Missing Teeth	Tooth Discoloration	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Children	3 (12.5)	16 (66.7)	0 (0.0)	0 (0.0)	0 (0.0)	1 (4.2)	4 (16.7)	24 (100.0)
Adolescent	5 (12.8)	29 (74.4)	2 (5.1)	0 (0.0)	1 (2.6)	2 (5.1)	0 (0.0)	39 (100.0)
Young Adult	16 (21.9)	38 (52.1)	1 (1.4)	3 (4.1)	4 (5.5)	7 (9.6)	4 (5.5)	73 (100.0)
Older Adult	7 (25.9)	10 (37.0)	1 (3.7)	5 (18.5)	2 (7.4)	1 (3.7)	1 (3.7)	27 (100.0)
Total	31 (19.0)	93 (57.1)	4 (2.5)	8 (4.9)	7 (4.3)	11 (6.7)	9 (5.5)	163 (100.0)

There was a statistically significant association between age group and aetiology of the trauma among the study participants (p<0.0001). Playground activities related to trauma were recorded for only children and adolescent participants, while eating hard foods was recorded for only young adults and older adults. There was a reduction in the proportion of participants with trauma related to falls and family violence related trauma with increasing age. Sporting activities related to trauma was observed only in adolescents and young adults. Road traffic accident associated trauma was recorded only for adolescents and young adults, with a higher proportion of young adults experiencing road traffic accident-related trauma. A higher proportion of

adolescents (20.5%) and young adults (16.4%) reported interpersonal violence related trauma. Also, a higher proportion of adolescents (12.8%) and older adults (7.4%) reported domestic accident-related trauma (Table 5).

**Table 5. Association between age and aetiology of trauma among the participants.**

Age Group	Aetiology of Trauma								Total N (%)
	Playground Activities N (%)	IPV N (%)	Falls N (%)	RTA N (%)	EHF N (%)	Domestic Accident N (%)	Family Violence N (%)	Sporting Activity N (%)	
Children	13 (54.2)	3 (12.5)	5 (20.8)	0 (0.0)	0 (0.0)	1 (4.2)	2 (8.3)	0 (0.0)	24 (100.0)
Adolescent	9 (23.1)	8 (20.5)	13 (33.3)	1 (2.6)	0 (0.0)	5 (12.8)	2 (5.1)	1 (2.6)	39 (100.0)
Young Adult	0 (0.0)	12 (16.4)	30 (41.1)	14 (19.2)	8 (11.0)	2 (2.7)	1 (1.4)	6 (8.2)	73 (100.0)
Older Adult	0 (0.0)	1 (3.7)	11 (40.7)	0 (0.0)	13 (48.1)	2 (7.4)	0 (0.0)	0 (0.0)	27 (100.0)
Total	22 (13.5)	24 (14.7)	59 (36.2)	15 (9.2)	21 (12.9)	10 (6.1)	5 (3.1)	7 (4.3)	163 (100.0)

p<0.0001; IPV = Inter Personal Violence; RTA = Road Traffic Accident; EHF = Eating Hard Food.

## Discussion

This study found a slight increase of traumatic injuries in females compared to males 1.04:1, which is in stark contrast to various studies which document male preponderance compared with females, with some even five times higher [6,7,10,11,15-17,29-34]. The reason for this may be the increasing female participation in contact sports and other activities due to increasing education on gender equality; also, females may seek treatment following trauma for aesthetic reasons and may have less tolerance for pain. Furthermore, the previous studies looked at specific age groups.

The gender distribution among adolescents was similar to previous studies on adolescents, which reported a higher male prevalence [10,17,22,26,30,34,35]. This may be because males at this stage of life tend to be more active with increased participation in sporting activities.

Young adults (20-40 years) accounted for more of the patients presenting with TDI's followed by the adolescents' group (10-19 years); this may be as a result of injuries that occurred during adolescence being treated in adulthood or maybe as a result of increased sporting activities or violence, this is similar to that found in a study among New Zealand adults [36] and previous Nigerian studies [6,32,33], most studies in literature looked at trauma in children at specific ages while others researched on adults only, thus making comparisons difficult.

The most frequent presenting symptoms in this study were fractured teeth and pain, a finding similar to reports of previous studies [32,33]. However, fractured teeth were the most frequent complaint across all age groups. This result is contrary to reports of a previous Jordanian study among children where pain or sensitivity was the most frequent presenting symptom [1]. The pain was most significant in younger and older adults than in children and adolescents and this was statistically significant. This may be because these age groups are independent and can seek oral health care without permission. Children and adolescents may not be brought forth for care by their parents/guardians if they do not see the urgency to do so. It has been reported that barriers do exist preventing persons from seeking oral healthcare even in the presence of dental pain [37].

The association between the etiology of dental trauma and age group in this study was statistically significant. This is comparable to other studies [34,38,39] and these still remain the most documented etiological factors. Playground mishaps were only recorded for children and adolescents. This is not surprising as children and adolescents tend to be involved in these activities and falls during play have been reported to be

a prevalent cause of dental trauma in children [1]. Eating hard foods was only recorded for young adolescents and older age groups. This has also been reported in a previous study on adults [6].

Sporting activities related to dental trauma was only reported in adolescents and young adults. Although a physically active lifestyle is important for all age groups [35], there has been rising concerns about the prevalence of sports-related dental injuries in children and youths [40]. Hence, it is not surprising to find sports-related dental trauma only in adolescents and young adults. Furthermore, these stages of life tend to be associated with more risky behaviors and activities. The etiological factors associated with dental trauma in young adults observed in this study are similar to that reported in this age group in previous studies [6,32,33].

Class II Ellis fractures were the most prevalent fractures seen; this is similar to previous findings [38,41-43]; this may be attributable to patients seeking care following trauma due to poor esthetics or pain. Other studies [31,44] that reported a higher prevalence of Ellis class I fracture might be due to the study design, mainly retrospective or epidemiological surveys. The reason for this could be that most patients with Ellis class I may not consider it important to treat the fracture, particularly if there is no pain present and this has also been documented by Juneja et al. [45]. Ellis class IV and III were the other prevailing types of fractures in this study, while Ellis VII was the least recorded.

Multiple traumatized teeth were most predominant and this is similar to reports by Jokic et al. [42], but in contrast to the findings of other studies [29,36,39], this may be as result of the wide age range of this study consisting of children, adolescents and adults compared to other studies which reported either in children and young adults or adults only. The maxillary central incisors were the most affected teeth; this corroborates the findings from other studies [34,39], while canines were the least affected; this may be a result of the vulnerable position of the maxillary central incisors in the arch and the possibility of them being protruded increases this vulnerability. The maxillary arch was also the most predominantly traumatized compared with the mandibular arch and this finding is similar to a previous study [42], while both arches were implicated in 9.2%.

The relative frequency of injury types varied across age groups and a statistically significant association was observed in this study, a finding similar to a previous study in Copenhagen [43]. Furthermore, the pattern of distribution of injury type across age groups recorded in this study was at variance with that documented in the Copenhagen study [43]. Class II; extended crown fracture with noticeable dentinal involvement without pulp exposure decreased with decreasing age from young adults to children, contrary to the decrease across age groups from children to adults observed in Copenhagen. The difference can be attributed to the type of teeth studied as this study, which included deciduous and permanent teeth, while the Copenhagen study involved only permanent ones. Also, the age groups were slightly different.

This study compared the patterns of trauma seen in children, adolescents and adults and identified the aetiology and injury type common to the various age groups; however, there is still room for research for tailor made preventive measures for the different age groups as trauma does not only impact on the quality of life of children but adults as well, thus education on the epidemiology and prevention cannot be overemphasized and should be taught across all spheres and ages.

## Conclusion

Traumatic dental injuries affect children, adolescents, and adults alike. Females were slightly more affected compared with males. Fractured teeth and pain were the most common presenting complaint, Ellis class II fracture was the most common presentation, the central incisors were the most vulnerable teeth across

all age groups, and multiple teeth were most affected. Age was significantly associated with the etiology and injury type of dental trauma.

### Authors' Contributions

EJE		<a href="https://orcid.org/0000-0002-3799-9634">https://orcid.org/0000-0002-3799-9634</a>	Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing - Original Draft, Writing - Review and Editing, Visualization and Project Administration.
CNM		<a href="https://orcid.org/0000-0001-8396-526X">https://orcid.org/0000-0001-8396-526X</a>	Conceptualization, Methodology, Formal Analysis, Investigation, Writing - Original Draft, Writing - Review and Editing.
All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.			

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None.

### Conflict of Interest

The authors declare no conflicts of interest.

### Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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