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ROAD TRAFFIC INJURIES AMONGST PAEDIATRIC PATIENTS PRESENTING AT THE MUHIMBILI ORTHOPAEDIC INSTITUTE, TANZANIA

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ABSTRACT

Background: Motor traffic injuries are very common worldwide and account for a major cause of morbidity and mortality among patients including children. In Africa, road fatality rates account for 24.1 deaths per 100,000 population. Studies have shown that a quarter (25.3%) involved children in a study done in Uganda. The objective of this study was to determine the pattern of injuries and their management among pediatric patients involved in motor traffic crashes attended at Muhimbili orthopedic institute.

Material and methods: A descriptive cross-sectional study was done at Muhimbili Orthopedic Institute from August 2018 to April 2019. The study included all road traffic injuries among children below 18 years. Participants were enrolled at the emergency medicine department and standard structured questionnaire was used to collect information. Variables included age, sex, residence, type of collision, day and time of injury, injury setting, protective gear usage, and type of motor vehicle. The filled in questionnaires were

checked for quality, coded and then analyzed. Frequency distributions were used to describe categorical variables and mean and standard deviation for continuous variables. Kruskal Wallis and Mann Whitney tests were used to test the association between the duration of hospital stay and socio-demographics as well as other characteristics of victims. Post-hoc tests were performed using Dunn's pairwise comparisons to determine groups which had significantly different duration of hospital stay in each factor. Bonferroni adjustment was applied to correct the p-value for multiple tests by multiplying the p-value by the number of tests performed. P-value of <0.05 was considered significant.

Results: A total of 186 patients were included in this study. The Mean age was 9.7 years and 55.9% of them were males. Motorcycles were responsible for almost three fifth of the road traffic crashes. Overall, 72.6% of them were involved in motor traffic crash as pedestrians. Two thirds of the pediatric patients arrived at the Emergency Department within 24 hours post-injury and 64.5% of them were brought by ambulance. Head and musculoskeletal injuries (extremities) were the most frequent body region injured accounting for 55.4 % and 23.7 % respectively.

Conclusion: Motorcycle accidents are still a significant problem as once again this was shown to be the most common cause of pediatric trauma. Majority of the pediatric trauma involved them as pedestrians. Head and extremity injuries were the most common injuries seen.

INTRODUCTION AND LITERATURE REVIEW

Road traffic injuries (RTI) represent a significant global public health concern. Each year, hundreds of thousands of children die from road traffic injuries and millions more suffer long-term consequences of non-fatal injuries(1). It is predicted that by the year 2030, RTIs will be the fifth leading cause of death worldwide and the seventh leading cause of disability-adjusted life years lost(2,3). Children aged 11 years and below are particularly at risk for injuries because they are unable to recognize and avoid many potential risks for injuries due to their limited judgment and their small physical stature limits their ability to see or to be seen by other road users(2,4,5).

In Africa, road fatality rates account for 24.1 deaths per 100,000 population, above the global average of 18.0 deaths per 100,000, despite the fact that the region represents 2% of the world's vehicles (6). Motorcycles are becoming increasingly popular in Africa because of inadequate public transportation systems.

Motorcyclists are often untrained and unlicensed and do not abide with traffic rules. They often ride too fast and overload their motorcycles with passengers or goods of (4). Road traffic crash in pediatric has also been reported in a number of African countries, for instance in Uganda, road traffic crashes were responsible for 25.3% of all injuries seen in the National pediatric emergency unit in Kampala (7). While in Maputo, Mozambique road traffic crashes were responsible for 14% of all injuries seen at the emergency Departments of three hospitals and 6% reported in Nyeri County in Kenya. (8,9). Patterns of pediatric injuries vary substantially within populations and across countries(9).

In Tanzania, road safety is still a serious problem and in recent years there has been an observed increase in a number of motor vehicles which also reflects the increase in trend of road traffic injuries (10). A study in Bugando medical center-Tanzania showed that the most injured body parts were: head, neck, and musculoskeletal system, and the most common type of injuries were open wounds and fractures. (11) A study

done by Museru et al in Dar es Salaam found that fractures were more common and account for 36.7%, followed by 21.1% of head or spine injuries. (12) A study showed road traffic injuries is the leading cause of death amongst pediatrics between 10 to 18 years and 3rd highest in causing disability-adjusted life years. (13)

This study aimed to find out the local pattern of injuries among pediatric patients following motor traffic crashes. The information obtained may contribute as basis for future study, the establishment of prevention strategies, planning interventions, policy making and road traffic crashes awareness campaigns.

METHODOLOGY

Study design and area

A descriptive cross-sectional study was done at Muhimbili Orthopedic Institute from August 2018 to April 2019. The study was conducted at Muhimbili orthopedic institute (MOI), which is a specialized hospital in orthopedic, trauma and neurosurgery. MOI is situated in Upanga West region of Ilala district. The Ilala district is one of the 5 districts in Dar-es-salaam and covers an area of around 360 Square meters and a population of 1,650,000 million as of 2022. (14)

Study population

Trauma patients below 18 years.

Inclusion criteria

All road traffic crash patients below 18 years treated at Muhimbili Orthopaedic Institute in the course of this study.

Exclusion criteria

Parent /guardian /relative who refused to consent.

Sample size estimation

The proportion of 14% was used in calculating the sample size using the following formula.

$$N = Z^2 p (1-p) / E^2$$

Where N is sample size

Z= 1.96 at 95% confidence interval

P= proportion of motor traffic crash injury victims which is 14% from a study done in Maputo, Mozambique (11).

E= is the margin error rate 5%

Substituting these values to the equation above;

$$N = (1.96)^2 \times 0.14 \times (1-0.14) / 0.05^2$$

Hence minimum Sample size was 186.

Research instruments

Standard structured Questionnaire was used in a face-to-face interview. Pre-test of the questionnaire was done two weeks before the beginning of this study. The researcher/assistant (residents in orthopedic surgery) were personally at emergency department when a motor traffic crash victim arrived. The x-ray films, Computer tomography (CT) scan and Magnetic Resonance imaging (MRI) for musculoskeletal, Head and spine injuries were done at Muhimbili Orthopedic institute. The interpretations and recording of x-ray films were done by a researcher with the assistance of the radiologist.

Data collection tools and technique

Data was collected by using a standard structured questionnaire. Diagnoses was made by the clinician on call together with the researcher after thorough clinical history, physical examination and radiological investigations (e.g. x-ray). Topographic locations of injuries were entered in the structured questionnaire.

The severity of the injury was determined using the Pediatric trauma score (PTS). (15)

Severe injury	0-5
Moderate injury	6-8
Mild injury	9-12

Patients with head injuries were classified according to the Glasgow Coma Score. Other injuries included spine injury (cervical, thoracic, and lumbar-sacral), chest injury (rib fractures, pneumothorax, haemothorax, lung contusion), abdominal injury and extremity injuries (fractures, dislocation, and soft tissue injuries). The extremity injuries were further divided into injuries of the upper and lower limbs. Dislocation of joints sprains and soft tissue injuries (tendon injuries, lacerations, abrasions, and contusions) were recorded.

Ethical consideration

Ethical clearance was obtained from the ethical clearance committee of MUHAS (Ref No. DA.287/298/01A/). Informed consent was sought from each patient's parents/guardian before being enrolled in the study. Parents/ guardians who refused to participate in the study were not denied access to routine treatment.

Data processing and analysis

The filled in questionnaires were checked for quality, coded and then entered into the Statistical Package for Social Studies (SPSS)

program (version 20). Frequency distributions were used to describe categorical variables and mean and standard deviation for continuous variables. Kruskal Wallis and Mann Whitney tests were used to test the association between the duration of hospital stay and socio-demographics as well as other characteristics of victims. Post-hoc tests were performed using Dunn's pairwise comparisons to determine groups which had significantly different duration of hospital stay in each factor. Bonferroni adjustment was applied to correct the p-value for multiple tests by multiplying the p-value by the number of tests performed. P-value of <0.05 was considered significant.

RESULTS

A total of 186 patients were included in this study. The Mean age was 9.7 years with a standard deviation of 5.10. More than half (55.9%) of those enrolled were male. In terms of the level of education, majority (40.9%) were Primary school children. Around two thirds (65.6%) of those injured were residing in Dar-es-salaam. Two fifth (40.2%) of the parents/guardians of the children were self-employed. (See Table 1)

Table 1: Socio-demographic characteristics of study participants (N=186)

Characteristic	Frequency	Percent
Age		
0-5 years	52	28.0
6-10 years	51	27.4
11-15 years	44	23.7
16-<18 years	39	21.0
Mean $\pm$ SD	9.70 $\pm$ 5.10	
Sex		
Male	104	55.9

Female	82	44.1
Level of education		
Primary school	76	40.9
Secondary	41	22.0
No formal Education	38	20.4
Preschool (kindergarten/Nursery)	31	16.7
Occupation of parent/guardian		
Self-employed	75	40.2
Employed	60	32.3
Peasant	25	13.4
Business	14	7.5
Housewife	12	6.5
Region of residence for parent/guardian		
Dar es Salaam	122	65.6
Others	64	34.4
The municipality (if parent/guardian resides in Dar es Salaam (n=122))		
Ilala	39	21.0
Kinondoni	53	28.5
Temeke	30	16.2

Motorcycles were responsible for the majority of the road traffic accidents accounting for 111 (59.7%) of all accidents whereas motor-vehicles accounts for about a third (34.4 %). Helmet and seat belt use among passenger in motorcycle, motorcyclists, and occupants was at 8% and 1.6 % of patients respectively. A motorcycle injuring a pedestrian accounted for the highest type of accident (47.3%), followed by a motor vehicle injuring a pedestrian (22%). Overall, 72.6% of the injured were pedestrians. (Table 2, figure 1, figure

2). There was almost equal distribution of patients injured on tarmac versus non-tarmac roads. About 4/5th (78 %) of the patients arrived at this tertiary hospital within 24 hours of the injury. (Table 2)

Almost all (97.30%) patients received pre-hospital care and 120 (64.5%) patients were brought by ambulance. Majority of injuries (91.3%) took place during the day. (Table 2)

Table 2: Characteristic of the scene of the accident and post-accident care among pediatric involved in the motor traffic crash

Characteristic	Frequency	Percent
Cause of road traffic crash		
Motorcycle	111	59.7
Motor vehicle (bus or truck, car)	64	34.4
Bicycle	9	4.8
Tricycle	2	1.1
Type of collision (mechanism of injury)		
Motorcycle –pedestrian	88	47.3
Motor vehicle-pedestrian	41	22.0
Motorcycle- motor vehicle	16	8.6
Motor vehicle –motor vehicle	14	7.5

Other collision	12	6.5
Motorcycle- bicycle	7	3.8
Motorcycle- motorcycle	4	2.2
Lone motorcycle (falling from a motorcycle)	4	2.2
The use of the striking vehicle		
Commercial	115	61.8
Private use	68	36.6
Others	3	1.6
Injury setting		
Road	157	84.4
Home compound.	29	15.6
Seatbelt/ restraint use in the car		
Yes	2	3.1
No	62	96.9
Helmet use, if motorcycle/pedal cyclist		
No	119	99.2
Yes	1	0.8
Time of accident		
Afternoon	73	39.2
Evening	59	31.7
Morning	38	20.4
Night	16	8.6
Patient's status in respect to motor-vehicle/motor-cycle		
Pedestrian	135	72.6
Passenger	39	21.0
Driver	12	6.5
Type of the road where the accident took place		
Tarmac	101	54.3
Non –tarmac road	85	45.7
Pre-hospital care		
Yes	181	97.30
No	5	2.70
Mechanism of transport to the hospital		
Ambulance	120	64.5
Private	49	26.3
Public	16	8.6
Police	1	0.5
The time interval between crash and arrival at the emergency department of MOI		
≤24 hours	145	78.0
>24 hours	41	22.0

The severity of the injury was determined using the Pediatric trauma score (PTS). (15)

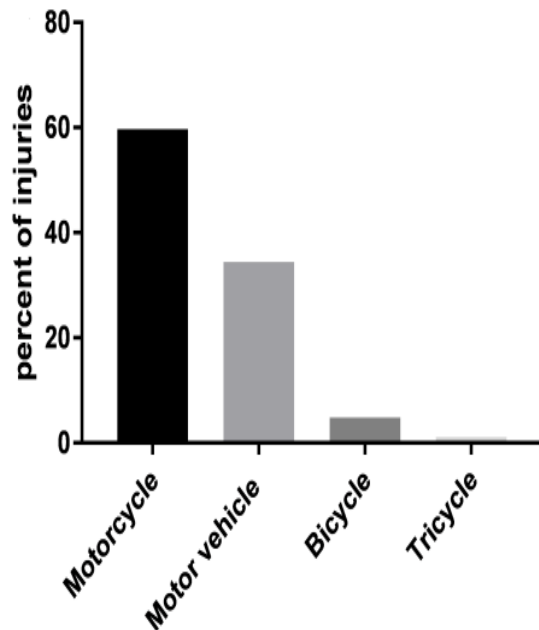


Figure 1: Cause of road traffic injury

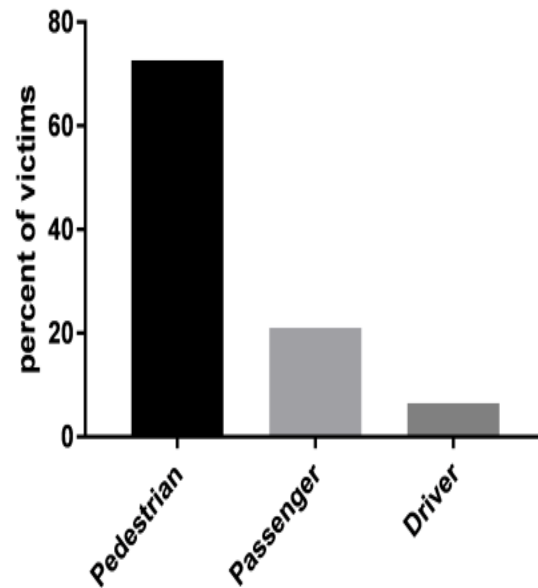


Figure 2: Patients status in respect to motor-vehicle/motor-cycle

Head and musculoskeletal injuries (extremities) accounted for 55.4 % and 23.7 % of the injuries respectively. Less than 1/5th (16.7%) of the patients had injury to more than one body region. The most common (30%) musculoskeletal injuries were fractures followed by soft tissue injuries (bruises, abrasions, lacerations, sprain

contusions, and tendon injuries) accounting for 26.3%. Most (78.5%) of the patients sustained closed fractures and more than half (59.5 %) occurred on the left side of the body and predominantly (75.9%) on the lower extremities. (See figure 3).

Table 3: Distribution of injuries by body regions and type of musculoskeletal injuries among pediatric patients involved in motor traffic crashes.

The pattern of injury	Number	Percent
Body region injured		
Head	103	55.4
Extremity	44	23.7
>One body region.	31	16.7
Others (Spine, pelvis)	8	4.3
Type of musculoskeletal injury		
Fracture	52	30.0
Soft tissue injuries	49	26.3
Fracture and soft tissue injuries	19	10.2

Sprain	4	2.2
Dislocation	2	1.1
Site of fracture		
Lower limb fractures	60	75.9
Upper limb fracture	18	22.8
Type of fracture		
Closed fracture	62	78.5
Open fracture	17	21.5

According to Pediatrics Trauma Score (PTS), more than half (59.1%) of the patients sustained mild injuries (PTS = 9–12). (See figure 4)

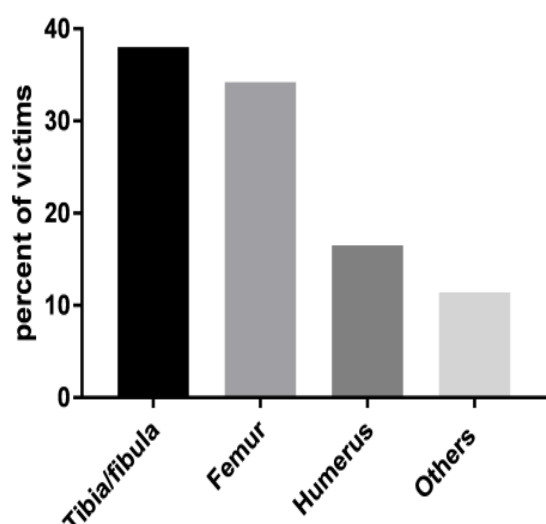


Figure 3: Bone fractured

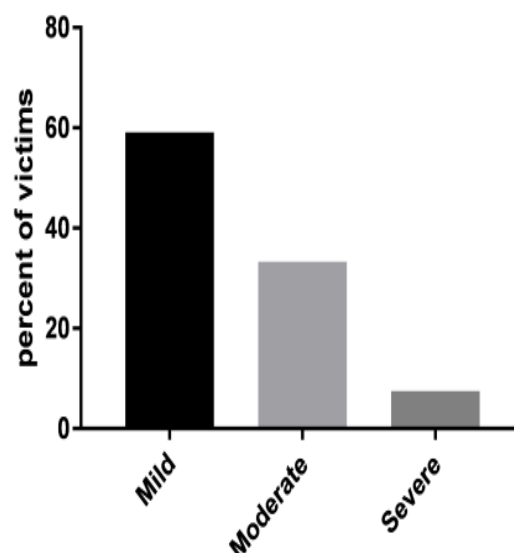


Figure 4: Pediatric trauma score

DISCUSSION

Children are susceptible to road traffic injuries due to their inability to recognize and avoid potential risks on their own (1,4,5). In Tanzania like other low and middle-income countries, most of towns and cities are compounded with a mixture of motorized and non-motorized transport on the same road ways with the pedestrians. (13)

Despite recent improvement in infrastructures and other means of transport in Dar es Salaam

such as introduction of Bus Rapid Transit (BRT) and trains, a number of challenges still remain such as overloaded public transport networks, inadequate maintenance of motor vehicles, over speed regardless of road signs, inadequate maintenance and development of roads, all of which combine to increase the risk of injuries on roads in our setting. (16)

During the period of study, a total of 186 pediatric injured patients were studied. The study shows that peak age of incidence was 0 to 5 years and 6-

10 years which are similar to other studies where the majority of patients were aged between 1 to 5 years and 6 to 10 years. (8, 13) The increased incidence of injuries in this age group reflects vulnerability of school going children in heavy traffic.

More than half (55.9) of injured pediatric patients in this study were males, with a male to female ratio of 1.3:1 which is similar to other studies (5,7,9). Male predominance in this study may be attributed to the overactive nature of male children as compared to females. (17) Furthermore, this may be explained by the fact that in this study only males were found to be riders despite government prohibition of riding motorcycles to those who are under 18 years. (16, 18)

A high proportion (65.6%) of children were from Dar es Salaam from which Kinondoni municipality had the most patients showing that most of the injuries came from high-density residential areas.

Motorcycle accidents were the leading (59.7%) cause of road traffic injuries followed by motor vehicles (34.4 %) which is similar to other studies (9,10,13) that showed that the majority of road traffic crashes were attributed to motorcycles. Similar to other studies (2,5,13), this study showed that pedestrians constituted 72.6 percent of the injured children. Pedestrians aged 10 years and below are particularly vulnerable because of their small physical size and underdeveloped abilities to dealing with traffic situations, both cognitive (attention focus, interpreting signs) and perceptual (locating sounds, judging speed, peripheral vision). High incidence of pedestrians among children has been attributed to their developmental and behavioral limitations in complex traffic situations (1,4,5).

Comparable with other studies (2,9), this study found that most of the children did not wear safety helmet during the injuries accounting for 99.2 percent, whilst only 2% of car occupants reported to using the car restraints.

The pre-hospital care among the patients involved in a motor traffic crash is of paramount

importance as it influences the ultimate outcome of patients after injury. In this study majority (97.30%) of participants received pre-hospital care which included, intravenous line establishment, intravenous fluid, analgesics and fracture splinting which is in dissimilar to a study done at Bugando Medical center, in Tanzania (13) where only 7.3% of patients had pre-hospital care. This may be explained by the fact that most of the patient attended at MOI, come from other municipal hospitals in Dar es Salaam and they have to be attended /resuscitated at Muhimbili National Hospital before coming to MOI emergency department.

Two thirds of the patients arrived at MOI Emergency Department within 24 hours after the accident which is in similar with the other studies (2,3,7). Pediatric injuries draw special attention to the parents/guardians hence seeking early medical care. Late presentation is common in asymptomatic and mild cases.

In this study the majority (120) of patients were brought by ambulance followed by private transport (26.3%) . This is contrary to the study done at Bugando medical center, in Tanzania which found that the majority (72.1%) of the patients brought by private transport (13). The effectiveness and efficiency of the ambulance system for transportation of patients particularly pediatrics age group is paramount important as it accounts significantly in the clinical outcome of these patients due to early medical attention.

In the present study, most injuries occurred during the day time which is similar with other studies (10,19). Over nearly 91.3% of the injuries took place during the day time, more in the afternoon (39.2%) and evening (31.7%) where there is traffic congestion due to increased traffic jams as well as increased human activities in the city with little monitoring of children. At this time most of children play or they are coming from school hence they at high risk of road traffic injuries.

Head and musculoskeletal injuries (extremities) were the most frequent body region injured accounting for 55.4 % and 23.7 % respectively. The commonest musculoskeletal injuries were

fracture accounting for 30%. Closed fracture were common (78.5%) and more than half (59.5%) of the fractures occurred in the left side of the body and predominantly (75.5%) on the lower extremities. Soft tissue injuries (bruises, abrasions, lacerations, sprain, contusions and tendon injuries) accounting for 26.3 percent. Similar results were also observed at Bugando medical center- Tanzania (13) where head injuries were most common and followed by injuries to the extremities. However other studies (3,5,8) have shown that extremities were the commonest body region injured. More head injuries in the present study could be explained by the fact that a few children occupants in cars (1.6%) used the seat belt and only 0.8% passenger in motorcycle and motorcyclist used the helmet. Also, there is an overall improvement in delivering orthopedic services in referring hospital in Tanzania, private hospitals and other regional hospitals where minor injuries and simple/complex fractures are attended in those particular hospitals. However for head injuries it is only at MOI where there is a well-developed efficiency center in our country for taking care of these patients with because of adequate availability of CT-Scan, MRI and ICU care and neurosurgeon services.

A high number of musculoskeletal injuries affecting mainly the lower extremities were attributed to the large number of pedestrians (72.6 %). Pedestrians are unprotected road users and therefore they are highly exposed to high risk of limb injuries. In this present study as with other studies, similar observations were made by others (9,20,21) where lower extremities were common and tibia and fibula were the commonest type of fracture observed.

In this study, it was found that 31 (16.7%) of patients sustained injuries in more than one body region which is in keeping with other studies (5,7,19). Few cases in this study had bilateral femur fracture and floating knee which is uncommon to this age group.

According to Pediatrics Trauma Score (PTS), most of the patients sustained mild injuries (PTS = 9–12) in 110 (59.1%) patients. Glasgow coma scale (GCS) was developed as a means of assessing a patient's level of consciousness to

those patients with head injuries and in this present study majority (61%) of patients has mild traumatic brain injuries. Pediatric trauma patients have relatively low mortality as compared to adults and this is reflected in previous trauma registry study. (22)

Conclusions

Motorcycle accidents are still a significant problem as it was shown to be the most common cause of pediatric trauma. Majority of the pediatric trauma involved them as pedestrians. Head injuries were common injuries seen as majority of pediatrics were not wearing helmets. Fractures, more commonly those involving lower limb fractures, and close fractures were the most common musculoskeletal injury.

Recommendations

More effort should be addressed on prevention through education and intervention programs to increase the awareness and understanding of child safety road usage and injury prevention as most pediatric injuries occurred sideways/ along the road as a pedestrian.

Study limitations

Patients with isolated visceral injuries that do not involve either musculoskeletal system or head injuries (CNS) were missed as they were admitted at Muhimbili National Hospital and not Muhimbili Orthopedic Institute. This study was done in one hospital and that may not reflect what is happening in other hospitals. Also, the study involved one center only, so interpretation of the results only applies to this study population. Therefore, if it would have been done in multiple hospital setting, the better view of pediatric trauma and its major causes would provide a clearer picture of the situation.

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Declaration

The findings of this research were part of a dissertation as partial fulfillment of Masters of

medicine in Orthopedics and trauma of one of the author.

Author contribution

JS came up with the study design, literature review and collected data. MM assisted with the data collection, wrote up the discussion and edited the manuscript. KN was responsible to oversee the entire study and worked on the analysis. RM was responsible to assist with the discussion and the conclusion. BM, RB, MN and EL all contributed equally by giving their inputs on the methodology and also assisting to collect data, clean it and analyzing it.

Conflict of interests

None of the authors had any conflicts of interest.

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