

# Epidemiology of pediatric trauma in Makkah, Kingdom of Saudi Arabia

## An observational cohort study

Mansour M. Almalki, MBBS, Mohammed E. Almalki, MBBS, Nedaa Alsulaimani, MBBS, Shabad Tariq, MBBS, Taif Alqabtani, MBBS, Fawaz Baalaraj, MBBS, Mohammed Ageel, MD.

### ABSTRACT

**الهدف:** تهدف هذه الدراسة إلى استكشاف وبائيات وأنماط صدمات الأطفال بالإضافة إلى مدة الإقامة في المستشفى والنتائج.

**المنهجية:** تم إجراء دراسة رجعية في مركز واحد على 605 مريضاً تتراوح أعمارهم بين 14 عاماً وأقل من يناير إلى ديسمبر 2022. وشملت الدراسة جميع المرضى الذين عانوا من صدمة مقصودة أو غير مقصودة في سن 14 عاماً أو أقل في عام 2022 واستبعدت الصدمة التي لم تحت زيارة غرفة الطوارئ.

**النتائج:** شملت معظم حالات الصدمات لدى الأطفال الأولاد (69.1%، العدد=418)، وشكلت الفتيات 30.90% فقط (العدد=187). كانت الصدمة أكثر شيوعاً عند الأطفال من عمر 1 إلى 5 سنوات (41.5%، العدد=251). كان السقوط من ارتفاع هو الوضع الأكثر شيوعاً للإصابة لدى كل من الفتيات والفتيان (العدد=253، 41.8%). أكثر أجزاء الجسم إصابة كانت الأطراف (العدد=357، 59%)، يليها الرأس (العدد=210، 34.7%). تم نقل معظم الأطفال إلى المستشفى عن طريق الخدمات الطبية الطارئة (ن=234، 38.7%). في معظم الحالات، تم إدخال الطفل إلى قسم الجراحة (ن=458، 75.7%)، بينما تمت معالجة البعض الآخر في قسم الطوارئ دون دخول (ن=93، 15.4%). كان معظم المرضى مستقرين بعد تلقي الرعاية القياسية (ن=558، 92.2%).

**الخلاصة:** لتقليل نفقات الرعاية الصحية وتحسين نتائج الصحة العامة، فإن إعطاء الأولوية للتدابير الوقائية أمر بالغ الأهمية. ويشمل ذلك زيادة الوعي العام، وتنفيذ بروتوكولات السلامة، وسن اللوائح الحكومية لمنع الإصابات التي يمكن تجنبها.

**Objectives:** To explore the epidemiology and patterns of pediatric trauma in addition to length of hospital stay and outcome.

**Methods:** A single-center retrospective study of 605 patients aged 14 years and younger was carried out from January to December 2022. The study included all patients who experienced intentional or unintentional trauma aged 14 years or below in 2022 and excluded trauma that did not prompt an emergency room visit.

**Results:** Most pediatric trauma cases involved boys (69.1%, n=418), and girls comprised only 30.9% (n=187). Trauma was most common in children one to 5 years old (41.5%, n=251). Falling from a height was the most common mode of injury in both girls and boys (n=253, 41.8%). The most common body parts involved were the extremities (n=357, 59%), followed by the head (n=210, 34.7%). Most children were transferred to hospital via emergency medical services (n=234, 38.7%). In most cases, the child was admitted to the surgical ward (n=458, 75.7%), while others were managed in the emergency department without admission (n=93, 15.4%). Most patients were stable after receiving standard care (n=558, 92.2%).

**Conclusion:** To reduce health care expenses and improve public health outcomes, prioritizing preventive measures is crucial. This includes increasing public awareness, implementing safety protocols, and enacting government regulations to prevent avoidable injuries.

**Keywords:** pediatric trauma, trauma registry, children, Saudi Arabia, Makkah

*Saudi Med J* 2023; Vol. 44 (1): 808-814  
doi: 10.15537/smj.2023.44.8. 20230292

From the College of Medicine, Umm Al-Qura University, Makkah, Kingdom of Saudi Arabia.

Received 19th April 2023. Accepted 11th July 2023.

Address correspondence and reprint request to: Dr. Nedaa Alsulaimani, College of Medicine, Umm Al-Qura University, Makkah, Kingdom of Saudi Arabia. E-mail: Nedaa.alsulaimani@gmail.com  
ORCID ID: <https://orcid.org/0000-0002-3562-7589>

Childhood trauma constitutes a serious public health concern worldwide, and it is one of the most common causes of childhood and adolescent mortality.<sup>1</sup> Around the world, injuries and violence involving children are responsible for approximately 950,000 deaths in children under 18 years of age annually. Moreover, children who are hospitalized for nonfatal injuries often experience life-long disabilities as result of their injuries.<sup>2</sup>

Motor vehicle collision (MVC), drowning, falls, burns, and poisoning are among the most common causes of death in children worldwide.<sup>2</sup> Road traffic accidents in Saudi Arabia are the highest worldwide, with an accident-to-injury ratio of 8:6 compared with 8:1.8 internationally.<sup>1</sup> In addition, in Saudi Arabia, 40% of the population are 19 years of age and younger. Therefore, childhood injury can significantly affect the country's health.<sup>3,4</sup>

A study carried out in Saudi Arabia concluded that the majority of preventable causes of death were related to injuries, among which MVCs contributed 60.6% of all deaths secondary to injuries.<sup>5</sup> In addition, there is a 16.6% reduction in disability-adjusted life years for children in Saudi Arabia, and out of this percentage, 8.1% can be attributed to MVCs.<sup>6,7</sup>

According to a World Health Organization (WHO) report, nearly 50% of all children under the age of 12 who presented to an emergency room (ER) with injuries were left disabled in some way.<sup>2</sup> Epidemiologic baseline data are necessary to assess the possible need for improved triage and preventive and rehabilitative strategies. This study aims to evaluate the epidemiology, patterns, and outcomes of trauma in the pediatric population in Makkah, Saudi Arabia.

**Methods.** The study was designed as a retrospective cohort study using data taken from patient records at Al-Noor Hospital, the only hospital in Makkah that has a trauma center. Data collection was carried out over 3 months, collecting data from records spanning January to December 2022. We included all children, 14 years old or younger in 2022, who presented with intentional or unintentional trauma. Traumas not prompting an ER visit were excluded.

Collected data included demographic characteristics, date and time of admission, time of presentation

after the accident, method of transfer, mechanism of trauma, body area involved, initial diagnosis, admission department, cross-sectional imaging, hospital length of stay (LOS), and outcome at discharge. The patients were divided into 4 age groups: below one year, 1 to 5 years, 6 to 10 years, and 11 to 14 years old. The mechanisms of injury included blunt trauma, falling from a height, penetrating injuries (gunshot, stabbing, and other injuries by sharp objects), and burns. The injuries were classified based on the body areas involved: head, neck, chest, abdominal organ, pelvis, extremities, back, and eye. We also categorized patients based on time of presentation after the accident: within 24 hours and after 24 hours from the incident.

We obtained the ethical approval from the Institutional Review Board approval from General Directorate of Health Affairs in Makkah, Saudi Arabia, ethical approval number: (H-02-K-076-0922-793). and carried out according to principles of Helsinki Declaration.

**Statistical analysis.** Data analysis was performed using IBM SPSS Statistics, Version 25. Significance was tested using the student's t test, while categorical variables were compared using the chi-square test. A multivariate logistic regression model was used to explore predictors of variable outcome measures. A significance level of  $p < 0.05$  was used for all tests.

**Results.** A total of 605 patients fulfilling the inclusion criteria were included, of which 69.1% were boys. The majority were between the ages of 1 and 5 (41.5%) years. The leading mechanism of injury was falling from a height (41.8%). Extremities were the most commonly involved area of the body (59%). Approximately two-thirds of the injured children presented less than 24 hours after injury (65.3%). Children transferred to the hospital by emergency medical services (EMS) constituted 38.7% of the entire sample. The majority of patients were admitted to the surgical ward (75.5%). One-third had cross-sectional imaging performed: computed tomography (CT) in 33.7% and magnetic resonance imaging (MRI) on 1%. Most of the cases (92%) ended up in stable condition, 6% were discharged against medical advice, 6 children (1%) died, and 0.8% had an unstable outcome. All of the children that died arrived by emergency medical service (EMS), 5 were admitted to the intensive care unit (ICU) and 1 died upon arrival (**Table 1**).

On initial diagnosis, extremity fractures recorded the heights percentage (42.5%), followed by skull fractures (11.6%), and burns (9.9%) (**Figure 1**).

**Disclosure.** Authors have no conflict of interests, and the work was not supported or funded by any drug company.

**Table 1** - Demographics and characteristics of pediatric trauma patients (N=605).

Variable	n (%)
<b>Age (years)</b>	
<1	56 (9.3)
1-5	251 (41.5)
6-10	199 (32.9)
11-14	99 (16.4)
<b>Gender</b>	
Male	418 (69.1)
Female	187 (30.9)
<b>Nationality</b>	
Saudi	493 (81.5)
Non-Saudi	112 (18.5)
<b>Mechanism of injury</b>	
Fall from a height	253 (41.8)
Blunt trauma	86 (14.2)
Motor vehicle collision	66 (10.9)
Burn	60 (9.9)
Penetrating wound	52 (8.6)
Not mentioned	88 (14.5)
<b>Body part involved</b>	
Extremities	357 (59)
Head	210 (34.7)
Chest	57 (9.4)
Neck	31 (5.1)
Pelvis	27 (4.5)
Abdominal organs	25 (4.1)
Back	14 (2.3)
Eye	9 (1.5)
<b>Time of presentation after accident</b>	
Less than 24h	395 (65.3)
More than 24h	38 (6.3)
Not mentioned	172 (28.4)
<b>Method of transfer</b>	
EMS	234 (38.7)
Family car	154 (25.5)
Transfer from another hospital	10 (1.7)
Not mentioned	207 (34.2)
<b>Admission unit</b>	
Surgical ward	458 (75.7)
Discharged from ER	93 (15.4)
Burn unit	60 (9.9)
ICU	32 (5.3)
<b>Cross-sectional imaging</b>	
CT	204 (33.7)
MRI	6 (1.0)
No imaging	395 (65.3)
<b>Outcome</b>	
Stable	558 (92.2)
DAMA	36 (6.0)
Died	6 (1.0)
Unstable	5 (0.8)

DAMA: discharged against medical advice, EMS: emergency medical services, ER: emergency room, ICU: intensive care unit, MRI: magnetic resonance imaging

This study explores variables linked to the duration of hospitalization using two categories: 3 days or less, or more than 3 days' hospitalization. Out of the variables, mechanism of injury, admission department, chest injury, abdominal organ injury, and pelvic injury had a statistically significant association with an extended hospital stay ( $p<0.05$ ). Conversely, age, time of arrival after the accident, method of transfer, head injury, neck injury, limb injury, back injury, and eye injury did not show a significant association with prolonged hospital stay (Table 2).

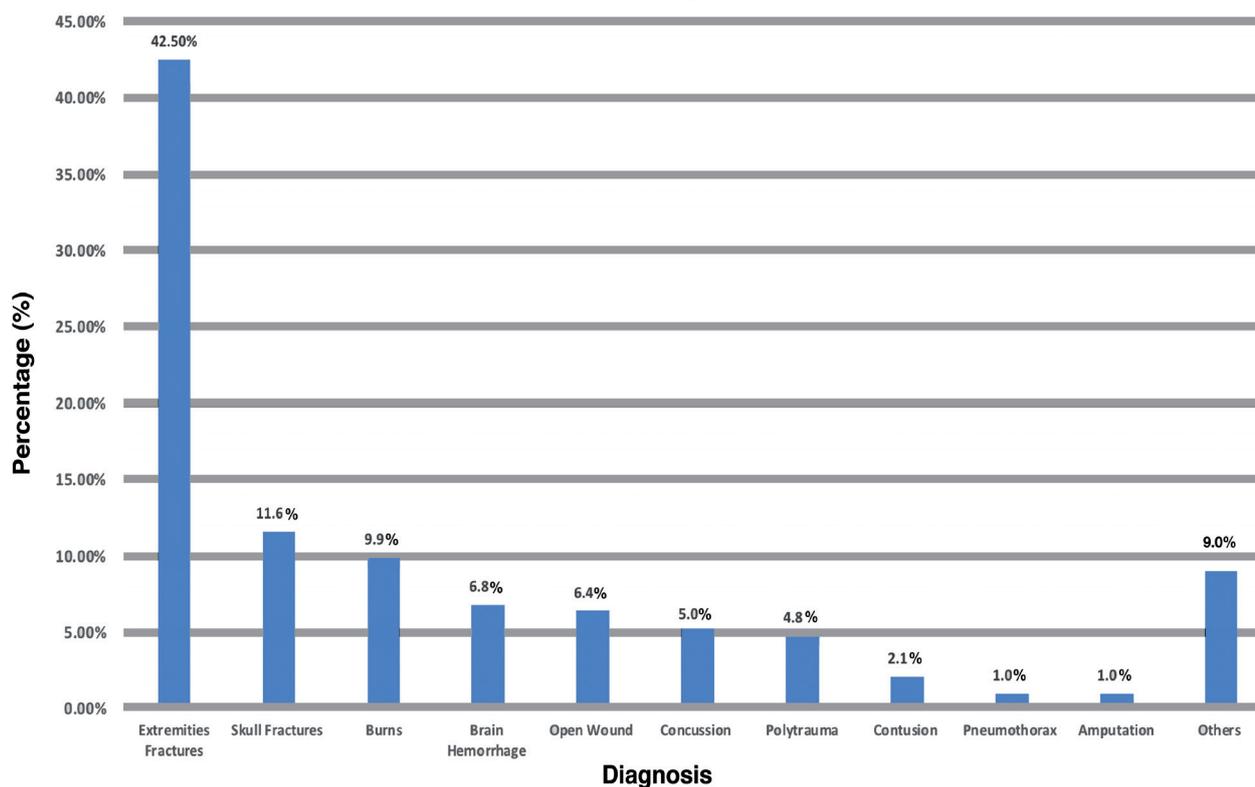
Patients with burn injuries were almost 10 times more likely to have a prolonged LOS than patients with fall injuries. In the same way, victims of MVCs had five times the odds for a prolonged LOS compared with those who sustained a fall injury (OR=5.885). According to regression analysis, these mechanisms are significant predictors of prolonged hospital LOS ( $p<0.05$ ). Moreover, patients admitted to the ICU were ten times more likely to have a prolonged LOS in comparison with patients who were admitted to the surgical ward (OR=10.491,  $p<0.05$ ) (Table 3).

**Discussion.** Trauma accounts for significant mortality and morbidity in children worldwide. Approximately 40% of all pediatric mortalities are due to unintentional injuries.<sup>2</sup> Globally, trauma is the most frequent reason for evaluation in the pediatric ER.<sup>8,9</sup> This study describes the most recent epidemiology, characteristics, and outcomes of pediatric trauma in Makkah, Saudi Arabia.

Based on the results of the present study, 1 to 5 years old was the predominant age of presentation (41.5%), as reported by previous studies.<sup>1,10,11</sup>

Boys were more likely than girls to experience traumatic injuries, with a ratio of 2:1. This is in line with multiple local and global studies carried out on the epidemiology of pediatric trauma.<sup>1,11,12</sup> A possible explanation for this ratio discrepancy is that boys are more energetic, adventurous, and particularly liable to engage in risky activities.

Falling from a height was the most common mechanism of injury (41.8%), corroborating earlier reports of pediatric trauma.<sup>11,12</sup> Younger children are especially fall-prone because they lack movement control and balance. When combined with their curious nature and immature judgement, this adds up to a risk of sustaining fall-related injuries at this age. Most of our population fit within the age group of 1 to 5 years old, which could explain why falling was the most common type of injury. Studies from Saudi Arabia, the United States, the United Kingdom, and the



**Figure 1** - Initial diagnosis of pediatric trauma patients.

United Arab Emirates documented similar findings in this age group.<sup>13-15</sup>

Based on the current study, injuries to the extremities (59%) and head injury (34.7%) had the highest incidence rates among types of trauma. These findings are consistent with those of earlier studies.<sup>12,16,17</sup>

Fractures in children are caused by a variety of factors, including regular engagement in sports, playground activities, and high-speed hobbies like skating and bicycling that place children in a settings where trauma-related fractures from falls and collisions are more likely to occur.<sup>18</sup>

Children frequently experience morbidity and death from head injuries. This may be attributed to the nature of the skull in children, which is characterized by having less bone density and being more malleable, providing the brain with less protection. The larger head-to-body ratio and weaker neck ligaments and spine musculature all contribute to the risk of traumatic brain injury in children.<sup>1,19</sup>

A sizable proportion of patients arrived to the hospital by EMS (38.7%). Although lower rates of EMS utilization have been reported, Alyafei et al<sup>12</sup> revealed a disproportionately higher number of patients

who utilized EMS (64.4%).<sup>1,10,11</sup> Considerable variation in the mode of transfer can be easily noticed across the literature, and it depends partially on multiple factors including ER proximity, access and availability of EMS, and injury characteristics and severity. Collectively, those factors could influence the guardians' choice of transportation.<sup>20</sup>

Concerning ER disposition, most patients were admitted to the surgical ward (75.7%). Only 5.3% needed admission to the ICU, as compared with two regional retrospective analyses demonstrating that almost half of the children were admitted to the ICU.<sup>1,12</sup> Our ER outcomes for pediatric trauma is encouraging, as many of the incidents were mild and avoidable if appropriate action was taken, such as enhancing public understanding of child safety precautions (at home, school, and on the road), putting primary injury prevention strategies into practice, and improving prehospital services for children.<sup>12</sup>

According to our results, 6 patients died (overall mortality rate was 1%). Several other studies have reported a mortality rate of 1% to 3%.<sup>11,13,16</sup> Motor vehicle collision was the leading cause of mortality (83.3%), which is consistent with other national

**Table 2** - Association between length of hospital stay and patient characteristics.

Variable	3 Days or less		More than 3 days		P-value
	n	(%)	n	%	
<i>Age (years)</i>					
Below 1 year	41	6.8	15	2.5	0.445
1-5	166	27.4	85	14.1	
6-10	128	21.1	71	11.7	
11-14	60	9.9	39	6.4	
<i>Mechanism of injury</i>					
Fall from a height	193	31.9	60	9.9	<0.05
Blunt trauma	57	9.4	29	4.8	
MVC	21	3.5	45	7.4	
Burn	15	2.5	45	7.4	
Penetrating wound	39	6.5	13	2.2	
Not mentioned	70	11.6	18	3.0	
<i>Time of presentation after accident</i>					
Less than 24h	251	41.5	144	23.8	0.24
More than 24h	23	5.3	15	2.5	
Not mentioned	121	20.0	51	8.4	
<i>Method of transfer</i>					
EMS	144	23.8	90	14.9	0.286
Family car	105	17.4	49	8.1	
Transfer from another hospital	5	0.8	5	0.8	
Not mentioned	141	23.3	66	10.9	
<i>Admission department</i>					
Surgical ward	314	51.9	144	23.8	<0.05
Discharged from ER	70	11.6	23	3.8	
Burn unit	7	1.2	14	2.3	
ICU	3	0.5	29	4.8	
<i>Body parts involved</i>					
Extremities	229	31.4	128	17.5	0.478
Head	137	18.8	73	10.0	0.985
Chest	19	2.6	38	5.2	<0.05
Neck	17	2.3	14	1.9	0.21
Pelvis	10	1.4	17	2.3	<0.05
Abdominal organs	10	1.4	15	2.1	<0.05
Back	10	1.4	4	0.6	0.625
Eye	8	1.1	1	0.1	0.50

CI: confidence interval, ER: emergency room, ICU: intensive care unit, MVC: motor vehicle collision, OR: odds ratio

reports.<sup>1,16</sup> All patients who died had arrived by EMS.

Analysis demonstrated that 34.7% had a prolonged LOS in the hospital. A similar rate was observed among pediatric admissions following traumatic injury in Norway.<sup>21</sup> Motor vehicle collision (10.9%) and burn injuries (9.9%) were positively associated with prolonged LOS. Alghnam et al<sup>22</sup> in their retrospective research carried out in Saudi Arabia found that roughly 50% of patients with a prolonged LOS were hospitalized because of an MVC.

Also, MVC victims were nearly 5 times more likely to have a longer LOS compared with patients who

sustained a fall injury, a finding similar to results of a previous report.<sup>23</sup>

Although ER visits attributed to MVCs were lower than what was found in previous articles, they were significantly associated with extended hospitalization (OR=5.885,  $p=0.000$ ).<sup>1,16,17</sup> These results are in line with prior studies.<sup>23-25</sup>

In the same way, admission to the ICU is one of the predictors of prolonged LOS which was found to be significantly associated with mortality and the severity of the injury.<sup>26</sup>

This result was expected since burn patients may need substantial care in the burn ICU, which involves prolonged monitoring of such critical cases. Barcelos et al,<sup>27</sup> during their retrospective investigation, found that burns in children have higher morbidity and functional repercussions. The significance of burn injuries is illustrated by the fact that they accounted for 20% of admissions to the ICU.

In addition, extended LOS increases the burden on the health care facility to aid in recovery, as burn patients also have a higher chance of contracting bacteria like *Pseudomonas aeruginosa*, which is highly resistant to antibiotics.<sup>28</sup>

A report by Keswani et al<sup>29</sup> showed a significant decrease in mortality in regions where educational campaigns on burns were introduced. Hence, preventive measures like education are essential to lower the risk of burn injuries. Together with properly fitted smoke detectors, parents play a crucial part in prevention.

This type of traumatic event emphasizes the significance of home accidents during children's developmental stage when easy kitchen access without proper supervision is present. Effective environmental management combined with an accident prevention strategy such as adding hot water temperature limiters will significantly affect these figures.<sup>30,31</sup>

Recent research in Saudi Arabia revealed that 2.4% of children lost their lives due to MVCs. Moreover, 53.8% of injured children were in the rear seat without seatbelts or car seats, and 9.1% of those children were driving.<sup>23</sup> In a previous international survey in Saudi Arabia, approximately 36.6% of participants routinely utilized child restraints, a rate that is far lower than rates in developed countries like the United States and Australia (>90%).<sup>32,33</sup>

Educating the general Saudi population, particularly parents, regarding the instructions that must be followed when children ride in the car is needed. This can be accomplished through targeted community-based campaigns and social media platforms, and, hopefully, this will lead to a decrease in the incidence of MVCs.

**Study limitation.** Our study is limited by its retrospective design.

In conclusion, our country has a significant public health concern after thoroughly reviewing the epidemiology of pediatric trauma in Saudi Arabia. Pediatric trauma is prevalent, and the most common cause of injury in children is falling from a height. The consequences of pediatric trauma can be severe and long lasting, with many children suffering from physical disabilities and psychological trauma from their injuries. One way to prevent children from climbing and falling is ensuring that furniture is kept away from windows and promoting the use of helmets and seat belts. Raising public awareness about the risk of pediatric trauma can be an effective way to reduce the number of injuries. Addressing this issue will necessitate a comprehensive and coordinated effort involving all stakeholders in the health care system.

**Acknowledgment.** *We gratefully acknowledge their supervisor, Dr. Mohammed Ageel, for his valuable guidance. We would like to thank Editor in the Life Sciences for their English language editing.*

## References

- Alomani H, Fareed A, Ibrahim H, Shaloot A, Elhalawany A, Alhajjaj M, et al. Pediatric trauma at a single center in the Qassim region of Saudi Arabia. *Ann Saudi Med* 2021; 41: 165-170.
- Peden M, Oyegbite K, Ozanne-Smith J et al. World Report on Child Injury Prevention - PubMed - NCBI. Peden M, Oyegbite K, Ozanne-Smith J, Hyder AA, Branche C, Rahman AF, et al., editors. *Geneva: World Health Organization* 2008; 31-56.
- General Authority for Statistics. Chapter 01 | Population & Demography | General Authority for Statistics. [Updated 2019; Accessed 2019 April 1]. Available from: <https://www.stats.gov.sa/en/1007-0>
- Alghnam S, Alkelya M, Al-Bedah K, Al-Enazi S. Burden of traumatic injuries in Saudi Arabia: lessons from a major trauma registry in Riyadh, Saudi Arabia. *Ann Saudi Med* 2014; 34: 291-296.
- Almuneef M, Saleheen H, AlBuhairan F, Al-Eissa M, Al Muntaser M, Al Alem H, et al. Child mortality in Saudi Arabia: Time for action at all levels. *Int J Pediatr Adolesc Med* 2021; 8: 165-171.
- Albedewi H, Al-Saud N, Kashkary A, Al-Qunaibet A, AlBalawi SM, Alghnam S. Epidemiology of childhood injuries in Saudi Arabia: a scoping review. *BMC Pediatr* 2021; 21.
- Abbafati C, Abbas KM, Abbasi-Kangevari M, Abd-Allah F, Abdelalim A, Abdollahi M, et al. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; 396: 1223-1249.
- Mohamed AS, Sagna A, Fall M, Ndoye NA, Mbaye PA, Fall AL, et al. Les accidents de la vie courante chez l'enfant à Dakar: à propos de 201 cas. *PAMJ* 2017; 27: 272.
- Waters PM, Skaggs DL, John M, Flynn JM. Rockwood and Wilkins Fractures in Children. 9th edition, Sacks DO, Wolters Kluwer Health, Inc. Netherland: 2019. pp. 1224.
- Mehmood A, Agrawal P, Allen KA, Al-Kashmiri A, Al-Busaidi A, Hyder AA. Childhood injuries in Oman: retrospective review of a multicentre trauma registry data. *BMJ Paediatr Open* 2018; 2: e000310.
- Liu JC, Ismael AA, Zaidi A, Sha'ban BW, Almutawa SE, Chatha AA, et al. Epidemiology of pediatric trauma in the Kingdom of Bahrain: a national pediatric trauma registry pilot study. *Inj Epidemiol* 2021; 8: 42.
- Alyafei KA, Toaimah F, El Menyar A, Al Thani H, Youssef B, Mollazehi M, et al. Analysis of pediatric trauma data from a hospital based trauma registry in Qatar. *Int J Crit Illn Inj Sci* 2023; 5: 21.
- AlAteeq MA, Alsulayhim AK, AlHargan F, AlSamaani IS, Alyousef M, AlDossari A, et al. Morbidity Patterns of Non-Traffic Unintentional Injuries Among the Pediatric Age Group Attending the Emergency Department at King Abdul-Aziz Medical City, Riyadh, Saudi Arabia. *Cureus* 2020; 12: e9258.
- Alhabdan S, Zamakhshary M, Alnaimi M, Mandora H, Alhamdan M, Al-Bedah K, et al. Epidemiology of traumatic head injury in children and adolescents in a major trauma center in Saudi Arabia: implications for injury prevention. *Ann Saudi Med* 2013; 33: 52-56.
- Naqvi G, Johansson G, Yip G, Rehm A, Carrothers A, Stöhr K. Mechanisms, patterns and outcomes of paediatric polytrauma in a UK major trauma centre. *Ann R Coll Surg Engl* 2017; 99: 39-45.
- Alnasser A, Othman A, Mobaireek O, Alharthy N, Algerian N, Al Zamel H, et al. Epidemiology of pediatric trauma at a tertiary hospital in Riyadh, Saudi Arabia. *J Nat Sci Biol Med* 2018; 9: 247-251.
- Oliver J, Avraham J, Frangos S, Tomita S, DiMaggio C. The Epidemiology of Inpatient Pediatric Trauma in United States Hospitals 2000 to 2011. *J Pediatr Surg* 2018; 53: 758-764.
- Bowden, S.A. Multiple Fractures. In: Stanley, T., Misra, M. (eds) *Endocrine Conditions in Pediatrics*. Springer, Cham: 2021. pp 23-27.
- Karepov Y, Kozyrev DA, Benifla M, Shapira V, Constantini S, Roth J. E-bike-related cranial injuries in pediatric population. *Childs Nerv Syst* 2019; 35: 1393-136.
- Thinnes R, Swanson MB, Wetjen K, Harland KK, Mohr NM. Preferences for Emergency medical service transport after childhood injury: An emergency department-based mixed methods study. *Injury* 2020; 51: 1961-1969.
- Nesje E, Valøy NN, Krüger AJ, Uleberg O. Epidemiology of paediatric trauma in Norway: A single-trauma centre observational study. *Int J Emerg Med* 2019; 12: 1-10.
- Alghnam S, Towhari JA, Al Babbain I, Al Nahdi M, Aldebasei MH, Alyami M, et al. The associations between injury mechanism and extended hospital stay among pediatric patients: Findings from a trauma center in Saudi Arabia. *BMC Pediatr* 2019; 19: 1-8.
- Alghnam S, Jastaniah E, Alwahaibi W, Alabbtain IT, Alqublan S, Bajwaiber M, et al. The prevalence of head and facial injuries among children in Saudi Arabia following road traffic crashes. *Ann Saudi Med* 2020; 40: 417-424.
- Donaldson LJ, Reckless IP, Scholes S, Mindell JS, Shelton NJ. The epidemiology of fractures in England. *J Epidemiol Community Health* 2008; 62: 174-180.

25. Ansari S, Akhdar F, Mandoorah M, Moutaery K. Causes and effects of road traffic accidents in Saudi Arabia. *Public Health* 200; 114: 37-39.
26. Yousefzadeh chabok S, Ranjbar taklimie F, Malekpouri R, Razzaghi A. Predicting mortality, hospital length of stay and need for surgery in pediatric trauma patients. *Chin J Traumatol* 2017; 20: 339-342.
27. Barcellos LG, Da Silva APP, Piva JP, Rech L, Brondani TG. Characteristics and outcome of burned children admitted to a pediatric intensive care unit. *Rev Bras Ter Intensiva* 2018; 30: 333-337.
28. Ahmad M. Pakistani experience of childhood burns in a private setup. *Ann Burns Fire Disasters* 2010; 23: 25.
29. Keswani MH. The prevention of burning injury. *Burns Incl Therm Inj* 1986; 12: 533-539.
30. Brooks NC, Song J, Boehning D, Kraft R, Finnerty CC, Herndon DN, et al. Propranolol Improves Impaired Hepatic Phosphatidylinositol 3-Kinase/Akt Signaling after Burn Injury. *Mol Med* 2012; 18: 707-711.
31. Mack KA, Liller KD, Baldwin G, Sleet D. Preventing unintentional injuries in the home using the health impact pyramid. *Health Educ Behav* 2015; 42: 115S-122S.
32. National Technical Information Service. Results of the National Child Restraint Use Special Study Results of the National Child Restraint Use Special Study 13. [Updated 2015: 2019 April 1]. Available from: <https://www.ntis.gov/>
33. National Highway Traffic Safety Administration. Effectiveness of Child Passenger Safety Information for the Safe Transportation of Children. [Updated 2013; 2019 April 1]. Available from: <https://www.nhtsa.gov/sites/nhtsa.gov/files/812245-effective-cps-safety-info.pdf>