

# Prevalence and Outcomes of Pediatric Trauma Cases in the Emergency Department in Saudi Arabia: A Systematic Review

Sohail Saad Alshahrani<sup>1\*</sup>, Marwah Ali Al Hausa<sup>1</sup>, Naif Ali Alaji<sup>2</sup>, Hussain Hayazi Albarqi<sup>3</sup>

<sup>1</sup>Specialist of Pediatric Emergency, Security Forces Hospital, Riyadh, Saudi Arabia

<sup>2</sup>Specialist of Pediatric Emergency, Alhabib Hospital, Riyadh, Saudi Arabia

<sup>3</sup>Fellow of Pediatric Emergency, Security Forces Hospital, Riyadh, Saudi Arabia

DOI: [10.36348/sjimps.2024.v10i07.013](https://doi.org/10.36348/sjimps.2024.v10i07.013)

| Received: 17.05.2024 | Accepted: 21.06.2024 | Published: 22.07.2024

\*Corresponding author: Sohail Saad Alshahrani

Specialist of Pediatric Emergency, Security Forces Hospital, Riyadh, Saudi Arabia

## Abstract

**Objectives:** To thoroughly evaluate the incidence, outcomes, and associated risk factors of trauma among children attending emergency departments in Saudi Arabia. **Methods:** A thorough search of pertinent databases was done in order to find studies that satisfied the requirements for inclusion. A thorough search of PubMed, Web of Science, SCOPUS, and Science Direct was conducted to find pertinent literature. **Results:** Ten studies, including a total of 2351 children who had various traumas, and 1705 (72.5%) of them were males, were included in our data. Cervical spine injuries occurred mainly due to blunt trauma, and the majority improved. MRI can shorten the time needed to clear the cervical spine and lower the number of injuries that are overlooked. Ocular traumas were reported in two studies, one due to chemical burns and the other due to fireworks. The two mechanisms left permanent complications, such as corneal opacity and limbal stem cell deficiency. Multiple traumas (such as fractures lacerations, burns, and brain injuries) that occurred due to falls, MVA, blunt traumas, and penetrating wounds. Most cases were stable and survived with no significant disability. **Conclusion:** Even with an increased risk, children rarely suffer serious injuries. Children displayed the many forms of trauma and its associated affective aspects. Ocular traumas held the most serious and life-threatening complications. Because there are many elements that contribute to trauma, it is advised that appropriate interventions and preventive measures be used in order to minimize trauma.

**Keywords:** Trauma; Children; Emergency; Saudi Arabia; Systematic review.

**Copyright © 2024 The Author(s):** This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

## INTRODUCTION

One of the leading causes of youth and adolescent death, childhood trauma is a major global public health concern [1]. Every year, injuries and acts of violence against children account for about 950,000 deaths in children under the age of eighteen worldwide. Furthermore, the injuries that hospitalized children for nonfatal accidents frequently leave them disabled for the rest of their lives [2]. A World Health Organization (WHO) survey states that approximately 50% of children under the age of 12 who brought injuries to an emergency department (ER) were rendered permanently impaired [2].

Since childhood and adolescence are two of the most delicate times in life, it is crucial to give special attention to their health during these years [3, 4]. As

children and adolescents are actually the ones who will shape society in the future, preserving their health can contribute to the growth of a thriving community [5]. The biological, psychological, and cognitive changes that take place during childhood and adolescence serve as the foundation for an individual's eventual physical, psychological, emotional, spiritual, and social maturity [6, 7].

Children and teenagers are frequently involved in accidents, including traffic accidents [8], falls [9], drownings [10], brain injuries [11], and orthopedic injuries [12]. These mishaps and situations have the potential to leave a person disabled, which is why it's important to pay attention to them [13]. One of the leading causes of accident-related death and disability is a head injury [14]. These injuries encompass a broad spectrum of extremely hazardous, severe, and sometimes

fatal lesions [15]. Traffic accidents are another category of trauma that are quite important [16]. Because these episodes might involve people and result in negative outcomes including psychological issues, desertion, and economic difficulties, it is especially important to pay attention to the variables impacting these people and strategies to reduce them [17, 18].

This systematic review aims to thoroughly evaluate the incidence, outcomes, and associated risk factors of trauma among children attending emergency departments in Saudi Arabia by synthesizing current literature, identifying knowledge gaps, and offering insights for future research and clinical practice.

## METHODS

We followed the recommendations in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [19] for this systematic review. An electronic search was performed on databases like PubMed, Web of Science, SCOPUS, and Science Direct in order to find English-language research that looked at the incidence and outcomes of pediatric trauma in Saudi Arabia. Relevant keywords were included in the search strategy for these situations. Independently, reviewers went through the search results, chose pertinent papers, collected data, and used the right assessment methods to determine how good the included research was.

### Eligibility Criteria:

#### Inclusion Criteria:

1. Studies published in the English language.
2. Studies reported the incidence of pediatric trauma.
3. Studies reporting relevant outcomes such as causes and mechanisms of traumas.
4. Studies conducted in Saudi Arabia
5. Studies involving human participants.
6. Randomized controlled trials, cohort studies, case-control studies, and cross-sectional studies.

#### Exclusion Criteria:

1. Studies not published in English.
2. Animal studies, *in vitro* studies, and review articles without original data.
3. Studies with insufficient data or unclear methodology.
4. Case reports and case series with fewer than five participants.
5. Studies with overlapping data or duplicate publications.

### Data Extraction

Rayyan (QCRI) was used to validate the search results in order to guarantee accuracy [20]. The inclusion and exclusion criteria were used to determine the relevancy of the titles and abstracts that the search produced. Papers that satisfied the inclusion requirements were carefully examined by the study team. Consensus was used to settle disagreements. Using a predetermined data extraction form, key study data, such as titles, authors, publication year, study location, gender distribution, participant demographics, mechanisms of traumas, type of trauma, outcomes, and conclusion were documented. To evaluate the possibility of bias, an impartial assessment instrument was created.

### Data Synthesis Strategy

Summaries of the research findings and elements were created utilizing information taken from pertinent studies in order to offer a qualitative assessment. The best method for making use of the data from the studies that were included was decided upon after the data collection for the systematic review was finished.

### Risk of Bias Assessment

The Joanna Briggs Institute (JBI) [21] critical assessment criteria for studies reporting prevalence data were utilized to assess the study's quality. This tool had nine questions. A score of one was given for a positive response, while a score of zero was given for a negative, ambiguous, or irrelevant response. The following scores will be categorized as low, moderate, and high quality, respectively: below 4, between 5 and 7, and above 8. The quality of the studies was evaluated by researchers independently, and differences were settled through discussion.

## RESULTS

### Systematic search outcomes

After 840 duplicates were removed, a total of 1516 study papers were found through a systematic search. After 676 studies had their titles and abstracts evaluated, 599 papers were discarded. Merely 3 articles were not located out of the 77 reports that were required to be retrieved. 74 articles passed the screening process for full-text evaluation; 39 were rejected due to incorrect study results, 21 due to incorrect population type, 2 articles were editor's letters, and 2 were abstracts. Ten research publications in this systematic review satisfied the requirements for eligibility. An overview of the procedure used to choose the research is illustrated in Figure 1.

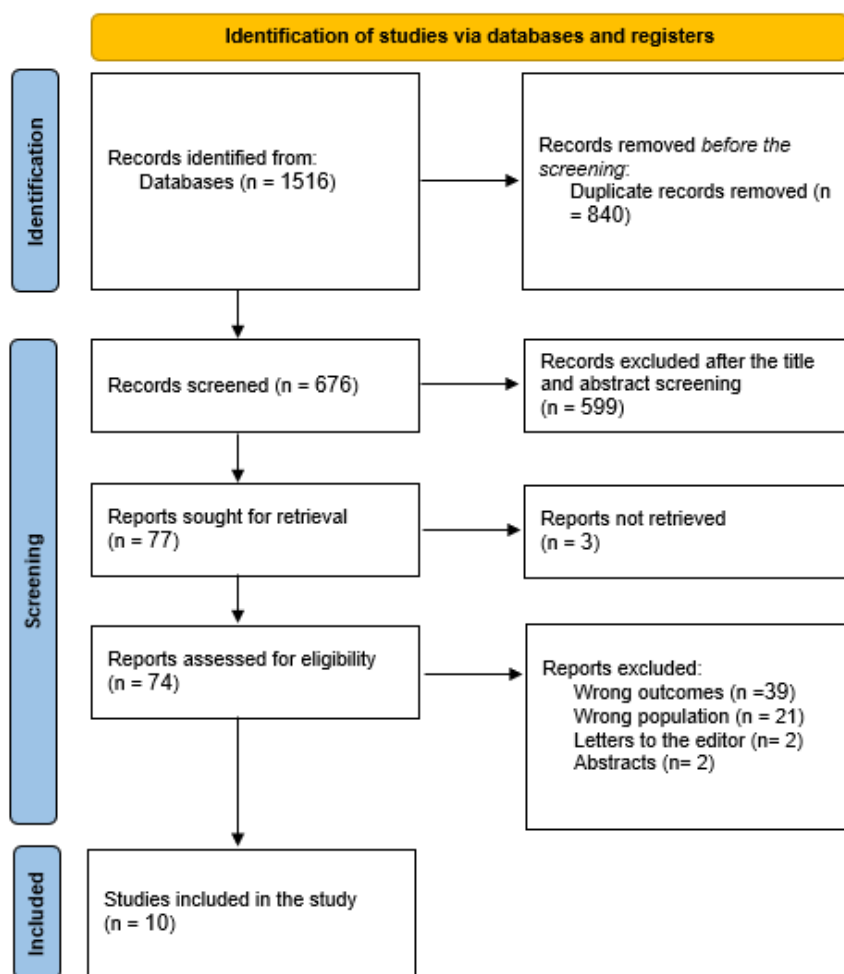


Figure 1: Study decision is summed up in a PRISMA diagram

### Sociodemographic features of the comprised studies

The research publications' sociodemographic information is displayed in Table 1. Ten studies, including a total of 2351 children who had various traumas, and 1705 (72.5%) of them were males, were included in our data. Eight studies were retrospective cohorts [22-27, 30, 31], one was prospective cohort [29], and one was cross-sectional [28]. Eight studies were conducted in Riyadh [22-25, 27, 28, 30, 31], one in Jeddah [29], and one in Makkah [26]. The earliest study was conducted in 2009 [29] and the latest in 2024 [23].

### Clinical outcomes

The clinical features are displayed in Table (2). The ten studies included variable pediatric traumas. Cervical spine injuries occurred mainly due to blunt trauma, and the majority improved. MRI can shorten the time needed to clear the cervical spine and lower the number of injuries that are overlooked [22].

Fractures occurred mainly due to MVA and falls, and all the reported cases healed. Fracture healing time was correlated with the mechanisms of damage, such as MVA, sports injuries, and fractures of the femur and forearm [23].

Ocular traumas were reported in two studies, one due to chemical burns [24] and the other due to fireworks [27]. The two mechanisms left permanent complications, such as corneal opacity and limbal stem cell deficiency.

Abusive head trauma was reported in 147 children [25]. As the number of cases of abusive head trauma is rising, policymakers, counselors, child protection professionals, and healthcare providers need to pay greater attention to these situations.

Two studies included multiple traumas (such as fractures lacerations, burns, and brain injuries) that occurred due to falls, MVA, blunt traumas, and penetrating wounds. Most cases were stable and survived with no significant disability. Many children who sustain traumas experience both psychological anguish and physical disability [26, 28].

Maxillofacial and dental traumas were reported in two studies [29, 31] and occurred mainly due to falls, impacts, and RTA. Most cases were males since boys tend to be more active and enthusiastic about outside activities.

Thoracic penetrating injuries were reported in 355 children and the majority of suffered injuries can be successfully treated without surgery [30].

**Table 1: The sociodemographic attributes of the participating populations**

Study	Study design	City	Participants	Mean age/ range	Females (%)
Al-Sarheed <i>et al.</i> , 2020 [22]	Retrospective cohort	Riyadh	62	8 ± 3.9	48 (77.4%)
Aldhiban <i>et al.</i> , 2024 [23]	Retrospective cohort	Riyadh	143	8.23 + 3.76	102 (71%)
Al-Ghadeer <i>et al.</i> , 2022 [24]	Retrospective cohort	Riyadh	147	1 - 16	106 (72.1%)
Alanazi <i>et al.</i> , 2021 [25]	Retrospective cohort	Riyadh	106	6.1 (months)	56 (52.8%)
Almalki <i>et al.</i> , 2023 [26]	Retrospective cohort	Makkah	605	1 - 14	418 (69.1%)
AlGhadeer & Khandekar, 2022 [27]	Retrospective cohort	Riyadh	107	9	96 (83.5%)
AlAteeq <i>et al.</i> , 2020 [28]	Cross-sectional	Riyadh	491	0-14	314 (64%)
Al-Malik <i>et al.</i> , 2009 [29]	Prospective cohort	Jeddah	112	0-17	79 (70.5%)
Alaqeel <i>et al.</i> , 2021 [30]	Retrospective cohort	Riyadh	355	0-18	354 (99.7%)
Al Shehri <i>et al.</i> , 2021 [31]	Retrospective cohort	Riyadh	223	0-12	132 (59.2%)

**Table 2: Clinical features and results of the included research**

Study ID	Mechanism of injury	Type of trauma	Outcomes	Conclusions	JBI
Al-Sarheed <i>et al.</i> , 2020 [22]	<ul style="list-style-type: none"> <li>Blunt trauma (98.4%)</li> <li>Penetrating trauma (1.6%)</li> </ul>	Cervical spinal injuries	<ul style="list-style-type: none"> <li>Improvement (78.2%)</li> <li>CNS injury (9.1%)</li> <li>Death (12.7%)</li> </ul>	It has been demonstrated that using MRI can shorten the time needed to clear the cervical spine and lower the amount of injuries that are overlooked.	Moderate
Aldhiban <i>et al.</i> , 2024 [23]	<ul style="list-style-type: none"> <li>MVA (35%)</li> <li>Fall (32%)</li> <li>Sport injuries (11%)</li> <li>Pedestrian injuries (9%)</li> <li>Not documented (13%)</li> </ul>	Fractures	All healed	A prolonged fracture healing time was independently correlated with clinical characteristics of the mechanisms of damage, such as MVA, sports injuries, and fractures of the femur and forearm.	High
Al-Ghadeer <i>et al.</i> , 2022 [24]	<ul style="list-style-type: none"> <li>Accidental chemical burns</li> </ul>	Ocular traumas	<ul style="list-style-type: none"> <li>Corneal opacification (28.7%)</li> <li>Limbal stem cell deficiency (22.2%)</li> <li>Symblepharon (18.4%)</li> </ul>	Visual results in the short term are not encouraging even with routine care.	Moderate
Alanazi <i>et al.</i> , 2021 [25]	Abusive	Head trauma	NM	The number of cases of abusive head trauma is rising, and policymakers, counselors, child protection professionals, and healthcare providers need to pay greater attention to these situations.	Moderate
Almalki <i>et al.</i> , 2023 [26]	<ul style="list-style-type: none"> <li>Fall from a height (41.8%)</li> <li>Blunt trauma (14.2%)</li> <li>MVA (10.9%)</li> <li>Burn (9.9%)</li> <li>Penetrating wound (8.6%)</li> </ul>	Multiple traumas	<ul style="list-style-type: none"> <li>Stable (92.2%)</li> <li>Discharged against medical advice (6%)</li> <li>Died (1%)</li> <li>Unstable (0.8%)</li> </ul>	The most frequent cause of injuries in children is falls, and pediatric trauma is common. Many children who sustain traumas experience both psychological anguish and physical disability.	Moderate

Study ID	Mechanism of injury	Type of trauma	Outcomes	Conclusions	JBI
AlGhaddeer & Khandekar, 2022 [27]	Fireworks	Ocular	<ul style="list-style-type: none"> <li>• Corneal opacity (21.3%)</li> <li>• Secondary Glaucoma (18.8%)</li> <li>• Traumatic cataract (17.9%)</li> <li>• Limba stem cell deficiency (12%)</li> </ul>	Patients with ocular morbidity and visual acuity may experience severe consequences from fireworks-related ocular injuries, especially if the event affects younger patients.	Moderate
AlAteeq <i>et al.</i> , 2020 [28]	Non-Traffic unintentional injuries	<ul style="list-style-type: none"> <li>• Fracture/dislocation/subluxation (47.3%)</li> <li>• Cut/laceration/open wound (21%)</li> <li>• Burn (17.5%)</li> <li>• Brain injury/intracranial bleeding (12.8%)</li> <li>• Near drowning (4.1%)</li> </ul>	<ul style="list-style-type: none"> <li>• No significant disability (40.1%)</li> <li>• Short-term disability (21.6%)</li> <li>• Long-term disability (24.2%)</li> <li>• Permanent disability (12.8%)</li> <li>• Death (1.2%)</li> </ul>	Unintentional pediatric injuries that do not involve driving are frequent, carry a high risk of morbidity and sequelae, and can be largely avoided.	Moderate
Al-Malik <i>et al.</i> , 2009 [29]	<ul style="list-style-type: none"> <li>• Fall (68.8%)</li> <li>• Impact (8.9%)</li> <li>• Collision (14.3%)</li> <li>• Others (burn, sharp objects) (8%)</li> </ul>	Maxillofacial trauma	NM	The majority of injuries (57%), with a male-to-female ratio of 5:1, happened on the street. This might be the case since guys tend to be more active and enthusiastic about outside activities.	High
Alaqeel <i>et al.</i> , 2021 [30]	Penetrating	Thoracic injuries	<ul style="list-style-type: none"> <li>• Required surgical intervention (4.2%)</li> <li>• Mortality rate was (3.4%)</li> </ul>	Injuries to the thoracic cavity account for 25% of all penetrating traumas in children. With good results, the majority of suffered injuries can be successfully treated without surgery.	Moderate
Al Shehri <i>et al.</i> , 2021 [31]	<ul style="list-style-type: none"> <li>• RTA (8.2%)</li> <li>• Inter-personal violence (1.4%)</li> <li>• Falling (64.4%)</li> <li>• Sports injury (1.4%)</li> </ul>	Maxillofacial and dental traumas	NM	The study also demonstrated the need for greater training focused on human resources, such as the addition of a general dentist and pedodontist to the OMFS team in order to handle juvenile patients.	Moderate

\*NM=Not-mentioned

## DISCUSSION

This comprehensive review included ten studies with variable pediatric traumas. We found that cervical spine injuries in Saudi children occurred mainly due to blunt trauma, and the majority improved. MRI can shorten the time needed to clear the cervical spine and lower the number of injuries that are overlooked [22]. Carroll *et al.*, reported that sports-related and cervical injuries were the most frequent mechanisms of damage, occurring more frequently than other levels [32]. Early

identification is crucial to minimize irreversible damage from spinal cord injuries, which have the potential to significantly affect a person's life. Because of their limited ability to communicate, spinal cord injuries in young children can be particularly difficult to diagnose at an early age.

We also found that fractures among children occurred mainly due to MVA and falls, and all the reported cases healed. Fracture healing time was

correlated with the mechanisms of damage, such as MVA, sports injuries, and fractures of the femur and forearm [23]. Similarly, Cintean *et al.*, reported that the third most frequent injury was a fracture, which mostly affected school-age children [33]. Recreational activities and falls were the most frequent causes of fractures. This is consistent with epidemiological research [34, 35], but other research points to RTA as the most frequent mechanism causing pediatric fractures [36].

In this study, we found that ocular traumas were reported in two studies, one due to chemical burns [24] and the other due to fireworks [27]. The two mechanisms left permanent complications, such as corneal opacity and limbal stem cell deficiency. Kaçer *et al.*, reported that acute eye trauma in children is still a major cause of avoidable monocular blindness. Children require additional attention because they are susceptible to ocular injuries. Playgrounds, amusement centers, and toys all need to be supervised by parents. Most ocular traumas might be avoided, particularly when engaging in activities that put one's eyes at risk and wearing protective goggles. Children should not have access to sharp items like pens, scissors, needles, knives, or household chemicals like alkaline or acidic cleaning solutions [37].

Surprisingly, abusive head trauma was reported in 147 children [25]. As the number of cases of abusive head trauma is rising, policymakers, counselors, child protection professionals, and healthcare providers need to pay greater attention to these situations. A multidisciplinary approach is necessary to diagnose abusive head trauma, which is a major source of fatal brain injuries in newborns and early children. The diagnosis is not simple and presents a medical, forensic, and social challenge. Accurate clinical history, a comprehensive ophthalmological examination (eye fundus), and neuroimaging to identify indications of brain and spinal injury are the mainstays of the diagnosis [38, 39].

Maxillofacial and dental traumas in this review were reported in two studies [29, 31] and occurred mainly due to falls, impacts, and RTA. Most cases were males since boys tend to be more active and enthusiastic about outside activities. This was in line with Barbosa *et al.*, who reported that the primary cause of maxillofacial trauma in children and adolescents is RTA [40]. RTA is the most significant mechanism globally, mostly in Africa and Asia, according to a recent study of maxillofacial fractures in the previous 30 years, encompassing all age groups. This conclusion is consistent with the current systematic review of the younger population [41].

The majority of Saudi children who suffered trauma were males (72.5%). This could be because women spend more time indoors and engage in very little outdoor activity than men do, despite the fact that men

spend more time in cars for both pleasure and transportation. This could be due to the extremely conservative and culturally humane aspects of some parts of Saudi Arabia, particularly the southern regions. They were also less likely to be in accidents because women were not allowed to drive in Saudi Arabia previously. The ratio might soon alter as more women are now permitted to drive in the nation [42].

This study's systematic review of trauma among Saudi Arabian children and adolescents is one of its strongest points, demonstrating its novelty. The absence of a meta-analysis study is one of the study's shortcomings; it should be taken into account in subsequent investigations.

## CONCLUSION

Even with an increased risk, children rarely suffer serious injuries. Children displayed the many forms of trauma and its associated affective aspects. Ocular traumas held the most serious and life-threatening complications. Because there are many elements that contribute to trauma, it is advised that appropriate interventions and preventive measures be used in order to minimize trauma.

## REFERENCES

- 1 Alomani, H., Fareed, A., Ibrahim, H., Shaloot, A., Elhalawany, A., Alhajjaj, M., ... & Almosallam, O. (2021). Pediatric trauma at a single center in the Qassim region of Saudi Arabia. *Annals of Saudi medicine*, 41(3), 165-170.
- 2 Peden, M., Oyegbite, K., & Ozanne-Smith, J. (2008). World Report on Child Injury Prevention - PubMed - NCBI. Peden, M., Oyegbite, K., Ozanne-Smith, J., Hyder, A. A., Branche, C., Rahman, A. F. editors. Geneva: World Health Organization, 31-56.
- 3 Azzopardi, P. S., Hearps, S. J., Francis, K. L., Kennedy, E. C., Mokdad, A. H., Kassebaum, N. J., ... & Patton, G. C. (2019). Progress in adolescent health and wellbeing: tracking 12 headline indicators for 195 countries and territories, 1990–2016. *The Lancet*, 393(10176), 1101-1118.
- 4 Öztürk Şahin, Ö., & Topan, A. (2019). Investigation of the fear of 7–18-year-old hospitalized children for illness and hospital. *Journal of religion and health*, 58, 1011-1023.
- 5 Gilani, R., & Motaghi, M. (2021). The relationship between social skills and misconduct with their teachers in high school students in the City Aligudarz 2018. *International journal of adolescent medicine and health*, 33(5), 20180242.
- 6 Stang, J. S., Story, M., & Kalina, B. (1997). School-based weight management services: perceptions and practices of school nurses and administrators. *American Journal of Health Promotion*, 11(3), 183-185.
- 7 Nesayan, A., & Gandomani, R. A. (2018). Prediction of emotion regulation based on attachment styles and perceived parenting styles in

- adolescents. *Journal of Pediatric Nursing*, 5(1), 1-10.
- 8 Tiruneh, B. T., Bifftu, B. B., & Dachew, B. A. (2019). Prevalence and factors associated with road traffic incident among adolescents and children in the hospitals of Amhara National Regional State, Ethiopia. *BMC emergency medicine*, 19(1), 25.
  - 9 Kim, E. J., Lim, J. Y., Kim, G. M., & Lee, M. K. (2019). Meta-analysis of the Diagnostic Test Accuracy of Pediatric Inpatient Fall Risk Assessment Scales. *Child Health Nursing Research*, 25(1), 56-64.
  - 10 Brenner, R. A., Committee on Injury, V., & Prevention, P. (2003). Prevention of drowning in infants, children, and adolescents. *Pediatrics*, 112(2), 440-445.
  - 11 Yeates, K. O. (2010). Mild traumatic brain injury and postconcussive symptoms in children and adolescents. *Journal of the International Neuropsychological Society*, 16(6), 953-960.
  - 12 Bogdanov, S., Brookes, N., Epps, A., Naismith, S. L., Teng, A., & Lah, S. (2019). Sleep disturbance in children with moderate or severe traumatic brain injury compared with children with orthopedic injury. *The Journal of Head Trauma Rehabilitation*, 34(2), 122-131.
  - 13 Fraser, A., Doan, D., Lundy, M., Bevill, G., & Aceros, J. (2019). Pediatric safety: review of the susceptibility of children with disabilities to injuries involving movement related events. *Injury Epidemiology*, 6(1), 12.
  - 14 Aghakhani, K., Eslami, S. H., Khara, A., & Bijandi, M. (2018). Epidemiologic study of fall-related head injury in Iran and its comparison with other countries. *Tehran University Medical Journal TUMS Publications*, 76(7), 437-445.
  - 15 Forouzan, A., Masoumi, K., Motamed, H., Teimouri, A., Barzegari, H., Zohrevandi, B., & Rasouli, F. (2015). Head trauma patients presented to emergency department; an epidemiologic study. *Iranian journal of emergency medicine*, 2(3), 134-138.
  - 16 Anjuman, T., Hasanat-E-Rabbi, S., Siddiqui, C. K. A., & Hoque, M. M., editors. (2020). Road traffic accident: A leading cause of the global burden of public health injuries and fatalities. Proc Int Conf Mech Eng Dhaka Bangladesh 200AD.
  - 17 Mohtashamamiri, Z., Yousefzadeh-Chabok, S. H., Haghdoust, Z., & Hemmati, H. (2015). Road Traffic Accidents, Life-threatening Phenomenon in Guilan Province: An Epidemiologic Study. *Journal of Guilan University of Medical Sciences*, 23(92), 1-8.
  - 18 Moradi, A., & Rahmani, K. (2014). Trend of traffic accidents and fatalities in Iran over 20 years (1993-2013). *Journal of Mazandaran University of Medical Sciences*, 24(119), 223-234.
  - 19 Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., & Chou, R. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*, 88, 105906.
  - 20 Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan—a web and mobile app for systematic reviews. *Systematic reviews*, 5, 1-10.
  - 21 Munn, Z., Aromataris, E., Tufanaru, C., Stern, C., Porritt, K., Farrow, J., ... & Jordan, Z. (2019). The development of software to support multiple systematic review types: the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI). *JBI evidence implementation*, 17(1), 36-43.
  - 22 Al-Sarheed, S., Alwatban, J., Alkhaibary, A., Babgi, Y., Al-Mohamadi, W., Masuadi, E. M., ... & Azzubi, M. (2020). Cervical spine clearance in unconscious pediatric trauma patients: a level I trauma center experience. *Child's Nervous System*, 36, 811-817.
  - 23 Aldhhiban Sr, L., Alhoshan, F., Alomari, R., Almatrafi, S. A., Alanazi, Y., Alsayegh, S., ... & Aljuraibah, F. N. (2024). Clinical characteristics and outcomes of limb fractures in Saudi children. *Cureus*, 16(3).
  - 24 Al-Ghadeer, H., Al Amry, M., Aldihan, K. A., Alobaidan, O. S., AlQahtani, G. M. S., & Khandekar, R. (2022). Demographic, clinical profile and management outcomes of ocular chemical injuries in Saudi children. *Clinical Ophthalmology (Auckland, NZ)*, 16, 3247.
  - 25 Alanazi, F. S., Saleheen, H., Al-Eissa, M., Alshamrani, A. A., Alhuwaymani, A. A., Jarwan, W. K., ... & Hamaid, M. (2021). Epidemiology of abusive head trauma among children in Saudi Arabia. *Cureus*, 13(10).
  - 26 Almalki, M. M., Almalki, M. E., Alsulaimani, N., Tariq, S., Alqahtani, T., Baalaraj, F., & Ageel, M. (2023). Epidemiology of pediatric trauma in Makkah, Kingdom of Saudi Arabia: an observational cohort study. *Saudi medical journal*, 44(8), 808.
  - 27 AlGhadeer, H., & Khandekar, R. (2022). Fireworks ocular injury in Saudi children: profile and management outcomes. *Scientific reports*, 12(1), 5942.
  - 28 AlAteeq, M. A., Alsulayhim, A. K., AlHargan, F., AlSamaani, I. S., Alyousef, M., & AlDossari, A. (2020). 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*, 12(7).
  - 29 Al-Malik, M. (2009). Oral injuries in children attending a hospital in Saudi Arabia. *Journal of maxillofacial and oral surgery*, 8, 34-39.
  - 30 Alaqeel, S. M., Howsawi, A. A., Al Namshan, M. K., & Al Maary, J. O. (2021). Patterns of pediatric thoracic penetrating injuries: a single-trauma-center

- experience in Riyadh, Saudi Arabia. *Saudi medical journal*, 42(3), 280.
- 31 Al Shehri, S. Z., Ababtain, R. A., Al Fotawi, R., Alkindi, M., Premnath, S., Alhindi, M., & Divakar, D. D. (2021). Pediatric maxillofacial and dental trauma: A retrospective review of pediatric emergency management in Riyadh, Kingdom of Saudi Arabia. *The Saudi Dental Journal*, 33(6), 328-333.
- 32 Carroll, T., Smith, C. D., Liu, X., Bonaventura, B., Mann, N., Liu, J., & Ebraheim, N. A. (2015). Spinal cord injuries without radiologic abnormality in children: a systematic review. *Spinal Cord*, 53(12), 842-848.
- 33 Cintean, R., Eickhoff, A., Zieger, J., Gebhard, F., & Schütze, K. (2023). Epidemiology, patterns, and mechanisms of pediatric trauma: a review of 12,508 patients. *European journal of trauma and emergency surgery*, 49(1), 451-459.
- 34 Suh, D., Jung, J. H., Chang, I., Lee, J. H., Jung, J. Y., & Kwak, Y. H. (2018). Epidemiology of playground equipment related/unrelated injuries to children: a registry-based cohort study from 6 emergency departments in Korea. *Medicine*, 97(50), e13705.
- 35 Rennie, L., Court-Brown, C. M., Mok, J. Y., & Beattie, T. F. (2007). The epidemiology of fractures in children. *Injury*, 38(8), 913-922.
- 36 Naqvi, G., Johansson, G., Yip, G., Rehm, A., Carrothers, A., & Stöhr, K. (2017). Mechanisms, patterns and outcomes of paediatric polytrauma in a UK major trauma centre. *The Annals of The Royal College of Surgeons of England*, 99(1), 39-45.
- 37 Kaçer, E. Ö., & Kaçer, İ. (2022). Ocular trauma in the pediatric age group: a systematic review. *Egyptian Pediatric Association Gazette*, 70(1), 28.
- 38 Maiese, A., Iannaccone, F., Scatena, A., Del Fante, Z., Oliva, A., Frati, P., & Fineschi, V. (2021). Pediatric abusive head trauma: a systematic review. *Diagnostics*, 11(4), 734.
- 39 La Russa, R., Maiese, A., Di Fazio, N., Morano, A., Di Bonaventura, C., De Matteis, A., ... & Fineschi, V. (2020). Post-traumatic meningitis is a diagnostic challenging time: a systematic review focusing on clinical and pathological features. *International journal of molecular sciences*, 21(11), 4148.
- 40 Barbosa, K. G. N., de Macedo Bernardino, Í., d'Avila, S., Ferreira, E. F. E., & Ferreira, R. C. (2017). Systematic review and meta-analysis to determine the proportion of maxillofacial trauma resulting from different etiologies among children and adolescents. *Oral and Maxillofacial Surgery*, 21, 131-145.
- 41 Boffano, P., Kommers, S. C., Karagozoglu, K. H., & Forouzanfar, T. (2014). Aetiology of maxillofacial fractures: a review of published studies during the last 30 years. *British Journal of Oral and Maxillofacial Surgery*, 52(10), 901-906.
- 42 Almasri, M. (2013). Severity and causality of maxillofacial trauma in the Southern region of Saudi Arabia. *The Saudi dental journal*, 25(3), 107-110.