



EFFECTIVENESS OF STANDARDIZED PEDIATRIC TRAUMA MANAGEMENT PROTOCOLS IN REDUCING COMPLICATIONS AND MORTALITY IN SAUDI EMERGENCY UNITS

Abdulkareem Alrukian^{1*}, Abdulrahman Almutairi², Hamad Al Kahtani³, Khaled H. Alfifiy⁴, Mnahi Al- Fahad Alharbi⁵, Sultan M. Alotaibi⁶, Raed M. Alotaibi⁷, Faisal A. AL Osaimi⁸, Abdulelah A. O. Alrashed⁹, Meshari M. Alotaibi¹⁰

^{1,2,3,4,5,6}EMT, Workplace Name The Red Crescent Authority City Riyadh.

⁷Emergency Medical Technician, Saudi Red Crescent Authority, 10RT0298664, Kingdom of Saudi Arabia.

⁸Emergency Medical Technician, Red Crescent, Riyadh, Saudi Arabia ,10RT1225278.

⁹Emergency Medical Technician (EMT), Saudi Red Crescent, Kingdom of Saudi Arabia.

¹⁰Emergency Medical Technician, Saudi Red Crescent Authority, Kingdom of Saudi Arabia.



***Corresponding Author: Abdulkareem Alrukian**

EMT, Workplace Name The Red Crescent Authority City Riyadh.

Email id: keemo-15@hotmail.com

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ABSTRACT

Trauma is a leading cause of morbidity and mortality among children worldwide, with pediatric patients in Saudi Arabia frequently affected by road traffic accidents, falls, and other injuries. Despite the existence of trauma care services, variability in clinical assessment and management across emergency units can adversely affect outcomes. This study aimed to evaluate the effectiveness of standardized pediatric trauma management protocols in reducing complications and mortality, and in improving care efficiency in Saudi emergency departments. A retrospective observational study was conducted, analyzing 155 pediatric trauma cases extracted from electronic medical records across tertiary, secondary, and regional hospitals. Key variables included age, injury severity score, time to first assessment, time to definitive care, length of hospital stay, sex, mechanism of injury, complications, mortality, and protocol adherence. Descriptive statistics, Chi-square tests, t-tests, and logistic regression analyses were performed using SPSS, with significance set at $p < 0.05$. Results demonstrated that protocol implementation was significantly associated with reduced complications and mortality, shorter times to definitive care, and decreased hospital length of stay. Moreover, higher adherence to protocols independently predicted improved survival outcomes. These findings highlight the critical role of structured trauma management protocols, alongside staff training and system-level coordination, in enhancing pediatric trauma care quality and patient safety in Saudi emergency settings.

Index Terms- Adherence, Complications, Mortality, Pediatric Trauma, Standardized Protocols.

I. INTRODUCTION / BACKGROUND

Trauma remains one of the most significant global health challenges, contributing to substantial morbidity and mortality among children and adolescents. According to the World Health Organization (WHO)^[1], injuries account for nearly one million child deaths each year, with trauma representing a major proportion of preventable mortality.^[2,3] In both developed and developing countries, trauma is recognized as the leading cause of death among children older than one year.

Pediatric trauma encompasses a wide range of injuries including those resulting from road traffic accidents, falls, burns, and physical assaults. The burden of such injuries extends beyond mortality, leading to lifelong disabilities, psychological distress, and considerable socioeconomic costs for families and healthcare systems. In Saudi Arabia, trauma has become an increasingly critical public health concern.^[4,5] The Kingdom has witnessed rapid socioeconomic development over the past few decades, accompanied by a surge in

urbanization, industrialization, and motorization. These factors have contributed to a notable rise in injury-related hospital admissions, particularly among children. Several local studies have identified road traffic accidents as a major cause of pediatric trauma, followed by falls, burns, and domestic injuries.^[6,7,8] Despite improvements in hospital infrastructure and emergency response systems, trauma continues to be a leading cause of death and disability among Saudi children. The high prevalence of pediatric injuries in the country highlights the urgent need for systematic approaches to enhance trauma care and improve patient outcomes. Effective trauma management in the pediatric population presents unique challenges.^[9,10] Children differ significantly from adults in anatomy, physiology, and response to injury. Their smaller body size, limited physiological reserves, and differing patterns of injury necessitate specialized assessment and treatment protocols.^[11,12] However, variations in training, experience, and resource availability among healthcare providers in emergency units often lead to inconsistencies in pediatric trauma care. Such inconsistencies may delay critical interventions, increase the risk of complications, and ultimately affect survival rates.^[13,14] In this context, the implementation of standardized trauma management protocols is essential to ensure timely, evidence-based, and coordinated care.^[15] Standardized trauma management protocols are structured clinical guidelines that outline systematic steps for assessing, stabilizing, and treating trauma patients.^[16,17] These protocols are typically based on international best practices such as the Advanced Trauma Life Support (ATLS) and Pediatric Advanced Life Support (PALS) programs.^[18] The goal of such protocols is to minimize variability in care delivery, reduce human error, and ensure that critical interventions are prioritized and executed efficiently. Numerous international studies have demonstrated that protocol-driven trauma care leads to better outcomes, including reduced mortality, fewer complications, shorter hospital stays, and improved functional recovery.^[19,20] In pediatric trauma, adherence to standardized management guidelines has been associated with more accurate assessment, faster resuscitation, and improved survival rates. Despite these demonstrated benefits, the extent to which standardized pediatric trauma management protocols are applied in Saudi emergency departments remains limited. Child injuries are considered one of the leading causes of death and disability in the Kingdom of Saudi Arabia, representing a significant proportion of emergency department visits. Variations in procedures between hospitals and differences in readiness levels may lead to delays in diagnosis or intervention, which in turn increase the rate of complications and mortality. Therefore, implementing standardized protocols for managing pediatric injuries aims to unify the evaluation and treatment process from the moment of arrival until transfer or discharge, ensuring rapid intervention, accurate decision-making, and improved clinical outcomes. While many tertiary hospitals in the Kingdom have adopted components of structured trauma care,

implementation remains inconsistent, particularly in secondary and regional hospitals.^[21,22] The lack of national standardization results in significant variation in the quality of trauma management across institutions.^[23] Factors contributing to these Standardized protocols are a set of approved medical procedures and criteria that organize the management of injured children in emergency settings. They include primary and secondary assessments based on ATLS and PALS principles adapted for children, triage criteria that depend on age and age-appropriate vital signs, and resuscitation algorithms (Airway–Breathing–Circulation) for children. They also provide clear criteria for transfer to specialized trauma centers and include follow-up and quality records for performance analysis (Trauma Registry & Audit). Inconsistencies include inadequate training in pediatric trauma care, absence of uniform national protocols, and limited adherence monitoring. Consequently, pediatric trauma outcomes continue to vary widely between hospitals, suggesting that the full potential of standardized trauma management has yet to be realized in Saudi Arabia.^[24,25] Moreover, while adult trauma care has received increasing attention through national initiatives and trauma registries, pediatric trauma remains under-researched. Few studies in Saudi Arabia have systematically evaluated the impact of standardized trauma protocols specifically for pediatric patients. The majority of existing research has focused on describing injury patterns and mortality rates rather than assessing the effectiveness of protocol implementation. This gap underscores the need for empirical evidence that evaluates whether the adoption of standardized pediatric trauma management protocols can lead to measurable improvements in outcomes such as mortality, complication rates, and efficiency of care in Saudi emergency settings.^[26] Globally, several studies have reported significant improvements in pediatric trauma outcomes following the implementation of structured management systems. For example, hospitals that implemented pediatric trauma checklists and standardized resuscitation sequences reported reductions in preventable deaths and faster time to definitive care.^[27,28] These studies emphasize that outcomes improve not only due to the protocol itself but also because of enhanced team communication, training, and workflow optimization. Translating these findings into the Saudi healthcare context could help develop a unified national framework for pediatric trauma management, ensuring equitable and high-quality care for all children, regardless of hospital location or resources.^[29] Implementing standardized protocols is not without challenges. Successful adoption requires commitment from hospital leadership, adequate staff training, continuous auditing, and integration with existing emergency workflows. Furthermore, adherence to the protocol must be monitored regularly to sustain improvement and avoid protocol fatigue.^[30,31] Despite these barriers, evidence suggests that once protocols are properly integrated into practice, they significantly enhance care coordination and reduce preventable

complications. Given the high burden of pediatric trauma in Saudi Arabia and the documented variability in care delivery, evaluating the effectiveness of standardized trauma management protocols is both timely and essential. Such research provides evidence to guide national policy and clinical practice, potentially reducing mortality and improving the overall quality of pediatric emergency care. By quantifying the impact of protocol implementation on measurable outcomes such as complications, mortality, and time to care, this study seeks to provide actionable data for healthcare administrators and policymakers.^[32] The findings can inform future trauma education programs, resource allocation, and nationwide protocol standardization efforts.

Ultimately, improving pediatric trauma care is not solely about reducing mortality—it is about enhancing the entire continuum of care from prehospital management to rehabilitation. Standardized trauma protocols offer a structured approach that ensures no critical steps are missed, promotes multidisciplinary teamwork, and supports consistent decision-making across healthcare settings. In Saudi Arabia, where pediatric trauma remains a preventable yet persistent cause of death and disability, such initiatives could transform the quality of emergency care and align national practice with international standards.

This study therefore addresses a critical gap in the literature by assessing whether the implementation of standardized pediatric trauma management protocols leads to improved outcomes in Saudi emergency units. Specifically, it examines whether the use of these protocols reduces complications, decreases mortality, and improves the timeliness of care among pediatric trauma patients. The results will provide empirical evidence on the value of protocol-based management and highlight areas where further improvements and training are needed.

Objectives / Research Question and Hypotheses

Research Objective

To evaluate the effectiveness of standardized pediatric trauma management protocols in reducing complications and mortality, and in improving care efficiency among pediatric trauma patients in Saudi emergency units.

Research Question

Does the implementation of standardized pediatric trauma management protocols reduce complications and mortality among pediatric trauma patients in Saudi emergency units?

Hypotheses

Null Hypothesis (H₀)

There is no significant difference in complication and mortality rates before and after the implementation of standardized pediatric trauma management protocols.

Alternative Hypothesis (H₁)

The implementation of standardized pediatric trauma management protocols significantly reduces complication and mortality rates among pediatric trauma patients in Saudi emergency units.

II. LITERATURE REVIEW

Trauma remains one of the leading causes of morbidity and mortality among children globally, and Saudi Arabia (SA) is no exception. Recent studies have highlighted the high burden of trauma, particularly due to motor vehicle crashes (MVCs) and falls, which continue to be major contributors to pediatric injury and hospitalization in the Kingdom (Alharbi et al., 2020).^[33] Despite ongoing local efforts to prevent injuries, the existing trauma care system in Saudi Arabia exhibits significant gaps when benchmarked against international standards. Alharbi et al. (2020) conducted a scoping review of Saudi trauma services and found that prehospital care aligns roughly with Level III WHO Trauma System Maturity Index (TSMI) standards. However, there are notable deficiencies, including the absence of standardized triage protocols, unclear referral pathways between secondary and tertiary care facilities, and the lack of national or regional trauma registries. The study concluded that while some infrastructure exists, comprehensive trauma systems with quality assurance mechanisms are still underdeveloped, underscoring the urgent need for system-level improvements.

Pediatric trauma, in particular, presents unique challenges due to children's distinct physiological and developmental characteristics. Alghnam et al. (2019)^[34] investigated the associations between injury mechanisms and extended hospital stays among 5,563 pediatric patients in a Saudi trauma center. Their study revealed that motor vehicle collisions were the leading cause of extended hospitalization, with affected children almost five times more likely to require prolonged care compared to those injured in falls. The findings highlight both the severity of trauma associated with MVCs and the impact on healthcare resources, emphasizing the importance of preventive strategies and efficient trauma care to minimize hospital length of stay and optimize patient outcomes. Saudi Arabia is witnessing a rise in pediatric injuries due to traffic accidents, falls, and burns. Recent national initiatives aim to establish a unified national trauma system and implement standardized medical protocols across all Ministry of Health hospitals and other medical institutions. Some local studies, for example in Mecca and Riyadh, have recommended adopting standardized pathways for immediate care and the transfer of critical cases. Early and standardized assessment ensures the prompt detection of severe injuries. Organized resuscitation following a fixed algorithm reduces procedural errors, while unified transport and transfer criteria prevent delays in reaching specialized centers. Additionally, a continuous quality monitoring system allows for performance improvement and periodic review of errors. Regional studies also

provide insight into pediatric trauma patterns and outcomes. Alomani et al. (2021)^[35] analyzed 133 pediatric trauma cases admitted to a single referral hospital in the Qassim region. The study found that road traffic accidents accounted for 52% of injuries, followed by falls from height (30%). Traumatic brain injury was the most common injury type, and nearly half of the children admitted to pediatric intensive care units required mechanical ventilation. The overall mortality was 3.7%, with most deaths attributed to road traffic accidents. These findings underscore the prevalence of severe trauma among Saudi children and the critical need for structured care pathways and specialized pediatric trauma services to reduce preventable mortality and improve outcomes. Effective pediatric trauma care depends not only on hospital infrastructure but also on prehospital and emergency care systems. Paramedics play a pivotal role in the initial stabilization of pediatric patients, and their competency directly influences outcomes. AlGhamdi et al. (2024)^[36] conducted a meta-analysis assessing paramedic-led prehospital pediatric intubation and found an overall success rate of 82.5%, with lower complication rates when muscle relaxants were used. Similarly, Altarjami et al. (2025)^[37] highlighted challenges faced by paramedics in pediatric emergencies, including limited pediatric exposure during training, communication barriers, medication dosing difficulties, and equipment availability. Despite these obstacles, when paramedics receive robust training, utilize standardized protocols, and operate within integrated emergency systems, outcomes improve significantly. These studies collectively suggest that strengthening prehospital care, alongside hospital-based protocols, is critical to improving pediatric trauma survival rates. In addition to prehospital and emergency care, in-hospital trauma management requires well-trained personnel and standardized procedures to ensure effective and timely care. Almarhabi (2024)^[38] examined the development of an evidence-based educational framework to enhance ICU nurses' trauma care competencies in Saudi Arabia. The study revealed that ICU nurses often lack sufficient trauma-specific education and in-service training, which can adversely affect patient outcomes. By developing a structured education framework tailored to the Saudi context, the study demonstrated that nurses' competency and confidence in managing critically injured patients improved. This underscores the importance of integrating continuous education and competency-based training with standardized trauma management protocols to enhance overall patient care quality. Recent efforts to formalize trauma systems in Saudi Arabia reflect the national commitment to improving trauma outcomes. Chowdhury et al. (2022)^[39] detailed the development of a nationwide trauma system aligned with Vision 2030. Using the FOCUS-PDCA model, stakeholders—including over 300 healthcare professionals—assessed the current system, identified gaps, and designed a trauma care standard document to guide network implementation across regions. The initiative emphasizes

the importance of stakeholder engagement, evidence-based guidelines, and context-specific adaptation, providing a model for developing trauma systems that integrate prehospital care, hospital services, and quality monitoring mechanisms. Collectively, these studies reveal several consistent themes relevant to pediatric trauma care in Saudi Arabia. First, motor vehicle collisions and falls dominate the pattern of pediatric trauma, often resulting in severe injuries, prolonged hospitalization, and significant mortality. Second, variability in trauma care systems, including the absence of standardized protocols, limited prehospital coordination, and inconsistent nurse and paramedic training, contributes to suboptimal outcomes. Third, structured interventions—including standardized trauma management protocols, competency-based training programs, and formal trauma networks—have been shown internationally and locally to improve efficiency, reduce complications, and enhance survival rates. Finally, the literature highlights the need for comprehensive national trauma registries and quality assurance programs to monitor performance, guide policy, and facilitate continuous improvement. Despite these insights, gaps remain in the literature. While some studies describe trauma epidemiology, few evaluate the effectiveness of standardized pediatric trauma management protocols in reducing complications and mortality within Saudi emergency units. Additionally, research integrating prehospital care, hospital interventions, and workforce competency development remains limited. Addressing these gaps is crucial for developing evidence-based strategies that can reduce preventable pediatric deaths and optimize the use of healthcare resources.^[40]

Based on the reviewed literature, it is evident that implementing standardized trauma management protocols, combined with targeted training and system-level reforms, is a promising approach to improving pediatric trauma outcomes in Saudi Arabia. This study aims to build upon this foundation by evaluating the impact of standardized protocols on complications, mortality, and care efficiency in pediatric trauma patients across Saudi emergency units.

III. RESULTS

Study Population and Demographics

VI. MATERIALS AND METHODS

Study Design

This study was a retrospective observational comparative study conducted to evaluate the effectiveness of standardized pediatric trauma management protocols in reducing complications and mortality among pediatric trauma patients in Saudi emergency units.

Study Setting

Data were collected from three major emergency departments in Saudi Arabia, including a tertiary care hospital, a secondary care hospital, and a regional

referral hospital. These hospitals were selected to represent a diverse cross-section of the healthcare system, including variations in resources, patient volume, and trauma care protocols.

Study Population and Sample

The study population consisted of pediatric trauma patients aged less than 18 years who presented to the selected emergency departments between January 2025 and September 2025. Inclusion criteria were patients admitted with trauma requiring emergency care, with complete medical records documenting injury characteristics, management, and outcomes. Patients with incomplete or missing key data were excluded.

A total of 155 cases meeting the inclusion criteria were analyzed. The sample included patients both before and after the implementation of standardized trauma management protocols, allowing for comparative assessment of outcomes.

Data Collection

Patient data were extracted from electronic medical records (EMRs) and trauma registries maintained at the participating hospitals. The following variables were collected:

Continuous variables: Age (years), Injury Severity Score (ISS), time to first assessment (minutes), time to definitive care (minutes), and length of hospital stay (days).

Categorical variables: Sex, mechanism of injury (falls, road traffic accidents, burns, assault, or other), complications (yes/no), mortality (survived/died), protocol implementation (yes/no), and level of protocol adherence (none, partial, full).

All data were anonymized to protect patient confidentiality.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics (version 24). Descriptive statistics were used to summarize the study population, including mean, standard deviation

(SD), median, and frequency percentages.

Comparisons between groups were performed using Chi-square tests for categorical variables (e.g., protocol implementation vs. complications or mortality).

Independent samples t-tests were used to compare continuous variables (e.g., time to definitive care, length of stay) between pre-and post-protocol implementation groups.

Logistic regression analysis was conducted to assess the association between protocol adherence and mortality, adjusting for relevant confounders such as age, ISS, and injury mechanism. A p-value of <0.05 was considered statistically significant for all analyses.

A total of 155 pediatric trauma patients were included in the study, with ages ranging from 0 to 17 years (mean $\pm$ SD: 8.30 ± 5.08 years). The sample was slightly male-predominant (54.2% male vs. 45.8% female). Road traffic accidents (RTA) and falls were the most frequent mechanisms of injury, accounting for 32.9% and 34.8% of cases, respectively, followed by burns (16.8%), other injuries (12.3%), and assault (3.2%).

Hospital admissions were distributed across tertiary (50.3%), secondary (29.7%), and regional hospitals (20.0%). Patients were almost evenly divided between the pre-implementation (48.4%) and post-implementation (51.6%) periods of the standardized trauma management protocols.

Descriptive Statistics of Clinical Variables

Key continuous variables are summarized in Table 1. The Injury Severity Score (ISS) averaged 11.19 ± 4.62 , indicating a predominance of moderate trauma severity. Time to first assessment ranged from 2 to 35 minutes (mean 17.30 ± 7.67 minutes), while the mean time to definitive care was 126.17 ± 67.36 minutes, reflecting variability in care delivery. The length of hospital stay averaged 7.66 ± 4.75 days. Physicians managing these cases had a mean experience of 7.81 ± 4.97 years.

Table 1: Descriptive Statistics of Continuous Variables Variable N. Mean SD Min Median Max.

Variable	N	Mean	SD	Min	Median	Max
Age (years)	155	8.30	5.08	0	8	17
ISS	155	11.19	4.62	4	11	25
Time to First Assessment (min)	155	17.30	7.67	2	18	35
Time to Definitive Care (min)	155	126.17	67.36	37	104	310
Length of Hospital Stay (days)	155	7.66	4.75	1	6	20
Physician Experience (years)	155	7.81	4.97	0	8	25

Protocol Implementation and Adherence

Among the study population, 51.6% of cases were managed under the standardized trauma protocol, while 48.4% were managed prior to protocol implementation. Assessment of protocol adherence showed that full adherence was achieved in 31.0% of cases, partial

adherence in 12.9%, and no adherence in 56.1%.

Complications and Mortality

Overall, 29.7% of patients experienced complications, while 16.1% of patients died during hospitalization. Mortality and complications were notably higher among patients managed without protocol implementation or

with low adherence.

Inferential Analysis

1. Association between Protocol Implementation and Outcomes

- **Complications:** Chi-square analysis indicated a significant association between protocol implementation and complications (χ^2 , $p < 0.001$), suggesting that patients managed under the protocol experienced fewer complications.
- **Mortality:** Protocol implementation was also significantly associated with mortality reduction (χ^2 , $p = 0.005$).

2. Impact on Continuous Outcomes

- **Time to Definitive Care:** Patients managed under the protocol had significantly shorter times to definitive care (t-test, $p < 0.001$).
- **Length of Hospital Stay:** Length of stay was significantly reduced in the post-protocol group (t-test, $p < 0.001$).

3. Predictors of Mortality

Logistic regression analysis revealed that higher protocol adherence was significantly associated with improved survival ($p = 0.006$), even after adjusting for confounders such as age, ISS, and mechanism of injury.

Evidence-Based Effectiveness

The implementation of standardized protocols and integrated trauma systems has been shown to improve outcomes for injured children. It enhances survival rates, reducing pediatric trauma mortality by 15–25% compared to non-prepared centers. It also decreases secondary complications such as respiratory failure, untreated shock, and delayed transfer to the operating room. Protocols accelerate response times, minimizing the interval from arrival to critical intervention (the Golden Hour) and improving coordination between emergency, ambulance, and intensive care departments. Additionally, they increase healthcare staff efficiency through unified training and regular simulation exercises.

V. DISCUSSION

The findings of this study provide compelling evidence supporting the effectiveness of standardized pediatric trauma management protocols in Saudi emergency units, highlighting significant improvements in patient outcomes and care efficiency. The analysis demonstrated that implementation of these protocols was associated with a marked reduction in complications and mortality, confirming the primary hypothesis that structured, evidence-based approaches to trauma care can improve survival and safety in pediatric populations. These results are consistent with prior studies that emphasize the critical role of organized trauma systems in reducing morbidity and mortality. For example, Alharbi et al. (2020) highlighted that the existing trauma care system in Saudi Arabia, while functional, lacks essential components such as standardized triage protocols,

referral pathways, and robust quality assurance mechanisms, which may contribute to preventable adverse outcomes. By implementing structured protocols and promoting adherence, the current study addressed these gaps, showing that patients managed under standardized guidelines had fewer complications and higher survival rates, aligning with international best practices. The study also revealed that the **time to definitive care** and **length of hospital stay** were significantly reduced post-protocol implementation, reflecting enhanced coordination, more timely interventions, and optimized resource utilization. These findings mirror the observations of Alghnam et al. (2019) and Alomani et al. (2021), who reported that severe injuries, particularly from motor vehicle collisions, are associated with prolonged hospitalizations and higher healthcare burdens, suggesting that any intervention reducing treatment delays and improving management efficiency can substantially benefit patient outcomes. Furthermore, the logistic regression analysis underscored the importance of protocol adherence as an independent predictor of survival, reinforcing the notion that implementation alone is insufficient without consistent application and compliance among healthcare providers. This observation is supported by AlGhamdi et al. (2024) and Altarjami et al. (2025), who highlighted that prehospital and early emergency care, including paramedic interventions and procedural competencies, directly influence pediatric trauma outcomes, and that variability in practice can undermine patient safety. The study also contributes to the growing literature on pediatric trauma care in Saudi Arabia, complementing regional research such as the Qassim study, which demonstrated high prevalence of severe injuries from road traffic accidents and falls, frequent need for intensive care interventions, and measurable mortality risks. Importantly, these findings underscore the multifactorial nature of trauma outcomes, which are influenced not only by patient characteristics such as age, injury severity, and mechanism, but also by system-level factors including the presence of standardized protocols, staff experience, and hospital resources. By integrating both prehospital and in-hospital considerations, the current study highlights that comprehensive trauma management requires alignment across the continuum of care, from rapid assessment and stabilization to definitive interventions and ongoing monitoring. Moreover, the study emphasizes the value of continuous staff education and competency development, echoing Almarhabi (2024), who demonstrated that structured in-service training for ICU nurses in trauma care enhances knowledge, clinical decision-making, and patient safety, particularly in high-acuity pediatric settings. This suggests that protocol implementation should be accompanied by targeted training programs to ensure proper execution, foster confidence among healthcare providers, and maximize the benefits of standardized care pathways. Additionally, the study aligns with national efforts to establish a robust trauma system in Saudi Arabia, as described by Chowdhury et al. (2022),

where stakeholder engagement, evidence-based guidelines, and context-specific adaptations are crucial to optimizing outcomes. The reduction in hospital length of stay and faster times to definitive care observed in this study not only improve clinical outcomes but also enhance operational efficiency, potentially reducing healthcare costs and resource strain, which is particularly relevant in high-volume emergency settings. Despite these positive findings, the study also highlights ongoing challenges, including variability in protocol adherence, the need for consistent quality monitoring, and the importance of maintaining adequate staffing and training levels across diverse hospital settings. These challenges suggest that the full benefits of standardized trauma protocols can only be realized through sustained institutional support, continuous evaluation, and integration with prehospital emergency services. The findings of this study therefore provide both a rationale and an evidence base for broader implementation of standardized pediatric trauma protocols across Saudi Arabia, emphasizing that systematic approaches can reduce preventable complications, enhance survival, and streamline care delivery. In conclusion, the study demonstrates that structured trauma management, coupled with rigorous adherence and staff education, is associated with significantly improved pediatric outcomes, shorter hospital stays, and more efficient emergency care, reinforcing the need for continued national efforts to establish comprehensive trauma systems, optimize resource utilization, and support ongoing professional development in trauma care. These results not only contribute to the understanding of pediatric trauma management in Saudi Arabia but also offer a model for other regions seeking to improve outcomes through evidence-based, standardized protocols.

Executive Recommendations for Saudi Emergency Units Training and Qualification: Train staff on ATLS/PALS for children and update certifications annually.

Emergency Equipment: Equip each department with a dedicated Pediatric Crash Cart.

Protocols and Algorithms: Display resuscitation and major pediatric trauma algorithms in visible locations.

Unified Transfer System: Clearly define regional referral centers and written transfer criteria.

Audit and Follow-up: Establish a Pediatric Trauma Registry to monitor outcomes and analyze performance every six months.

VI. CONCLUSION

Implementing standardized protocols for managing pediatric injuries in emergency units across Saudi Arabia represents a crucial step toward improving care quality and reducing mortality and complications. The success of these efforts depends on full commitment from medical staff, continuous training, and the establishment of a comprehensive national trauma system that supports ongoing monitoring and performance improvement. This

study demonstrates that the implementation of standardized pediatric trauma management protocols in Saudi emergency units is associated with significant improvements in patient outcomes, including reductions in complications and mortality, shorter times to definitive care, and decreased hospital length of stay. The findings highlight that both the presence of structured protocols and adherence to these protocols are critical determinants of survival and overall care quality. By addressing gaps in prehospital and in-hospital trauma management, including variability in clinical practice and staff training, the study provides evidence that standardized approaches enhance the efficiency and effectiveness of pediatric trauma care. Furthermore, the results emphasize the importance of continuous professional education, system-level coordination, and integration of evidence-based guidelines across emergency care settings to optimize patient outcomes. This research supports the broader national initiative to strengthen trauma systems in Saudi Arabia, offering a model for other regions aiming to reduce preventable pediatric deaths and improve healthcare resource utilization. Overall, the study underscores that the adoption and consistent application of standardized trauma protocols, combined with staff competency development and quality monitoring, represent a critical strategy for improving pediatric trauma care and safeguarding the health of children across the Kingdom.

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