Factors Influencing the Major Trauma Clinical Outcomes in Hospitals in the Lake Region Economic Block (LREB), Kenya

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ABSTRACT

Context: Trauma contributes to substantial economic losses, accounting for over 3.9% of global Gross Domestic Product (GDP). In countries like Kenya, it heavily strains healthcare systems. Effective management of major trauma, particularly in emergency departments, is critical to improving outcomes and reducing preventable deaths.

Aim: This study aimed to assess factors influencing the major trauma clinical outcomes at hospitals in the Lake Region Economic Block (LREB), Kenya.

Methods: This study employed an analytical cross-sectional design and recruited 110 major trauma patients. A multi-stage sampling technique was utilized to select participants. The study was conducted in two major hospitals Kakamega and Vihiga counties. A trauma chart review form adapted from the WHO Data Set for Injury was used to collect data.

Results: There was a trend-level correlation between the mechanism of injury and ICU admission (p=0.055). Patients who sustained gunshot injuries had the significant shortest hospital length of stay (4 days) compared to Road Traffic Accident (RTA) (19 days). Airway intervention had a statistically significant association with ICU admission (p<0.001), mortality (p<0.001), and hospital length of stay (p<0.008). Endotracheal intubation (ETT) and suctioning were more common among patients who were admitted to the ICU than among those who were not (21.7% vs 3.4%; 39.1% vs 20.7%, respectively). The majority (80%) of the patients who died had an airway intervention performed at the Emergency department (ED) with ETT and suctioning as the most common intervention (66.6%). ED duration and hospital Length of Stay (LOS) correlation was moderately positive (ρ=0.263, p=0.0055). Age and gender significantly contributed to ICU admission decisions ($\Delta\chi^2$ = 24.80, p=0.010).

Conclusion: Age and gender are associated with ICU admission**.** Gunshot injuries were linked to shorter hospital stays and death. Endotracheal intubation and suctioning were associated with the need for ICU admission and increased mortality. ED duration was positively associated with longer hospital length of stay (LOS). Hospitals should adopt mechanism-specific clinical pathways and ensure timely ED interventions and disposition for definitive care to reduce prolonged hospital stays and mortality.

Keywords: Factors, major trauma, outcomes

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1. Introduction

Trauma remains a major global public health burden, accounting for about 4.4 million deaths annually, or 8% of all global deaths *(World Health Organization, 2024a).* Injuries and violence contribute nearly 10% of all years lived with disability, with road traffic injuries alone responsible for over 1.35 million fatalities each year *(World Health Organization, 2018).* In Africa, trauma claims more than 250,000 lives annually *(WHO, 2024a),* and most hospitals lack organized trauma treatment systems and multidisciplinary clinical pathways *(Alayande et al., 2022; Gregson et al., 2019).*

Trauma results in significant economic losses, accounting for over 3.9% of the global gross domestic product (GDP) spent on managing its consequences *(World Health Organization, 2024b).* Effective management of major trauma patients, especially in emergency departments (EDs), is vital for improving outcomes and preventing avoidable deaths *(Mohamed et al., 2018).* Clinical pathways in healthcare have emerged as essential decision-making tools, enabling healthcare providers to deliver standardized, evidence-based care *(Trimarchi et al., 2021).* Implementing the Major Trauma Clinical Pathway (MTCP) in EDs is a promising strategy to streamline trauma care and enhance patient outcomes *(Khavandegar et al., 2024).* Assessing the MTCP's effectiveness could inform improvements in trauma protocols and help address disparities in trauma management *(Khavandegar et al., 2024).*

Patient demographics significantly influence trauma outcomes. Age is a critical factor; older patients often have

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poorer outcomes due to comorbidities and age-related physiological changes. *Alnemare (2024)* noted that elderly trauma patients experienced longer hospital stays and higher mortality rates, highlighting the need for age-specific pathways. Gender also influences outcomes, with men more frequently involved in high-risk activities that lead to traumatic injuries *(Mollayeva et al., 2018)*. Socioeconomic status further affects access to care and health literacy, contributing to disparities in trauma outcomes. *Turner et al. (2022)* found that patients from low socioeconomic backgrounds often face delays in receiving care, leading to poorer prognoses.

The mechanism of injury plays a critical role in the effectiveness of trauma care, as it determines the nature and severity of the injury *(Martino et al., 2020)*. Blunt trauma (e.g., falls, vehicular accidents) and penetrating trauma (e.g., gunshot or stab wounds) demand different diagnostic and therapeutic approaches *(Abdelwahed & Martinez, 2022)*. Blunt trauma may require extensive imaging and surgical evaluation for internal injuries, while penetrating trauma often calls for immediate stabilization and surgical intervention *(Stawicki, 2017)*. Tools like the Injury Severity Score (ISS) help prioritize care based on injury mechanisms, ensuring efficient resource allocation and improved outcomes *(Palmer et al., 2016)*.

Effective triaging is essential in emergency care, as it directly affects patient outcomes. *Ming et al. (2016)* emphasized that proper triaging reduces wait times and enhances patient flow, optimizing ED function. Conversely, delayed triaging is linked to increased morbidity and mortality. ED length of stay is another key factor; prolonged stays can lead to complications and higher admission rates *(Burgess et al., 2022)*. Implementing structured management protocols can help reduce delays and enhance the efficiency of trauma care. Many healthcare institutions lack standardized trauma care protocols or dedicated clinical pathways. *Wesson et al. (2015)* advocate for quality improvement programs in hospital-based trauma care, focusing on processes that enhance service delivery. Proper triage in the ED can ensure timely treatment, reducing the risk of mortality and long-term disability *(Soontorn et al., 2018)*.

2. Significance of the study

In developing countries like Kenya, trauma places a heavy burden on healthcare systems. Trauma is among the top three causes of hospital admissions and is a leading contributor to mortality and disability *(Gathecha et al., 2018)*. Data from the *Kenya National Bureau of Statistics (2023)* shows that of nearly 10,000 road traffic accidents reported in 2022, about 50% were fatal, while the rest resulted in severe injuries. Facilities in the Lake Region Economic Block (LREB), including Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH) and Moi Teaching and Referral Hospital (MTRH), record high trauma incidences and considerable mortality among emergency cases *(Cholo et al., 2023; Lampi et al., 2018)*. In these regions of western Kenya, access to standardized trauma care protocols is limited *(Mulwafu et al., 2017)*. Despite these alarming statistics, the implementation of structured trauma care pathways such as the Major Trauma Clinical Pathway (MTCP) remains minimal, and its influence on patient outcomes in resource-limited settings has not been fully explored.

Although numerous studies have explored clinical outcomes in hospital settings, most have focused on conditions such as stroke and their effects on quality of life, patient satisfaction, documentation, and costs *(Pritts et al., 1999)*. There is limited research on trauma clinical outcomes. While some facilities have adopted trauma pathways, little is known about their effectiveness. The purpose of this study was to assess factors influencing the the major trauma clinical outcomes among trauma patients treated in emergency departments of hospitals within the Lake Region Economic Bloc (LREB), Kenya. Based on the current study findings, the establishment of evidence-based practices in trauma can be informed by improving the existing clinical management protocols.

3. Aim of the study

This study aimed to evaluate factors influencing the major trauma clinical outcomes at hospitals in the Lake Region Economic Block (LREB), Kenya.

3.1. Operational definitions

Trauma: Bodily harm resulting from acute exposure to an external force or substance (i.e., mechanical, thermal, electrical, chemical, or radiant) and near drowning, including unintentional and violence-related causes

Major Trauma: Trauma that meets any one of the following: Injury Severity Score (ISS) ≥15; Abbreviated Injury Scale (AIS) ≥3 for 2 injuries; Systolic Blood Pressure (SBP) <90; GCS <8.

Trauma Clinical Pathway: Standardized systematic intervention guidelines for specific traumatic injuries.

Trauma Clinical Management: Immediate management of the physical effects of trauma and stabilization of the patient.

Hospitals: Emergency departments, Intensive Care Units, and general wards.

Patient Outcomes: ICU admission from ED, Hospital length of stay (LOS), and mortality.

Factors: assessed in this study are patient-related and emergency department-related factors that included sociodemographic characteristics (age, gender), mechanism of injury (road traffic injury, falls, stab, gunshot), ED duration, triage category (immediate, urgent), and airway interventions (ETT, suction).

4. Subjects & Methods

4.1. Research Design

This study adopted an analytical cross-sectional design to assess the factors influencing the major trauma clinical outcome in hospitals within the Lake Region Economic Block (LREB), Kenya. The study design measures exposure and outcome variables simultaneously in a defined population at a single point in time, with the purpose of assessing the association between the exposure of interest and specific health outcomes *(Gordis, 2013).*

4.2. Study Setting

This study was conducted in Kakamega and Vihiga counties, which are part of the Lake Region Economic Block in western Kenya. Covering a combined land area of over 17,000 square kilometers, these counties are home to diverse populations across rural, urban, and peri-urban settings *(Kenyan National Bureau of Statistics, 2019).* The region's major economic activities include agriculture, fishing, small-scale trade, and emerging industrial ventures.

The data was collected from two major hospitals, Kakamega County Referral Hospital and Vihiga County Referral Hospital, with bed capacity of 450 and 165, respectively. These are both public level 5 facilities that provide general and specialized outpatient and inpatient services. Each represents the unique healthcare dynamics of its respective counties. These hospitals serve as critical points for trauma care, the Trauma Care Clinical Pathway was applied in both settings, making them ideal for assessing the factors influencing major trauma clinical outcomes.

4.3. Study Subjects

The study population comprised patients presenting with major trauma at Kakamega and Vihiga counties within the Lake Region Economic Block.

Sample size calculation

Fisher's formula *(Fisher et al, 1998*) was used to calculate the sample size, thus:

n = Z2pq/d2

n= (1.96)2(0.3) (0.7)/ (0.05)2 ≈ 322 participants

Where *n* is the desired sample size in a population >10,000; *p* is the estimated proportion in the target population with the characteristic being measured; *q* is the proportion in the target population without the desired trait (1-p); *d* is desired margin of error of 5% (0.05) and Z is the score at 95% confidence interval (1.96).

Since the study population was <10,000, an alternative modified Fisher's formula was used, thus:

nf = n/1+n/N

nf= 322/(1+322/150) =102.35

Where, *nf* is desired sample population; *n* is the desired sample size; *N* is the estimate of the population size (estimate number of major trauma patients attended to the EDs of the two hospitals). Compensating for 7% nonrespondents resulted in a final sample of 110 patients.

Sampling technique

In this study, a multi-stage sampling approach was used. Purposive sampling was applied to select Kakamega and Vihiga counties within the Lake Region Economic Block in western Kenya. From these counties, two level five referral hospitals were also purposively selected based on their capacity to manage severe trauma cases, as defined by an Injury Severity Score (ISS) of 15 or higher, and their availability of advanced resources and skilled personnel for comprehensive trauma care. The two facilities utilized the Major Trauma Clinical Pathway in the care of the trauma patients.

Operational feasibility and comparability of facility characteristics were also considered. Sample size per facility was determined using probability proportional to size (PPS), based on the number of major trauma patients treated in the emergency department over the preceding three months (Table 1). Trauma patients with an Injury Severity Score (ISS) of 15 or greater who presented to the Emergency Departments of the selected facilities were included, while trauma patients referred from other hospitals after stabilization were excluded.

Table (1): Sample distribution of major trauma patients at EDs in study areas (n=110).

Facility	Total patients attended	No required
Kakamega	104	76
Vihiga	46	34
Total	150	110

4.4. Tools of Data Collection

4.4.1. Trauma Chart Review Form

The tool was adapted from the WHO Data Set for Injury *(WHO, 2024b).* Additional fields were added to capture major trauma clinical data, including determination of the mechanism of injury, establishment of level of consciousness, control of catastrophic bleeding, airway and breathing interventions, and shock management. Modifications were made in some areas, including demographics (education level, marital status), time of injury, mechanism of injury (fall, gunshot), triage category (immediate, urgent), and detailed vital signs at disposition. These additions took into consideration the local context applicable to the study settings.

The aim of this tool was to extract uniform, clinically significant data from patient medical records for evaluating the factors influencing the major trauma clinical outcomes and the outcomes of trauma patients presenting to the emergency department.

The tool was designed to ensure standardized data collection from patients' charts. It captured comprehensive information on patients' demographics, mechanisms of injury, triage category, ED duration, and final disposition or outcome (ICU admission, Hospital LOS, and mortality). The validity of the tool was ensured through a pretest that yielded a Kappa coefficient of 0.64, indicating good agreement and reliability.

4.5. Procedures

Approval to conduct the study was first sought from the university's graduate school, followed by ethical clearance from the Institutional Ethics and Review Committee (MMUST/IERC/025/2022). The National Commission for Science, Technology, and Innovation also granted authorization (NACOSTI/P/22/16647). Permissions were obtained from the respective county health departments, administrative heads, and ethical committees of Kakamega CGH and Vihiga CRH. For patients, consent was sought directly or from next of kin post-stabilization, with implied consent applied where appropriate *(Edwards & Johnson, 2021).* Confidentiality and anonymity were strictly maintained using coded identifiers known only to the research team. While the study posed no physical harm, potential psychological risks were minimized by ensuring participants' privacy and data protection throughout the research process.

Data were obtained through a structured chart review tool, custom-designed to extract standardized information from patient medical records. For each eligible chart, the reviewer systematically reviewed the documented details and entered them into the corresponding sections of the tool. The clinical outcomes data were obtained from the clinician documentation. Demographic data, such as age, gender, and marital status, were extracted from the registration and clerking notes at initial presentation. Injury details, including mechanism and anatomic location of injury, and the recorded Injury Severity Score, were extracted from the trauma assessment notes. Admission details to the emergency department, such as date and time of arrival and triage category, were obtained from the clinicians' documentation.

Then, disposition details were transcribed from the final entries in the patient record: date and time of ED exit; where disposed to (ICU, operating theatre, ward). Finally, the date of final disposition from the hospital (ward or ICU) and the outcome (alive or dead) were recorded on the form. Completed forms were reviewed for accuracy and completeness prior to data entry and analysis. Data collection was conducted over six months.

4.6. Data analysis

Once the data was collected, cleaned, and coded, it was entered into a computer and securely stored in the cloud. The data management process involved importing trauma-related data from a CSV file into R (version 4.1.1), comprising 110 observations from two counties for data analysis. To assess factors influencing the MTCP, tests of association were conducted between demographic factors, mechanisms of injury, triage categories, ED duration, airway interventions, and patient outcomes. A significance level of $p \leq 0.05$ was used throughout the analysis to determine statistical significance.

5. Results

Table 2 reveals the patients' demographic data collected included age and gender. Among the 110 studied patients, the majority (49.1%) were in the 20–39-year age group. The older age group (70–79 years) was the least at 2.8%. In terms of gender, 60% were males, while 40% were females.

Table 3 reveals the association between the mechanisms of injury and the patient trauma outcomes. The majority of cases were caused by road traffic injuries, which also showed higher rates of ICU admission (30.8%) and mortality (23.1%). Gunshot injuries were the least and had the highest percentage of ICU admissions and deaths (50%). Fisher's Exact Test demonstrated a trend level correlation between the mechanism of injury and ICU admission (p=0.055), but no significance with mortality (p=0.087). Across injury mechanisms, hospital length of stay varied significantly (Kruskal–Wallis, p=0.041). The longest median hospital stays were 28 days for patients with burns. Stab wounds and gunshot injuries had the shortest hospital stays, at 16 and 4 days, respectively, while road traffic injuries had a shorter median stay of 19 days.

Table 4 demonstrates that neither triage category nor length of stay in the emergency department (ED) was significantly associated with ICU admission (p=0.475; p=0.417, respectively). The median ED length of stay was nearly identical for patients admitted to the ICU and those not admitted (40 vs 41 minutes). The association between airway interventions and ICU admission was statistically significant (p<0.001). Airway interventions, endotracheal intubation (ETT), and suctioning were more common among patients who were admitted to the ICU than among those who were not (21.7% vs 3.4%; 39.1% vs 20.7%, respectively). The majority (71.3%) of patients who were not admitted to the ICU did not receive any airway intervention in the ED.

Table 5 reveals that the triage category and length of stay in ED did not exhibit a significant association with mortality rates (p = 0.803; p = 0.972). For both groups, the majority were triaged as urgent (66.3% vs 60.0%). Airway interventions were significantly associated with mortality (p <0.001). Most of the patients who died (80%) had an airway interventions performed at the ED, with ETT and suctioning as the most common (66.6%). The average length of stay at the ED for both groups was 40 minutes.

Table 6 demonstrates the correlation between emergency department factors and hospital length of stay. The triage category did not show a significant relationship with the Hospital LOS (p=0.327). Airway interventions were significantly associated with Hospital LOS (p= 0.059). Patients who received no airway intervention had the longest median LOS (22 days), while those who received ETT had the shortest median LOS (6.5 days), followed by suction (19 days) and position (14 days). The single patient who received both suction and ETT had the shortest LOS of 1 day. The correlation between ED length of stay and Hospital LOS is moderately positive (ρ = 0.263, p = 0.0055).

Two logistic regression models were fitted to examine factors associated with final patient outcome and ICU admission, as demonstrated in table 7. All models included age category and gender. For the final outcome, the model demonstrated poor fit with no statistical significance ($\Delta\chi^2$=4.89, p=0.936). ICU admission model, however, showed a good fit ($\Delta\chi^2$ = 24.80, p = .010) with a moderate explanatory power (McFadden R^2 = 0.220; Nagelkerke R^2 = 0.315).

Table (2): Frequency and percentage distribution of the studied patients' demographics (n=110).

Factors	Total patients	
	No.	%
Age category		
<20 years	4	3.6
20-29 years	30	27.3
30-39 years	24	21.8
40-49 years	18	16.4
50-59 years	16	14.5
60-69 years	15	13.6
70-79 years	3	2.8
Gender		
Male	66	60
Female	44	40

Table (3): Association between the mechanism of injury among the studied patients and trauma outcomes (n=110).

Mechanism of Injury	Total (N=110)		ICU Admission		Mortality		Median Hospital LOS	
	No.	%	No.	%	No.	%	IQR	Days
Road Traffic Injury	52	47.3	16	30.8	12	23.1	19.0	8.0
Falls	20	18.2	0	0.0	0	0.0	28.0	12.0
Stab Wounds	18	16.4	3	20.0	1	6.7	16.0	7.8
Burns	10	9	1	10.0	1	10.0	28.0	7.0
Assault	8	7.3	2	25.0	0	0.0	25.0	7.0
Gunshot	2	1.8	1	50.0	1	50.0	4.0	0.0
Test value			$\chi^2 = 10.35$		χ^2=9.88		H=11.54	
p-value			0.055[1]		0.087[1]		0.041[2]	

[1]Fisher's Exact Test. [2]Kruskal-Wallis Test

Table (4): Association between emergency department factors and ICU admission (n=110).

Factors	ICU Admission (n=23)*1*		No ICU Admission (n=87)*1*		Test Used	p-value
	No.	%	No.	%		
Triage Category						
Immediate	10	43.5	28	32.2	Pearson $\chi^2 = 1.05$	0.475
Urgent	13	56.5	59	67.8		
Airway interventions						
ETT	5	21.7	3	3.4		
Suction	9	39.1	18	20.7		
Position	1	4.3	4	4.6	Fishers exact=15.22	<0.001
None	7	30.4	62	71.3		
Suction+ETT	1	4.3	0	0		
ED Duration (mins)	40.0	15.0	41.0	22.5	Wilcoxon rank-sum W=912.5	0.417

1Data presented as median (IQR) for continuous variables, n (%) for categorical variables

Table (5): Association between emergency department factors and mortality (n=110).

Factors	Survived (n=95) *1*		Died (n=15) *1*		Test Used	p-value
	No.	%	No.	%		
Triage Category						
Immediate	32	33.7	6	40.0	Pearson $\chi^2 = 0.231$	0.803
Urgent	63	66.3	9	60.0		
Airway interventions						
ETT	3	3.2	5	33.3		
Suction	22	23.2	5	33.3		
Position	4	4.2	1	6.7	Fisher's Exact = 23.41	<0.001
None	66	69.5	3	20.0		
Suction+ETT	0	0	1	6.7		
ED Duration (mins)	40.0	20.0	40.0	25.0	Wilcoxon rank-sum W = 705.5	0.972

1Data presented as median (IQR) for continuous variables, n (%) for categorical variables

Table (6): Association between emergency department factors and hospital length of stay (LOS) (n=110).

Factors	Category	Test of significance	p-value
Triage Category	Median LOS (IQR) Immediate (n=38): 23.5 (15.5) Urgent (n=72): 21.0 (13.5)	Kruskal-Wallis H=2.235	0.327
Airway interventions	Median LOS (IQR) ETT (n=8): 6.5 (2, 19.2) Suction (n=27): 19 (9.5, 24) Position (n=5): 14 (14, 20) None (n=69): 22 (15, 30) Suction+ETT (n=1):1 (1, 1)	Kruskal-Wallis H=13.812	0.059
ED Duration (mins)	<1 hour (n=45): 18 (12, 24) 1-2 hours (n=35): 22 (14.8, 29.3) ≥ 2 hours (n=30): 26.5 (18.5, 34.5)	Spearman Correlation ρ=0.263	0.0055

Table (7): Logistic Regression Model fit for demographic factors and patient outcomes.

Outcome	$\Delta\chi^2$	p-value	McFadden R^2	Nagelkerke R^2
Final outcome	4.89	0.936	0.056	0.079
ICU admission	24.80	0.010	0.220	0.315

6. Discussion

Major trauma contributes significantly to morbidity and mortality in Kenya, with considerable burden in Lake Region Economic Block (LREB). The clinical outcomes in major trauma patients vary across different health facilities, indicating influence of hospital and patient related factors. This study aimed to evaluate factors influencing the major trauma clinical outcomes at hospitals in the Lake Region Economic Block (LREB), Kenya.

Regarding patient demographics, nearly two-thirds were males. About half of the participants were in the 29-39 years age group, with the fewest in the 70-79 years age group. The elevated risk among male patients in this study may be attributed to the widespread use of motorcycles as a primary mode of transport by men. These findings are consistent with previous studies, which report higher trauma incidence among males, often linked to road traffic accidents and interpersonal violence *(Alberdi et al., 2014; Baker et al., 2020; WHO, 2024b).*

The mechanism of injury emerged as one of the factors that influence the outcomes of major trauma. Road traffic accidents (RTAs) were identified as the leading cause of injury, accounting for nearly half of the cases. The high incidence of RTAs can be linked to the increasing use of motorized transport operated by drivers with limited or no formal training. This aligns with findings from similar studies by *Gopinath et al. (2017); Jabbour et al. (2013)* who reflect broader trends in road traffic injuries in Kenya and other low- and middle-income countries.

While burns and stab wounds had fewer ICU admissions and mortality despite relatively moderate cases, falls with nearly a comparable number of cases were linked to neither ICU admissions nor fatalities suggesting that the clinical outcomes are more related to injury characteristics and severity, contrary to the findings by *Mamo et al. (2023)* that despite lower frequencies, these injuries can result in significant critical care needs.

Despite being uncommon, gunshot wounds had the highest percentage of ICU admissions and deaths, but a shorter length of hospital stay suggesting early mortality. This is contrary to a study by *Wolf et al. (2019)* that linked firearm injuries with higher ICU admission rates, but longer hospital stays. The trend level correlation between the mechanism of injury and ICU admission warrants further investigation. Hospital length of stay varied significantly, suggesting that these variations are related to the mechanism of injury.

Overall, the triage categories did not show statistical significance in relation to patient outcomes, which could be due to limited variability in triage levels. Whereas the majority of patients were triaged as urgent, this finding contrasts with the existing literature linking efficient triage processes to better patient outcomes in trauma care *(Martino et al., 2020; Soontorn et al., 2018).*

The significant association between airway interventions and ICU admission suggests that patients admitted to the ICU were more likely to have received advanced airway interventions—particularly endotracheal intubation and suctioning. Similar findings were reported by *Talmy et al. (2025),* who found that endotracheal intubation in the Emergency Department (ED) was independently associated with a greater than 2-fold increase in the odds of ICU admission. Patients who went on to die were significantly more likely to have advanced airway interventions performed than those who survived. In addition, patients who required suction and ETT placement had a higher risk of mortality than those who did not, similar to the study by *Lin et al. (2025),* indicating that trauma patients requiring advanced airway intervention had a much higher likelihood of death. The time the patient spent in the ED did not show a significant association with ICU admission. The median ED length of stay for those who were admitted and those who were not was nearly identical.

For the patients who died, the majority were triaged as urgent. Although overall significance was not established for mortality, this finding may suggest that under triaging for trauma patients at the ED can lead to increased mortality, as posited by *Dunham et al. (2024).*

However, the study demonstrated a moderate to substantially positive correlation between ED length of stay and Hospital LOS. This suggests that patients who had a longer length of stay in the ED tended to experience an extended hospital stay, which aligns with the findings of *van Dijk et al (2025)* that patients who remain in the ED longer are likely to have extended inpatient stays, indicating a downstream effect of ED boarding on hospital utilization. This is possibly due to the patient's clinical complexity or delays in receiving definitive treatment. The study, however, did not establish any significant association between length of stay in ED and mortality rates, indicating that duration of time taken by the trauma patient at the ED does not influence mortality.

The findings of the logistic regression indicate that age and gender did not improve the model for the final outcome but did significantly contribute to ICU admission decisions. This finding is similar to that of *Larsson et al (2019),* who found that gender (male) is associated with an increased likelihood of ICU admission in trauma.

7. Conclusion

Patient age and gender, specific injury mechanisms, airway interventions, and ED duration are significantly associated with trauma patient outcomes. Gunshot injuries are associated with higher ICU admissions, shorter hospital stays, and deaths. Airway interventions, notably ETT and suctioning, are associated with the need for ICU admission and increased mortality. Longer emergency department duration correlates with longer hospital length of stay.

8. Recommendations

Hospitals need to incorporate age- and gender-stratification into ED trauma triage and clinical decision-making. Emergency departments should utilize mechanism-specific clinical pathways for life-threatening trauma, such as gunshot injuries, and ensure early ICU activation for critical care.

Finally, the Emergency department administrators should develop and implement standard operating procedures for advanced airway interventions in trauma patients, particularly endotracheal intubation and suctioning, and ensure early disposition decisions for definitive care.

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