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Systematic review

Road traffic accident patients presenting to the emergency department: clinical predictors of severe outcomes and mortality; a systematic review

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ABSTRACT

Background: Road traffic accidents (RTA) are a major cause of death, disability, and emergency care burden worldwide. This review synthesizes clinical predictors of severe outcomes and mortality in RTA patients presenting to emergency departments or related acute hospital settings. **Methods:** A systematic review was conducted using PubMed, Web of Science, Scopus, and Embase. Original studies reporting mortality, severe injury, disability, poor outcome, or related severe consequences in RTA patients were eligible. Screening followed a PRISMA-style process. Data were extracted on study characteristics, outcomes, and reported predictors. Findings were synthesized qualitatively. **Results:** Eight studies were included. Most were prospective, retrospective, cross-sectional, or cohort designs. Sample sizes ranged from 211 to 1,471 participants. Mortality ranged from 3.6% to 14.69%. Severe injury prevalence reached 36.4%, while permanent disability ranged from 4.6% to 6.1% in reported studies. Important predictors of poor outcome included low Glasgow Coma Scale, hypotension or systolic blood pressure ≤ 89 mmHg, head injury, multiple trauma, high injury severity, ICU admission, complications during treatment, delayed presentation, lack of first aid, lack of ambulance transport, comorbidity, rural residence, and pedestrian status. **Conclusion:** Predictors of severe outcomes and mortality in the included studies were severe neurological impairment, hemodynamic instability, advanced injury burden, and delayed access to care.

Keywords

Road traffic accidents; emergency department; mortality; severe outcomes; clinical predictors

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Introduction

Road traffic accidents (RTA) are a major public health problem and among the leading causes of death and long-term disability worldwide, with 1.24 million deaths annually and 20 to 50 million non-fatal injuries reported each year [1]. The burden falls on low- and middle-income countries, where more than 85% of deaths and 90% of disability-adjusted life years from road traffic injuries (RTI) occur despite these settings having a smaller share of the world's registered vehicles [1]. Hospital-based studies found that RTIs account for a substantial share of trauma presentations, with a median proportion of 32% in trauma patients and a median death proportion of 5% in reported RTI cases [2]. The pooled prevalence of road traffic injury among trauma patients was 31.5%, and the time-trend analysis [3]. These findings show that RTA trauma is a major emergency care burden that contributes to avoidable death, disability, and pressure on hospital services [2,3].

Outcomes after RTAs are influenced by the crash itself and the organization and timeliness of emergency care before hospital arrival [4,5]. A systematic review of prehospital emergency care in low- and middle-income countries found that these systems are fragmented and uncoordinated, with shortages of trained responders, equipment, transport capacity, and communication infrastructure [4]. Because a large proportion of deaths from injuries, especially RTAs, occur before reaching hospital, delays in notification, dispatch, response, on-scene care, and transport can worsen survival and later functional outcome [4]. This systems problem is reflected in inter-facility transfer data, where transferred trauma patients in low- and middle-income countries took longer to reach referral hospitals and had higher mortality than

directly transferred patients, with a pooled odds ratio of 1.55 [5], these indicate that ED outcomes are shaped by prehospital care quality, transfer pathways, and trauma system maturity rather than by injury mechanism alone [4,5].

Clinical predictors of poor outcome need special attention because they support rapid triage, early resuscitation, and prioritization of limited emergency resources in acute care settings [6,7]. In a systematic review and meta-analysis, mortality was associated with male sex, increasing age, urban street crashes, roadway defects, speeding, not maintaining focus on the road, not fastening seatbelts, reckless overtaking, pedestrian status, and light condition [7]. Severe neurological injury also central to prognosis after RTI, since RTAs are a major cause of traumatic brain injury (TBI), especially in young males, and TBI strongly linked with mortality and disability in low- and middle-income settings [8]. In ICU trauma patients, Glasgow Coma Scale showed high accuracy for predicting mortality and poor outcome and performed better than several physiologic scoring systems [6]. Altered consciousness, severe head injury, physiological instability, and high injury severity are clinically important candidates when studying severe outcomes after RTAs [6,8].

The literature still fragmented in regions and outcomes and does not provide one focused synthesis of clinical predictors of severe outcomes and mortality among RTA patients presenting to EDs and related acute care settings [2,4,7]. Existing evidence shows wide heterogeneity in case definitions, data sources, and reporting standards [2,8]. The present review was conducted to synthesize original studies and evaluate the clinical predictors of severe outcomes and mortality in RTA

patients presenting to EDs or related acute hospital settings.

Method

This study was conducted as a systematic review to analyze original articles evaluated clinical predictors of severe outcomes and mortality in RTA patients presenting to EDs or other acute hospital care settings. The review focused on studies reporting mortality, severe injury, disability, poor outcome, or other clinically consequences after RTAs.

A literature search was carried out using four electronic databases: PubMed, Web of Science, Scopus, and Embase. The search was designed to identify relevant original studies on RTA patients, emergency care, clinical predictors, severe outcomes, and mortality. Database results were imported for screening, and duplicate records were removed before the selection process.

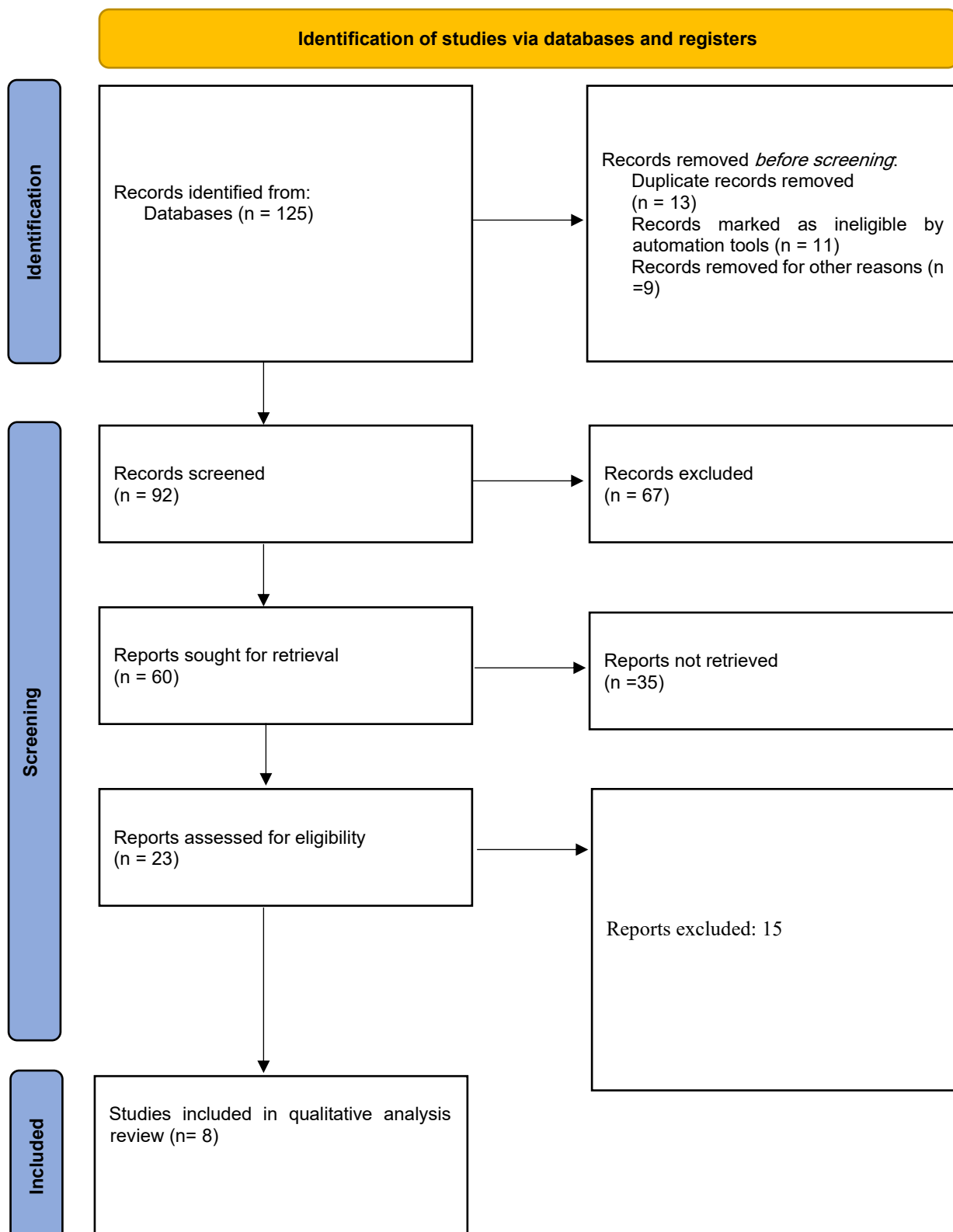
Studies were included if they were original research articles reporting RTA patients managed in EDs or related acute hospital settings and they assessed severe outcomes or mortality with corresponding predictive or associated clinical factors. Prospective, retrospective, cross-sectional, and cohort studies were eligible for inclusion. Studies were excluded if

they were duplicates, ineligible during screening, unavailable for retrieval, or did not match the review objective after full-text assessment. Some hospital-based studies with broader admission settings were retained when they included emergency-presenting trauma patients and reported review-relevant severe outcomes.

The study selection process followed a PRISMA-style approach. A total of 125 records were initially identified from the databases. After removal of 13 duplicate records, 11 records marked as ineligible by automation tools, and 9 records removed for other reasons, 92 records remained for screening. Of these, 67 records were excluded. Sixty reports were sought for retrieval, of which 35 were not retrieved. Twenty-three full-text reports were assessed for eligibility, and 15 were excluded after full-text review. Finally, eight studies were included in the qualitative synthesis.

Data were extracted from each included study on study characteristics, country and setting, design, sample size, population, main outcomes, and reported predictors or associated factors of severe outcomes and mortality. The findings were summarized descriptively and presented in tables. Results were synthesized qualitatively rather than pooled in a meta-analysis.

Fig 1: PRISMA flow chart of articles selection



Result

A total of eight studies were included in this review, prospective, retrospective, cross-sectional, and cohort designs. Most studies were hospital-based and evaluated RTA victims presenting to EDs or acute care settings, although two studies had broader hospital inclusion and were retained because they still reported severe outcomes relevant to emergency care. Sample sizes ranged from 211 to 1,471 participants. In the included studies, males formed the majority of victims, and the mean age, when reported, was around the late twenties to early thirties. The main review-relevant outcomes were mortality, disability, severe injury, poor functional outcome, and short-term fatality after admission.

The reported outcome rates showed an important burden of severe consequences after RTAs. Mortality ranged from 3.6% at discharge in the Iranian cohort to 14.69% for 24-hour mortality in the Ugandan multicenter study. Other fatality estimates were high, including 7.4% in Seid et al., 12.9% in Demisse et al., 8.79% in Beyera et al., 5.3% in Deresse et al., and 12.6% in Afacho et al. Permanent disability was documented in several studies. In Seid et al., 6.1% of survivors were discharged with permanent disability, and Hatamabadi et al. reported 5.8% severe disability at discharge, with some residual disability still present after one year. Severe injury was common, and Baru et al. reporting a prevalence of 36.4%. In Deresse et al., most patients were discharged without prominent disability, and a meaningful minority experienced either permanent disability or death. These findings indicate that RTAs in emergency and

hospital settings are associated with early mortality, considerable injury severity, and non-negligible long-term morbidity.

The pattern of injury and clinical presentation was consistent with high trauma burden. RTAs were a leading cause of trauma, with pedestrians, passengers, and drivers all heavily represented. Affected body regions included the extremities and head and neck. Soft tissue injuries, fractures, dislocations, polytrauma, head injury, open wounds, and visceral injuries were described. In the Hawassa cohort, fractures and open wounds were common, and more than one-third of patients had polytrauma or head injury. Loss of consciousness, ICU admission, and prolonged hospital stay were also reported, supporting the clinical seriousness of these cases. More than half of deaths in the Hawassa study occurred within the first 72 hours.

Across studies, poor outcomes were linked to markers of physiological instability, severe trauma, and delays in care. Lower systolic blood pressure and lower Glasgow Coma Scale were significant predictors of fatality in Seid et al. In Afacho et al., mortality was predicted by GCS below 8, GCS 9–12, systolic blood pressure of 89 mmHg or lower, ICU admission, and development of complications during treatment. Deresse et al. found that arrival later than 24 hours after injury and severe injury were associated with poor outcome. Other reported factors were older age, comorbidity, rural residence, pedestrian status, night-time or weekend injury, lack of first aid, head injury, multiple trauma, spinal injury, ventilator need, and high injury severity scores.

Table 1. characteristics of the included studies

Study	Country and setting	Design	Sample	Population included in paper	Main review-relevant outcome
Seid et al., 2015 [9]	Ethiopia; Adult ED, Tikur Anbessa Specialized Hospital, Addis Ababa	Prospective hospital-based study	230	RTA victims aged ≥14 years attending the adult ED; followed until discharge or death	Mortality, disability, and hospital length of stay; predictors of fatalities
Baru et al., 2019 [10]	Ethiopia; EDs of selected public hospitals, Addis Ababa	Hospital-based cross-sectional study	363	Road traffic collision victims referred to EDs, regardless of severity	Severe injury by Kampala Trauma Score II
Hatamabadi et al., 2017 [11]	Iran; 2 educational hospitals, Tehran	Retrospective cohort with 1-year follow-up	1471	Hospitalized RTI patients; the paper also captured transport route to the ED	Poor outcome, death, disability, and 1-year outcome
Demisse et al., 2021 [12]	Ethiopia; emergency outpatient departments of public and private hospitals, Adama Town	Institution-based cross-sectional study	381	RTI victims admitted to EDs / EOPDs	RTI-related death
Kamabu et al., 2023 [13]	Uganda; emergency units of 6 hospitals in western Uganda	Prospective multicenter cohort	211	RTA victims admitted and managed in emergency units; followed for 24 h	24-hour mortality
Beyera et al., 2024 [14]	Ethiopia; ED of St. Luke Hospital	Institution-based cross-sectional study using record review	364	RTI victims admitted to the ED	Fatality and associated factors
Deresse et al., 2021 [15]	Borderline eligible because the cohort came from EOPD, surgical wards, and orthopedic wards, but it still included emergency-presenting trauma patients and reported severe outcomes.	Adama Hospital Medical College		556 trauma patients in total; 304 RTAs.	Injured patients managed at EOPD, surgical and orthopedic wards; RTA subgroup analyzed for outcome.
Afacho et al., 2024 [16]	Not strictly ED-only; broader hospital-based eligibility only. It studied RTA victims admitted	Hawassa University Comprehensive Specialized Hospital and Yanet Trauma and Surgery		398 admitted RTA victims.	Hospital-admitted RTA victims selected from records.

Study	Country and setting	Design	Sample	Population included in paper	Main review-relevant outcome
	to hospitals and excluded those admitted <24 hours.	Specialty Center, Hawassa city			

Table 2. main findings and outcomes

Study	Main outcome(s)	Main findings and outcome rate	Independent predictors or associated factors reported
Seid et al., 2015	Death, disability, LOS	Mortality was 7.4%. Among survivors, 6.1% were discharged with permanent disability. Mean LOS was 7.12 ± 10.5 days.	Higher age, lower systolic blood pressure on admission, and lower Glasgow Coma Scale were significant predictors of fatality.
Baru et al., 2019	Severe injury	Severe injury prevalence was 36.4%.	Higher severity was associated with motorbike rider without helmet, multiple injuries, larger vehicle size, dark lighting condition, cross-city/rural collision, and travelling unrestrained on the back of a truck. Lower severity was associated with extrication by healthcare professional, extrication by police, and strict traffic police control.
Hatamabadi et al., 2017	Poor outcome, death, disability	At discharge, 3.6% died and 5.8% had severe disability. At 1-year, residual disability persisted in a smaller proportion.	Poor outcome was associated with underlying disease, loss of consciousness >24 h, spinal injury, multiple trauma, higher ISS, need for ventilator, and organ injuries during hospitalization.
Demisse et al., 2021	RTI-related death	Death magnitude was 12.9%.	Death was associated with age 25–44 years, rural residence, pedestrian status, night-time injury, weekend injury, not receiving first aid at injury site, and known comorbidity.
Kamabu et al., 2023	24-hour mortality	24-hour mortality was 14.69%.	On multivariable analysis, only road-user category and injury severity by KTS II remained significant; motorcyclists had higher mortality, and severe injury strongly predicted death.
Beyera et al., 2024	Fatality	RTI fatality magnitude was 8.79%; average annual fatality trend was 8.34% deaths/month.	Fatality was associated with lack of ambulance transport to hospital and head injury.

Study	Main outcome(s)	Main findings and outcome rate	Independent predictors or associated factors reported
Deresse et al., 2021	Among 304 RTI cases, 90.1% were discharged without prominent disability, 4.6% had permanent disability, and 5.3% died.	Mean age was 29.05 years; 74.8% were male. Among RTA cases, 44.4% were pedestrians and 41.4% were passengers. Soft tissue injury was most common (51.0%), and injury severity was 42.4% mild, 34.9% moderate, and 22.7% severe.	In multivariable analysis, pre-hospital delay >24 hours predicted unfavorable outcome (AOR 13.3, 95% CI 4.3–41.7) and severe injury predicted unfavorable outcome (AOR 22.372, 95% CI 6.409–78.091).
Afacho et al., 2024	Overall mortality incidence was 7.34 per 10,000 person-hours; 12.6% died during follow-up. More than half of deaths occurred within 72 hours of admission.	Mean age was 32.28 ± 15.02 years; 83.4% were male. Victims were 36.43% drivers, 35.18% pedestrians, and 28.39% passengers. Head injury was present in 33.92%, polytrauma in 35.17%, fractures in 73.12%, and open wounds in 63.56%.	Independent mortality predictors were GCS <8 (aHR 5.86, 95% CI 2.00–17.19), GCS 9–12 (aHR 3.27, 95% CI 1.28–8.40), SBP ≤89 mmHg (aHR 4.41, 95% CI 2.22–8.77), ICU admission (aHR 3.89, 95% CI 1.83–8.28), and developed complications (aHR 5.48, 95% CI 2.74–11.01).

Discussion

The present review shows that severe outcomes after RTAs are common in emergency and acute hospital settings, with included studies reporting early mortality, permanent disability, and severe injury in different low- and middle-income settings. This pattern is consistent with studies showing that road traffic injury forms a major share of the trauma burden in sub-Saharan Africa, where the median proportion of RTI in trauma patients was 32% and the median proportion of death in included hospital-based studies was 5%, although published estimates differ widely by country, case mix, and data quality [2].

An important finding in this review is that poor outcomes were linked to low Glasgow Coma Scale, hypotension, head injury, multiple trauma, and greater injury severity. This is reasonable because these variables reflect major physiological

compromise and secondary injury after trauma rather than only the external mechanism of the crash. The importance of hypotension is supported by a recent meta-analysis in traumatic brain injury, which found increased mortality in patients with hypotension, with adjusted odds showing more than a twofold increase in death risk [17].

The present findings indicate that neurological compromise matters greatly in RTA outcomes, especially when low GCS and head injury are present. This is in line with trauma literature showing that brain injury is a major contributor to death and disability, and it helps explain why patients with depressed consciousness in the included studies had worse short-term outcomes. Our findings support early recognition of altered mental status and shock as priority markers during triage, resuscitation, and referral because these

features identify the subgroup most at risk of deterioration soon after arrival [17].

Another important finding in this review is the role of delayed care and worse outcomes among patients arriving late or receiving limited early support. A systematic review of trauma system assessment found that most studies focused on delay in receiving quality care, but barriers in reaching care and deciding to seek care were also important and much less studied [18]. Reviews of prehospital emergency care in LMICs describe fragmented and uncoordinated systems with shortages of trained personnel, equipment, and transport capacity, all of which can worsen outcomes in time-sensitive trauma such as RTA [4].

The findings related to lack of first aid, lack of ambulance transport, and worse outcomes among pedestrians fit previous evidence. In a systematic review and meta-analysis, mortality was associated with older age, male sex, pedestrian status, and several unsafe road-user and road-environment factors [7]. Prehospital post-crash data indicates that timeliness of care is important even if the traditional “golden hour” should not be applied too rigidly to every case, and trauma system development is associated with lower mortality as systems become more mature and coordinated [19,20]. Our review supports that severe neurological impairment, hemodynamic instability, major injury burden, and delayed access to organized trauma care are the main drivers of death and other serious outcomes after RTA [7,19,20].

Conclusion

This systematic review showed that RTA patients presenting to ED or hospital settings face a risk of death, severe injury, and disability. In the included

studies, the most consistent predictors of poor outcome were low Glasgow Coma Scale, hypotension, head injury, severe or multiple trauma, high injury severity, and delayed access to care. Other factors included lack of first aid, lack of ambulance transport, comorbidity, pedestrian status, and rural residence. These support identification of neurological impairment, hemodynamic compromise, and delayed presentation in triage and resuscitation to improve prioritization and management of patients after RTAs.

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