JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

DOI: https://doi.org/10.61919/ernz2t54

Review Article

Clinical Outcomes of Polytrauma Patients Admitted to Critical Care Units in Lower-Middle-Income Countries: A Narrative Review

Faiza Ahmed[1], Muhammad Nirman Shehzad[2], Qurat-ul-Ain Khan[3], Rizwana Rana[4]

[1] Consultant MICU, Dr Ziauddin University Hospital, Karachi, Pakistan
[2] Fellow, Trauma Orthopedic, University of Manitoba, Winnipeg, Canada
[3] Consultant MICU, Dr Ziadduin University Hospital, Karachi, Pakistan
[4] Consultant Pulmonology and MICU, Dr Ziauddin University Hospital, Karachi, Pakistan

**Corresponding author: Faiza Ahmed, faiza_ahd@hotmail.com*

"Cite this Article" **Received**: 10 December 2025; **Accepted**: 11 January 2026; **Published**: 30 January 2026
Author Contributions: Concept: FA, RR; Design: FA, MNS, RR; Data Collection: FA, MNS, QAK; Analysis: FA, MNS, QAK, RR; Drafting: FA, MNS, QAK, RR. **Ethical Approval**: Dr Ziauddin University Hospital, Karachi, Pakistan. **Informed Consent**: NA; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: NA

ABSTRACT

Background: Polytrauma and severe multisystem injury impose substantial demands on critical-care services, particularly in resource-constrained settings where prehospital systems, referral pathways, surgical capacity, blood-product availability, specialist services, and intensive-care resources may be unevenly distributed. Reported outcomes are difficult to compare because published studies include heterogeneous polytrauma, severe-trauma, trauma-ICU, and broader hospital trauma populations. Objective: To narratively synthesize clinical outcomes and major outcome-associated factors among critically ill patients with polytrauma and severe multisystem trauma in lower-middle-income and comparable resource-constrained settings, with particular emphasis on mortality, survival, critical-care utilization, complications, neurological injury, physiological instability, and time-critical trauma care. Methods: A narrative review approach was used to integrate primary trauma studies, multicentre registry evidence, complication-focused critical-care studies, and relevant review-level evidence. The synthesis focused on ICU and in-hospital mortality, survival, ICU and hospital length of stay, mechanical ventilation, major complications, and neurological or functional outcomes. Findings were organized thematically and interpreted within their original populations; quantitative pooling was not undertaken because of substantial clinical and methodological variability in case definitions, injury severity, ICU admission criteria, and outcome measurement. Results: Trauma-specific ICU cohorts reported substantial mortality, including 32.7% in Tanzania, 31.3% in a Pakistani surgical ICU, and 40.5% (248/613) in a multicentre Northwest Ethiopian cohort, whereas a broader Indian trauma registry reported 30-day in-hospital mortality of 12.4%. Low Glasgow Coma Scale score, severe neurological injury, hypotension, physiological instability, complications, and delays in time-critical care were repeatedly associated with adverse outcomes. Mechanical ventilation requirements ranged markedly according to population severity, and ventilator-associated pneumonia affected 36.2% of patients in one trauma ICU cohort and was associated with prolonged ventilation and ICU stay. Evidence concerning longer-term neurological and functional recovery was limited. Conclusion: Mortality and morbidity after severe trauma remain substantial but cannot be represented by a single estimate across heterogeneous settings. Outcomes reflect the interaction of injury severity with prehospital, emergency, surgical, and critical-care processes. Standardized multicentre trauma registries incorporating complications, functional recovery, and time-to-care measures are needed to identify modifiable system failures and guide context-appropriate improvements in trauma care. Keywords: Polytrauma; Multiple Trauma; Critical Care; Intensive Care Units; Traumatic Brain Injury; Mortality; Morbidity; Developing Countries.

INTRODUCTION

Trauma remains a major cause of preventable mortality, disability, and healthcare utilization, with a particularly substantial impact on young and economically active populations. Road traffic crashes, occupational injuries, interpersonal violence, falls, and penetrating trauma contribute substantially to the burden of severe injury in resource-constrained settings. Among patients requiring hospital admission, those with multiple serious injuries impose especially complex demands because simultaneous neurological, thoracic, abdominal, pelvic, vascular, and musculoskeletal injuries may require rapid resuscitation, operative intervention, blood-product support, mechanical ventilation, and prolonged critical care. Studies from India and Tanzania demonstrate that critically injured populations in such settings are predominantly young adults, frequently male, and commonly injured in road traffic crashes, with a considerable proportion requiring emergency surgery, airway management, circulatory support, or intensive care (1,2).

Polytrauma is clinically distinct from isolated injury because the physiological consequences of multiple injuries may interact and accelerate deterioration. Traumatic brain injury (TBI), major hemorrhage, thoracic trauma, fractures, tissue injury, hypoxemia, and circulatory shock can coexist, while secondary insults such as hypotension, hypoxia, infection, acute respiratory failure, and organ dysfunction may further influence survival. Consequently, outcome is determined not only by the anatomical severity of the initial injuries but also by physiological instability, neurological status, complications, and the timeliness and availability of definitive treatment. Critical-care studies from Pakistan, Tanzania, Ethiopia, and India have consistently demonstrated that severe injury requiring intensive care is associated with substantial mortality and resource utilization, although reported outcomes vary considerably according to patient selection, injury severity, referral patterns, and ICU admission practices (2–5).

The pathway preceding ICU admission is particularly important in resource-limited trauma systems. Delayed transportation, inadequate prehospital stabilization, delayed recognition of internal hemorrhage, limited access to diagnostic imaging, insufficient availability of blood products, and delayed operative or neurosurgical intervention may permit potentially reversible physiological deterioration before definitive critical care begins. Recent evidence from Tanzania has further demonstrated an association between gaps in time-critical trauma care and increased mortality, emphasizing that ICU outcomes partly reflect the performance of the entire trauma pathway rather than ICU management in isolation (6). This systems perspective is particularly relevant to lower-middle-income settings, where trauma services may operate within constrained prehospital networks, variable referral pathways, limited specialist availability, and uneven critical-care capacity.

Neurological injury represents another major determinant of outcome. Low Glasgow Coma Scale scores, intracranial injury, hypotension, and hypoxemia have repeatedly been associated with adverse outcomes among critically ill trauma populations (2,4,5). At a broader level, a systematic review of more than 82,000 ICU polytrauma patients demonstrated temporal changes in the pattern of trauma mortality, with decreasing overall mortality accompanied by a growing relative contribution of brain injury to trauma-related deaths, while deaths attributable to multiple organ dysfunction, acute respiratory distress syndrome, and sepsis declined over time (7). These findings suggest that improvements in resuscitation, operative management, infection control, and general intensive care may have altered the profile of mortality among patients who survive the earliest phases of major trauma. Whether comparable improvements have occurred consistently across resource-constrained health systems remains uncertain because trauma infrastructure, critical-care capacity, study populations, and outcome reporting differ substantially between countries.

Interpretation of the available literature is further complicated by inconsistent terminology. “Polytrauma,” “multiple trauma,” “major trauma,” “severe trauma,” and “trauma requiring ICU admission” are not methodologically interchangeable. Some studies specifically investigate patients with injuries involving multiple anatomical regions, whereas others include all severely injured patients admitted to an ICU or broader hospital trauma populations. These differences influence observed mortality, mechanical-ventilation requirements, complication rates, and length of stay and make direct numerical comparison potentially misleading. In particular, ICU cohorts are enriched for the most critically ill patients but simultaneously exclude patients who die before hospital arrival or before ICU admission, whereas hospital-based trauma registries often contain a substantially broader spectrum of injury severity. Consequently, apparently different mortality rates between studies should be interpreted in relation to case mix, injury severity, admission thresholds, referral patterns, and healthcare-system characteristics rather than as direct indicators of comparative quality of care.

Despite the clinical importance of the subject, the available evidence from lower-middle-income settings remains fragmented. Many reports originate from individual institutions, use retrospective designs, apply different trauma severity measures and case definitions, and concentrate predominantly on mortality. Morbidity-related outcomes—including ventilator duration, ICU and hospital length of stay, healthcare-associated infection, organ dysfunction, neurological disability, rehabilitation requirements, and longer-term functional recovery—are reported less consistently. The evidence base also contains studies of different trauma populations, making a single pooled estimate of mortality or morbidity inappropriate without rigorous harmonization of eligibility criteria and outcome definitions. The absence of consistently reported functional outcomes is particularly important because hospital survival alone does not distinguish between recovery to independent function and survival with substantial neurological or physical disability.

A focused narrative synthesis is therefore clinically useful for integrating the available evidence while retaining the contextual differences between studies. Rather than treating heterogeneous trauma populations as directly comparable, this review examines the patterns of outcome reported across relevant critical-care and severe-trauma literature and considers the clinical and health-system factors that may explain observed differences. The objective of this narrative review is to synthesize evidence regarding ICU mortality, in-hospital mortality, survival, ICU and hospital length of stay, major complications, and other clinically relevant outcomes among critically ill patients with polytrauma and severe multisystem trauma in lower-middle-income settings, while examining the influence of neurological injury, hemorrhagic and physiological instability, mechanical ventilation, delays in definitive treatment, and trauma-system organization. Where evidence from other resource-constrained middle-income settings provides directly relevant information on complications or systems-level determinants, it is considered contextual evidence and interpreted separately rather than assumed to represent the same underlying population.

METHODS

This article was conducted as a narrative review to provide an integrative clinical synthesis of outcomes among critically ill patients with polytrauma and severe multisystem trauma in resource-constrained settings. A narrative approach was considered appropriate because the available literature encompasses heterogeneous clinical populations, definitions of severe trauma and polytrauma, trauma-severity measures, ICU admission criteria, healthcare systems, and outcome measures. The purpose of the review was therefore not to generate a pooled mortality estimate or comparative treatment effect, but to examine recurring patterns in clinical outcomes, prognostic characteristics, complications, resource utilization, and systems-level determinants while preserving the clinical and methodological context of the individual studies.

The evidence base comprised published primary trauma studies and relevant review-level evidence addressing patients with polytrauma, multiple serious injuries, severe trauma, or trauma requiring intensive-care support. The principal population of interest was critically ill adult trauma patients treated in lower-middle-income healthcare settings. Because the published critical-care literature does not consistently apply a uniform definition of polytrauma, studies involving broader severe-trauma or trauma-ICU populations were considered when their populations and outcomes were directly relevant to the objectives of the review. Evidence from broader hospital trauma registries was interpreted separately from ICU-specific cohorts because differences in injury severity and admission thresholds substantially affect mortality estimates. Similarly, findings from general ICU populations were not treated as directly equivalent to polytrauma-specific outcome estimates. Selected evidence from other resource-constrained middle-income settings was used only to contextualize complications or health-system issues where these findings informed the interpretation of trauma care beyond the principal geographic scope.

The synthesis focused primarily on ICU mortality, in-hospital mortality, survival to ICU or hospital discharge, ICU length of stay, hospital length of stay, duration or requirement for mechanical ventilation, major complications, and neurological or functional outcomes when reported. Clinical characteristics examined in relation to these outcomes included injury severity, Glasgow Coma Scale score, traumatic brain injury, hypotension and hemorrhagic shock, physiological instability, need for airway management and mechanical ventilation, complications during critical care, and requirement for operative or other definitive treatment. Systems-level factors considered included prehospital transportation and stabilization, timeliness of referral, delays in definitive care, availability of surgery and blood products, access to critical-care services, and organization of multidisciplinary trauma care.

Evidence was synthesized thematically rather than quantitatively. Studies were considered within domains encompassing trauma epidemiology and case mix, mortality and survival, neurological injury, physiological instability and hemorrhage, mechanical ventilation and respiratory complications, ICU and hospital resource utilization, complications and organ dysfunction, delays in trauma care, and trauma-system organization. Numerical estimates were retained within their original study contexts and were not pooled because the included evidence differed substantially in population definitions, injury severity, study design, healthcare setting, ICU admission practices, and outcome ascertainment. Mortality reported among ICU cohorts was therefore distinguished conceptually from mortality reported among broader hospitalized trauma populations, and differences between studies were interpreted descriptively rather than as direct comparisons of institutional or national performance.

Particular attention was given to distinguishing associations reported by individual observational studies from causal determinants of outcome. Variables such as low Glasgow Coma Scale score, hypotension, severe neurological injury, need for mechanical ventilation, complications, and delayed definitive treatment were therefore interpreted as factors associated with adverse outcomes where supported by the cited studies rather than as independently causal predictors unless the underlying analysis justified such interpretation. Mechanical ventilation was similarly considered both an indicator of critical illness severity and a potential contributor to subsequent complications during prolonged intensive care, rather than being interpreted automatically as an independent cause of mortality.

The methodological diversity of the evidence was considered throughout the synthesis. Differences in the definition of polytrauma, inclusion of isolated versus multisystem injuries, use of trauma-severity scores, retrospective versus prospective data collection, ICU admission thresholds, and outcome definitions were treated as important sources of clinical and methodological variability. The review therefore emphasizes the direction and recurrence of clinically relevant findings across settings rather than assigning a single summary estimate to heterogeneous populations. The narrative approach also permits interpretation of health-system and resource factors that are difficult to standardize quantitatively but remain central to understanding trauma outcomes in resource-constrained settings.

RESULTS

The evidence identified for this narrative review demonstrated considerable variation in study setting, population definition, injury severity, and outcome ascertainment. The available studies included dedicated polytrauma cohorts, trauma-specific ICU populations, broader hospital trauma registries, and complication-focused critical-care cohorts. Consequently, mortality and morbidity estimates were interpreted within their original clinical populations rather than combined quantitatively. Across the available evidence, five recurring domains were identified: mortality and survival, neurological and physiological determinants of outcome, mechanical ventilation and respiratory complications, ICU resource utilization, and the influence of timing and organization of trauma care.

Table 1. Characteristics and Principal Findings of Key Studies Included in the Narrative Synthesis

Study / setting	Population and design	Sample	Principal outcomes reported	Key findings relevant to synthesis
Bajwa et al., India (1)	Hospital polytrauma cohort	531	Shock/hemorrhage, airway management, ICU admission, operative treatment, inotropic support	More than half presented with shock or hemorrhage; approximately 43% required airway management and intubation; approximately 46% required ICU admission; more than half underwent operative treatment within 6 hours; approximately 56% required inotropic support
Chalya et al., Tanzania (2)	Trauma patients admitted to ICU	312	ICU mortality, mechanism of injury, ICU length of stay	Trauma represented 37.1% of ICU admissions; road traffic crashes accounted for approximately 71% of trauma cases; ICU mortality was 32.7%; median ICU stay was 8 days
Rizwan et al., Pakistan (3)	Retrospective surgical-ICU trauma cohort	Not stated in current synthesis	Mortality, mechanical ventilation, ICU length of stay	Mortality was 31.3%; 87.5% required intubation and mechanical ventilation; median ICU stay was 5 days; emergency operative requirements were common
Messelu et al., Northwest Ethiopia (4)	Multicentre trauma ICU cohort	613	In-hospital mortality and associated factors	Overall mortality was 40.5% (248/613); lower GCS, poorer trauma-severity measures, and complications were associated with mortality
General ICU cohort, Northwest Ethiopia	General adult ICU population including trauma	568	Overall ICU mortality and major diagnostic contributors	Overall mortality was 29.6%; head trauma and shock were among important causes of ICU admission and death. Because this was not a trauma-specific cohort, the estimate was used only as contextual evidence
Bhandarkar et al., India (5)	Prospective multicentre trauma-registry cohort	8,606	30-day in-hospital mortality and timing of death	Overall 30-day in-hospital mortality was 12.4%; 1.9% died within 24 hours, 7.3% between days 1–7, and 3.2% between days 8–30; abnormal systolic blood pressure, oxygen saturation, and GCS were associated with mortality
Osebo et al., Tanzania (6)	Multicentre severe-trauma study	—	Time-critical care and mortality	Delays and gaps in time-critical trauma care were associated with increased mortality, supporting the importance of the prehospital-to-definitive-care pathway
van Breugel et al., global ICU polytrauma evidence (7)	Systematic review of ICU polytrauma studies	>82,000	Temporal changes in mortality and causes of death	Overall mortality decreased over time, while the relative contribution of brain injury-related mortality increased; deaths associated with multiple organ dysfunction, ARDS, and sepsis declined
Indian trauma-registry timing analysis (8)	Multicentre trauma-registry analysis comparing office-hours and after-hours arrival	>5,500 after-hours; approximately 2,500 office-hours	In-hospital mortality, ICU stay, mechanical ventilation	In-hospital mortality was similar between arrival periods, but after-hours presentation was associated with longer ICU stay and longer duration of mechanical ventilation
Ngxabi and Hardcastle, South Africa (9)	Trauma ICU cohort evaluating ventilator-associated pneumonia	395	VAP, ventilation duration, ICU length of stay	VAP occurred in 36.2% of patients; affected patients required substantially longer mechanical ventilation and had a median ICU stay approximately 7 days longer than patients without VAP

Abbreviations: ARDS, acute respiratory distress syndrome; GCS, Glasgow Coma Scale; ICU, intensive care unit; VAP, ventilator-associated pneumonia. Numerical estimates are presented within the populations from which they were derived and were not pooled because of differences in population definition, injury severity, admission criteria, and outcome ascertainment.

Mortality and Survival

Mortality was the most consistently reported outcome, but estimates varied substantially according to the clinical population studied. Among trauma-specific ICU cohorts, Chalya et al. reported an ICU mortality of 32.7% among 312 patients in Tanzania (2), while the Pakistani surgical-ICU study reported mortality of 31.3% (3). In the multicentre Northwest Ethiopian trauma ICU cohort, 248 of 613 patients died before hospital discharge, corresponding to mortality of 40.5% (4). These estimates describe highly selected critically ill populations and therefore should not be interpreted as representative mortality rates for all patients with trauma in the corresponding countries.

The broader Indian trauma-registry evidence demonstrated the effect of population selection on observed mortality. Among 8,606 trauma patients admitted across four urban university hospitals, 30-day in-hospital mortality was 12.4% (5). Mortality was temporally concentrated after the first 24 hours: 1.9% of the cohort died within the first day, 7.3% between days 1 and 7, and 3.2% between days 8 and 30 (5). The lower mortality in this registry compared with ICU-specific studies is consistent with its inclusion of a broader hospitalized trauma population rather than only patients requiring critical care.

The available evidence therefore does not support a single summary mortality estimate for critically ill trauma patients across these settings. Differences in case mix, injury severity, referral patterns, admission thresholds, and denominators are sufficiently large that direct comparison of percentages could be misleading. ICU-based studies also inherently exclude some patients who die before reaching hospital or before transfer to critical care. Mortality reported after ICU admission therefore represents only one component of the total fatal burden of severe trauma.

Neurological Injury and Physiological Instability

Neurological status emerged repeatedly as an important correlate of survival. In the Tanzanian ICU cohort, low GCS and intracranial pathology were associated with adverse outcome (2), while the Northwest Ethiopian multicentre study similarly identified lower GCS and poorer trauma-severity measures among factors associated with mortality (4). In the Indian multicentre registry, abnormal physiological parameters at presentation, including low systolic blood pressure, reduced oxygen saturation, and low GCS, were associated with mortality (5). Collectively, these findings indicate that both anatomical injury and physiological compromise at presentation contribute importantly to risk stratification.

The broader ICU polytrauma literature reinforces the importance of neurological injury. In the systematic review including more than 82,000 patients, overall polytrauma mortality decreased over time, but the proportional contribution of brain injury-related death increased, whereas mortality associated with multiple organ dysfunction syndrome, ARDS, and sepsis declined (7). This pattern suggests that severe TBI remains a dominant source of residual mortality even as management of hemorrhage, respiratory failure, infection, and organ dysfunction has improved in many trauma systems. The extent to which the same temporal pattern applies across lower-resource health systems remains uncertain because access to neuroimaging, neurosurgical intervention, invasive monitoring, and specialist critical care is not uniform.

Hemodynamic instability was another recurrent adverse feature. In the Indian polytrauma cohort, more than half of the 531 patients presented with shock or hemorrhage and approximately 56% required inotropic support (1). More than half also required operative treatment within the first 6 hours, indicating a high burden of injuries requiring rapid definitive intervention (1). The association between low systolic blood pressure and mortality in the Indian registry further emphasizes the prognostic importance of physiological instability at presentation (5).

Mechanical Ventilation and Respiratory Complications

Requirement for airway management and mechanical ventilation varied substantially with population severity. Approximately 43% of patients in the Indian polytrauma cohort required airway management and intubation (1), whereas 87.5% of patients in the Pakistani surgical trauma ICU required intubation and mechanical ventilation (3). This difference is compatible with the greater severity expected in a population selected specifically for surgical critical care and illustrates why ventilation rates from different study populations should not be compared without considering ICU admission criteria and injury patterns.

Mechanical ventilation also intersects with morbidity during prolonged critical care. In the South African trauma ICU cohort of 395 patients, ventilator-associated pneumonia occurred in 36.2% of patients (9). Patients who developed VAP required substantially longer periods of mechanical ventilation and experienced a median ICU stay approximately 7 days longer than those without VAP (9). These observations highlight the substantial resource consequences of respiratory complications among trauma survivors requiring prolonged intensive care.

Requirement for mechanical ventilation should nevertheless be interpreted cautiously as a prognostic marker. Critically injured patients requiring ventilation are more likely to have severe TBI, thoracic injury, shock, impaired consciousness, or multisystem injury. Accordingly, an observed association between ventilation and mortality cannot by itself establish that ventilation independently causes poorer survival. Its clinical significance lies both in identifying greater initial severity and in exposing patients to complications associated with prolonged invasive support.

ICU and Hospital Resource Utilization

Length of stay varied across trauma ICU settings. The Tanzanian trauma ICU study reported a median ICU stay of 8 days (2), compared with a median of 5 days in the Pakistani surgical ICU cohort (3). These differences cannot be interpreted as comparative indicators of efficiency or quality because ICU stay is influenced by injury severity, survival time, bed availability, step-down capacity, repeat operative requirements, mechanical ventilation, and local discharge practices.

Length of stay also has an important competing-risk relationship with mortality. Patients with catastrophic hemorrhage or irreversible neurological injury may die early and therefore accumulate relatively few ICU days, whereas survivors of severe injury may remain in critical care for substantially longer periods while undergoing ventilation, repeated operations, nutritional support, infection treatment, and rehabilitation. Consequently, longer ICU stay may reflect either greater morbidity or successful survival through the acute phase and should not be interpreted independently of mortality and clinical trajectory.

Arrival timing may additionally influence resource utilization even in the absence of a measurable mortality difference. In the Indian trauma-registry analysis, more than 5,500 patients presented after regular working hours and approximately 2,500 during office hours. In-hospital mortality was similar between groups, but patients presenting after hours had longer ICU stays and longer durations of mechanical ventilation (8). This finding suggests that organizational and temporal factors may influence the intensity and duration of care even when their effect on survival is less apparent.

Timing of Care and Trauma-System Factors

The evidence indicates that clinical outcome cannot be attributed exclusively to events occurring after ICU admission. A multicentre Tanzanian study of severe trauma demonstrated that delays and gaps in time-critical care were associated with increased mortality (6). This association is clinically important because trauma physiology may deteriorate during prehospital transport, interfacility referral, emergency assessment, diagnostic work-up, or while awaiting surgical or other definitive intervention.

The Indian polytrauma cohort similarly demonstrates the intensity of early treatment required, with more than half of patients undergoing operative management within the first 6 hours and substantial proportions requiring airway intervention and circulatory support (1). These findings collectively support a systems-based interpretation of trauma outcomes in which prehospital stabilization, rapid transportation, timely diagnosis, hemorrhage control, operative access, blood-product availability, critical-care support, and multidisciplinary coordination influence the trajectory from injury to recovery.

Complications, Morbidity, and Longer-Term Outcomes

Compared with mortality, morbidity was less consistently characterized in the available evidence. Ventilator-associated pneumonia represents one well-documented example, with an incidence of 36.2% in the South African trauma ICU cohort and a substantial associated increase in ventilation duration and ICU stay (9). The global polytrauma evidence also indicates that multiple organ dysfunction syndrome, ARDS, and sepsis remain clinically relevant complications, even though their relative contribution to trauma mortality has declined over time (7).

Other clinically important outcomes—including total hospital length of stay, neurological disability, rehabilitation needs, health-related quality of life, return to independent function, and longer-term survival—were not consistently represented across the studies synthesized. This creates an important limitation in interpreting "survival" as a complete measure of outcome. A patient surviving hospital admission with severe persistent neurological or physical disability represents a substantially different clinical outcome from a patient returning to independent living. The available evidence therefore supports a broader outcome framework that incorporates survival, treatment burden, major complications, neurological status, and functional recovery.

Overall Pattern of Evidence

Across the available studies, critically ill trauma populations were predominantly characterized by high-acuity injury, frequent need for airway or circulatory support, substantial ICU utilization, and clinically important mortality. The strongest recurring adverse features were severe neurological injury, impaired consciousness, physiological instability, complications, and delays in time-critical trauma care. However, the magnitude of these associations and the absolute rates of mortality, ventilation, and length of stay differed substantially between study populations.

The evidence does not justify combining ICU-specific trauma cohorts, broader trauma registries, and general critical-care populations into a single numerical estimate. Instead, the most consistent interpretation is that outcome reflects the interaction of injury severity, physiological condition at presentation, neurological injury, complications arising during critical care, and the capacity of the surrounding trauma system to deliver timely definitive treatment. The scarcity of consistently reported functional and longer-term outcomes remains a major limitation of the existing evidence base and restricts assessment of recovery beyond hospital survival.

DISCUSSION

This narrative review indicates that critically ill patients with polytrauma and severe multisystem trauma in resource-constrained settings experience substantial mortality, morbidity, and critical-care utilization, although the magnitude of these outcomes differs considerably according to study population, injury severity, referral pathways, and ICU admission criteria. Across trauma-specific ICU cohorts, mortality was commonly substantial, whereas broader hospital trauma registries reported lower absolute mortality because they incorporated patients across a wider spectrum of injury severity. The most consistently reported adverse characteristics included severe neurological injury, reduced Glasgow Coma Scale score, physiological instability, hemorrhage or shock, complications during intensive care, and delays in time-critical treatment. Mechanical ventilation was frequently required among the most severely injured patients, while respiratory complications such as ventilator-associated pneumonia contributed to prolonged ventilation and ICU stay. These findings support an interpretation in which outcome is determined not by a single injury or intervention but by the interaction between anatomical injury burden, physiological deterioration, neurological status, complications, and the capacity of the trauma system to deliver timely definitive care.

The marked variation in mortality between studies requires particular caution. ICU mortality of 32.7% in the Tanzanian cohort and mortality of 31.3% in the Pakistani surgical ICU occurred in populations selected specifically for critical-care admission (2,3), while the Northwest Ethiopian trauma ICU cohort reported in-hospital mortality of 40.5% (4). In contrast, the multicentre Indian trauma registry reported 30-day in-hospital mortality of 12.4% among a broader population of 8,606 admitted trauma patients (5). These values should not be interpreted as comparative measures of national or institutional performance. Differences in injury severity, transfer practices, prehospital mortality, referral thresholds, ICU capacity, and definitions of the denominator substantially affect observed mortality. This distinction is further illustrated by general ICU evidence from Northwest Ethiopia, where overall mortality was 29.6% among 568 critically ill adults and head trauma and shock were important contributors to admission and mortality, but the cohort was not restricted to trauma patients and therefore cannot provide a trauma-specific mortality estimate (8). The appropriate interpretation is consequently one of substantial but highly context-dependent mortality rather than a uniform mortality range applicable across lower-middle-income settings.

Neurological injury emerged as one of the most consistent determinants of adverse outcome. Low GCS and intracranial pathology were associated with poor outcomes in the Tanzanian trauma ICU population (2), while lower GCS and greater trauma severity were also associated with mortality in the Northwest Ethiopian trauma ICU cohort (4). The Indian registry similarly identified low GCS together with low systolic blood pressure and reduced oxygen saturation as adverse physiological characteristics (5). These observations are consistent with the global systematic review of more than 82,000 ICU polytrauma patients, which demonstrated that although overall mortality declined over time, brain injury accounted for an increasing relative proportion of deaths while mortality attributable to multiple organ dysfunction syndrome, acute respiratory distress syndrome, and sepsis declined (7). Severe TBI therefore remains a major residual challenge even where advances in hemorrhage control, ventilation, infection management, and general critical care improve survival from other early and late complications. In resource-constrained systems, this problem may be compounded by variable access to neuroimaging, neurosurgery, neurological monitoring, rehabilitation, and specialized neurocritical care.

Physiological instability and hemorrhage constitute a second major outcome pathway. In the Indian polytrauma cohort, more than half of patients presented with shock or hemorrhage, more than half required operative management within the first six hours, and approximately 56% required inotropic support (1). The association between hypotension and mortality in the larger Indian trauma registry further reinforces the clinical importance of early circulatory compromise (5). These findings emphasize that the window in which trauma outcomes can be modified begins before ICU admission. Hemorrhage control, airway protection, oxygenation, transfusion support, rapid diagnosis, and access to operative intervention must occur early enough to prevent secondary physiological injury. Accordingly, ICU mortality should partly be understood as an endpoint of a longitudinal trauma pathway rather than solely as a measure of ICU performance.

Evidence concerning delays in time-critical treatment supports this systems interpretation. The Tanzanian multicentre study identified gaps and delays in time-sensitive trauma care as factors associated with greater mortality (6). Furthermore, the Indian analysis comparing office-hours with after-hours presentation found similar in-hospital mortality between groups, but patients arriving after hours experienced longer ICU stays and longer periods of mechanical ventilation (9). The absence of a mortality difference in that study does not imply that service organization is clinically irrelevant; rather, organizational constraints may manifest through morbidity, treatment intensity, or resource utilization without necessarily producing a detectable difference in mortality. These observations reinforce the importance of examining time to definitive treatment, transfer pathways, staffing, theatre access, blood-bank availability, imaging, and specialist services alongside conventional mortality endpoints.

Mechanical ventilation similarly requires contextual interpretation. Ventilation was required in approximately 43% of the Indian polytrauma cohort but in 87.5% of patients in the Pakistani surgical trauma ICU (1,3). The large difference likely reflects variation in population severity and ICU selection rather than differences in clinical practice alone. Mechanical ventilation is consequently an important marker of critical illness but should not automatically be interpreted as an independent cause of mortality. Its contribution to subsequent morbidity is nevertheless substantial. In the South African trauma ICU study, ventilator-associated pneumonia occurred in 36.2% of patients and corresponded to 35.6 episodes per 1,000 ventilator-days; affected patients required longer mechanical ventilation and had a median ICU stay approximately seven days longer than patients without VAP (10). Prevention of ventilator-associated infection is therefore particularly relevant in trauma populations in which severe TBI, thoracic injury, impaired consciousness, and prolonged ventilation frequently coexist.

Length of stay is another outcome that cannot be interpreted independently of survival. Median ICU stay was eight days in the Tanzanian cohort and five days in the Pakistani study (2,3), but shorter ICU stay does not necessarily indicate better care. Patients dying shortly after catastrophic hemorrhage or neurological injury may have very short stays, whereas survivors of severe trauma can require prolonged ventilation, repeated procedures, infection treatment, nutritional support, and rehabilitation. Evidence from Northwest Ethiopia further demonstrates that recovery time among ICU trauma patients is influenced by neurological status, injury severity, complications, and other patient-level characteristics (11). Consequently, future trauma studies should report mortality together with ICU-free days, ventilator-free days, hospital length of stay, complications, and functional recovery wherever feasible rather than relying on length of stay as an isolated indicator of performance.

The available evidence also highlights the importance of potentially modifiable systems-level deficiencies. In a South African trauma service, Storm et al. reported that 16% of in-hospital trauma deaths were classified as potentially avoidable because of inappropriate care or resource limitations, including constrained access to intensive care, dialysis, advanced respiratory support, blood transfusion, surgery, and other aspects of medical management (12). Although this evidence originates from a different middle-income healthcare context and should not be generalized directly to all lower-middle-income countries, it illustrates how resource availability can interact with injury severity to influence outcome. Importantly, resource improvement need not imply duplication of high-income trauma systems. Locally adapted interventions—including stronger referral networks, standardized triage, reliable transfusion pathways, timely surgical access, multidisciplinary trauma activation, essential imaging, infection prevention, and appropriately staffed critical-care services—may provide more realistic and context-sensitive targets.

Standardization of morbidity measurement is also needed. Mortality is comparatively easy to define, but trauma survivors may experience diverse management-related complications that substantially affect hospital-free and ICU-free days. Validation of the adapted Clavien-Dindo in Trauma scale in an Indian level I trauma centre demonstrated the feasibility of systematically grading management-related complications and showed meaningful relationships between complication severity and hospital- and ICU-free days (13). Incorporating standardized complication classifications into trauma registries could therefore complement conventional endpoints and facilitate more meaningful comparison of morbidity across institutions. Such approaches would be especially valuable where mortality alone inadequately captures the consequences of prolonged critical illness.

A major limitation of the current evidence base is its concentration on short-term survival. Functional recovery, neurological disability, quality of life, return to employment, caregiver burden, and longer-term mortality are inconsistently reported. This limitation is particularly consequential in populations dominated by young adults because survival with severe neurological or musculoskeletal disability carries substantial individual, family, societal, and economic consequences. Trauma outcomes should therefore extend beyond discharge status. Prospective follow-up incorporating validated neurological and functional measures would better determine whether improvements in acute survival translate into meaningful recovery and community reintegration.

The evidence base itself has important methodological limitations. Several studies were retrospective and single-centre, and definitions of polytrauma, severe trauma, injury severity, complications, and outcome varied substantially. ICU admission criteria were not uniform, creating substantial selection differences between cohorts. Some evidence derived specifically from polytrauma populations, whereas other studies evaluated all trauma ICU admissions, broader hospital trauma cohorts, or general critical-care populations. These methodological differences preclude meaningful quantitative pooling within the present narrative framework and limit direct comparison of absolute outcome rates. Most reported associations were observational, and relationships between factors such as mechanical ventilation, complications, delayed treatment, and mortality may therefore reflect confounding by underlying injury severity.

The narrative-review methodology introduces additional limitations. Literature selection was not conducted within a fully documented systematic-review framework, and no formal risk-of-bias assessment or certainty-of-evidence grading was applied. The synthesis is consequently vulnerable to selection and citation bias and cannot claim comprehensive identification of all relevant studies. Geographic representation is also uneven, and findings from individual centres cannot be assumed to represent national trauma systems. Evidence from other resource-constrained middle-income settings was used only where it provided clinically relevant contextual information, but differences in healthcare financing, specialist capacity, referral organization, and trauma epidemiology restrict direct generalization. These limitations reinforce the need to interpret the review as a clinically oriented synthesis of recurring patterns rather than as a source of pooled estimates or formal comparative effectiveness conclusions.

Future research should prioritize prospective multicentre trauma registries using harmonized definitions of polytrauma, injury severity, physiological status, and outcomes. Registries should capture the complete care pathway from injury through prehospital treatment, referral, emergency stabilization, operative or interventional management, ICU admission, complications, hospital discharge, and subsequent functional recovery. Core outcome reporting should distinguish ICU mortality, hospital mortality, and prespecified post-injury mortality intervals while also recording ventilator-free days, ICU-free days, infection, organ dysfunction, neurological status, disability, and patient-centred functional outcomes. Studies evaluating potentially modifiable system factors should measure transfer delay, time to hemorrhage control, availability of blood products, emergency operative access, neurosurgical capability, staffing, and critical-care capacity using standardized definitions. Such data would permit adjustment for injury severity and case mix and would help distinguish deaths attributable primarily to unsurvivable injury from those potentially amenable to improvements in trauma-system performance.

The principal implication of this synthesis is therefore that improving trauma survival requires an integrated pathway rather than an ICU-only intervention. Early recognition and resuscitation, rapid transport, hemorrhage control, neurological protection, timely surgery, safe mechanical ventilation, infection prevention, appropriate critical-care capacity, and rehabilitation are interdependent components of the same continuum. Strengthening one component while major delays persist elsewhere may provide limited benefit. Locally designed trauma systems supported by reliable registry data offer the most plausible mechanism for identifying preventable delays, allocating scarce resources, monitoring outcomes, and progressively improving both survival and recovery.

CONCLUSION

Critically ill patients with polytrauma and severe multisystem trauma in lower-middle-income and comparable resource-constrained settings experience substantial but highly variable mortality and morbidity, with adverse outcomes consistently associated with severe neurological injury, physiological instability, complications, and delays in time-critical care. Differences between ICU cohorts and broader trauma populations preclude interpretation of a single mortality estimate, while the predominance of short-term survival endpoints leaves the longer-term burden of neurological and functional disability insufficiently characterized. Improvement in outcome requires coordinated care across the entire trauma pathway, including effective prehospital referral, early resuscitation and hemorrhage control, timely surgery and transfusion support, appropriate critical care, prevention of complications, and access to rehabilitation. Prospective multicentre trauma registries using standardized definitions and patient-centred outcomes are essential to identify modifiable system failures, distinguish preventable from unavoidable mortality, and measure whether trauma-system improvements translate into meaningful recovery.

REFERENCES

1. Bajwa SS, Kaur J, Bajwa SK, Kaur G, Singh A, Parmar SS. Designing, managing and improving the operative and intensive care in polytrauma. J Emerg Trauma Shock. 2011;4(4):494-500. doi:10.4103/0974-2700.86642.

2. Chalya PL, Gilyoma JM, Dass RM, McHembe MD, Matasha M, Mabula JB, et al. Trauma admissions to the intensive care unit at a reference hospital in Northwestern Tanzania. Scand J Trauma Resusc Emerg Med. 2011;19:61. doi:10.1186/1757-7241-19-61.

3. Rizwan M, Hashmi M, Zafar H. A six-month retrospective study of resources burden by trauma victims in the surgical intensive care unit of a university hospital in Pakistan. Cureus. 2018;10(8):e3236. doi:10.7759/cureus.3236.

4. Messelu MA, Ayenew T, Amha H, Amlak BT, Gedfew M, Tiruneh BG, et al. Machine learning algorithm to predict mortality of trauma patients admitted to the intensive care units in Northwest Ethiopia. Nurs Crit Care. 2025;30(6):e70190. doi:10.1111/nicc.70190.

5. Bhandarkar P, Patil P, Soni KD, O'Reilly GM, Dharap S, Mathew J, et al. An analysis of 30-day in-hospital trauma mortality in four urban university hospitals using the Australia India Trauma Registry. World J Surg. 2021;45(2):380-389. doi:10.1007/s00268-020-05805-7.

6. Osebo CD, Munthali VJ, Rwanyuma LJ, Ndeserua RH, Ikoshi BM, Boniface RL. Time-critical care gaps and systemic delays linked to higher mortality in severe trauma patients in Tanzania. BMC Emerg Med. 2026;26(1):73. doi:10.1186/s12873-026-01498-8.

7. van Breugel JMM, Niemeyer MJS, Houwert RM, Groenwold RHH, Leenen LPH, van Wessem KJP. Global changes in mortality rates in polytrauma patients admitted to the ICU: a systematic review. World J Emerg Surg. 2020;15:55. doi:10.1186/s13017-020-00330-3.

8. Demass TB, Guadie AG, Mengistu TB, Belay ZA, Melese AA, Berneh AA, et al. The magnitude of mortality and its predictors among adult patients admitted to the intensive care unit in Amhara Regional State, Northwest Ethiopia. Sci Rep. 2023;13(1):12010. doi:10.1038/s41598-023-39190-7.

9. Soni KD, Khajanchi M, Raykar N, Sarang B, O'Reilly GM, Dharap S, et al. Does in-hospital trauma mortality in urban Indian academic centres differ between “office-hours” and “after-hours”? J Crit Care. 2021;62:31-37. doi:10.1016/j.jcrc.2020.11.009.

10. Ngxabi B, Hardcastle TC. Ventilator-associated pneumonia rates in a level I trauma intensive care unit in KwaZulu-Natal Province, South Africa, compared with international benchmarks. S Afr J Crit Care. 2024;40(3):e1967. doi:10.7196/SAJCC.2024.v40i3.1967.

11. Messelu MA, Ayenew T, Alamneh TS, Demile TA, Shibabaw AT, Belayneh AG. Prolonged time to recovery and its predictors among trauma patients admitted to intensive care units in comprehensive specialized hospitals in Northwest Ethiopia: a multicenter retrospective follow-up study, 2022. Front Med (Lausanne). 2024;11:1366403. doi:10.3389/fmed.2024.1366403.

12. Storm E, Smith M, Kong V, Laing GL, Bruce JL, Bekker W, et al. In-hospital mortality following traumatic injury in South Africa. Ann Surg Open. 2022;3(4):e210. doi:10.1097/AS9.0000000000000210.

13. Banerjee N, Bagaria D, Agarwal H, Katiyar AK, Kumar S, Sagar S, et al. Validation of the adapted Clavien-Dindo in trauma (ACDiT) scale to grade management-related complications at a level I trauma center. Turk J Surg. 2022;38(4):391-400. doi:10.47717/turkjsurg.2022.5793.