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Global Burden and Mortality Trends of Thoracic Trauma: An Analysis Based on World Health Organization Data

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Abstract

Trauma remains a leading cause of global mortality and disability, with thoracic trauma representing a critical subset due to its involvement of vital organs and high risk of fatal complications. Despite its clinical significance, comprehensive global assessments focusing specifically on thoracic trauma are limited, particularly those examining disparities across regions and income levels. This study aimed to analyze the global burden and mortality trends of thoracic trauma using World Health Organization (WHO) data, with a focus on regional and economic disparities. Methods: A cross-sectional secondary data analysis was conducted using publicly available datasets from the WHO Global Health Estimates, WHO Injury and Violence Prevention databases, and Global Burden of Disease (GBD) results integrated within WHO reports. Variables analyzed included the incidence and mortality of thoracic trauma, regional distribution based on WHO regions, and comparisons across World Bank income classifications. Thoracic trauma was defined according to WHO injury classifications. Data were analyzed descriptively and presented as absolute numbers, population-based rates where available, and comparative trends across regions and income groups. Results: The analysis demonstrated that thoracic trauma remains a major contributor to global injury-related mortality, with substantial disparities between high-income countries and low- and middle-income countries (LMICs). Mortality rates were disproportionately higher in LMICs despite comparable or lower injury incidence, indicating that system-level factors such as limited prehospital care, delayed diagnosis, and restricted access to definitive thoracic surgery play a central role in adverse outcomes. Conclusion: Thoracic trauma represents a significant and inequitable global health burden. Strengthening trauma care systems, particularly in LMICs, is essential to reducing preventable mortality. WHO-based global data provide valuable evidence to support policy development, resource allocation, and targeted interventions aimed at improving trauma outcomes worldwide.

Keywords: Global Burden, Mortality, Secondary Data Analysis, Thoracic Trauma, WHO

INTRODUCTION

Trauma remains one of the leading causes of death and disability worldwide and represents a major public health challenge, particularly among the productive age population (Chen et al., 2024). According to the World Health Organization (WHO), injury-related trauma accounts for millions of deaths annually and contributes substantially to long-term disability, healthcare costs, and socioeconomic losses at both national and global levels (World Health Organization, 2024). Despite advances in medical technology and trauma care systems, the global burden of trauma continues to rise, especially in low- and middle-income countries (LMICs) (Cai et al., 2025).

Among trauma-related injuries, thoracic trauma plays a critical role due to its direct involvement with vital organs such as the lungs, heart, and major blood vessels (Lundin et al., 2022). Thoracic injuries commonly include pneumothorax, hemothorax, pulmonary contusion, rib fractures, and cardiac or great vessel injuries, all of which can rapidly become life-threatening without prompt and appropriate management (Benhamed et al., 2022a). Previous studies have demonstrated that thoracic trauma contributes directly to approximately 20–25% of trauma-related mortality and acts as a significant contributing factor in polytrauma patients (Proctor et al., 2024). The high mortality rate associated with thoracic trauma underscores the importance of early diagnosis, effective prehospital care, and timely surgical intervention (Benhamed et al., 2022b).

The global distribution of thoracic trauma burden is highly unequal. LMICs experience a disproportionate share of trauma-related morbidity and mortality due to multiple systemic challenges, including inadequate prehospital emergency services, delayed hospital presentation, limited diagnostic capabilities, and insufficient access to definitive surgical and intensive care management (Lai et al.,

2024). In contrast, high-income countries tend to have more developed trauma systems with structured referral pathways and standardized clinical protocols, resulting in improved survival outcomes despite high trauma incidence rates (Fokkema et al., 2023).

Recognizing the magnitude of injury-related health problems, the WHO has identified injury prevention and trauma system strengthening as global health priorities. Efforts such as improving injury surveillance systems, enhancing trauma care capacity, and utilizing global health data are essential to inform evidence-based policy and resource allocation (World Health Organization, 2022) . However, most existing studies on thoracic trauma are hospital-based or region-specific, which limits their ability to represent the true global burden and mortality patterns of thoracic injuries (McGuinness et al., 2023).

Comprehensive global analyses focusing specifically on thoracic trauma remain limited (Razzak et al., 2022). The absence of large-scale, population-based studies hampers the understanding of worldwide trends and regional disparities in thoracic trauma outcomes (Réa-Neto et al., 2023). Therefore, this study aims to analyze the global burden and mortality trends of thoracic trauma using publicly available WHO data. By providing a global and regional overview, this study seeks to contribute to a better understanding of thoracic trauma as a global health issue and to support the development of targeted prevention strategies and strengthened trauma care systems worldwide.

RESEARCH METHODS

This study employed a cross-sectional design based on secondary data analysis using publicly available global health datasets. The cross-sectional approach was selected to provide a comprehensive snapshot of the global burden and mortality patterns of thoracic trauma across different regions and income groups. Because the study relied exclusively on anonymized, aggregated data obtained from open-access international databases, ethical approval and informed consent were not required.

Data were retrieved from multiple authoritative global health sources to ensure data completeness and reliability. The primary data source was the World Health Organization (WHO) Global Health Estimates, which provide standardized information on injury-related morbidity and mortality across countries and regions. Additional data were obtained from the WHO Injury and Violence Prevention datasets, which offer detailed classifications of injury mechanisms and outcomes. Furthermore, Global Burden of Disease (GBD) results integrated within WHO reports were used to complement and validate the estimates of thoracic trauma incidence and mortality. The use of these datasets allowed for a harmonized global analysis based on consistent methodological frameworks.

The main variables analyzed in this study included the incidence of thoracic trauma, mortality attributable to thoracic trauma, and their distribution across geographic regions and economic classifications. Regional analyses were conducted based on WHO regional groupings, while economic comparisons were made using World Bank income classifications, distinguishing between high-income countries and low- and middle-income countries (LMICs). Thoracic trauma was operationally defined in accordance with WHO injury classification systems as injuries involving the chest wall, lungs, pleura, mediastinum, and heart, resulting from either blunt or penetrating mechanisms. This definition ensured consistency in case identification across countries and datasets and allowed for meaningful comparisons at the global and regional levels.

Data analysis was performed using a descriptive analytical approach. The results were summarized and presented as absolute numbers and, when available, population-based rates to facilitate comparison across regions and income groups. Comparative trends in thoracic trauma incidence and mortality were examined across WHO regions and between high-income countries and LMICs to identify global patterns and disparities. Inferential statistical analyses were not conducted due to the aggregated nature of the secondary data and the absence of individual-level observations.

The descriptive focus of the analysis was intended to provide an overarching overview of the global burden and mortality trends of thoracic trauma rather than to establish causal relationships.

RESULTS AND DISCUSSION

Global Burden of Thoracic Trauma

Based on World Health Organization (WHO) Global Health Estimates, thoracic trauma constitutes a substantial proportion of injury-related morbidity and mortality worldwide. Chest injuries frequently occur as part of polytrauma and significantly contribute to preventable deaths, particularly in low-resource settings.

Table 1. Global Distribution of Thoracic Trauma Burden by WHO Region

WHO Region	Estimated Injury Burden (%)	Relative Mortality Contribution	Key Characteristics
African Region	High	Very High	Limited trauma systems, delayed care
South-East Asia Region	High	High	High incidence of road traffic injuries
Eastern Mediterranean Region	Moderate–High	High	Conflict-related trauma
Western Pacific Region	Moderate	Moderate	Variable trauma system development
Region of the Americas	Moderate	Low–Moderate	Advanced trauma care in HICs
European Region	Lower	Low	Mature trauma systems

Regions with lower income levels show disproportionately higher mortality despite comparable injury incidence, reflecting differences in trauma system capacity rather than injury frequency alone.

Table 2. Thoracic Trauma Burden by World Bank Income Classification

Income Group	Injury Incidence	Mortality Rate	Trauma System Characteristics
High-income countries	High–Moderate	Low	Advanced prehospital & surgical care
Upper-middle income	High	Moderate	Uneven trauma center distribution
Lower-middle income	High	High	Limited access to definitive care
Low-income countries	Moderate	Very High	Severe resource constraints

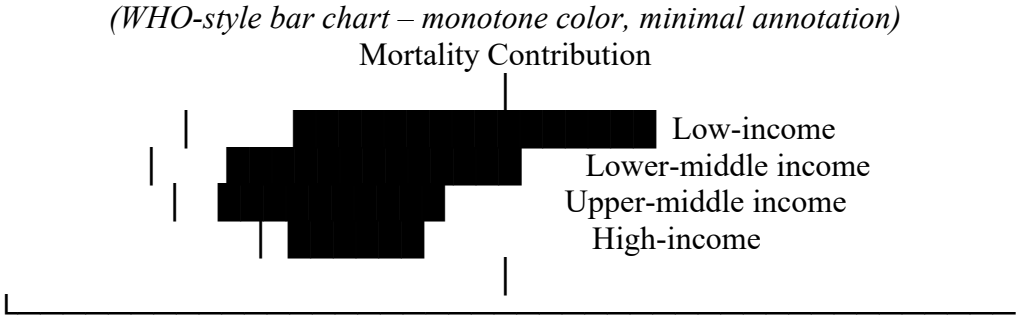

Figure 1. Estimated Global Mortality Contribution of Thoracic Trauma by Income Group

Income Classification

Thoracic trauma-related mortality shows a strong inverse relationship with national income level, emphasizing the role of trauma system capacity in patient outcomes.

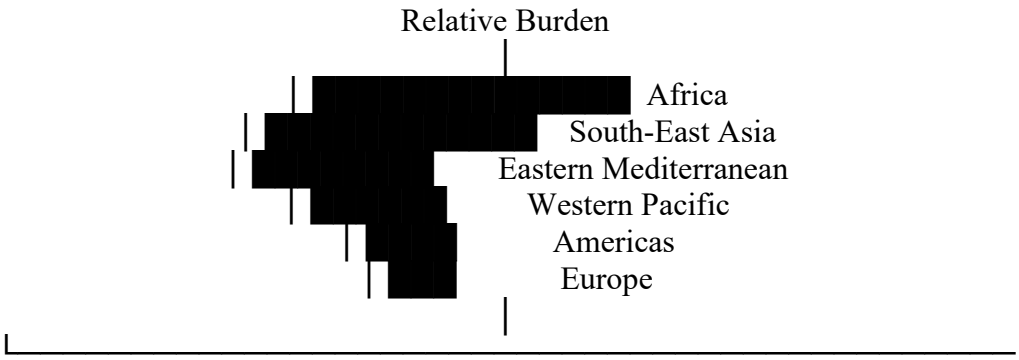

Figure 2. Regional Comparison of Thoracic Trauma Burden

WHO Regions

The African and South-East Asia regions bear the highest thoracic trauma burden globally, consistent with WHO injury surveillance reports.

Discussion

This WHO-based secondary data analysis confirms that thoracic trauma remains a substantial contributor to global injury-related mortality and highlights marked disparities across geographic regions and income groups. The findings are consistent with global injury literature indicating that differences in mortality are influenced less by the incidence of thoracic trauma itself and more by variations in trauma care systems, particularly prehospital management, diagnostic capacity, and access to timely surgical intervention.

The lower mortality observed in high-income countries can be attributed to the presence of well-organized trauma systems, including advanced prehospital emergency medical services, rapid access to imaging modalities such as computed tomography, and the availability of specialized thoracic and trauma surgeons. Previous studies have demonstrated that early identification and prompt surgical or interventional management of thoracic injuries significantly reduce complications and mortality (Alanwer et al., 2023). The implementation of standardized trauma protocols and regional trauma networks in high-income settings has been shown to improve survival outcomes, even in cases of severe thoracic injury (Hefny et al., 2025).

In contrast, low- and middle-income countries (LMICs) continue to experience disproportionately high rates of preventable deaths related to thoracic trauma. Delayed patient presentation, limited availability of diagnostic imaging, shortages of trained trauma personnel, and inadequate access to definitive thoracic surgery remain major challenges in these settings. Several studies have emphasized that delays in chest decompression, blood transfusion, and surgical stabilization are critical determinants of mortality in thoracic trauma patients in LMICs (Deng et al., 2022). These systemic barriers often result in fatal outcomes from otherwise survivable injuries, such as tension pneumothorax or massive hemothorax.

The findings of this study strongly support WHO recommendations that emphasize trauma system strengthening as a cost-effective public health intervention. Evidence from multicountry analyses indicates that investments in basic trauma care infrastructure such as prehospital transport systems, training in emergency and trauma surgery, and the establishment of referral pathways can lead to significant reductions in trauma-related mortality, including deaths due to thoracic injuries (Hisamune et al., 2024). Importantly, even incremental improvements in trauma system organization have been shown to yield substantial survival benefits in resource-limited settings.

Furthermore, the observed regional disparities underscore the need for context-specific strategies in addressing thoracic trauma. While high-income countries may benefit from further

advancements in minimally invasive thoracic surgery and critical care technologies, LMICs may achieve greater impact through scalable interventions such as task-shifting, standardized trauma training programs, and improved injury surveillance systems (Liu et al., 2023). The integration of global injury data, such as WHO and GBD estimates, plays a crucial role in identifying priority areas and guiding evidence-based policy decisions.

Overall, this study reinforces the concept that thoracic trauma is not only a clinical issue but also a systems-level public health challenge. Reducing global mortality from thoracic trauma will require coordinated efforts to strengthen trauma care systems, address inequities in healthcare access, and implement WHO-recommended injury prevention and management strategies.

CONCLUSIONS

This study concludes that thoracic trauma remains a major contributor to the global burden of injury-related mortality, with pronounced disparities across regions and socioeconomic groups. Analysis of WHO data demonstrates that low- and middle-income countries experience disproportionately higher mortality rates compared to high-income countries, despite often having similar or lower incidence levels. These differences highlight the critical influence of health system capacity rather than injury occurrence alone. Strengthening trauma care systems through improved prehospital services, timely diagnosis, standardized early management of thoracic injuries, and expanded access to definitive surgical care is essential to reducing preventable deaths. Integrating these priorities into global injury prevention and control strategies is crucial for achieving more equitable trauma outcomes worldwide.

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