

Global Injury: Burden, Prevention, Data, AI

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Introduction

This comprehensive analysis reveals the significant and persistent global burden of traumatic brain injury (TBI) from 1990 to 2019. It breaks down the epidemiology by age, sex, region, and common causes like road injuries and falls, underscoring TBI as a major public health challenge worldwide. What this really means is effective prevention and management strategies are critically needed, especially in low- and middle-income countries[1].

This systematic review highlights the increasing application of Machine Learning (ML) in predicting and preventing injuries across various domains, from sports to occupational safety and public health. It explores diverse ML models and data sources, demonstrating their potential to identify high-risk situations and individuals, allowing for targeted interventions. Here's the thing: ML offers a powerful toolset for proactive injury management, but data quality and model interpretability remain crucial[2].

This systematic review examines the epidemiology of non-fatal injuries in Australia, identifying key causes such as falls, sports injuries, and transport-related incidents, and highlighting specific demographic groups at higher risk. The analysis points to the significant burden these injuries place on the healthcare system and individuals. Let's break it down: understanding these patterns is fundamental for developing effective, targeted injury prevention programs across the country[3].

This scoping review sheds light on the challenges and existing landscape of injury surveillance systems and data sources in low- and middle-income countries (LMICs). It reveals a fragmented picture, with varying data quality and coverage, often relying on hospital-based data. What this really means is there's a critical need for standardized, comprehensive surveillance systems to accurately assess the injury burden and inform prevention strategies in these resource-limited settings[4].

This scoping review explores the burgeoning role of Artificial Intelligence (AI) and Machine Learning (ML) in traumatic injury research, highlighting applications from predicting patient outcomes to optimizing resource allocation and aiding in diagnosis. It shows how these technologies are beginning to transform the field, offering new avenues for improving care. What this really means is AI and ML hold immense promise for enhancing trauma management, but careful validation and integration into clinical workflows are essential[5].

This systematic review synthesizes the evidence on the economic burden of injury in Canada, providing a crucial understanding of the direct and indirect costs associated with injuries. It highlights the substantial financial impact on individuals, healthcare systems, and the broader economy, often under-recognized. What this really means is that robust injury prevention strategies are not just about health

outcomes; they are also a sound economic investment[6].

This systematic review examines various prognostic models used to predict functional outcomes after traumatic brain injury (TBI). It analyzes the strengths and weaknesses of different approaches, highlighting the complexity in developing accurate and clinically useful predictions. Here's the thing: while progress has been made, creating robust models that genuinely aid in personalized patient care and rehabilitation planning remains a significant challenge, often limited by data heterogeneity[7].

This systematic review synthesizes current evidence on the epidemiology and outcomes of traumatic spinal cord injury (TSCI) across Europe. It highlights incidence rates, common causes, and variations in outcomes, emphasizing the significant long-term burden associated with TSCI. What this really means is that while there's progress in acute care, consistent long-term data and standardized reporting are essential for improving prevention and rehabilitation strategies regionally[8].

This systematic review delves into the epidemiology of falls among older adults, a major cause of injury and mortality. It identifies key risk factors such as age, medication use, and environmental hazards, underscoring the widespread nature of this public health issue. Here's the thing: effective fall prevention strategies must be multi-faceted, addressing both intrinsic individual vulnerabilities and external environmental risks to truly make a difference[9].

This systematic review and meta-analysis provides a comprehensive overview of the epidemiology of traumatic dental injuries (TDIs), detailing their prevalence, incidence, and common etiological factors across different populations. It highlights the significant public health impact of TDIs, particularly among children and adolescents. What this really means is that prevention efforts, including sports mouthguards and safety education, are crucial to mitigate the long-term consequences of these injuries[10].

Description

The global burden of traumatic brain injury (TBI) from 1990 to 2019 represents a persistent public health challenge, with significant epidemiological breakdowns by age, sex, region, and common causes like road injuries and falls. This underscores the critical need for effective prevention and management, particularly in low- and middle-income countries [1]. Prognostic models for predicting functional outcomes after TBI are complex, with varying strengths and weaknesses. While advancements have been made, creating robust models that genuinely aid in personalized patient care and rehabilitation planning remains a significant hurdle, often complicated by data heterogeneity [7]. Similarly, traumatic spinal cord injury (TSCI) in Europe carries a substantial long-term burden, with incidence rates and

causes varying across regions. Progress in acute care is noted, but consistent long-term data and standardized reporting are essential for enhancing prevention and rehabilitation strategies regionally [8].

Beyond specific trauma types, the epidemiology of non-fatal injuries is diverse. In Australia, key causes include falls, sports injuries, and transport-related incidents, placing a significant burden on individuals and the healthcare system. Understanding these patterns is fundamental for developing effective, targeted injury prevention programs nationwide [3]. Falls among older adults are a major public health issue, identifying age, medication use, and environmental hazards as key risk factors. Here's the thing: effective fall prevention strategies must be multi-faceted, addressing both intrinsic individual vulnerabilities and external environmental risks to truly make a difference [9]. Traumatic dental injuries (TDIs) also have a significant public health impact, especially among children and adolescents, with prevention efforts like sports mouthguards and safety education being crucial to mitigate long-term consequences [10].

The economic burden of injury is substantial and often under-recognized. A systematic review on Canada revealed significant direct and indirect costs associated with injuries, impacting individuals, healthcare systems, and the broader economy. What this really means is that robust injury prevention strategies are not merely about health outcomes; they represent a sound economic investment [6]. Despite the clear need for injury data, surveillance systems, especially in low- and middle-income countries (LMICs), face challenges. A fragmented picture emerges, with varying data quality and coverage, often relying on hospital-based data. There is a critical need for standardized, comprehensive surveillance systems to accurately assess the injury burden and inform prevention strategies in these resource-limited settings [4].

Technological advancements, particularly in Artificial Intelligence (AI) and Machine Learning (ML), are increasingly being leveraged in injury prediction, prevention, and research. ML is applied across various domains, from sports to occupational safety, utilizing diverse models and data sources to identify high-risk situations and individuals, allowing for targeted interventions. Here's the thing: ML offers a powerful toolset for proactive injury management, though data quality and model interpretability remain crucial [2]. The role of AI and ML is also burgeoning in traumatic injury research itself, with applications spanning from predicting patient outcomes to optimizing resource allocation and aiding in diagnosis. What this really means is AI and ML hold immense promise for enhancing trauma management, but careful validation and integration into clinical workflows are essential for their full potential [5].

Conclusion

Global injury burden is a significant public health challenge, particularly traumatic brain injury (TBI) with its widespread impact across ages, sexes, and regions, driven by causes like road incidents and falls. Effective prevention and management are urgently needed, especially in low- and middle-income countries. Beyond TBI, non-fatal injuries in specific regions like Australia also impose a substantial burden on healthcare systems, necessitating targeted prevention programs. Injuries among older adults, specifically falls, are a major concern due to their high incidence and associated mortality, demanding multi-faceted prevention strategies that address both individual vulnerabilities and environmental risks.

The economic implications of injuries are also profound, as evidenced by studies on the direct and indirect costs in countries like Canada, emphasizing that prevention is not just a health imperative but a sound economic investment. However, effective prevention and response are hampered by challenges in injury surveillance systems, particularly in low- and middle-income countries, where data qual-

ity and coverage are often fragmented. There's a critical need for standardized, comprehensive systems to accurately assess the burden and inform strategies.

In addressing these complex injury challenges, advanced technologies like Artificial Intelligence (AI) and Machine Learning (ML) are emerging as powerful tools. ML is increasingly applied in predicting and preventing injuries across diverse fields, from sports to occupational safety, by identifying high-risk situations and individuals for targeted interventions. AI and ML are also transforming traumatic injury research, with applications in predicting patient outcomes, optimizing resource allocation, and aiding diagnosis. While these technologies hold immense promise for enhancing trauma management and prognostic modeling for conditions like TBI, careful validation and integration into clinical workflows, alongside addressing data heterogeneity, are essential for their full potential. Furthermore, understanding the specific epidemiology of conditions like traumatic spinal cord injury and traumatic dental injuries highlights the diverse nature of injury burdens and the need for tailored prevention efforts.

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Conflict of Interest

None.

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