Review Article

Burden and Determinants of Road Traffic Injuries in Low- and Middle-Income Countries: A Systematic Review

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Abstract

Road traffic injuries (RTIs) are a leading cause of preventable death and disability globally, with 1.35 million deaths and 20–50 million non-fatal injuries reported annually. The burden disproportionately affects low- and middle-income countries (LMICs), including Bangladesh, where rapid motorization, inadequate infrastructure, weak enforcement, and limited trauma care exacerbate risks. Vulnerable road users such as pedestrians, cyclists, and motorcyclists account for the majority of fatalities, while young adults and males are particularly affected. The economic impact is substantial, with losses estimated at 2–3% of GDP in Bangladesh. This systematic review synthesizes evidence from PubMed, WHO, World Bank, and national sources on the epidemiology, risk factors, economic burden, interventions, and policy frameworks for RTIs. Key contributing factors include speeding, driver fatigue, traffic rule violations, poor road conditions, and low use of helmets and seatbelts. Despite national strategies and global frameworks like the UN Decade of Action for Road Safety (2021–2030), implementation gaps persist, with less than 1% of transport budgets allocated to safety initiatives. Effective reduction of fatalities requires systemic approaches integrating engineering, enforcement, education, and emergency care, alongside strengthened data systems and sustained investment. Prioritizing RTIs in health and transport policy is essential to reduce mortality, economic losses, and achieve meaningful improvements in road safety in Bangladesh and other LMICs.

Keywords: Road traffic injury, epidemiology, low- and middle-income countries, safe system, Bangladesh.

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Introduction

Road traffic injuries (RTIs) have emerged as one of the leading causes of preventable death and disability worldwide. The World Health Organization (WHO) estimates that each year 1.35 million people die and 20–50 million sustain non-fatal injuries as a result of road crashes [1]. RTIs are now recognized as a major global health epidemic, comparable to diseases such as tuberculosis and malaria in terms of their mortality and economic burden [2]. Despite global initiatives, the rate of decline in road traffic deaths remains stagnant, especially in low- and middle-income countries (LMICs).

From a demographic standpoint, young people between 5 and 29 years are disproportionately affected, making RTIs the leading cause of death in this age group globally [3]. Males represent nearly three-quarters (73%) of all traffic-related fatalities, largely due to greater exposure and risk-taking behavior [4]. Vulnerable road users including pedestrians, cyclists, and motorcyclists account for more than half of all global road deaths, emphasizing inequities in road safety and infrastructure design [5].

Economically, the impact is enormous. The global loss from RTIs is estimated at 3% of world GDP annually, with even greater relative losses in developing economies where access to social safety nets and health insurance is limited [6]. In LMICs, including Bangladesh, RTIs represent both a health and development crisis, pushing families into poverty through loss of income and high treatment costs.

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Bangladesh, one of the most densely populated countries in the world, has experienced rapid motorization without proportional improvements in road infrastructure, regulation, and enforcement [7]. The result is a growing epidemic of road crashes, with pedestrians, rickshaw pullers, and public transport passengers being the most vulnerable. According to BRTA (2023), more than 6,200 deaths were officially recorded in 2022, though independent estimates suggest that the real number exceeds 20,000 deaths annually, given pervasive underreporting [8,9].

Several factors contribute to Bangladesh's high RTI burden: reckless driving, poor vehicle maintenance, inadequate signage and road design, low helmet and seatbelt compliance, weak law enforcement, and limited emergency response capacity [10]. The issue extends beyond individual behavior to systemic challenges in governance, urban planning, and resource allocation.

Given the cross-cutting nature of RTIs spanning health, transport, justice, and finance sectors effective control requires coordinated, data-driven approaches. The Decade of Action for Road Safety 2021–2030, led by the WHO and UN, provides a renewed global framework emphasizing a "Safe System Approach," focusing on safer roads, vehicles, users, and post-crash care [11]. For Bangladesh, aligning national policy with these principles is essential for meaningful reduction in mortality and long-term economic losses.

Methods

Search strategy

A systematic review approach was conducted in accordance with the PRISMA 2020 guidelines [12]. Comprehensive electronic searches were performed in PubMed, Google Scholar, WHO Global Health Observatory, and World Bank Open Data. The following keywords and Boolean combinations were used: "road traffic injury", "road crash", "road safety", "Bangladesh", "low- and middle-income countries", and "injury prevention". Searches were limited to studies published between 2010 and 2025. Grey literature was also reviewed, including national reports from the Bangladesh Bureau of Statistics (BBS), Bangladesh Road Transport Authority (BRTA), and WHO policy briefs and global road safety reports. Reference lists of included studies were screened to identify additional relevant sources. Figure 1 displays the screening process.

Inclusion and exclusion criteria

The inclusion criteria for this systematic review encompassed studies that reported epidemiological data on road traffic injuries (RTIs), including mortality, morbidity, incidence, prevalence, and disability-adjusted life years (DALYs). Studies conducted in Bangladesh or other low- and middle-income countries (LMICs) were included to provide a comparative global context. Research addressing risk factors such as behavioral, infrastructural, legislative, or vehicle-related was considered, as were evaluations of interventions or policy measures aimed at reducing RTIs. Eligible publications were required to be in English, published between 2010 and 2024, and included peer-reviewed articles, governmental reports, WHO or World Bank policy briefs, and other high-quality grey literature. Studies were excluded if they were not directly related to road traffic or transport injuries, such as occupational injuries unrelated to traffic, or if they were case reports, letters to editors, or opinion pieces lacking quantitative or qualitative data. Additionally, studies with incomplete methodology, insufficient data for extraction, or duplicate publications superseded by more recent analyses were excluded.

Data extraction and synthesis

The findings from the included studies were synthesized thematically across key domains: global epidemiology and burden of RTIs, risk factors (behavioral, infrastructural, vehicle-related, and legislative), economic impact (direct and indirect costs), intervention effectiveness (e.g., helmet and seatbelt use, speed enforcement, alcohol control, and safe road infrastructure), and policy gaps with a focus on Bangladesh and LMICs. Quantitative data were summarized using descriptive statistics, while qualitative data were narratively analyzed to provide contextual insights and highlight trends, disparities, and priority areas for intervention.

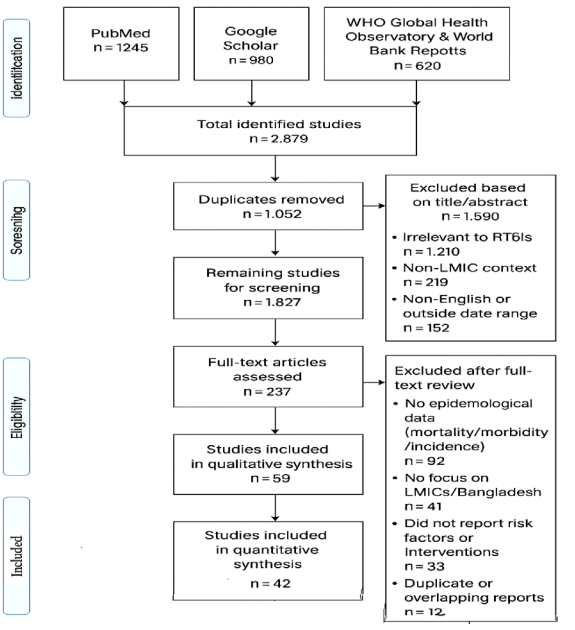

Figure 1: Flow chart of article screening process.

Results

Global epidemiology of road traffic injuries

Globally, RTIs remain a top ten cause of death and are projected to rise unless urgent measures are implemented [13,14]. The burden is highly uneven: Africa records the highest fatality rate (26.6 per 100,000 population), followed by Southeast Asia (20.7 per 100,000) [15]. In contrast, high-income countries have achieved substantial reductions through consistent enforcement and vehicle safety standards.

Despite global targets, progress has stalled. Between 2010 and 2020, road traffic deaths plateaued rather than declined, particularly in LMICs where rapid urbanization has outpaced infrastructure development [16,17]. Vulnerable users remain at greatest risk in Asia, pedestrians and two-wheel vehicle users account for nearly 65% of all road fatalities [18].

Economic burden

The financial cost of RTIs is staggering. The World Bank (2022) estimated global losses exceeding US$1.8 trillion annually, with LMICs losing between 1–5% of GDP to road crashes [19]. In Bangladesh, a 2020 World Bank analysis placed annual losses at 2–3% of GDP, or nearly US$4.8 billion, factoring in healthcare costs, lost productivity, and property damage [20]. These losses directly hinder economic growth and human capital development, particularly among working-age men.

Risk factors for road traffic injuries

Risk factors for RTIs fall into four categories: human, vehicle, environmental, and systemic. Significant determinants include speeding, impaired driving, distracted driving (mobile phone use), non-use of helmets or seatbelts, and overloading of vehicles [21-23]. Structural factors such as poorly maintained roads, lack of pedestrian crossings, and inadequate traffic signage further heighten risks [24,25].

In Bangladesh, observational studies show that helmet use among motorcyclists is below 40%, while seatbelt compliance is under 10% [26,27]. Speeding and overtaking are common causes of crashes, especially on highways linking Dhaka, Sylhet, and Chattogram [28]. Additionally, public transport operators often work under unsafe schedules and poor vehicle conditions, increasing crash risk.

Interventions and global response

Global best practices emphasize the 'Safe System Approach', focusing on designing road environments that minimize the consequences of human error [29]. Proven interventions include stricter speed enforcement, alcohol limits, use of protective equipment, and post-crash trauma care systems. Sweden's 'Vision Zero' and the Netherlands' Sustainable Safety models demonstrate how integrated planning and political commitment can drastically reduce fatalities [30]. WHO's Global Plan for the Decade of Action for Road Safety (2021–2030) urges member states to reduce deaths by 50% by implementing evidence-based measures and strengthening intersectoral collaboration [31,32].

Bangladesh context

Bangladesh has made progress in recognizing RTIs as a national health issue, yet implementation of safety measures remains inadequate. The BRTA and National Road Safety Council oversee safety initiatives, but overlapping jurisdictions and limited enforcement capacity impede effectiveness [7,33,34]. The National Road Safety Strategic Action Plan (2021–2025) includes goals for safer roads, enhanced driver training, and trauma care systems; however, funding remains limited [35].

Urban centers such as Dhaka, Sylhet, and Chattogram face severe congestion, poor pedestrian infrastructure, and unsafe crossings. Several studies have highlighted fundamental contributing factors to RTIs in Bangladesh, including speeding and overtaking, driver fatigue (particularly among truck drivers), improper driving habits, and use of bright headlights that blind oncoming drivers. Limited knowledge of traffic rules is also significant, with nearly one-third of RTI victims unaware of driving regulations [9,36-40], and rule violations ranking as the second leading cause of RTIs. Furthermore, a WHO assessment (2023) reported that only 35% of road crash victims receive pre-hospital care within the first hour, a critical factor for survival [41]. Civil society organizations like the Nirapad Sarak Chai Foundation advocate for awareness and legislative reforms, but systemic coordination gaps persist [42].

Financing gaps and policy challenges

Less than 1% of Bangladesh's transport budget is currently devoted to road safety initiatives [24]. This underinvestment limits data systems, enforcement technology, and post-crash medical infrastructure. Additionally, the lack of a centralized accident surveillance system leads to inconsistent and underreported data. Donor-supported projects by WHO, GRSF, and Bloomberg Philanthropies have demonstrated success in pilot areas but require national scaling [9,24,43,44].

This table presents a summary of strategic findings from global and Bangladesh studies on road traffic injuries, including epidemiology, risk factors, policy insights, and interventions.

Domains	Findings
Global epidemiology	RTIs are a top ten cause of death; Africa (26.6/100,000) and Southeast Asia (20.7/100,000) have highest rates; deaths plateaued 2010–2020; pedestrians and two-wheel users ~65% of fatalities in Asia.
Economic burden	Global losses >US$1.8T/year; LMICs lose 1–5% GDP; Bangladesh loses 2–3% GDP (~US$4.8B), affecting working-age men most.
Risk factors	Human: speeding, impaired/distracted driving, non-use of helmets/seatbelts, overloading. Vehicle: poor maintenance, unsafe schedules. Environmental: poor roads, lack of crossings/ signage. Systemic: weak enforcement, limited emergency care. Helmet use <40%, seatbelt <10% in Bangladesh.
Interventions	Safe System Approach; speed enforcement, alcohol limits, protective equipment, trauma care; examples: Sweden's Vision Zero, Netherlands' Sustainable Safety; WHO target: 50% death reduction.
Bangladesh context	Recognized as health issue but implementation limited; key contributors: speeding, overtaking, driver fatigue, poor traffic rule knowledge; only 35% receive pre-hospital care within first hour.
Policy & funding	<1% of transport budget for road safety; no centralized accident surveillance; pilot donor projects need national scaling.
Recommendations	Multi-sectoral systemic approach needed: urban planning, trauma registry, emergency response, ITS, traffic education, strict enforcement; investment return up to 20:1.

Discussion

Road traffic injuries represent a complex intersection of public health, governance, and development policy. Their persistence despite decades of global advocacy underscores the need for systemic change rather than piecemeal interventions. Globally, the shift toward the 'Safe System Approach' highlights that human error is inevitable but fatalities are preventable if systems are designed to absorb those errors without resulting in death or serious injury [44-46].

In Bangladesh, despite recognition of RTIs as a major public health threat, road safety is still largely viewed as a transport issue rather than a multi-sectoral challenge. Fragmented institutional responsibility split among the Ministry of Road Transport, BRTA, police, and health services has hampered coordination. Moreover, weak enforcement, limited public education, and inadequate trauma care have compounded the burden [47-50].

The country's rapid urbanization presents both opportunities and challenges. As cities expand, integrating road safety into urban planning can yield significant benefits. For instance, developing dedicated pedestrian lanes, enforcing vehicle fitness regulations, and introducing smart traffic management systems can reduce accident rates. The use of intelligent transport systems (ITS), as implemented in countries like India and Vietnam, can improve monitoring and accountability.

Bangladesh also requires a national trauma registry and emergency response network, supported by trained paramedics and modern ambulatory services. Integration of road safety education into school curricula can foster long-term behavioral change. Furthermore, enforcing stricter penalties for speeding, unlicensed driving, and overloading must become national priorities.

The economic rationale for investment in road safety is strong: the World Bank estimates that every dollar spent on road safety interventions yields up to US$20 in economic returns through avoided deaths, productivity preservation, and healthcare savings [24]. Therefore, investing in safety is not merely a moral obligation but a fiscal imperative.

Conclusion

Road traffic injuries (RTIs) continue to pose a high, preventable burden in low- and middle-income countries, including Bangladesh. Achieving the target of halving deaths by 2030 will require significant improvements in data collection, road infrastructure, legislation, trauma care, and coordinated multi-sectoral action. Priorities include protecting vulnerable road users, managing speed, enforcing traffic laws, and strengthening post-crash care. Given the substantial economic and developmental impact, RTIs must be central to health and transport policies. Effective reduction of fatalities in Bangladesh will depend on shifting from reactive measures to a systemic approach that integrates engineering, enforcement, education, and emergency response, aligned with the UN Decade of Action for Road Safety (2021–2030) and supported by sustained domestic investment.

Conflicts of Interest: The authors declare no conflict of interest.

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