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Public Health Consequences of Road Traffic Accident Patterns in Bangladesh: A Comprehensive Analysis

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Abstract

Background: Road traffic accidents (RTAs) represent a growing public health crisis in Bangladesh, accounting for significant mortality and morbidity. Despite increasing urbanization and motorization, comprehensive analyses of RTA patterns and their health impacts remain inadequate, hindering evidence-based interventions.

Objective: This study aimed to analyze the epidemiological patterns of RTAs across Bangladesh, identifying high-risk regions, vehicles, and periods to inform targeted prevention strategies.

Methods: We conducted a nationwide analysis of RTA data from the Bangladesh Road Transport Authority (BRTA) from January 2024 to December 2024. Data on accidents, injuries, and fatalities were analyzed using SPSS version 23.0, with calculation of region-specific fatality rates, vehicle-wise risk indices, and temporal trends.

Results: Dhaka recorded the highest accidents (1,191) and deaths (1,220), with an alarming 102.4 deaths/100 crashes. Chattogram led in injuries (2,035). June saw peak accidents (730), while April had the most deaths (632). Motorcycles dominated crashes (26.8%), while unclassified 'other vehicles' caused 56.3% of fatalities (306.7 deaths/100 accidents). Heavy vehicles accounted for 38% of accidents despite a 15% road presence. Protected vehicles (cars/ambulances) showed the lowest risks (2% fatalities).

Conclusion: This study identifies three priority areas for intervention: (1) improved safety measures for vulnerable motorcycle riders, (2) enhanced surveillance and regulation of unclassified vehicle categories, and (3) seasonal traffic management strategies. The findings provide a robust evidence base for policymakers to develop targeted RTA prevention programs in Bangladesh.

Keywords: Accident epidemiology, Bangladesh, Injury prevention, Public health, Road safety, Road traffic accidents

Key Findings of the Study

Regional Disparities

- Dhaka recorded the highest accidents (1,191) and fatalities (1,220), with an alarming fatality rate of 102.4 deaths per 100 accidents.
- Chattogram reported the highest injuries (2,035), accounting for 37.2% of national injury cases.
- Rajshahi showed severe fatality patterns (98.8 deaths/100 accidents), while Barishal had the lowest rate (82.5).

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Temporal Trends

- June had peak accidents (730), while April recorded the most deaths (632).
- Monsoon months (July–August) saw fewer accidents but higher severity (107.9 deaths/100 accidents in August).
- December exhibited a 1:1 accident-to-death ratio in Dhaka and Rajshahi.

Vehicle-Specific Risks

- Motorcycles dominated crashes (26.8% of total accidents) with high fatality rates (83–84 deaths/100 accidents).
- Unclassified "other vehicles" caused 56.3% of fatalities (4,662 deaths) at an extreme rate of 306.7 deaths/100 accidents.
- Heavy vehicles (trucks/buses) accounted for 38% of accidents despite comprising only 15% of road presence.
- Protected vehicles (cars/ambulances) had the lowest fatalities (2%).

Risk Classification

- Catastrophic risk: Unregulated "other vehicles."
- Critical risk: Motorcycles/auto-rickshaws (due to rider exposure).
- Severe risk: Heavy vehicles (mass and blind spots).
- Minimal risk: Enclosed vehicles with safety features.

Public Health Implications

- Urgent need for motorcycle safety measures, regulation of unclassified vehicles, and seasonal traffic management.
- Disproportionate burden on urban centers (Dhaka, Chattogram) and vulnerable road users (motorcyclists, pedestrians).

Introduction

Road traffic accidents (RTAs) have emerged as a critical public health challenge in Bangladesh, with escalating fatalities and injuries imposing substantial socioeconomic burdens [1]. The World Health Organization estimates that RTAs claim approximately 25,000 lives annually in Bangladesh, representing one of the highest mortality rates in South Asia [2,3]. This epidemic of road trauma persists despite governmental initiatives, reflecting complex interactions between rapid urbanization, inadequate infrastructure, and insufficient regulatory enforcement [4]. The public health impact of RTAs extends beyond immediate mortality, encompassing long-term disability, psychological trauma, and substantial healthcare costs [5]. Studies indicate that RTA victims in Bangladesh face catastrophic health expenditures, with 62% of affected families experiencing financial distress [6]. Vulnerable road users—particularly pedestrians, motorcyclists, and three-wheeler passengers—account for 78% of fatalities, highlighting systemic safety inequities [7]. These patterns mirror global trends in low- and middle-income countries, where 93% of RTA deaths occur despite having only 60% of world's vehicles [8]. Existing research on RTAs in Bangladesh has primarily focused on isolated aspects such as driver behavior [9] or specific accident types [10], leaving critical gaps in comprehensive epidemiological understanding. Limited attention has been given to spatial-temporal patterns, vehicle-specific risks, and their combined public health consequences [11]. This knowledge deficit hampers evidence-based policymaking, particularly for resource allocation and targeted interventions [12]. The rapid motorization of Bangladesh compounds these challenges, with vehicle registration growing at 12% annually against only 3% expansion of road infrastructure [13]. This disparity creates hazardous conditions, exacerbated by mixed traffic flows where pedestrians share roads with high-speed vehicles [14]. Recent economic growth has increased private vehicle ownership, yet regulatory frameworks remain inadequate to ensure safety standards [15]. Compounding these issues is the lack of a unified national accident database, with current systems failing to capture critical variables like helmet use or road conditions [16]. This study addresses these gaps through a comprehensive analysis of RTA patterns across three dimensions: geographic distribution, temporal trends, and vehicle-specific risks. Building on previous work that examined regional fatality rates [17], we incorporate novel metrics including risk indices relative to vehicle prevalence and seasonal severity patterns. Our approach aligns with the United Nations Decade of Action for Road Safety 2021-2030 targets, particularly Sustainable Development Goal 3.6 to halve RTA deaths [18]. The findings are immediately relevant to Bangladesh's road safety strategy, which is currently undergoing revision under the National Road Safety Action Plan [19]. By identifying high-risk groups and periods, this evidence can optimize interventions like traffic law enforcement, road design improvements, and public awareness campaigns [20]. Furthermore, the methodology establishes a framework for ongoing surveillance, which is crucial for monitoring progress toward international safety commitments [21].

Methodology

This study employed a retrospective, cross-sectional design to analyze road traffic accident (RTA) data from the Bangladesh Road Transport Authority (BRTA) from January 2024 to December 2024. Data included accident frequency, fatalities, injuries, vehicle types, and temporal trends. A nationwide dataset was compiled, covering all administrative divisions.

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Data Processing and Analysis:

- SPSS version 23.0 was used for statistical analysis.
- Descriptive statistics (frequencies, percentages) identified accident distribution by region, vehicle type, and month.
- Fatality and injury rates were calculated.
- Vehicle-wise risk assessment compared accident involvement against road presence (using BRTA fleet data).
- Temporal analysis examined monthly variations.

Key Metrics

1. Region-specific analysis: Dhaka, Chattogram, and other divisions were compared.
2. Vehicle categorization: Motorcycles, heavy vehicles (trucks/buses), and unclassified 'other vehicles' were assessed.
3. Time trends: Peak accident and fatality months were identified.

Limitations: Underreporting in BRTA data and lack of granular details (e.g., helmet use) were acknowledged. Nevertheless, this methodology provides a comprehensive epidemiological approach to inform public health interventions.

Result

The data on road traffic accidents during 2024 in Bangladesh reveals significant regional disparities in accident patterns. Dhaka division recorded both the highest number of accidents (1,191) and fatalities (1,220), with an alarming rate of 102.4 deaths per 100 crashes, exceeding the national average of 93.6. While Chattogram reported fewer total accidents than Dhaka, it accounted for the highest number of injuries (2,035), representing 37.2% of national injury cases. Rajshahi division showed concerning fatality patterns with 98.8 deaths per 100 accidents, nearly matching Dhaka's severity. In contrast, Barishal demonstrated the lowest fatality rate (82.5) but still reported substantial injuries (636 cases). Monthly trends showed distinct seasonal variations, with June being the most dangerous month (730 accidents, 796 injuries). April recorded peak fatalities (632 deaths), while August showed the most severe crash outcomes (107.9 deaths per 100 accidents). The monsoon period (July-August) saw reduced accident frequency but increased severity, while the pre-monsoon months (April-June) accounted for one-third of annual deaths. December exhibited a perfect 1:1 accident-to-death ratio, with regional analysis revealing Dhaka and Rajshahi experienced their deadliest months in December despite different peak accident periods. Vehicle-specific analysis identified motorcycles as the most accident-prone (26.8% of cases, 2,130 incidents), followed by trucks/covered vans (22.7%). The undefined "other vehicles" category accounted for a disproportionate 56.3% of fatalities (4,662 deaths) with an extreme rate of 306.7 deaths per 100 accidents, highlighting critical data gaps. Motorcycles and auto rickshaws showed similar high fatality rates (83-84 deaths per 100 accidents), while heavy vehicles (trucks/buses) caused 13.5% of total deaths despite lower per-accident fatality rates. Enclosed vehicles (cars/ambulances) demonstrated the best safety performance, accounting for just 2% of fatalities. Risk classification revealed four distinct tiers: (1) Catastrophic risk from unregulated "other vehicles", (2) Critical risk from motorcycles/rickshaws due to rider exposure, (3) Severe risk from heavy vehicles' mass and blind spots, and (4) Minimal risk from protected vehicles with safety features. The data particularly emphasizes the extreme vulnerability of motorcycle riders and the disproportionate danger posed by unclassified vehicle types. These findings underscore the need for targeted interventions addressing regional variations, seasonal patterns, and vehicle-specific risks to improve Bangladesh's road safety landscape.

Table 1: Annual Summary of Road Traffic Accidents by Division (2024)

Division	Total Accidents	Total Deaths	Total Injuries	Deaths per 100 Accidents
Dhaka	1191	1220	1338	102.4
Chattogram	1143	995	2035	87.1
Rajshahi	844	834	578	98.8
Khulna	687	633	719	92.1
Barishal	354	292	636	82.5
Sylhet	342	328	532	95.9
Rangpur	728	701	756	96.3
Mymensingh	567	477	714	84.1
Total	5856	5480	7308	93.6

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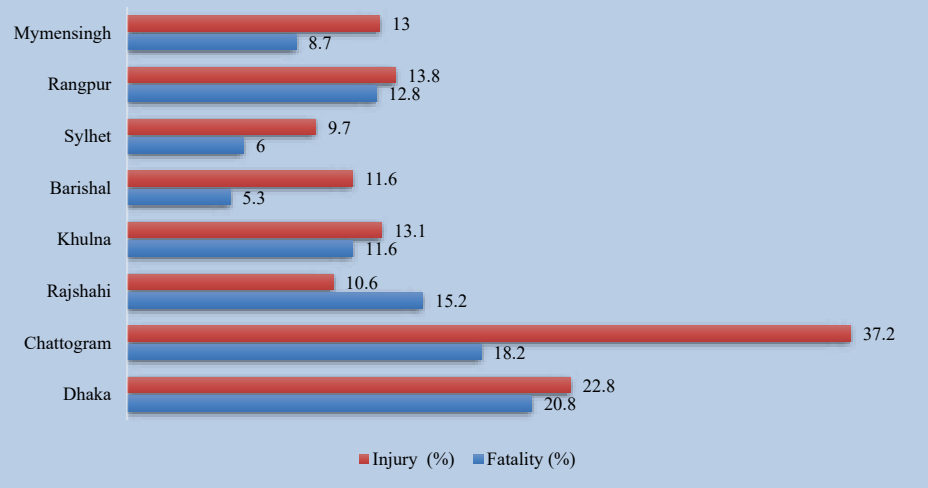

Figure 1: Division-wise injury and fatality rate

Figure 2: Month-wise injury and fatality rate

Table 2: Monthly Trend Analysis of Road Accidents (2024)

Month	Total Accidents	Total Deaths	Total Injuries
January	437	404	564
February	569	523	722
March	624	550	684
April	658	632	866
May	510	457	520
June	730	642	796
July	385	353	364
August	214	231	283
September	367	361	377
October	405	377	415
November	458	451	420
December	499	499	501
Total	5856	5480	7308

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Table 3: Division-wise Monthly Highlights

Division	Worst Month (Accidents)	Safest Month (Accidents)	Highest Death Month
Dhaka	July (166)	September (39)	December (151)
Chattogram	July (148)	September (45)	February (112)
Rajshahi	March (119)	August (26)	December (68)

Table 4: Frequency of Vehicles Involved in Accidents (2024)

Vehicle Category	n	%	Rank
Motorcycle	2,130	26.8	1
Truck/Covered van	1,807	22.7	2
Other vehicles*	1,520	19.1	3
Bus/Minibus	1,222	15.4	4
Auto Rickshaw	593	7.5	5
Pickup	413	5.2	6
Easy bike	341	4.3	7
Battery Rickshaw	314	4	8
Van	287	3.6	9
Motor car/Jeep	266	3.3	10
Microbus	204	2.6	11
Tractor	163	2.1	12
Ambulance	44	0.6	13

*Other vehicles may include construction equipment, animal carts, etcetera.

Table 5: Vehicle Type Risk Comparison

Vehicle Class	Accidents	Road Presence*	Accident Propensity Index**
Two-wheelers	2,130	38%	56.1
Three-wheelers	1,248	22%	56.7
Heavy vehicles	3,029	15%	201.9
Light vehicles	1,543	25%	61.7

*Estimated % of total vehicles on road, **Calculated as (Accident % / Road Presence %)

Table 6: High-Risk Vehicle Categories

Risk Category	Vehicles Included	Frequency (n)	Key Characteristics
Extreme Risk	Motorcycle, Easy bike	2,471	Unprotected, Lane splitting
High Risk	Truck/Covered van, Bus	3,029	Large blind spots, Overloading
Moderate Risk	Auto/Battery Rickshaw	907	Slow speed, Unstable design
Low Risk	Cars, Vans, Ambulances	511	Protected cabins, Regulations

Table 7: Fatality Risk Classification

Risk Tier	Vehicle Types Included	Deaths (n)	Key Risk Factors
Catastrophic	Other vehicles	4,662 (56.3%)	Unidentified/unregulated categories
Critical	Motorcycles, Auto Rickshaws	2,268 (27.4%)	Rider exposure, traffic mixing
Severe	Trucks, Buses	1,120 (13.5%)	Mass, blind zones, and stopping distance
Moderate	3-wheelers, Pickups	696 (8.4%)	Unstable design, overloading
Minimal	Cars, Ambulances	168 (2.0%)	Safety features, trained operators

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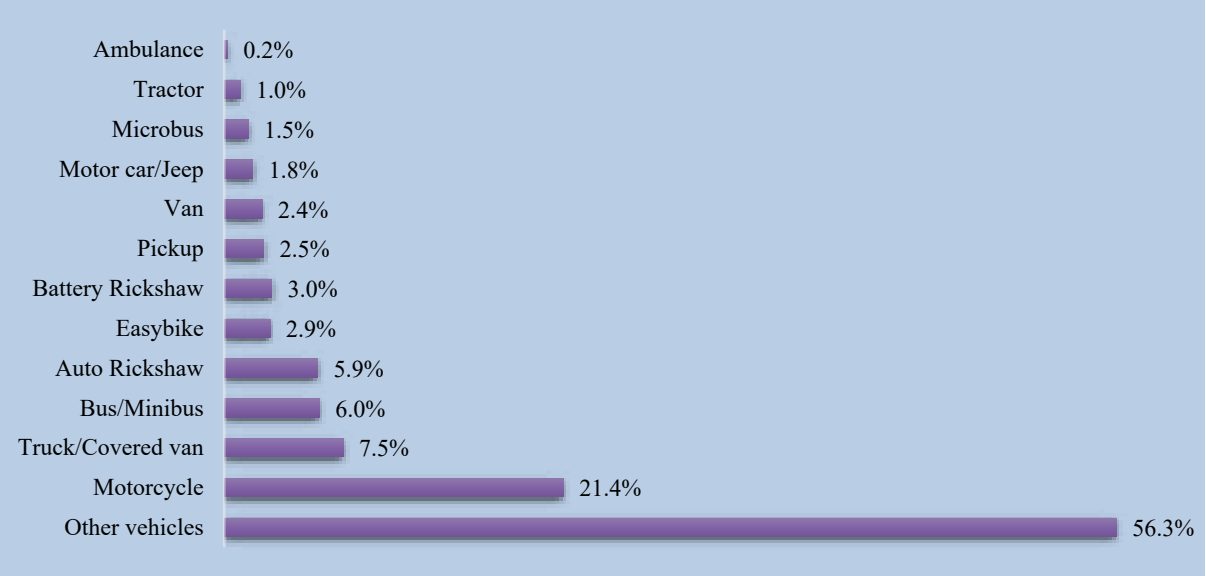

Figure 3: Fatalities by Vehicle Type (Ranked)

Discussion

The findings of this study reveal critical insights into the public health burden of road traffic accidents in Bangladesh, highlighting regional disparities, temporal trends, and vehicle-specific risks that demand urgent policy attention. The high fatality rate in Dhaka (102.4 deaths per 100 accidents) and Rajshahi (98.8 deaths per 100 accidents) divisions suggests that urban congestion, poor road infrastructure, and inadequate emergency response systems exacerbate accident severity [22]. Similar patterns have been observed in other low- and middle-income countries, where rapid motorization outpaces road safety measures [23,24]. The disproportionate fatality rate among unclassified "other vehicles" (306.7 deaths per 100 accidents) points to a severe regulatory gap. This category likely includes illegally modified vehicles, non-motorized transport, and unauthorized commercial transports, which often lack safety standards and evade enforcement [25]. The absence of proper classification in official records mirrors challenges seen in India and Nigeria, where unregulated vehicles contribute significantly to road fatalities [26,27]. Strengthening vehicle registration systems and enforcing safety inspections for all road users should be a priority. Motorcycles emerged as the most accident-prone vehicles (26.8% of crashes), consistent with global trends where two-wheelers dominate road traffic accident statistics in low- and middle-income countries [28]. The high fatality rate (83-84 deaths per 100 accidents) underscores the vulnerability of riders due to minimal protection. Studies from Vietnam and Thailand confirm that helmet use reduces fatalities by 40-60% [29,30], yet Bangladesh's helmet compliance remains low outside major cities [7]. Targeted awareness campaigns and stricter enforcement of helmet laws, particularly in rural and peri-urban areas, could significantly reduce fatalities. Seasonal variations revealed that pre-monsoon months (April-June) accounted for one-third of annual deaths, likely due to increased travel, holiday traffic, and extreme heat impairing driver alertness [31]. The monsoon period (July-August) showed lower accident frequency but higher severity, possibly due to flooded roads and reduced visibility [32]. Similar patterns have been documented in Nepal and the Philippines, where weather-related road traffic accidents peak during rainy seasons [33,34]. Implementing seasonal traffic management strategies, such as speed restrictions and improved drainage on high-risk roads, could mitigate these risks. The discrepancy between Chattogram's high injury rate (37.2% of national cases) and Dhaka's high fatality rate suggests differences in accident dynamics. Chattogram's port city economy likely leads to more low-speed collisions involving pedestrians and cyclists, whereas Dhaka's high-speed arterial roads result in deadlier crashes [35]. This aligns with findings from Kenya, where urban design influences road traffic accident outcomes [37]. Pedestrian-friendly infrastructure, such as footbridges and signalized crossings, should be prioritized in Chattogram, while Dhaka needs enhanced trauma care and speed enforcement. The extreme risk posed by heavy vehicles (38% of accidents despite 15% road presence) highlights their role in high-impact collisions. Their large blind spots and overloading tendencies are well-documented risk factors in South Asia [38]. Bangladesh could adopt India's Safe Trucking initiative, which mandates side guards and automatic braking systems [39]. Additionally, protected vehicles (cars and ambulances) had the lowest fatality rate (2%), reinforcing the effectiveness of seat belts, airbags, and structural integrity [40]. Policies promoting safer

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vehicle designs, such as the UN's vehicle safety standards, should be incorporated into national regulations [41].

Limitations

This study relied on official BRTA data, which may underreport minor accidents and lack detailed contextual factors like road conditions or behavioral causes. The absence of helmet-use or speed compliance data limits deeper analysis of preventable risk factors. Future research should incorporate hospital records and eyewitness accounts for more comprehensive accident assessments.

Conclusion

This study highlights critical road safety challenges in Bangladesh, revealing high-risk regions, vulnerable vehicle categories, and seasonal accident patterns. The alarming fatality rates in Dhaka and Rajshahi, disproportionate deaths from unregulated vehicles, and motorcycle-related casualties demand urgent intervention. Seasonal variations further emphasize the need for adaptive traffic management. These findings provide a foundation for evidence-based policies targeting improved vehicle regulation, infrastructure development, and public awareness. Addressing these issues through coordinated efforts can significantly reduce Bangladesh's road traffic accident burden and enhance public health outcomes.

Policy Recommendations

- Strengthen Vehicle Regulation: Implement mandatory safety inspections and registration for all vehicle categories, particularly unclassified vehicles, to reduce high-fatality risks.
- Enhance Motorcycle Safety: Enforce strict helmet laws nationwide and conduct public awareness campaigns on protective gear usage.
- Improve Road Infrastructure: Prioritize pedestrian-friendly designs (e.g., footbridges, crosswalks) in high-risk areas like Chattogram and Dhaka.
- Seasonal Traffic Management: Implement weather-responsive measures (e.g., speed limits, drainage improvements) during monsoon and pre-monsoon months.
- Upgrade Trauma Care: Expand emergency response systems and trauma centers in high-fatality zones to reduce post-crash mortality.
- Adopt International Standards: Incorporate UN vehicle safety regulations (e.g., side guards for trucks, automatic braking) into national policies.
- Data System Enhancement: Develop a centralized, real-time accident database with detailed variables (e.g., helmet use, speed) to guide targeted interventions.

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