Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Medicine

Epidemiological Profile and Pattern of Road Traffic Accident Fatalities: A Forensic Study from a Tertiary Medical Center in Bangladesh

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DOI: https://doi.org/10.36347/sjams.2025.v13i07.002 | **Received:** 17.05.2025 | **Accepted:** 21.06.2025 | **Published:** 01.07.2025

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Abstract **Original Research Article**

***Background*:** Road traffic accidents (RTAs) are a significant public health issue in Bangladesh, contributing to a substantial number of fatalities and disabilities each year. The forensic investigation of these deaths offers critical insights into their epidemiological patterns, which can help shape preventive strategies. ***Aim*:** This study aims to analyze the epidemiological characteristics and injury patterns of fatal RTA cases brought for autopsy to Rangpur Medical College, Rangpur, Bangladesh over a two-year period. ***Methods*:** This retrospective cross-sectional study was conducted at the Department of Forensic Medicine & Toxicology, Rangpur Medical College, Rangpur, Bangladesh, from January 2023 to December 2024. A total of 100 cases of RTA fatalities subjected to postmortem examination were included. Data were extracted from autopsy reports, police records, and hospital files. Variables studied included age, sex, time and site of accident, type of vehicle involved, nature and distribution of injuries, and cause of death. ***Results*:** The majority of victims were male (82%), with the most affected age group being 21–40 years (56%). Most accidents occurred on highways (62%), predominantly involving motorcycles (38%) and trucks (27%). Head injuries were the most frequent cause of death (64%), followed by polytrauma (21%) and thoracic injuries (10%). Accidents occurred most commonly in the evening hours (5 PM–9 PM) and on weekends. ***Conclusion*:** RTAs in Bangladesh predominantly affect young males, with head injuries being the leading cause of death. The study emphasizes the need for stringent traffic laws, public awareness, and improved emergency care services.

Keywords: Road traffic accident, Epidemiology, Forensic autopsy, Head injury.

INTRODUCTION

Road traffic accidents (RTAs) have emerged as a major global public health issue, accounting for approximately 1.19 million deaths annually and an even greater number of injuries and disabilities worldwide, according to the World Health Organization (WHO) [1]. These accidents are not only a significant cause of mortality but also impose a substantial economic burden on individuals, families, and health systems, particularly in low- and middle-income countries (LMICs) like Bangladesh [2]. In many developing nations, the rapid growth of motorization, coupled with inadequate road safety measures, poor enforcement of traffic regulations, and insufficient infrastructure, has escalated the incidence of RTAs [3].

Bangladesh, a densely populated South Asian country, has been experiencing a steady rise in RTAs over the past two decades. The country's growing urbanization, increased vehicle ownership, and lack of effective traffic law enforcement have contributed significantly to the problem [4]. According to data from the Bangladesh Road Transport Authority (BRTA), more than 5,000 people die annually due to road traffic crashes, with thousands more sustaining severe injuries or permanent disabilities [5]. Despite these alarming statistics, comprehensive studies focusing on the epidemiological and forensic characteristics of RTA-related fatalities remain limited in the country, particularly in its northern regions.

The pattern of injuries and the demographics of victims involved in RTAs can vary widely depending on the region, road conditions, traffic volume, and types of

vehicles in use. Males, especially those in the productive age group of 20–40 years, are disproportionately affected due to their increased mobility, occupational exposure, and risk-taking behavior [6]. In Bangladesh, motorcycles and three-wheelers are widely used as primary modes of transportation, especially in semi-urban and rural areas, making riders and passengers vulnerable to fatal injuries. Furthermore, pedestrians, particularly children and the elderly, often fall victim to high-speed collisions due to the absence of pedestrian-friendly infrastructure [7].

From a forensic medicine perspective, the autopsy findings in RTA fatalities are crucial for understanding the mechanism and cause of death, identifying patterns of injury, and differentiating accidental injuries from homicidal or suicidal trauma. Head injuries are frequently the most common and fatal consequence in road traffic deaths, especially in motorcyclists and pedestrians [8]. Thoracoabdominal injuries, spinal injuries, and long bone fractures with associated hemorrhage also contribute significantly to mortality. Detailed forensic analysis aids in the accurate certification of death, supports legal proceedings, and provides invaluable data for public health planning [9].

Northern Bangladesh, including the Rangpur division, is particularly susceptible to road traffic crashes due to its network of national highways, high-density vehicle movement, and insufficient traffic regulation enforcement. Despite being a major regional center, Rangpur lacks robust trauma care systems and emergency response facilities, often resulting in delayed medical intervention and increased fatality rates. Moreover, the absence of centralized injury surveillance systems and underreporting further obscure the actual burden of road traffic deaths in this region [10].

There is a clear need to generate reliable, autopsy-based epidemiological data from tertiary centers such as Rangpur Medical College and Hospital, which receives a substantial number of medico-legal cases from across Northern Bangladesh. Such data are essential for identifying the high-risk groups, prevalent injury patterns, time and location of crashes, and types of vehicles involved in fatal incidents. These insights can significantly inform road safety interventions, including policy development, public health campaigns, infrastructure enhancement, and improvements in emergency trauma care.

The current study aims to fill this gap by retrospectively analyzing 100 cases of RTA-related deaths subjected to forensic autopsy at Rangpur Medical College over a two-year period (January 2023 to December 2024). The objectives are to assess the demographic distribution, temporal and spatial trends, and anatomical injury profiles among victims. The study also seeks to identify the most common vehicles involved in fatal crashes and the predominant causes of death.

By highlighting these epidemiological and forensic patterns, this research intends to contribute evidence-based knowledge for stakeholders, including policymakers, public health officials, traffic authorities, and emergency service providers. Ultimately, the study aspires to support the implementation of preventive strategies that can reduce the incidence and severity of road traffic fatalities in Bangladesh.

MATERIALS AND METHODS

Study Design

This was a retrospective, descriptive, cross-sectional study conducted at the department of Forensic Medicine & Toxicology, Rangpur Medical College, Rangpur which serves as a major referral center for this region in Bangladesh.

Study Period and Sample Size

The study was conducted over a two-year period from January 2023 to December 2024. A total of 100 confirmed RTA fatalities brought for postmortem examination during this time were included.

Inclusion and Exclusion Criteria

- **Inclusion criteria:**
  - All cases of death due to road traffic accidents confirmed through police reports and autopsy findings.
  - Victims whose complete data were available.

- **Exclusion criteria:**
  - Deaths due to other causes or suspicious deaths not confirmed as RTA.
  - Incomplete or missing documentation.

Data Collection

Data were extracted from autopsy reports, police investigation files, hospital records, and next-of-kin interviews where applicable. A structured proforma was used to collect information on:

- Demographics: age, sex, occupation
- Circumstances: site and time of accident, type of vehicle involved, role of the victim (driver, passenger, pedestrian)
- Nature and site of injuries
- Cause of death

Data Analysis

The collected data were analyzed using Microsoft Excel and SPSS software. Descriptive statistics were used to represent findings as frequencies, percentages, and graphs.

RESULTS

A total of 100 road traffic accident (RTA) fatality cases were included in this retrospective study

conducted at Rangpur Medical College Hospital from January 2023 to December 2024. The findings are presented below.

Table 1: Age and Sex Distribution of Victims (n = 100)

Age Group (Years)	Male (n=82)	Female (n=18)	Total (%)
0–20	8	4	12 (12%)
21–40	48	8	56 (56%)
41–60	18	4	22 (22%)
>60	8	2	10 (10%)
Total	**82**	**18**	**100**

Among the 100 RTA fatalities, 82 were male and 18 were female. The most affected age group was 21–40 years, accounting for 56% of total deaths, with 48 males and 8 females. This highlights that young adult males are particularly vulnerable due to increased mobility and exposure to traffic risks.

Age and Sex Distribution

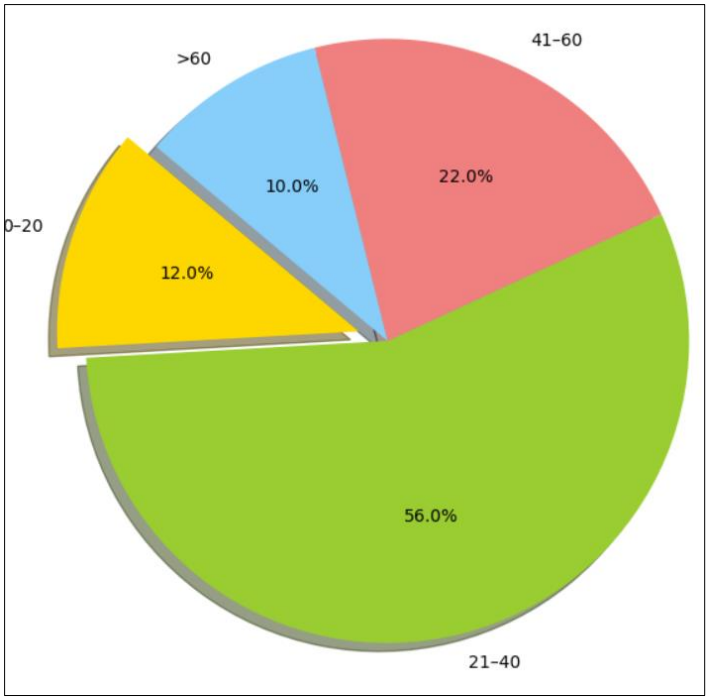

Chart I: Age and Sex distribution of victim

This chart visually represents the age distribution of victims, highlighting the proportional breakdown across different age groups. It provides a clear comparison, emphasizing the dominant age range impacted in the study.

Table 2: Type of Vehicle Involved in Fatal Accidents

Vehicle Type	Number of Cases	Percentage (%)
Motorcycle	38	38%
Truck/Lorry	27	27%
Bus	18	18%
Rickshaw/CNG	10	10%
Private Car	7	7%
Total	**100**	**100%**

Motorcycles were involved in the highest number of fatal crashes (38 cases, 38%), followed by trucks/lorries (27 cases, 27%) and buses (18 cases, 18%). The high incidence of motorcycle-related deaths reflects their widespread use and inadequate protective measures like helmet use.

Type of Vehicle Involved

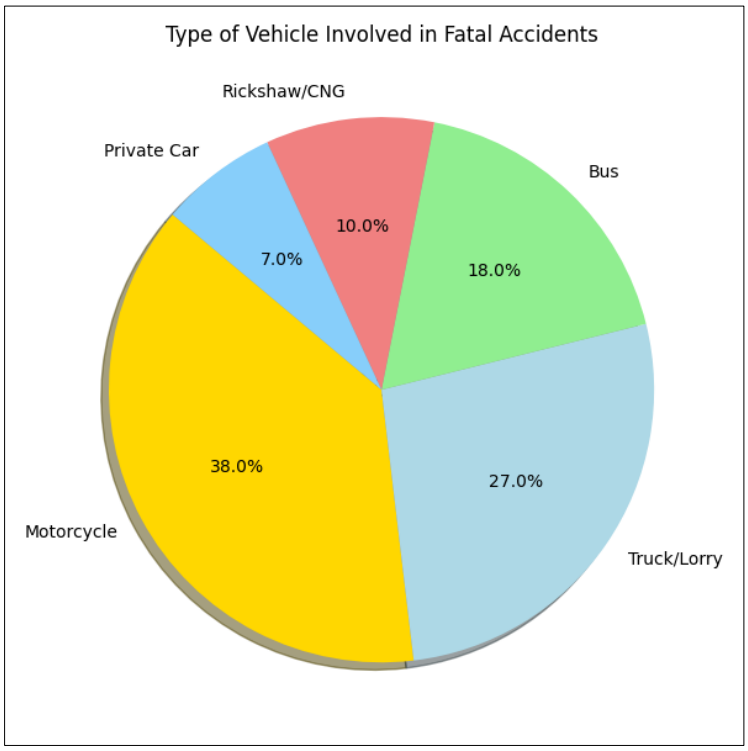

Chart II: Type of Vehicle Involved in Fatal Accidents

This pie chart visually represents the distribution of vehicle types involved in fatal accidents, highlighting motorcycles as the most frequently involved. The chart provides a clear comparison, emphasizing the varying levels of risk associated with different vehicle categories.

Table 3: Role of Victims in the Accident

Role of Victim	Number of Cases	Percentage (%)
Pedestrian	40	40%
Rider/Driver	36	36%
Passenger	24	24%
Total	**100**	**100%**

Pedestrians constituted the largest group of victims (40%), followed by riders/drivers (36%) and passengers (24%). The high pedestrian fatality rate underscores the lack of safe walkways and crossing infrastructure in Bangladesh.

Table 4: Time of Occurrence of Accidents

Time Interval	Number of Cases	Percentage (%)
Morning (6 AM–12 PM)	18	18%
Afternoon (12–5 PM)	22	22%
Evening (5–9 PM)	41	41%
Night (9 PM–6 AM)	19	19%
Total	**100**	**100%**

Evening hours (5–9 PM) recorded the highest number of fatal accidents (41%), followed by afternoon (22%) and night (19%). The peak in evening accidents may be due to poor visibility, traffic congestion, and commuter rush.

Table 5: Primary Cause of Death Based on Autopsy Findings

Cause of Death	Number of Cases	Percentage (%)
Head Injury (TBI)	64	64%
Polytrauma	21	21%
Thoracic Injury	10	10%
Abdominal Injury	3	3%
Hemorrhage (Limb Fx)	2	2%
Total	**100**	**100%**

Head injury was the leading cause of death in 64 cases (64%), followed by polytrauma (21%) and thoracic injuries (10%). This pattern emphasizes the need for head protection and the critical role of helmet enforcement in preventing fatalities.

DISCUSSION

Road traffic accidents (RTAs) continue to be a critical public health challenge globally, with a disproportionately high burden in low- and middle-income countries, including Bangladesh. This study, conducted in the Forensic Medicine Department at Rangpur Medical College, provides valuable insights into the epidemiological and forensic profile of 100 fatal RTA cases over a two-year period.

The predominance of young adult males (56% of fatalities were in the 21–40-year age group) in this study is consistent with several regional and global studies. Males are more likely to be engaged in high-risk behaviors such as speeding, not wearing helmets or seatbelts, and operating vehicles under fatigue or influence [11]. Similar trends were observed in studies from Dhaka and Chittagong, where the 21–40-year age group represented the majority of RTA victims [12, 13].

Motorcycles were involved in the highest number of fatal incidents (38%), followed by heavy vehicles such as trucks and buses. This finding echoes previous reports highlighting motorcycles as one of the riskiest forms of transportation in Bangladesh due to their widespread use, poor road discipline, and lack of helmet use [14]. Furthermore, the absence of designated lanes and inadequate regulation of heavy vehicle movement significantly increases fatal crash risk [15].

Pedestrians accounted for 40% of the deaths in this study, a finding that reaffirms the extreme vulnerability of this group in urban and peri-urban Bangladesh. Previous literature has identified pedestrians, especially children and the elderly, as common victims of road fatalities due to poor pedestrian infrastructure and disregard for traffic rules [16]. In our setting, the lack of overpasses, footpaths, and traffic signals in high-density areas likely contributes to this trend.

The majority of fatal accidents occurred during the evening (41%), aligning with global data showing that RTAs are more common during peak traffic hours and periods of reduced visibility [17]. Factors such as driver fatigue, low lighting, and increased pedestrian and vehicle movement during these hours play a crucial role in increasing risk [18].

From a forensic perspective, head injuries were identified as the leading cause of death, accounting for 64% of cases. This is consistent with prior studies where traumatic brain injuries (TBI) were the most fatal consequence of RTAs, particularly among motorcyclists and pedestrians [19]. The high incidence of head injuries indicates a significant gap in helmet compliance and vehicle safety measures, and calls for stricter enforcement of protective gear use and public awareness.

Polytrauma (21%) and thoracic injuries (10%) were also notable contributors to mortality, highlighting the severity of impact and lack of timely trauma care services in rural and semi-urban areas of northern Bangladesh. A study from India reported similar patterns, emphasizing the importance of rapid transport and availability of emergency care in improving survival outcomes [20].

The findings of this study have several implications. First, targeted interventions such as awareness campaigns focusing on helmet and seatbelt usage, strict regulation of heavy vehicle movement, and the development of pedestrian-friendly infrastructure are urgently needed. Second, law enforcement agencies must prioritize the implementation of traffic rules, particularly during evening hours when accidents peak. Finally, forensic autopsy-based surveillance systems can offer critical, real-time insights into fatal injury patterns and help shape national road safety policies.

CONCLUSION

This forensic study of road traffic accident fatalities over a two-year period in Forensic Medicine Department at Rangpur Medical College, Rangpur provides a comprehensive overview of the demographic, temporal, and injury-related characteristics of victims. The data reveals that young adult males, particularly those aged 21–40 years, are the most affected group. Motorcycles and heavy vehicles are the leading contributors to fatal accidents, while pedestrians represent the most vulnerable group. Evening hours accounted for the highest frequency of deaths, and traumatic brain injury was the predominant cause of fatality.

The findings highlight critical gaps in road safety infrastructure, public awareness, and enforcement of traffic laws. Immediate attention to helmet and seatbelt usage, traffic regulation, and trauma care systems is essential to reduce the burden of road traffic fatalities in northern Bangladesh.

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