International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Demographic Determinants and Injury Patterns in Fatal Road Traffic Incidents: An Autopsy Based Study from Northern Region of Bengal

Deepmalya Sengupta[1], Tanay Mohanta[2], Shobhan Roy[3]

[1] Assistant Professor, Department of FMT, NRS Medical College, West Bengal.
[2] Associate Professor, Department of FMT, MJN Medical College & Hospital, West Bengal.
[3] Associate Professor, Department of FMT, Deben Mahata Government Medical College & Hospital, West Bengal.

OPEN ACCESS

Corresponding Author:

Dr. Deepmalya Sengupta
Assistant Professor, Department of FMT, NRS Medical College, West Bengal.

Received: 26-10-2025
Accepted: 22-11-2025
Available online: 30-11-2025

ABSTRACT

Background: Road traffic incidents remain a major cause of preventable mortality in India, with disproportionate impact on regions with mixed traffic patterns, limited road safety infrastructure and high two-wheeler usage. Autopsy-based studies provide crucial insights into fatal injury patterns that are often under-reported in clinical datasets.
Objectives: To analyze the socio-demographic characteristics, incident profile and detailed external and internal injury patterns in fatal road traffic incidence cases examined at MJN Medical College and Hospital, Cooch Behar.
Materials and Methods: This observational cross-sectional study included all confirmed fatal road traffic incidence cases autopsied over a period of one year. Cases with incomplete history, advanced decomposition or significant postmortem artifacts were excluded. Data were collected from inquest reports, hospital records and detailed postmortem findings. Statistical analysis was performed using descriptive methods.
Results: Of 1326 autopsies, 188 (14.2%) were due to road traffic incidents. Males constituted 91.5% of victims, with the 21–40-year age group most affected. Two-wheeler users formed the largest victim category (47.3%), followed by pedestrians (29.2%). Most deaths (76.6%) occurred within 24 hours of the incident. Abrasions (23.4%) and lacerations (21.4%) were the predominant external injuries. The head–face region was involved in 25.8% of cases, while intracranial hemorrhages (20.8%) and skull/maxillofacial fractures (25%) were the most common internal injuries. Extremity trauma (54.1%) and multiple fractures (19.2%) reflected high-energy impacts.
Conclusion: These findings underscore the need for strengthened enforcement of helmet and road safety measures, improved infrastructure for vulnerable road users and enhanced pre-hospital trauma care systems.

Keywords: *Road traffic incidents, autopsy, injury patterns, head injury, two-wheeler riders, pedestrians, forensic pathology.*

INTRODUCTION

Road traffic incidents represent a global public health crisis and remain one of the leading causes of mortality and morbidity worldwide. According to the World Health Organization (WHO), approximately 1.3 million people are killed in road crashes each year and by 2030, road traffic injuries are projected to become the seventh leading cause of death globally. [1] This burden falls disproportionately on low- and middle-income countries, which account for over 90% of global road fatalities despite possessing only about half of the world's vehicles. [2]

In India, the situation is particularly alarming. The country records over 150,000 deaths annually due to road traffic crashes—one of the highest fatality counts reported globally. [3] This translates to an average of 474 lives lost every day, or nearly 20 deaths every hour. [3] Regions like West Bengal, situated in the eastern part of the country, contribute substantially

to this toll, driven by factors such as dense traffic, mixed road users, inadequate road safety infrastructure and inconsistent enforcement of traffic regulations.

Understanding the demographic determinants and the precise patterns of injury in fatal road traffic incidents is essential for developing region-specific prevention strategies and optimizing trauma care protocols. Medico-legal autopsy provides the most definitive data on the extent of trauma, which is often crucial for informing policy. [4] Despite multiple studies from various parts of India, there is a paucity of published data from the northern region of West Bengal, particularly the Cooch Behar district—an area marked by heterogeneous road conditions, a high proportion of two-wheeler users, and significant interstate vehicular movement.

This study was thus conducted to systematically analyze the demographic profile, incident characteristics, and detailed autopsy findings - including both external and internal injury patterns among fatal road traffic incident victims examined at MJN Medical College and Hospital, Cooch Behar. By providing a comprehensive assessment of injury distribution, survival period, and victim categories, this study aims to contribute region-specific evidence to enhance both preventive strategies and forensic evaluation in road traffic fatalities.

AIMS AND OBJECTIVES

1) To analyze the socio-demographic profile of fatal road traffic incident victims, including age, sex, religion, and domicile.
2) To evaluate incident-related factors including type of vehicle involved, role/position of victim, time of occurrence, and survival period
3) To document and interpret the pattern, type, and regional distribution of injuries—both external and internal—including fractures, intracranial hemorrhages, and involvement of major body regions.

MATERIALS AND METHODS

This observational, cross-sectional study was conducted in the Department of Forensic Medicine and Toxicology, MJN Medical College and Hospital, Cooch Behar over the period of 1 year from 1st April 2023 to 31st March 2024. All medico-legal autopsies performed during this time were screened and cases where death was attributable to a road traffic incidents were included.

Inclusion criteria comprised all confirmed fatal road traffic incident cases—brought dead or hospital deaths—with adequate supportive history from police inquest papers, medical documents or next of kin. Decomposed, charred or mutilated bodies; cases with incomplete or unreliable history and those with extensive postmortem artifacts that interfered with injury assessment were excluded.

Data were collected using a pre-designed proforma. Information was obtained from inquest reports, bed-head tickets, injury reports and statements from relatives or accompanying police personnel. Variables recorded included demographic details (age, sex, religion, residence), circumstances of the incident (time of occurrence, vehicles involved, survival period) and detailed external and internal injury findings.

A meticulous post-mortem examination was performed to record detailed autopsy findings. Injuries were recorded based on type (e.g., abrasion, laceration, fracture) and location (e.g., head-face, upper limbs, lower limbs). Data were entered into tabular form and analyzed using descriptive statistics.

Ethical approval was obtained from the Institutional Ethics Committee and confidentiality of medico-legal records was strictly maintained.

RESULTS

This study analyzed 188 fatal road traffic incident cases autopsied at a MJNMCH, Cooch Bhear tertiary, representing 14.2% of all autopsies (1326 cases) conducted during the 1-year study period.

Males overwhelmingly dominated the cases (91.5%), with females comprising only 8.5%. The most affected age groups were 21–30 and 31–40 years, each accounting for 40 cases (42.6% collectively). Among males, the peak incidence occurred in the 31–40 years (22.1%) and 21–30 years (20.3%) groups, while for females, the 21–30 years group constituted the highest proportion (31.3%) (Table 1).

Most victims were Hindus (82.45%), followed by Muslims (16%) (Table 2). A slightly higher proportion of incidents involved individuals from rural areas (54.3%) compared to urban areas (45.75%) as seen in Table 3. Table 4 shows that the highest number of fatal incidents occurred during the evening and night hours, specifically 18:00 - 24:00 Hrs. (70 cases, 37.2%) and 12:00 - 18:00 Hrs. (69 cases, 36.7%). These two periods collectively accounted for over 70% of all cases.

Based on the findings in Table 5, two-wheeler users formed the largest victim category (47.3%), with riders alone accounting for nearly 40% of all deaths. Pedestrians constituted the second-largest group (29.2%), whereas fatalities among three- and four-wheeler occupants were comparatively lower, likely due to better vehicle protection.

Most victims (76.6%) died within 24 hours of the incident; 79 subjects succumbed within the first day, while 65 subjects were brought dead. Only 23.4% survived beyond 24 hours (Table 6).

Abrasions (23.4%) were the most common external injury, followed by lacerations (21.4%). Intracranial hemorrhages were present in 20.8% of victims, and fractures/dislocations in 20.4% (Table 7). Among victims who sustained bony injuries, the skull and maxillofacial region was the most commonly affected site, comprising 25.0% of all fractures. Multiple fractures were present in 19.2% of cases, reflecting a high incidence of polytrauma. Lower limb (10.1%) and rib (9.0%) fractures were also frequently encountered. (Table 8)

Table 9 shows that injuries were predominantly located in the extremities and the head–face region. Upper limbs (27.3%) and lower limbs (26.8%) injuries together comprised over half of all cases, followed closely by head and face injuries (25.8%). Chest (9.7%) and abdominal (8.2%) trauma formed a smaller but relevant proportion.

Table 1: Age and Sex wise distribution of Road Traffic Incident Cases.

Age Group	Female	Percentage	Male	Percentage	Total
0-10 years	1	6.3%	7	4.1%	**8**
11-20 years	2	12.5%	34	19.8%	**36**
21-30 years	5	31.3%	35	20.3%	**40**
31-40 years	2	12.5%	38	22.1%	**40**
41-50 years	1	6.3%	25	14.5%	**26**
51-60 years	4	25.0%	19	11%	**23**
> 60 years	1	6.3%	14	8.1%	**15**
Total	**16**	**100.0%**	**172**	**100.0%**	**188**

Table 2: Religion wise distribution of Road Traffic Incident Cases.

Religion	Cases (Percentages)
Hindu	155 (82.4%)
Muslim	30 (16%)
Christian	2 (1.1%)
Other/Unspecified	1 (0.5%)
Total	**188 (100%)**

Table 3: Domicile wise distribution of Road Traffic Incident Cases.

Domicile	Cases (Percentages)
Rural	102 (54.3%)
Urban	86 (45.75%)
Total	**188 (100%)**

Table 4: Distribution of Cases based on time of incidence.

Time of Incidence	Cases (Percentages)
00:00 - 06:00 Hrs.	10 (5.3%)
06:00 - 12:00 Hrs.	39 (20.7%)
12:00 - 18:00 Hrs.	69 (36.7%)
18:00 - 24:00 Hrs.	70 (37.2%)
Total	**188 (100%)**

Table 5: Distribution of Cases based on type of vehicle and position of victim.

Type of Vehicle and Position of Victim	Cases (Percentages)
Pedestrian	55 (29.2%)
Two-wheeler rider	75 (39.9%)
Two-wheeler pillion	14 (7.4%)
Three-wheeler driver	8 (4.3%)
Passenger	4 (2.1%)
Four-wheeler driver	8 (4.3%)
Passenger	24 (12.8%)
Total	**188 (100%)**

Table 6: Distribution of Cases based on period of survivability.

Period of Survivability	Cases (Percentages)
Brought dead	65 (34.6%)
Within 24 hours	79 (42%)
After 24 hours of treatment	44 (23.4%)
Total	**188 (100%)**

Table 7: Distribution of Cases based on type of injury sustained.

Type of Injury	Cases (Percentages)
Abrasion	147 (23.4%)
Bruise	63 (10%)
Laceration	133 (21.4%)
Fracture/dislocation	128 (20.4%)
Intracranial Hemorrhages	131 (20.8%)
Ruptured viscus	27 (4.3%)

Table 8: Types of fractures sustained.

Region of Fracture	Cases (Percentages)
Skull and maxillofacial	47 (25%)
Upper limb	6 (3.2%)
Lower limb	19 (10.1%)
Ribs	17 (9%)
Pelvic	2 (1.1%)
Vertebral	1 (0.5%)
Multiple	36 (19.2%)
No fracture	60 (31.9%)

Table 9: Distribution of Cases based on site of injury.

Site of Injury	Cases (Percentages)
Head and face	107 (25.8%)
Neck	5 (1.2%)
Upper limb	113 (27.3%)
Lower limb	111 (26.8%)
Chest	40 (9.7%)
Abdomen	34 (8.2%)
Pelvic	4 (1%)

DISCUSSION

The present study analyzed 188 fatal road traffic incident cases brought for medicolegal autopsy at MJN Medical College and Hospital, Cooch Behar. Our findings are largely consistent with national trends, yet they highlight specific vulnerabilities pertinent to local road safety and trauma management strategies.

A pronounced male predominance (91.5%) was observed in the present study, aligning with the trend consistently reported all across India, where male victims account for 80–95% of road traffic fatalities.[5-7] This disparity is generally attributed to greater male exposure to vehicular environments due to occupational mobility, longer commuting distances and a higher propensity for risk-taking behaviors such as speeding, non-compliance with safety regulations and increased nighttime travel.

The majority of victims belonged to the 21–40-year age group (42.6%). This concentration among young adults parallels the findings of Sharma et al. [4], Shareef ML and Khan MT [5] and Saxena et al. [7]. In contrast, Ambade et al. [8] reported a more differentiated age-risk pattern: two-wheeler fatalities peaked at 21–30 years, four-wheeler occupants at 41–50 years and pedestrians at 51–60 years. The predominance of deaths among individuals in their most economically productive years underscores the substantial socio-economic implications of road traffic fatalities.

Most victims hailed from rural areas (54.3%), a trend consistent with reports from eastern and northeastern India, where rapid motorization has outpaced road infrastructure improvement. [4,9] Rural roads in Cooch Behar district often lack proper illumination, lane demarcation and pedestrian-safe zones, increasing crash risk.

The temporal distribution of incidents showed a clear peak in the late afternoon and evening. Similar evening predominance has been reported by Sharma et al. [4] and Manoranjan B et al. [10]. In contrast, Singh et al. [11] and Solagberu et al. [12]

documented morning peaks, likely linked to school and office commute traffic. The pronounced evening–night peak in our region may be attributed to local traffic patterns, reduced visibility, driver fatigue and increased pedestrian activity.

Two-wheeler users constituted the largest victim group with riders alone accounting for nearly 40% of fatalities, aligning with observations by Ambade et al. [8] and Manoranjan B et al. [10]. This pattern likely reflects poor helmet compliance, widespread use of low-engine motorcycles and the absence of segregated lanes. Pedestrian deaths were also considerable (29.2%), pointing to infrastructural gaps in mixed-traffic settings. Unlike our findings, studies from Dhaka [13] and Chandigarh [14] report pedestrians as the predominant victims, likely due to higher foot traffic in dense urban environments. International literature [15], however, often identifies motor vehicle occupants as the main fatality group, underscoring contrasts between high-income countries—where enclosed-vehicle crashes dominate—and India, where systemic issues in road design, enforcement and traffic management disproportionately impact two-wheelers and pedestrians.

Most victims (76.6%) died within the first 24 hours, with 34.6% brought dead, a pattern consistent with previous autopsy studies. [4,10] Such rapid mortality underscores the severity of primary impact injuries and indicates significant gaps in pre-hospital care and early emergency response during the critical "Golden Hour" of trauma management. [16]

Abrasions (23.4%) and lacerations (21.4%) were the most common external injuries, consistent with previous autopsy findings [4]. Fatal trauma predominantly involved the head–face region (25.8%) and the high burden of severe head injury—evidenced by intracranial hemorrhages (20.8%) and skull/maxillofacial fractures (25%)—confirms head trauma as the leading cause of death, particularly among two-wheeler users and pedestrians. This pattern aligns with global and Indian literature [4.8] and mirrors the craniofacial fracture distribution reported by Manoranjan et al. [10]. Frequent extremity injuries (54.1%) and multiple fractures (19.2%) further indicate high-energy polytrauma characteristic of motorcycle crashes and pedestrian impacts. Our predominance of skull and facial fractures differs from studies by Rudresh [17] and Gupta et al. [18], where rib and vertebral fractures were more common—likely reflecting differences in crash dynamics and vehicle types. Additionally, while head injuries were the leading fatal pattern in our cohort, other authors have observed abdominal organ trauma as the primary cause of death [19], underscoring variability in protective gear use, impact mechanics and crash circumstances. Torso-dominant trauma described in Western literature [20] typically involves restrained four-wheeler occupants, who constitute a smaller proportion of victims in our region.

Taken together, these findings highlight persistent gaps in road-user safety and trauma system preparedness, underscoring the need for targeted preventive, infrastructural and emergency care improvements in the region.

CONCLUSION

Road traffic incidents continue to pose a major public health and socio-economic challenge in India, particularly in regions with dense mixed traffic, varied road conditions and limited enforcement of safety regulations. Autopsy-based analysis remains crucial for understanding the true burden of trauma, identifying vulnerable road-user groups and providing objective evidence to guide preventive and legal measures. This study contributes region-specific data from the Cooch Behar district in West Bengal, an area where published literature remains limited despite high accident load and diverse traffic patterns.

Strengthening road safety requires a multi-sectoral approach. Priority should be given to enforcing protective measures (e.g., helmet and seatbelt use), improving pedestrian infrastructure, regulating vehicular speed and enhancing visibility and traffic monitoring during high-risk hours. Public education on safe road behavior, responsible driving practices and prompt first-aid response can significantly mitigate injury severity. Equally important is the establishment of well-equipped trauma care systems, efficient referral pathways and trained emergency responders to improve survival outcomes.

Continued surveillance through systematic autopsy studies and regional databases is essential for shaping evidence-based policies, tailoring interventions to local needs and reducing the preventable mortality associated with road traffic incidents. The insights generated through such forensic research can support both public health initiatives and the justice system in addressing this persistent threat.

Conflict of Interest: Authors declare that there is no conflict of interest.
Financial Disclosure: None.

REFERENCES

1. World Health Organization. Global status report on road safety 2018. Geneva: World Health Organization; 2018.
2. Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, et al. The World report on road traffic injury prevention. Geneva: World Health Organization; 2004.
3. Ministry of Road Transport and Highways, Government of India. Road accidents in India 2019. New Delhi: Transport Research Wing; 2020.
4. Sharma RK, Das H, Choudhury A. Retrospective Analysis of Pattern of Injuries in Road Traffic Accidents: An Autopsy Based Study. Int J Adv Med Sci. 2016;1(2):57–64.

5. Shareef ML, Khan MT. Pattern of injuries from road traffic accidents at tertiary care teaching hospital. MedPulse Int J Forensic Med. 2019;12(3):1–4.
6. Gautam NS, Kain V, Chaudhary A, Kumar S, Jain S, Bano T. Epidemiological Correlates of Road Traffic Injured Victims Admitted at Tertiary Care Center in Western Uttar Pradesh, India. Int J Acad Med Pharm. 2024;6(1):1461–6.
7. Saxena D, Juglan S, Sane MR, Varun A. A study of pattern of injuries sustained in fatal road traffic accidents: An original research. Int J Health Sci. 2022;6(S2):6795–800.
8. Ambade VN, Kunal BS, Manu S. Pattern of injuries in different types of victims of road traffic accident in central India: A comparative study. J Forensic Sci Res. 2021; 5:7-11.
9. Mohanty MK, Arun M, Singh SB. Road traffic fatalities in rural Odisha: An epidemiological overview. *Medico-Legal Update.* 2017;17(2):78–83.
10. Manoranjan B, Somashekhar SP, Ravindra SH, Vishal VK, Prasanna SJ, Pratima R, Dhivagar K. A study of injury pattern and mode of accident of fatal injuries in RTA cases admitted in a tertiary care centre: 3-year retrospective study. *J Indian Acad Forensic Med.* 2023;45(2):132–136.
11. Singh A, Bhardwaj A, Pathak R. Epidemiological profile of road traffic accident cases: A retrospective study. Med J Armed Forces India. 2018;74(1):12–15.
12. Solagberu BA, Ofoegbu CKP, Nasir AA, Ogundipe OK, Adekanye AO, Abdur-Rahman LO.Traffic injury patterns in Nigeria: A review of hospital-based studies. *Accident Analysis and Prevention.* 2014; 72:87–92.
13. Ahmed M, Rahman FN. Pattern of injuries among road traffic accident victims in Dhaka. J Bangladesh Coll Phys Surg. 2017;35(2):65–69.
14. Sharma BR, Harish D. Road traffic accidents in Chandigarh: Autopsy study. J Indian Acad Forensic Med. 2001;23(2):72–76.
15. Toro K, Hubay M, Sotonyi P, Keller E. Fatal traffic injuries among pedestrians, bicyclist and motor vehicle occupants. *Forensic Sci Int*. 2005;151(2-3):151-6.
16. Tejpal R, Kumar K, Singh S, Sharma A, Kumar H. Prospective Study on the Pattern and Severity of Injuries in Road Traffic Accidents Brought for Medico-Legal Autopsy. Int J Life Sci Biotechnol Pharm Res. 2025;14(7):1736–40.
17. Rudresh YC. Department of Forensic Medicine and Toxicology, Akash Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka, India. Biomedicine. 2024;44(3):348–356.
18. Gupta S, et al. Patterns of skeletal injuries in fatal RTAs. Int J Med Toxicol Legal Med. 2018;21(1):33–37.
19. Kumar S, Verma AK. Pattern of internal injuries in fatal road traffic accidents. J Clin Diagn Res. 2016;10(5): HC01–HC04.
20. Greve MW, Zink BJ. Pathophysiology of traumatic brain injury. J Trauma. 2009; 62:S1–S9.