Section: Miscellaneous

Original Research Article

EPIDEMIOLOGICAL PROFILE AND INJURY SEVERITY PATTERN AMONG ROAD TRAFFIC ACCIDENT VICTIMS ADMITTED TO A TERTIARY CARE TRAUMA CENTRE IN HARYANA

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ABSTRACT

Background: Road Traffic Accidents (RTAs) are a major public health problem worldwide and are associated with significant morbidity, mortality, and socioeconomic burden. Young adults, particularly males and two-wheeler users, are commonly affected. Understanding the epidemiological profile and injury severity pattern among RTA victims is essential for planning preventive and trauma care strategies. The aim is to study the epidemiological profile and injury severity pattern among road traffic accident victims admitted to a tertiary care trauma centre in Haryana.

Materials and Methods: A hospital-based cross-sectional study was conducted among 400 road traffic accident victims admitted to a Trauma Centre attached to Pt. B.D. Sharma PGIMS, Rohtak, Haryana. Data were collected using a pre-designed and pre-tested semi-structured study proforma after obtaining informed written consent and assent. Information regarding socio-demographic characteristics, accident profile, injury pattern, human risk factors, and trauma severity was obtained. Injury severity was assessed using Kampala Trauma Score-2 (KTS-2). Data were analysed using SPSS version 20, and appropriate statistical tests were applied.

Results: The majority of victims belonged to the 21–30 years age group (35.0%) and were males (88.8%). Majority of them were from rural areas (65.7%). Two-wheelers were the most commonly involved vehicles (55.5%), and motorcyclists constituted the commonest group amongst them(28.0%). Longitudinal collisions were the commonest type of accident (59.6%), with most accidents occurring on single straight roads (76.5%). Fractures (84.7%) and multiple injuries (80.5%) were the predominant injury pattern. Moderate injuries accounted for 43.6% of cases, while severe injuries constituted 40.4%. Alcohol intake, non-use of helmets, and driver distraction were associated risk factors.

Conclusion: RTAs predominantly affect young adult males and two-wheeler users. Multiple injuries and fractures were the most common injury patterns, with a high proportion of moderate-to-severe trauma. Strengthening road safety measures, promoting helmet and seatbelt use, and improving emergency trauma care services are essential to reduce the burden of RTAs.

Keywords: Road traffic accidents, trauma severity, Kampala Trauma Score-2, epidemiological profile, injury patterns, two-wheeler accidents, fractures.

INTRODUCTION

Road traffic accidents (RTAs) are a major global public health problem and one of the leading causes of mortality and morbidity worldwide. RTAs involve injuries caused by transportation incidents on roads and highways and frequently result in severe physical, psychological, and socioeconomic consequences. The number of accidents and injuries is rising quickly, and they are becoming major causes of death, especially for people between the ages of 15 and 34.[1] India has one of the highest rates of road traffic fatalities in the world, with the fatality rate being nearly 20 times higher than that of developed countries.[1] According to the Registrar General of India, officially recorded injury-related fatalities represent only a fraction of the actual burden, indicating substantial underreporting. Road traffic injuries contribute significantly to Disability Adjusted Life Years (DALYs), accounting for nearly 17% of total DALY losses in the country.[1]

In India, road transportation is still the most popular form of transportation and is essential to the country's economic progress. Road traffic injuries are among the top causes of hospitalization, disability, and death, placing a heavy burden on our country's healthcare system and economy.[1]

Traffic injuries are acknowledged as a major public health concern on a global scale. According to the World Health Organization (WHO), approximately 1.19 million deaths occur annually due to road traffic accidents, corresponding to nearly 15 deaths per 100,000 population. RTAs remain the leading cause of death among children and young adults aged 5–29 years.[2] Nearly 92% of road traffic fatalities worldwide occur in low- and middle-income nations, where the cost is disproportionately greater. The male-to-female fatality ratio is around 3:1, meaning that males are more commonly affected than women. Along with death, RTAs cause long-term impairments, decreased productivity, psychological distress, and financial losses that account for around 3% of the GDP of most nations.[3]

In India, road traffic accidents continue to rise at an alarming rate. According to the Ministry of Road Transport and Highways, a total of 4,61,312 road accidents were reported during 2022, causing 1,68,491 deaths and injuries to more than 4,43,366 individuals.[4] Compared to the previous year, accidents increased by 11.9%, fatalities by 9.4%, and injuries by 15.3%. These figures translate to approximately 1,264 accidents and 462 deaths every day in the country. Fatal accidents constituted 33.8% of all reported accidents in 2022. Such statistics highlight the urgent need for effective preventive measures and strengthened trauma care services.[4]

An occurrence involving at least one moving vehicle on a public route that causes one or more people to be injured or killed is referred to as a road traffic accident.[3] Several factors contribute to the occurrence and severity of RTAs. Over-speeding, drinking alcohol while driving, driving carelessly, not using seat belts and helmets, bad road conditions, dangerous infrastructure, distracted driving from cell phone use, and growing traffic congestion are all significant risk factors.[5]

Driving under the influence of alcohol or psychoactive substances further increases the likelihood of serious and fatal accidents. Similarly, non-use of helmets and seat belts significantly increases the risk of severe injuries and mortality. While seat belt use lowers the risk of mortality among front-seat passengers by 40–50%, proper helmet use can reduce the risk of death by over 40% and serious head injury by over 70%.[6]

Numerous research carried out over India have emphasized the injury patterns and epidemiological traits connected to RTAs. According to Raghavan et al., the majority of RTA casualties were men between the ages of 20 and 39, and the majority of incidents were on highways.[7,8] According to Sharma et al., two-wheeler participation and self-fall or skid incidents were quite common among traffic injuries.[9] Khare et al. showed that the majority of casualties were two-wheeler riders, and the most frequent mechanism of damage was head-on crashes.[10] Salam et al. also noted that there were more male victims in the 21–30 age range, and that the most often injured body parts were the head and face.[11]

The most susceptible demographics impacted by traffic accidents are young adult males, especially motorcyclists and pedestrians, according to prior research.[12] Additional research has shown that important contributing variables include speeding, alcohol consumption, bad roads, dim illumination, and not wearing a helmet.[13] The mechanism of the accident, the use of safety precautions, and the accessibility of prompt trauma treatment all affect the severity of injuries. In many parts of India, particularly Haryana, there is still a lack of epidemiological data and insufficient documentation of injury severity pattern and related causes, despite the rising incidence of traffic injuries.[14,15] Planning successful preventative measures, enhancing trauma care services, and lowering morbidity and mortality related to road traffic injuries all depend on an understanding of the epidemiological profile and injury severity among RTA victims. So the current study was conducted in order to identify the sociodemographic profile and risk factors, and to assess the injury pattern, and severity of injuries among road traffic accident victims admitted to a tertiary care trauma centre in Haryana.

Aim and Objectives

Aim: To study the epidemiological profile and injury severity patterns among road traffic accident victims admitted to a tertiary care trauma centre in Haryana.

Objectives

1. To assess the pattern of injuries among the study subjects

2. To identify the socio-demographic variables and other risk factors associated with road traffic accidents.
3. To assess the severity of injuries and factors associated with it.

MATERIALS AND METHODS

Study Design: This was a hospital-based cross-sectional study.

Study Area: The study was conducted at the Dhanwantari Apex Trauma Centre of Pt. B.D. Sharma PGIMS, Rohtak, Haryana, which is one of the premier referral trauma centres in the state.

Study Period: The study was conducted over a period of approximately one year from the commencement of the study which was Jan 2024 to Dec 2024.

Study Population: The study population included road traffic accident victims admitted to the trauma centre. In cases where victims were unable to respond, information was obtained from attendants.

Inclusion Criteria

Patients admitted to the trauma centre.

Patients or attendants willing to give written informed consent and assent(in case of minors)

Exclusion Criteria

Victims brought dead to the hospital.

Critically injured unconscious patients without attendants to provide consent.

Sample Size: The sample size was calculated using the formula:

$n=(Z_{(1-\alpha/2)})^2 pq┤/L^2$

Considering the prevalence of severely injured patients as 30.6% and allowable error as 15%, the calculated sample size was 387. A total of 400 study participants were included in the study.

Data Collection: Patients admitted overnight to the trauma centre were selected by random sampling. Approximately 5–6 patients were selected per day, and data collection was conducted twice weekly on rotating days. Information was collected using a pre-designed, pre-tested, semi-structured questionnaire after obtaining informed consent.

Study Tools: Data regarding socio-demographic profile, accident characteristics, injury pattern, and risk factors were collected using a pre-tested, pre-designed semi-structured study proforma. Kampala Trauma Score-2 (KTS-2) was used to assess injury severity. Socioeconomic status was assessed using the Modified B.G. Prasad Scale (2022).

Data Analysis: Data were entered into Microsoft Excel and analysed using SPSS version 20. Appropriate statistical tests were applied, wherever necessary.

Ethical Consideration: Permission from the Institutional Ethics Committee of Pt. B.D. Sharma PGIMS, Rohtak, was obtained (No.BREC/24/359) before commencement of the study. Assent (>7yrs) and written informed consent was obtained from all adult study participants (parents/guardians in case of minors) or their attendants, and confidentiality was maintained throughout the study.

RESULTS

Table 1: Socio-demographic Profile of Study Participants (n=400)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (Years)	≤10	9	2.3
	11–20	34	8.5
	21–30	140	35.0
	31–40	96	24.0
	41–50	82	20.5
	51–60	34	8.5
	>60	5	1.3
Gender	Male	355	88.8
	Female	45	11.2
Residence	Rural	263	65.7
	Urban	137	34.3
Education	Illiterate	73	18.3
	Literate	327	81.7

[Table 1] presents the socio-demographic profile of the study participants. More than one-third of the road traffic accident victims belonged to the age group of 21–30 years, (35.0%; n=140), followed by the 31–40 years (24.0%; n=96), and the 41–50 years (20.5%; n=82). Children <10yrs constituted 2.3% (n=9), while participants aged 11–20yrs and 51–60 years each constituted 8.5% (n=34). With just 1.3% (n=5) of the instances, those over 60 were the least affected age group. Majority of the RTA victims were males (88.8%; n=355). Around 2/3rd (65.7%; n=263) of the participants were from rural region. In terms of educational status, 81.7% (n=327) of study participants were literate, whereas 18.3% (n=73) were illiterate.

Table 2: Distribution of study participants according to Road user and Vehicle type (n=400)

Variable	Category	Frequency (n)	Percentage (%)
Type of Road User	Motorcyclist	112	28.0
	Driver	90	22.5

	Pillion Rider	77	19.2
	Pedestrian	63	15.8
	Passengers	29	7.2
	Bicycle User	18	4.5
	Not Known	11	2.8
Type of Vehicle Involved	Two-wheeler	222	55.5
	Four-wheeler	137	34.3
	Three-wheeler	41	10.2

[Table 2] shows that motorcyclists made up the largest group of road users, making up 28.0% (n=112) followed by 4-wheeeler drivers (22.5%, n = 90) and pillion riders (19.2%, n = 77) came next. Of the study participants, 15.8% (n=63) were pedestrians, while 7.2% (n=29) were passengers. In 2.8% (n=11) of the incidents, the kind of road user was unknown, and 4.5% (n=18) were cyclists. Two-wheelers were the most often involved vehicle, making up 55.5% (n=222) of the total. Around 1/3rd (34.3%; n=137) of them included 4-wheelers, whereas 10.2% (n=41) involved 3-wheelers.

Table 3: Distribution of study participants as per Accident Characteristics (n=400)

Variable	Category	Frequency (n)	Percentage (%)
Type of Accident	Longitudinal collision	239	59.6
	Run-off collision	64	16.0
	Side collision	31	7.7
	Fall from moving vehicle	28	7.1
	Rear-end collision	14	3.5
	Roll over	14	3.5
	Others	10	2.5
Site of Accident	Single straight road	306	76.5
	T-junction	41	10.2
	Y-junction	30	7.5
	4-way intersection	23	5.8
Time of Occurrence	6 am–2 pm	106	26.5
	2 pm–10 pm	162	40.5
	10 pm–6 am	132	33.0

[Table 3] depicts that longitudinal collisions were the most common (59.6%;n=239). Run-off collisions constituted 16.0% (n=64), followed by side collisions at 7.7% (n=31). Rear-end accidents and rollovers each contributed 3.5% (n=14), while falls from moving vehicles accounted for 7.1% (n=28). In terms of the accident site, single straight roads accounted for 76.5% (n=306) while T-junctions made up 10.2% (n=41), Y-junctions 7.5% (n=30), and 4-way intersections 5.8% (n=23). About 40% (n=162) of the incidents took place between 2 and 10 p.m. while 33.0% (n=132) of accidents happened between 10 p.m. and 6 a.m., while 26.5% (n=106) happened between 6 a.m. and 2 p.m.

Table 4: Pattern of Injury and Severity (n=400)

Variable	Category	Frequency (n)	Percentage (%)
Pattern of Injury	Fracture	339	84.7
	Laceration	247	61.7
	Bruise	166	41.5
	Crushed injury	160	40.0
	Dislocation	125	31.2
	Cuts	13	3.2
Site of Injury	Multiple injuries	322	80.5
	Lower limb	46	11.5
	Upper limb	20	5.0
	Chest	4	1.0
	Head	4	1.0
	Abdomen	2	0.5
	Neck	2	0.5
Severity of Injury (KTS-2)	Mild	64	16.0
	Moderate	175	43.6
	Severe	161	40.4

[Table 4] shows that fractures were the most common injury affecting 84.7% (n=339) of cases. Lacerations were observed among 61.7% (n=247), while bruises and crushed injuries in 41.5% (n=166) and 40.0% (n=160) of cases, respectively. Cuts were the least frequent injury type, seen in just 3.2% (n=13) of individuals, whereas dislocations accounted for 31.2% (n=125). In terms of the location of injury, 80.5% (n=322) of the individuals had numerous injuries. 11.5% (n=46) had lower limb injuries, while 5.0% (n=20) had upper limb injuries. Chest and head injuries made up 1.0% (n=4) of all injuries, whereas neck and belly injuries made up 0.5% (n=2) of all injuries. Moderate injuries accounted for 43.6%

(n=175) of the cases, according to the Kampala Trauma Score-2 (KTS-2) assessment of injury severity. Of the participants, 16.0% (n=64) had mild injuries, whereas 40.4% (n=161) had severe injuries.

Table 5: Distribution of Study Participants According to Human Risk Factors (n=400)

Human Factors	Yes n (%)	No n (%)	Don't Know n (%)
Driver distraction	56 (27.7)	134 (66.3)	12 (6.0)
History of drug intake	25 (9.4)	217 (82.0)	23 (8.6)
Feeling of sleepiness	17 (6.4)	196 (74.0)	51 (19.6)
Stress factor present	40 (15.0)	208 (78.0)	17 (8.0)
Evidence of alcohol intake	36 (13.5)	189 (71.3)	40 (15.2)
Seat belt used*	60 (61.9)	27 (27.9)	10 (10.2)
Helmet used**	78 (41.3)	99 (52.4)	12 (6.3)

[Table 5] depicts the various human risk factors associated with road traffic accidents. Driver distraction was reported in 27.7%, while 66.3% denied distraction and 6.0% were uncertain. A total of 9.4% had a history of drug use, while 6.4% of participants reported feeling sleepy at the time of the accident;15.0% reported having stress issues. A total of 13.5% had evidence of alcohol usage. About 62% of 4-wheeler riders reported using seatbelts. More than half (52.4%) denied using helmet as riders and pillion riders, and 6.3% were unsure about helmet usage.

DISCUSSION

The present study was conducted to assess the epidemiological profile and injury severity pattern among RTA victims admitted to a tertiary care trauma centre in Haryana. The findings provide important insights into the demographic distribution, accident characteristics, injury patterns, and associated risk factors among RTA victims.

According to [Table 1] Most commonly affected group of victims were in the economically productive age range of 21–30 years (35.0%), followed by 31–40 years (24.0%) and 41–50 years (20.5%). The vast majority (88.8%) were males only 11.2% of the casualties. These results are in line with research by Raghavan K et al. and Chhetri et al., who likewise found that young adult men predominated the RTA casualties.[8,16] Young men are more susceptible to traffic injuries because they are more likely to participate in outdoor activities, commute for work, and drive recklessly or at high speeds. The mean age observed in the present study was also comparable to the findings of Khare G et al.[10]

Additionally, the current study showed that the majority of participants were from rural region(65.7%) and were literate (81.7%) [Table 1]. Sharma S, et al. observed similar results, with the majority of participants coming from rural areas. Rural inhabitants are more likely to be RTA victims as they frequently travel large distances on highways and travel along poorly maintained roadways.[9] The majority of literate people might be a reflection of Haryana's rising literacy rate. According to [Table 2], motorcyclists made up the most common group among RTA victims (28.0%), followed by drivers (22.5%) and pillion riders (19.2%). The most often vehicles involved were two-wheelers (55.5%), followed by four-wheelers (34.3%).

These results are similar to those found by Mishra P, et al. and Awasthi, et al., who noted that the most susceptible category was powered two-wheelers.[17,18] This may be due to the growing usage of motorbikes because of their affordability, simplicity of mobility, and fuel economy. However, there is little physical protection that is provided by two-wheelers, which raises the risk of serious injury.

According to [Table 3], longitudinal or head-on collisions accounted for 59.6% of all incidents, with run-off collisions coming in second at 16.0%. Similar findings were observed by Pradhan et al. and Sharma S et al.[5,9] High-speed driving, overtaking, poor lane discipline, and reduced adherence to traffic regulations may explain the predominance of such collisions. Furthermore, the majority of RTAs (76.5%) were on single straight routes, indicating that high vehicular speed and a lack of awareness on straight roads significantly increases the likelihood of accidents. The majority of accidents in the present study occurred between 2-10 PM (40.5%), followed by 10 PM-6 AM (33.0%) [Table 3]. Anand N et al. and Anantharaman V et al. found similar results, reporting greater accident frequency in the evening and at night. RTAs may occur more frequently during these hours due to increased traffic congestion, decreased visibility, driver weariness, and alcohol intake.[19,20]

According to Table 4, fractures accounted for 84.7% of all injuries, followed by lacerations (61.7%), bruises (41.5%), and crushed injuries (40.0%). Similar results were observed by Sharma S et al. and Kalra R et al.[21,22] This may be explained by high-speed impacts and direct trauma during accidents commonly causing fractures. Furthermore, 80.5% of them had multiple injuries, suggesting that they were exposed to significant high-energy trauma.

The majority of injuries (43.6%) were moderate, closely followed by severe injuries (40.4%), according to the Kampala Trauma Score-2 (KTS-2) assessment of injury severity [Table 4]. This result is in contrast to research findings by Temizel S. et al., where the majority of injuries were minor. The higher percentage of moderate-to-severe injuries may be explained by the fact that the present study was carried out at a tertiary care trauma centre, which frequently receives referred severe trauma patients from nearby healthcare facilities.[23]

The frequency of accidents and the severity of injuries were also significantly influenced by human behavioural variables as 13.5% had evidence of alcohol consumption, 27.7% reported distraction while driving, and 15.0% cited stressors [Table 5]. Similar results highlighting the impact of alcohol and behavioural risk factors in RTAs were reported by Sharma S et al. and Mitra S et al.[21,24] Alcohol use increases the risk of accidents by impairing judgment, response time, and motor coordination. Poor attention to safety precautions was also noted in the research. Only 41.3% wore helmets, and 61.9% used seat belts [Table 5]. Anand N et al. and Mishra P et al. reported similar findings.[19,17] The danger of serious trauma, fractures, and brain injuries is greatly increased when helmets and seatbelts are not used. To increase adherence to preventive measures, better enforcement of road safety legislation and awareness campaigns are crucial. Overall, the results of present study highlight the fact that RTAs are linked with considerable morbidity and they mostly impact young and productive age group. The amount and duration of accidents and the severity of injuries they cause are significantly influenced by a number of changeable variables, including drinking alcohol, speeding, not wearing seatbelts and helmets, and insufficient traffic laws. Strengthening road safety measures, promoting safe driving practices, improving emergency trauma care services, and enforcing traffic laws are essential to reduce the burden of RTAs in Haryana and similar settings.

CONCLUSION

The present study provides valuable insights into the epidemiological profile, accident characteristics, injury patterns, and severity among RTA victims admitted to a tertiary care trauma centre in Haryana. According to the study, young adult males in the productive age group were most commonly involved. The majority of vehicles engaged in crashes were two-wheelers, and the most common accident pattern was longitudinal collisions on straight roadways. The majority of patients had moderate-to-severe injuries, with multiple injuries and fractures being the most frequent injuries. The incidence and severity of injuries were greatly influenced by behavioural and environmental risk factors, including alcohol use, driver distraction, speeding, disregard for seatbelt and helmet use, lack of traffic control measures, and poor vehicle conditions. The results show how urgently traffic laws must be strictly enforced, helmet and seatbelt use must be encouraged, road infrastructure must be improved, and emergency trauma care facilities must be strengthened. To lessen the cost of RTAs, public awareness campaigns about safe driving techniques and abstaining from drinking while driving are crucial. Trauma care services need early referral, prompt first assistance, and quick transportation via ambulance services. Road traffic accident-related morbidity and death can be significantly decreased with integrated trauma treatment systems and effective prevention measures.

Limitations of Study

1. The study was hospital-based and conducted in a tertiary care trauma centre; therefore, the findings may not be generalizable to the entire community or other healthcare settings.
2. Only admitted patients were included in the study, which may have excluded minor injuries and victims who died before reaching the hospital.
3. Certain behavioural factors such as alcohol intake, stress, and driver distraction were self-reported and may have been under-reported.
4. The cross-sectional design of the study limits the establishment of causal relationships between risk factors and injury severity.
5. Some confounding variables related to environmental and human factors may not have been completely controlled during analysis.

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