

Factors Associated with Road Traffic Injuries among Adult Patients in Urban India

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Abstract

This community-based analytical cross-sectional study was conducted among 252 patients, 38.5% were aged 19–29 years and 80.2% were males. Most participants were urban residents (65.9%) and educated up to high school (42.8%). Nearly half of accidents occurred at speeds exceeding 60 km/h, and 39.7% reported non-use of safety measures; helmet use was reported by 66.7%. Multiple injuries were more common among patients from middle and lower-middle socioeconomic groups. Substance users showed higher proportions of fractures (30.7%) and multiple injuries (35.7%), whereas soft-tissue injuries predominated among non-users. Young males, particularly two-wheeler users from lower socioeconomic groups, are disproportionately affected by RTAs. Inadequate safety compliance, substance use, and delays in care worsen injury outcomes. Strengthened enforcement of road safety laws, improved pre-hospital care, and targeted preventive interventions for young adults are urgently required. Road traffic injuries in urban India predominantly affect young males, especially two-wheeler users. High-speed driving, poor compliance with helmet and seatbelt use, substance consumption, and mobile phone use significantly increase the risk of severe injuries such as fractures and multiple injuries. Strengthening road safety enforcement, promoting protective behaviours, and improving pre-hospital trauma care are crucial to reducing the burden of road traffic injuries.

Key Message

Road traffic injuries in urban India predominantly affect young males, especially two-wheeler users. High-speed driving, poor compliance with helmet and seatbelt use, substance consumption, and mobile phone use significantly increase the risk of severe injuries such as fractures and multiple injuries. Strengthening road safety enforcement, promoting protective behaviours, and improving pre-hospital trauma care are crucial to reducing the burden of road traffic injuries.

Introduction

Road traffic accidents (RTAs) cause about 1.19 million deaths and 20–50 million injuries globally, with 90% of deaths in low- and middle-income countries. Over half of fatalities involve vulnerable road users, and nearly two-thirds occur among people aged 18–59 years, with a global target to reduce RTA deaths by 50% by 2030 (1). An RTA is defined as a road accident involving at least one moving vehicle (2). In 2023, India reported 4,80,583 accidents, 34.5% fatal; Uttar Pradesh had the highest fatalities (13.7%), mostly due to over-speeding (72.4%) (3). Peak accidents occur 18:00–21:00 hrs (19.9%) (4). Economic costs reach 1–1.5% GNP (5). This study examines injury types and associated factors in RTA patients.

Material and Methods

Study Design and Setting:

A descriptive cross-sectional study was conducted at the Trauma Centre of a tertiary care hospital in Lucknow, from December 2023 to November 2024.

Sample size determination:

Prevalence of road traffic injury 93.21% among road traffic accident patients in India during 2021.^[3]

Sample size was calculated using the following formula:

$$n = \frac{(\sqrt{z_{1-\alpha/2}})^2 \times \sqrt{p \times q}}{\sqrt{d^2}}$$

Daniel WW (1999). Biostatistics: A Foundation for Analysis in the Health Sciences. 7th edition. New York: John Wiley & Sons.

Where, n = sample size,

z = value of normal deviate at confidence interval,

p = prevalence of road traffic injury among road traffic accident patients (**93.21%**).

q = 1-prevalance (**6.79**),

d = absolute error 1 percent

The sample size was calculated to be

Using design effect of 1.5

Finally, **252** patients will be targeted in the study.

Selection of the study participants:

Total 252 participants selected via purposive sampling technique based on Inclusion criteria encompassed all age groups and both sexes involved in RTAs, while exclusion criteria included cases brought dead, medico-legal cases under police investigation, or non-consenting patients after obtaining consent.

Study tool:

Data was collected using a pretested semi-structured questionnaire covering socio-demographic details, patient information, vehicle- and road-related factors, human factors, and injury- and treatment-related factors.

Data collection:

All RTA patients presenting to the emergency or trauma department were approached, informed about the study, assured confidentiality, and written informed consent was taken. Data were collected by the investigator through a questionnaire administered to patients or attendants. Eligible cases were assessed consecutively until the target sample of 252 was achieved.

Data processing and analysis:

Descriptive statistics are presented as frequencies and percentages, with graphs used for visualization. Associations between categorical variables were analyzed using the Chi-Square test in SPSS version 24 (IBM, Chicago, USA). Ethical approval (XXVI-PGTSC-IIA/P2I) was obtained from the Institutional Ethical Committee of King George's Medical University, Lucknow, and written informed consent was secured from all participants.

Results

Table 1. Showed that most RTA cases were males (80.2%), aged 19–29 years (38.5%), from urban areas (65.9%), Hindus (85.3%), and OBC category (56.0%). Over half were married (55.6%) and had education up to high school (42.8%). Most were unskilled/manual workers or in agriculture (38.1%), belonged to joint families (78.2%), and were from socio-economic class III (middle class, 39.7%).

Table 1
Socio Demographic profile and Accident-Related Variables (N = 252):

Socio-demographic Variables	Categories	Frequency	Percentage
Age (In Completed Years)	19–29	97	38.5
	30–39	63	25.0
	40–49	54	21.4
	50–60	38	15.1
Sex	Male	202	80.2
	Female	50	19.8
Residence	Urban	166	65.9
	Rural	86	34.1
Religion	Hindu	215	85.3
	Muslim	26	10.3
	Sikh	6	2.4
	Christian	5	2.0
Categories	General	57	22.6
	OBC	141	56.0
	SC	49	19.4
	ST	5	2.0
Marital status:	Married	140	55.6
	Unmarried	89	35.3
	Other	7/9/7	2.8/3.6/2.8
Education of RTI patients[#]	Illiterate	37	14.7
	Up to High school	108	42.8
	Intermediate and above	107	42.5
Occupation[#]	Skilled manual & above	65	25.8
	Unskilled manual/Agriculture	96	38.1
	Unemployed/Housewife	91	36.1
Type of Family	Joint	197	78.2
	Nuclear	55	21.8
Socioeconomic Status[*]	Upper class	25	9.9
	Upper middle class	38	15.1
	Middle class	100	39.7
	Lower middle class	76	30.2
	Lower class	13	5.2

Figure 1.1 Showed that the highest number of accidents occurred on Saturday 27.8%, followed by Friday 17.9%, a gradual decrease was observed through the weekdays, with the lowest number on Sunday 6.7%. and the majority 35.3%, and **Fig. 1.2** showed that the accidents occurred during the evening to midnight period (6 PM – 12 Midnight), followed by 30.2%, occurred during the afternoon

Table 2. The study showed a significant association between the Socioeconomic Status of participant and type of injury sustained. Most cases of multiple injury were reported among individual belonging to the lower middle class 39.7% and middle class 30.2%. A significant association was also observed between helmet use and injury type, where multiple injuries 79.4%, soft-tissue injuries (51.0%), and fractures 66.7% being more frequent among non-helmet users. Soft tissue injuries (86.3%) were more common in those who did not consume any substance. A significant association of victims using mobile phones had higher occurrences of multiple injury (27.0%) followed by fracture (17.3%) and soft tissue injuries (5.9%), speeds greater than 60 km/h were mostly associated with fractures (65.3%) and multiple injuries (51.6%), soft tissue injuries were primarily reported in cases with moderate (30–60 km/h) and low-speed (< 30 km/h) collisions, drivers experienced the highest share of multiple injuries (60.3%) and fractures (82.7%), whereas pillion riders and passengers were suffering from soft tissue injuries. There were no significant associations between injury type and age groups, gender, education and occupation of the RTA victims.

Table 2

Association Between Age group, Gender, Education, Occupation, Socioeconomic status, safety measures (helmet, seatbelt), Substance take before the accident, use of mobile, use of mobile, speed of vehicle and position of RTA patients with Type of Road Traffic Injuries (N = 252):

Variable	Categories	Outcome								χ^2	P-Value
		Total cases	Multiple injury (n)		Soft tissue (Laceration, Incised Wound)		Fractures				
			No	%	No	%	No	%			
Age Group	19–29	97	57	45.2	15	29.4	25	33.3	7.330	.291	
	30–39	63	27	21.4	13	25.5	23	30.7			
	40–49	54	24	19.0	12	10.9	18	24.0			
	50–60	38	18	14.3	11	21.6	9	12.0			
Gender	Male	202	99	78.6	45	88.2	58	77.3	2.668	.263	
	Female	50	27	21.4	6	11.8	17	22.7			
Education Level	Illiterate	37	19	15.1	5	9.8	13	17.3	2.198	.699	
	Up to High school	108	51	40.5	23	45.1	34	45.3			
	Intermediate and above	107	56	53.5	23	45.1	28	37.3			
Occupation [#]	Skilled manual & above	67	25	19.8	17	33.3	23	30.7	5.065	.281	
	Unskilled manual/ Agriculture	90	48	38.1	18	35.3	25	33.3			
	Unemployed/Housewife	95	53	42.1	16	31.4	27	36.0			
Socioeconomic Status*	Upper class	25	13	10.3	12	23.5	0	0.0	61.47	< .001	
	Upper middle class	38	18	14.3	0	0.0	20	26.7			
	Middle class	100	38	30.2	19	37.3	43	57.3			
	Lower middle class	76	50	39.7	20	39.2	6	8.0			
	Lower class	13	7	5.6	0	0.0	6	8.0			
Helmet Usage	Yes	76	26	20.6	25	49.0	25	33.3	14.398	< .001	
	No	176	100	79.4	26	51.0	50	66.7			
substance take before the accident	Yes	75	45	35.7	7	13.7	23	30.7	115.985	< .001	
	No	177	81	64.3	44	86.3	52	52.7			
Substance Type (n-75)	Alcohol	60	40	31.7	5	9.8	15	20.0	30.360	< .001	
	Bhang	3	3	2.4	0	0.0	0	0.0			
	Others	12	12	9.5	0	0.0	0	0.0			
	None	177	71	56.3	46	90.2	60	80.0			
Mobile Use While Driving	Yes	50	34	27.0	3	5.9	13	17.3	10.58	.005	
	No	202	92	73.0	48	94.1	62	82.7			

Speed Category of vehicle	> 60 km/h	125	65	51.6	11	21.6	49	65.3	98.508	< .001
	30–60 km/h	56	15	11.9	26	51.0	15	20.0		
	< 30 km/h	11	0	0.0	11	21.6	0	0.0		
	do not remember	60	46	36.5	3	5.9	11	14.7		
Position of RTA patient	Driver	164	76	60.3	26	51.0	62	82.7	52.303	< .001
	Pillion Rider	25	13	10.3	12	23.5	0	0.0		
	Passenger	25	12	9.5	13	25.5	0	0.0		
	Pedestrian	38	25	19.8	0	0.0	13	17.3		

Table 3. The study showed a significant association between type of road and type of injury sustained. The majority of multiple injuries **63.5%** and fracture **50.7%** occurred on highways; fractures were most commonly associated with two-wheeler accidents **66.7%**, four-wheelers were predominantly linked to multiple injuries **30.2%**, while soft tissue injuries (**51%**) were frequently seen in "other" vehicle categories, potholes were strongly associated with soft tissue injuries (**49%**), fractures were more likely to occur at sites with speed breakers (10.7%). There was no significant association seen between injury type with road condition and sign board.

Table 3

Association between Road type, Vehicle type, Road Conditions, Sign board, Pothole on road and speed breaker with Type of Road Traffic Injuries (N = 252)

Categories		Outcome								χ^2	P-Value
		Total cases	Multiple injury (n)		Soft tissue (Laceration, Incised Wound)		Fractures				
			No	%	No	%	No	%			
Road Type	Highway	131	80	63.5	13	25.5	38	50.7	30.077	< .001	
	Two-lane Road	64	23	18.3	15	29.4	26	34.7			
	Street Road	25	10	7.9	10	19.6	5	6.7			
	Others	32	13	10.3	13	25.5	6	8.0			
Vehicle Type	Two-wheeler	113	38	30.2	25	49.0	50	66.7	129.386	< .001	
	Three-wheeler	12	0	0.0	0	0.0	12	16.0			
	Four-wheeler	38	38	30.2	0	0.0	0	0.0			
	Pedestrian	38	25	19.6	0	0.0	13	17.3			
	Others	51	25	19.6	26	51.0	0	0.0			
Road Condition	Dry	100	52	41.3	20	39.2	28	37.3	6.881	0.332	
	Wet	118	53	42.1	25	49.0	40	53.3			
	Oil Spilled	2	0	0.0	1	2.0	1	1.3			
	Others	32	21	16.7	5	9.8	6	8.0			
Sign Boards	Yes	80	32	25.4	24	47.1	24	32.0	8.605	.072	
	No	40	20	15.9	6	11.8	14	18.7			
	do not remember	132	74	58.7	21	41.2	37	49.3			
Pothole on road	Yes	25	0	0.0	25	49.0	0	0.0	148.737	< .001	
	No	139	77	61.1	0	0.0	62	82.7			
	Do not remember	88	49	38.9	26	51.0	13	17.3			
Speed breaker	Yes	12	4	3.2	0	0.0	8	10.7	17.453	.002	
	No	141	82	65.1	23	45.1	36	48.0			
	Do not remember	99	40	31.7	28	54.9	31	41.3			

Discussion

This cross-sectional study including 252 road traffic accident (RTA) victims aged more than 18 years admitted to the trauma center at King George's Medical University, Lucknow. The majority of victims were males (80.2%), belonged to the 19–29-year age group (38.5%), resided in urban areas (65.9%), and had education up to the high-school level (42.8%). With regard to

socioeconomic status, most cases belonged to Class III (middle class) (39.7%), followed by Class IV (lower middle class) (30.2%). The lowest proportions were observed in Class I (9.9%) and Class V (5.2%).

These findings are consistent with those reported by **Rajiv Ratan Singh et al. (2023)**^[6], who observed a predominance of males (74.6%) and individuals aged 15–35 years (43.1%). **Afukaar F et al. (2003)**^[7] also reported a higher incidence of RTAs in urban areas (66.8%). Similarly, **Darivemula S et al. (2025)**^[5] found a marked male predominance (77.8%) and reported that most victims belonged to the 21–40-year age group (51.9%). **Bicholkar A et al. (2022)**^[8] reported that young adults were predominantly affected, with the highest proportion in the 30–40-year age group (30.5%), followed by the 20–30-year group (25.9%). **Chauhan A et al. (2014)**^[9] reported a mean age of 32 years, with the 16–30-year age group being most commonly affected (44.6%).

Helmet use was associated with a higher proportion of soft-tissue injuries (49%), whereas non-helmet users sustained a greater proportion of fractures (66.7%) and multiple injuries (79.4%). Similarly, substance users had a higher prevalence of fractures (30.7%) and multiple injuries (35.7%). Mobile phone use at the time of the accident was associated with multiple injuries (27%), fractures (17.3%), and soft-tissue injuries (5.9%).

In the present study, 70.2% of victims denied any substance use prior to the accident, while 29.8% reported consumption of a substance within three hours before the RTA. Alcohol consumption was reported by 10.3% of cases, smoking by 6.3%, and use of other substances by 2.0%. These findings were statistically significant ($p < 0.001$) and comparable to those reported by **Konlan K et al. (2022)**^[10]. **Bazílio G et al. (2022)**^[11] reported a positive blood alcohol concentration in 6.3% of drivers, while **Boniface R et al. (2016)**^[12] and **Chauhan A et al. (2014)**^[9] reported alcohol consumption in 21.7% and 8.6% of victims, respectively.

Regarding behavioural risk factors, nearly half of the accidents (49.6%) involved vehicles traveling at speeds greater than 60 km/h. Only 45.2% of victims reported using safety measures, 66.7% used helmets, and 10.3% had consumed alcohol prior to the accident. Similar observations were made by **Rajiv Ratan Singh et al. (2023)**^{(6) [9]}, who reported low helmet and seatbelt usage. Speeding and alcohol consumption have also been highlighted as major risk factors in earlier studies (**Pathak S et al., 2014**^[13], **Boniface R et al., 2016**^[12]).

In the present study, most victims were drivers (65.1%), followed by pedestrians (15.1%), while pillion riders and passengers accounted for 9.9% each. This association was statistically significant ($p < 0.001$). Similar findings were reported by **Dash D et al. (2019)**^[14], who highlighted the growing contribution of pedestrian and cyclist-related accidents to road traffic fatalities.

More than half of the accidents occurred on highways (52.0%), followed by two-lane roads (25.4%), other roads (12.7%), and street roads (9.9%). These findings are consistent with those of **Gururaj G et al. (2016)**^[15], who reported that nearly 50% of fatal RTIs occurred on national highways. **Chauhan A et al. (2014)**^[9], however, reported a higher proportion of RTIs on municipal and rural roads.

The highest proportion of accidents occurred on Saturdays (27.8%), followed by Fridays (17.9%). A gradual decline in the number of accidents was observed during the remaining weekdays, with the lowest incidence reported on Sundays (6.7%). This association was not statistically significant ($p = 0.147$). Comparable findings were reported by **Chauhan A et al. (2014)**^[9], who observed higher accident frequencies on Tuesdays (19.9%) and Wednesdays (19.5%), with relatively fewer cases during weekends.

Conclusion

This hospital-based cross-sectional study of 252 adult RTA patients highlights a high burden among young urban males from middle socioeconomic groups. Two-wheelers were most involved, with many victims lacking licenses or not using helmets/seatbelts. Alcohol use contributed to injuries. Approximately half of the accidents, involved vehicles traveling at

speeds greater than 60 km/h. Victims using mobile phones had higher occurrences of multiple injury followed by fracture, and soft tissue injuries. Among RTA patients, those who wore helmets had a higher incidence of minor soft tissue injuries, whereas patients without helmets were more likely to sustain multiple injuries and fractures.

Injury patterns were significantly associated with socio-demographics, road conditions, vehicle factors, and safety practices. The findings emphasize the need for stricter road safety enforcement, helmet and seatbelt use, prevention of substance-impaired driving, improved pre-hospital care, and public awareness campaigns to reduce RTA-related morbidity and mortality.

Declarations

Ethical Approval

Ethical approval was obtained from the Institutional Ethics Committee of King George's Medical University, U.P., Lucknow (Approval Ref. No. XXVI-PGTSC-IIA/P21) on 13 February 2025. Written informed consent was obtained from all study participants before enrolment. The study was conducted in accordance with institutional ethical guidelines and the Declaration of Helsinki.

Consent to Publish

Not applicable as no identifiable participant information or images are included in the manuscript.

Conflict of Interest:

None declared.

Funding:

No external funding was received.

Author Contribution

The corresponding author is Dr Saurabh Kashyap and co-other is Dr Anish Khanna, Dr Rajeev Misra and Dr Akshata M A

Data Availability

Deidentified individual participant data that support the findings of this study will be available from the corresponding author upon reasonable request. Access will be provided to qualified researchers for academic and non-commercial purposes in accordance with institutional ethical guidelines.

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Figures

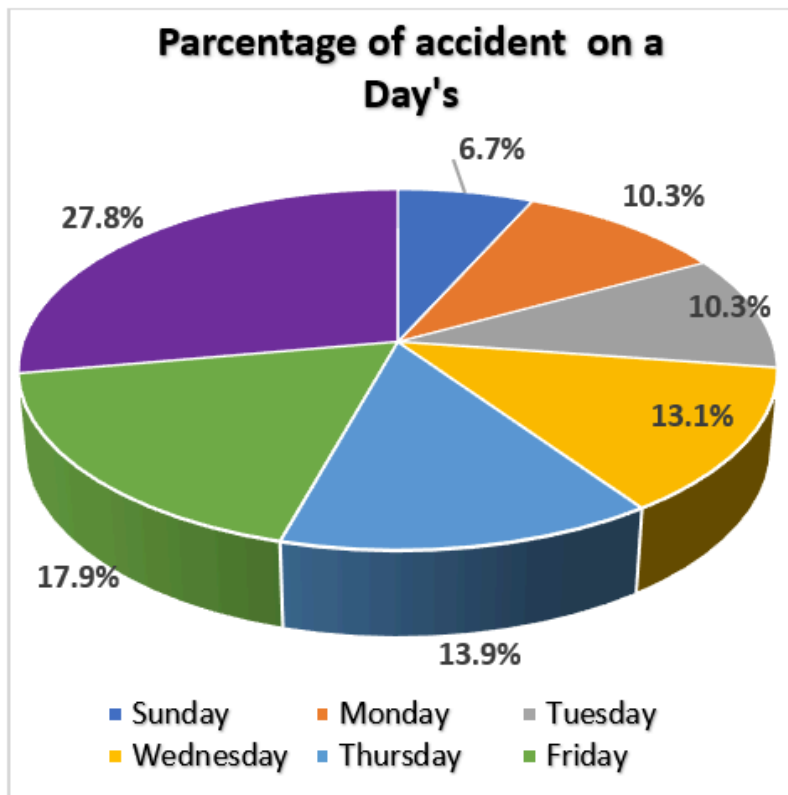


Figure 1.1: Number of RTA on the basis of Day's.

Figure 1

See image above for figure legend

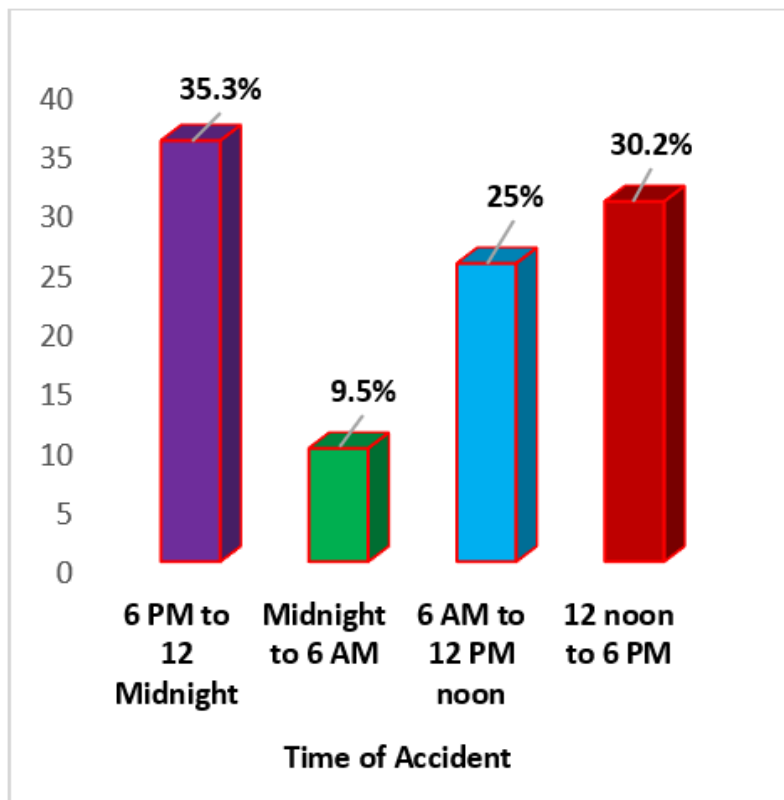


Figure 1.2: Number of RTA on the basis of Timing.

Figure 2

See image above for figure legend