

Vehicle- and Transport-Related Risk Factors Among Road Traffic Accident Victims Presenting to a Tertiary Care Hospital in Jodhpur

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Abstract:

Background: Road traffic accidents remain an important cause of injury, disability and death, particularly in low- and middle-income countries. Vehicle- and transport-related factors such as type of vehicle, speed, overcrowding, maintenance status, first aid and mode of transport to hospital can influence both accident occurrence and post-crash outcome.

Aim: To study vehicle- and transport-related risk factors among road traffic accident victims presenting to a tertiary care hospital in Jodhpur.

Material and Methods: This hospital-based cross-sectional study was conducted in the Accidental Emergency Department of a tertiary care hospital in Jodhpur, in coordination with the Department of Community Medicine, from November 2020 to January 2021. A total of 200 road traffic accident victims presenting within 24 hours of the accident were included. Data were collected using a semi-structured proforma after informed consent. Information regarding victim's vehicle, opposite colliding vehicle, speed, vehicle occupancy, maintenance status, first aid and transport to hospital was recorded. Data were analysed using MS Excel and Epi Info software.

Results: Motorised two-wheelers were the most common victim's vehicle, 97 (48.5%), followed by pedestrians, 58 (29.0%). The opposite colliding vehicle was most commonly a motorised four-wheeler, 102 (51.0%). Among non-pedestrian victims, speed of 61–80 km/h was most common, 76 (54.3%). Overcrowding was seen in 20 (14.1%) vehicles, and 103 (78.6%) motorised vehicles had not been serviced within the last 6–12 months. Private vehicles transported 105 (52.5%) victims to hospital, while ambulance was used in 66 (33.0%) cases. First aid was provided to 103 (51.5%) victims. Victim's vehicle and opposite colliding vehicle showed significant association ($p=0.002$).

Conclusion: Two-wheeler involvement, higher speed, poor maintenance and limited ambulance use were important findings. Regular vehicle fitness checks, speed control and improved pre-hospital care are recommended.

Keywords: Road Traffic Accidents, Vehicle Factors, Transport Factors, Two-Wheeler, Vehicle Speed, First Aid, Jodhpur.

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Introduction

Road traffic accidents are an important epidemiological problem and remain one of the major contributors to injury, disability and death, especially in low- and middle-income countries. In

the epidemiological approach to road traffic injuries, accidents are understood through the interaction of host, agent and environment. The vehicle acts as the agent or carrier of mechanical

energy, and its characteristics can influence both the occurrence of the accident and the severity of injuries. [1,2] Vehicle-related factors such as speed, type of vehicle, poor maintenance, defective brakes, worn-out tyres, overloading and lack of safety features can increase the risk of road traffic accidents. Over speeding is one of the most commonly reported causes of road accidents and deaths in India. [3] Two-wheelers are also frequently involved in road traffic accidents and contribute substantially to road traffic injuries. Apart from the vehicle involved in the crash, transport after the accident is equally important. Delay in shifting the victim, lack of ambulance use, improper transfer and absence of first aid may worsen the final outcome. [4,5,6]

In this paper, we discuss only the vehicle- and transport-related risk factors among road traffic accident victims. The study focuses on vehicle speed, maintenance, overloading, type of vehicle, first aid received and mode of transport used to bring the victim to the hospital among patients presenting to a tertiary care hospital in Jodhpur.

Material and Methodology

This cross-sectional hospital-based study was conducted among road traffic accident victims presenting to the Accidental Emergency Department of a tertiary care hospital in Jodhpur. The study was carried out in coordination with the Department of Community Medicine from November 2020 to January 2021. The study population consisted of road traffic accident victims who attended the emergency department within 24 hours of the accident.

The sample size was estimated at 95% confidence interval and 7% absolute allowable error using the formula for estimation of a single sample proportion. The expected proportion was taken as 36.7%, based on the proportion of victims not using helmet at the time of accident as reported by Puneet Misra et al.⁵ The minimum sample size was calculated as 190, and it was rounded off to 200. All eligible road traffic accident cases reporting during the study period were included.

Institutional Ethics Committee approval was obtained before starting the study. Written informed consent was taken from the study participants or their attendants. Data were collected using a semi-structured proforma. Information was collected directly from the victim whenever possible. If the victim was unconscious or unable to give details, the attendant or ambulance driver was interviewed. Information from trauma centre records was also used wherever required to complete missing details.

This paper specifically studied vehicle- and transport-related factors in road traffic accidents.

Details were collected regarding type of vehicle involved, speed of vehicle, maintenance status of vehicle, overloading or overcrowding of vehicle, first aid given to the victim and the vehicle used for transport to hospital. Overcrowding was considered when the number of occupants was more than the legally permitted limit for that vehicle. Vehicle maintenance was considered satisfactory if servicing had been done within the last 6 to 12 months.

All victims of any age and either gender with a history of road traffic accident in the last 24 hours were included in the study. Patients brought dead or moribund, where details could not be obtained, were excluded. Any mass casualty involving six or more persons was also excluded to avoid over-representation from a single accident event.

Data were entered into Microsoft Excel and a master chart was prepared. Statistical analysis was carried out using Epi Info software. Frequencies and percentages were used for categorical variables, while mean and standard deviation were used for continuous variables. Chi-square test was applied for categorical variables and Student's t-test for continuous variables. A p value of less than 0.05 was taken as statistically significant.

Results

A total of 200 road traffic accident victims were assessed for vehicle- and transport-related factors. The most common victim's vehicle was a motorised two-wheeler, reported in 97 (48.5%) cases. Pedestrians accounted for 58 (29.0%) victims, followed by motorised four-wheelers in 27 (13.5%), bicycles in 11 (5.5%) and motorised three-wheelers in 7 (3.5%) cases. The opposite colliding vehicle was most commonly a motorised four-wheeler, seen in 102 (51.0%) cases, followed by motorised two-wheelers in 48 (24.0%) and motorised three-wheelers in 36 (18.0%) cases. Collision with any other object or divider was reported in 14 (7.0%) cases (Table 1).

Speed of the victim's vehicle was assessed among 140 non-pedestrian victims. The most common speed range was 61–80 km/h, observed in 76 (54.3%) cases, followed by 41–60 km/h in 45 (32.1%) cases. Speed less than 20 km/h was reported in 9 (6.4%) cases, while 20–40 km/h and more than 80 km/h were reported in 5 (3.6%) cases each. Vehicle occupancy was assessed among 142 non-pedestrian victims. Most vehicles were occupied up to the permitted capacity, 122 (85.9%), while 20 (14.1%) vehicles were overcrowded or 150% occupied. Vehicle maintenance was assessed among 131 motorised vehicles. Servicing within the last 6–12 months was reported in only 23 (17.6%) vehicles, whereas 103 (78.6%) vehicles were not serviced within this period. In 5 (3.8%)

cases, the maintenance status was not remembered by the victim or attendant (Table 2).

Regarding transport to hospital, private motorised two-, three- or four-wheelers were used in 105 (52.5%) cases, followed by ambulance in 66 (33.0%) and PCR van in 29 (14.5%) cases. First aid was provided to 103 (51.5%) victims, while 97 (48.5%) did not receive first aid. Among all victims, first aid was provided in the ambulance in 66 (33.0%) cases and by PCR in 29 (14.5%) cases. Other first aid providers, including nursing staff, driver of opposite vehicle, medical shop and relatives, together accounted for 8 (4.0%) cases (Table 3). A significant association was observed between victim's vehicle and opposite colliding vehicle.

The most common collision pattern was between motorised two-wheelers and motorised four-wheelers, seen in 49 cases. Among pedestrians, collision with motorised four-wheelers was most common, 25 cases, followed by collision with motorised two-wheelers, 20 cases. Among motorised four-wheeler victims, 17 collided with another motorised four-wheeler. This association was statistically significant ($\chi^2 = 30.51$, $df = 12$, $p = 0.002$) (Table 4). These findings indicate that motorised two-wheelers were the most commonly involved victim vehicles, while motorised four-wheelers were the most common opposite colliding vehicles.

Higher vehicle speed, poor recent maintenance and use of private vehicles for hospital transport were important vehicle- and transport-related findings in this study.

Table 1: Distribution according to victim's vehicle and opposite colliding vehicle

Variable	Category	n	%
Victim's vehicle	Motorised two-wheeler	97	48.5
	Pedestrian	58	29.0
	Motorised four-wheeler	27	13.5
	Bicycle	11	5.5
	Motorised three-wheeler	7	3.5
Opposite colliding vehicle	Motorised four-wheeler	102	51.0
	Motorised two-wheeler	48	24.0
	Motorised three-wheeler	36	18.0
	Any other/object/divider	14	7.0

Table 2: Distribution according to vehicle speed, occupancy and maintenance

Vehicle-related factor	Category	n	%
Speed of victim's vehicle	<20 km/h	9	6.4
	20–40 km/h	5	3.6
	41–60 km/h	45	32.1
	61–80 km/h	76	54.3
	>80 km/h	5	3.6
Vehicle occupancy	≤100% occupied	122	85.9
	150% occupied/overcrowded	20	14.1
Vehicle maintenance	Serviced within last 6–12 months	23	17.6
	Not serviced within last 6–12 months	103	78.6
	Did not remember	5	3.8

Note: Speed was assessed among 140 non-pedestrian victims, occupancy among 142 non-pedestrian victims and maintenance among 131 motorised vehicles.

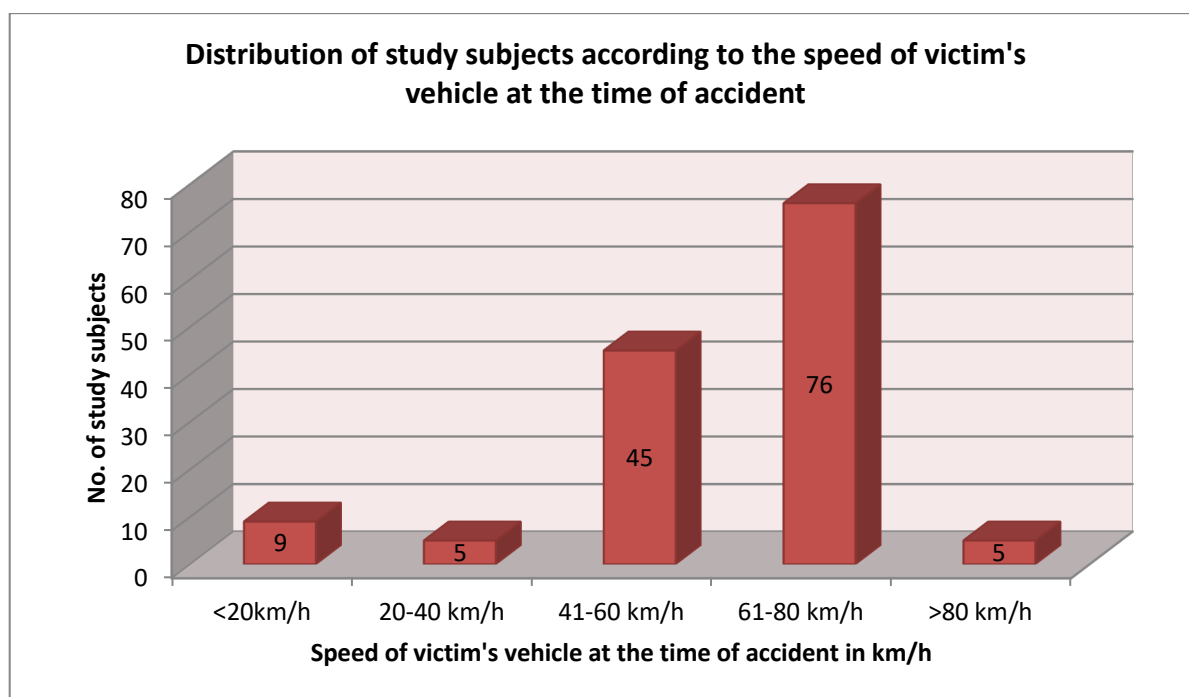
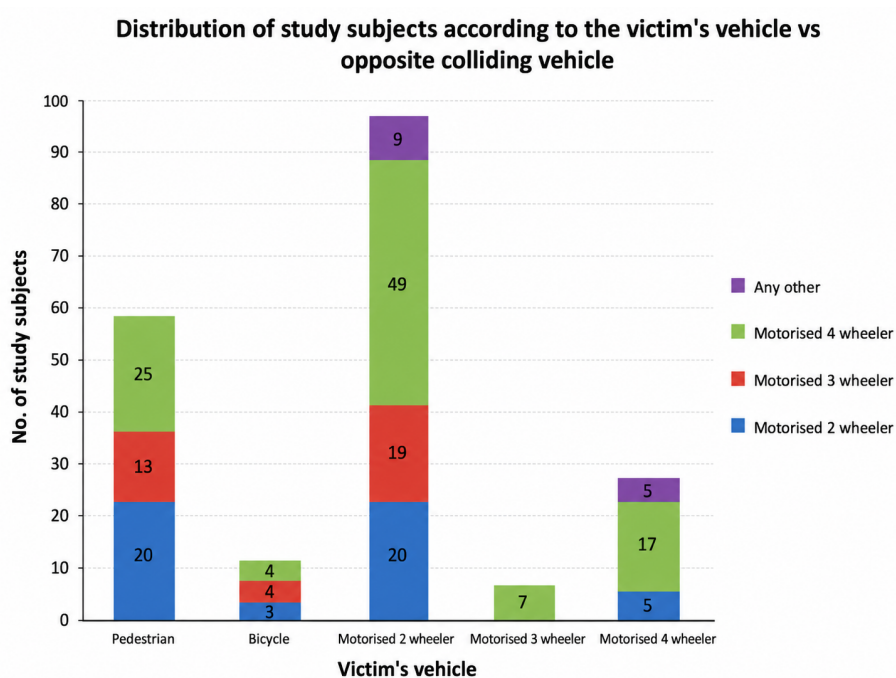
Table 3: Transport and first-aid profile of road traffic accident victims

Variable	Category	n	%
Vehicle used for transport to hospital	Private motorised 2/3/4-wheeler	105	52.5
	Ambulance	66	33.0
	PCR van	29	14.5
First aid provided	Yes	103	51.5
	No	97	48.5
First aid provider	In ambulance	66	33.0
	PCR	29	14.5
	Other provider	8	4.0
	No first aid provider	97	48.5

Table 4: Association between victim's vehicle and opposite colliding vehicle

Victim's vehicle	Motorised 2-wheeler	Motorised 3-wheeler	Motorised 4-wheeler	Any other/object	Total
Pedestrian	20	13	25	0	58
Bicycle	3	4	4	0	11
Motorised two-wheeler	20	19	49	9	97
Motorised three-wheeler	0	0	7	0	7
Motorised four-wheeler	5	0	17	5	27
Total	48	36	102	14	200

$\chi^2 = 30.51$, $df = 12$, $p = 0.002$; Significant

**Figure 1: Distribution of study subjects according to the speed of victim's vehicle at the time of accident****Figure 2: Distribution of study subjects according to the victim's vehicle v/s opposite colliding vehicle**

Discussion

Vehicle- and transport-related factors form an important component of road traffic accident epidemiology because the vehicle acts as the carrier of mechanical energy during the crash. In the present study, motorised two-wheelers were the most common victim's vehicle, accounting for 97 (48.5%) cases, followed by pedestrians in 58 (29.0%) cases and motorised four-wheelers in 27 (13.5%) cases. This finding is consistent with Bhanu Awasthi et al. [7], who reported that two-wheelers were commonly involved in RTAs, particularly among male participants. Vijaya Laxmi Shrestha et al. [8] also found that two-wheelers were commonly involved in accidents, while Alex Joseph et al. [9] reported that two-wheelers accounted for the highest share of total road accidents. Govind Kumar Gupta et al. [10] and Ruikar et al. [11] also observed that two-wheeler occupants formed a major proportion of road accident victims.

In the present study, the opposite colliding vehicle was most commonly a motorised four-wheeler, seen in 102 (51.0%) cases, followed by motorised two-wheelers in 48 (24.0%) and motorised three-wheelers in 36 (18.0%) cases. The association between victim's vehicle and opposite colliding vehicle was statistically significant, with the most common collision pattern being between a motorised two-wheeler and a motorised four-wheeler. This reflects the vulnerability of two-wheeler users when they collide with heavier vehicles.

Speed was an important vehicle-related finding in the present study. Among non-pedestrian victims, 76 (54.3%) accidents occurred at a vehicle speed of 61–80 km/h and 45 (32.1%) occurred at 41–60 km/h. Thus, the majority of accidents occurred at moderate to high speeds. Yasser Mehmood et al. [12] reported overspeeding as the most common cause of accidents, and Rajesh Neeluri et al. [13] also observed overspeeding as a major precipitating factor. The findings are important because increasing speed reduces reaction time and increases the severity of injury after impact. Vehicle occupancy was also assessed, and 20 (14.1%) vehicles were 150% occupied, indicating overcrowding. Overcrowding can reduce vehicle balance, increase driver distraction and worsen injury severity during a crash.

Vehicle maintenance was another important factor. In the present study, 103 (78.6%) motorised vehicles were not serviced within the last 6–12 months, while only 23 (17.6%) had been serviced during this period. Poor maintenance may contribute to vehicle defects such as brake failure, poor tyre condition and lighting defects, which can increase crash risk. Although many previous

studies focus on the type of vehicle and speed, maintenance status is less frequently studied, making this finding locally important. Pre-hospital transport also showed important gaps. Private motorised two-, three- or four-wheelers were used to transport 105 (52.5%) victims to hospital, while ambulance transport was used in only 66 (33.0%) cases and PCR van in 29 (14.5%) cases. Puneet Mishra et al. [5] reported that PCR vans and private vehicles were commonly used for transporting victims, while ambulance use was limited. This reflects inadequacy or underutilization of organized emergency transport systems. In the present study, first aid was provided to 103 (51.5%) victims, but 97 (48.5%) did not receive any first aid. Sadhana Awasthi et al. [14] reported poor first-aid training among drivers, and Devarshi Rastogi et al. [15] found that first-aid coverage was lower among fatally injured victims. These findings highlight the need for strengthening ambulance services, first-aid training and community-based emergency response systems.

Conclusion

Motorised two-wheelers were the most commonly involved victim vehicles, while motorised four-wheelers were the most common opposite colliding vehicles. Higher vehicle speed, poor recent vehicle maintenance, overcrowding and frequent use of private vehicles for hospital transport were important findings. Regular vehicle fitness checks, speed control and monitoring of overloading should be strengthened. Ambulance availability and basic first-aid training for drivers, police and community responders are recommended to improve pre-hospital care.

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