Hospital-based surveillance for Road Traffic Injuries (RTIs) in a tertiary care hospital

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ABSTRACT

Road traffic accidents (RTAs) lead to significant mortality, morbidity and economic loss in India. The present study aims to characterize epidemiology of Road traffic injuries (RTIs) with information from multiple data sources and to describe factors associated with RTIs. Patients admitted with RTIs in a tertiary care hospital were included in this cross-sectional observational study. Hospital records, case sheets of RTA victims and interview of the participants with a questionnaire were used for collecting data. Majority (29%) of road traffic accidents occurred between 4pm and 8 pm, with 60% self-fall or skid. Around 23.8% consumed alcohol, 63.3% exceeded speed limit, 85% rescued within 30 minutes, 57% transported to hospital by government ambulance, 30% reached tertiary care directly, 6.5% had reduced GCS score. Young adult male were the major victims of RTAs with speed violation as a common risk behavior. The findings suggest a need for implementation of speed violation detection systems to bring down the occurrence of RTAs.

INTRODUCTION

Road traffic accidents (RTAs) cause 50 million injuries or disabilities globally on an annual basis with developing countries attributing to 93% mortality (1). India has second largest road network (67 lakh kilometres) in the world and 78% of road traffic injuries (RTIs) occur in economically productive working population causing 15.56 fatalities per 100,000 people (2,3). Sustainable Development Goal (SDG) 3's Target calls for a reduction in worldwide road traffic fatalities and injuries by half by 2020(1). Injury prevention has not received much attention in India. Since 1990, RTA rates has climbed by 50% and Disability adjusted life years (DALYs) due to RTIs were 65% more in 2016 compared to 1990 in India. Across all states, disease burden due to traffic accidents has increased substantially (4). Only a small number of institutes in India have trauma registries from which the information from RTIs can be obtained. Evidence suggests that hospital-based RTIs surveillance is extremely helpful for developing better strategies for monitoring and preventing RTIs (5).

The Government of India is operating to establish a national injury surveillance system within the framework of the Trauma Programme to reduce RTI burden and benefit economy (6). According to the data, Tamil Nadu leads the list of road accidents in India among all states and Union Territories and

ranks second to Uttar Pradesh in terms of mortality. The number of RTAs increase every year considerably (6). Human factors like drunk driving, lack of judgment, fatigue, distraction, and confusion, along with inexperienced, risky, aggressive, careless drivers, unsafe road infrastructure, inadequate safety measures, and insufficient enforcement contribute to traffic accidents (7).

In order to evaluate the need gap for effective interventions, it is imperative to broaden the research on the burden of RTA in terms of contextual, epidemiological, and risk variables in the community by multiple data sources. Hence, the present study was carried out as a hospital-based survey to enable us to identify the epidemiology of road traffic injuries and the various factors associated with road traffic injuries.

Objectives

1. To characterize epidemiology of RTIs (nature, types, distribution, pattern) with information from multiple data sources (hospital/police/emergency transport)
2. To describe factors associated with road traffic injuries.

MATERIAL & METHODS

Study design and setting: This was a descriptive cross-sectional study carried out in a tertiary care public health hospital in South India with 1717 beds catering to the needs of 30 lakh population. This tertiary care teaching care hospital has an emergency medicine department with trauma care unit and rapid response team interlinked with emergency responder system under State Government's Trauma, Accident and Emergency Initiative (TAEI). The rapid response team and the hospital has advanced facilities & multidisciplinary specialists for triaging and managing polytrauma cases.

Eligibility Criteria: All patients who were victims of RTA and hospitalized in the emergency care department and treated as in-patients between April 2021 to October 2021 were eligible for the study. A person injured on road without involvement of vehicle were excluded from the study. Patients who were unconscious with no reliable source of information (no collateral history from police or bystanders or paramedic team), who were brought dead and patients who refused to give informed consent were excluded from the study. All the non-vehicle related injuries were excluded since the study focused exclusively on epidemiology of vehicle related RTAs.

Operational definition: Road Traffic Accident (RTA) was taken as an accident involving any one moving vehicle in a road (vehicle in motion) or collision of a vehicle in motion with another vehicle or animal or pedestrian or fixed obstacle resulting in injury of one or more persons.

Ethics Approval: Permission was obtained from the institutional ethics committee before initiating the study. (Reference no: F01/20/11/2019). The study was conducted in accordance with declaration of Helsinki.Written informed consent was obtained before data collection from all the study participants. For children and patients without consciousness, consent was taken from the relative.

Data Collection: Data were collected from hospital records/case sheets of RTA victims as well as by interviewing participants. For unconscious patients, data were collected at the site from bystanders and from paramedics of 108 ambulance. Questions about road traffic accidents and related factors were adapted from literature and modified according to the local needs such as condition of roads, streetlight & road structure (8). A semi-structured questionnaire was developed by focus group discussion and this questionnaire was piloted and validated before administering to the study participants. The final data collection tool consisted of following sections and details:

I. Demographic variables (Ten questions related to hospital number, AR number, admission date, time, age, gender, occupation, education, income, respondent details)

II. Details of RTA (Six questions related to time & date of RTA, type & site of RTA, first information report and injured person details)

III. Road related & environmental factors (six questions related to road type, condition of the road, traffic control, speed limit, weather & lighting)

IV. Vehicle & Person related information (Ten questions related on condition of headlight, brakes, number of vehicles involved in RTA, persons injured, overspeed, quality of driving, licensure status, safety precautions, alcohol consumption and mobile use)

V. Pre hospital care and details of referral (Eight questions related to rescue time, type, details of first aid, first point of care, status of care and clinical status)

Three interviewers were trained for data collection and the collected responses were randomly checked for quality and consistency of the data quality was assured. Data collected were coded and entered in Microsoft Excel. Specific instructions on coding documents were provided to the interviewers and they were trained for data entry. Manual data checking and editing was done by the investigators to remove duplicate entries and for quality assurance. Data analysis was done with GNU PSPP version 1.6.2-g78a33a by Free Software

Foundation. Descriptive statistical analysis was done. Continuous variables were expressed as mean and standard deviation. Frequencies and percentages were used to describe categorical variables.

RESULTS

A total of 1028 participants were approached for the study and 960 were taken up for analysis after removal of data due to duplication and incomplete information. Duplicate entries were determined with the help of Accident registry number and Hospital number assigned to the patient and were removed. The mean age of the study participants is 39.09±16.69 (38.04-40.15). Patients' age ranged from 2 years to 95 years. Among the respondents, 17.3% (166/960) were RTA victims, 75.2% (722/960) were family members or friends, 7% (67/960) were ambulance drivers 0.5% (5/960) were co-passenger or other sources. Among the injured 84% were male. The majority of injured individuals (39.7%) were aged 26-45 years, with 29% of incidents occurring between 4 pm and 8 pm. Most RTAs (68.4%) occurred in urban areas. Over 60% of incidents were caused by vehicle skids or self-falls, while 25% were caused by collisions between two vehicles. Most RTAs (81.5%) occurred on single-lane two-way roads, with 51% occurring in uncontrolled traffic, 10.4% of the RTA occurred in roundabout / cross roads whereas 7% of RTA occurred in blind /curved roads. (Table 1).

Table 1: Socio-demographic characteristics of the injured patients and baseline data of road traffic accidents

Sociodemographic characteristics		Frequency	Percentage
Age group	≤25	246	25.6
	26-45	381	39.7
	46-65	276	28.8
	>65	57	5.9
Gender	Male	807	84.1
	Female	153	15.9
Education	No formal schooling	91	9.5
(n=953)	Primary	243	25.5
	Secondary/HSC	573	60.1
	Graduate	46	4.8
Work status	Non-earning	687	71.9
(n=956)	Earning	269	28.1
Place of RTA	Urban area	657	68.4
	Rural area	303	31.6
Time of occurrence	12 am-4 am	35	3.6
	4 am-8 am	77	8
	8 am- 12 pm	182	19
	12pm-4 pm	221	23
	4pm-8pm	283	29.5
	8pm-12am	162	16.9
Type of RTA	Self-fall / skid	577	60.1
	Crash between two/more vehicles	245	25
	Crash with pedestrian/animal	115	12
	Crash with fixed obstacle/parked vehicle	17	1.8
	Others	6	0.6
Type of road	National highway	15	1.6
	State highway	256	26.7
	District roads	546	56.9
	Village roads	141	14.7
	Unknown	2	0.2
Subtype road	One-way road	39	4.1
	Single lane two-way road	782	81.5
	Double lane two-way road	139	14.5
Traffic controlled by	Traffic signal	439	45.7
	Uncontrolled	493	51.4
	Unknown	28	2.9

The study found that over 90% of road traffic accidents (RTAs) occurred in clear weather and sufficient light, with 56.9% occurring in district roads and 26.7% in state highways. Overspeeding was reported in 63.3% RTAs in the current study. Drivers were the most commonly injured, followed by passengers and pedestrians. Only 17.8% of victims took safety measures, and 17.5%

experienced distracted driving and uncontrolled driving (Table 2). Nearly one quarter of the RTA victims were drivers and consumed alcohol.

Distracted driving (17%), mobile phone use (8.8%) and uncontrolled driving (7.5%) were the other reported factors (Table 2).

Table 2: Distribution of environmental, vehicle and person related factors with the occurrence of RTA

RTA Variables		Frequency	Percentage
Environmental factors			
Weather condition	Clear	898	93.5
	Hot / dry weather	25	2.7
	Rainy	14	1.5
	Fog / Mist/ Smoke	10	1
	Severe winds	10	1
	Unknown	3	0.3
Light condition	Excess light	59	6.1
	Sufficient light	810	84.4
	Insufficient light	90	9.4
	Unknown	1	0.1
Condition of the road	Safe	796	82.9
	Slippery (Wet/Oily)	34	3.5
	Muddy	15	1.6
	Rutted/ pot holed	95	9.9
	Slippery and Muddy	3	0.3
	Slippery and rutted	12	1.2
	Muddy and rutted	3	0.3
	Unknown	2	0.2
Presence of speed breaker at RTA site	Yes	611	63.6
	No	349	36.4
Vehicle related factors			
Number of vehicles involved in RTA(n=958)	1	724	75.6
	2	234	24.4
Overspeed at the time of RTA	Yes	608	63.3
	No	350	36.5
	Unknown	2	.2
Condition of the headlight	Working	940	97.9
	Only one light working	1	0.1
	Not working	2	0.2
	Unknown	17	1.8
Condition of the brake	Working properly	952	99.2
	Not working	1	0.1
	Unknown	7	0.7
Person related factors			
Type of road user involved in RTA	Driver	714	74.4
	Passenger	138	14.4
	Pedestrian	108	11.3
Safety precautions taken at time of RTA	Seat belt worn	20	2.1
	Helmet worn	149	15.5
	Followed traffic signal/Zebra crossing	2	0.2
	Not taken	789	82.2
Alcohol consumption during accident	Driver of the injured vehicle/counterpart vehicle	228	23.8
	Passengers	3	0.3
	Pedestrian	2	0.2
	Not consumed	707	73.6
	Unknown	20	2.1
Driving quality	Safe driving	723	75.3
	Distracted driving	163	17
	Uncontrolled driving	72	7.5
	Unknown	2	0.2
Mobile use	Driver of the injured vehicle	66	6.8
	Driver of the counterpart vehicle	19	2
	Pedestrian	2	0.2
	Not used	846	88.1
	Unknown	27	2.8

Around 85% of RTA victims were rescued within 30 minutes, with 86.3% receiving first aid. Over half (57%) were transported to the hospital by government ambulance. thirty percent reached tertiary care centers directly. Primary point of care was primary health care centers (5.8%) and district government hospitals (52.7%) with nonavailability of specialists and equipment (555/990,57.8%) being the major reason for referral to the tertiary care center. (Table 3). In 93.5% Glasgow coma scale (GCS) score was in the range 13-15 and around 62 patients (6.5%) [37/990 had GCS 9-12 and 25/990 had GCS 3-8] had moderate to severely impaired GCS score indicating acute traumatic brain injury.

Table 3: Distribution of variables of prehospital care among road traffic accident victims

Prehospital Care		Frequency	Percentage
Time for rescue	Immediately/No delay	12	1.3
	Less than 30 minutes	822	85.6
	30 minutes -1 hour	113	11.8
	1-2 hours	10	1
	>2 hours	2	0.2
Rescue type	Self	84	8.8
	Friends/ relatives	432	45.0
	Driver/ passenger/ co passenger	12	1.3
	Local people/ passerby	417	43.4
	Police	15	1.6
First aid given	Yes	828	86.3
	No	132	13.7
First aid site(n=828)	At the accident site	66	8
	Nearby public hospital	461	55.7
	Neary private clinic	168	20.3
	Ambulance	122	14.7
	Others	11	1.3
Mode of transport to hospital	Self	46	4.8
	Govt. ambulance	547	57.0
	Private ambulance	13	1.4
	Private vehicle	350	36.5
	Others	4	0.4
No. of facilities visited before tertiary care centre	0	299	31.1
	1	457	47.6
	2	203	21.1
	3	1	.1
First point of care	Primary health centre	56	5.8
	District government hospital	506	52.7
	Others	398	41.5
Status of injured	Unconscious	62	6.5%
	Conscious	898	93.5%

DISCUSSION

Road traffic injuries are on the rise each and every year with increase in number of vehicles and motorisation. The present study reveals that most of RTA victims were young male of age group 26-45 years. National statistics on RTA also corroborates this finding, where 47-49% of RTA victims belonged to the same age group (9). Published literature from different states of India also reveal that 50-75% of the RTA victims were less than 45 years of age (10-12). Male predominance might be due to that driving is primarily viewed as a male activity in India and only 6.28% of women hold driving license in India (13). A recent study published by Thomas et al estimated an out-of-pocket expenditure in injury to be around Rs 9000- Rs 57000 for treatment in public and private sector hospitals respectively (14). So, RTI in young productive population can have negative impact on per capita income and hamper economic growth of a developing nation. The present study reveals RTA occurs during rush hour predominantly in the evening (4pm-8pm) which is the time for evening commute to home from workplace and schools. Rush hour accidents mainly happen due to impatient frustrated and distracted driving occurring due to increase in traffic volume (15).

Road related factors contributing to RTAs are in concordance with a study done in Indian metropolitan city (16). Two-way single lane roads were the site of majority of RTAs. This underlines the urgent need for improving road infrastructure by maintaining signage, pedestrian pathways and road lane markings and creating public awareness to drive in the respective lanes to bring down the RTA occurrence. Most of the RTA occurred in urban

district roads compared to state or national highway in the current study similar to a study done in Mumbai (17). Self-fall and skid constituted 60% RTA in the current study involving motorised two wheelers which is high when compared to a study done by Neeraj et al in 2023 where 33% of self-fall was reported (18). The study found that over 80% of participants did not follow road safety behavior, with speed violation being the most common risky riding behavior in Indian motorists. A recent survey indicated that speed violation was the most common self-reported risky riding behaviour in Indian motorists similar to the present study (19). Potential policy changes on enforcing traffic rules with strict punishments and public awareness campaigns on the risks of speed and traffic violation can create a behavioural change among the public.

Drivers accounted for three-fourths of RTA victims, followed by passengers and pedestrians. This is on a higher side when compared to other studies reported in literature where 55%-60% of the RTI were sustained by drivers (18). The encouraging part of the present study is that 85% of RTA victims were rescued within half an hour and given first aid, but in contrast to a study from Rajasthan where only 20% of RTA victims received first aid but 93% were rescued in 30 minutes (18). The passerby or the local (43%) were the first to rescue the victims in the current study. One third of the participants reached tertiary care centre directly in the current study. The rescue time had significant impact on Glasgow coma scale (GCS) on admission. More than half of the victims were transported by government ambulance in the current study. Better utilization of 108 ambulance services might be due to increased awareness of public on toll-free emergency response team in case of RTA. Transporting a patient from accident site to a health care facility is of critical value since any delay in it function as a barrier in emergency care.

CONCLUSION

Young adults and male gender were predominantly affected in RTA. Majority of RTA occurred in urban district roads. Road safety measures were not adequately followed by RTA victims. Speed violation was the most common risky behaviour observed in RTA victims. Information, education and communication activities on road safety can be periodically conducted in schools and colleges to impart behavioural change in young adults who are major victims of RTA. Strict enforcement of traffic rules on use of helmet, seat-belt and other safety gears can bring down the RTA. Traffic rules violation detection system can be imparted into the system to bring down the menace of RTA.

RECOMMENDATION

Information, education and communication activities on road safety can be periodically conducted in schools and colleges to impart behavioural change in young adults who are major victims of RTA. Strict enforcement of traffic rules on use of helmet, seat-belt and other safety gears can bring down the RTA. Traffic rules violation detection system can be imparted into the system to bring down the menace of RTA.

LIMITATION OF THE STUDY

The study's large sample size and epidemiological profile of RTA may not reflect the representative data and has to be interpreted with caution since the study included only hospitalized patients and did not include data on RTA victims who were brought dead or who did not reach the hospital (minor injuries). The current study did not evaluate the long-term outcomes (mortality & morbidity) associated with the RTA related factors. Future large-scale multicentric studies including all patients of RTA with outcome assessment are recommended to address the above-mentioned research gaps.

RELEVANCE OF THE STUDY

The present study provides data on the burden of Road traffic injuries in terms of contextual, epidemiological, and risk variables in a tertiary care setup from Southern part of Tamil Nadu.

CONFLICT OF INTEREST

There are no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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