Epidemiological Factors of Road Traffic Accidents: A Study in a Tertiary Care Setting in India

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ABSTRACT

BACKGROUND: With over 130,000 deaths annually, India has overtaken China for the worst road traffic accident rate worldwide. The objective of our study was to assess the socio-demographic profile of non-fatal road traffic accident victims admitted in a tertiary care setting, to find out the epidemiological factors behind it and to assess the pattern of injuries incurred by the victims.

METHODS: This descriptive, cross-sectional, hospital-based prospective study was conducted in a tertiary care setting in Kolkata, India from January to June, 2010. All subjects were non-fatal road traffic accident victims admitted under two randomly selected units of surgery and orthopedics departments. ICD classification was used to code the accident type.

RESULTS: Almost 75% of the victims were < 40 years, with the male to female ratio of 8.3:1. Victims, vehicles and road conditions were not at fault in 55.33%, 57.28% and 45.63% of the road traffic accident cases, but inexperienced drivers, poor safety measures, excessive speed, overloaded vehicles, broken and narrow roads and poor street lighting were found to be the major contributory factors. Majority of the victims were pedestrians (V 01, 02, 03, 04 and 09) followed by motorcycle riders (V 21, 22, 23, 24, 27 and 29). Fractures were the commonest injuries followed by head injury.

CONCLUSION: The study highlighted interaction of several factors like lack of experience of drivers, low awareness of safety measures, narrow, broken and ill-illuminated roads, excessive speed with overloaded vehicles responsible for road traffic accidents.

Keywords: Road Traffic Accidents; Risk Factors; Tertiary Care Setting; ICD Classification

INTRODUCTION

The World Health Organization's Global Status Report on Road Safety highlighted that more people die in road traffic accidents (RTAs) in India than anywhere else in the world, including the more populous China [1].

In India alone, the death toll rose to 14/hour in 2009 as opposed to 13/hour the previous year. According to the latest report of National Crime Records Bureau (NCRB), the total number of deaths every year due to road accidents has now surpassed the 135,000 mark [1].

About 40% of spinal cord injuries occur in RTAs and the accident survivors are either confined to the bed or are wheelchair bound for the rest of their lives. The cost of these accidents and death is Rs.55 billion or 12.5 billion US dollars every year [2]. The best chance of survival for a serious RTA victim is if they are brought into the emergency department within the first hour of trauma or the so-called golden hour [2].

Although an important cause of morbidity and mortality, the under reporting of RTA is common and sometimes the sole sources of RTA information in a metropolitan city like Kolkata are police and hospitals. While there are five medical colleges in Kolkata, there are no state-

funded trauma centers. Recently state government has taken an initiative to establish a trauma center in Kolkata. Despite enhanced focus, the epidemiology of RTAs and understanding and identification of remedial factors is lacking in Kolkata. A better understanding of the common factors implicated in RTAs will help in appropriate allotment of resources and procurement of logistics. With this in mind, we planned and implemented our study with an aim to build a database of epidemiological factors of RTAs and pattern of injuries. More specifically, this study was conducted with the objective to assess the socio-demographic profile of non-fatal RTA victims admitted in a tertiary care setting, to find out the epidemiological factors behind RTAs, and to assess the pattern of injuries incurred by the RTA victims.

METHODS AND MATERIALS

Study design: This descriptive, cross-sectional, prospective study was conducted in a tertiary care setting in Kolkata, West Bengal, India.

Study period: January 2010 to June 2010.

Study population: Victims of non-fatal RTAs who were admitted to the participating hospital. Operational definition: For RTA, operational definition was used following the Department of Transport of UK [3] that "involves personal injury occurring on the public highway (including footways) in which at least one road vehicle or a vehicle in collision with a pedestrian is involved and which becomes known to the police within 30 days of its occurrence. This definition includes collisions involving non-motor vehicles such as pedal cycles and ridden horses on public roads. The vehicle need not be moving and accidents involving stationary vehicles and pedestrians or users are included. One accident may give rise to several casualties."

Study technique adopted: From the list of units of the department of surgery and department of orthopedics, two units, one from each discipline were selected by simple random sampling and all the patients of RTAs admitted in these units during the study period were selected. Before conducting the study, institutional ethical clearance and informed consent of the victims was obtained. The sampled units were visited the day following the day of admission to enquire whether any RTA patient had been admitted in the unit or not. Victims or their close relatives (if victims were unable to give interview) were interviewed using a pre-tested pre-designed semi-structured proforma. Case sheet of the victims were also referred for cross checking. To identify the outcome and details of the given treatment, the medical records were checked again at the time of patient discharge from the hospital. Fatal RTA cases were excluded from the study.

Sample size: A total of 206 individuals admitted to the hospital with non-fatal RTA.

Study variables: We collected socio-demographic information of the victims, description of the accidents in their own words, human, road, vehicle and environmental factors behind the accidents, type of injury and the treatment given.

Analysis: ICD-10 was used to classify the accidents. Socio-economic status was assessed following Prasad's classification [4]. The results were analyzed using EPI info 3.5.1.

RESULTS

Of the 206 study participants, 154 (75%) were younger than 40 years; 184 (89.32%) were males with a male to female ratio of 8.3:1; 108 (52.43%) were from rural areas; 62 (30.69%) read up to grade 10 and 42 (20.79%) had never been to a school; 104 (50.38%) and 40 (19.41%) were laborers and students, respectively (Table 1).

In 114 (55.33%) cases of RTAs, victims did not have any faults, but they were inexperienced drivers and unprotected by safety measures in 28 (13.59%) and 24 (11.65%) episodes, respectively (Table 2). Vehicles and road conditions were not responsible for RTAs in 118 (57.28%) and 94 (45.63%) participants, but excessive speed, overloaded vehicles, broken roads, narrow roads and poor lighting were contributory factors in 64 (31.06%), 32 (15.53%), 52 (25.24%), 36 (17.48%) and 24 (11.65%) of the RTAs, respectively.

RTA and time of the day: Most of the RTAs occurred between 6:00 A.M and 12:00 PM (65; 31.55%) followed by 6:00 P.M and 12:00 AM (56; 27.18%), 12:00 PM and 6:00 A.M (43; 20.87%) and 12:00 AM and 6:00 P.M (42; 20.39%).

Referral to a tertiary care center: Of the 206

Table 1: Socio-demographic profile of RTA victims (n=206)

Socio-demographic Characteristics	Number	Percentage
Age (years)		
<18	56	27.18
18-40	98	47.57
41-60	40	19.42
>60	12	5.83
Sex		
Male	184	89.32
female	22	10.62
Residence		
Rural	108	52.43
Urban	98	47.57
Educational status (n= 202)*		
Illiterate	42	20.79
Primary	22	10.89
Middle school	62	30.69
Secondary	34	16.83
Higher secondary	26	12.87
Graduate and above	16	7.92
Occupation		
Skilled labor	32	15.43
Unskilled labor	72	34.95
Service	24	11.64
Business	18	8.72
Student	40	19.41
Housewife	12	5.87
Others	8	3.88
Socio economic status		
(Per capita income in Rs.)	44	21.36
Upper (>2200)	42	20.39
Upper middle(1100-1999)	48	27.18
Lower middle (660-1099)	34	16.51
Upper lower (330-659)	30	14.56
Lower (<330)		

*Rest were below 7 years of age, so educational status was not considered

RTA cases, 118 (57.28%) were referred, of which 41 (34.74%) were referred from primary healthcare center, 63 (53.38%) from secondary healthcare center and 14 (12%) were, surprisingly, from tertiary care, probably due to non-availability of certain specialized care in the referring centers. Geographically, 77 (37.37%) of RTA occurred at Kolkata and rest in other districts of southern West Bengal, even 2 cases were reported to occur in Bihar, a state adjacent to West Bengal.

Types of victims in RTA: According to ICD classification, majority of RTAs (Fig 1) involved pedestrians (70; 34%) who were injured after

Table 2: Distribution of study population according to victim characteristics, road and vehicle conditions (n=206)

Distribution of Study Population	Number	Percentage
Victim characteristics	24	11.65
Unprotected with helmet or safety belt	2	0.97
Intoxicated with alcohol	14	6.79
Mental anxiety	14	13.59
Lack of experience of driving	4	1.94
Using mobile	2	0.97
Talking in groups	12	5.82
Impulsive and risk taking behavior	10	4.85
Sleepy/ suffering from vertigo	114	55.33
No fault in part of victim		
Vehicle conditions		
Excessive speed	64	31.06
Faulty machine	16	7.76
Overloaded vehicle	32	15.53
Others*	18	8.73
No problem with the vehicle	118	57.28
Road conditions		
Broken road	52	25.24
Crowded road	4	1.94
Defective signal	2	0.97
Narrow road	36	17.48
Poor lighting	24	11.65
Road crossing	14	6.80
Speed brakers	14	6.80
Others	2	0.97
No problems with the road	94	45.63

collision with other vehicles (V 01, 02, 03, 04 and 09). Of 70 injured pedestrians, 24 were injured by collision with heavy transport vehicles or buses (V04); 36 were injured by 2 or 3 wheeled motor vehicles or cars (V 02 & V 03); 4 had collision with pedal cyclists (V01) and 6 could not specify the exact type (V09). Of the 36 motor cyclists (V 21, 22, 23, 24, 27, 28 and 29), 13 were injured by collision with heavy transport vehicle; 11 by collision with 3 wheelers; 4 and 2 riders with cars and pedal cyclists respectively; 4 had no collision but the motor cycle had turned upside down due to inexperienced drivers or broken roads and 2 could not specify the type of vehicle with which the collision occurred. Fifty percent of the motor cyclists were not wearing helmets. Bus occupant injury consisted of 30 (14.6%) individuals with ICD classification of V 77 and 78, where majority (21) was injured in a single incidence of bus falling in a canal. Among

the pedal cyclist injury (18; 8.7%), 7 each were injured by collision with buses (V 14) and non-collision type accidents (V 18). Among the RTAs involving the occupants of 3 wheeled motor vehicles (16; 7.8%) and pickup trucks & vans (14; 6.8%), majority were injured with non-collision type of accidents (V38 and V 58), whereas in heavy transport vehicles (11; 5.8%)most of the injuries occurred due to collision with a stationary object (V 67) like tree or roadside constructions. Of all the vehicles involved in RTAs, buses and heavy transport vehicles were most common the most common offending agents, followed by 4 and 3 wheelers**.**

Pattern of injury: Of the 206 RTA victims, 141 (68.44%) had fractures, 59 (28.64%) had head injury, 41 (19.91%) had abrasion, bruise, hematoma and visceral injury followed by 24 (11.65%) patients who sustained lacerated injury. Among the fractures, 54 (38.29%), 31 (21.98%) and 23 (16.31%) were of tibia-fibula, radius-ulna and humerus, respectively. Surgical correction was performed in 122 (59.22%), whereas 84 (40.78%) were treated conservatively.

Only 85 (41.3%) patients arrived at a healthcare facility within the first hour of accident and none of the victims received any treatment during transit to a healthcare facility.

DISCUSSION

The present cross-sectional prospective study conducted in a tertiary care hospital of Kolkata found that almost 75% of the RTA victims were younger than 40 years and majority were males. The implications of injury to this particular demographic are significant and societal costs not only include the cost of healthcare but also the cost of loss of economically productive days [5-12]. The fact that males are at higher risk of RTA than women can be attributed to their greater exposure to traffic and more risky behavior than females such as hanging on the side of bus, running to catch a bus, aggressive driving, impatience, lack of attention and drinking alcohol prior to driving.

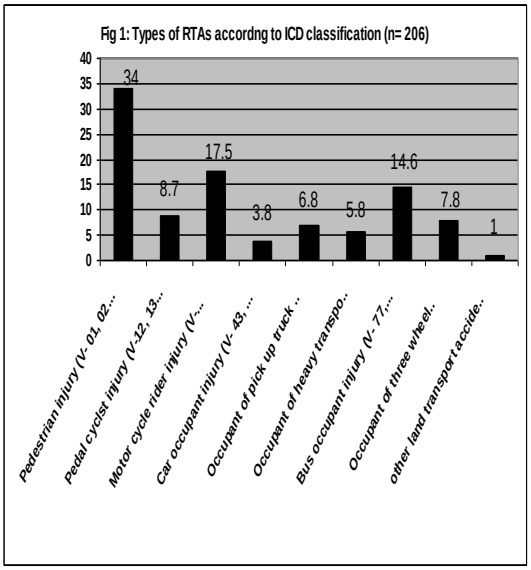
Socio-demographic profile of RTA victims also revealed that they came almost equally from rural and urban background, majority were illiterates or only school educated, laborers and students. Several other studies [6, 10] had similar findings. The finding that relatively poorly educated individuals were more likely to get into traffic accidents can be due to less awareness about the traffic rules and safety measures. In contrast to our findings, a study in Western Nepal by Mishra B et al [7] had observed it more among school educated and graduates and a study in Mexico didn't find any association with level of education [13]. We cannot rule out that more educated and relatively wealthy individuals may have received treatment at a private healthcare facility.

Considering the time of the day when RTAs commonly occurred, most of the RTAs were between 6:00 A.M and 12:00 PM (31%) followed by between 6:00 P.M to 12:00 AM (27.2%). Our results probably stem from the fact that these are the time periods when there is high human and traffic congestion on roads. However, still a significant number of accidents (20%) occurred during hours when there is little traffic and these may have resulted from absence of traffic police and traffic signals, violation of traffic rules and low visibility. Our results are similar to the study in Nepal [7] where majority of the accidents were reported to occur at 3:00 PM to 7:00 P.M followed by 7 A.M to 11 A.M. But Ganveer B G [5] and Malhotra C [12] reported that accidents mostly occurred during the daytime in Nagpur and Delhi respectively.

Considering the human factors involved in the accidents, 50% of motor cycle riders were not wearing helmets in the present study. Several studies had found this percentage higher such as in Bangalore and Pune [14] (75%), in Nagpur [8] (74%), Haryana [11] (100%) of India and Peru (35%) [15]. The present study observed that 13.6% of the victims were inexperienced drivers. In Indian setting, Patil SS et al [9] in Maharastra and Jha N et al [10] in Pondicherry had similar observations that about one third to one fourth of drivers had no license and they were mostly 2 wheeler drivers, whereas Tiwary R et al [8] found a higher percentage (43.5%) in Nagpur. The difference might be due to the variation in measures taken for enforcing the existing laws, especially in rural belts of different parts of India. The social implications were easy accessibility of the vehicles especially 2 wheelers to the younger age groups and low awareness of youngsters with safety measures, thus increasing their vulnerability. Mishra B et al [7] observed history of recent mental conflicts in 10.8% cases and as a whole personal problem like low tolerance, inattentiveness and hyperactivity as factors in 33% RTAs. The present study found that 6.8% had mental anxiety during the time of accidents and impulsive risk taking behavior in 5.8% individuals. However, only 2 persons (1%) were under the influence of alcohol as observed in the

present study, which was far less than reported by Jha N et al [6] (16.8%), Patil SS [9] (29.5%), Mishra B [7] (46.4%) from India and Akgür SA et al [16] (54.4%) at Turkey. As a whole, human factors were seen to be involved in 54.7% of cases, which is much lower (74.4%) than observed by Singh H et al [11]. Considering the problems with vehicles and road conditions, similar to Mishra B et al [7], the present study found high speed of vehicles and narrow and broken roads as the responsible factors for the RTAs. Overcrowding of all types of vehicles wasA predominant factor as observed by several other studies in India [8, 9], whereas the present study had observed it only in 15.5% of cases. Pedestrians were the commonest group of victims (34%), followed by motor cycle riders, bus occupants and pedal cyclists. Similar observations were reported in Haryana [11] and Delhi [12]. However, studies in Maharastra, India [9], Nepal [7] and Pandicherry [10] had found RTAs more frequent among drivers and

Figure 1: Types of RTAs according to ICD classification (n=206)



passengers, whereas in Pune and Bangalore [14] the 2 wheelers were the most frequent victims followed by pedestrians. The difference might be due to the preponderance of the vehicles in different study areas.

In this study, fractures were the commonest injuries afflicted to the victims, of which lower limbs were the commonest site for fractures. Similar findings were reported by Tiwary RR et al [8] and Patil SS et al [9]. However several studies [11, 12] had seen more injury of head and neck which might be due to selection of both fatal and non-fatal study population in those studies.

CONCLUSION

The study highlighted the interaction of several factors involved in the occurrence of road traffic accidents especially the low awareness about the safety measures, lack of experience of drivers, narrow and broken roads with poor lighting especially in the crossings and speed breakers, overloaded vehicles and high speed. The high incidence of RTA injuries in our study highlights the need for urgent steps to protect pedestrians. There should also be stricter laws and better enforcement of the laws already on the book. Wide availability of first aid to the victims of RTA and establishing high quality, modern trauma centers along with recruitment and retention of well-trained trauma specialists will help to mitigate the effects of RTA. Further studies are needed to assess which interventions are more likely to prevent RTAs and decrease the morbidity and mortality associated with RTA.

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