ORIGINAL ARTICLE

Patterns of road traffic injuries in a vulnerable population in Hyderabad, India

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Objective: To describe patterns of road traffic injuries (RTI) in a vulnerable population—pedestrians and users of motorized two-wheeled vehicles (MTVs)—in Hyderabad, India.

Methods: 4019 pedestrians and 4183 MTV drivers provided information on the most recent road traffic crash (RTC) irrespective of the level of injury in the last one year for 17 454 and 17 242 household members, respectively. Crashes in which any household member was involved as a pedestrian or MTV user were analysed.

Results: Involvement in an RTC as a pedestrian or MTV user was reported for 1513 (4.4%, 95% CI 4.2 to 4.6%) people in the last one year. In these crashes, the person involved was an MTV user in 1264 (83.5%), aged 21–40 years in 973 (64.3%), and male in 1202 (79.4%). Six (0.4%) people died in RTCs and the cause was collision with a vehicle/person in 1133 (75%) crashes. Among the 1306 people who were injured and survived, 174 (13.3%) were treated as inpatients, 38 (2.9%) could not return fully to routine daily activities, 630 (48.2%) took leave from their regular occupation, and 13 (1%) lost their jobs following injury. Using a three month recall period, the annual incidence per 100 000 population of RTC as a pedestrian or MTV user was 2288 and of non-fatal RTI was 1931, and that of fatal RTI using one year recall period was 17.3 in this population.

Conclusions: These findings on how RTI are caused, their type, and outcomes in pedestrians and MTV users can assist in identifying interventions to improve road safety for this vulnerable population in India, and can also be useful for monitoring the effectiveness of such interventions.

An estimated 82 700 people died and 404 800 were injured in road traffic crashes (RTC) in India in 2002.[1] The numbers of deaths from road traffic injuries (RTI) were the second highest in the South East Asia Region of the World Health Organization in 2002, and these deaths were mainly accounted for by India.[2] Despite this significant burden of RTI, only 0.1% of all health research published from India and included in PubMed in 2002 was related to RTI.[3]

In low and middle income countries including India, pedestrians, cyclists, and motorized two-wheeled vehicle (MTV) users are exposed to a higher risk of RTI and resulting fatalities than private car users.[2 4–12] It has been suggested that policy makers in these countries have ignored RTI as a public health problem because the poor, who are disproportionately affected by RTI, are the least likely to influence policy making, and hence benefit the least from the policies designed for motorized travel.[2 5 13] In addition, comprehensive data on the various aspects of RTI for different types of road users, which could assist better understanding and reduce burden, are not readily available for these countries including India.

The objective of this report is to describe RTC and resulting RTI in pedestrians and MTV users in Hyderabad city in southern India. Currently, MTVs account for 80% of all the non-transport motor vehicles in India.[14] Hyderabad is the sixth largest Indian city with an estimated population of 5.5 million in 2001.[15] Hyderabad had 1.18 million registered motor vehicles in 2001–02, the majority being MTVs (77%), followed by 11% cars, and the rest were other types of motor vehicles.[16]

METHODS

Study respondents

In order to document RTI in pedestrians and MTV users, we assumed that people in the households of pedestrians and MTV drivers were also more likely to be using the road as a pedestrian or MTV user. With this assumption, the study respondents included pedestrians and MTV drivers aged >15 years who were residents of Hyderabad. These respondents provided details on RTC and resulting RTI for people living in their households (people living under one roof and eating from the same kitchen) including self. The study was designed to conduct interviews with at least 4000 each of pedestrian and MTV driver respondents.

Recruitment of study respondents

The pedestrian respondents were people using government/private run local city buses and were recruited at bus stops. The study team surveyed the city to list all bus stops, including "virtual" bus stops (for example, a traffic junction serving as a bus stop). Of the 102 bus stops listed, 12 (11.8%) were categorized as high, 48 (47%) medium, and 42 (41.2%) low volume bus stops, based on the average number of people available at the bus stops at any given time between 8:00am to 7:00pm. Of these, 76 (74.5%) bus stops with some place/shelter to conduct interviews were selected for the study with the aim of interviewing a similar number of respondents from high, medium, and low volume bus stops. The study team requested people waiting at these bus stops to participate, and those who agreed were asked to move to a corner of the bus stop for interview.

Drivers of MTVs (moped, scooterette, scooter, and motorcycle) were recruited at 51 of the 92 retail petrol filling stations of three oil companies in Hyderabad that were functional for at least six months at the time of this study. Forty one petrol filling stations were excluded either because of lack of space to conduct interviews or because the oil

Abbreviations: MTV, motorized two-wheeled vehicle; RTC, road traffic crashes; RTI, road traffic injuries.

companies refused permission. Of the selected 51 petrol filling stations, 17 (33.3%) were high, 23 (45.1%) were medium, and 11 (21.6%) were low volume petrol filling stations (according to categorisation followed by the oil companies based on average number of vehicles procuring petrol per day in each petrol filling station). We aimed to interview a similar number of respondents from high, medium, and low volume petrol filling stations. MTV drivers who stopped at the request of study team to listen to the purpose of the study were asked to participate, and those who agreed were interviewed at an area setup for this purpose at the petrol filling station.

Data collection

Two trained teams, each consisting of a supervisor and four interviewers, were involved in data collection. Written informed consent for participation was sought from all respondents. Questionnaires designed for this study were initially developed in English, translated into Telugu and Hindi, the two main local languages, following which these were back translated into English in order to ensure accurate meaning and intent of the questions, and were pilot tested in a sample of the population. The pedestrian and MTV driver respondents provided data on demographic details and on history of RTC in the last one year for all people living in their household. RTC were defined as a crash on a public road irrespective of the nature of injury (none/minor/major) resulting either from collision with a vehicle/person/object/animal and involving at least one moving vehicle, or skidding/overturning of a moving vehicle, or fall while getting in/alighting from a moving public transport. Detailed documentation of the most recent RTC event in the last one year (irrespective of injury or no injury) was done for those who were alive after an RTC. For those who had died in an RTC in the last one year, details of the RTC that had resulted in death were documented. The interview duration ranged from 25 to 40 minutes, and they were done between 8:00am to 7:00pm. This study was conducted from April to November 2004.

Pedestrians and motorized two-wheeled vehicle users form the largest group of road users in India. Photo: p Virot/WHO.

Data analysis

Data were entered in an MS Access database and analysed using SPSS software. We report details of those RTCs in the last one year in which people living in the pedestrian and MTV driver respondent households were involved as a MTV user or as a pedestrian. Detailed description of the types and causes of RTC and the extent of injuries are presented. RTCs involving the person as MTV user were classified based on the other party involved in the RTC:

- *MTV* and pedestrian (M-P): person in the household involved in RTC was MTV user and crash was with a pedestrian
- *MTV* and another MTV (M-M): person in the household involved in RTC was MTV user and crash was with another MTV

Table 1 Details of the most recent road traffic crashes involving a person as pedestrian or user of motorized two-wheeled vehicle in the last one year

Variable	Variable categories	Total (% of n; n = 1513)	*MTV** and pedestrian, M-P (% of n; n = 33)	*MTV** and motorized two-wheeler, M-M (% of n; n = 355)	*MTV** and others, M-O (% of n; n = 876)	*Pedestrian** and motorized two-wheeler, P-M (% of n; n = 153)	*Pedestrian** and others, P-O (% of n; n = 96)
Age group (years)†	⩽15	*57* (3.8)	0	*5* (1.4)	19 (2.2)	26 (17.0)	*7* (7.3)
	16–20	215 (14.2)	*5* (15.2)	*52* (14.6)	106 (12.1)	30 (19.6)	22 (22.9)
	21–30	644 (42.6)	15 (45.5)	167 (47.0)	399 (45.5)	38 (24.8)	25 (26.0)
	31–40	329 (21.7)	*7* (21.2)	81 (22.8)	204 (23.3)	23 (15.0)	14 (14.6)
	41–50	198 (13.1)	3 (9.1)	43 (12.1)	112 (12.8)	23 (15.0)	17 (17.7)
	>50	70 (4.6)	3 (9.1)	*7* (2.0)	36 (4.1)	13 (8.5)	11 (11.5)
Sex†	Male	1202 (79.4)	27 (81.8)	296 (83.4)	725 (82.8)	90 (58.8)	64 (66.7)
	Female	311 (20.6)	6 (18.2)	*59* (16.6)	151 (17.2)	63 (41.2)	32 (33.3)
Time of crash†	Day	1214 (80.2)	25 (75.8)	297 (83.7)	671 (76.6)	136 (88.9)	85 (88.5)
	Night	299 (19.8)	8 (24.2)	*58* (16.3)	205 (23.4)	17 (11.1)	11 (11.5)
Type of crash†‡	Collision with vehicle/person	1133 (75.0)	32 (97.0)	355 (100)	499 (57.0)	153 (100)	94 (98.9)
	Skidding/overturning of vehicle	270 (17.9)	0	0	270 (30.9)	0	0
	Collision with a non-moving object	54 (3.6)	0	0	54 (6.2)	0	0
	Collision with an animal	28 (1.9)	0	0	28 (3.2)	0	0
	Road related causes	19 (1.3)	0	0	19 (2.2)	0	0
	Others	*7* (0.5)	1 (3.0)	0	*5* (0.6)	0	1 (1.1)
Injury†	None	201 (13.3)	*5* (15.2)	70 (19.7)	110 (12.6)	8 (5.2)	8 (8.3)
	Minor bruises only	420 (27.8)	12 (36.4)	101 (28.5)	235 (26.8)	39 (25.5)	33 (34.4)
	More than minor bruises	886 (58.6)	16 (48.5)	184 (51.8)	526 (60.0)	105 (68.6)	*55* (57.3)
	Death	*6* (0.4)	0	0	*5* (0.6)	1 (0.6)	0

*Italics denote the status of the person for whom data are presented.
†$p<0.001$, χ^2 test.
‡Data not available for two people.

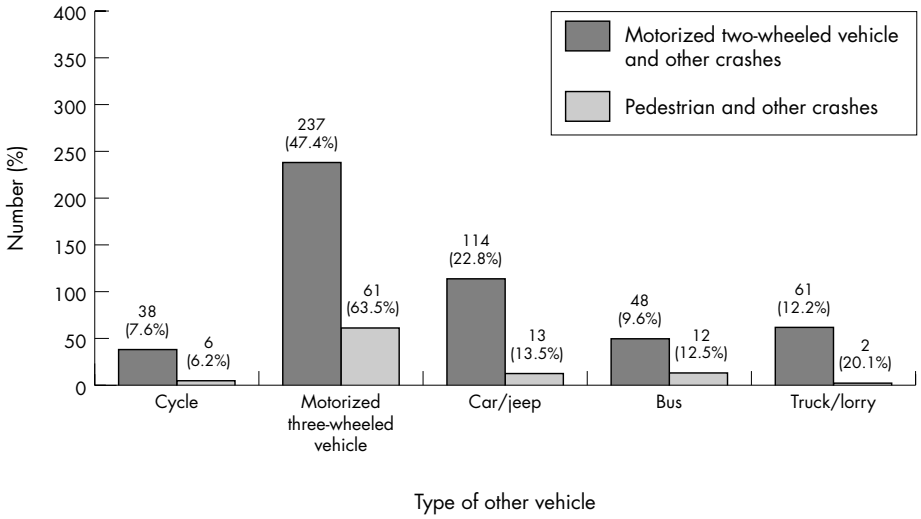

Figure 1 Details of the "other vehicle" involved in the motorized two-wheeled vehicle and other (M-O) crashes and in the pedestrian and other (P-O) crashes. Data not available for four people.

- *MTV* and other vehicles/no vehicle (M-O): person in the household involved in RTC was MTV user and crash was either with a vehicle other than MTV or no other vehicle was involved (skidding/overturning).

Similarly, RTC involving the person as a pedestrian were classified as:

- *Pedestrian* and MTV (P-M): person in the household involved in RTC was pedestrian and crash was with MTV
- *Pedestrian* and other vehicle (P-O): person in the household involved in RTC was pedestrian and crash was with a vehicle other than MTV.

We also estimated the annual incidence of fatal and non-fatal RTI for this population, using the number of deaths due to RTI reported for a one year recall period for fatal RTI and a three month recall period for non-fatal RTI.[17 18]

RESULTS

Participation

A total of 5523 pedestrian respondents were approached, of whom 1412 (25.6%) declined to participate. Of the remaining 4111 pedestrians, 4019 (97.8%) took part in the study. Similarly, 6150 MTV driver respondents were contacted of whom 984 (16%) did not stop and 157 (2.5%) asked not be disturbed. Of the 5009 (81.4%) MTV drivers who stopped to listen to the purpose of the study, 4183 (83.5%) participated.

Among the 8202 pedestrians and MTV drivers respondents, 6012 (73.3%) were males, 5296 (64.6%) were currently married, and 4295 (52.4%) were the main income earner in their households. The per capita monthly household income was Indian rupees (Rs) 2000 or less (US$ 44.4) for 3360 (41%), Rs 2001–4000 for 2314 (28.2%), >Rs 4000 (US$ 88.9) for 1284 (15.6%), and not available for 1234 (15.1%) respondents.

The 4019 pedestrians and 4183 MTV drivers provided RTC history for 17 454 and 17 242 people living in their households (including self), respectively. Of these 34 696 people, 18605 (53.6%) were males, 6599 (19.1%) ⩽15 years of age, 13 384 (38.6%) between 16–30 years, 10 673 (30.8%) 31–50 years, and 4040 (11.6%) >50 years.

Overall RTC history

For the total 34 696 people, history of at least one RTC as any type of road user in the last one year not resulting in death was reported for 1837 (5.3%, 95% CI 5.1 to 5.5%) with only one RTC incident in the last one year for 1710 (93.1%) people. History of death in RTC in the last one year was reported for seven (0.020%, 95% CI 0.008 to 0.041%) people.

RTC history as pedestrian or MTV user

For the total 34 696 people, involvement as a pedestrian or MTV user in the most recent RTC in the last one year was reported for 1513 (4.4%, 95% CI 4.2 to 4.6%) people of whom

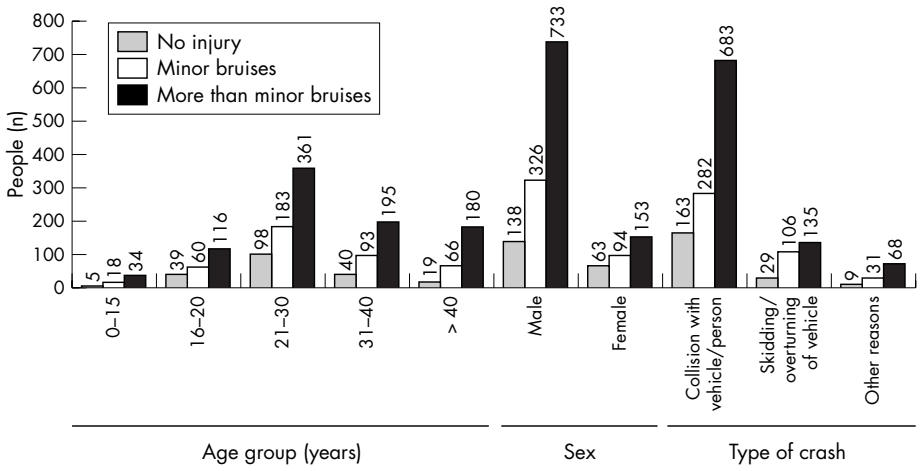

Figure 2 Distribution of the level of injuries for pedestrian or user of a motorized two-wheeled vehicle who survived road traffic crash in the last one year based on the age group, sex, and type of crash. Other reasons in type of crash include collision with a non-moving object/animal, road related causes, and other causes. $p<0.001$ for all variables; χ^2 test.

Table 2 Details of injuries for people who were injured in and survived road traffic crashes as a pedestrian or user of motorized two-wheeled vehicle in the last one year

Variable	Variable categories	Number injured (% of n; n = 1306)	*MTV** and pedestrian, M-P (% of n; n = 28)	*MTV** and motorized two-wheeler, M-M (% of n; n = 285)	*MTV** and others, M-O (% of n; n = 761)	*Pedestrian** and motorized two-wheeler, P-M (% of n; n = 153)	*Pedestrian** and others, P-O (% of n; n = 88)
Place of injury†	Head/neck	128 (9.8)	3 (10.7)	24 (8.4)	88 (11.6)	7 (4.9)	6 (6.8)
	Face	54 (4.1)	2 (7.1)	9 (3.2)	36 (4.7)	5 (3.5)	2 (2.3)
	Hand/shoulder/arm	330 (25.3)	9 (32.1)	75 (26.3)	204 (26.8)	30 (20.8)	12 (13.6)
	Abdomen/stomach/chest	10 (0.8)	0	1 (0.4)	7 (0.9)	2 (1.4)	0
	Leg/knee	412 (31.5)	5 (17.9)	77 (27.0)	246 (32.3)	51 (35.4)	33 (37.5)
	Minor bruises‡	440 (33.7)	12 (42.9)	103 (36.1)	242 (31.8)	46 (31.9)	37 (42.0)
	Others	16 (1.2)	0	2 (0.7)	12 (1.6)	2 (1.4)	0
Sought treatment outside home§	Yes	995 (76.2)	18 (64.3)	215 (76.5)	591 (78.0)	118 (81.9)	53 (63.1)
	No	300 (23.0)	10 (35.7)	66 (23.5)	167 (22.0)	26 (18.1)	31 (36.9)
Treatment provided as¶	Outpatient	809 (82.3)	18 (100)	186 (86.9)	463 (79.7)	102 (86.4)	40 (76.9)
	Inpatient	174 (17.7)	0	28 (13.1)	118 (20.3)	16 (13.6)	12 (23.1)
Returned to routine daily activities completely**	Yes	1267 (97.0)	28 (100)	284 (99.6)	739 (97.2)	136 (94.4)	80 (90.9)
	No	38 (3.0)	0	1 (0.4)	21 (2.7)	8 (5.5)	8 (0.9)

*Italics denote the status of the person for whom data are presented.
†For the 1306 people who had sustained injuries; the total adds to more than 1306 as multiple places of injuries were reported for some; p = 0.085, 0.569, 0.047, 0.642, 0.099, and 0.576 for head/neck, face, hand/shoulder/arm, abdomen/stomach/chest, leg/knee, and others, respectively, χ^2 test.
‡Location of minor bruises on the body was not documented; p = 0.002, χ^2 test.
§Data not available for 11 people; p = 0.007, χ^2 test.
¶For the 995 people who had sought treatment for injuries outside home; data not available for 12; p = 0.016, χ^2 test.
**Data not available for one person; p<0.001, χ^2 test.

1264 (83.5%) were MTV users and 249 (16.5%) were pedestrian. Of these 1513 RTC, 1507 (99.6%) did not result in death, six (0.4%) resulted in the death of the person involved, 784 (51.8%) were RTC histories of the respondents who gave interview, and 729 (48.2%) were of the persons living in their households.

Details of RTC

Among these 1513 RTC, 33 (2.2%) were M-P, 355 (23.5%) M-M, 876 (57.9%) M-O, 153 (10.1%) P-M, and 96 (6.3%) P-O crashes (table 1). Of the 1513 involved in RTC, 973 (64.3%) were aged 21–40 years, 1202 (79.4%) were males, and the type of crash was collision with a vehicle/person for 1133 (75%) (table 1).

For the 1264 people involved in an RTC as an MTV user, 1105 (87.4%) were driving MTVs, and for the 249 involved in an RTC as a pedestrian, 131 (52.6%) were crossing the road, 81 (32.5%) were walking on the road, 22 (8.8%) were standing on the road, nine (3.6%) were alighting from/trying to catch a moving bus, and three (1.2%) were doing other activities on road at the time of crash.

Details of the other vehicle involved for the M-O and P-O crashes are shown in figure 1. Motorized three-wheeled vehicles were the ''other vehicle'' involved in majority of the M-O and P-O crashes. Among the M-O crashes, skidding/overturning of vehicle was responsible for 30.9% of RTC (table 1). For the 54 M-O crashes due to collision with a non-moving object, road divider was the object in 32 (59.2%), stone on the road in 13 (24.1%), speed-breaker, tree, or footpath in two each (3.7%), wall in one (1.8%), and other objects in two (3.7%) crashes. For the 19 M-O crashes with road related reasons as type of RTC, eight (42.1%) were due to a pit/ditch on the road, three (15.8%) due to an open manhole, and remaining due to other causes.

Extent of injury in RTC

Of the 1513 people involved in RTC, 201 (13.3%) had sustained no injuries and six (0.4%) had died (table 1). Of the six who died, three (50%) were between 21–40 years of age and three (50%) >40 years of age; five (83.3%) were males, five (83.3%) were MTV users, all had collision with a vehicle and had sustained head injuries, and three (50%) had died at the crash site.

The levels of injuries by age, sex, and type of crash for the 1507 who survived RTC are shown in figure 2. Leg/knee (31.5%) followed by hand/arm/shoulder (25.3%) were the most frequent places of injury for 1306 people who were injured in and survived RTC (table 2). Head injuries were reported significantly more for MTV users compared with pedestrians (p = 0.018). Of the 1306 with any level of injury who had survived RTC, 995 (76.2%) had sought treatment outside home for their injuries, including 174 (17.7%) hospitalized for treatment with their hospital stay ranging from one to 60 days (mean = 7.7 days, median = 4 days). Thirty eight (2.9%) of the 1306 with any level of injury who had survived RTC had not returned completely to their routine daily activities at the time of the interview. The major physical problems cited by these 38 individuals were: 15 (46.9%) had difficulty in walking, eight (25%) had difficulty in using hand/arm, five (15.6%) were unable to sit/stand/sleep straight (not mutually exclusive). Of the 1306 people with any level of injury who had survived an RTC, 630 (48.2%) had taken leave ranging from one to 270 days (mean = 16.8 days; median = 10 days) from their regular occupation/school because of RTI, and 13 (1%) had lost their jobs following RTI.

Estimates for annual incidence

The annual incidence per 100 000 population in this population of 34 696 people of involvement in RTCs as a pedestrian was 369 and as MTV user was 1919, of fatal RTI as a pedestrian was 2.9 and as MTV user was 14.4, and that of non-fatal RTI as a pedestrian was 337 and as MTV user was 1594.

DISCUSSION

Recent studies from Asia have shown that pedestrians and MTV users have the highest rates of injury in RTCs.[10 11 19–21] Much of the available data on RTI in developing countries deal with mortality and severe injuries reported in the records of police, hospitals, or road safety agencies. In this paper we have reported data on RTC among pedestrians and MTV users, and the outcomes of these crashes in Hyderabad city

including RTCs that resulted in no or minor injuries. Such data are not readily available for India because RTCs that result in no/minor injury are not reflected in police and hospital records.

This study has some limitations. The study participants may not be representative of all pedestrians or MTV users in Hyderabad. It is likely that non-fatal RTI are underreported in our study. First, since we used proxy documentation of RTI for the people living in a household, it is likely that the study respondent was not aware of all RTCs for each person in his/her household. This could have resulted in underreporting of non-fatal RTI; the extent of underreporting is difficult to comment upon. In a study in Ghana, the rate estimates for severe injuries were not affected when data were collected from proxy (other family member).[17] Second, recall bias for non-fatal injuries has been documented previously.[17 18] Results from these studies suggest that because more severe injuries are less frequent, a one year recall period is appropriate to collect data on non-fatal injuries, but a recall period of three months should be used to calculate overall non-fatal injury rate.[17 18] We used data for one year recall to describe various aspects of RTI and to estimate the annual incidence of fatal RTCs but have used three month recall to estimate the annual incidence of non-fatal RTCs.

It is interesting to note that 35.7% of all RTC were between pedestrians and MTV users themselves (M-P, M-M, and P-M crashes). It is not surprising that males outnumbered females with RTC history in this study, as is documented from elsewhere,[2 7] and is also captured in RTI records of police in Hyderabad.[11 12] This overrepresentation of males is probably related to their higher exposure to road traffic due to economic opportunities and also higher risk taking behavior.[2 10 22 23] Among people with RTC history in our study, 64.3% were 21–40 years of age. Higher occurrence of mortality and morbidity due to RTI among young adults is well documented.[24]

Collision with a vehicle/person was responsible for 75% of the reported RTCs. Among pedestrians who had a collision with vehicles, a little over half reported collisions while crossing a road and another 32.5% while walking on the road. It is more common in Hyderabad for pedestrians to cross the road anywhere (usually right across their destination) than to cross it at a designated pedestrian crossing (when available), and to walk on the road than on footpaths (often in the direction of traffic resulting in not being aware of vehicles coming behind them). However, road design also contributes to non-use of pedestrian crossings and footpaths. Pedestrian crossings are often available only at a significant walking distance from bus stops and hence people avoid walking that distance by crossing the road anywhere they like. Footpaths are often occupied by hawkers, have uneven pathway to walk on, and have little space to walk because the City Corporation has used these for planting trees to beautify the city.

Similarly, collisions with other vehicles for MTV users are common in Hyderabad as they compete with larger vehicles for space. Auto-rickshaws were the most common other vehicle involved in RTC with MTVs. This is not surprising since auto-rickshaws form a large proportion of commercial vehicles in Hyderabad and also account for a high proportion of registered traffic law violations along with MTV drivers, especially driving violations that carry a higher risk of being involved in a crash in Hyderabad.[25] For MTV users, these data also highlight types of RTC other than collision with a vehicle/person, such as skidding/overturning of vehicle, collision with road divider, RTC due to a pit/ditch on the road or an open manhole. Such data highlighting the vehicle and environment related issues for RTC are not readily available for India,[11] but are necessary for comprehensive understanding of RTCs to plan strategies for minimizing their risk.

Nearly six out of 10 people with RTC history suffered more than minor bruises, with injuries to lower limbs accounting for a significant proportion. Data from the Global Burden of Disease Project show that nearly 20% of those injured in non-fatal RTCs had fractures to the lower limbs.[26] Head injuries were reported significantly more for MTV users than pedestrians in this study. Head injuries are reported to be the main cause of mortality in MTV users from other parts of the world,[27–30] and the use of helmets has been shown to reduce fatal and serious head injuries.[29] We did not document use of helmet for household members involved in RTCs as MTV user. However, 69.8% of the 4183 MTV driver respondents in this study reported no/very occasional use of helmet, with reasons ranging from discomfort, not necessary to wear helmet, and inconvenience.[31] Use of helmet was made compulsory in Hyderabad only in January 2005, and even now many do not use it.

The mean length of hospital stay reported was 7.7 days (range 1–60 days) for those who were treated as inpatients in our study. This duration is less than the mean hospital stay of 20 days (range 3.8–44.6 days) for RTI reported from low and middle income countries.[7] This could possibly be due to inclusion of a broader range of injuries in our study population, including a higher proportion of less severe injuries. In our study 2.9% of those who were injured and survived did not return fully to their routine daily activities. Hand and leg related morbidity was cited for those who did not recover fully. It has also been reported previously that pedestrians and MTV users report more continuing medical problems and require more assistance compared with other types of road users.[32]

Like in many other low and middle income countries, MTVs and public transport (used by pedestrians) are often the only affordable means of transport in India. There is also evidence that victims of RTCs in these countries—pedestrians

Key points

- Data on patterns of road traffic injuries among vulnerable groups—pedestrians and motorized two-wheeled vehicle (MTV) users—who account for a large proportion of these injuries in India, are not readily available.
- Of 34 696 people for whom data were available, history of involvement as a pedestrian or user of MTV in the most recent road traffic crash in the last one year was reported for 1513 (4.4%), of whom six (0.4%) had died.
- Among this vulnerable population, the annual incidence per 100 000 population of involvement in road traffic crashes as a pedestrian or MTV user was 2288, of non-fatal road traffic injuries was 1931, and of fatal road traffic injuries was 17.3.
- People aged 21–40 years, males, and collision with a vehicle/person accounted for the highest proportion of these crashes.
- Among those injured, 31.5% had injuries to leg/knee, 76.2% sought treatment outside home, and 3% could not return to normal daily activities after being injured.
- These findings can help identify interventions to improve road safety for this vulnerable population in India, and could also be used for monitoring the effectiveness of such interventions.

and users of two-wheeled vehicles—are mainly the poor.[2 5 33] Pedestrians and MTV users form the largest group of road users in Indian cities, and also account for a large proportion of RTI as they share traffic space with four-wheeled vehicles. However, road design and traffic management fail to provide adequate safety to them in such a mix of traffic. This study has documented how RTI are caused, their type, and outcomes in these vulnerable road users. These findings reinforce the interventions suggested to improve road safety in south Asia including India,[34] and could also be useful for monitoring the effectiveness of such interventions in the long term.

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