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Position paper

Urban traffic safety assessment: A case study of six Indian cities

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ABSTRACT

This study reports the results of fatal road traffic fatal crash data from six mid-sized cities in India: Agra, Amritsar, Bhopal, Ludhiana, Vadodara, and Vishakhapatnam. Relative to total road fatalities, the percentage of vulnerable road user deaths in all six cities range between 84% and 93%, car occupant fatalities between 2% and 4%, and TST occupants less than 5%. The largest proportion of fatalities for all road user categories (especially vulnerable road users) is associated with collisions with buses and trucks, followed by collisions with cars; however, the proportion of pedestrian fatalities associated with MTW collisions ranges from 8% to 25% of the total. The data indicate that the 0–14 age group is underrepresented in proportion to its share of the population, including children riding motorcycles. Occupant fatality rates per 100,000 vehicles for MTW and TST occupants are 2–3 and 3–5 times higher, respectively, than for cars. However, estimates of association with fatal crashes show that MTWs and cars pose a similar risk to society, with TSTs representing a slightly smaller risk. Confirming some of these results will require data with a higher level of detail.

1. Introduction

1n 1990, road traffic injuries (RTIs) corresponded to the tenth leading cause of death across the globe. In 2013, the global situation worsened, with RTI moving up to the fifth position after ischaemic heart disease, lower respiratory infections, cerebrovascular disease, and diarrhoeal diseases [1]. While the number of life years lost due to RTI has increased globally, the situation has improved in many of the OECD countries [2] but not in most low- and middle-income countries [3]. Among the low- and middle-income countries, India accounts for a large share of the deaths and disabilities contributed by RTI, owing partly to the country's large share of the world population [3] and a lack of appropriate road safety measures [4]. In 2014, RTI resulted in 141,526 fatalities in India, resulting in a rate of 11 deaths per 100,000 population as compared to rates of in more successful countries, where rates tended to be around 3 or 4 deaths per 100,000 population [5].

The high rate of RTI in India is also evident in its cities, where the fatality rates vary between 3 and 35 per 100,000 populations [4,5]. Interestingly, the low end of that spectrum compares well with some of the safest cities in the world, while the higher end ranks with some of the worst. Over the past decade, the fatality rate in some of these cities has increased by a factor of 4 or more. However, as details of RTI and crashes are not in the public domain for most cities, it is difficult to ascribe reliable reasons for these differences and the increases in fatalities over time.

Official road traffic crash data for most cities in India do not include fatalities by road user category. Such data are only available from a few cities and research studies done on selected locations on rural highways. Table 1 shows the traffic fatalities by road user category in Delhi, Mumbai, and selected locations on national and state highways [6–9]. These data show that car occupants represented a small proportion of the total fatalities: 4% and 3% in Mumbai and Delhi, respectively, and 15% on rural highways. Vulnerable road users (pedestrians, bicyclists, and motorised two-wheeler riders) accounted for 89% and 83% of the deaths in Mumbai and Delhi, respectively, and 47% to 76% of those on highways. This pattern is very different from those in high-income countries [10].

The high incidence of vulnerable road user fatalities has a negative influence on many conditions in urban life, including the freedom of children and the elderly to use the street and public transport. Safety on public transport access trips is one important issue. Unless walking trips are safe from accidents, harassment, and crime, people avoid using public transport. Therefore, safety emerges as a precondition for promoting public transport and active travel [11–15]. However, it would be difficult to promote effective road safety countermeasures all over the country in the absence of RTI details from more cities in India. The present study aims to establish an understanding of road

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Table 1
Modal share of road traffic fatalities in Mumbai, Delhi, and four rural highway locations in India.

Location		Fatalities by road user type, %						
		Pedestrian	Bicycle	Motorised two-wheeler	Car	Bus	Truck	Unknown & other
Urban	Mumbai (2008–2012)[1]	58	2	29	4	0	0	7
	Delhi (2013)[2]	47	10	26	3	4	3	7
Rural highways	Highways (1998)[3]	32	11	24	15	3	14	1
	2-Lane NH8 2 (2010–2014)[4]	20	2	42	14	9	13	1
	4-Lane NH24 (2010–2014)[4]	27	5	44	8	7	4	4
	6-Lane NH1 (2010–2014)[4]	34	3	10	6	5	41	1

Notes: (1) Average of data for 2008–2012, adapted from [9]; (2) source: [7]; (3) data for locations on 34 national and state highways in India, 1998 [6]; (4) source: [8].

traffic crash details in mid-size Indian cities and present the results of data collected from six cities with populations in the range of 1.0–2.0 million people.

2. Method

2.1. Selection of cities

Six cities with populations between 1.0 and 2.0 million and different RTI fatality rates were selected from different locations in India: Agra, Amritsar, Bhopal, Ludhiana, Vadodara, and Vishakhapatnam. Table 2 shows the population and fatality rate for each city [16,17]. These cities exemplify the type of growing urban agglomerations that observers expect to experience high growth rates over the next decade.

2.2. Data collection

Research assistants were sent to Agra, Amritsar, Bhopal, Ludhiana, Vadodara, and Vishakhapatnam to obtain primary data on vehicle registration, road traffic fatality cases, and other data available from secondary sources (such as transportation and city development plan studies commissioned by the respective city governments). Researchers visited all the city police stations and placed requests for copies of First Information Reports (FIRs) detailing fatal road traffic crashes for the period from 2008 to 2011. The data from these records were coded onto accident recording forms designed specifically for this project. The data from these forms were then entered into spreadsheets for computer analysis. The following variables were used for analysis:

- Victim gender
- Month, day, and time of the crash
- Road user type and crash vehicle type
- Type of road where the crash occurred
- Vehicles registered in the city
- Brief description of the crash as recorded by the police.

These were the only variables in the police files that were considered reliable. The data coders were also asked to note details of crashes that had any special characteristics and reports of crashes involving children. Fatality data could not be obtained for the full four-year period for all the cities. Table 3 shows the number of records obtained from each city. Vehicle registration data for Amritsar was not available.

3. Results and discussion

3.1. Vehicle registration

Table 4 shows the number of vehicles in 2011 for five of the six cities in the study. Data for Amritsar were not available. Fig. 1 shows an example of a three-wheeled scooter taxi (TST). The actual numbers of personal vehicles (cars and motorised two-wheelers) are estimated to be 60% of the official number for cars and 50% of the official number for motorised two-wheelers. These adjustments have been made because the official numbers of personal vehicles are inflated; in India, owners pay a lifetime registration tax upon purchasing a vehicle, but most owners do not de-register their vehicles when they stop using them. Our estimates of actual vehicle numbers are based on three survey studies that were conducted to determine the number of vehicles on the road in India [18,19].

Table 4 shows the relative proportions of vehicles registered in five of the cities in the study. Overall, the cities have similar vehicle proportions. However, Ludhiana has the highest number of cars and MTWs, while Vadodara and Vishakhapatnam have a much higher proportion of TSTs.

3.2. Modal share of RTI fatalities

Fig. 2 shows the proportions of road traffic fatalities by road user type in the six Indian cities. The total number of vulnerable road user deaths in all six cities ranges between 84% and 93%, with car occupant fatalities varying between 2% and 4%. TST occupants account for less than 5% of all deaths in all the cities besides Vishakhapatnam, where the proportion is 8%. These total proportions are similar to those in the megacities of Mumbai and Delhi. However, these smaller cities have lower relative proportions of pedestrian fatalities and higher relative proportions of MTW than the figures for the megacities. This may be because the proportion of MTW ownership is higher in the smaller cities than in the megacities [4]. Helmet use by MTW riders is not enforced in any of these cities, though helmet use is mandated by the Motor Vehicles Act 1988 of India [20]. The high rate of MTW fatalities could be reduced significantly if the existing mandatory helmet laws were enforced in all the cities and laws requiring MTWs to keep their lights on during the day were implemented [21–24].

Ludhiana and Amritsar have relatively high proportions of bicyclists. Anecdotal evidence suggests that these cities have higher rates of bicycle use than the other cities in the study, but we cannot confirm this conjecture. At present, we are unable to determine the reasons for a higher rate of MTW fatalities in Vishakhapatnam.

Table 2
Population and road traffic fatality data for six cities selected for the study [16,17].

	City					
	Agra	Amritsar	Bhopal	Ludhiana	Vadodara	Vishakhapatnam
2011 population	1,574,542	1,132,761	1,795,648	1,613,878	1,666,703	1,730,320
2011 road traffic fatalities	653	70	254	294	172	416
Fatalities per 100,000 persons	41	6	14	18	10	24