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Epidemiology of Road Traffic Injuries in Delhi: Result of a Survey

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By Pramod Kumar Verma*, K.N. Tewari**

Abstract

Among 30 554 population, there were 680 traffic injuries with (IR) 22.3 per 1 000 population. Of the total injuries, 69% occurred in the age group of 15 to 35 and males were four times more affected than females. The business group had a higher incidence (IR 44.0) followed by the service group (IR 40.1) and the labour group (IR 28.9). The annual incidence was highest among people with sixth to eighth class education level (5.3), followed by graduates (3.6). Limbs (62.2%) were the most affected part followed by head injury (11.2%). Superficial injuries were most common (47.4%), followed by fractures (20.7%), crush injuries (14.1%) and concealed injuries (12.4%). 19.3% injuries occurred during recreational activity. Majority of the injured victims (92.4%) were administered treatment within six hours while 70.0% availed treatment within one hour of injury. Majority of injured victims took treatment from a nearby private clinic (44.4%), followed by treatment from government hospitals (26.8%) and private hospitals (16.0%). Outpatient treatment was required by 47.1%; 5.9% were hospitalized; 9% of patients were critically ill due to injuries, 1.8% had to be operated upon, and 1.3% had to be admitted to Intensive Care Units (ICU). Most of the victims resumed work within 2-4 days of injury (19.3%), followed by 5-7 days absence from work (14.7%), while 13.4% could not resume normal work for 1-2 months. Injury was more common among two-wheelers used by the victims (46.3%), and among pedestrians (24.85%).

Introduction

Due to the fast pace of modernization, basic needs including the requirement of a vehicle for transportation are expanding rapidly and resulting in an epidemic situation of injury everywhere including developing countries. The risk factors are increasing in some developing countries; for example, motor vehicle ownership may double within five years causing streets and highways to become choked by inadequately maintained vehicles[1]. According to the World Health Report 2002, of the global burden of injury, 30.3% morbidity and 28.7% mortality occurred in the South-East Asia Region[2]. According to a report of the Ministry of Home Affairs, Government of India, one accident occurs every two minutes and one suicide every five minutes in India, with the accident rate corresponding to 45 per 100 000 population. Delhi ranks fifth among other states/Union Territories of India in respect of accidents. In 1999, India had 40 939 000 vehicles and 306 400 road traffic accidents, which correspond to a rate of 7.5 accidents/ 1 000 vehicles. Of the total 340 454 accidental injuries and 244 412 accidental deaths, 95.3% injuries (324 520) and 33.2% deaths (81 036) were due to road traffic, which correspond to rates of 7.9 and 2.0 per 1 000 vehicles respectively. The sex ratio of road traffic injury in India was 4.5 males: 1 female[3]. The Registrar General of India's report on the survey of causes of death (rural), 1993 shows that 8.7% mortality was due to accidental injuries[4]. According to the National Road Transport Council and Trauma Cases Association, at least 25 000 lives are lost every year due to road accidents in India. India has only 1% of vehicles in the world but accounts for nearly 6% of the total cases of unintentional injuries. The uninten-tional injury rate in India is 34.6/10 000 vehicles, while the accident rates in USA and Sweden are only 14 and 4.8 respectively[5].The cost of injury estimated for both developed (USA) and developing (India) countries is equally high as compared to the countries' per capita income i.e. the ratios of cost per fatality: per capita income are 20:1 and 17:1 respectively[6,7].

Methods

A sample size[8] of 30 554 population residing in 5 412 households of the Municipal Corporation of Delhi (MCD) was selected for this study by using the systematic random sampling method. A semi-structured interview schedule was used to collect retrospective one-year data on epidemio-logical factors of traffic injuries in October 2002. The definition of injury used for this study is "External force/non-contagious

substance, striking the body or entering into the body and causing anatomical dis-continuity of tissue or derange physiological function of body". The study included all major injuries caused by the involvement of at least one moving vehicle but did not include minor injuries which did not need any treatment or did not affect work and were not recallable at the time of interview. Funds for this study were provided by the World Health Organization, South-East Asia Regional Office.

Results

About the area of study

As per the 2001census, Delhi had a population of 13 803 085 within an area of 14 835 sq. km., out of which 97% population (13 383 877) resided in the area of MCD[9]. In the area of study, most of the families were nuclear (59.4%) as compared to joint families (40.6). Majority of households had five-six members (38.2%) or three-four members (30.2%). However, there were large families too with seven-eight members (15.6%) or more than nine members (11.6%).

Magnitude of injury

Among the 30 554 population surveyed, there were 2 232 major injuries either affecting work or for which treatment was availed, which corresponded to an annual incidence of 73.1 per 1 000 population (morbidity 62.5; disability 9.0, and mortality 1.5). Out of 2 232 injuries, 680 were traffic injuries which corresponded to an annual incidence of 22.3 per 1 000 population (18.5 morbidity; 3.4 disability, and 0.4 mortality). Apart from these major injuries, 1 334 minor injuries including 206 traffic injuries were noted during the last one year which did not affect work and did not need any treatment except application of routine antiseptic lotions like minor cuts during shaving or other routine work. These minor injuries corresponded to an annual incidence of 43.7 per 1 000 population (6.7 for traffic injuries). The annual incidence of the combined minor and major injuries was noted as 116.7 per 1 000 population (29.0 for traffic injuries). The morbidity pattern of injuries shows maximum cases of falls (38%) followed by traffic (31%), mechanical injuries (11%), burns (8%), and animal-bites (7%) etc. as shown in Figure 1.

Epidemiological Factors of Traffic Injury

Host factors

Age: The incidence of traffic injury per 1 000 population was high in the age group of 15 to 55 years but the total number of injuries were more in the age group of 15 to 35 (69% i.e. 470 out of 680) as shown in Figure 2)

Figure 1. *Distribution of 2 232 different types of major injuries, Delhi, 2002*

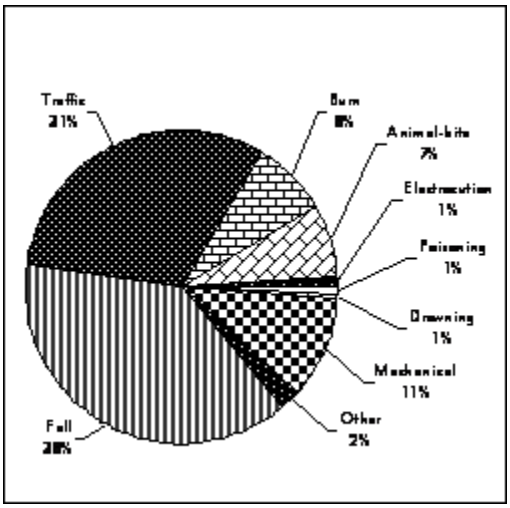
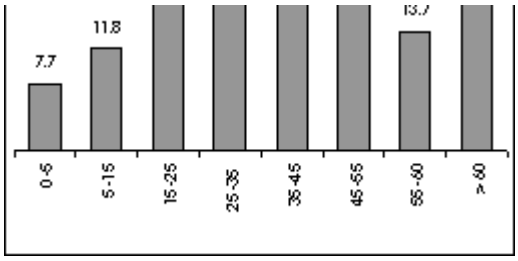


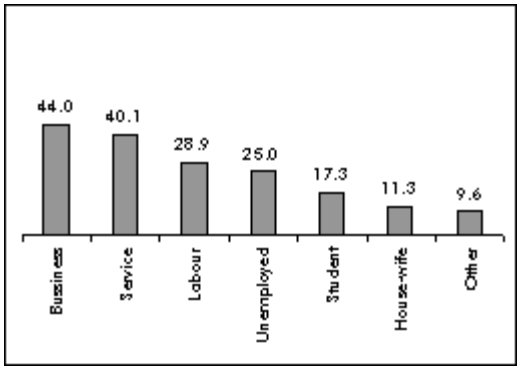
Figure 2. *Age-wise annual incidence of road traffic injuries per 1 000 population in Delhi, 2002*



Sex: The annual incidence of injury was noted to be four times higher among males (IR 17.6) as compared to females (IR 4.7).

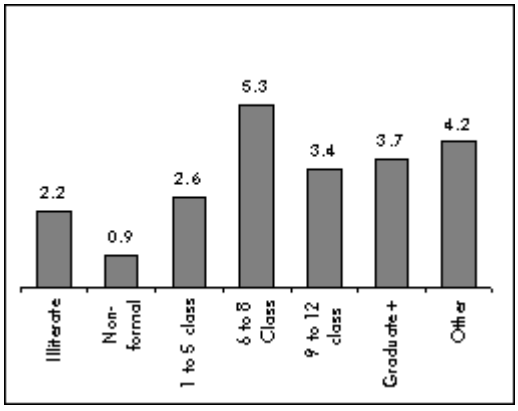
Occupation: The business group was noted to have a higher incidence of traffic injury (IR 44.0), followed by the service group (IR 40.1) and the labour group (IR 28.9). Housewives had the least incidence of traffic injuries (IR 11.3) as shown in Figure 3.

Figure 3. *Occupation-wise annual incidence of road traffic injuries per 1 000 population, Delhi, 2002*



Education: The annual incidence of traffic injuries per 1 000 population was the highest among people with an education level corresponding to class sixth to eighth, followed by 3.6 among graduates and 3.4 among those with an educational level corresponding to class ninth to twelfth. However, injuries were less common among the lower educational group. As seen from the Figure 4, traffic injuries were higher among the educated group of people.

Figure 4. *Education-wise annual incidence of road traffic injuries per 1 000 population, Delhi, 2002*



Marital status: The annual incidence of traffic injuries was more common in the married group (IR 10.4) as compared to those in the separated or divorced group (IR 0.1).

Part of Body: As shown in Table 1, limbs (62.2% i.e. 41.3% lower limbs and 20.9% upper limbs) were the most affected parts of the body in majority of traffic injuries followed by head (11.2%), while abdomen and thorax injuries were much less common among traffic injury victims. Out of total 680 injury cases, 152 were noted to lose consciousness immediately after the injury event and of them, 29 recovered consciousness immediately while 123 remained unconscious for longer time.

Type of Injury: As per distribution of injury cases according to type of injuries, superficial injuries were found to be the most common (47.4), followed by fractures (20.7%); crush injuries (14.1%), and con-cealed injuries (12.4%). Among bleeding cases, blood transfusion was more frequently given among traffic injuries (31 cases) (See Table 1).

Ailment at the time of injury: While 1.9% reported to have consumed alcohol/drug, and 1.0% reported acute illness prior to the accident; these could be predisposing factors for traffic injuries (See Table 1).

Activities at the time of Injury: Out of 680 injury cases, 19.3% injuries occurred during recreational activities, followed by 3.1% which were attributed by respondents due to hurry and 1.9% due to fatigue after work. These risk factors may play a significant role in the occurrence of traffic injuries (See Table 1).

Table 1:Distribution of 680 various types of road traffic injuries affecting different parts of the body and their predisposing factors, Delhi, 2002

Part of the body	Type of injury	Type of ailment	Nature of activity
Head 76 (11.2%)	Superficial 322 (47.4%)	Acute illness 7 (1.0%)	Routine work 498 (73.2%)
Neck 13 (1.9%)	Crush injury 96 (14.1%)	Chronic illness 3 (0.4%)	Fatigue after work 12 (1.8%)
Chest 13 (1.9%)	Sprain 23 (3.4%)	Disability 3 (0.4%)	Recreational 131 (19.3%)
Abdomen 7 (4.4%)	Fracture 141 (20.7%)	Alcoholism/ drug addiction 13 (1.9%)	Hurry 21 (3.1%)
Limbs 394 (62.2%)	Concealed injury 84 (12.4)	Mental stress 6 (0.9%)	Other 18 (2.6%)
Other 125 (18.4%)	Others 14 (2.0%)	None 638 (93.8%)	

Environmental Factors

Months of the year: The maximum number of injuries occurred in July, August and September (387 cases), which is the hot-wet season in this part of India.

Time of occurrence of injury: As observed from the study data, most injuries occurred between Indian Standard Time (IST) 15-18 hours (146), followed by: between IST 12-15 hours (123), and between IST 18-21 hours (117) (See Figure 5).

Local environmental condition of the place of injury: Out of 680 injured victims, it was observed that 30.3% injuries occurred in congested areas, 7.2% occurred due to faulty designing, 26.8% due to poor visibility and 27.6% due to unfavourable weather conditions (See Table 2).

Figure 5. Distribution of cases of injuries by hours in Delhi, 2002

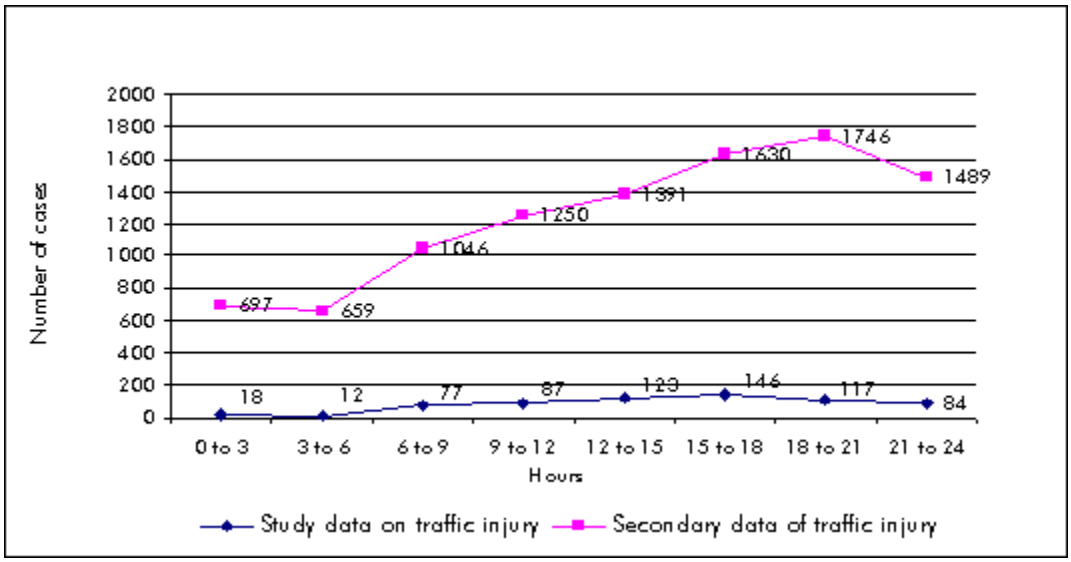


Table 2:Local environmental condition of the place of road traffic injury, Delhi, 2002

Condition of environ-ment	Congested area	Faulty design	Visibility	Unfavour-able weather
Yes	206 (30.3%)	49 (7.2%)	182 (26.8%)	188 (27.6%)
No	444 (65.3%)	590 (86.8%)	457 (67.2%)	443 (65.1%)
Unknown	30 (4.4%)	41 (6.0%)	41 (6.0%)	49 (7.2%)
Total	680 (100%)	680 (100%)	680 (100%)	680 (100%)

Table 3: Distribution of the 680 road traffic injury cases according to the type of vehicle (including pedestrians) involved during the accident, Delhi, 2002

Type of vehicle (including pedestrians)	Victim vehicle	%	Hitting vehicle	%
Bicycle	96	14.1	35	5.2
Two-wheeler	315	46.3	167	24.6
Three-wheeler	35	5.2	94	13.8
Car	25	3.7	102	15.0
Bus	12	1.8	45	6.6
Truck/ tempo	5	0.7	49	7.2
Rail	0	0.0	6	0.9
Pedestrians	169	24.9	0	0.0
Other	23	3.4	182	26.8
Total	680	100	680	100

Agents/Factors Causing Traffic Injury

Type of vehicle involved: The injury data regarding the type of vehicle involved in traffic accidents show that injury was more common among occupants of two-wheelers (46.3%) and pedestrians (24.9%). More often, the hitting vehicles were two-wheelers (24.56%), followed by cars (15%) and three-wheelers (13.82%) (See Table 3).

Cause of event: High speed (31.03%) and congested roads with high vehicular density (20.44%) were the leading factors for occurrence of traffic injury. The other major factor was badly-maintained slippery roads (16.47%) (See Table 4).

Table 4:*Distribution of road traffic injured victims according to the cause of event, Delhi, 2002*

Cause of event	No. of cases	%
Mechanical fault of vehicle	43	6.32
High speed	211	31.03
Congested road	139	20.44
Poor light	19	2.79
Slippery/ill-maintained road	112	16.47
Obstacle	31	4.56
Fault of pedestrian	24	3.53
Other	101	14.85

Total	680	100

Post-Injury Care and Disability Factors

Transportation used for reaching Medical Centre: As shown in Table 5, autos/taxis (35.7%) were observed to be the most commonly used mode of transport to reach the health set-up for treatment in majority of cases, followed by bicycles (9.4%); ambulances (4.9%); public transport (4.1%), and two-wheelers (2.1%). Ambulance was not a frequently used transport. Police Control Room (PCR) vans were more commonly used vehicles. The use of these vehicles was largely dependent on their easy availability nearby at the time of injury.

*Time lapse between injury and treatment:*In the study conducted, the majority of injured victims (92.4%) availed treatment within six hours, while 70.0% availed treatment within one hour of injury. Transportation facility and availability of health facilities did not appear to be a problem in this study area (Table 5).

Table 5:*Post-injury care of 680 road traffic injuries, Delhi, 2002*

Vehicle used for transportation	Time interval	Nature of treatment	Agency of treatment
Nothing 171 (25.1%)	1 hour 475 (70.0%)	First-aid only 176 (25.9%)	Govt. dispensary 21 (3.1%)
Bicycle 64 (9.4%)	1-6 hours 152 (22.4%)	Out-patient 320 (47.1%)	Govt. hospital 182 (26.8%)
2-wheeler 14 (2.1%)	6-12 hours 24 (3.5%)	Emergency care 123 (18.1%)	Private clinic 302 (44.4%)
Auto./taxi 243 (35.7%)	12-24 hours 10 (1.5%)	Hospitalized 40 (5.9%)	Private hospital 109 (16.0%)
Bus/Public 28 (4.1%)	>24 hours 19 (2.8%)	Intensive care 9 (1.3%)	Self 66 (9.7%)
Ambulance 33 (4.9%)	–	Major operation 12 (1.8%)	–

Health facility providing treatment: The majority of the injured victims had taken treatment from a nearby private clinic (44.4%), followed by government hospitals (26.8%) and private hospitals (16.0%). Government dispensaries were utilized only in 3.1% cases, which were open only during specific hours of the day (See Table 5).

Nature of treatment received: It was observed from the study that in majority of cases, the victims took outdoor (OPD) level treatment (47.1%) and first-aid treatment only (25.9%). Out of a total of 680 cases of road traffic injuries, 9.0% victims were in critical condition; 5.9% were hospitalized, 1.8% were operated upon, and 1.3% were admitted to ICU (See Table 5).

Number of days of hospitalization: 56.5% of the victims were discharged within 1 to 4 days (See Table 6).

Table 6: *Post-injury disability of 680 road traffic injuries, Delhi, 2002*

No. of days	Work affected	Hospitalized
<1	16 (2.3%)	27 (4.0%)
2-4	145 (21.3%)	36 (5.3%)
5-7	105 (15.4%)	24 (3.5%)
8-10	39 (5.7%)	12 (1.8%)
11-14	5 (0.7%)	1 (0.1%)
15-21	58 (8.5%)	9 (1.3%)

22-28	12 (1.8%)	3 (0.4%)
29-60	82 (12.1%)	4 (0.5%)
61-90	14 (2.1%)	3 (0.4%)
>90	12 (1.8%)	1 (0.1%)
Other	192 (28.2%)	560 (82.4%)
Total	680 (100%)	680 (100%)

*Work loss due to injury:*Most victims resumed work within 2-4 days of injury (19.3%), followed by 5-7 days of work loss (14.7%), while 13.4% could not resume normal work for 1-2 months (See Table 6).

Discussion

Prevention and care of injury is a multidisciplinary area and requires inter-sectoral coordination for planning. Presently, most developing countries do not have any surveillance system nor planning for injury prevention. Lack of efficient surveil-lance system results in biased reporting of injury by different agencies, for example, traffic injuries constitute 95.7% of all injuries according to police department[3], however, only 31% were found to be due to traffic injuries in the present study. This may be because most traffic injuries are medico-legal and are reported to the government through the police department. Other types of injuries not having medico-legal implications might get treated either at government or private health set-ups and therefore, remain under-reported. The current study shows that 45.4% of injured victims had taken treatment at a private clinic. In fact, as per reports of Halsey[10] , private practitioners treated one third of all injuries, which accounted for under-reporting of injuries. Hospital records are based on the International Classification of Diseases (ICD)-10 coding[11]. Under this system, it is difficult to categorize injuries as per the dual system of coding i.e. whether it should be included in anatomical type of injury (open wound, fracture, dislocation etc.) or in the cause of injury (traffic, fall, burn etc.) category. Of the injuries reported at two major and six colony hospitals of MCD, only 24% were traffic injuries. It was difficult to trace other traffic injuries recorded among other anatomical groups i.e. fractures, wounds etc. This may be the reason for under-reporting of traffic injuries by the health sector. So the need was felt to modify the ICD-10 reporting system. Of the two parameters i.e. type of injury and cause of injury, one may be used for ascertaining the magnitude and the other for research and planning purposes. In order to assess the severity of the injury, the report must have a separate category of injury like outdoor/ indoor, primary/ secondary/ tertiary-level in-juries or type of treatment (ward/ operation/ intensive care). The annual incidence rates for major injuries: 73.1 (31% traffic) and for all injuries: 116.7 (25% traffic) per 1 000 population respectively, as found in this study, are consistent with findings of other community-based studies, such as 93 (29% traffic) by Pramod[12]; 115 (5.7% traffic) by Gordon[13], and 311 by Rahman[14]. This difference in incidence may well be due to the use of author's own definition of injury based on criteria of inclusion and exclusion of different types of severity. It was found that injuries were more common among those in the young and productive age group; other studies also showed the same pattern.[15,16] As more traffic injuries were reported during the evening time, legal measures could be strengthened during those hours. Even though roadside fatality is the highest in India as compared to other countries, there is no planning for road safety[17]. As mentioned in various ad hoc studies and some of the WHO technical reports along with present study data, there is an urgent need of planning for injury prevention in developing countries.[18,19,20,21]

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* Principal Investigator of WHO-MCD project on Epidemiology of Injury and Epidemiologist, Shahdara (S) Zone, Municipal Corporation of Delhi, India

**Director, Health Services and Investigator of WHO-MCD project on Epidemiology of Injury, Municipal Corporation of Delhi, India.

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