ORIGINAL RESEARCH

An Analysis of Demographic Factors in Fatal Road Traffic Accidents Caused By Motorized Two-Wheelers in a City in Central India

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ABSTRACT
The road traffic accidents are a type of man-made illness. The two wheeler accidents have the maximum share of road traffic accident fatalities in India. In this paper, we analyzed the various demographic factors of the victims of motorized two wheeler accidents and found that males comprised of the majority of the victims. The majority of the victims belonged to the upper lower socioeconomic strata of the society. Among the accidents, the maximum accidents happened while driving the motorized two wheeler, on state highways and while driving of motorized two wheeler of engine capacity of less than 150cc.
Keywords: Demographic factors, motorized two wheelers, road traffic accidents, demography

INTRODUCTION

Abdel Omran proposed three phases of health loss patterns when a country's economy improved in his initial definition of the epidemiological transition from 1971[1]. A nation would go through a first "period of plague and starvation" and a second "era of receding pandemics." Increased burden from "degenerative and man-made illnesses" would be a part of the third phase, which Salomon and Murray summarized in their 2002 study as health loss from "cancers, cardiovascular disorders, and accidents."[2] In March 2010, the United Nations (UN) General Assembly proclaimed 2011–2020 the Decade of Action for Road Safety.[3] In 2015, the UN General Assembly set up Sustainable Development Goal of decreasing road traffic deaths and accidents through 50% through 2020.[4] More recently, WHO published the Global Road Safety Status Report 2018 and focused on road safety targets with performance targets in the WHO General Program of Work 2019-2023.[5]

According to the NCRB data, in 2022 two wheeler accidents had the maximum share of the road traffic accidents (45.5%), resulting in 77,876 fatalities.[6] The fatality risk due to road traffic accidents in India is 4-5 times higher than high income countries as Switzerland, Singapore and Sweden.[7] In 2019, India's two-wheeler sector sold an all-time high of 21 million vehicles, setting a new record. This amount is nearly double the 11.77 million two-wheeler units sold in India in 2011. However, two wheeler sales in India decreased from previous years to 13.47 million units in fiscal year 2022.[8,9]

AIMS & OBJECTIVES

To determine the various demographic factors of the victims of motorized two wheeler accidents.

MATERIALS & METHODS

The present study was conducted at Department of Forensic Medicine & Toxicology, Gandhi Medical College, Bhopal (M.P.). All the deaths pertaining to the fatal motorized two-wheeler accidents brought to the Gandhi Medical College Mortuary during this study period have been included. The history regarding the circumstances of the accidents and other relevant data was collected through the thorough history taking from the police personnel, friends, relatives etc.

RESULTS

In the current study, the proportion of deaths due to fatal motorized two-wheeler accidents was found to be 19.13% with Male: Female ratio being 5.7:1. The peak age group involved was 21- 30 years comprising of 34.97% followed by 51-60 years (Table 1). Among the males highest incidence of fatal motorized two-wheeler accidents was seen in age group of 21-30 years resulting in 37.96% of total fatalities, while among females, the highest incidence was seen in the age group of 51-60 years (Table 2). Majority of the victims (76%) were Motorcycle drivers, followed by 1st pillion passengers (20%), and the least were 2nd pillion riders (4%). Out of the drivers, males were in majority (99.1%) while females were dominant while riding pillion which is 56.2% and 69.4% for 1st and 2nd pillion riders respectively. While driving the two wheeler, the male fatality was 99.1% while the female fatality was 0.9%.

The highest fatalities were recorded of the persons who were uneducated (21.4%), who were unskilled (29.8%) or semi-skilled (24%) workers and those who earned Rs. 7887-13,160 per month (41.1%). That makes maximum deaths observed in upper lower socio economic strata of the society (52.05%) followed by lower social economic strata of the society (17.65%), according to the Modified Kuppuswamy Scale (Table 3 to 6). The upper socio economic strata of society (3.76%) are the least involved in accidental deaths. While the maximum numbers of accidents are seen in bikes having engine capacity of less than 150 cc (84.9%), no such cases were seen in bikes having engine capacity of more than 200 cc and sports bike or heavy duty bike (Table 7).

The most common cause of accident is skidding (42.7%), followed by collision with vehicle (39.9%). Since there are a number of road factors, like stray animals on the road, poor road conditions, poor road lighting, over-speeding, driving under influence of alcohol etc., skidding is the most likely to be the commonest cause of bike accident. There are also some cases that do not have any mode of accident, i.e., unknown causes. Persons who daily commute to other towns or places for work might get involved in some kind of mishappening or accident. In such cases, the history is not clear about the mode of accident (Table 8).

The maximum deaths occurred among married (68.5%) people followed by unmarried people (29%) since married people are usually working. The maximum deaths occurred among people living in urban areas (55.24%) since majority of the jobs are in the urban area and urban areas have much more facilities than rural areas. It is not uncommon for the people residing in the rural areas to visit nearby cities for some work or to purchase amenities.

It was observed that the maximum number of the accidents happened on the state highways (53.6%), followed by the city roads (Table 9).

Table 1: Age of Victims

Age (in years)	Number	Percentage
0 years-10 years	17	1.94%
11 years- 20 years	77	8.77%
21 years-30 years	307	34.97%
31 years- 40 years	136	15.50%
41 years-50 years	128	14.58%
51 years- 60years	208	23.69%
> 60 years	5	0.57%
Total	878	100%

Table: 2: Age Distribution Among Gender of Victims

Age (in years)	Male	Female
0 years-10 years	7	10
11 years- 20 years	77	0
21 years-30 years	290	17
31 years- 40 years	115	21
41 years-50 years	109	19
51 years- 60years	149	59
> 60 years	00	5
Total	747	131

Table 3: Number of Victims as per the Education Status

Education Status	No. of cases	Percentage (n=878)
Uneducated	188	21.4%
Primary	164	18.7%
Middle	151	17.2%
Secondary	210	23.9%
Higher Secondary/Diploma	88	10.02%
Graduate	73	8.3%
Post-graduate	4	0.5%
Doctorate	0	00
Total	878	100%

Table 4: Number of Victims as per the Occupation

Occupation	No. of cases	Percentage (n=878)
Student/Unemployed	151	17.2%
Unskilled worker	262	29.8%
Semi-skilled worker	211	24%
Skilled worker	130	14.8%
Clerical, shop-owner/farm	54	6.2%
Semi-professional	37	4.2%
Professional (white collar)	26	3%
Retired	7	0.8%
Total	878	100%

Table 5: Number of Victims as per the Income

Income (Per Month)	No. of cases	Percentage (n=878)
<2640	155	17.7%
2641-7886	98	11.2%
7887-13160	361	41.1%
13161-19758	125	14.2%
19759-26354	77	8.8%
26355-52733	45	5.1%
>52734	17	1.9%
Total	878	100%

Table 6: Deaths According To Socioeconomic Status

Socioeconomic Status	Number	Percent
Lower	155	17.65
Upper Lower	457	52.05
Lower Middle	142	16.17
Upper Middle	91	10.36
Upper	33	3.76

Table 7: Deaths According To Type of The Motorized Two-Wheeler

Type	Number	Percentage
<150 cc bike	745	84.9%
150-200 cc bike	56	6.4%
Gearless Scooters	74	8.43%
Electric Scooters	03	0.34%

Table 8: Table Showing Various Modes of Accident

Mode	Number	Percentage
Collision with bike	44	5.01%
Collision with other vehicle	350	39.9%
Skidding	375	42.7%
Collision with stationary object	45	5.1%
Collision with animal	13	1.5%
Other	24	2.7%
Unknown	27	3.1%

Table 9: Table Showing Number of Accidents Depending On The Site

Place	Number	Percentage
City Road	309	35.2%
State Highway	471	53.6%
National Highway	32	3.6%
Village Road	66	7.5%

DISCUSSION

This study showed that motorized two-wheeler accident deaths accounted for 19.13% of all the autopsies performed in the department of Forensic Medicine & Toxicology, Gandhi Medical College, Bhopal, Madhya Pradesh, India, a figure slightly higher than 17.9% reported in a previous study by Sachin Chourasia et al[10] and 13.45% by K. Ravimuni et al.[11] A motorbike accident rate of 1% is reported in a road traffic accident statistics report in Johannesburg, South Africa.[12] The significantly lower incidence figure recorded in South Africa may be due to the fact that commercial motorcycle use is not as prevalent in that nation as it is in India. The lower percentage in the United States (13%) might be attributed to the good influence of legislative measures implemented by road safety authorities targeted at lowering motorcycle and motor vehicle accidents.[13] Motorcycles are also not employed for transportation in the United States as they do in India. Males made up the vast majority of motorcycle accident casualties in this research (84.97%). This matches the findings of research conducted by Chourasia et al (82.5%) and Faduyile F, Emiogun F, Soyemi S, et al.[10,14] In other regions of the world, surveys found an overwhelming male preponderance ranging between 87% and 90.8%.[15-17] This worldwide observed male majority among motorcycle accident victims may be attributed to the fact that men are the breadwinners in most developing nations, and hence are more prone to turn to commercial motorcycle riding to make ends meet.

This study also found that the most common age group for motorcycle accidents was 21-30 years old. This age group is in accordance with the age group as described by Chourasia et al,[10] but is in contrast to the study done Faduyile F, Emiogun F, Soyemi S, et al who concluded that the most common age group in RTA is 31-40 years.[14] The likely rationale for the greater risk of motorcycle accident mortality among participants between the ages of 21 and 30 in this research is since Bhopal is the Capital City of the state of Madhya Pradesh and is surrounded by many villages and other smaller towns. As a result, many people arrive to Bhopal in the search of job or work as daily wage workers since the majority of jobless persons in India are between the ages of 21 and 30. The majority of casualties (75.5%) were motorized two-wheeler drivers, followed by 1st pillion passengers (20.4%), and 2nd pillion passengers (4.1%). The findings are in accordance to the study done by Animesh Jain et al in Mangalore, India.[18] Motorized two-wheeler drivers are more likely to die

in a crash because there is no protection over the inherently unstable motorcycle, and the full impact of a crash is transmitted to the occupant, resulting in a likely fatal outcome, especially in those who do not adhere to safety measures. Among the pillion riders, females constituted for 58.4% of the victims, which is much higher than the study done by Sukumar Sanjay et al, according to which the percentage of the female victims was 41%. The probable cause of the high female fatalities while riding pillion could be that in India, majority of the two-wheeler drivers are males and females usually prefer to sit behind the driver, as the passenger. Also, the majority of the female pillion riders belong to the 50-60 year group, hence they might be unable to drive a two-wheeler and hence prefer to ride pillion. There was a strong association between female riding pillion and fatalities having a p-value of $p<0.00001$.

There was a strong association between driver fatalities in this study in both the genders with a p-value of $p<0.00001$, meaning that the drivers are more at risk as compared to the pillion riders. The majority of the victims were married (68.5%), with Male to Female ratio of 4.5:1. This finding does not support the finding of the study done by G. Whitlock, Robyn Norton, Taane G. Clark et. al. who in their cohort study found little reliable evidence about whether single people and married people have importantly different risks of motor vehicle driver injury.[20] But in this study, there was positive association between the deaths of married people as compared to the unmarried people ($p=0.000082$). The probable reason for this high rate of victims belonging to the married status is that usually males are the main source of income of their households and they have responsibility of feeding their families and parenting their kids.

The study shows that the maximum number of victims belong to the upper lower socioeconomic strata (52.05%), followed by the lower socioeconomic strata (17.65%) of the society which is in accordance with the study done by Rahul Goel et al and Athanasios Theofilatosa & George Yannisa.[21, 22]

The maximum number of accidents happened with the cases in which the motorized two-wheeler was of the engine capacity of 150 cc or less. The most probable cause to this is that such motorized two-wheelers are cheap in the Indian markets and offer a good mileage over consumption of only a few amount of the fuel, i.e., petrol, but such motorized two-wheelers do not have the security features of high end motorized two-wheelers. Since the majority of the victims belong to the lower and upper lower socioeconomic strata of the

society, they too prefer such vehicles either new one or used one/second hand because of their cheaper price and good mileage. There has been no significant data available to compare in the literature regarding this point. However, there was a positive association present between fatalities occurred with motorized two-wheelers as compared to the others, with a p-value of p=.011328.

This study also sheds the light on the place of the accident. It was observed that the maximum number of the accidents happened on the state highway (53.6%), followed by the city road (35.2%). The probable reason for this maybe is that since the majority of the victims belong to upper lower socioeconomic strata or from the lower social economic strata, they usually commute daily via motorized two-wheelers for their work since the possibility of them being a daily wage worker is at the maximum. The incidence of accidents happening on the city roads is next highest. The probable reason for that is in the city, many people seldom follow the traffic rules and drive recklessly and such reckless driving is the reason for the accidents. There has been no significant data available to compare in the literature regarding this point. However, in the study done by Mishra B, Sinha Mishra ND et al, it was observed that 26.53% of non-collision accidents in the narrow and defective roads where as wide roads were responsible for collision type accidents i.e. 61.97%. Non-collision accidents like running of the road, overturning were found to be significantly associated with narrow and defective road conditions.[23]

CONCLUSION

The infrastructure for pedestrians is poor, cyclists are almost non-existent, and two wheelers uses the same lanes as other motorized modes. Combining two wheelers with vehicles of much higher weight and speed will result in a higher risk of injury. In this context, improving safety through the design of the built environment can be very effective. Therefore, it is important to understand the factors in the built environment that influence mortality risk. Two wheelers behavior, accident frequency, and severity interact differently under different circumstances, and research for co-examining these interactions is needed. Given that two wheeler safeties is a growing social problem globally, the benefits of this approach for future research could be significant, as future research findings. This more comprehensive approach will enable the development of countermeasures. Although there is a National Road Safety Board in India, the road safety efforts are falling behind the requirements of a speedily growing nation like India. A "zero tolerance" policy should be applied to the most common violations: dangerous and reckless driving; failure to comply with traffic rules; running red lights; driving under the influence of alcohol; do not use seat belts; and driving without a helmet – to bring about tangible change.

But strict enforcement of traffic rules and stiff penalties will not be enough to resolve the long-running crisis. A change in the psychology of traffic participants, drivers and traffic participants being aware of their responsibilities will bring about change. Most countries apply a multidisciplinary approach to transport planning and road design. It is performed by psychologists, engineers, doctors, sociologists, automobile experts, etc. In India, road transport remains a civil engineering problem.

Lessons can be learned from the outstanding guidelines and best practices for good road driving practiced in developed countries where safety, order and discipline are ingrained in the people. Simply holding the annual Road Safety Week in the first week of January serves no purpose. Drivers must learn to show consideration and respect for other motorists and pedestrians to make our roads safer. But the road ahead seems long.

CONFLICT OF INTEREST
None

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