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AN EPIDEMIOLOGICAL STUDY OF NON-FATAL ROAD TRAFFIC ACCIDENTS CASES IN ALLAHABAD REGION, INDIA

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Abstract

The present Study evaluates various epidemiological factors associated with non-fatal Road Traffic Accidents (Rats) cases. A total of 100 non-fatal RTA cases admitted to orthopedic, surgery or emergency departments of SRN hospital during June 2005 to May 2006 were included for the purpose of present study. All victims were thoroughly interviewed and followed up-to 30 days where necessary.

In non-fatal Rats, M/F ratio was 9:1. Mean age of accident was 36.6 year with range 11-80 years. Maximum 26(26%) cases were in the age group 21-30 years. Mostly non-fatal Rats occurred in winter seasons 40(40%). MTW occupants 46(46%) were maximally injured road user in non-fatal Rats. The lower socioeconomic class predominated the study 58(58%) cases. Majority of the victims belonged to rural habitat. Majority of victims showed low level of education, 72 % victims were educated up-to 10^{th} standard. Maximum 30(30%) accidents took place in between 16.00-20.00 hrs. Majority of accidents occurred on highways. Four wheeled heavy vehicles were responsible for 36(36%) cases of non-fatal Rats. In 52% cases the site of primary impact of the responsible vehicle was side. Maximum 34(34%) victims of non-fatal Rats had to stay in the hospital for 3-4 weeks. Carelessness was responsible for a maximum 40 (40%) cases of non-fatal Rats followed by fatigue and sleepiness 38 (38%), while alcohol was responsible for 22 (22%) cases.

The important features on non-fatal Rats are predominance of young male individuals, an increased involvement of MTW occupants, and a low level of education among of victims of non-fatal Rats. Non-fatal Rats are associated with multiple preventable risk factors.

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Introduction

Whose world report on Road Traffic Injury Prevention defines a "Road Traffic Injury as fatal or non fatal injuries incurred as a result of Road Traffic Crash".[1] Of late, vehicular accidents have taken an epidemic form world over owing to modernizations and rapid increase in road transportation. Currently motor vehicle accidents rank ninth in order of disease burden and are projected to be ranked third in the year 2020[2.]

The magnitude of the problems can be gauged by the fact that in 2002, there were 1.19 million deaths from road accident in world, in addition for every death there were as many as 50-100 minor injuries and 10-20 serious injuries requiring a long process of expensive nursing care treatment and rehabilitation. Persons injured in road traffic accident (RTA) occupied 10-30% beds in hospitals [3.] Rats cost a lot to the individual families, communities and nation. Recent estimates show that RTA corresponds to at least 1-2 to percent of GNP per annum loss to the nation around the world [4.]

Like any other disease, accidents too are caused by interaction between host and environment. Human factors include age, sex, education, medical condition, lack of bodily protection and psycho-social factor like lack of exposure, impulsiveness, aggressiveness, defective judgment and delay in decisions. Environmental Factors include condition of roads, defective vehicles, and proportion of different types of road user, bad weather and inadequate information regarding existing laws. Evidence shows that with an established set of interventions, road traffic injuries have been reduced in many high-income countries.[5] However this has not happened in many poor countries.

Since non-fatal Rats depend on number of factors, like type of accidents, mode of injuries, colliding vehicle, site of impact etc, hence the study of various responsible factors vital for setting priorities for the prevention of such injuries and the outcome will have a major impact and repercussions on national scenario towards formulating preventive measures.

The aim of the present study is to evaluate the prevalence of non-fatal road traffic accidents and to analyse impact of various epidemiological factors to formulate preventive measures for road traffic accident cases suiting to the requirements of our country.

Material & Method

The material for this prospective one year study (Ist June 2005 to 31st May 2006) in respect to admitted non-fatal road traffic accidents comprised of those cases of Rats who were admitted to the surgery, orthopaedics or emergency wards of SRN Hospital attached to MLN Medical College, Allahabad, UP.

For the purpose of the present study, a Road Traffic Accident (RTA) was defined as an accident, which took place on the road between two or more objects, one of which must be any kind of moving vehicle. Any injury on the road without involvement of a vehicle (e.g. a person slipping and falling on the road and sustaining injury) or injury involving a stationary vehicle (e.g. persons getting injured while washing or loading a vehicle) or deaths due to RTA were excluded from the study. The victims of the accidents were interviewed to obtain the required information about the circumstances leading to accident.

Observations

During one-year study period a total 1492 medico-legal cases were registered in emergency department of SRN Hospital. Of these 389 cases (26.0 %) were of road traffic accidents. Of 389 cases only 153 (10.25%) cases were of non fatal Rats which got admitted in emergency/ surgery/ orthopedic wards of SRN Hospital. During 30 days follow up of these 153, cases 31 fatalities occurred, whereas 22 cases had left against medical advise (LAMA) hence these were excluded for the purpose of the present study. Thus, the present study included only 100 cases of non-fatal road traffic accidents.

Table –1: Distribution of age, sex and types of road user in non-fatal Rats.

Age groups in year	Pedestrian No. (%)	Pedalcyclist No. (%)	M TW occupants No. (%)	FW occupants No. (%)	Male No. (%)	Female No. (%)	Total No. (%)
11-20	2	6	8	2	16	2	18 (18 %)
21-30	-	-	18	8	22	4	26 (26%)
31-40	2	8	6	6	20	2	22 (22%)
41-50	4	-	6	6	16	-	16 (16%)
51-60	-	4	4	-	6	2	8 (8 %)
61-70	2	-	2	-	4	-	4 (4 %)
71-80	2	-	2	2	6	-	6 (6 %)
Total	12 (12%)	18 (18%)	46 (46%)	24 (24%)	90 (90%)	10 (10%)	100 (100%)

Table – 2: Seasonal Variation and distribution of time period and habitat of non-fatal Rats.

Season	Cases No. (%)	Time Period	Case No. %)	Habitat	Case No. (%)
Winter (Nov. to Feb.)	40 (40%)	6 A.M. to 6 P.M.	75 (75%)	Rural	62 (62 %)
Summer (Mar to June)	39 (39 %)				
Rainy (July to Oct)	21 (21 %)				
Total	100 (100 %)		100 (100 %)		100 (100%)

Table No.1 depicts that in non-fatal Rats, maximum number of cases 26 (26%) were in the age group 21 – 30 years, while least 4 (4%) case in 61 - 70 yrs age group. Male predominated over female. Male accounted for 90% cases while female only 10% of cases. Male/Female Ratio - 9: 1. Mean age of accident was 36.6 year with range 11-80 years.

Motorized two wheeler occupants (motorcyclist and Scooterist etc.) 46 cases (46%) were maximally injured road user in non-fatal accidents while pedestrian 12 (12%) were least.

Table 2 depicts that maximum number of non-fatal Rats' occurred in winter season 40 (40 %) cases followed by summer. mostly non-fatal Rats' occurred during the time period of 6 A.M. to 6 P.M. 75 cases (75 %). Majority of victims belonged to rural habitat 62 (62%) cases while 38 (38%) cases belonged to urban habitat.

The lower socio-economic class predominate the study 58 cases (58%) followed by middle class 38 (38%) and only 4 cases (4%) belong to upper class.

Table – 3: Distribution of Religion and Socio-economic status of non-fatal Rats

Class	No. of cases	Religion	No. of cases
Upper	4 (4%)	Hindu	88 (88%)
Middle	38 (38%)	Muslims	12 (12%)
Lower	58 (58%)	Sikh & Christian	-
Total	100 (100 %)	Total	100 (100 %)

Table – 4: Education status and occupation of victims of non-fatal Rats

Educations status	No. of cases (%)	Occupation of Victims	No. of cases (%)
Illiterate	20(20%)	Driver/Conductors of F.W.	20 (20%)
< V^{th} class	16(16%)	Labour	18 (18%)
VI to X	36(36%)	Students	18 (18%)
XI to XII	17(17%)	Employee in services	12 (12%)
Graduate	7(7%)	Shop keepers	10 (10%)
Postgraduate/ Professional	4(4%)	Agriculturist	8 (8%)
		Retired persons	6 (6 %)
		House wife	4 (4 %)
		Unemployed	4 (4 %)
Total	100	Total	100 (100%)

Table-3 exhibits that the lower socio-economic class predominate the study 58 cases (58%) followed by middle class 38 (38%) and only 4 cases (4%) belong to upper class of the society. Of total 100 non-fatal cases 88(88%) victims were Hindu by religion and12 (12%) Muslims.

Table 4 exhibits that majority of victims of non-fatal Rats had education up to Xth standard 72 cases (72 %) there was least involvement of postgraduate / professional 4 cases (4%). Driver/conductors of four wheelers were maximally involved 20 cases (20%), laborers and students were the next larger groups each with 18 cases (18%) House wife and unemployed persons each included 4 cases (4 %).

Table –5: Distribution of types of offender vehicles involved in non-fatal Rats and occurrence of accidents in relation to types of Road.

Types of vehicle	No. of cases (%)	Types of Road	No. of cases (%)
FW heavy vehicle	36 (36%)	Highway	32 (32%)
FW light vehicle	26 (26%)	Road	30(30%)
MTW vehicle	14 (14%)	Lane	22(22%)
Three wheeler	10 (10%)	Junction of road to lane	12(12%)
Others	14 (14%)	Turning of roads	4(4%)
Total	100 (100%)	Total	100(100%)

Table-5 depicts that four wheeled heavy vehicles were responsible for maximum 36 (36%) cases of non-fatal Rats followed by light vehicle 26 (26%) cases. A majority of 32(32%) accidents occurred on highway followed by road 30(30%) and lane 22 cases (22%).

Table – 6: Distribution of accidents in relation to the number of vehicle involved, site of primary impacts by the vehicle.

No. of Vehicle	No. of cases (%)	Site of impact	No. of cases (%)
One	8 (8%)	Front	24 (24%)
Two	80 (80%)	Side	52(52%)
Three	10 (10%)	Rear	18 (18%)
Unknown	2 (2%)	Unknown	6 (6%)
Total	100 (100%)	Total	100 (100%)

Table 6 depicts that collision between two vehicles were responsible for majority of 80 (80%) cases, followed by 10 (10%) cases with three wheelers whereas one vehicle was involved in 8 (8 %) cases of accidents. In 52% of cases the site of primary impact of the responsible vehicle was side followed by front of vehicle 24 cases (24%) and in only 18% cases the site of primary impact was rear of the vehicle.

Table – 7: Mode of injuries in non-fatal Rats

S. N.	Injuries	Pedestrian no. of injuries (%)	Pedal-cyclist no. of injuries (%)	MTW occupants no. of Injuries (%)	FW occupants no. of injuries (%)	Total no. of injuries (%)
1.	Primary impact injuries	28 (58.3)	16 (80.0)	30 (45.5)	12 (46.2)	86(53.75)
2.	Secondary injuries	20 (41.7)	4 (20.0)	36 (54.5)	14 (53.8)	74(46.25)
	TOTAL	48 (30.0)	20 (12.5)	66 (41.2)	26 (16.3)	160(100)

Table 7 depicts that a total of 160 injuries were recorded in 100 non-fatal cases. Of those 86 (53.75) injuries were produced by primary impact while 74 (46.25) injuries were secondary injuries. Not even single case of secondary impact injuries were identified in any type of road users. chi ² test was applied and was found significant ($chi^2 = 8.33$, $df=3$, $p<0.05$).

Table 8: Duration of Hospital stay following non-fatal Rats and distribution of Risk factors associated with non-fatal Rats.

No. of weeks	No. of cases (%)	Risk factors responsible	No. of cases (%)
< 1	3 (3%)	Alcohol	22 (22%)
1.1 – 2	10 (10%)	Carelessness	40(40%)
2.1 – 3	18 (18%)	Cellular phone talking while driving	10(10%)
3.1 – 4	34 (34%)	Human error	20 (20%)
4.1 – 5	14 (14%)	Fatigue/Sleepiness	38 (38%)
5.1 – 6	15(15%)	Faulty environment	28 (28%)
6.1 – 7	4 (4%)	Faulty vehicle	22 (22%)
> 7	2 (2%)		
Total	100	Total no. of cases = 100	

Table-8 depicts that with regards to stay of injured person in the hospital following non fatal Rats, it was observed that maximum 34 (34%) victims of non-fatal Rats had to stay in S.R.N. Hospital for 3 to 4 weeks and least 2 (2%) stayed for more than 7 weeks. Regarding risk factors carelessness was responsible for a maximum 40 (40%) cases of non-fatal Rats followed by fatigue and sleepiness 38 (38%), while alcohol was responsible for 22 (22%) cases. Use of cellular phone while driving was responsible for only 10 (10%) cases. It may be stated that multiple risk factors may be associated simultaneously in each of non-fatal Rats.

Discussion

World over the road traffic accidents, in particular non-fatal road traffic accidents are showing a steep rise affecting all classes and strata of the society and are the leading cause of the global burden of disease. In majority of cases, road accidents are largely preventable and are usually caused by human errors, overtaking and speeding, fatigue, sleepiness, alcohol drinking, faulty environment, faulty vehicle, poor road infrastructure etc.

In this study an attempt has been made to assess prevalence of non-fatal road traffic accidents (Rats) reporting to the tertiary care hospital and to analyse the epidemiological factors in relation to the victims, vehicles, site of impacts etc. Besides, features pertaining to hosts (road users), the agents (vehicles) and the environmental conditions (roads, seasons, time of day etc.), place of accident, risk factors and stay in the hospital, were evaluated.

The present study comprised of 100 non-fatal road traffic accidents cases who were admitted to SRN hospital. With reference to seasonal variations in cases of non-fatal Rats, it is observed that winter season (Nov. to Feb.) recorded maximum RTA cases followed by summer and rainy season. This can be explained by the fact that during winter months in North India there are longer hours of darkness hence poor visibility to drivers at night and during early hours of the day due to foggy weather conditions besides slow reaction time owing to extreme cold affecting both drivers and road users. Our findings are in agreement with those of other workers.[6, 7]

In summer, excessive perspiration and early exhaustion due to extreme heat affects the efficacy of driver thus interferes the obeying of traffic rules by drivers. whereas a lesser incidence during the rainy season is probably due to the fact that people mostly remained indoors and thus reduced exposure to risk of traffic accidents. Mirahmadizadeh et al[8] has also observed that most Rats happen in winter months (38.4%) and are least in spring (16.4%).

A predominant involvement of males in non-fatal Rats can be logically explained by the facts that males lead a more active life, remain most of the time outdoors to earn bread and butter besides they are more involved in activities such as driving and traveling and have a universal tendency to take undue risks. In contrast, females remain mostly indoors due to cultural backgrounds and household works, low potential of employment and reduced outdoor activities. Our findings are in general agreement with those of other workers in the field.[9, 10,11,12,13]

Our findings that non-fatal Rats involve younger population are in contrast to those of World Report on Road Traffic Injury Prevention, WHO, Geneva, 2004, which observes overall elderly people are more likely killed or seriously disabled than younger people due to lack of resilience.[14]

A greater involvement of younger age group individuals is as observed in this study is owing to the fact that they have an inherent tendency to take risks, pay scant regard to traffic rules, lead more active life. Besides, young individuals are fascinated with activities like boarding a moving vehicle, traveling on footboard of buses, risky speedy driving and crossing roads carelessly. This also reveals that people of the most active and productive age group are involved in non-fatal Rats that add a serious economic loss to the community. A younger age group involvement is in contrast to Modi[15] who has reported that elderly people with defective sight and hearing, and children are more often involved. A lesser incidence beyond 60 yrs of age is probably owing to the fact that elderly pass their times mostly indoors follow traffic rules and fewer tendencies to take undue risks. No involvement in less than 10 years of age, in the present study suggests that kids are mostly being accompanied by the elderly persons, parents, relations, or grown up persons.

In the present study observes a greater involvement of motorized two wheeler and four wheelers occupants and together these are responsible for 70% cases of non-fatal Rats, whereas pedal cyclists and pedestrians are less commonly involved. A greater involvement of motorcyclist/scooterists in the present study is owing to careless, rash driving; thrill seeking, overtaking behavior; scant regard for traffic rules and less stability and poor maintenance of the vehicle. Moreover, two wheeler vehicles are being mostly used by 20-40 year of age group. Our findings are in conformity with those of others.[10, 13, 16] An increased involvement of four wheeler occupants can be explained by the fact that this region is having several highways thus drivers are tempted to drive at high speed and therefore more prone to Rats, besides a scant regard to traffic rules by drivers and their poor traffic sense together with poor highway infrastructure. Our findings are in agreement with studies in developed countries that observed that four wheeled vehicle occupants are more commonly involved in Rats though entirely due to different reasoning. In Western countries motorization has been to such a great extent that pedestrians are scarce on the roads, they have much improved highways and advanced automobile engineering allowing very high speed to the automobiles. Overall, our findings are in conformity with those of Mirahmadizadeh [8] who have also observed that motor-cycles (49.73%) and cars (40.7%) are more commonly evolved in Rats.

In the present study, a lesser involvement of pedestrians and pedal cyclist cannot be logically explained because pedestrians are the commonest road users in India hence should comparatively be more exposed to the risk of accidents, besides lack of proper footpath facilities and increased encroachment of roads by vendors are added risk factors. In an earlier study from this centre, Kaul et al[7] have reported maximum number of fatalities amongst pedestrians. A lesser involvement of pedal cyclist can be explained as they are a group of cautious road users and have lesser speed hence more control on vehicle.

In the present study drivers, conductors of four wheeler and laborers together comprise of 38% of cases of non-fatal Rats. All these occupational class belonging to poor socio-economical background and are illiterate. Students and employee in services constitute another major chunk (30%). Their involvement is owing to more exposure to outdoor activities. Retired persons and housewives are least involved in non-fatal Rats owing to their confinement to indoor activities.

Our findings regarding socio-economic status of victims of non-fatal Rats, it is observed that lower and middle class persons together comprise of 96% of cases. A predominant involvement of rural habitat over urban populace is in conformity with those of Jha.[10] Since Allahabad is surrounded on all sides with rural areas hence, these rural populace routinely visit the city, thus are prone to Rats. Only scanty reports are available on this aspect.

In this study 72% of cases of non-fatal Rats are educated up-to 10^{th} standard whereas only 4% cases are postgraduate/professionals. It reflects that literacy does play an important role. Our findings are in agreement with those of other workers.[9, 10]

Regarding occurrence of accidents in relation to types of road, it is observed that maximum 32% accidents occurred on highways followed by roads and least 4% of cases occurred at turning of roads. It may be argued that highways being very busy and having maximum traffic loads hence greater incidence of non-fatal Rats. On the other hand, lanes permit fewer numbers of vehicles that too at slower speed, hence fewer numbers of Rats. Moreover, at turning of roads vehicle drivers become more cautious hence least number of accidents occurs. Our finding is in agreement with Kaul et al[7] who have observed that 83.05% of Rats have occurred on highways and 15.58% Rats took place on road.

In the present study four wheeled heavy vehicles and four wheeled light vehicles together accounted for maximum 62% of offending vehicles whereas three wheelers (tempo, auto-rickshaws and three-wheeler vans) were minimally responsible for accidents. This is due to a higher speed of four wheelers as compared to other offending vehicles. Our findings are in agreement with other worker.[9, 10, 11, 17.]

Regarding site of primary impact, by the vehicle in accidents, it is noted that side impact was more common compared to front and rear impacts. These findings are in accordance to those of Ganveer[13] and Basu[18] who have also observed higher incidence of primary impacts by the side of the vehicles in the victims of non-fatal Rats**.** This observation is probably due to overtaking mentality amongst two wheeler drivers. In contrast to our findings Grattan[19] has observed that in 70% Cases vehicle impacts are frontal whereas in 20% cases it is by the side. Kaul et al[7], in there study of fatal Rats have observed that front impact was commonest contrary to our findings of side impact in non fatal Rats.

As regards the duration of stay in the hospital of the non-fatal Rats victims, it is observed that a great majority of victims (65%) have been discharged within 4 weeks of admission and only 3% cases have been discharged within one week. A total of 6% cases stayed in the hospital beyond 6 weeks.

Non-fatal Rats more commonly have occurred during daytime between 6 AM to 6 PM and remaining 25% cases have occurred during nighttime. This finding can be explained as during this period larger number of students, labourers and office goers and other persons are on the roads hurrying for the place of works or institutions hence are exposed to greater risk of Rats. Moreover, there is a greater rush during this period of time hence increased incidence. This finding is in agreement with those of Malhotra [9], Jha [10], Ganveer [13] and Lal.[20]

Risk factors like carelessness (40%) and fatigue/sleepiness (38%) are responsible for majority of Rats. Drinking alcohol and faulty vehicles each are responsible for 22% of Rats and are other important risk factors associated with non-fatal Rats. Cellular phone talking during driving is comparatively a lesser risk factor. This finding is in contrast of Redelmeior [21] who has observed that risk of collision when using a cellular phone is four times higher than the risk when a cellular phone is not being used.

It must be emphasized that risk factors have to be curtailed to curb the incidence of non-fatal Rats. It is also relevant that in majority of cases more than one risk factors are simultaneously involved at the time of accidents. Our findings are in close accordance with Malhotra[9], Lal, [20] Andrew[22], Mohammad et al[23], Manuela[24] and Agnihotri.[25]

In conclusion, since non-fatal Rats cause a lot of economic burden to the individuals and to the nation and since non-fatal Rats are largely preventable hence a reduction/controlling of various risk factors responsible for non-fatal Rats will definitely reduce their incidences. Besides, there are immense benefits of investing in measures to prevent road accidents. Informed decision making and intervention by Government including enactment of legislation to control speed and alcohol consumption, strict implementation of traffic rules, mandating the use of safety belts and helmets besides safer design of vehicles, and infrastructure like roads etc. will contribute a lot towards prevention of non-fatal Rats. Further, as injury is a public health issue and Rats take a heavy toll of human lives, government should strengthen the health sector both in respect to better emergency accident services & trauma management and rehabilitation of non-fatal RTA cases. Finally awareness about proper traffic rules through media of mass communications like newspapers, radio, television, posters and documentary films will also immensely contribute towards prevention.

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