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Original Article

Determinants of injuries and Road Traffic Accidents amongst service personnel in a large Defence station

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ABSTRACT

Background: Injuries are assuming epidemic proportions globally; and in India. Also, previous decade witnessed carnage on Indian roads, with nearly 12 lakh people killed and 55 lakhs disabled in road crashes. The trend in Armed Forces is reflective of the aforesaid patterns. Behaviour and socio-demographic background of the victims are significant determinants of injuries and road accidents. Community-based epidemiological information on these aspects is envisaged to contribute in their preventive strategy. Towards this direction, the present study was conducted with aim to generate socio-behavioural profile of injuries and Road Traffic Accidents (RTAs) amongst service personnel in a large defence station; and to evaluate their determinants.

Methods: A cross sectional descriptive study was carried out among 796 Naval personnel onboard warships in large Naval station. Data on socio-behavioural aspects and determinants of injuries and road accidents was collected using a pre-validated questionnaire; and by scrutiny of relevant records. Data was analysed using MSExcel, Epi-info and SPSS 17.

Results: Young and middle-aged persons were predominantly involved in injuries and road accidents. Two-wheeler users sustained maximum road accidents. Human factor was a significant determinant in RTAs and injuries. A majority of victims admitted that human factors were the predominant cause of road accidents; and opined that the events were preventable.

Conclusions: Age-specific Behavioural Change Communication strategies aimed at refining user outlook are imperative; tailored to sociodemographic milieu of user/victim. Incorporation of a dynamic feedback/reporting mechanism, creation of 'armed forces-specific road safety and injury prevention policy' and safety audits on injuries and road crashes are measures in this direction.

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Introduction

Injuries are evolving into a 'universal' problem. As per latest estimates, more than 5 million people succumb to injuries every year the world over. By the year 2020, injuries are anticipated to become one of the leading causes of morbidity.[1] Poor people in low and middle income countries are the most affected group. As India is passing through a major transitional phase in the social, demographic and epidemiological realms, injuries are emerging as a major public health problem. In India too, injury ranks next only to diarrhoeal diseases and respiratory infections in terms of burden of disease inflicted on the society.[2]

As a corollary, the spectrum of Road Traffic Accidents (RTAs) and the consequent morbidity and mortality, are gradually assuming epidemic proportions. One of the working definitions of an RTA is 'a fatal or non-fatal injury incurred as a result of a collision involving at least one moving vehicle'.[3] Across the globe, about 1.3 million people die annually consequent to RTAs, thus translating into just more than 3500 daily deaths. In addition, injuries (non-fatal) are sustained by 20–50 million persons every year, thus forming a significant cause of disability. Significantly, road accidents are among the top three causes of death among people of productive age (15–44 years). It is anticipated that in the absence of urgent interventions, RTAs will climb to fifth position in leading cause of deaths the world over, by causing about 2.4 million deaths each year.[4] About 10% of road crash fatalities worldwide take place in India. The number of people dying due to road crashes is maximum in India as compared to any other nation including China, the most populous nation. Incidence of deaths due to road accidents has witnessed an alarming rising trend in the past decade, with a 44.2% rise for year 2011 over 2001. This means a death every five minutes on Indian roads, which is expected to escalate to one death every three minutes by 2020.[5] Injuries Non-Enemy Action (Injuries NEA), which includes road accidents, are among the leading cause of hospital admissions in the Armed Forces, accounting for 19.50 per 1000 hospital admissions; amounting to 16.65% of the total hospital admissions.[6]

Both RTAs and injuries (Non RTAs) are no longer perceived as random, unavoidable events but rather as ones that are largely preventable. Behaviour, of an individual in particular and the community in general plays a vital role in causation or aggravation of the circumstances related to both RTAs and injuries. The human factor appears to be the most prevalent contributing factor of road traffic crashes and injuries. This includes driving behaviour, impaired skills personal traits such as impatience, type A personality, a sense of urgency, impulsive attitude and the like.

In order to develop and implement mechanisms for prevention and control of both RTAs and injuries from other causes in the Armed Forces, community-based epidemiological information on the burden posed by RTAs and injuries is required. This study is an attempt in this direction.

The aim of this study was to evaluate certain determinants of RTAs and injuries among service personnel in a large Naval station. The objectives are to evaluate the social and behavioural determinants of RTAs and injuries among the study population; to create a socio-behavioural profile and thereon to make specific recommendations on preventive strategies to be adopted, towards reducing the adverse impact caused due to RTAs and other injuries (both Training and Non-training).

Materials and methods

The study was a descriptive observational study, which was based on questionnaire and review of records. It was conducted in various establishments of the Indian Navy in a large Naval station. The reference/target population comprises all serving personnel of the Indian Navy, which included both Officers and Sailors. The study population consisted of a representative sub-set of serving personnel, which involved a cross-section of Officers and Sailors. Personnel of all ranks, trades and branches were taken as study population. Both afloat and ashore units were included in the study. Relevant data on the number of personnel at various establishments and the rank-wise break-up was obtained from records section. Serving personnel of the Indian Navy posted/serving in various billets in the station were included in the study; while personnel who were in the station on Temporary duty or were on leave were excluded from the study, as also were retired personnel staying in the station and personnel released from Naval Service.

The prevalence of RTAs and Non-RTA injuries among serving personnel was taken as 60%; this assumption was based on the findings of a pilot study carried out among a representative sample of study subjects. Error of margin was taken as 5%, confidence interval as 95% and power as 80%. Consequently, the sample size was worked out to be 738 (Epi-info 7). To cater to refusals, a target of 812 was planned by adding 10%, however a total of 796 personnel participated, with a refusal rate of 2%. Stratified Random Sampling technique was used, wherein each sub-set of the sample was proportionately representative of the strata from which it was measured. The units/establishments in the station were divided into various strata for the purpose of sampling; for example, Training Establishments, Naval Air Station, Provost Unit, Naval medical establishments, Shore establishments and Ships and Submarines. From the break-up/details of personnel borne in each unit in the station, a representative sample was drawn randomly from each stratum/unit of the study population, using Population Proportionate to Size (PPS) method. The sample size thus drawn included study subjects who had sustained either RTAs or injuries due to Non-RTA events, or both, which worked out to 796 (seven hundred and ninety-six).

The study was conducted from May 2011 to April 2013. Data was collected using the following modalities: (a) Scrutiny of records available with Naval Provost Unit, Naval Hospital and other units on RTAs and injuries (Non-RTA). All relevant records/data sheets from the respective units (such as medico-legal case documents from and injury reports from Medical centres) were analysed towards this end. (b) Through the means of a questionnaire. A structured Interview schedule (Questionnaire) was used to record information on the socio-behavioural profile and determinants of RTAs and Non-RTA

injuries in the study population. The questionnaire was structured into domains including personal particulars (such as age, education), social details pertaining to road/vehicular use and accidents thereon (such as duration of driving experience, mode of transport at time of accident, etc.) and whether the accident could be attributed to road, vehicle, human factors or a combination of these. The other domains intended to assess preventability aspect of accident as felt by the study subject. Similar domains were used for data collection on profiling and determinants of injuries; these included habitability or human factor in causation of injury; and preventability aspects thereof. The time frame for recall of both RTAs and injuries was a period of 3 years from the time of data collection in respect of the study (i.e. May 2008–December 2009). The same time frame for occurrence of injuries and RTAs was applied while carrying out scrutiny of records/reports.

All the study subjects were explained in detail about the purpose and methodology of the study and Informed consent was obtained. Data thus collected were entered into Excel worksheets and coded appropriately; and analysed using appropriate statistical tests. The results were expressed in terms of mean, standard deviation, confidence intervals; and in terms of numbers and percentage. *p*-value computation was done where required.

Operational definition(s) of the Variables identified for study: RTA: Any accident involving at least one road vehicle, occurring on a road open to public circulation, and in which at least one person is injured. Injury (Non-RTA): refers to damage to the body produced by energy exchanges that have relatively sudden discernible effects, excluding those sustained as a consequence of RTAs. These injuries were classified as minor and major, depending on the extent of damage to the body, as per the Abbreviated Injury Scale (AIS), which is an ordinal scale to assess the severity of injury. For the purpose of data collation and analysis, the six-point ordinal scale of injury laid down in AIS was clubbed into two groups, minor and major. 'Minor' injuries included those graded 'Minor and moderate' of the AIS scale; and the grades of 'Serious', 'Severe', 'Critical' and 'Maximum' in the AIS scale were classified as 'Major' injuries. Human factor: 'any determinant attributable to subjective aspect of the driver/road user who met with the accident; these include an increased sense of urgency, hurried working (driving) style, speaking on mobile while driving, etc.'

Results

Injuries

A total of 362 subjects were studied for profiling of injuries. More than half (56.6%) of those who had sustained injuries, were in the 20–40 years age group (Table 1). Nearly three-fourths (72.2%) had sustained minor injuries, as compared to 27.8% whose injury was major (Table 2).

The distribution of cause of injury among the three studied determinants, namely equipment/habitability conditions, human factors and a combination of the two were as follows: 40% of the injuries were attributed by the subjects to a combination of human and habitability factors, 34.5% to human factors and 25.5% to habitability factors. A majority (76.4%) of the personnel were of the opinion that the injury they had sustained was preventable while the remainder (23.6%) felt that the injury was inevitable (Table 3).

Road Traffic Accidents

Data collected from a total of 384 subjects were analysed for profiling of RTAs. The predominant age group involved in

Table 1 – Age-wise distribution of injuries and Road Traffic Accident cases.

Age (years)	Road Traffic Accidents		Injuries	
	Numbers	Percentage	Numbers	Percentage
<20	37	9.7	75	20.7
20–40	305	79.7	205	56.6
>40	42	10.6	82	22.7
Total	384	100	362	100
	Mean (age): 29 years; SD: 4.7 years 95% CI (of age) = 19.6–38.4 years		Mean (age): 30.7 years; SD: 5.4 years 95% CI (of age) = 19.9–41.5	

Table 2 – Distribution of injuries and RTA cases as per type/experience.

Driving experience (number of years)	Road Traffic Accidents		Injuries		
	Numbers	Percentage	Type	Numbers	Percentage
≤10	111	29.0	Major	101	27.8
11–20	178	46.4	Minor	261	72.2
>20	114	29.6	Total	362	100.0
Total	384	100			
Mean (No. of years of driving experience): 16.4 years; SD: 3.6. 95% CI (of driving experience) = 9.2–23.6 ($16.4 \pm 2 * 3.6$).					

Table 3 – Determinants and profile of injuries and Road Traffic Accident victims.

Injuries			Road Traffic Accidents		
Factor	Numbers	Percentage	Factor	Numbers	Percentage
			Mode of transport		
			Pedestrian	34	09.0
			Two-wheeler	318	82.7
			Four-Wheeler	32	08.3
			Total	384	100.0
Cause			*Cause*		
Equipment/habitability	92	25.5	Road	31	8.1
Human	125	34.5	Vehicle	49	12.8
Combined	145	40.0	Human	192	50.0
Total	362	100.0	Combined	112	29.1
			Total	384	100.0
Preventability			*Preventability*		
Preventable	277	76.4	Preventable	334	87.0
Inevitable	85	23.6	Inevitable	50	13.0
Total	362	100.0	Total	384	100.0

RTAs was of the range 20–40 years (79.7% of the study participants). Persons more than 40 years of age constituted 10.6%, and those less than 20 years of age 9.7% of the sample studied. The mean age of personnel who met with any RTA was 29 ± 4.7 years (Table 1).

Nearly half (46.4%) of those who had met with a RTA, had 11–20 years of driving experience; followed in nearly equal proportions by those with more than 20 years (29.6%) and less than 10 years of driving experience (27.6%). A minimal proportion (1.4%), had no driving experience at the time of meeting with an accident. These included the pedestrians and/or pillion riders. The average number of driving experience among the study subjects was 16.4 ± 3.6 years, with a 95% CI ranging from 9.2 to 23.6 years of driving experience. Two-wheelers were found to be involved in the vast majority (82.7%) of accidents. Pedestrian and four-wheeler, as modes of transport were found to be equally involved in lesser proportions in RTAs (08.3% and 09.0%, respectively) (Table 2).

Human factors as defined above were found to contribute to the maximum proportion (49.6%) of RTAs while combined factors (two or more; of vehicle, road and human factors) led to 29.4%. One-eighth (12.5%) of the respondents attributed the accident to vehicle-related factors, whereas the least contribution to RTAs was found to be from Road factors (7.5%). An overwhelming majority of the study subjects (87.0%) felt that the accidents were preventable; whereas 13% felt that the accidents were inevitable (Table 3).

Discussion

Injuries

Involvement of 20–40 year age group in injuries is similar to the finding of an epidemiological study of injuries in rural Pondicherry.[7] A common observation between the studies on RTAs and injuries is the relatively younger to middle age group of the victims; potentially leading to damaging, life-long consequences for the individual and family. The need to arrive at community-specific interventions for their prevention, therefore becomes all the more urgent.

The importance of combination of human behavioural and social factors in the causation of injuries and RTAs, as found by this study has been corroborated by several other studies under different, varied settings.[8,9] There are, however, different findings in this regard as per a WHO study report[10] Obviously, there is a felt need to conduct deeper studies to widen the horizon of our knowledge in this regard.

The finding of the present study, wherein more than three-fourths of the study subjects opined that their injury sustained was preventable, is in contrast to a study in a rural area.[7] However, the reason for the difference in such a finding between the two studies may be attributed to the different socio-demographic settings under which they were conducted.

Road Traffic Accidents

The predominant age group of personnel involved in RTAs, was 20–40 years, with the mean age being 29 years. Similar results have been found in a report released by Ministry of Road and Surface Transport, Govt. of India[5]; as per which 53.1% of those who met with an RTA, belonged to age group 25–65 years. A study conducted at Pune (Command Hospital, Southern Command)[11] among cases of RTAs admitted to a tertiary care centre of the Armed Forces, found the most common age group for RTAs as 20–30 years. However, another Indian study in Vadodara city among young drivers found that young drivers below 20 years of age were most commonly involved in accidents on roads.[12] The probable reason for this finding lies in the fact that the study population of the said study was mainly young drivers.

Our study finding of majority (46.4%) RTAs, having 11–20 years of driving experience, followed in nearly equal proportions (one-fourth each) by those with more than 20 and less than 10 years of driving experience is different from a hospital based study of RTAs,[11] which found nearly half of them having less than 10 years of driving experience. This difference in

findings may be due to the fact that study settings were different from our community-based study. Our study results of two-wheelers as the main mode of transport involved in the vast majority of accidents are similar to the findings in report released by Ministry of Road and Surface Transport.[5] However, the percentage of their involvement was comparatively lesser (25.23%). The apparent reason for this observation may be because the report included data compiled on all modes of surface transport, such as trucks, tempos, heavy vehicles etc. Whereas the present study was conducted among Naval personnel, whose predominant modes of transport are two wheelers and cars.

Similarly, our study finding of human factors as predominant cause of accidents is corroborated by the report by Ministry of Road Transport and Highways,[5] which cites fault of driver as the reason (79%) of RTAs. Over speeding, overloading/overcrowding of vehicles and talking on mobile phone while driving were the main 'driver-related faults' as brought out by the report.

Studies on road user outlook have brought out that unsafe driving practices like high speed, not using helmets and seatbelts while driving and using mobile phones while driving were responsible for a majority of road accidents.[13,14] Further, the common reasons mentioned by young drivers were ''Fault of a Pedestrian'' and ''Poor Road condition'' while common reasons for not using helmets and seat belts were ''Feeling uncomfortable'', ''Not a habit'' and ''short duration of driving''. Clearly, this points to an attitudinal determinant among drivers, which needs to be assessed and addressed.

The preventability of accidents as brought out by our study (87%) is corroborated by studies in varied settings.[15,16] This clearly points to the fact that knowledge is prevalent but as mentioned earlier, appropriate attitude and practices are lacking.

Recommendations

The above-mentioned findings of the present study need to be corroborated by larger studies in varied settings, prior to being applied throughout the Armed Forces.

In view of the preponderance of younger age group persons meeting with accidents and injuries, it is necessary that Behaviour Communication Change (BCC) strategies aimed at this particular age group be implemented across various echelons. Further, as two-wheelers have been found to be the predominant mode of transport involved in RTAs, prevention and control strategies need to lay specific emphasis on safe two-wheeler riding. As preventability of accidents and injuries is admitted to by most personnel, the horizon of the 'preventability element' of accidents is to be widened, rather than focussing on 'damage control' as a primary control strategy determinant.

Conflicts of interest

The authors have none to declare.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.mjafi.2016.08.002.

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