

Original Research Article

A cross sectional study on the determinants of railway fatalities in different age groups

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ABSTRACT

Background: Over the last few decades many railway accidents and fatalities have occurred in India as well as worldwide. Cities having a high economic activity and are complex spatial structures, are supported by transport systems. The evolution of mass rapid transport system in the form of sub-urban railway network has increased railway casualties in the cities as the railroads pass through residential and commercial zones.

Methods: This cross-sectional observational study was conducted at R. G. Kar medical college and hospital police Morgue attached to the department of forensic medicine and toxicology (FMT), Kolkata on the randomly selected medico legal postmortems over last 4 years.

Results: Railway accidents were common in males with mean age group of 38.98 years and was almost identical with the female mean age. The accidents mostly occurred in the office hours during the day time. Chi square test of association gave significant results between the different age groups with sex and grievous injuries sustained the people. Injuries sustained by the train showed that they were found mostly over the head followed by spine and thorax. Major cause of death was due to head injuries.

Conclusions: The article gives an idea about the relevant demographic profiles and association with the age-related factors that can be taken up as means to prevent the accidents.

Keywords: Railway accidents, Demographic profile, Fatal injury, Postmortem

INTRODUCTION

The Kolkata suburban is a railway system for the suburbs surrounding the 'city of joy'. Due to the geographical spread of the population, the rail network is one of the principal modes of mass transport in Kolkata. As Kolkata's population swelled from a heavy inflow of migrants in past decades, frequent overcrowding has become a serious issue, and numerous safety concerns have been raised over these years. Out of which railway fatality is one of the important concerns that we are to deal with.

The injuries of pedestrians that are associated with train mishaps, can be devastating, and usually results in death or irreparable damage such as amputation or paralysis. These injuries are mostly accidental or sometimes suicidal. They may be caused when a person is crossing the line, getting injured while walking on the railroad or working on line are also liable to get injured.¹

As far as India is concern, fatalities mostly occur due to overcrowded local trains and protruding objects on the side of rail lines often injure persons hanging on to the door and the bar.² Similarly, a person travelling illegally on the roof of a train may be injured by electrocution or

by low over bridges or tunnels when the train passes under them.

In rail accidents, several types of injuries may be found due to direct impact or transmitted force or secondary injuries caused by heavy objects falling on the head or body, persons sleeping on the upper berth being thrown down, or injuries from splinters and broken glass on damaged compartment. It is not uncommon for a person to lie down on the line in front of an oncoming train to commit suicide. Rarely the body of a victim of homicide may be placed on the tract to simulate suicide or accident. Examination of injuries on the body, the scene of crime and chemical analysis of viscera will often solve mystery.

This study is unique in this context that it has taken into consideration almost all the demographic variables possible. The novelty of the study has been in the in-depth analysis to find out few determinants of railway accidents and has become extensive and fruitful for the future researchers to work on this matter.

Primary objective of the study is to analyze the cases in relation to different demographic data of the victim, to find out the nature of injury and exact cause of death and to find out different determinants of such accidents in young and older age groups.

METHOD

The study was an observational cross-sectional one. The study has been conducted in the R. G. Kar medical College and Hospital Police Morgue attached to the department of FMT, Kolkata, 700004. It was conducted between 1st February 2017 to 31st January 2022.

The study population was selected from the dead bodies on whom medicolegal autopsy was performed with history and findings were suggestive of railway fatality.

Sample size: sample size was calculated based on the few previous year's proportion rate of the railway accidents amongst the dead bodies coming for autopsy and was found to be 3%. The authors used the online sample size calculator from www.calculator.net and got the sample size of 178 with 99.99% confidence interval and 5% margin of error. In order to minimize sampling error 10% more samples were taken and the total number were 200.

Inclusion and exclusion criteria

Except for those cases which were decomposed and those cases whose cause of death were unrelated to accidents, all were taken as a case for the study.

Procedure

Following the approval of the Institutional ethical committee (of R. G. Kar medical college), the study was conducted. The dead bodies selected on the basis of the

inclusion and exclusion criteria were subjected to postmortem examination using conventional "I" shaped incision. The demographic data were collected from the inquest report and were noted down in the excel sheet and papers and asking one or two questions to the relatives of the deceased, if required. Finally, all the data were tabulated in one excel sheet and the demographic variables were analyzed with descriptive statistics and the analysis of groups were done using chi-square test. In all cases the value for statistical significance was taken to be less than 0.05.

RESULTS

Out of the total 200 cases studied these are the observation analyzed below-

Table 1: Demographic profile.

Demographic profile		N
Gender, (n=200)	Male	162
	Female	38
Age (Years) (Mean age- M-38.98, F-39.29)	<20	24
	<40	101
	<60	48
	>60	27
Religion	Hindu	130
	Muslim	8
	Christians	1
	Unknown	61
Month wise distribution	First quarter	33
	Second quarter	70
	Third quarter	72
	Fourth quarter	28
Time of incidence	Night between 6 pm to 12 am	42
	Night between 12 am to 6 am	19
	Day between 6 am to 12 pm	83
	Day between 12 pm to 6 pm	56
Occupation	Student	24
	Service	20
	Self employed	35
	Retired	10
	unemployed people	30
	Unknown	81

The descriptive statistics (Table 1) of the research shows male predominance with the commonest religion being the Hindus followed by the unknown group. April to September is the period of the year where are the railway accidents happened most with the major incidence occurring between the 6:00 a.m. to 12:00 p.m. There was no significant variation between the types of occupation of the subjects except for the major chunk that was unknown.

There was indeed an overlapping of injuries (Table 2 and 3) sustained during the accident commonest being the head and spinal injuries. Extradural and subdural hemorrhages were the major cause of death in most of the

cases. Injury to intra-abdominal organs were comparatively lesser, where rupture liver being commonest one.

Chi square test of association (Table 4) revealed significant association between the age groups (young and old) with the sex and ability to withstand the impact of injuries. The study revealed no such association with the presence and absence of alcohol in the stomach.

Table 2: Incidence of organs affected.

Organs affected	Cases	Percentage (%)
Head injury	112	56
Spinal injury	108	54
Abdominal injury	78	39
Chest injury	102	53
Injury upper limb	76	38
Injury lower limb	75	37.5

Table 3: Types of injury to different organs.

Organs involved	Types of injury	N	Percentage (%)
Brain	Extradural hemorrhage	115	57
	Subdural hemorrhage	131	65
	Structural brain injury	152	76
Spine	Fracture spine	100	50
	Spine dislocation	78	39
Chest	Fracture ribs	106	53
	Injury to lung	45	22.5
	Injury to heart	38	19
	Injury to other mediastinal structure	60	30
Abdomen	Injury to liver	56	28
	Injury to spleen	44	22
	Injury to kidney	20	10
	Injury to intestine including stomach	24	12
Upper limb	Fracture	72	36
	Dislocation	28	14
	Injury to soft tissue	76	38
Lower limb	Fracture	64	32
	Dislocation	22	11
	Injury to soft tissue	75	37.5

Table 4: Chi-square test of association between two groups.

Variables	Male	Female	Brought dead	Death after hospital admission	Alcohol present in the stomach	Alcohol absents in the stomach
Fatality in young age group	95	29	81	44	11	114
Fatality in older age group	67	9	61	14	4	71
P value	0.019		0.012		0.367	

DISCUSSION

The incidence of deaths was far more common along the up line (trains travelling towards zonal headquarters) which amounted to 163 than down line (trains departing from zonal headquarters) which amounted to 37. It was observed that with male predominance, the fatal train accidents occurred throughout the year without any uniformity but with seasonal variation. Fatalities were highest in rainy season and lowest in winter season. The male predominance over female was due to the fact that most of the outstation activities are usually carried out by the males.³ The maximum numbers of victims were found to be in the age group of 20-40 years as this age group seemed to be the most dynamic one.⁴ The passengers on the train, specially males of these age group takes the risk to get boarding in the running train,

hanging on to the doors, windows or side bars and travelling on the roof getting injured by low over-bridges, tunnels, also leaning out of the windows of a running train when the trains are overcrowded especially in the day times. Males are doing most of the laborers work along the rail tracks (Gagman), they try to cross the rail lines while the train is nearby, and also take the risk of walking along the track, hence contribute to the case fatalities.⁵ Justifiably the in service candidates and self-employed ones formed the majority of the deceased.

Study clearly shows that majority of victims died on the spot because of sustaining severe type of crush injuries, which is mostly due to the massive impact of the moving train that generates tremendous momentum and result in such outcome.⁶ Injuries sustained by the train showed that crush injuries were found mostly over lower limbs

followed by the upper limb, face and head, neck regions and then the thorax and abdomen. Head injury was the commonest type of injury which resulted for the cause of most of the deaths.⁷ The crush separation of the trunk from the body was seen in good number of cases whereas the multiple fractures to the ribs were commonly seen due to effect of shearing and grinding force from the rotating train wheels. Most of the injuries sustained were abrasions and contused abrasions followed by the laceration and the fracture of limbs and then the decapitation. The study clearly revealed that head was injured in most of the cases followed by spine, thorax, abdomen, upper limb and lower limb in descending order which is a common finding in other studies.^{4,5,8} Considering the thoraco-abdominal organ involvement, the crush laceration and the contusion to the lung was seen in most of the cases compared to the heart injuries. The reason is because lung is the superficial organ than the heart and occupies maximum area of the thoracic cavity / rib cage.⁸ Abdominal wounds are sustained following the primary and secondary impact resulting in grave injuries to the abdominal viscera. Similar finding was observed by almost all the authors on this topic.⁶⁻⁸

Beyond these demographic findings the study also tries to evaluate the association of the younger and the older age groups with few determinants of railway accidents. The mean age for the males dying due to railway accident was found to be 38.98 years whereas for the females it was 39.29 years. Independent "t" tests showed that the $p=0.4533$ and was not significant which highlights that there is no difference between the apparent variation of age of male and female victims dying due to railway accidents. The total number of cases were now divided into two groups. One group less than equal to 40 years (young age group) of age and the other greater than 40 years (old age group); as 40 years is considered to be the beginning of the middle age.⁹ At first, these two age groups were compared with the male and female group to find out whether there is any association between the different groups or in other words, can sex be a determinant of fatality in railway accidents in different age groups. On calculation the chi square statistics is found to be 5.4148 with a $p=0.019$ which was significant. The same age groups were now compared with the groups who died on the spot and with those who died after hospitalization. The chi-square test statistics was 6.2231 with a $p=0.012$ and was found to be significant.

Finally, the two age groups were compared with group with suspected alcoholic content in the stomach while the other without search finding. The chi-square statistics was 0.82 with a $p=0.367$ and was not significant. From the above finding it can be concluded that there is significant association between the sex and the grievous nature of injuries sustained with the different age groups. Whereas the findings in relation to alcoholic content has no association with the same groups. It is a common finding that with younger age groups and male predominance the death rate is higher in most of the

countries.¹⁰ Similarly, the older age groups are more susceptible to the injuries occurring due to impact of the rail, hence the spot death cases are much more in this age group.¹¹ Though some of the foreign literatures have shown that alcohol consumption has a relation with the railway fatalities, but for this country it is not the same, may be due to the cultural differences.¹²

Limitation

The chi square statistics only shows the association between the two parameters but the strength of association could not be determined.

CONCLUSION

Most of the railway fatalities in the research were in the bread earning age group particularly among the males. The increasing number of populations, overcrowding in the trains, reckless and careless behavior of passengers, pedestrians and the train drivers towards safety norms are the constant causes of fatalities. Though these types of occurrences are beyond the direct control of rail, the findings in the research shows there is a strong association has been seen between younger age groups with male population and younger age groups with ability to withstand trauma. The high levels of the fatalities that is common in the younger age group with significant association as shown in the article can make a significant contribution to formulate the strategy to bring down these fatalities.

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