



Original communication

# Epidemiology & preventive aspects of railway suicides and fatalities related to trespassing accidents



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## ABSTRACT

**Purpose:** Suicide and trespass are major contributors to risk on the railway, resulting in around 170–180 fatalities per year in Lucknow region, as well as associated major disruption to the rail network. Lucknow is the capital city of the state of Uttar Pradesh in India.

**Methods:** The analysis included train-pedestrian fatalities during 2007–2012. The data for 2007–2012 were collected from the autopsy reports of the university, case sheets from the hospital, the general prosecutor's investigation report and the inquest reports from police.

**Results:** The results show that a majority of victims were males. Half of the suicide victims were 20–39 years old. Accidents happened most frequently in situations when a person was walking on the tracks/in front of train (22.7%) or were crossing the tracks illegally (20.9%). Among all train-pedestrian fatalities, about half of the victims (48%) were intoxicated by alcohol. Female suicide victims suffered from mental health problems more frequently (55.8%) than male suicide victims.

**Conclusion:** Overall, there is a reason to believe that train-pedestrian fatalities are unavoidable. By contrast, the effective prevention of railway suicides and accidents should be based on a systems approach involving effective measures introduced by several organisations such as government, railway organisation, various authorities (such as public health, education, enforcement, urban planning) and communities. These measures can often be used to prevent both trespassing and suicides, even though their effectiveness may depend on the target group. In addition, there are measures specifically targeted to prevent either trespassing or suicides.

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## 1. Introduction

The injuries and deaths due to accidents are going on increasing in the modern way of living. The accidental deaths are mostly due to the road traffic accidents but the deaths due to railway fatalities are also not negligible, especially in the areas where railway traffic is higher. An Indian railway is one of the largest among the world railways. It had been over 150 years back, the first train rolled on an

Indian Track. It carries millions of passengers, tons of freight and is the life line of the country. Indian railways employs over a million people, runs an impressive network over 63,000 km.

Among all fatal railway accidents in India, train-pedestrian fatalities are the most frequent accident type. During 2010, the cases of deaths due to 'Rail-Road Accidents' have increased by 120.8% from 1516 cases in 2009 to 3347 in 2010. 2879 victims (out of 3347 deaths) were males and 468 were females.<sup>1</sup> The statistics of the NCRB (National Crime Records Bureau)<sup>1</sup> show that 3.1% of train-pedestrian fatalities on Indian railways were suicides out of 13,459 during 2010. However, the classification of train-pedestrian collisions is frequently challenging. Specifically, in many cases there is insufficient information to make a definitive classification.<sup>2</sup> This concerns both railway fatalities<sup>2</sup> and road traffic fatalities.<sup>3</sup> In addition to practical issues (such as insufficient information), the accurate identification of railway suicides can be complicated due

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to the social, legal, financial or ethical implications of assigning suicide as a cause of death.<sup>4</sup>

Railway suicide is a violent method of choice, especially for younger men, who falsely believe that it is a fast, painless, foolproof way to end one's life. Suicide in India is slightly above world rate. Of the half million people reported to die of suicide worldwide every year, 20% are Indians, for 17% of world population.<sup>5</sup> Compared with the neighbouring countries, suicides are more common per inhabitant in India than in Pakistan, Sri Lanka, Lithuania, Latvia, Estonia and the Russian Federation, but less common per inhabitant than in the china.<sup>6</sup>

Official Statistics of India<sup>7</sup> shows that the most frequently used suicide method in India was poisoning (36.6%), hanging (32.1%) and self-immolation (7.9%). 3.1 per cent of all suicides were railway suicides. In other European countries the proportion of railway suicides has been slightly higher, between 5 and 7%.<sup>8–11</sup>

Even though railway suicides constitute a relatively small percentage of total suicides committed in India, the societal costs of suicides, as well as costs related to unintentional train-pedestrian fatalities, are high. In addition to the loss of human life, train-pedestrian collisions cause considerable delays (primary and secondary) to railway traffic and a serious work-related stress factor and trauma for engine drivers, other railroad and rescue employees and to people who witness the event. Suicide and trespass are major contributors to risk on the railway, resulting in around 170–180 fatalities per year in Lucknow region, as well as associated major disruption to the rail network. The results should provide us with useful information on train-pedestrian collisions and make it possible to investigate similarities and differences between different types of events (suicide, accident, unknown). This detailed information on train-pedestrian collisions will help identify the areas for future research, and help determine general preventive strategies for train-pedestrian collisions or separate strategies for different types of events. For example, Mishra<sup>2</sup> indicated that prevention strategies for reducing trespassing accidents are not necessarily similar to those for preventing suicides, because as opposed to accidents, suicides consist of persons deliberately putting themselves in situations where they will be struck by train.

## 2. Material & methods

An observational retrospective study was done during 2007–2012 on railway fatalities (which concerns upsurge of suicides and trespasses on railway property) from Lucknow region, which were autopsied according to attorney request at Forensic Medicine & Toxicology Department of King George's Medical University, Lucknow, India. Retrospective data were collected from the autopsy reports of the university, case sheet from the hospital, the general prosecutor's investigation report and the inquest reports from police by the enumerators. The combined dataset included information related to time and place of occurrence, age, sex, intoxication and mental health of the victim, victim's pre-crash behaviour, type of event and type of train.

The final data included all cases from the police reports and death certificates that satisfied the criteria of intentional or unintentional train-pedestrian fatalities. The information concerning intoxication (alcohol, medicines and drugs) was gleaned from the autopsy reports. Thus, all victims with no information on alcohol level were assumed not to be intoxicated. Specifically, alcohol and medicines are tested for in all victims and drugs generally in all victims except the elderly. Information concerning mental health, self-destruction and suicide note or farewells was collected from the death certificates and from police reports. In most of the cases the information in the police reports was augmented based on

**Table 1**

Victim's gender and age by the type of event.

Variable/level		Type of event			
		Suicide (%)	Accident (%)	Unknown (%)	Total (%)
<b>Gender</b>	Male	193 (65%)	447 (79.8%)	148 (75.9%)	788 (74.9%)
	Female	104 (35%)	113 (20.2%)	47 (24.1%)	264 (25.1%)
	Total	297 (100%)	560 (100%)	195 (100%)	1052 (100%)
<b>Mean age</b>					
<b>Age</b>	4.6	0–9	5		13 (1.2%)
	15.5	10–19	93		167 (15.9%)
	23.4	20–29	83	171	352 (33.5%)
	37.8	30–39	58	18	174 (16.5%)
	42.9	40–49	43	69	125 (11.9%)
	56.3	50–59	19	63	114 (10.8%)
	69	60–69	19	55	85 (8.1%)
	Unknown	0–9	05	11	22 (2%)
	Total	297	560	195	1052 (100%)

interviews with close relatives to find out correct information. The main results are presented in frequency tables.

## 3. Results

During the 6-year observation period, a total of 1052 train-pedestrian fatalities occurred on the Lucknow region railway network. This number 297 (28.23%) were classified as suicides, 560 as accidents and 195 as unclassified events (Table 1).

Although a relatively small proportion of data consists of pure trespassing accidents, railway suicides often involve elements of trespassing. The overall number of completed suicides in the Lucknow region population covering the same time period was 7672. Thus, fatal railway suicides accounted for 3.87% of all suicides over the 6-year period, ranging from 3.5% in 2011 to 4.1% in 2012. In all types of train-pedestrian fatalities most victims were males (65% of suicides, 79.8% of accidents and 75.9% of unknown events) (Table 1). Approximately half of the suicide victims (47.5%) were 20–39 years old and 64.6% of all accidents happened to people aged 10–39 years. People who commit railway suicide are on average younger age. For example, the proportion of suicide victims under 40 years of age was 62.6% among railway suicides.

A majority of suicide victims waited on the tracks for a while before the train arrived. Less frequent behaviours included crossing the tracks illegally and fall from crowded coaches. Accidents

**Table 2**

Victim's pre-crash behaviour by the type of event.

Variable/level	Type of event			
	Suicide	Accident	Unknown	Total
Behaviour				
Throwing oneself directly in front of an oncoming train.	128	0	11	139 (13.2%)
Lying, sitting, crouching, kneeling etc. on the tracks	66	69	23	158 (15%)
Standing	18	58	10	86 (8.2%)
Walking on the tracks/in front of train	35	127	45	207 (19.7%)
Crossing the tracks illegally	2	117	14	133 (12.6%)
Fall from crowded coaches	0	72	20	92 (8.7%)
Unmanned railroad crossings	23	92	33	148 (14.1%)
Impact with railway electric poles/electrocution	5	25	11	41 (3.9%)
Unknown	20	0	28	48 (4.6%)
Total	297	560	195	1052 (100%)

**Table 3**

Victim's intoxication and mental health by the type of event.

Variable/level		Type of event			
		Suicide	Accident	Unknown	Total
Intoxication	Alcohol, medicines and/or drugs	118 (39.7%)	312 (55.7%)	20 (10.3%)	450 (42.8%)
	No intoxication	179 (60.3%)	248 (44.3%)	175 (89.7%)	602 (57.2%)
	Total	297 (100%)	560 (100%)	195 (100%)	1052 (100%)
Mental health	Depression	73 (24.5%)	0 (0%)	21 (10.8%)	94 (8.9%)
	Other psychiatric illness	41 (13.8%)	28 (5%)	0 (0%)	69 (6.6%)
	No history of psychiatric illness	175 (58.9%)	492 (87.9%)	13 (6.7%)	680 (64.6%)
	Unknown	8 (2.7%)	40 (7.1%)	13 (6.7%)	61 (5.8%)
	Total	297 (100%)	560 (100%)	195 (100%)	1052 (100%)

happened most frequently in situations when a person was walking on the tracks/in front of train (22.7%) or were crossing the tracks illegally (20.9%). In addition, some people met with an accident while crossing unmanned railroad tracks (16.4%) or they fell from crowded coaches (12.9%) (Table 2).

Based on data there was no significant difference between genders or age groups in pre-crash behaviour of suicides or accidents. Among all train-pedestrian fatalities, about half of the victims (42.8%) were intoxicated by alcohol, medicines and/or drugs (39.7% of suicides, 55.7% of accidents and 10.3% of unknown events). Males (52.6%) were more frequently intoxicated than females (37.3%). The suicide victims suffered from mental health problems much more frequently than accident victims. Female suicide victims suffered from mental health problems more frequently (55.8%) than male suicide victims (28.5%) (Table 3). According to close relatives interviewed by the police, 29.6% of suicide victims had tried to commit suicide previously or had threatened to do so. This behaviour was more likely for females than males. Among the suicide victims, 23.0% left a suicide note or said goodbye to their close relatives by SMS or phone call.

Crush laceration and the contusion to the lung were seen in most of the cases as compare to the heart. Injury to lungs was seen in the 86.9% cases whereas injury to the heart was seen only in 13.1% cases. Liver injury was observed in 39.7% followed by the kidneys (31.5%) and the spleen (28.8%) (Table 4).

Maximum numbers of fatalities were due to injuries to vital organs i.e. 718 (68.2%). Shock and haemorrhage accounts for 184 (17.5%) alone and head injury in 148 (14.1%) cases (Table 5).

Fatalities by rail occur throughout the year but uniformly was not observed in the victims of railway accidents. However, the fatalities were equivalently seen in all the seasons i.e. in summer season 335 cases (31.8%), rainy season 349 cases (33.17%) and in winter season 368 cases (34.9%) (Fig. 1).

Train-pedestrian fatalities concentrated in areas where population density is high and train traffic is dense. Out of all train-person fatalities, 24.1% occurred either at the station or in their

vicinity (not more than 100 m away). The proportion is about the same for both suicides and accidents.

#### 4. Discussion

The main aim of this study was to describe the frequency of fatalities, timing of collisions and characteristics of persons killed in train-pedestrian collisions on Indian railways.

- > Most of the victims were males in all types of fatal train-pedestrian collisions. The result is supported by [8,9,12] (suicides) and [13–15] (accidents). Suicide is more of a mental health problem and issue should be taken seriously. Factors like professional pressures, drug-related problems, alcohol, and depression leads men for committing suicides while women commit suicide due to family conflicts, stress or domestic violence. Elderly often commit suicide due to loneliness, terminal diseases, family feud, etc.
- > People who commit railway suicide are on average younger than people who choose some other suicide method. The same result has been found earlier in other countries as well. [15–17] Van Houwelingen et al. [15] have proposed that young people may choose railway suicide as a method due to the high levels of impulsivity at that age and not having access to alternative means, such as medication. Overall, these results suggest a special focus on young people in the prevention of railway suicides.
- > The majority of suicide victims seemed to be waiting in the vicinity of the track for a while before the train arrived. The result confirms earlier findings [18,19].
- > The accidents happened most often in situations where a person was walking on the tracks, walking in front of train, fall from crowded coach, electrocution (it is a common to see commuters sitting on the roof of trains), impact with railway electric poles (travellers leaning out of local trains are at risk of being hit by electric poles that are all along the tracks), unmanned & manned railroad crossings which are in different with earlier results showing that trespassers are typically looking for the shortest and fastest route or using an existing path. [20] As on April 1, 2007, there were 12,808 manned and 2606 unmanned level crossings (excluding 'D' class cattle crossings and canal crossings) in the

**Table 4**

Thoracic and abdominal organ injury in fatal railway accident.

Organ	Type of injury		
	Contusion	Crush/laceration	%
<b>Thorax</b>			
Lungs	349	388	86.9
Heart	49	62	13.1
<b>Abdomen</b>			
Liver	78	465	39.7
Spleen	36	358	28.8
Kidney	144	287	31.5
Stomach	<b>Perforation</b>		
	115		
Intestines	236		
Bladder	147		

**Table 5**

Cause of death in railway fatalities.

Cause of death	Cases	(%)
Injury to the vital organs	718	68.2
Head injury	148	14.1
Shock & haemorrhages	184	17.5
Septicaemia	2	0.2
<b>Total</b>	<b>1052</b>	<b>100</b>

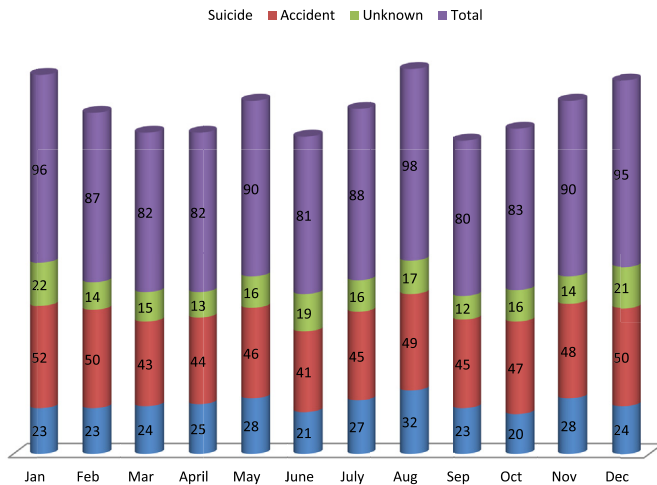


Fig. 1. Fatal train-person collision by time of occurrence (month) and by type of event.

state of Uttar-Pradesh.<sup>31</sup> The foot bridges are very narrow and crowded. It takes more than 10 min during rush hour to go from one end to the other. People therefore decide to jump on to the tracks to go to the other side. It is then that they get hit by oncoming trains.

- Among all train-person fatalities, significant share of victims were intoxicated by alcohol, medicines and/or drugs (concerning suicides supported by<sup>23</sup> concerning trespassing accidents supported by<sup>21,22</sup>). Furthermore, several suicide victims had mental problems before the event.<sup>23</sup>
- Concerning 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. Reason is that lung is the superficial organ than the heart and occupies maximum area of the thoracic cavity/rib cage. Most of the parts of the heart are retro-sternal therefore lungs are more vulnerable to injury as compare to the heart. The majority of serious injuries to the chest occurred from forced compression by the train in effect of the wheels of the trains. Abdominal injuries are sustained following the primary and secondary impact resulting in grave injuries to the abdominal viscera.
- Maximum numbers of fatalities were due to injuries to vital organs followed by shock & haemorrhage, head injury and in only 2 case septicaemias was the cause of death. Similar finding was observed by.<sup>28–30</sup>
- It was observed that the fatal train accidents occurred throughout the year with very little uniformity and seasonal variation. In summer season 335 cases (31.8%), rainy season 349 cases (33.17%) and winter season 278 cases (34.98%). In Sweden more suicides were committed during the summer months (April–September) and during the winter months (October–March) and in Australia almost half of railway suicides occurred during April–May and September–October.<sup>19</sup>

However, in order to prevent unmanned level crossing accidents, public awareness programmes and publicity campaigns are undertaken regularly for educating road users for observing safe practices while crossing unmanned level crossings. Level crossings, on reaching the laid down traffic volume criteria of manning, are also progressively manned. As a special measure to reduce the number of level crossings, Zonal Railways have been given power to consider and sanction 'Limited Use Subways' wherever technically feasible. Efforts are also being made to close down as many of unmanned level crossings as possible, suggesting their merger with

another level crossing in the close vicinity. High-risk locations should be identified and building of over- and underpasses, effective fencing or landscaping should be introduced.

Silla and Luoma<sup>24</sup> showed that fencing and landscaping can reduce trespassing by more than 90%. However, the effects of such measures on suicides might be more limited. As indicated by Law et al.<sup>31</sup> simply restricting the access to railway lines has nothing to do with the attempter's suicidal intent. Thus, it is possible that suicidal persons move to some other location with easier access to railway tracks or decide to use some other method. However, Rådbo et al.<sup>25</sup> argue that there is little evidence to support that reducing availability to the method would simply transfer the problem to another method. If the attempt has been complicated or even inhibited by building a fence, it gives the person more time to think about their intended act and they will possibly also realise its irrationality. In addition, information about these hot spots can also be used to reduce train speed in high-risk areas. Surveillance performed by staff and/or technically has also been proposed as a measure to identify and intervene with potential suicide victims just before they attempt suicide. Rådbo et al.<sup>8</sup> pointed out that pre-crash behaviour such as walking and loitering close to or on the tracks enables the early detection of suicidal persons and potentially also enables timely intervention, such as early breaking of train or intrusion by station staff. The above measures can be supported by educational measures, such as the safety education of school children, since more than half of all railway accidents happen to people aged between 10 and 29 years and the ability of small children to perceive and assess the risks related to trespassing is limited.<sup>26</sup> Public health organisations can play a significant role in the prevention of train-pedestrian fatalities as well, especially railway suicides. The railway safety panel will suggest a high-level safety panel be set up to implement its recommendations relating to safety and that a fee be added to every ticket to form a safety fund. The results of this study show that less than half of the railway suicide victims were intoxicated and a substantial number of victims suffered from depression or other mental health problems. The use of alcohol while sad or depressed conveys an increased risk of self-reported suicide attempts among young people not reporting suicidal ideation and furthermore, it is important to discuss the negative consequences of a train suicide to the patients themselves, to their friends, close relatives and also to frequent commuters.<sup>27</sup> Therefore, improved public health policy focusing on the use of alcohol and drugs as well as on mental health problems would be an essential part of the strategy for preventing the overly frequent suicides and accidents that occur on railways. Many results of this study can be utilised to identify high-risk persons and assess various risks. For example, information on pre-crash behaviour will help better understand the behaviour of people who are at risk of committing a railway suicide: if a patient indicates a specific suicide plan including typical characteristics of railway suicide, this suggests that the plan might be quite likely. This discussion would aim at decreasing the perceived attractiveness of railway suicides, and all suicides in general.

Limitations of this study are that it done in a small region of India. Classification into suicide/accident based on the police reports or information from close relatives.

## 5. Conclusion

The results show the main demographic groups and the type of behaviour that should be focused on when planning the preventive measures. The increasing number of population, overcrowding in the trains, reckless and careless behaviour of the passengers, pedestrians and the train drivers towards safety norms are the constant causes of railway fatalities. Overall, there is no reason to



believe that train-pedestrian fatalities are unavoidable. By contrast, the effective prevention of railway suicides and trespassing accidents should be based on a systems approach involving effective measures introduced by several organisations such as government, railway organisations, various authorities (such as public health, education, enforcement, urban planning) and communities. Coordinated action, as emphasised by the systems approach, are essential in order to coordinate and manage the implementation of single and/or combined countermeasures and to follow their effectiveness. Furthermore, it is important to take advantage of previous/ongoing practices and experiences (both national and international) and to exploit them so as to ascertain that available funding for prevention work will be used efficiently. Same measures can often be used to prevent both railway suicides and trespassing accidents, even though their effectiveness may depend on the target group. In addition, there are measures specifically targeted to prevent either railway suicides or trespassing accidents. The recommended countermeasures include e.g. under- and overpasses, physical barriers, prohibitive signs, enforcement, campaigns and training of railway staff.

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None.

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#### Conflict of interest

None.

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