

## SHORT ARTICLE

**Road Traffic Injuries in Tamil Nadu: A Growing Public Health Issue**Alex Joseph<sup>1</sup>, Dhasarathi Kumar<sup>2</sup>, Mappillairaju Bagavandas<sup>3</sup>, Roshini Nair Geetha<sup>4</sup>

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<a href="#">Abstract</a>	<a href="#">Introduction</a>	<a href="#">Methodology</a>	<a href="#">Results</a>	<a href="#">Conclusion</a>	<a href="#">References</a>	<a href="#">Citation</a>	<a href="#">Tables / Figures</a>
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**Abstract**

**Background:** Every year about 5 million people die worldwide due to Injuries, Road traffic Injuries are a neglected public health problem. In the state of Tamil Nadu, India the total number of road accidents has been on a constant rise. **Objective:** This study aims to provide a description of the reported road traffic accidents in Tamil Nadu based on location, injury rates and fatality rates. **Methods:** Secondary data on Road traffic accidents was collected from state and national reports published on various authentic sources. Cluster analysis was carried. **Result:** Two-wheelers accounted for the highest share in total road accidents, Males were found to have higher risk than females. The districts with high injury rates were Villupuram, Ariyalur, Cuddalore, Thiruvavur, Kanchipuram and Nagapatinam. If the current circumstances continue, we predicted that, by the year 2023 the total number of accidents will be approximately 75985 in Tamilnadu. **Conclusion:** The Tamil Nadu Governments efforts to stop and reverse the increasing trend in the number of road traffic accidents, deaths, injuries through adoption of comprehensive measures covering Engineering, Education, Emergency care and Enforcement is seeing its results, but there is a need for more effective implementation across the state.

**Keywords**

Cluster Analysis; Injury; Road Traffic Accident; Secondary Data; and Time Series Analysis.

**Introduction**

Globally around 5 million people die every year due to injuries. (1) Due to increased access to the motor vehicles, lack of knowledge, negligence, thoughtlessness, risk-taking behavior, and insufficient safety protocols the road traffic injuries is noticeably increased in India. (2) Studies show about 70% of the Traumatic brain injuries (TBI) due to RTA-related injuries. (3,4)

Globally the number of road traffic deaths almost reached a plateau since 2007. (5) The economic impact of road traffic injuries is very high in low income and middle-income countries between 1% and 2% of their GDP which is more than the total development aid received by these countries. (1) In Tamil Nadu, road accidents have been on a constant rise, the number has almost doubled in

2016 compared to 2000. Tamil Nadu is one of the best states in the country having taken many initiatives to protect the lives of road users. Still, the total number of road accidents cases has been on a constant rise.

The Sustainable Developmental Goals targets the global number of deaths and injuries from road traffic crashes by 2020 has to be halved. (5)

### Aims & Objectives

This study aims to provide a description of the reported road traffic accidents in Tamil Nadu based on location, injury rates and fatality rates.

### Material & Methods

**Study Type:** Secondary data analysis

#### Operational Definitions

**Injury:** The Injury is defined as any physical damage or acute physical condition to the human body which is caused by the rate of beyond the threshold of human tolerance or acute exposure to the unbearable level of energy

**Road traffic accident:** "A Road Traffic Accident (RTA) can be defined as, an event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved. RTA involves high human suffering and socioeconomic costs in terms of premature deaths, injuries, loss of productivity"

**Data Source:** Data is collected from the electronic sources such as online databases, internet and hard copy of the data also received from the office of the State Transport Department of Tamilnadu.

**Process of Data Collection:** Secondary data on Road traffic accidents was collected from state and national reports published on various authentic sources such as Website of Ministry of Road Transport and Highways, Chennai Regional Transport Office (RTO), Tamil Nadu Vehicle Registration Details, Tamil Nadu RTO, State Transport Department of Tamil Nadu, Scheme for Strengthening Public Transport System, these data was processed and analyzed to understand the severity and trends over time, regarding the accidents in India and Tamil Nadu. In addition to this, after explanation of the purpose of study to the State Transport Department of Tamil Nadu, we collected hard copies of the official data which is recorded by the State Transport Department of Tamil Nadu, and analyzed the data to study the trends and number of injuries and fatal accidents over a period of time in Tamil Nadu.

**Statistical Procedure:** Data entered in Microsoft Excel 2019, and statistical analysis was carried out using SPSS v 16.0 and Minitab v 19.0 softwares. Cluster analysis was carried out to find the natural clustering. District-wise Injury rates in Tamil Nadu are clustered; we performed the hierarchical clustering, which showed that there are two clusters in the data. The hierarchical cluster formed in this research based on the Euclidean distance, angle and we have found that the standard correlation coefficient within clusters. We performed time series plot of total accidents and time series analysis, which showed that there is constant rise in total number of accidents.

**Ethical Considerations:** The secondary data had no identifying information and it did not require a review by the ethical board.

**Accident severity index:** Usually in accident risk, the injury rate and fatality rate are not considered. To rectify this negative aspect of the Accident Severity Index (Chand and Alex 2007- ASI) is used. Weighted Severity Index is calculated based on the formulae,

$$(WSI) = (41 \times K) + (4 \times GI) + (1 \times MI)$$

Where, K is the number of persons killed

GI is the number of grievous injuries

MI is the number of minor injuries

$$ASI = \frac{\sum_{K=1}^4 W_k NS_{kt}^I}{\sum_{K=1}^4 W_k}$$

Accident Severity Index is calculated based on the four indicators such as the number of accidents, population, road length, area and number of registered vehicles. (6)

### Results

**Road accidents based on Type of vehicle:** During the year of 2015, two-wheelers accounted for the highest share in total road accidents followed by the group of Cars, Jeeps & Taxis. The share of two-wheelers in total road accidents has increased from 26.3 percent in 2013 to 27.3 percent in 2014 and 28.8 percent in 2015. The total number of jeeps, cars, and taxis also slightly increased from 22.2 percent in 2013 to 23.6 percent in 2015.

**Accidents based on severity in Tamil Nadu:** If we look into the reports by Accidental deaths and Suicides in India, for the year 2011-2016, Tamil Nadu has been ranked constantly on the top three for having the maximum number of road accidents among the other states in the country. Although in the year 2015, Tamil Nadu ranks first followed by Maharashtra, when we compare the accident

severities among these two states, the cities in Maharashtra have the highest accident severity than Tamil Nadu. In Tamil Nadu, among the million cities the highest accident severity is 20.7 whereas, in Maharashtra, the highest accident severity is 30.4. Out of the 69059 total accidents, 14524 were fatal accidents which had 15642 fatalities and 54345 non-fatal cases. Of the total accidents, 79701 persons were injured as reported by the state Road Transport Department in their "road accidents statistics data". The State Transport Authority statistics for the period 2014 to 2018 on total accidents, fatal accidents, non-fatal accidents and number of persons injured in Tamil Nadu is given (Figure 1), it shows a slight decline in the accidents during the last two years (8). Time series plot (Figure 2) shows total number of accidents during the period of 2001 to 2018.

Fitted Trend Equation

$$Y_t = 50517 + 1107 \times t$$

A time series analysis was performed with the total number of accidents from 2001 to 2018 using Minitab software. The table 1 shows if the current circumstances continue without any change, it is predicted that by the year 2023 the total number of accidents will be approximately 75986 in Tamilnadu.

#### District-wise Fatality rates in Tamil Nadu:

The fatality rates for each district were calculated with the data on number of road accident deaths and the vehicle population for each of the 32 districts in Tamil Nadu. The fatality rate is defined as the number of deaths per 10,000 registered vehicles per year. Then based on the fatality rates of the districts, the clustering was identified for each year from 2012 to 2016 and the patterns of clustering among the districts were studied. Overall there were two clusters identified, where one cluster had the districts with low fatality rates and the other cluster had districts with high fatality rates.

**Cluster 1:** In the year 2012, 30 districts were clustered in the first cluster having all the districts with low fatality rates. The average fatality rate of this cluster having low fatality rate districts was 9.74.

**Cluster 2:** In the year 2012, only two districts namely Villupuram and Ariyalur had high fatality rates when compared to the other districts and they were clustered in the second cluster. The average fatality rate of the second cluster was 12.47 and it is higher when compared to the first cluster.

**Cluster 1:** In the year 2016, 22 districts had a low fatality rate; the average fatality rate for districts was

9.46. **Cluster 2:** Whereas about 10 districts were having a high fatality rate and the average fatality rate was 11.17. The districts Ramanathapuram, Karur, Theni, Perambalur, Tiruvannamalai, and Dindugul which had low fatality rates in 2014 had moved to high fatality rate districts in addition to Krishnagiri, Kanchipuram, Villupuram, and Ariyalur. Dendrogram (Figure 3) shows there is two natural cluster, **Cluster 1:** The natural cluster formed based on the low fatal Accidents, low Non-Fatal accidents, number of person injured, fatalities and total accident during the year of 2001 to 2006, whereas **Cluster 2:** has the higher incidence of fatal Accidents, Non-Fatal accidents, number of person injured, fatalities and total accident, it happened in the year of 2007 to 2017.

#### District-wise Injury rates in Tamil Nadu:

The road accidents statistics data from state transport department consists of data on a total number of injured persons in each district and number of vehicle population in each district, our study derived at the injury rate for the district. With the data on injury rate for each district over a period of five years from 2012 to 2016, cluster analysis was carried out to find the natural clustering present if any. The hierarchical clustering showed that there were two clusters in the data emerging in Tamilnadu. For the year 2012, the two clusters were found. **Cluster 1:** There were 30 districts clustered together. The thirty districts in the first cluster were clustered together with a cluster center of 9.80.

**Cluster 2:** In cluster 2, there were only two districts namely Villupuram and Ariyalur with the cluster center of 12.98 and both the districts had a higher injury rate when compared to the other districts.

In the year 2016, **Cluster 1:** There were seven districts in the cluster 1 which has the high injury rate. The average injury rate of this cluster is 9.57.

**Cluster 2:** 25 district which has low injury rate were clustered together. Overall, when we compare the injury rates in the 32 districts of Tamil Nadu from 2012 to 2016, there are few districts which are constantly having high injury rates across the years. The notable districts with high injury rates are Villupuram, Ariyalur, Cuddalore, Thiruvarur, Kanchipuram and Nagapatinam.

#### Discussion

A study conducted by Das A states that India has higher motor vehicle accident rate and there is lack of population-based data on how many RTAs result

in TBI. By this estimation, in 2010, 2.2 million people had TBI due to RTA alone, road accidents are account for nearly 60%-70% of Traumatic brain injuries. (3,7) Our result shows that two-wheelers are account for high accident rates, which was in line with study conducted by **Nilambar Jha** that two-wheeler accidents are leading among RTAs, truck stands next to two wheelers. A study conducted by **Shruthi P** shows that out of 1512 post-mortem cases 225 deaths are due to RTA. (9) The study by Kini shows Tamil Nadu with the highest percentage share of accidents 14.9 % in India. (10)

This study estimated that during 2016, about 22 districts had a low fatality rate; the average fatality rate for districts was 9.46. But about 10 districts were having a high fatality rate and the average fatality rate was 11.17. These districts include Ramanathapuram, Karur, Theni, Perambalur, Tiruvannamalai, Dindugul, Krishnagiri, Kanchipuram, Villupuram, and Ariyalur. Villupuram has the longest network highways, as well as high vehicle movement; these might have contributed to the high fatality in Villupuram. A study by Sanjay Kumar shows burden of road accidents in India is marginally lower in its metropolitan cities similar to our findings. (11) A study by Venkata Raghava found that increased number of RTIs and fatal RTIs on smaller roads of Vellore district, which was in line with our findings. (12) Being one of the most urbanized state in India, Tamilnadu has higher average road network coverage than Indian average road network coverage. (13)

### Conclusion

Road traffic Injuries are the third major preventable cause of death. Even though India constitutes 1% of the vehicle population in the world, the percentage of road traffic fatalities was nearly 10% in India. Our study shows that we should focus on the districts such as Ramanathapuram, Karur, Theni, Perambalur, Tiruvannamalai, Dindugul, Krishnagiri, Kanchipuram, Villupuram, and Ariyalur because these districts has high number of fatal accident, non-fatal accident, number of injured person, and total accident rate.

### Recommendation

The study result indicated that there is a need of innovative measures to stop this modern epidemic of motor vehicle accidents focusing especially in towns and smaller cities.

### Limitation of the study

The secondary data may have inconsistencies and reporting bias.

### Relevance of the study

India, being a signatory to the Brasilia declaration, district specific RTA data is very essential for the reduction of road accidents and traffic fatalities by 50% by 2022.

### Authors Contribution

AJ worked in conceptualization, reviewing, editing and finalization of the manuscript, BD supervised and guided the analysis. DK performed analysis and draft preparation, RN collected, cleaned and did data management.

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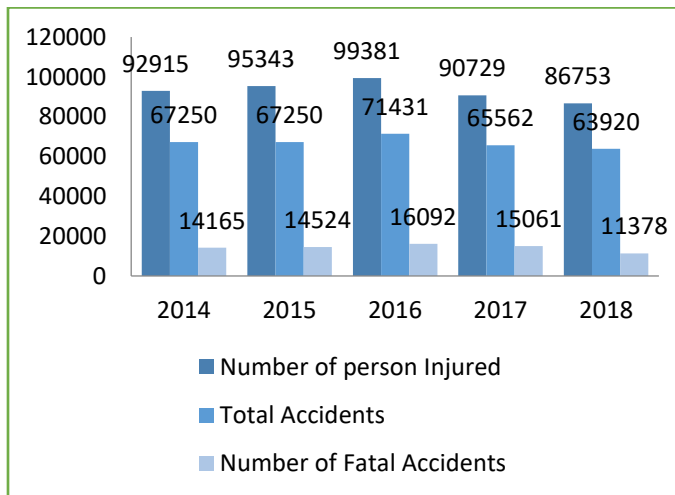
**Tables**

**TABLE 1 TIME SERIES ANALYSIS OF TOTAL NUMBER OF ACCIDENT**

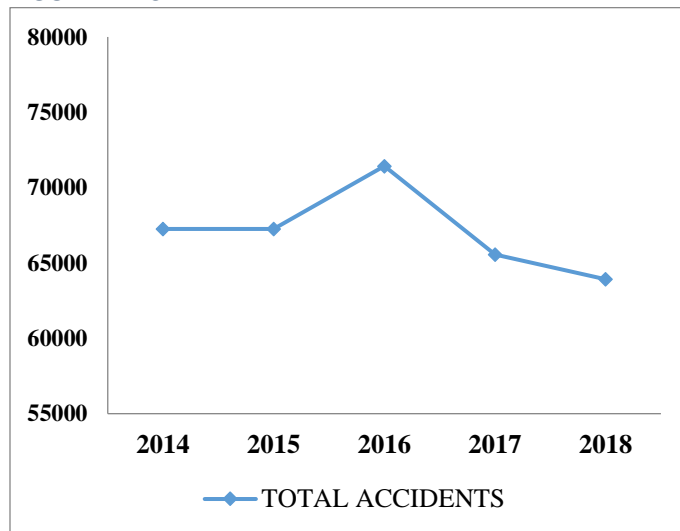
Period	Forecast
2019	71556
2020	72664
2021	73771
2022	74878
2023	75986

**Figures**

**FIGURE 1 TOTAL ACCIDENTS, FATAL ACCIDENTS AND NUMBER OF PERSONS INJURED IN TAMIL NADU FROM 2014-2018**



**FIGURE 2 TIME SERIES PLOT OF TOTAL ACCIDENTS**



**FIGURE 3 DENDROGRAM OF TAMIL NADU RTA FOR THE TIME PERIOD 2001-2016**

