

## REVIEW ARTICLE

**Road safety in India: a public health concern**Shradha S Parsekar<sup>1</sup>, Mannat M Singh<sup>2</sup>, Bhumika T Venkatesh<sup>3</sup>, Sreekumaran N Nair<sup>4</sup><sup>1,2</sup>Systematic Review Officer, <sup>3</sup>Research Officer, <sup>4</sup>Director, Public Health Evidence South Asia, Manipal University, Manipal, India

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**Corresponding Author**

Address for Correspondence: Shradha S Parsekar, Public Health Evidence South Asia, Manipal University, Manipal, India  
E Mail ID: shraddhagoa@rediffmail.com

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**Abstract**

**Introduction**: Road traffic accident (RTA) is one of the major preventable public health problems and is on the rise which can be attributed to increase in the number of vehicles and lifestyle changes and risky attitudes. This paper is intended to search for available published information which in turn might help the policy makers as well as practitioners to make use of it. **Methods**: The information has been gathered from papers related to RTAs from various databases such as PubMed, Google scholar, government websites to get an overview in India for the last 15 years. **Result and Conclusion**: The burden of RTA was found to be considerably high globally as well as in India. RTA causes a number of effects which can be: economical, physical, psychological and social. The burden of RTA is on the rise which makes it necessary to take a multi-sectoral approach in its prevention and control

**Key Words**

Road safety; India; Adverse effects; Control and prevention

**Introduction**

Road traffic accident (RTA(s)) is one of the major preventable public health problems (1-4) and is on the rise which can be attributed to increase in the number of vehicles, lifestyle changes and risky attitudes (2, 3, 5, 6). Injuries due to RTA as one of the prime causes to the 'global burden of diseases' was on the 10<sup>th</sup> position in the year 2002 (3), but according to 'Global status report on road safety 2013' it is on the eighth place and expected to be at the fifth place by 2030 if trends continue at the same pace (1, 7). In low and middle income countries (LMIC's) mortality due to RTA is projected to rise by 83% provided stringent measures are not taken. The fatality rate due to RTA in South Asia was 10.2/100,000 persons in the year 2000 which is predicted to rise to 18.9/100,000 persons by the year 2020 (predicted to change by: 144 %) (3). LMIC's account for 91% of the global mortality due to RTA

although these countries have only about 50% of the world's vehicles (8).

RTA is 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". "A collision between vehicles and pedestrians, animals, and geographical or architectural obstacles can be also termed as RTA" (3, 8).

According to "National Crime Records Bureau, Ministry of Home Affairs", RTA accounted for about one third of all unnatural causes of accidental deaths in the year 2013(9, 10). Around 443,001 RTAs were reported in the same year. Mortality due to RTA has declined by 1.2% during the year 2013 in comparison to year 2012 (9).

Globally, nearly 1.2 million people die each year due to RTA (2, 3, 7, 11-16). Injuries account for 2.1 % of global deaths due to it (3). As stated by Deutsche

Welle report 'India has the highest number of road accidents in the world' (17) as well as highest number of deaths due to it (10). Every year 130,000 deaths are reported due to RTA in India (12, 16-19) which accounts for 6% of the global burden, though it has only 1% of the vehicles globally (4, , 18, 19). When compared to developed nations, the number of RTAs in India were three times higher (15). It has overtaken even the most populous China (10, 15, 17).

Experts caution that the actual estimate of mortality as well as injuries due to RTA could be much higher than what is actually reported, which could be because of underreporting (15, 17, 20). Of the total estimated 1.4 million RTAs, only 0.4 million are recorded each year, which is even worse in rural areas (15). Around 40 people, below 25 years of age, die due to RTA every hour in the world, while in India it is 14 deaths/hour. As per World Health Organization (WHO), it is the second most prime cause of mortality among 5-29 year olds (17). The deaths due to RTA in India accounts for twice more than the deaths caused due to malaria, HIV, cholera etc. all put together (15).

This paper is intended to search for available published information which in turn might help the policy makers as well as practitioners to make use of it. The information has been gathered from papers related to RTA from various databases such as PubMed, Google scholar, government websites to get an overview in India, for the last 15 years.

### Factors responsible for injuries due to RTA

Human, vehicular and environmental factors play an important role before, at the time and after the crash (8, 22). The various factors responsible for RTAs according to the phases of crash are depicted in [table 1](#).

**Human:** Drivers fault accounts for majority of all the accidents (2, 8, 10, 15).

**Age and gender:** About half of the accident victims in the year 2011 were in the age group of 25 to 65 years, followed by the age group of 15 to 24 years (30.3%). More than 50% of the casualties (4, 8, 23, 24) as well as deaths due to RTAs were in the productive age group (2, 3) because these people were expected to use the roads more (20). Of them, majority were males (1-4, 6, 7, 12, 23) which can be due to the fact that males were more involved in outdoor work when compared to females and thus more frequently viable for RTAs (12). In a study

conducted at Jha *et al.* (22) 71% of victims of the accident were below 40 years of age.

**Inadequate infrastructure:** e.g. non availability of footpath (12), inappropriate road markings, signals and lack of maintenance of roads (10). Another factor is inappropriate road design & layout (23) and/or ignorance of driver, which leads to wrong way driving (20).

**Growing number of vehicles:** Risky road situations have been generated due to the growing number of automobiles along with population growth, which leads to jamming problems in the nation for which road infrastructures are usually not prepared to manage the heavy flow of traffic (10).

**Rescue operations:** Delay in providing required medical services is one of the causes of mortality due to RTAs (12).

**Drunken driving and drugs:** Nearly 50 % of the nations of the world lack evidence on alcohol related deaths due to RTAs (7). Drunken driving has been stated as a major factor for RTAs (1, 11, 14, 17, 20, 21, 23, 24).

**Safety devices:** Evidence on the usage of helmet is scarce (7, 21, 24). Properly wearing a helmet while riding a motorbike can lessen the risk of dying by nearly 40% as well as the risk of severe injuries by more than 70% (8). Wearing a seat-belt declines the probability of fatality in the person sitting in the front-seat by 40–60% and of rear-seat passengers by between 25–75% (3, 7, 8, 15). Using child restraints reduces deaths by approximately 70% (3, 8) in infants and 54 % in toddlers (3). Only about 32% of the population globally have executed child restrained laws (7).

**Distraction while driving:** There are many types of distractions that can lead to impaired driving, one of them is using mobile phones while driving. Those drivers who use phones during driving have four times more odds of becoming a victim of RTAs when compared to those who do not indulge in such practice (8).

**Speed:** As the speed increases the probability of occurrence of crash as well as the degree of its consequences also increases (1, 3, 8).

**Enforcement of Laws:** Less than one tenth (7%) of the countries of the world have sufficient laws which address risk factors of RTAs such as speed, drunken driving, overloading the vehicle(10) and use of protective devices like seat belts, child restraints and helmets (7, 8). Stringent drunk and driving laws help to protect about 70% of the population globally (7).

Though laws on road safety do exist in India their implementation is very weak (15, 21). The execution of these laws as per the Supreme Court is a state responsibility (25) unfortunately, child restrained laws do not exist in our nation (15).

Mode of Transport: Pedestrians and cyclists/two-wheelers account for majority of all deaths due to RTAs (6-8, 12, 16, 20). Study done by Jha *et al.* (22) and Dsouza *et al.* (4) reported it to be 22% and 41% for pedestrians respectively.

Time of the day: Driving during night is more risky than day which can be attributed to fatigue and/or alcohol consumption (20).

### Trends of fatality and injuries due to RTA in India

According to WHO, the death rate due to RTAs rose from 16.8/100,000 in 2009 to 18.9/100,000 in 2013 (19). Number of deaths and injuries due to RTAs in India between the years 2001 and 2011 raised by 5.8% and 2.4% respectively. In the year 2011, 497,686 RTAs were reported in India. Out of the total RTAs the proportion of fatal ones have increased from 18.1% to 24.4% from the year 2000 to 2011, also the casualties have increased by 1.3% in the year 2012 compared to 2011 (8).

Deaths due to RTAs have risen by approximately two fifth between the years 2003-2008 in India (17). Presently on the Indian road there is one death every six minutes which is predicted to rise to one death every three minutes by 2020 (15, 19). The mortality due to RTAs have been increasing by approximately 8% per year (11, 15).

The injuries and fatalities in India due to RTAs from the year 1998-2012 are depicted in the [figure 1](#).

In a study done by Ruikar (8), the number of people injured per 10,000 vehicles have reduced from 500 in the year 1970 to 36 in the year 2011. The deaths per 10,000 vehicles in the nation has also declined from around 104 in 1970 to 10 in 2011 (8). Within India, the share of Karnataka in the total number of RTAs has declined from 9.5% in 2008 to 9% in 2011 and the share in the total number of injuries was 12.1% in 2008 which reduced to 11.7% in 2011 (8). In the year 2013, 39,591 cases and 9,044 deaths of RTAs were reported (9). In the year 2014 (upto Sep), a total of 3839 accidents took place in Bengaluru, which lead to injury of 3082 people and death of 557 (26). The accident statistics of various years of the city is depicted in [table 2](#).

### Adverse effects of RTAs

As per WHO, injuries due to RTAs was the sixth most important reason for mortality in India leading to hospitalization, fatalities, disabilities and socio economic losses (4, 13).

Following are the various adverse effects of RTAs:

#### 1. Economic

RTAs cost US \$518 billion globally and accounts for 1-2% of gross national product in LMIC's (2, 3, 10). In developing nations a loss of about \$100 billion/year occurs because of RTAs (10). As a result of RTAs, the affected families have to put up with the cost of extended medical care(3), bear the loss of wage earner (3, 15), take additional care of the disabled which ultimately leads them to poverty (1, 3, 12, 21), because the expenses are borne exclusively by the family of the disabled (10, 15). In India, the gross domestic product lost due to RTAs was 1-3% in the year 2008-09 (7, 8, 10, 11, 14). RTAs also contributes to the massive burden on the health sector (e.g. pre hospital and acute care as well as rehabilitation) (8). Lack of road safety leads to spending of 20 billion/year in India which corresponds to food requirements of half of the countries malnourished children (10).

#### 2. Physical health

The number of people injured/disabled due to RTAs range from 20 to 50 million (2, 8). RTA contributes to 90 % of disability adjusted life years (DALY's) lost (2). By the year 2020, it is estimated that RTAs will be the third among the various causes of DALY's lost (1). More than three fifth of traumatic brain injuries were caused due to RTA in India (11). The most commonly involved part of the body was head and neck followed by extremities (1, 6, 12, 24).

3. RTAs also has effect on the psychological and social well-being of a person and his/her family (8).

### Control and prevention

A multi-sectoral approach should be used for the controlling and preventing RTAs which is depicted in [figure 2](#).

### Conclusion

This paper was intended to get an overview of road safety in India. It provides evidence on factors responsible for injuries, trends of fatalities, various adverse effects as well as about control and prevention of road traffic accidents (RTAs) in a

condensed form. This might help the policy makers as well as practitioners to make use of this evidence in forming policies for tackling the issue of RTA which is on the rise. The burden of RTA was found to be considerably high globally including India. RTA is one of the major preventable public health problems and is on the rise which can be attributed to increase in the number of vehicles, lifestyle changes and risky attitudes. Though the burden of RTAs in India is high, there is dearth of evidence on it at the national level, which is a serious issue. RTAs cause a number of adverse effects which can be: economical, physical, psychological and social. The burden of RTA is increasing, making it necessary to take a multi-sectoral approach for its prevention and control.

## References

1. Singh R, Singh HK, Gupta SC, Kumar Y. Pattern, severity and circumstances of injuries sustained in road traffic accidents: a tertiary care hospital-based study. *Indian J Community Med.* 2014 Jan;39(1):30-4. doi: 10.4103/0970-0218.126353. PubMed PMID: 24696537; PubMed Central PMCID: PMC3968579. [PubMed]
2. Joshi AK, Joshi C, Singh M, Singh V. Road traffic accidents in hilly regions of northern India: What has to be done? *World J Emerg Med.* 2014;5(2):112-5. doi: 10.5847/wjem.j.1920-8642.2014.02.006. PubMed PMID: 25215159; PubMed Central PMCID: PMC4129877. [PubMed]
3. Mohan D, Tiwari G, Khayesi N, Nafukho FM. Road Traffic Injury Prevention: training manual. Geneva, World Health Organization 2006. Available from: <http://apps.who.int/iris/handle/10665/43271>
4. Dsouza C, Rao VV, Kumar A, Diaz E. Epidemiological trends of trauma in tertiary care centre in dakshina kannada district of karnataka, India. *J Clin Diagn Res.* 2014 Mar;8(3):66-8. doi: 10.7860/JCDR/2014/8643.4109. Epub 2014 Mar 15. PubMed PMID: 24783084; PubMed Central PMCID: PMC4003689. [PubMed]
5. Grimm M, Treibich C. Determinants of road traffic crash fatalities across Indian States. *Health Econ.* 2013 Aug;22(8):915-30. doi: 10.1002/hec.2870. Epub 2012 Aug 30. PubMed PMID: 22936645. [PubMed]
6. Kanchan T, Kulkarni V, Bakkannavar SM, Kumar N, Unnikrishnan B. Analysis of fatal road traffic accidents in a coastal township of South India. *J Forensic Leg Med.* 2012 Nov;19(8):448-51. doi: 10.1016/j.jflm.2012.02.031. Epub 2012 Mar 10. PubMed PMID: 23084306. [PubMed]
7. World Health Organization. Global Status Report on Road Safety 2013: Supporting a decade of action, 2013. Available from: [http://www.who.int/violence\\_injury\\_prevention/road\\_safety\\_status/2013/en/](http://www.who.int/violence_injury_prevention/road_safety_status/2013/en/)
8. Ruikar M. National statistics of road traffic accidents in India. *J Orthop Traumatol Rehabil.* 2013;6(1):1. Available from: <http://www.jotr.in/article.asp?issn=0975-7341;year=2013;volume=6;issue=1;spage=1;epage=6;aulast=Ruikar>
9. Chapter 1. Accidental Deaths in India. Available from: [ncrb.nic.in/ADSI2010/accidental-deaths-10.pdf](http://ncrb.nic.in/ADSI2010/accidental-deaths-10.pdf)

## Authors Contribution

All the authors considerably contributed to the concept and design, getting hold of data, analysis and interpretation; conscripting and reviewing the article; and approving it for publication.

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10. Kengen Y, Renard A. Road safety in India: Insights and Analysis. India transport portal 2012. Available from: [http://indiatransportportal.com/wp-content/uploads/2012/11/Road\\_safety\\_2012.pdf](http://indiatransportportal.com/wp-content/uploads/2012/11/Road_safety_2012.pdf)
11. Das A, Botticello AL, Wylie GR, Radhakrishnan K. Neurologic disability: a hidden epidemic for India. *Neurology.* 2012 Nov 20;79(21):2146-7. doi: 10.1212/WNL.0b013e3182752cdb. Review. PubMed PMID: 23170012; PubMed Central PMCID: PMC3511929. [PubMed]
12. Farooqui JM, Chavan KD, Bangal RS, Syed MM, Thacker PJ, Alam S, Sahu S, Farooqui AA, Kalakoti P. Pattern of injury in fatal road traffic accidents in a rural area of western Maharashtra, India. *Australas Med J.* 2013 Sep 30;6(9):476-82. doi: 10.4066/AMJ.2013.1839. eCollection 2013. PubMed PMID: 24133540; PubMed Central PMCID: PMC3794418. [PubMed]
13. Barffour M, Gupta S, Gururaj G, Hyder AA. Evidence-based road safety practice in India: assessment of the adequacy of publicly available data in meeting requirements for comprehensive road safety data systems. *Traffic Inj Prev.* 2012;13 Suppl 1:17-23. doi: 10.1080/15389588.2011.636780. PubMed PMID: 22414124. [PubMed]
14. Pathak SM, Jindal AK, Verma AK, Mahen A. An epidemiological study of road traffic accident cases admitted in a tertiary care hospital. *Med J Armed Forces India.* 2014 Jan;70(1):32-5. doi: 10.1016/j.mjafi.2013.04.012. Epub 2013 Aug 30. PubMed PMID: 24623944; PubMed Central PMCID: PMC3946410. [PubMed]
15. Rajasekaran S. The Alarming Facts of Road Accidents in India. Indian Orthopaedic Association. Available from: <http://ioaindia.org/ROADTRAFFICACCIDENTS.pdf>
16. Mundi R, Chaudhry H, Flores-Miranda N, Puthukudy N, Petrisor B, Schemitsch EH, Bhandari M. Roads in India: safety and knowledge cross-sectional evaluation. *J Orthop Trauma.* 2014;28 Suppl 1:S30-2. doi: 10.1097/BOT.000000000000115. PubMed PMID: 24857995. [PubMed]
17. Krishnan M. India has the highest number of road accidents in the world. Deutsche Welle. Apr 29, 2010. Available from: [www.dw.de/india-has-the-highest-number-of-road-accidents-in-the-world/a-5519345-1](http://www.dw.de/india-has-the-highest-number-of-road-accidents-in-the-world/a-5519345-1)

18. Sir Ratan Tata Trust and Navajbai Ratan Tata Trust. Epidemiology of Road Traffic Accidents in India: a Review of Literature. Available from: [http://www.srtt.org/road\\_traffic\\_accidents.htm](http://www.srtt.org/road_traffic_accidents.htm)

19. Krishnan V. Taking note of road death in India. Live mint. Sep 18, 2013. Available from: [www.livemint.com/Opinion/D8iIIQDQkx8RGRdzros9tl/Taking-note-of-road-deaths-in-India.html](http://www.livemint.com/Opinion/D8iIIQDQkx8RGRdzros9tl/Taking-note-of-road-deaths-in-India.html)

20. Mohan D, Tsimhoni O, Sivak M, Flannagan MJ. Road Safety in India: Challenges and Opportunities. Michigan, The University of Michigan Transportation Research Institute 2009. Available from: [http://www.ki.se/csp/pdf/Publications/DM\\_UMTRI\\_2009\\_1\\_1.pdf](http://www.ki.se/csp/pdf/Publications/DM_UMTRI_2009_1_1.pdf)

21. Dhillon MS, Rajasekharan S, Sancheti P. Status of road safety and injury burden: India. J Orthop Trauma. 2014;28 Suppl 1:S43-4. doi: 10.1097/BOT.0000000000000116. PubMed PMID: 24682166. [PubMed]

22. Jha N, Srinivasa DK, Roy G, Jagdish S. Epidemiological Study of Road Traffic Accident Cases: A Study from South India. Indian J. Community Med. 2004;29(1):20-4. Available from: <http://medind.nic.in/iaj/t04/i1/iajt04i1p20o.pdf>

23. Mirkazemi R, Kar A. A population-based study on road traffic injuries in Pune City, India. Traffic Inj Prev. 2014;15(4):379-85. doi: 10.1080/15389588.2013.826800. PubMed PMID: 24471362. [PubMed]

24. Bhuyan PJ, Ahmed F. Road traffic accident: an emerging public health problem in assam. Indian J Community Med. 2013 Apr;38(2):100-4. doi: 10.4103/0970-0218.112441. PubMed PMID: 23878423; PubMed Central PMCID: PMC3714936. [PubMed].

25. Chatterjee P. India's Supreme Court tells government to improve road safety record. BMJ. 2014 May 12;348:g3254. doi: 10.1136/bmj.g3254. PubMed PMID: 24821491. [PubMed].

26. Bangalore City traffic Police. Accident Statistic. 2014. Available from: [http://www.bangaloretrafficpolice.gov.in/index.php?option=com\\_content&view=article&id=55&btp=55](http://www.bangaloretrafficpolice.gov.in/index.php?option=com_content&view=article&id=55&btp=55)

**Tables**

**TABLE 1 FACTORS RESPONSIBLE FOR INJURIES DUE TO RTA'S**

Phase	Factors		
	Human	Vehicles & equipment's	Environment
<b>Before the crash</b>	Awareness, behavior, disability, law enforcement	Condition of the vehicle	Road layout and design, speed limitations, pedestrian facilities
<b>At the time of crash</b>	Use of protective devices, disability	Vehicle equipped with protective devices	Crash protective roadside objects
<b>After the crash</b>	Provision of first aid, access to healthcare	Ease of access	Rescue

Source: WHO [3]

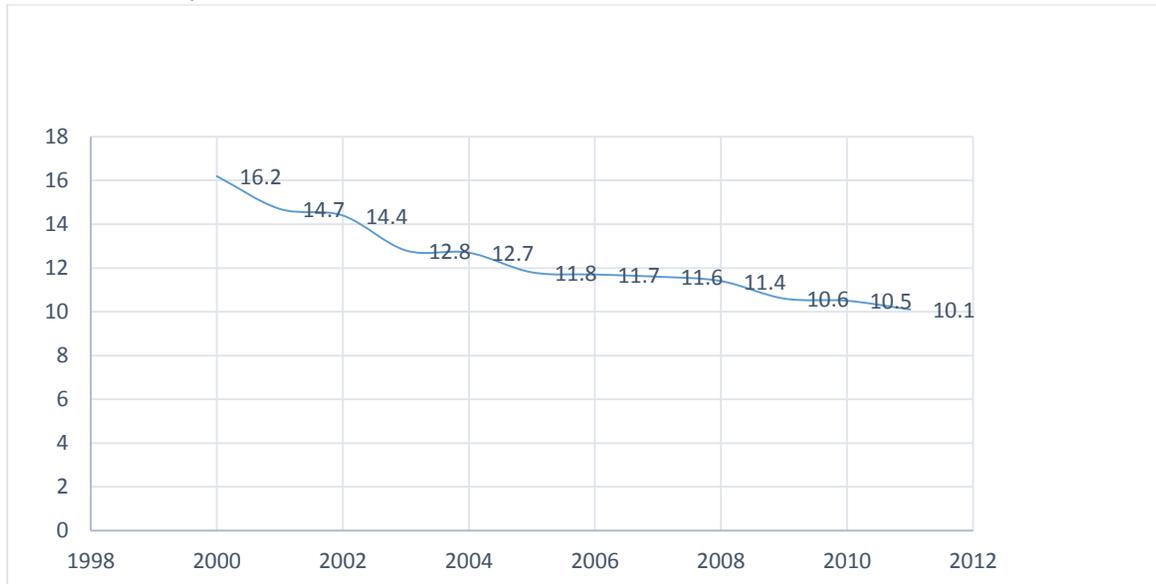
**TABLE 2 FREQUENCY OF DEATHS AND INJURIES REPORTED DUE TO RTA'S FROM 2003 TO 2014 IN BENGALURU**

Year	Total # accidents	# of people injured	# of people killed
2004	9101	6921	903
2005	7578	5899	836
2006	7561	6048	915
2007	8426	6591	981
2008	7772	6150	892
2009	6875	5668	761
2010	6483	5343	858
2011	6024	4976	757
2012	5502	4471	760
2013	5230	4289	771
2014 (Up to Sep)	3839	3082	557

Source: Bengaluru city traffic police [26]

**Figures**

**FIGURE 1 FREQUENCY OF PEOPLE WHO DIED PER TEN THOUSAND VEHICLES DURING THE YEARS 1998-2012**



**FIGURE 2 CONTROL AND PREVENTION OF RTAS**

