



**National Institute of Mental
Health and Neuro Sciences**

ADVANCING ROAD SAFETY IN INDIA

Implementation is the key

S U M M A R Y



WHO Collaborating Centre for
Injury Prevention and Safety Promotion



NATIONAL INSTITUTE OF MENTAL HEALTH AND NEURO SCIENCES

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NATIONAL INSTITUTE OF MENTAL HEALTH AND NEURO SCIENCES

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India is undergoing major transformation due to globalization, industrialization, urbanization and technology revolution that has altered health and disease dynamics of Indians. Today, health priorities and efforts are gradually shifting towards control of chronic non-communicable diseases and injuries. More people died due to heart diseases and injuries in India, than communicable diseases in 2015.

Every day, nearly 400 people died in road accidents in India in year 2015; most of them are young in their productive age groups. The number of people who suffered serious injuries is expected to be 30 times more than the number of deaths. These numbers could be much higher considering issues of underreporting. The impact of road accidents on individual, family and society in terms of morbidity, disability, economic and social fall-out is immense. Lack of a powerful and functional road safety authority at national and state level, dedicated funding, inter-sectoral coordination and regular surveillance are a few of the major challenges that needs to be overcome to make significant progress for road safety in India.

Evidence from high income countries clearly indicate that road accidents are predictable and preventable. The UN Decade for road safety (2011-2020) advocates application of 5 pillars (Road safety Management, Safer road infrastructure, Safe vehicles, Safer road use behaviour and Post crash care) as a framework to reduce road accidents and deaths globally. The challenges lie in translating this knowledge to action in India.

NIMHANS provides quality care for persons with brain injuries and at free of cost for poor people. The Dept of Epidemiology / Centre for Public Health at NIMHANS is also the WHO collaborating centre for Injury prevention and safety promotion. The Centre has been actively working in road safety issues since last two decades. The Department has implemented key research cum action projects, developed resource material and trained different categories of professionals, involved in advocacy and provides policy and programmatic inputs for road safety. The Bangalore Road safety and Injury Surveillance Project (2007-12) is one such example that has greatly helped road safety programming in the country.

I am happy that in collaboration with UL India Pvt Ltd., NIMHANS has brought out this much needed comprehensive report on road safety which will serve as a useful resource to advance road safety situation in India. This evidence based report can be used by policy makers, road safety professionals, health managers and researchers, is a wakeup call for all of us to act. I wish them all the best !


Dr. B. N. Gangadhar
Director

Place: Bangalore
Date: 04-04-2017

Dr. Poonam Khetrpal Singh



India is experiencing increasing road traffic injuries amidst increasing motorization and infrastructure growth in recent years. Every day, nearly 400 road deaths occur on Indian roads and several thousands are hospitalized due to road crashes. WHO estimates the incidence of road deaths to be 16.6 per 100000 population in India. With nearly 3% of all deaths being due to road accidents, and especially with high rates among young people and males, the issue calls for serious and coordinated action from the government and all other stakeholders.

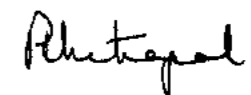
Evidence from high-income countries clearly indicates that road accidents are predictable and preventable. WHO, over time, has facilitated strengthening of road safety programmes at the country level. However, implementation by state and local governments is key to realize sustainable success, and this has been happening at a slow pace and much more needs to be done.

Recognizing the enormity of the problem, the Government of India and governments of its different states have taken several steps in recent years. The Motor Vehicles Amendment Bill 2016 is a landmark step in this direction. Several judicial directives in recent times are aimed at strong actions to be taken by governments. The implementation of these key steps will be an urgent necessity to improve the current scenario. This calls for participation of all key stakeholders in different ministries, industry, academia and civil society to develop coordinated and convergent actions to advance road safety in India. The Regional Office and India Country Office of WHO are major partners in this process in India.

The WHO Collaborating Centre for Injury Prevention and Safety Promotion at NIMHANS has been a major partner in road safety and injury prevention efforts in South-East Asia for several years now and has contributed in a number of ways. The Centre is actively engaged in research, capacity-building, human resource development, advocacy, policy and programme development as well as monitoring and evaluation. The five years of the Bangalore Road Safety Programme is an integrated model with replication. The Centre's contribution to helmet legislation, reduction of drink driving, pedestrian safety and post-crash care are well known and are built on data-driven programmes.

The United Nations Decade for Road Safety (2011-2020) advocates application of "five pillars" (Road safety management, safer road infrastructure, safe vehicles, safer road use behaviour and post-crash care) as a framework to reduce road accidents and deaths globally. Ensuring road safety is now recognized as a need for sustainable development. The targets set for the same is to halve the global number of deaths and injuries from road traffic crashes by 2020. Information systems to guide further progress need to be improved in this scenario.

This report, by the WHO Collaborating Centre at NIMHANS and Underwriters Laboratories India, has brought available information on road safety in India on one platform that will be useful for many activities among different stakeholders. This public-private collaboration between NIMHANS and Underwriters Laboratories India is also an example of the need for coordinated and convergent actions to strengthen road safety. I strongly hope that this report and the deliberations will move the road safety agenda forward in India.



Dr Poonam Khetrpal Singh
Regional Director
WHO South-East Asia Region

MESSAGE



With 400 deaths every day, Indian Roads have become one of the most notorious in the world, and Road Safety is the single biggest Public Safety challenge that we face today. Reports of the NCRB reveal that majority of the victims are below 40 years of age and independent studies and reviews indicate that pedestrians and two-wheelers bear the brunt. And again, the total numbers are growing every year.

Many steps are being discussed to enhance Road Safety covering a wide spectrum of areas— legislation, Infrastructure, Technology, Enforcement, Emergency Response and Education. The recently introduced Motor Vehicle (Amendment Bill) 2016 is a welcome right

step. Given the magnitude of the challenge and its multi-dimensional nature, we need a coordinated action that is based on reliable facts and proven safety science.

In 2013, when UL took the decision to join the cause of Road Safety in India, bringing with it, the approach of Safety Science, it was well aware that there will be considerable time before results can be seen. Amongst the many areas that need attention, UL decided to focus on a few-- Education and Demonstration Projects being two of them. Also felt was the need for a Status Report that paints a realistic picture of Road Safety in India.

During the year 2016, UL and NIMHANS collaborated to develop the report, **Advancing Road Safety in India**, building this over the many sets of research reports and statistics available on the subject.

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ABBREVIATIONS

ADSI:	Accidental Deaths and Suicides in India
BRSP:	Bangalore Road Traffic Injury Surveillance Project
CSR:	Corporate Social Responsibility
GDP:	Gross Domestic Product
GRSSR:	Global Road Safety Status Report
HICs:	High Income Countries
LMICs:	Low and Middle Income Countries
MCCD:	Medical Certification of Cause of Death
MoRTH:	Ministry of Road Transport and Highways
MVA:	Motor Vehicles Act
NCRB:	National Crime Records Bureau
RTIs:	Road Traffic Injuries
RTO:	Regional Transport Office
SRS:	Sample Registration System
TRIPP:	Transportation Research And Injury Prevention Programme
PPP:	Public Private Partnership
VRU:	Vulnerable Road Users
WHO:	World Health Organization

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PURPOSE

The present report provides a comprehensive review of road safety scenario in India from a public health perspective. Data sources for the review include published and unpublished reports from National Crime Records Bureau (2016) , Ministry of Road Transport and Highways (2016) as well as global reports and independent research studies / reports/ unpublished documents. The report focusses on Road Traffic Injuries, deaths , disabilities, risk factors, injury patterns and distributions, as well as the current Indian response to this burgeoning epidemic. This summary report in conjunction with the detailed report entitled “Advancing Road Safety in India-- implementation is the key ” and “Advancing Road Safety in India-- facts and figures” provides in-depth information on all aspects of road safety and the current road safety initiatives from the Indian region. These reports are aimed at policy makers from different sectors and road safety practitioners from diverse disciplines for taking all possible steps to save lives and reduce injuries on Indian roads.



PRELUDE

In 2015, an estimated 175,000 persons died (148,707 as per official reports of National Crime Records Bureau-2016) and 5,250,000 were hospitalized due to road crashes in India. This number has been increasing from year to year and loss of so many precious lives, predominantly young males, should be of serious concern to everyone. While every death and disabled person is an unbearable loss and burden to their families, the collective loss to Indian society is huge and phenomenal in economic terms, roughly amounting to 3 % of total GDP.

Road safety is a much debated topic in Indian society. With the non availability of robust and good quality data on the most essential aspects of road safety, the efforts to address the problem are largely based on individual opinions, collective at times and policy driven on few occasions. In this scenario, it is critical to understand that our ongoing efforts are not sufficient and convergent enough to control the problem as is evident with increasing deaths and injuries from year to year.

Road traffic deaths and injuries (RTIs) are multicausal in nature and hence, solutions need to be multipronged and multisectoral in implementation. However, these solutions cannot be implemented in a vacuum and should be based on robust data operating through policies and programmes. Since road safety is the shared responsibility of nearly 15–20 different ministries, implementing road safety programmes requires well-coordinated and integrated approaches at both national and state levels. This unified approach and convergence of actions has largely been missing in the Indian region which is socioeconomically and politically diverse and will continue to remain so.

It is well known and acknowledged that there are many proven and effective interventions that work to reduce RTIs. While several road safety legislations and their enforcement are quick enough to yield

results in some areas, others like making all roads ideally safe are time consuming and resource intensive. Indian approach to road safety has largely centered around victim blaming and listing human errors. Consequently, education of road users has remained the major solution and this has not worked very effectively till date. Furthermore, people are likely to make mistakes and such simple mistakes should not cost lives. Thus, developing road safety requires a larger systems approach moving beyond small scale efforts.

Some efforts have begun in India in the last few years. The proposed amendments to Indian Motor Vehicles Act by the Ministry of Road Transport and Highways, The Motor Vehicles (Amendment) Bill, 2016, has been passed by Lok Sabha and is awaiting approval from Rajya Sabha of the Indian Parliament at the time of this report. Presence of a road safety policy, recent judicial directives in number of areas by the Hon. Supreme court and state judiciaries, the Good Samaritan law, increasing investments in road infrastructure, initiatives by Ministry of Health to strengthen trauma care, introduction of new accident reporting formats, and a larger ongoing debate in the society are a few noteworthy developments in recent times.

Understanding the underlying issues, the burden, operating risk factors, causative mechanisms and prevailing systems that contribute for death and disability is often the first step in unraveling the problem. The present report is a step in this direction. Highlighted below are some measures that need to be implemented to decrease the burden of RTIs. While some of these are included in the newly amended MVA of 2016, implementation on a priority basis and in a coordinated manner is the key to reduce RTIs. Some need to be adopted immediately, while a few others require sustainable efforts to influence long term systemic changes.

What needs to be done now

- **Establish a lead road safety agency** at national and state levels to govern all aspects pertaining to road safety; such agencies should be guided and supported by a national/ state road safety action plan(s) and be equipped with the power, expertise and capacity to carry out the necessary activities independently.
- **Notify legislations with regard to helmets, seat belts, drinking and driving, speeding, day time running lights and use of cell phones** on an urgent basis in all Indian states. These legislations should be implemented by enforcement agencies that need to augment and train their manpower, upgrade technology, and enforce on a continuous basis.
- **Establish a dedicated and ring-fenced road safety fund** at national and state levels to cover all road safety initiatives. Funding should come from both central and state levels and invested in managing the five pillars of road safety.
- **Mandate road safety audits for all new and existing roads** from the designing stage itself. Road building agencies should be held responsible for violating norms. Low cost engineering solutions should be encouraged across the states to solve safety inadequacies of all roads possibly safe.
- **Create a Motor Vehicle Accident Fund** to provide compulsory insurance for all road users in India and also develop a scheme for cashless treatment for all RTI victims soon after a crash in the earliest possible time.
- **Standardize, regulate, and enforce vehicle safety requirements.** Cars should conform to the crash testing standards specified by NCAP. Similar safety tests should be developed for other types of locally manufactured Indian vehicles.

Since road safety is the shared responsibility of nearly 15–20 different ministries, implementing road safety programmes requires well-coordinated and integrated approaches at both national and state levels. This unified approach and convergence of actions has largely been missing in the Indian region which is socioeconomically and politically diverse and will continue to remain so



What needs a sustainable engagement

- **Build capacities across various sectors**—police, health, and transport-- at central and state levels in a planned and phased manner.
- **Establish Centres of excellence in road safety** in different domains or specialities that can continuously work towards road safety by undertaking capacity building, training, research, monitoring and all related activities.
- **Strengthen trauma care on a priority** basis in all district hospitals, medical college hospitals and trauma care centers that are already established or under consideration in all states with required human, financial and technical resources to cover both hospital care and rehabilitation services.
- **Adopt the principle of safe systems approach** for design of all new roads. The road design should be forgiving, factoring in the assumption that people will always make mistakes ; such mistakes should not lead to death and life threatening injury.
- **Strengthen road safety information systems** to obtain reliable, robust and good quality data to guide all road safety activities. Mechanisms to obtain good data through the newly introduced road accident data collection formats should be strengthened at district and state levels with technical inputs.
- **Undertake large scale advocacy activities and targeted public awareness campaigns** to place road safety on national agenda and bring behavioural changes among road users



THE CHANGING FACE OF TRANSPORT ENVIRONMENT



India is experiencing unprecedented growth

India, one of the biggest democracies in the world is home to a population of 1,336,928,853. (1) The Country is a topographically, culturally, linguistically and ethnically diverse federal republic governed under a parliamentary system with 29 states and 7 union territories. Since its independence in 1947, India has nearly doubled in terms of population size, infrastructure as well as overall socioeconomic development, albeit with regional variations. Between 2001 and

2015, the per-capita income of Indians increased more than 5-fold, from ₹17917 to ₹93231/- (2). Increasing motor vehicles in an environment of easy availability, aggressive marketing, better purchasing power and the necessity of travel has led to an unprecedented motorization in India. Parallel to this growth, injuries in general and Road Traffic Injuries (RTIs) in particular, have risen to be the major cause of deaths and injuries among Indians.

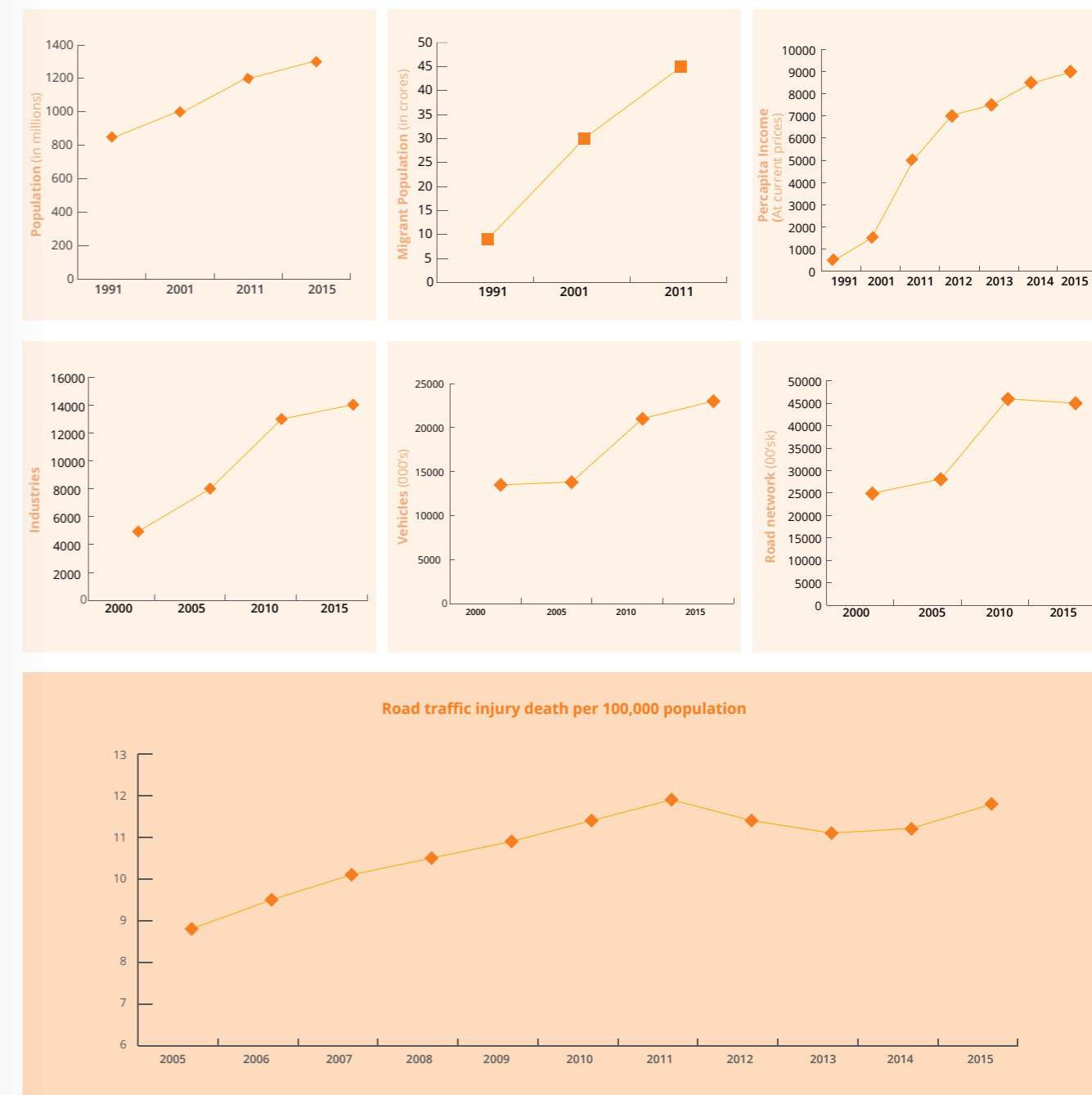
Rapid Industrialization, Urbanization, and Motorization are closely linked to increasing health risks

Macro-economic and developmental policies/programmes are interwoven and driven by trade, commerce, industrialization, urbanization, migration, and others. The liberalized economic policies of successive Indian governments has brought significant changes in all these areas during the last 2 decades. Indian population increased from 1.03 billion in 2001 to 1.31 billion by 2015, an increase of 27%. Urban India has grown by 12.2%, from 27.7% in 2001 to 31.1% in 2011. (1) Estimates indicate that nearly 41% of the Indian population will be urban by 2030. The number of rural migrants increased from 314 million (1991–2001) to 453 million (2001–2011) during this decade. The per capita income of an Indian has increased from INR.17917 in year 2000-01 to INR.93231 by 2015-16,(2) indicating the growing purchasing or spending power of Indians.

These changes along with others has created a socio-economic milieu that has brought in unprecedented motorization and greater exposure of people to complex transport environments (Figure 1). To keep pace with motorization, road infrastructure has also been increasing, though at a much slower pace. The association between industrialization, road expansion and motorization has been a significant one. However, these changes and the accompanying growth has not been uniform, with glaring disparities in different parts of the country. Furthermore, the policies in each of these areas has not given the due consideration to the expected health impact nor have health professionals made any significant efforts to address the likely impacts.

Estimates indicate that nearly 41% of the Indian population will be urban by 2030

Figure 1: Changing trends of macro factors influencing road safety



Trends of vehicular growth point at an increasing risk exposure

With travel for work, education, health care and leisure activities becoming a necessity for people, vehicular growth has increased in an unprecedented manner in the last 2 decades. Nearly 128 million new vehicles (Figure 2) and 20.3 lakh kilometers of new roads were added since the year 2001. Vehicular density has increased from 2.8 vehicles per km in year 2000 to 31 vehicles per km in 2011(3,4) Globally, India ranks 4th in terms of vehicular population, with 117 vehicles per 1000 population (2013). The number of total registered vehicles has recorded a trend growth rate of 9.8 percent during the last ten years (2005 to 2015) and as on 31st March 2015 there were 210 million registered vehicles in India. (5)

Figure 2: Number of registered vehicles in India (2005-15, in millions)

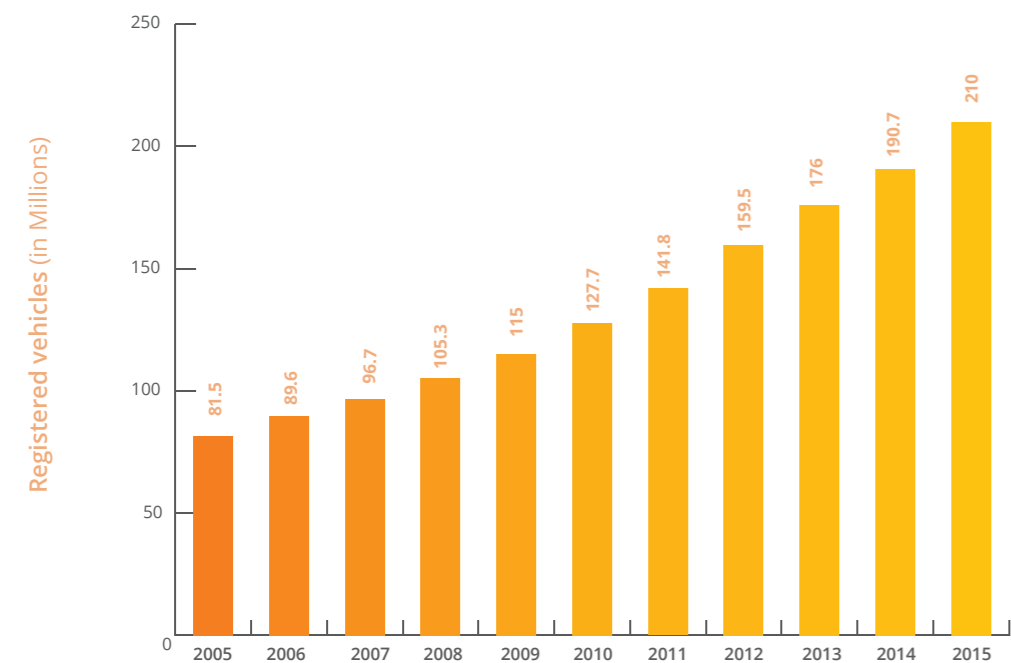
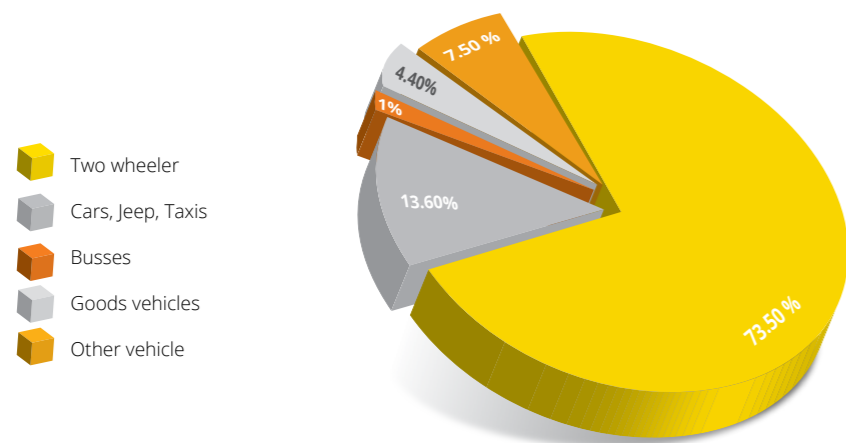


Figure 3: Distribution of different vehicle types (2015)



While personalized modes of transport have seen phenomenal growth, investment in mass transport systems has been limited. Personalized mode of transport (cars and two wheelers) constituted about 87 percent of total vehicle population, with two wheelers making up 73% of that figure (Figure 3) (Transport Year Book 2015, MoRTH) (5). This growth has not been uniform as seen by the fact that Goa has 476 vehicles/1000 population, Tamil Nadu has 256 vehicles/1000 population while Bihar has only 31 vehicles per 1000 population. An alarming facet of this growth has been an increase in exposure risk for people while they are on roads. The fact that motorization policies of successive governments have not given due importance to safety of people on roads is witnessed by a constant and continuous increase in road deaths and injuries amidst the absence of strong safety policies and programmes.

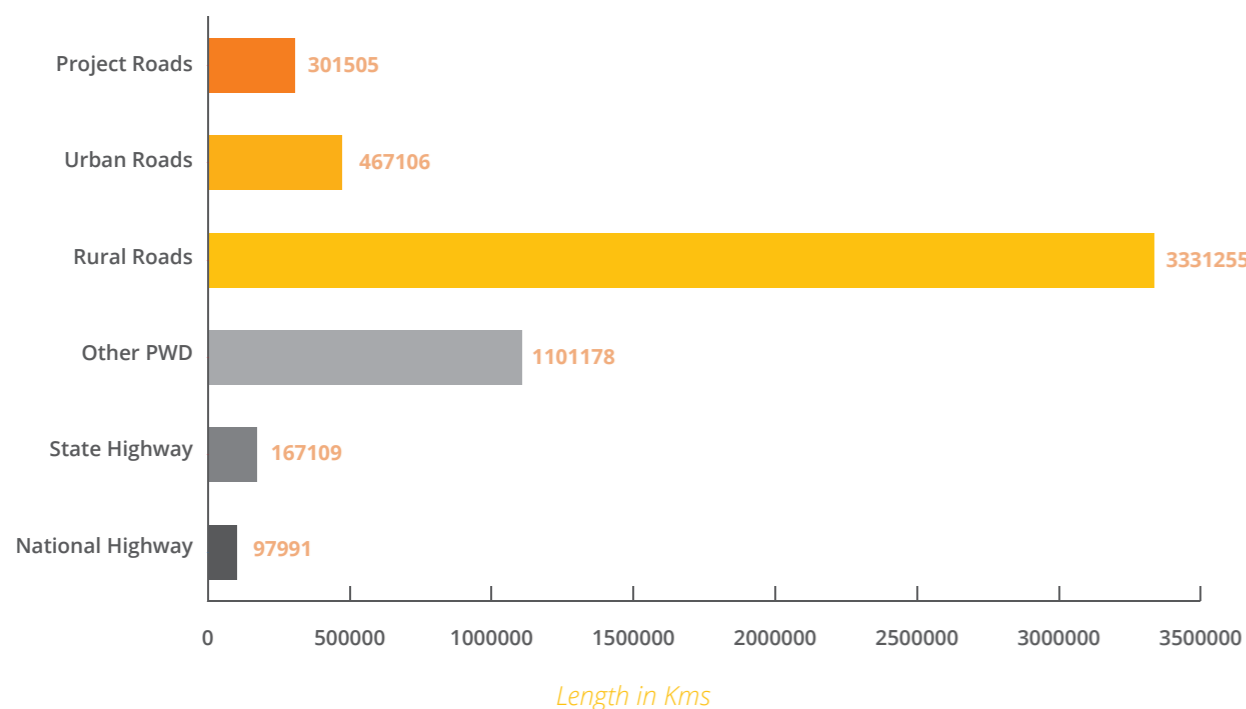
HOW IS THIS CHANGE AFFECTING INDIA?



Road network is expanding but safety has been compromised

Development, operation and maintenance of roads in India is the shared responsibility of different authorities at both state and central levels. This is also a major contributing factor for the variations in the quantity and quality of roads in India. India is home to the second longest road network in the world (54,72,144 kilometres), 4.8% of which are highways. National highways (97,991 kms) and state highways constitute (1,67,109 kms) 1.79% and 3.05% of all roads in India (Figure 4) (3). In the last decade (2001 to 2011), the road length increased from 2,52,001 kms to 4,64,294 kms, an increase by 84 % (3). Nearly 20-22 kms of roads were added daily against stated addition of nearly 40 kms per day. Amidst this road infrastructure expansion, safety parameters have lagged behind as seen by a continuous increase in RTIs and deaths.

Figure 4: Type of roads and their length in Km, India-- 2015

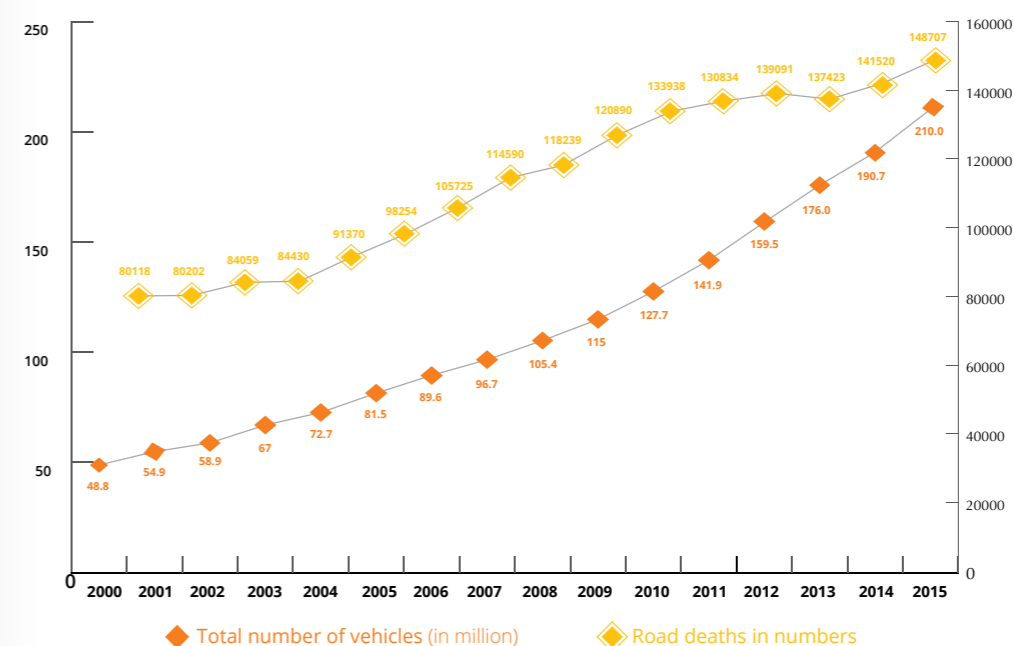


Motorization has impacted health of people

Though motorization fosters trade and transportation systems, it has also led to several health, environmental and social consequences, both directly and indirectly. Environmental effects of motorization include increased fuel consumption, emission of greenhouse gases and its consequent effects, climate change, air pollution, noise pollution and several others; limited data has shown these changes. Health of people has been severely affected as seen by an increase in road crashes, injuries, deaths and disabilities (Figure 5).

There has been an increase in respiratory and skin related morbidities; allergies; psychosomatic effects; mental health problems such as stress, anxiety, depression; noncommunicable diseases such as obesity, hypertension, diabetes; chronic conditions such as dementia; and several others. Significantly, motorization is one of the major contributory factors for the growing burden of noncommunicable diseases in India during the last decade. The necessity of travel and greater reliance on personal vehicles in the absence of safe public transport systems has only compromised health of people. *Furthermore, transportation policies have given peripheral importance or no importance to its likely impact on health of people.*

Figure 5: Motor vehicles and road deaths in India (2000-2015)



In 2015, Road Traffic Injuries (RTIs) accounted for 2.9% of all deaths and 43% of all injury deaths

Road deaths are on a continuous increase

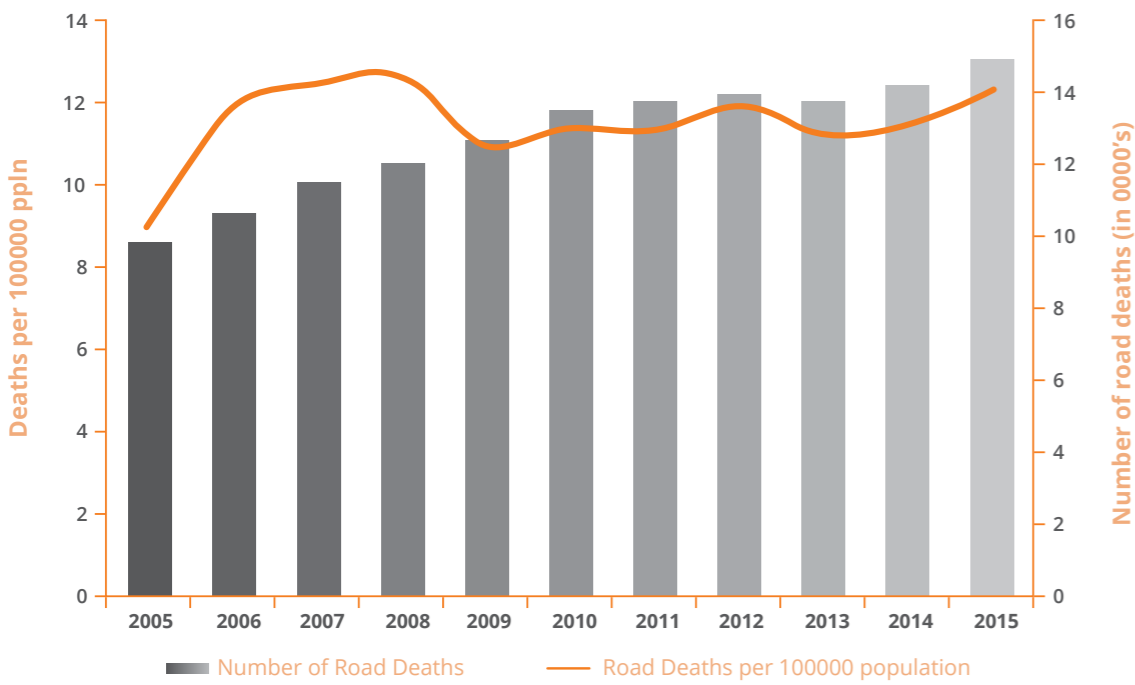
In 2015, Road Traffic Injuries (RTIs) accounted for 2.9% of all deaths and 43% of all injury deaths. (SCD, 2014). An estimated 1,75,000 deaths (1,48,707 as per official reports) due to RTIs is a serious call for implementing urgent preventive measures. There is an immediate need to put in place such measures to reduce these deaths and disabilities. Political leadership, policy makers, professionals from various disciplines, industry leaders, and the society need to take serious note of this scenario and act together to reduce this growing burden.

On an average, about 1,374 road crashes and 400 deaths take place every day on Indian roads translating to 57 accidents and loss of 17 lives per hour. The number of deaths due to RTIs increased

from 98,254 in the year 2005 to 1,48,707 in 2015, an increase of 51%. Accident severity has also increased by 34.7% in the same period. Deaths per 1,00,000 population increased from 8.9 in 2005 to 11.7 by 2015 (3). However, deaths per 10,000 vehicles decreased from 12.1 to 7.5 in the same period, more due to measurement fallacies. The deaths per kilometer of travel is not known due to lack of data.

Evidence from research studies, which differ in their methodologies and place of study, indicate that mortality among RTI victims seeking care in hospitals varies from 2.9% to 33.3% and proportional mortality due to RTIs among all hospital deaths ranged from 6.7% to 60.7%. Evidence from surveillance studies indicates that road crash mortality rate is 14 per 100,000 population in Bengaluru, much higher than national figures; similar observations are seen for few Indian states and cities.

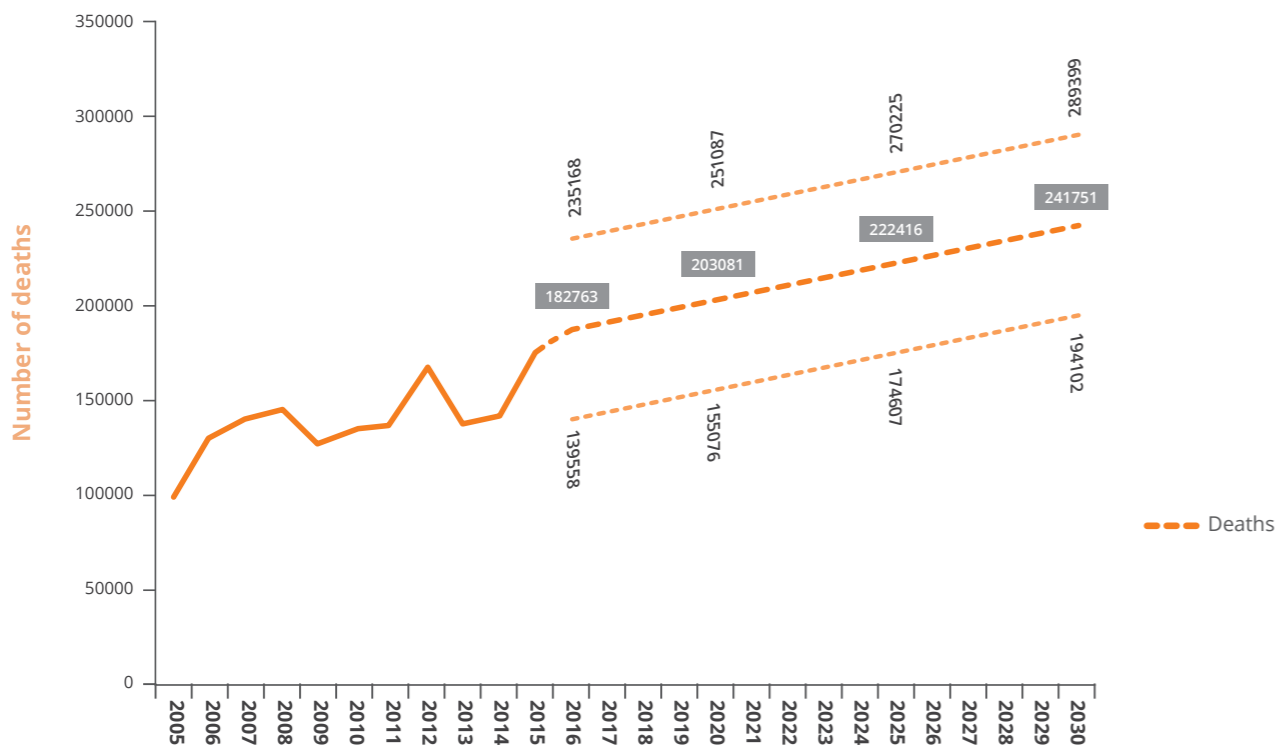
Figure 6: Motor vehicles and road deaths in India (2000-2015)



With existing scenario, India will witness deaths of more than 2,00,000 persons every year by 2030

Based on the estimate of ~1,75,000 deaths in 2015, nearly 2,41,751 (95% Confidence Interval 194102 - 289399) persons are estimated to die due to road crashes in the year 2030, if the scenario remains unchanged and if strong and integrated road safety mechanisms are not put in place (Figure 7). Approximately 3.21 million more lives are estimated to be lost between 2016 to 2030 (based on forecasts using Auto Regressive Integrated Moving Average (ARIMA) statistical method) (Figure 7).

Figure 7: Estimates of RTI deaths in India: Present and till 2030 (95% Confidence Interval)



PROFILE OF ROAD ACCIDENTS IN INDIA

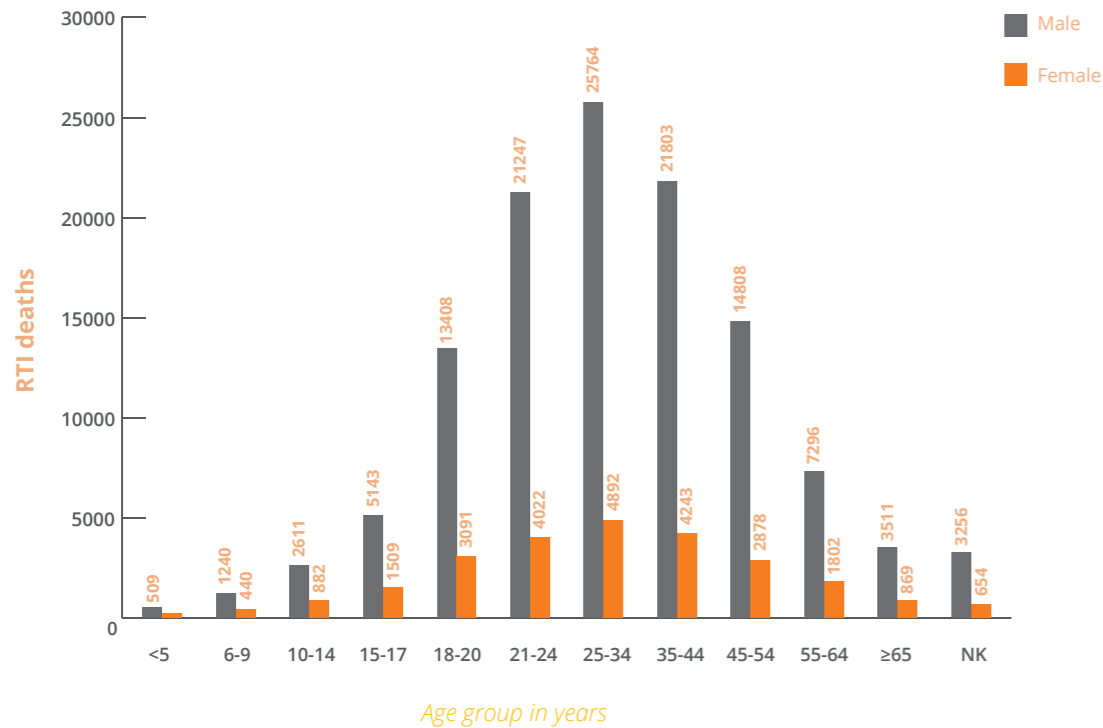
Young people, predominantly males are affected most

Evidence from various national reports (NCRB, SRS, MCCD) as well as few independent studies indicate that RTIs and fatalities are five times higher in males (82-86%) compared to females, due to greater exposure to unsafe traffic environments as well as due to their greater risk-taking behaviours. Deaths begin to rise from 14-15 years of age, peaks at around 25-34 years and shows a decline in later years of life (Figure 8). Summary of evidence from large sample studies across India reveal that 30%

of all persons involved in road crashes are aged between 21-30 years (6,7,8). Most accidents among males occurred in their productive age group of 18-60 years. Four percent of all road accident fatalities occurred in children, while elderly beyond 60 years contributed to 3% of RTI deaths.

The 5 years of Bangalore Road safety and Injury Prevention Programme (BRSP) revealed that road deaths and injuries among children was 5% and 7%, while elderly accounted for 10% and 3% respectively. In both the groups, males were predominant with a ratio of 6:1 and 4:1 respectively (9).

Figure 8: Age and gender distribution of RTI deaths in India (MoRTH, 2015).

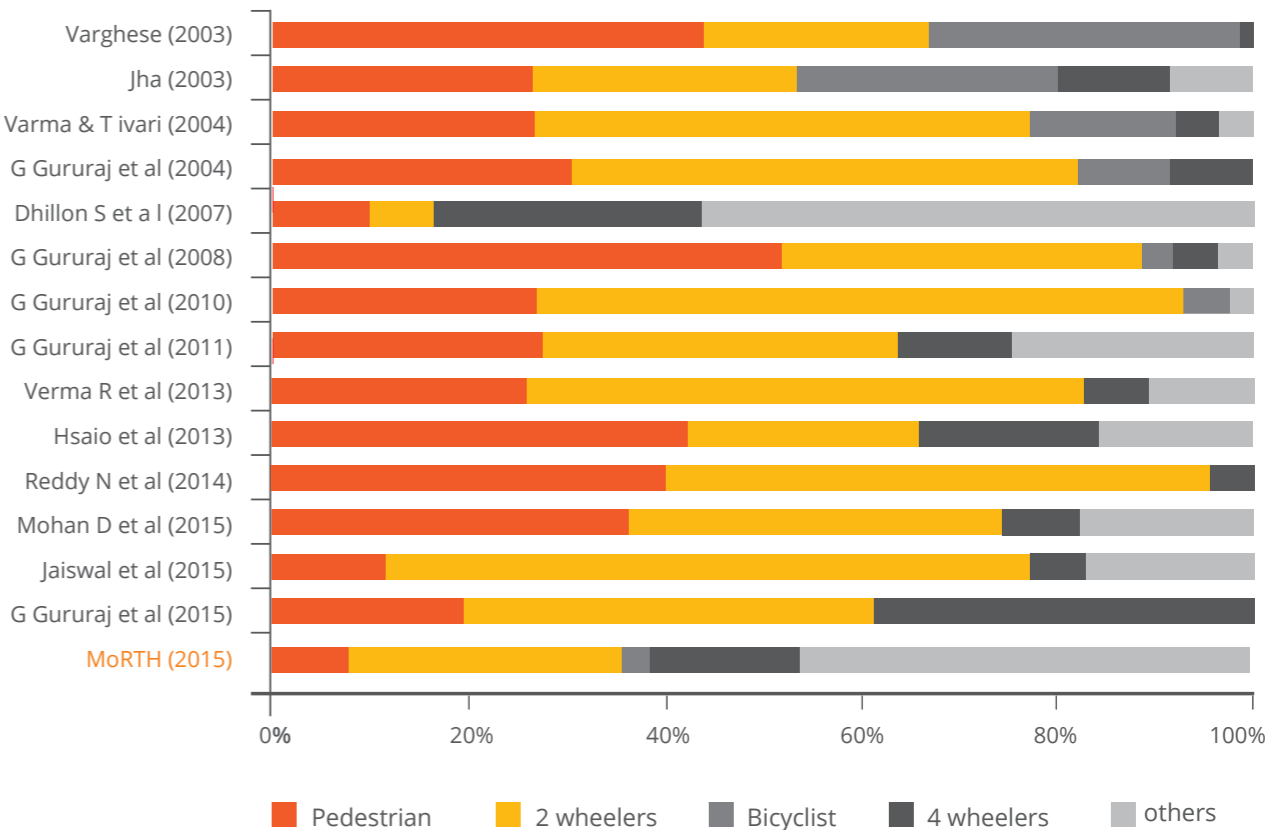


Pedestrians (30-40%), two wheeler riders and pillions (30-40%) and cyclists (~10%) account for nearly 80% of road deaths and injuries

Pedestrians, Motorcyclists and Cyclists are the most vulnerable

Despite accelerated motorization, walking, cycling and travel in 2 or 3 wheelers remain the predominant modes of Indian travel. Different categories of road users, both motorized and non-motorized types, share the existing roads but differ in their vulnerability to RTIs. Based on a summary of available data from Indian studies, it can be concluded that pedestrians (30-40%), two wheeler riders/ pillions (30-40%) and cyclists (~10%) account for nearly 80% of road deaths and injuries, which is in contrast with official reports due to fallacies in reporting practices. This is also at variance with data from HICs where motorcar occupants contribute the most. The nationally representative million death study revealed that 37% were pedestrian deaths and 20% were two-wheeler users. This data is strongly supported by many independent population and hospital based studies with variations.

Figure 9: Percent Fatalities among vulnerable road users



Poor and middle income sections of society are affected most

As per national data, road crashes and fatalities are observed to be higher among Indian states with higher and faster socio-economic development. Higher the GDP, higher road crashes and fatalities in Indian states, which is attributed to increased motorization and greater exposure (depicted by size of bubbles in Figure 12). This pattern is observed across all states in India except in Maharashtra, probably due to greater availability and use of public transportation systems. However, within the states and at a national level, most of the injured and killed belong to lower and middle income sections of society as per data from few independent studies. The largest household survey on RTIs with data from 20,000 households covering 96,414 individuals (10)

revealed that poor are affected most. This is due to the fact that poorer sections of the society have less access to safe transport, cannot afford motorcars and have limited access to trauma care due to increasing costs. With poorer sections of society being predominantly pedestrians, two wheeler users or cyclists, their exposure as unprotected road users is highest. Furthermore, with low accident health insurance coverage levels and lack of access to quality rehabilitation services, survivors face considerable hardships throughout life.

The largest household survey on RTIs with data from 20,000 households covering 96,414 individuals revealed that the poor are affected the most

Differentials in the burden of RTIs exist across Indian states

Road safety numbers and indicators in Indian states are unlikely to be uniform as states are in different stages of development, with varied practices and in implementation of road safety programmes. Twenty three Indian states and Union territories reported an increasing trend in road deaths during the last decade. In 2015, 14 Indian states had higher than the national average of 11.7 road deaths/ 100000 population, with highest number of deaths being reported from the state of Uttar Pradesh (12.1% of all road deaths in India) (Figure 11) (3) . The five southern Indian states of Karnataka, Tamil Nadu, Kerala, Andhra Pradesh and Maharashtra together accounted for 46.8% of accidents, 35% of all deaths, and have mortality rates ranging from to 15-21/ 1,00,000 population, much higher than the national rate. States with lesser vehicles, lack of well established data systems, hilly terrain and lesser urbanization reported lesser accidents and deaths.

Figure 10: Road deaths in different Indian States (% share)

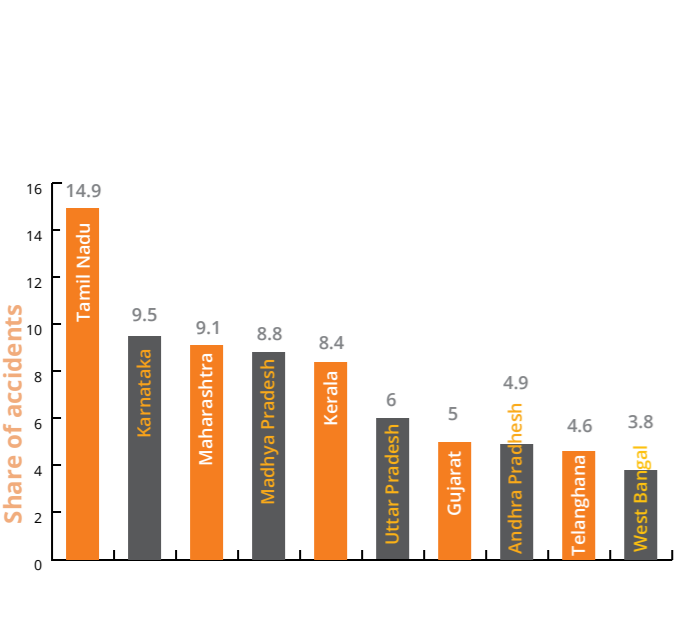
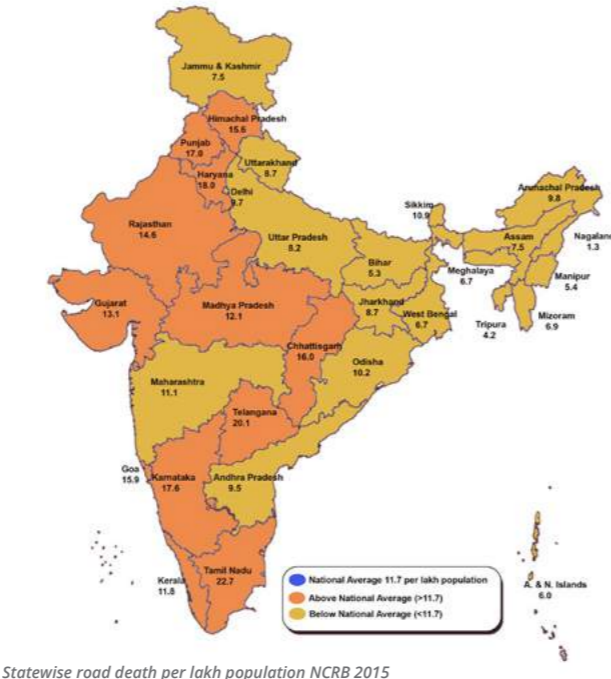
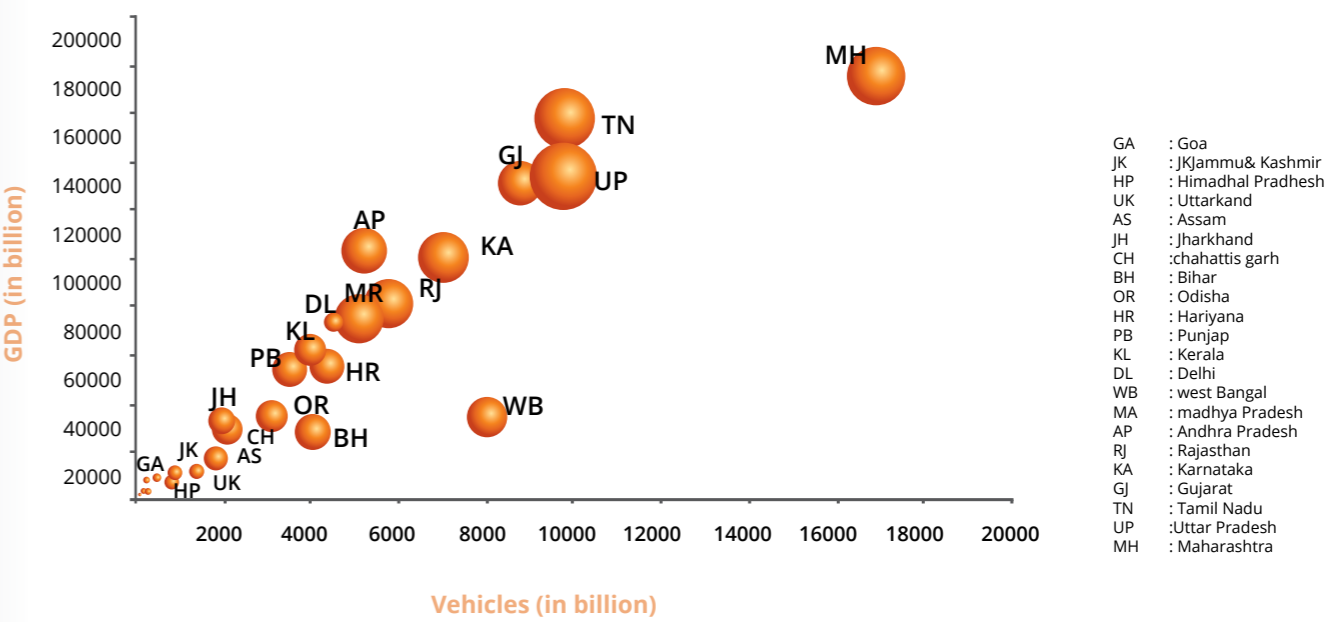


Figure 11: Distribution of road deaths (per 100,000 population) across Indian states, 2015



Statewise road death per lakh population NCRB 2015

Figure 12: Road deaths (NCRB 2015) in relation to GDP and vehicles (state-wise)

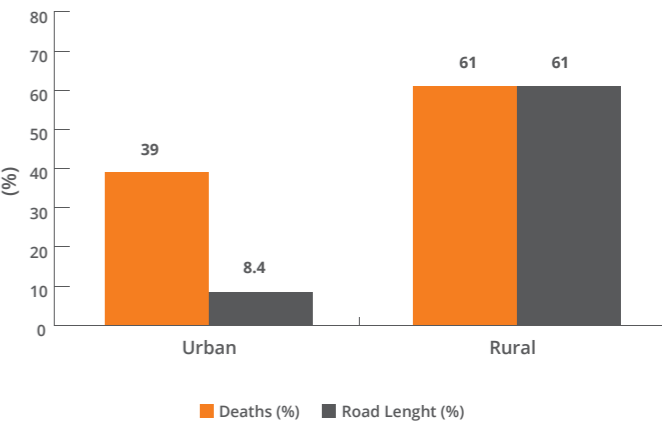


Nearly 80% of accidents and 88% of deaths occur in rural India.

As per national reports, only 22.1% of accidents and 11.3% of road deaths occurred in the 50 million plus cities in India in 2015 (MoRTH,2015). Thus, it is clear that large number of road crashes and deaths occur on rural roads, which include most of the national and state highways) where road safety is yet to gain prominence (Figure 13). Vehicle registrations are high in urban India as compared to rural India and this is changing fast. The number of road deaths was highest in Delhi (1316) in 2015 which also has the highest number of vehicles as well as vehicles per 1000 population, followed by Bengaluru. Number of accidents was highest in Chennai (7328). Much of the debate on road safety in India is more of an urban phenomenon, whereas rural India is yet to be connected and engaged.

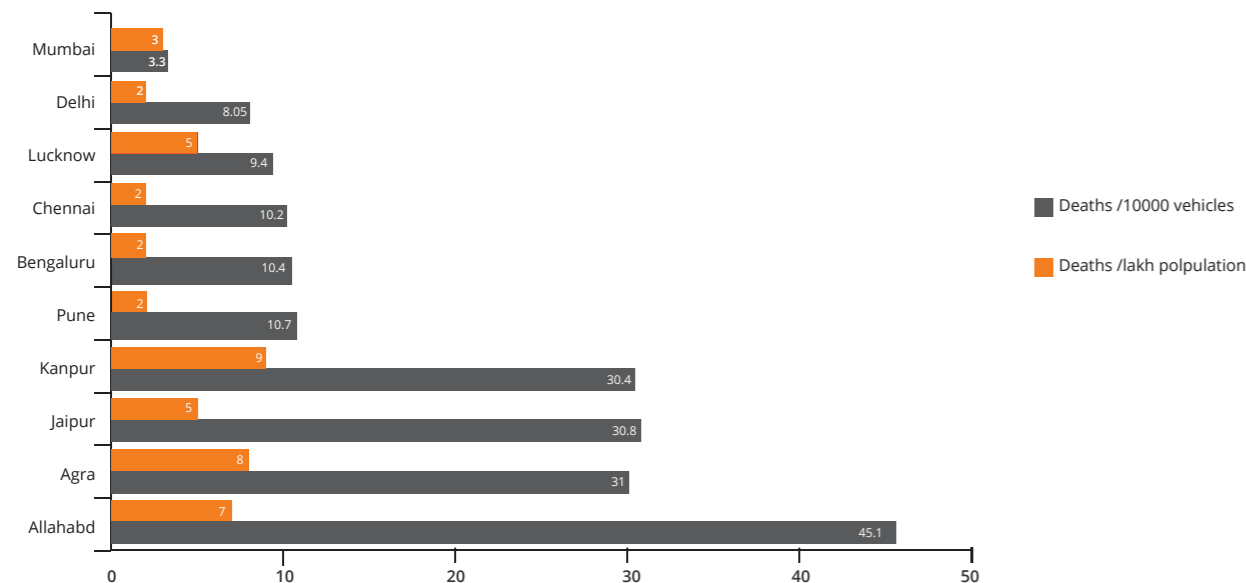
Much of the debate on road safety in India is more of an urban phenomenon, and rural India is yet to be connected and engaged

Figure 13: Rural versus Urban road accident deaths (%) in India (2015)



Over time, cities with high population and greater number of vehicles (specially the metropolis) have seen a plateauing of deaths or even a mild decrease due to increasing vehicle density, traffic congestion and accompanying reduction in speeds; the burden has only shifted to grade 2 and 3 cities (Figure 14) due to rapid motorization, increasing infrastructure, rapid mobility in the absence of safety policies and programmes highlighting the need for strong road safety and mass transport programmes at early stages of motorization.

Figure 14: Road deaths as per population and vehicles in ten select Indian cities



Highways are the neural links of connectivity, but are unsafe

Indian Highways (54,72,144 kilometres) account for 4.84% of road length but contribute to 52.4% of road accidents and 63% of road deaths in India as shown in Figure 4 (3). In the total road network, national and state highways account for 97,991 and 1,67,109 kms respectively. There are many factors that make the highways prone to RTIs-- unsafe design, heterogenous traffic, roads that promote speed, greater exposure of people to vehicular movement, driver fatigue during long journeys, night driving, conspicuity issues and under-developed trauma care systems. Since 2013, an increasing trend of accidents and deaths has been observed on national highways in contrast to a decreasing trend in state highways. Nearly 35.2% of crashes were fatal in highways. Highest deaths on national highways were recorded in Uttar Pradesh (7773), Tamil Nadu (5752) and Rajasthan (3709). Independent hospital-based studies conducted across India also reveal higher number of deaths on highways (25%-90% based on study location) compared to other roads. With a commitment of the government to increase investments in highway expansion, safety should receive highest importance and not to be left behind .

Indian Highways account for 4.84% of road length but contribute to 52.4% of road accidents and 63% of road deaths

Figure 15A: Percentage of accidents, injuries and deaths on various types of roads , 2015 (3)

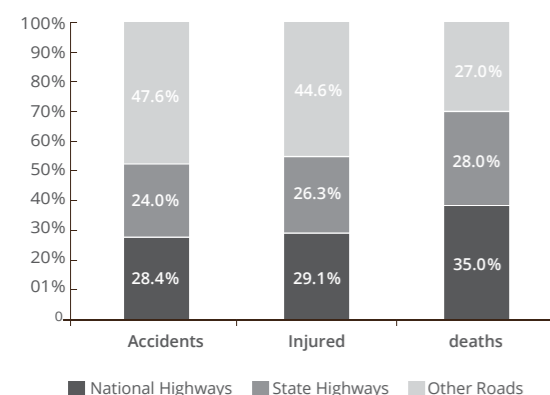
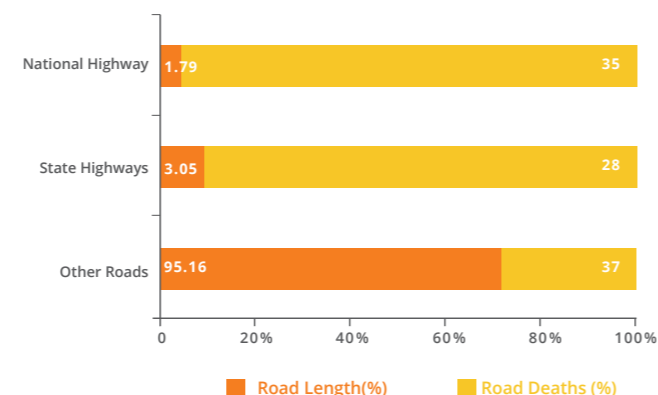


Figure 15B: Percentage deaths on various types of roads, 2015



"Where" people die in road crashes is vital to design interventions

Deaths from road crashes occur in a three-wave pattern. A study undertaken by Gururaj G et al (2007-12) in Bengaluru revealed that nearly 30-40% of deaths occur during the first wave (at or near to crash site), 10-20% during the second wave (in-transit to health facility), and nearly half of deaths

during the third wave (in hospital and thereafter). Independent studies across India also exhibited a similar pattern and indicated that 22-65% of all road accident deaths occur at the site of crash, with hemorrhage, precipitating cardiac shock, and arrest being the major reasons of death. This observation is of specific importance as it stresses on the need for primary and secondary prevention strategies in road safety.

Figure 16: Proportion of on-site road deaths from different studies

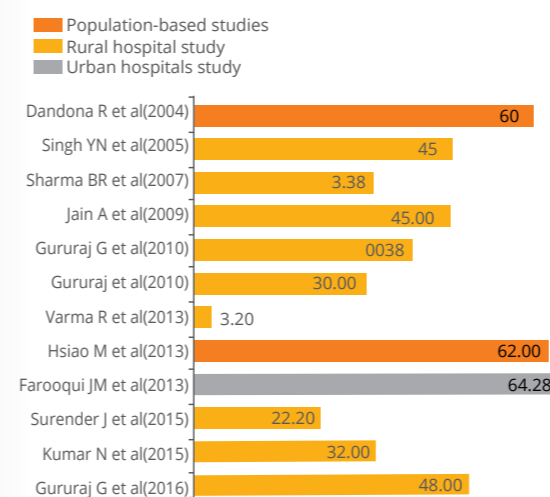
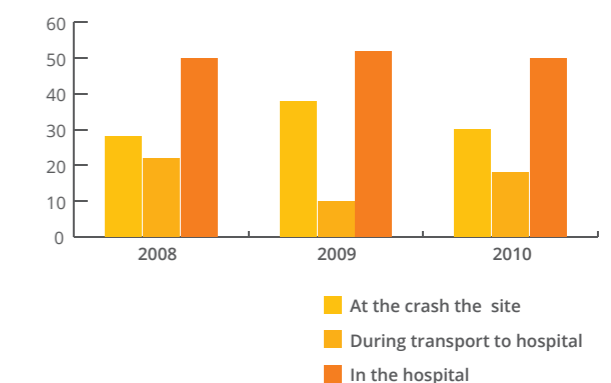


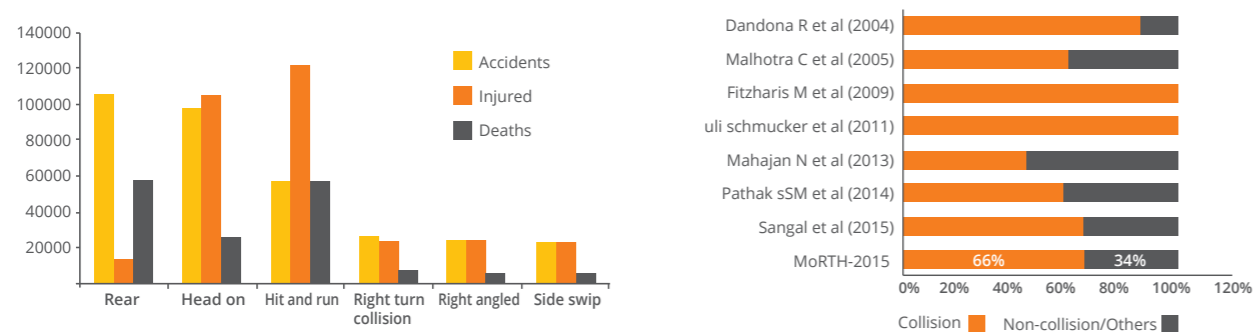
Figure 17: Place of death in road accidents (9)



Collision-related accidents are the most common pattern

Official reports (MoRTH) indicate that out of every 10 road accidents, nearly 6 were due to collision. Collision deaths also accounted for 55% of all road accident deaths in India. Depending on whether the road is separated or not, head-on collisions and rear-end collisions predominate. Data indicates that head-on collision in unseparated roads accounted for 19% of all accidents and 17.4 % of deaths, while rear-end collisions accounted for 11.4% of accidents and 9.7% of deaths. Review of crash patterns in several Indian cities shows that pedestrians, two wheelers, and bicyclists collide with heavy vehicles in fatal crashes among 67-86% of total crashes (10). However, collisions among pedestrians, two wheelers and cyclists has also become a major pattern for both fatal and nonfatal crashes in places with high presence of two wheelers, more commonly in cities as well as on highways.. Among crashes and deaths involving public transport buses (9), >80% of collisions involved pedestrians, two-wheeler riders, and pillions. Commonly referred to as "self-accidents," skid and fall or hitting a stationary object or roll-over crashes are the most common in one-fourth of crashes. This pattern varies across states and cities of India as well as on highways, urban roads, and rural roads. Interestingly, collision between two-wheelers and pedestrians has become a common feature in recent times across many parts of India; greater the speed of two wheelers, higher the number of deaths and serious injuries.

Figure 18: Accidents, injuries, and deaths by collision accidents in India



Survivors of road crashes live with varying disabilities

The Global Road Safety Status Report 2015 indicates that of all the disabilities resulting from injuries, 28% are due to RTIs. The Global Burden of Disease (2013) informs that RTIs are the ninth leading cause of DALYs lost in India, increasing by 15% between 1990 and 2013 (12). Road crashes are the fourth leading cause of disability in the age group of 15–44 years (13). Independent studies show a wide variation in disability rates, varying between 1.33% and 15% among hospitalized road accident cases (14-17). A large-scale population-based study of Traumatic Brain Injuries in Bengaluru revealed that 15% of the injured had varying levels of disability at 24 months post-discharge (15) and 18 % had died due to complications of road crashes. In Hyderabad, the disability rate due to road accidents was 35 per 1,00,000 population (Dandona et al, 2008). (16) Irrespective of data source and nature, in more specific terms, 100% of the severely injured, 50% of the moderately injured, and 10–20% of the mildly injured will have lifelong disabilities (15).

RISK FACTORS

Road design, maintenance, and use are critical for road safety

‘Defective roads’ accounted for 1.45% of accidents in the year 2015 as per official reports, but independent research findings indicate this to be significantly higher. IndiaRAP studies, undertaken on nearly 10,444 kilometers of roads (18), indicated that most Indian roads do not meet the even three-star ratings of safety standards (Figure 20). Studies undertaken by few researchers that also investigated road crashes reveal that road infrastructure defects (slippery roads, pot holes, poor design) alone contributed to 6% of fatal crashes and in combination with vehicles and human factors they account for 36% of fatal crashes (19). Recognition and treatment of accident hot spots-- black spots-- has been widely debated, and 786 black spots have been identified on national highways for prioritized management by MoRTH in 2016. With virtually most roads being death traps and road design, maintenance, and operation being the responsibility of state and local governments, only local data based on crash investigation and analysis can lead the way forward. The future of road safety in India largely depends upon the design of Indian roads that integrate safety amidst mobility for all categories of road users.

Figure 20: IRAP India Four States Project –Technical Report 2011

STAR RATING BY ROAD USER						
Road User	5 Star	4 Star	3 Star	2 Star	1 Star	Not Rated
Vehicle Occupants	0%	7%	21%	51%	21%	0%
Motor cyclists	0%	4%	8%	40%	48%	0%
Bicyclists*	0%	0%	1%	35%	20%	44%
Pedestrians	0%	0%	1%	81%	0%	18%

Star ratings are not produced for sections of road user activity recorded.

IRAP India Technical Report 2012

Vehicle safety has still lagged behind in India

Nearly 182,445,000 vehicles are registered in India, a vehicle per every 7 Indians. Nearly 2.8% of all road deaths in 2015 were due to vehicular defects as per official reports (3, 20). Information from hospital studies point out that 5.8-10% of all accidents are due to defective vehicles based on self reports. While some progress is becoming evident on safety of motor cars, safety features of two wheelers and three wheelers and locally manufactured vehicles is a matter of serious concern. Safety performance of select Indian cars revealed that many variants of Indian cars failed to meet safety standards like airbags, electronic steering and advanced

braking system (ABS). Most critically, safer two wheelers are an absolute requirement for India given their outstanding numbers. Furthermore, safety of public transport vehicles and introduction of safe fleet management systems are an absolute necessity for India as they transport millions of people every day. The specific requirements for improving vehicle safety can only come from in-depth crash analysis studies that are missing today.



Information from hospital studies points out that 5.8–10% of all accidents are due to defective vehicles based on self reports

Human behavior and acceptance of safety are central to road safety

“Man behind the wheel” is central to road safety. Given the risk-taking behaviors of even the most literate road users, efforts to keep them safe are of paramount importance in India. Attitudes such as “accidents are accidents”, “it doesn’t happen to me”, “accidents are due to bad times”, “god’s wish” are closely linked to their behaviors on the road. While all people need to behave safely on the road, it is the responsibility of road designers and builders,

vehicle manufacturers, and governments to assume the limitations of human behavior and take steps to make the road environment safer for them. While well-proven strategies exist to make road users safe, how to make them safe and in what way are still questions amidst poor safety and regulatory environments. Human behaviors linked to use of helmet and seat belt, drink-driving, speeding, use of mobile phones, compliance to traffic rules, pedestrian road use behaviors, and others need a proper understanding and mechanisms to address them.

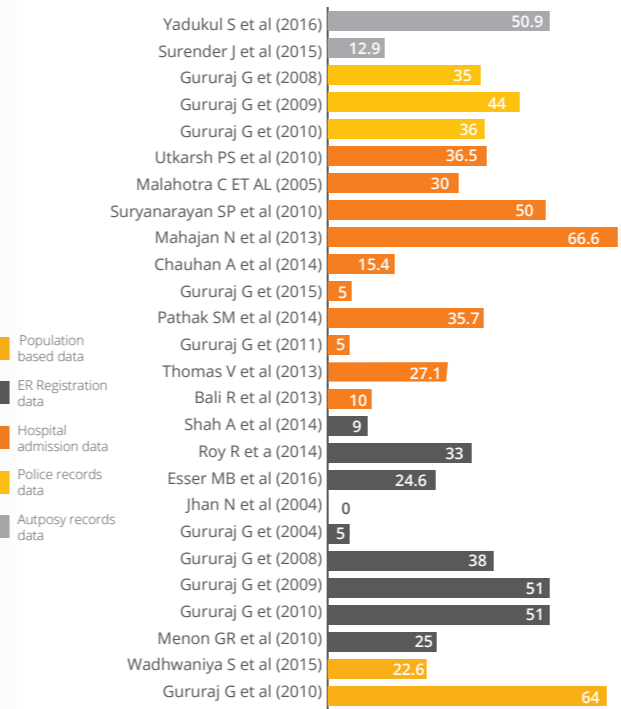
Although helmets are life savers, usage is poor

Use of helmets by two wheeler riders and pillions reduces deaths and injuries by nearly 40% and 70% respectively as per WHO (21). The presence of a helmet at the time of crash reduces the deceleration of the skull and hence the brain movement internally; absorbs some of the impact of crash through the cushioning effect; spreads the forces of the impact over a greater surface area; and prevents direct contact between the skull and the impacting object by acting as a mechanical barrier.

The Global Road Safety Status Report-- (GRSSR) 2015 reports that the current level of enforcement pertaining to helmet usage in India is rated at 4 (out of 10), with only 40% of riders wearing helmets; this indicates the limited implementation of a vital safety measure (12). With helmet legislation and enforcement being a state issue, the legislation is not notified, non-uniform in implementation, and invites very low penalties (INR. 100 as per existing law and likely to be revised as per the new amendment).

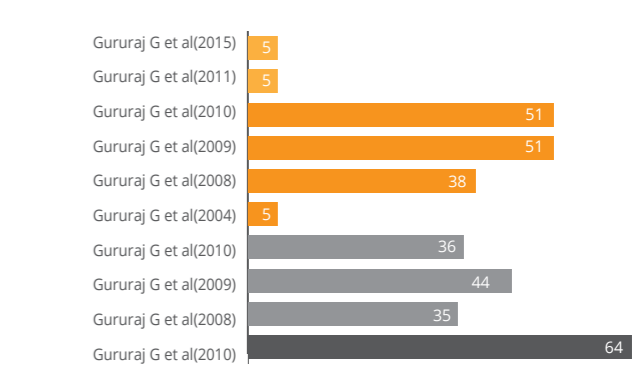
The Global Road Safety Status Report-- (GRSSR) 2015 reports that the current level of enforcement pertaining to helmet usage in India is rated at 4 (out of 10), with only 40% of riders wearing helmets

Figure 21: Helmet use: evidence from independent research (%)



This is well substantiated by the fact that road-side surveys in cities like Bangalore and Hyderabad indicate helmet use to be less than 50% among riders, while it is much lower among pillion riders. On highways and in rural areas, there is no data in this regard. Helmet use among hospital admitted RTI cases ranged between 5-66% (clustered around 27-50%), while emergency room studies indicate helmet use to vary around 24-51%.

Figure 22: Prevalence of helmet use in Bangalore and neighbouring areas (%)



Drink driving is rampant and unchecked

A drunken driver is not only a risk to himself, but also to several others on the road. Use of alcohol while driving interferes with vision, reflexes, judgment and coordination, thereby increasing the risk of RTIs. Driving under the influence of alcohol increases the risk of road crashes by 2.2 times as compared to non-users, deaths by 2 fold and injuries by more than 1.5 times (22).

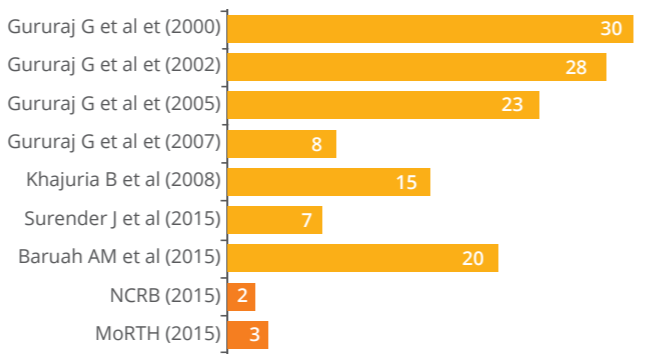
Driving under the influence of alcohol is an offence in India. While the legally permissible levels of alcohol in blood is <0.03mcg/dl for driving, the implementation is at the discretion of enforcement agencies. As per GRSSR, the current level of enforcement pertaining to drink driving in India is rated at 4 on a scale of 1-10. Review of Indian data indicates that nearly a third of RTIs occur during night times and a third of these are linked to alcohol. Data from 5 epidemiological studies of NIMHANS indicate the involvement of alcohol to vary between 10 and 30% in all fatal road crashes (23). However, official reports indicate that driving under influence of drug/alcohol contributed to only 2-3.3% of deaths (alcohol to 1.5 % of deaths), indicating serious underreporting of alcohol related crashes (3,20).

Past efforts to control alcohol related problems such as legal age of consumption, timings and days, location of alcohol outlets, complete or partial prohibition,

increased counseling and rehabilitation services – and public information programmes have had limited impact.

Recent attempts to curb alcohol use and specially during driving in the form of increasing public awareness, state-wide prohibition, banning sale of alcohol within 500 meters from national and state highways across the country, increased penalty in the recently proposed amendment to the MVA needs detailed evaluation studies to assess both direct and collateral effects of these interventions.

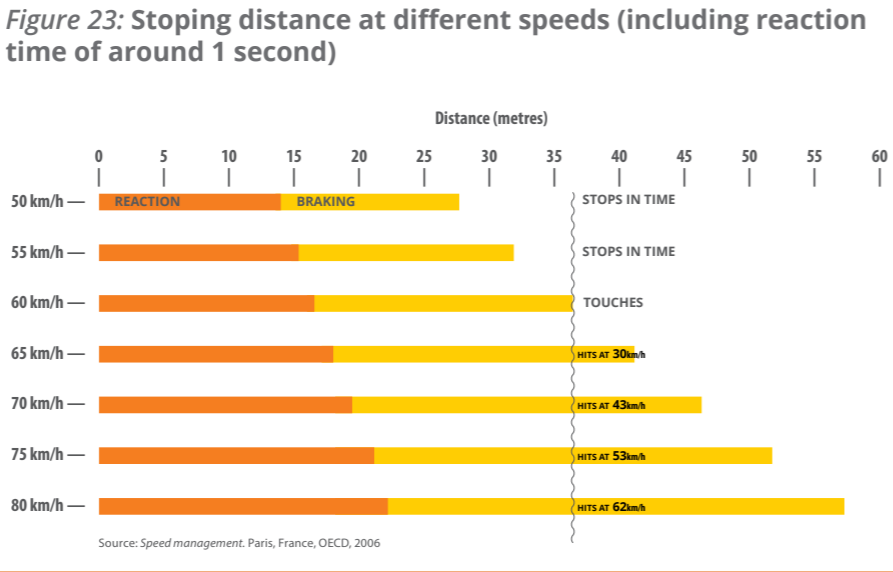
Figure 23: Alcohol use and road deaths: Evidence from hospital studies and national reports(%)



Driving under influence of alcohol increases the risk of road crashes by 2.2 times as compared to non-users, deaths by 2 fold and injuries by more than 1.5 times

Speeding is the major contributor for deaths and injuries

Over speeding leads to greater number of crashes as vehicle control is extremely difficult at high speeds. (Figure 23) Every fatal crash and majority of severe to moderate road injuries involve an element of speeding by one or the other vehicle, though it is not systematically assessed in India through crash investigation and analysis. Rash driving, careless driving, negligent driving, and dangerous driving are often a few of the terms used in official as well as media reports, referring indirectly to over speeding.



An increase in mean speed levels by 5% results in a spike in number of road crashes by 10% and leads to 20% increase in fatality (24). In India, though the speed limit law is in place under the Indian Motor Vehicles Act of 1988, there is no uniform and strict enforcement throughout the country on different roads.

Data collated from state crime bureaus by MoRTH shows that 48% of road accidents and 44% of road

deaths were due to over speeding and overtaking. Based on direct interviews with hospital subjects, qualitative studies in Bangalore and Hyderabad indicate speeding as the single most contributory factor for RTIs. As early as 2002, the Hon. Supreme Court of India issued directives to states to install speed governors in all commercial vehicles to measure and regulate speed, but implementation is poor. Till date, efforts are lacking to implement the speed monitoring interventions.

Compliance to seat belt legislation needs stricter enforcement

Seat belts are an important safety mechanism and reduce deaths and injuries among front car occupants by 45-50% and 20-45% respectively. Seat belts act by reducing the velocity of the body as it experiences a sudden decrease in speed; spreading the stopping force needed to decelerate the passenger across his or her body and prevents the body from hitting the windshield or steering column of a car at high speed; and reduces most of the stopping force and increases the time taken for the body to come to a stop (25).

In India, the Central Motor Vehicles Rules 1989, mandates the use of seat belts by driver and the occupant of front seats as well as occupants of rear seat facing front, while vehicle is in motion. However, use of seat belts is limited as shown by road-side observation surveys in Bangalore which revealed that only 17% of drivers secured themselves with a seat belt, while in Delhi it was nearly 90% (9), and studies on road accident victims indicate that seat belt use at the time of accident varied between 14 and 40% (9,25-31). Even though most modern-day cars are fitted with seat belts, their use by drivers remains low, and enforcement is not high across the country. As per GRSSR 2015, the rating of current seat belt enforcement was reported to be 4 on a scale of 1-10 (12).

Child restraints are yet to become a norm in India

Child restraints act by preventing injury during a collision or a sudden stop by preventing movement of the child away from the vehicle structure. It distributes the forces of a crash over the strongest

parts of the body, with minimum damage to the soft tissues. In India, 4% of all RTI deaths occur among children (3,20) while studies from NIMHANS (9) indicated that road deaths and injuries among children was 5% and 7% respectively. Data with regard to compliance to child restraint use and its effectiveness is not available for Indian settings.

Distracted driving due to cell phones is significant

Driving while using cell phones affects attention and concentration, leading to distracted driving. Use of mobile phones of any type, handheld or otherwise, while driving is all pervasive in Indian society, though usage of mobiles while driving is a punishable offence under the category of dangerous driving vide Section 184 of Motor Vehicles Act.

Official reports do not provide data regarding association between road accidents and mobile phone use in India. Road-side observations on nearly 140,000 drivers of different vehicles in Bengaluru (BRSP) observed that 6.5% of drivers were using cell phones during driving (9). Studies by independent research indicate the use to be around 12% (32). Further, population based data is required to understand the association between cell phone use and driving, as use of cell phone is on a continuous increase in India.

Nearly 11-25% of road accident victims reported driver fatigue at time of crash

Fatigue from long driving hours, continuous driving, driving during illness and lack of alertness pose major risks of accidents. Fatigue along with sleep deprivation is a well recognized risk factor and has not been well understood in India. Official Reports released in 2015 suggest that 0.004% of all deaths are attributable to fatigue or illness, whereas 1.5% are attributed to lack of alertness while driving (20). Independent studies reveal that 11-25% of RTI victims reported driver fatigue at the time of crash (27, 33). The effects of fatigue and sleeplessness on road behaviour needs to be better understood in India to formulate interventions.

Young novice drivers are at an increased risk for road crashes

As people begin to drive vehicles from the age of 16 with a learner's license, there is an increased risk of road deaths and injuries, both to themselves and others. Young people, owing to their inexperience, lack of maturity and judgment, indulge in impulsive and risk-taking behaviours and succumb to peer

is an overestimate as licenses are not cancelled after death, severe disability, or disease.

Nearly 59,000 accidents occurred among young drivers with a learner's license and 45,000 occurred among those without a driving license in India (2015). Many young drivers are responsible for road accidents, as 1022 driver-deaths occurred among drivers less than 14 years of age. Driver licensing has been an area of intense debate-- several procedural laxities within the system have been observed. Though many initiatives have been undertaken in recent times, data is lacking on the effectiveness of these measures. The Hon. Supreme Court of India, in 2015, strongly discouraged young people from driving and has fixed the responsibility of untoward deaths and injuries on parents.

Till now, driving without a valid license attracted minimum penalties and enforcement has been poor in this regard. The recent amended MVA has fixed penalty at ₹5000/- and aims at developing the national drivers' data base, which would definitely help in better enforcement.

Nearly 59,000 accidents occurred among young drivers with a learner's license and 45,000 occurred among those without driving license in India in 2015

pressures. Also, their simplified understanding of transport environments poses a great threat. Nearly 10.1 million Driving Licenses were issued in India in the year 2011, highest being in Maharashtra (1.5 million). Data on number of licenses issued by RTOs

Pedestrian facilities and road use behaviours contribute to road crashes

Almost all road users are pedestrians, at least for a short period, during the course of their journey. With nearly 40 % of deaths and injuries accounted for by pedestrians, availability of safe-walking and crossing areas becomes a basic necessity on all roads. While many facilities like skywalks and subways have been built to aid the pedestrians, it has been observed that people do not prefer to use them for variety of reasons. Apart from issues related to personal safety and convenience, they are not suitable to the physically challenged, elderly, pregnant women and children. Even when footpaths and crosswalks are available, such facilities are not adequately utilized by people. Consequently, crashes are an inevitable outcome, especially in case of collision with heavy and medium-sized vehicles moving at high speeds.

Data from BRSP revealed that pedestrians were the largest category of road users killed in road crashes. For example, in Bengaluru, it is estimated that pedestrians constitute nearly 52% of total road fatalities. The killed and injured pedestrians, primarily men, were highest in the age group of 16-45 years. One fourth of the injured and killed pedestrians were children and elderly. Crash pattern analyses indicate that nearly 24% of pedestrians were hit by cars, 22% by two wheelers, and 18% by buses. Nearly 60% pedestrians reported crossing the road at time of crash and majority occurred in mid-blocks (9).

With nearly 40% of deaths and injuries constituting pedestrians, availability of safe walking and crossing areas is a basic necessity

Poor visibility is an issue that needs to be considered seriously

Poor visibility of people, vehicles and roads is a contributory factor for road crashes. Nearly 1/3rd of road crashes in India occurred during night time, when visibility is poor. Bad visibility due to weather conditions was responsible for 1% of road accidents and 1.5% of road deaths in India during 2015 (20). Detailed data with regard to contribution of poor visibility of roads and people to the total accidents is lacking in India. Apart from visibility due to environmental and vehicle-related issues, assessment of visual acuity of drivers in Guwahati revealed that 12% had 'unacceptable' levels of depth judgment test, 7% failed in the glare recovery test, and 5% were found to have problem of tunnel vision. Vision testing among public transport

bus drivers in Karnataka revealed that 63.75% of the drivers had at least one visual defect, and comparison of their road crash histories showed high crash involvement rates (87%) (34). Newer safety technologies are being used to enhance visibility of vehicles like day time running head lamps, reflector head lamps etc. However, the impact of these interventions needs to be established with good quality accident investigation and analysis.

Nearly 1/3rd of road crashes in India occurred during night time, when visibility is poor

Role of drugs in road crashes needs to be understood in India

India is home to a wide variety of prescribed and illicit drugs, both of which are available freely. Depending on the nature of the drug, its effects on human mind and body are varied and can affect driving in a significant manner. Data is totally lacking in this regard due to difficulties in assessments on the road-side or in hospitals. Though NCRB reports that 4.2% of road deaths were due to influence of alcohol and illicit drugs, there is no break-up of the same. In a hospital based study in Greater Noida, Rupali Roy et al reported that drug use among hospitalized RTI subjects was 18.7%. (27). With many people, especially middle aged and elderly, using a variety of prescription drugs, their influence on road crashes needs to be ascertained.

To promote safe practices among road users, the above-mentioned risk factors need better

understanding and development of mechanisms from a public health perspective. Observational studies undertaken by WHO Collaboration Centre at NIMHANS in Bangalore have revealed that use of helmets and seat belts is more prominent wherever and whenever there is police presence. Drunken driving, speeding, and use of cell phones are also controlled when checks are carried out in a visible manner with use of technology, accompanied by reasonably high penalties. Safe practices are markedly low in peripheral areas, and during holidays, evenings, and night times, indicating that legislation along with enforcement by police on the ground makes people safer. Token implementation strategies are not known to be effective. This view was also expressed by people in several rounds of focused group discussions and interviews in independent studies. The pattern remains similar across the country.



ROAD ACCIDENTS: A PUBLIC HEALTH EMERGENCY

RTIs are a major public health problem in India

Among the several types of injuries, RTIs are the leading contributor of mortality and disability in India. Deaths are only the tip of the iceberg; the number of survivors is estimated to be approximately 5 million people. The actual number of persons disabled for short or long term is unknown due to lack of reliable data, but it is estimated that RTIs account for 15% of total disabilities.

Apart from the loss of loved ones, along with the pain and suffering of those affected, deaths and disabilities due to injuries and RTIs cause a significant damage to the society. RTIs leave a huge impact on health of affected individuals and family members, affecting various aspects of people's lives ranging from limited ability to work to long term psychosocial problems that impact their quality of life.

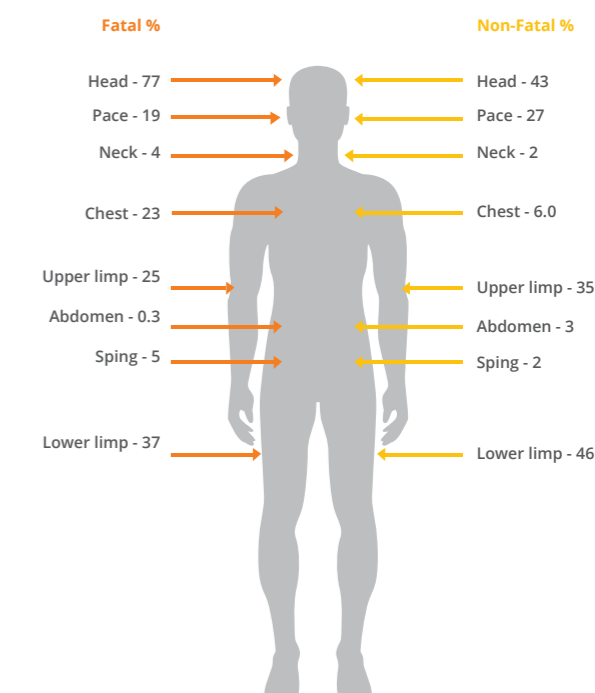
Health sector bears the brunt of RTIs and injuries, as huge amounts of resources are spent for care and rehabilitation. The economic burden on survivors and their family members is massive and unmeasured. With nearly 60% of road deaths occurring on the way to or in the hospital, the health sector has to develop appropriate mechanisms to deliver efficient care for injured. Rehabilitation of injured needs greater attention, as integrated services are unavailable, especially in rural India. Thus, there is an immediate need to put in place coordinated measures to address trauma care. Political leadership, policy makers, professionals from a wide variety of disciplines, industry leaders, and the society together need to take serious note of this scenario and act together to reduce this growing burden.

Majority of road crashes result in brain damage

Epidemiological studies in both hospital and population settings have documented that nearly 50–60% of hospitalized RTI persons have sustained one or more injuries to brain and related structures (9,35-42). Head and neck are the most commonly affected parts in both fatal (30-91%) and non-fatal road accidents (60%). Autopsy based studies have shown that more than 80 % of fatal road crashes had an injury to the brain. The Million Death Study reported that 52% of road deaths were directly due to brain injury (6). Extremities (lower limb: 49% and upper limb: 38%) are the next common site of injuries (9,35-39). Apart from sudden and instantaneous death, traumatic brain injury leads to cerebral contusions, hemorrhages, skull fracture and neurological disabilities, affecting every function of brain, resulting in problems that range from mild cognitive impairments to persistent vegetative states. In the absence of well-defined rehabilitation programmes, majority have to live with lifelong impairments and disabilities that affect individuals and families.

Epidemiological studies in both hospital and population settings have documented that nearly 50–60% of hospitalized RTI persons have sustained one or more injuries to brain and related structures

Figure 24: Anatomical sites of injury in fatal and non-fatal road crashes- BRSP 2007-2010



Post crash care is deficient in India

Trauma care is not a single-step process, but a continuum of activities. Well established trauma care systems integrate pre-hospital care, in-hospital trauma care, referral services and rehabilitation help to reduce morbidity, fatality and disability due to road crashes. The trimodal distribution of deaths following a road crash emphasizes the need for efficient and continuous care soon after an injury. An integrated and coordinated approach encompassing human (staffing and training) and physical (infrastructure, equipment and supplies) resources as well as the process (organization, administration and delivery) is required at all levels to deliver ideal trauma care 43). The experience from HICs reveals that efficient trauma care systems can reduce deaths by 20–25% and the impact of severe injuries by 40%. Data on trauma care issues are limited in India. Available data from India indicate various deficiencies in existing systems in the country, which contribute to poor outcomes.

Experience from HICs reveals that efficient trauma care systems can reduce deaths by 20–25% and the impact of severe injuries by 40%

Prehospital systems need strengthening in India

Pre-hospital trauma care systems specifically focus on trauma care at the site of injury and en route to a fixed health facility, which provides basic first aid, triage at the site of occurrence or in first contact

On an average, around 45% of injured received first aid in different parts of India, and time taken to receive first aid ranged from 30 to 60 min as per hospital-based studies

the fatalities can be averted if victims can reach a hospital within the shortest possible time (referred to as the golden hour) (44). Evidence from Bengaluru points out that 32% and 45% of RTI patients reached a hospital in less than one hour and three hours respectively; delayed arrival was significantly higher in rural areas (9). A large study of highway crashes



in Kolar district showed that 96% of accident victims reached a health care facility within one hour of accident, primarily due to easy access to a number of health care facilities located at a short distance within the district. On an average, around 45% of injured received first aid in different parts of India and time taken to receive first aid ranged between 30 to 60 min in hospital-based studies (28,45). However, most first-aid provided was limited to calling an ambulance (41.5%).

Though ambulances are the recommended modes of transport, the proportion of injured transported in an ambulance varied from as low as 7.5% to a high

Table 1: Distribution of road accident victims according to first aid received(%)

Sl no	Author	Year	Place	Sample	Received first aid(%)
Among - fatal RTAs					
1	Gururaj G et al	2008	Bangalore	3427	21.0
2	Kumaran N et al	2015	Varanasi	100	34.5
Among non - fatal RTAs					
1	Gururaj G et al	2014	Kolar	2689	44.1
2	Celine et al	2014	Ernakulum	7660	59.2
3	Gururaj G et al	2011	Tumkur	5192	42.0
4	Gururaj G et al	2008	Bangalore	24586	55.0
5	Reddy GMM et al	2009	Chandigarh	95	17.0
6	Gururaj G et al	2004	Bangalore*	7142	84.1

of 46% (27,46). Studies indicate that 40-70% of the injured victims were transported to the healthcare facilities in private vehicles such as three-wheeled autos rickshaws, personal vehicles, and police vehicles as arrival of ambulances to crash site is not immediate. Among the ambulance services, Gunapati Venkata Krishnareddy Emergency Management and Research Institute (GVK EMRI), accessible through 108, is the most frequently used as people are familiar with its call number. Its services have expanded geographically with 14,000 ambulances and, most importantly, are free of charge.

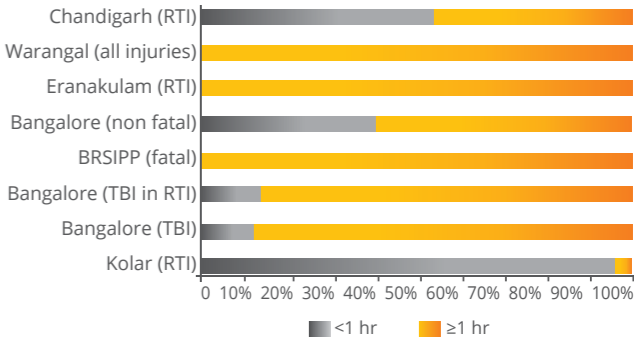
Good Samaritan law needs total implementation

Pre-hospital trauma care is important as nearly 10-15% of deaths occur between crash site and trauma care centre. Bystanders, often the first care responders, are apprehensive about helping accident victims since they fear legal consequences (88%). To overcome the same, India enacted a Good Samaritan law in year 2015 to safeguard the bystanders who help trauma victims. According to the law, a Good Samaritan will not be liable for any civil or criminal action for any injury or death of the victim, and disciplinary action will be taken against public officials who coerce Good Samaritan to reveal his/her personal details. Even in hospitals, a good Samaritan will not be forced to reveal his/her personal details and will not be forced to bear the initial cost of treatment. The Good Samaritan can choose to be an eyewitness and cannot be compelled to provide details. Undoubtedly, the implementation of the law requires a change in societal mindset and a strong enforcement system to check the violations of police officials and hospitals.

Referral patterns indicate trauma care facilities are deficient in public sector

Well established referral systems help the accident victim reach a definitive trauma care facility from the facility providing primary care based on initial triage. Available Indian studies indicate that around 10-

Figure 25: Distribution of road accidents and injuries by time taken to reach health care facility



30% of the injured had directly reached a definitive trauma care facility, whereas nearly 70-90% of RTI victims had contacted or received care from one or more hospitals before reaching a definitive trauma care facility. The referral proportion (from primary to a definitive health care facility) varied from 30-100%. Among those who were referred to a trauma care facility, 50-90% were referred from

Nearly 70-90% of RTI victims had contacted or received care from one or more hospitals before reaching a definitive trauma care facility

Table 2: Distribution of injuries according to source of referral- Evidence from Hospital based studies (%)

SL no	Author	Year	Place	Nature of injury	Size	Proportion referred	Public	Private
1	Gururaj G et al	1994	Bangalore	Head injury	2897	79.2	49.2	30
2	Gururaj G et al	2004	Bangalore	TBI	7142	86	42	18
3	Gururaj G et al		Bangalore	Fatal injuries	3427	76	54	22
				Non fatal injuries	5344	47	22	18
4	Menon G et all	2010	Bangalore and Pune	Injuries	3167	30.3	10.30	20
5	Gururaj G et al	2011	Tumkur	non fatal injuries	5192	100	90	10
6	Pallavisarji U et al	2013	Tumkur	Injuries	363	100	50	50

public health care facilities and 10-30% from private hospitals. Reviewed data on the source of referrals shows that <50% of referrals are from the private sector, indicating a deficiency of trauma care facilities in the government sector (7,9,15,35,47). The most common reasons for referral were lack of services and resources in peripheral institutions, medico legal barriers, and cost of care (especially in private hospitals). The recent introduction of several cashless treatment and insurance schemes require further evaluation.

Hospital trauma care services-- the unmet need

Trauma care systems are not fully established in India and where it exists is primarily urban-oriented. Services are delivered through a chain of 25,308 primary care centers, 5396 community hospitals, 1022 Sub-divisional hospital, 763 district hospitals, 462 medical college hospitals, and a few tertiary specialized centers covering 31% urban and 69% of rural areas. There are several private care institutions ranging from small nursing homes to corporate hospitals that provide trauma care, though precise numbers are not known. Limited studies have documented various deficiencies in different components of hospital services. Predominant deficiencies identified were gaps in communication between transport facility and trauma care facility, lack of trained staff in ambulance and emergency rooms, deficient manpower and facilities, and an absence of defined protocols and guidelines (44,48). Assessment of trauma care facilities across 50 health care institutions in India revealed that ambulances lacked trained paramedics, but were equipped with

basic life supporting equipment. Nearly 90% had no communication systems between ambulances and hospitals. Hospitals lacked trained staff to handle trauma cases in the emergency department and no triage or trauma care protocols were followed (44). The recent assessment of trauma care facilities in a district hospital revealed glaring gaps in manpower and facilities that resulted in increased referrals to urban hospitals (49). Key Efforts in the millennium in India include initiation of National Highways Trauma Care Project (NHTCP), National Highways Accident Relief Services Scheme (NHARSS), NHAI Incident Management System and Emergency Medical Services, all of which are in differential stages of implementation in different states. Under 11 th Five Year Plan of India, it is proposed to establish 140 trauma centres (23 level I, 57 level-II, and 60 level-III) at an estimated cost of 7.32 billion along the golden quadrilateral, north-south, and east-west corridors of the national highways under this Scheme. The functioning of trauma care centers built on highways across the country needs proper evaluation to improve services.



Rehabilitation services needs strengthening need

Road crashes leave a host of disabilities among survivors. Disability is thus not just a health deficit but a complex situation, reflecting the interaction between an affected individual, his/her family and the larger environment and systems. Nearly 100% of the severely injured, 50% of the moderately injured and 10-20% of the mildly injured will have lifelong disabilities. Independent studies indicate that the disability rates vary between 1.33% to 15% among hospitalized RTIs. Large scale population based study of Traumatic Brain Injury in Bangalore revealed that nearly 15% of the injured had varying levels of disability at 24 months post discharge (15). More surprisingly, 18% of those discharged alive from the hospital had died post-discharge indicating the lack of rehabilitation services. Overcoming the difficulties faced by people with disabilities requires multiple interventions to remove environmental and social barriers (WHO). Rehabilitation services at present are limited to certification of level of disability, monetary compensation, patchy physiotherapy services, provision of mobility aids and social incentives like concessions in travel, employment and government schemes; however, only a few avail these services and benefits. These are delivered by the welfare department, mostly through public-private partnership model via civil society agencies with limited coverage and access. Exclusive programmes for rehabilitation of accident victims or community based rehabilitation initiatives are limited in India.

Cost of trauma care is spiraling upwards

There is an immediate unmet need to provide financial risk protection for road accident victims in India. Cost of trauma care is prohibitive, especially considering that a large proportion of the population

is not covered under any kind of health insurance policies, and 70 % of India lives in rural areas. It is estimated that injuries in total and RTIs in particular cost 5% and 3% of GDP respectively.

High OOP expenditure for treatment indicates need for increasing public health spending for prevention of injury and providing financial risk protection

In real monetary terms, a 2004 review by Mohan D (50) indicated that the economic cost of road traffic injuries and deaths (year 2000) is approximated at ₹550,000 million. Bhattacharya et al, 2008,

examined willingness to pay (WTP) to reduce risk of dying in road traffic accidents in Delhi and estimated that the "value of a statistical life (VSL)" for exposed beneficiaries is 150,000 Purchasing Power Parity (PPP) dollars. Costs of RTIs can be direct and indirect affecting various spheres of an individual's life. Medical costs accounted for 43% of cost of care of road accident victims in year 2009 in Chandigarh (51). The average cost of surgery was ₹4500 and prosthesis was ₹2450. Shankar Prinja et al, 2016, in a cohort study of healthcare costs (out of pocket expenditure(OOP)) of RTI patients admitted at least for one night in a tertiary hospital estimated the mean OOP expenditure for RTI cases during hospitalisation at USD 400 (95% CI: 344-456) (52). The prevalence of catastrophic expenditure was 30%. In a recent study of economic evaluation of RTIs in a tertiary care institution, it was estimated that the direct medical costs were ₹123,301, which accounted for nearly 50% of total economic loss (₹244,906) (53). Anecdotal evidence indicates that the costs in private sector is significantly high as compared to public sector facilities. High OOP expenditure for treatment indicates need for increasing public health spending for prevention of injury and providing financial risk protection (52).

NOTABLE STEPS TAKEN IN THE PAST DECADE

Recognizing the enormity of the problem, some useful initiatives were undertaken to improve road safety in India by both central and state governments. However, many of these are to be implemented in totality.

Based on the petition *Rajashekar vs Government of India*, the Supreme Court constituted an empowered committee to oversee progress in implementation of road safety initiatives in Indian states that undertook such initiatives in the last 3 years.

Amendment to the Indian Motor Vehicles act of 198 is awaiting a final approval by the Indian Parliament (passed in Lok Sabha on 10th April 2017.) Once it is in force, it aims to introduce sweeping changes to the earlier road safety provisions. Constitution of national and state road safety boards with powers, increased penalties for traffic violations, addressing driver license and training issues, increasing accountability of road builders and vehicle manufacturers, higher and speedy compensation to accident victims are a few new inclusions to the act.

Few Indian states like Kerala have set up a State Road Safety Authority, while Karnataka and Gujarat are in the process of setting up such authorities.

Introduction of a new accident data collection and reporting format by MoRTH is expected to provide better quality data that can aid decision-making processes.

Directives from the Supreme Court and High Courts on a range of issues including implementation of stricter laws with regard to helmets, drunken driving, overspeeding, school safety, Good Samaritan Law, and mandating speed governors in public transport and heavy vehicles are all measures in the right direction and need strict enforcement on the ground. The feasibility of the recent directive on banning of alcohol outlets and sales within 500 meters of state and national highways is still being debated, considering its impact on economy and job losses.

Several guidelines by National Highway Authority of India and MoRTH on developing safer roads, including mandatory road safety audits, sets the right tone for safety improvements.

Few Indian cities have adopted technology for improving traffic management and road safety through use of breathalysers, surveillance cameras, speed monitoring cameras, etc.

There have been efforts to enhance and integrate ambulance services under a common easily accessible number all over the country through a variety of projects under public private partnerships.

The Ministry of Health has introduced several schemes such as recognizing emergency medicine as a specialty, developing state action plans, increasing manpower position, scaling-up technical resources under trauma care programme, and strengthening trauma care services on highways.

The pilot programmes on cashless scheme by Ministry of Health as well as state schemes like 'Harish Santhwana Scheme' in Karnataka as well as different schemes in other states are aimed at provision of timely care for RTI subjects and need further assessment.

The results and success of these schemes and several more that are in the pipeline rests on two critical factors:

The pace and process of implementation of these laws/ guidelines and standards at state, district, and city levels.

How well they are monitored and evaluated for impact.

MAJOR SYSTEMIC CHALLENGES FACING ROAD SAFETY

IMPEDIMENTS TO ROAD SAFETY IN INDIA

Based on a review of the current scenario, it is evident that there are several gaps in our understanding of road safety issues and challenges in implementing road safety programmes in India. The issues listed below, which are administrative, social, legal, technological, economic or political in nature, cause significant impediments to Road Safety in India.

- Lack of an administrative framework for Road Safety
- Absence of a lead coordinating agency that can govern, coordinate, fund, direct, support, implement, monitor and evaluate road safety activities
- Absence of a well-defined road safety action plans at national and state levels.
- Poor coordination between different ministries and departments
- Deficient human and technical resources to manage Road Safety
- Absence of dedicated funding mechanisms
- Lack of dedicated and targeted programmes
- Weak legislations that are further interpreted differently by states
- Poor level of enforcement amidst limited resources
- Little emphasis on safety of roads and vehicles
- Deficient trauma care services in terms of affordability, availability, coverage, and quality
- Minimal or gradually evolving rehabilitation services
- Absence of community engagement and participation
- Absence of monitoring and evaluation
- Lack of reliable data systems to guide evidence-based actions in road safety
- Greater emphasis on information to road users to be safe rather than measures to make them safe.

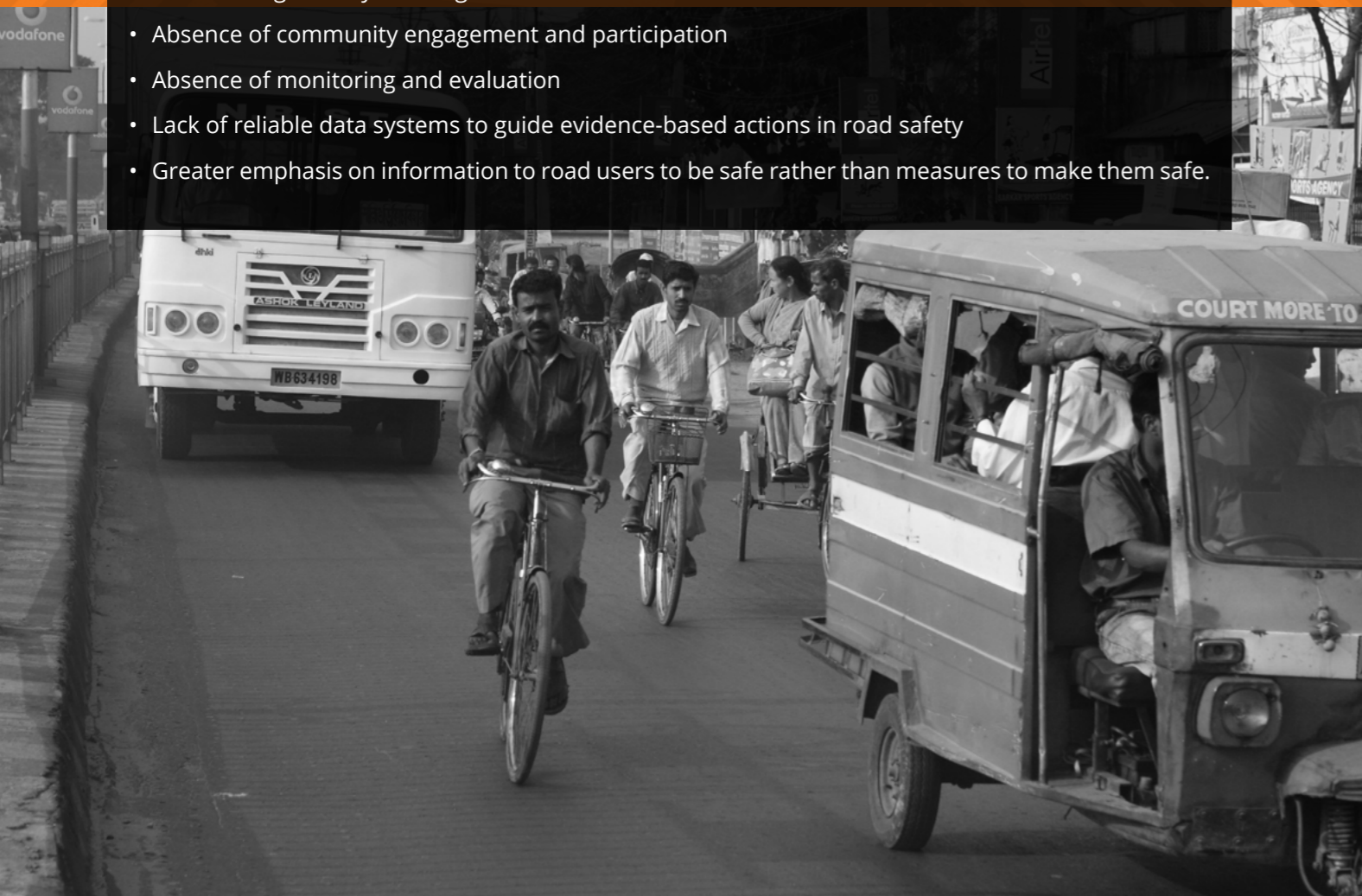


Studies indicate that, as compared to the official reports, the number of deaths are likely to be higher by nearly 20%, while serious injuries are underreported by more than 50%

RTIs are hugely underreported in India

For a variety of legal, social, economic and administrative reasons, RTIs and other injuries in official reports are highly underreported thus undermining the severity of the problem. Few Indian studies indicate the number of deaths is likely to be higher by nearly 20%, while serious injuries are underreported by more than 50% as compared to official reports. Data from WHO and the Global Burden of Diseases indicate the number of RTI deaths to be 16.6 and 20.7 per 100,000 population respectively in 2015. Pedestrian deaths and two wheeler deaths were grossly under-represented in national data (9.5%) as compared to 30-40% in other studies (26,54,55).

The situation with regard to nonfatal RTIs is worse in India. As per official reports, 4,82,389 persons were injured in RTIs in 2015 with a ratio of 1 : 4 between death and injury. As early as 2000, Gururaj et al revealed underreporting of serious injuries by more than 50%, confirmed by previous studies. The 5 years of Bengaluru Road Safety Programme showed the ratio of deaths to hospitalizations to minor injuries to be 1 : 30 : 70, while a population survey in Haryana indicated the same to be 1:29:69 (56). Based on the Bengaluru study, it is estimated that serious nonfatal injuries are approximately 50 million and minor injuries are being 120 million.



Road safety information systems in India are not robust and are disjointed in nature

Decisions in road safety are often made in an ad-hoc and disjointed manner in India, primarily due to lack of good-quality data.

As RTIs are considered medico-legal in nature, the primary responsibility of investigation, information collection, compilation, analysis and reporting rests with police. Several limitations exist as the data is collected by untrained personnel and reported on predetermined formats. Barffour et al, in a review of publicly available data, concluded that in police data sources, availability of data on safety performance indicators was 60 percent at both national and state levels. Furthermore, several inadequacies in quality of data ranging from misrepresentation of road user categories among deaths to lack of information on

risk factors has been observed (57).

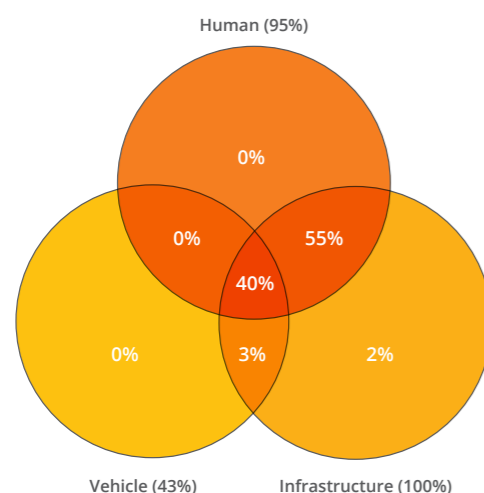
Glaringly, health sector data is nonexistent as surveillance and trauma registries are yet to be implemented at national and state levels. The existing hospital records, though elaborate on management of injured, does not have information on required aspects of road safety. Also, there is no uniform system for reporting to a centralized agency; no such agency exists. Most often, researchers have to set up data collection mechanisms for the limited period of study.

The police and hospital information systems are primarily implemented from a criminal and legal perspective and data required for road safety interventions from a public health perspective are often missing. It is hoped that the new accident recording and reporting formats introduced by MoRTH in March 2017 will improve the situation.

Road accidents are due to multiple causes

For a long time, it has been reported in many official reports and independent studies that nearly 80-90% of RTIs are predominantly due to human errors. Consequently, actions are proposed and undertaken to change or improve human behavior, but these have not resulted in any significant positive change. However, it has been increasingly realized that several factors linked to road, vehicle and transport environment along with human behaviours and practices interact in a complex way resulting in road crashes. Preliminary research undertaken by JP Research, India, in selected sample across a few locations indicate the interactive nature and multifactorial nature of road crashes; study undertaken on a small sample (n=81) based on crash analysis indicated the influence of human factors to be 95%, vehicle 43% and infrastructural factors as 100% in Kolkata (Figure 19) (19). Even though this complex interaction is well understood in HICs, efforts in this direction are just beginning in India and can only come from in-depth crash investigation and analysis, which is totally lacking in India.

Figure 26: Multifactorial nature of road accident causation



Source: Kolkata- study of 81 accident case analysis (JP researchers Pvt Ltd)

Several factors linked to road, vehicle and transport environment along with human behaviours and practices interact in a complex way resulting in road crashes

Regulation and Enforcement needs to be strong in implementation

Regulatory and Enforcement approaches like helmet legislation, seat belt legislation, drink driving speeding are some of key human behaviour related legislations that are in force in India but their enforcement is limited differentially across states and cities. In contrast to educational approaches, regulatory approaches yield quick and measurable results, but are subject to challenges in enforcement and long term sustainability.

Indian Motor Vehicles Act (MVA) of 1988 is the primary tool for enforcing road safety rules and regulations in India but enforcement of the several provisions in the act has been very weak in India

due to poor coordination between centre and state, human resource constraints, lack of training, multitasking by enforcement officials, neglect of safety by public, limited use of technology, faulty or misinterpretation of laws, ineffective penalty levels, delayed judicial reaction, corruption and others. Some of the recent initiatives like Good Samaritan Law, banning sale of alcohol within 500 meters on all national and state highways to curb drinking and driving, mandatory installation of speed governors in public transport and heavy goods vehicles require good implementation on the ground. The most recent amendment to Indian Motor Vehicles Act is promising, and once passed by both houses of Parliament, needs strict implementation by all states covering urban and rural areas, including all highways.



Coordination among stake holders and convergence of actions is critical to end Chaos on roads and to avert the Crisis

As different stake holders and agencies work independently without convergence, there is a lack of coordination among different road agencies in India. Lack of well-defined road safety policies and programmes at national and state levels have

slowed the pace of road safety activities. Some Indian states have drafted their individual policies and these are not strong enough to guide road safety activities. For several years, the National and State Road Safety Councils have existed in India as advisory bodies. The Indian Motor Vehicles act of 1988, with amendment in 2002 and smaller individual changes to the Act in an ad-hoc manner, has been the primary tool for enforcement of road safety regulations, and a comprehensive road safety legislation has been lacking.

CHARTING A WAY TOWARDS SAFER ROADS

Road accidents are predictable and preventable

Road accidents have a complex phenomenology as indicated by the Haddon’s matrix depicting the inter linkages between human, vehicles and the road environment as well as the possible actions that can be undertaken during pre-crash, crash, and post-crash periods to implement injury prevention and care interventions (Table 3) (58). Thus, RTIs are no more a matter of chance alone but occur due to complex interplay of risks in human behaviour, road and vehicle conditions, and are accentuated further by systems that govern these components. Global

Table 3: Haddon’s Matrix

Phase		Factors		
		Human	Vehicles and Equipment	Environment
Pre-crash	Crash prevention	Information Attitudes Impairment Police Enforcement	Road worthiness Lighting Braking Handling Speed Management	Road design and layout Speed Limits Pedestrian facilities
Crash	Injury prevention during crash	Use of restraints Impairments	Occupant restraints Other safety devices Crash protective design	Crash protective road side objects
Post crash	Life sustaining treatment	First Aid skills Access to medics	Ease of access Fire risk	Rescue facilities Congestion

RTIs are no more a matter of chance alone but occurs due to complex interplay of risks in human behaviour, road and vehicle conditions accentuated further by systems that govern these components.

experience of nearly 5 decades has clearly demonstrated what works, what does not work and what efforts have limited impact on road safety. The recommendations of the World Report on Road Traffic Injury Prevention (58) and the Commission for Global Road Safety (59) forms the basis of all road safety activities. Evidence-driven scientific management of road safety issues to plan, develop and implement activities in each country is supported in number of ways with several guidelines and best practice manuals by WHO (<http://www.who.int/roadsafety>). Alongside, many countries, organizations, and road safety practitioners have tried several interventions to understand what works in what manner and at what cost, and their experiences have paved the way for further improvements. The success of these approaches is visible in many HICs around the world. Countries like Sweden, The Netherlands, Australia and others are moving towards ‘Vision Zero’ approaches.

Road Safety is a global priority

Beginning with the World Report on Road Traffic Injury Prevention by WHO in 2004, road safety began to be considered as a serious health problem in many countries of the world including India. The United Nations, launched the ‘Decade of Action for Road safety 2011-2020’ to bring in a global focus and by encouraging countries to follow a scientific and evidence-based pathway to address road safety. The “Global plan for the Decade of Action for Road Safety 2011-2020” has a defined a target to reduce road deaths by 50% in all countries (with a base year of 2010) by 2020 and provides information on evidence-based interventions to be adopted by all member countries. The Sustainable Development Goals, which include goals of reducing road deaths and creating safer transport environments (60), to be achieved by 2030 by all countries has further boosted this movement.

SUSTAINABLE DEVELOPMENT GOAL 3

Ensure healthy lives and promote well-being for all at all ages:
3.6. By 2020, halve the number of global deaths and injuries from road traffic accidents.

SUSTAINABLE DEVELOPMENT GOAL 11

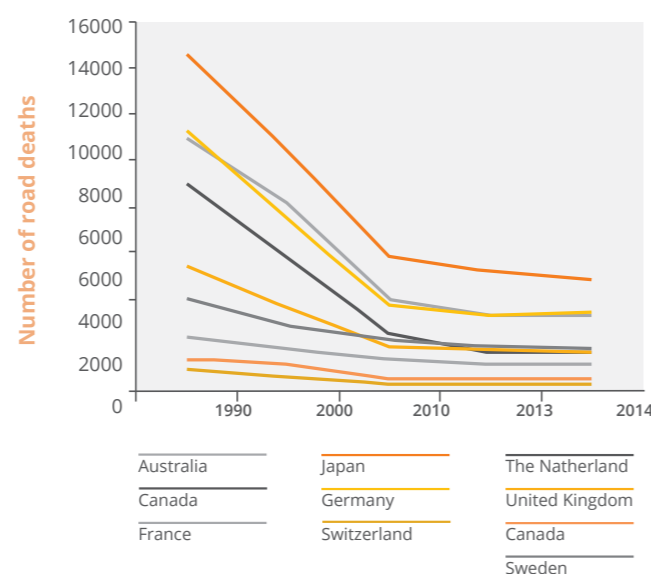
Make cities and human settlement inclusive, safe, resilient and sustainable:
11.2. By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

Success in road safety is visible across the globe

Evidence from HICs clearly indicates that road deaths and injuries are predictable and preventable through well-organized and coordinated road safety programmes. By adopting public health programmes and safe systems approaches, most HICs have reduced accidents and fatalities since 1970s. This success is largely attributed to a number of political, economic and social factors, some of which are listed below:

- Political will to reduce deaths and injuries
- Well-defined road safety policies spanning the sectors of transport, health, education and enforcement
- A national lead agency to implement activities in coordination with different sectors
- Integrated approaches to tackle multifactorial causes and risks
- Strong and implementable road safety action plans
- Intersectoral coordination and convergence of actions
- Increasing funding for road safety activities at national and sub-national levels
- Data-driven interventions
- Adopting or Adapting safe systems approaches
- Setting and working towards achievable and measurable targets
- Strengthening national and provincial legislations
- Scaling up enforcement mechanisms
- Strong advocacy and education campaigns through community engagement
- Systematic monitoring & evaluation of process and changes

Figure 26: Change in road traffic fatalities in select countries



Data is essential to devise solutions

Robust and reliable data is essential for road safety to guide all policies, programmes and interventions. In the era of evidence based public health systems, data plays a pivotal role to evaluate the need and effectiveness of solutions. Data that is currently available in India is based on police records and only cover indicators on burden and distribution of crashes, injuries and deaths with significant under-reporting. Data needs to include other components such as risk factors (alcohol use, speeding, helmet use, mobile phone use), road condition, socio-economic impact, trauma care systems, vehicle safety, and compliance to legislations; such data needs to be available on a single coordinated platform in a timely and reliable manner. Efforts to overcome these data challenges are in early stages.

- The Tamil Nadu Road Accident Reporting System has been collecting data using a standard format through hand held devices (61).
- The Ministry of Road transport and Highways has recently revised accident data collection formats in March 2017, but it needs to place systematic efforts in training the police personnel and strengthening of the crime bureaus to ensure timely compilation and reporting (62).

- Few examples from Bangalore, Pune, Hyderabad, Vishakhapatnam, and 3 districts in state of Karnataka under the World bank funded schemes such as the District injury Surveillance Programme in Tumkur and highway crash study in Kolar have implemented injury surveillance programmes using data extracted from police and hospital records (28,35).
- The Ministry of Health has recently established a National Injury Surveillance Centre in Delhi, which is expected to play a bigger role in data collection from health care institutions. (63).
- The feasibility of injury surveillance using autopsy data from mortuary centers has shown promising results and needs scaling-up to a larger level (64).
- In-depth crash investigation and analysis is undertaken across very few centers in India such as Transportation Research & Injury Prevention Programme and JP group.

Well proven and evidence-based interventions exist, but translating these to implementable solutions is the biggest challenge in India

Interventions that work

- **Presence of a lead agency** that can coordinate, develop, guide, formulate, fund, implement, monitor and evaluate road safety activities at national and state level. This agency needs to have requisite mandate, power, staffing and funding to drive all road safety activities.
- **Well drafted national road safety action plans** at national and provincial levels to guide states, road safety authorities and stakeholders to effectively implement and monitor road safety activities.
- **Setting national and state targets** to ascertain progress and to measure effectiveness of interventions.
- **Mandatory road safety audits** to monitor conditions of existing roads and bring in appropriate and feasible corrections to avoid crashes.
- **Shift towards mass public transport systems** which promise a decrease in direct exposure to travel environment, reduce congestion and reduce crashes.
- **Low cost road and vehicle engineering solutions** which improve safety.
- **Measures that control, restrict, and limit speeding** through a combination of road engineering and vehicle technologies such as traffic calming measures, speed cameras, speed governors, traffic signal lights, speed bumps, speed control devices etc.
- **Traffic separation** on all possible roads between speeding traffic and vulnerable road users
- **Mandatory helmet legislation covering both riders and pillions** and enforced in a uniform and visible manner with reasonably high penalties for violators
- **Mandatory drink drive laws** that promote checks and enforcement by police in a random, visible and uniform manner with reasonably high and stiff penalties
- **Mandatory ban on cell-phone use during driving** and enforcement to prevent driver distraction
- **Mandatory seat belts laws** for passengers seated in the front and rear of all vehicles of medium to high engine capacities.

- **Graduated driver licensing systems** for reducing crashes, especially among younger people
- **Enforcement of mandatory day time running lights** to improve vehicle visibility
- **Child restraints and booster seats** appropriate to age of children to reduce injuries and fatalities among children.
- **Pedestrian-inclusive road design**, access to walking and crossing facilities with enforcement to reduce pedestrian crashes and deaths.
- **Organized and coordinated trauma care systems** covering prehospital, transport, triage and tal care
- **Training of physicians in ATLS and paramedics in BTLS** to decrease mortality rates of trauma victims.
- **Community and institution based rehabilitation services** to reduce post-crash disabilities
- **Passive countermeasures or automatic protection** to reduces active participation by road users
- **Legislation and enforcement supported by community acceptance and engagement**

Interventions that have limited impact

- Mere education and awareness campaigns without change in road or vehicles or systems has not been impactful
- Education of children and school road safety programmes has shown mixed results with increase in knowledge that may or mot get converted to actual reduction in deaths and injuries
- Campaigns without a defined target and a fixed outcome with limited reach are ineffective.
- Post license driver education to follow safe road behaviours has not been found effective
- Building roads without embedded safety features can be riskier from a safety point of view
- Mere presence of a legislation and token enforcement that has limited coverage has also not yielded positive results.

Safe systems approach is the need of the hour

The “Safe System” approach that has gained momentum in recent years aims to develop roads and transport systems considering human vulnerability (66). Substantial evidence from HICs indicates that adopting a ‘safe systems approach’ helps to reduce accidents, injuries and deaths.

The principles of safe system approach are

- Recognition of human error in the transport system
- Recognition of human physical vulnerability and limits
- Promotion of a shared responsibility
- Promotion of ethical values in road safety.
- Promotion of a systems approach

Figure 27: Safe systems approach (65)



Substantial evidence from HICs indicates that adopting a ‘Safe Systems Approach’ helps to reduce accidents, injuries and deaths.

Source: Powered two- and three-wheeler safety: a road safety manual for decision-makers and practitioners. Geneva: World Health Organization; 2017.

The broad foundation and pillars of safe system approach are based on the understanding that Safe systems recognizes that ‘to err is human’ and this needs to be considered to reduce crashes and deaths by ensuring safety in roads, vehicles, human behaviour and overall road safety environment. This approach addresses all determinants that make roads, road use and vehicles safer to humans as well as promote safe road behaviour among road users.



FIVE PILLARS OF ROAD SAFETY

The UN Decade of Action for Road Safety recommends member countries and international agencies to implement many activities at international, national and sub-national levels as per the five pillars of road safety which refer to road safety management, safer road infrastructure,

safer vehicles, safer road users and post crash care systems. Several guidelines and reference materials are available globally on each of the pillars and India needs to identify best practices and mechanisms for implementation.



INTERNATIONAL COORDINATION
STRENGTHENING GLOBAL ARCHITECTURE
FOR ROAD SAFETY

Road safety management

Road safety management refers to systematic management of road safety activities like creating enabling political, financial, legislative, legal, regulatory and institutional environments for road safety. It also implies developing systems for implementing, monitoring and evaluation of road safety activities. Road safety in India is implemented by 15-20 ministries and departments at central and state levels (Transport, police, health, welfare, law, industry etc). No single agency or authority exists in India for road safety. This has led to limitations in uniform implementation of road safety activities across the states as they differ widely in socio-political-economic development. Hence, there is a great imperative to establish strong road safety management institutional mechanisms.

Safer Road Infrastructure

Safe infrastructure refers to establishing safe roads and transport environments through combined measures (engineering and public health) that permit mobility by eliminating or reducing barriers and risks in the road environment (63). The standards and guidelines for safe road development in India are provided by Indian Road Congress, Indian Road Research Institute, Bureau of Indian Standards, National Highway Authority and other agencies. With absence of regular road safety audits in national and state level, ensuring safe roads is a huge challenge.

Safer Vehicles

Safer vehicles refers to incorporating better safety features in the design and manufacture of vehicles. Due to lack of well-defined national guidelines, technology constraints, issues in technology transfer, vehicle safety has lagged behind. Safety standards in many vehicles, especially two wheelers, autorickshaws, tempos, public transport vehicles etc., in India are evolving and have Infrastructure Safe vehicles Road user behaviour Post crash care various shortcomings compared to HICs. Updated and uniform specification of minimum safety standards for each category of vehicle coupled with strict enforcement at all levels is the need of the hour.

Safer Road Users

The concept of safe road users revolves around bringing about a behavioural change to accept safe practices using comprehensive programs and multiple approaches, thereby decreasing their vulnerability. In India, all national reports (MoRTH, NCRB) and a host of independent studies indicate that human errors account for >80 % of accidents. Many educational and awareness programmes are conducted but not in a systematic manner, and hence the impact of such efforts is unclear. A combination of strong legislations, strict enforcement, effective public awareness, use of technology is required to improve behaviour of road users.

Post Crash Systems

This pillar of road safety aims to increase responsiveness to post-crash emergencies and improve the ability of health care systems to provide appropriate emergency treatment and longer term rehabilitation for crash victims. In India, trauma care systems are yet to develop fully across the country and are more of an urban phenomenon; now spreading to districts. In contrast, trauma care systems in HICs are driven by centralized and coordinated systems that focus on quality and timely access to trauma victims. Trauma care in India needs to be responsive and inclusive and should be focusing on different levels of health care system along with engagement of private sector to provide timely care as well as to reduce costs.

NEED FOR AN IMPLEMENTABLE FRAMEWORK FOR ROAD SAFETY IN INDIA

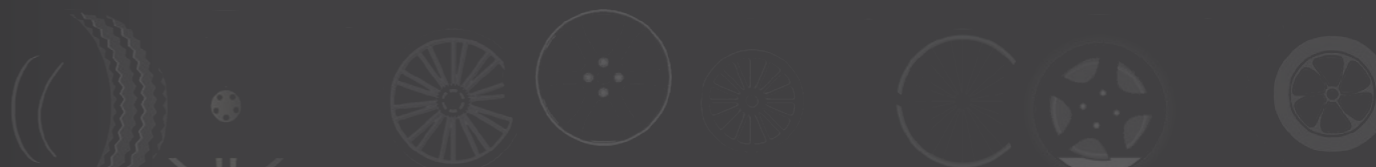
The wide ranging discussions and debates about road safety in India point to a strong need for data-driven and implementable mechanisms within a framework for road safety. Such a defined framework can bring together policy makers, build consensus among administrators and political leadership, aid data driven programmes, help prioritization of activities, improve public engagement and convergence of actions, all of which are considered key elements for success in road safety.

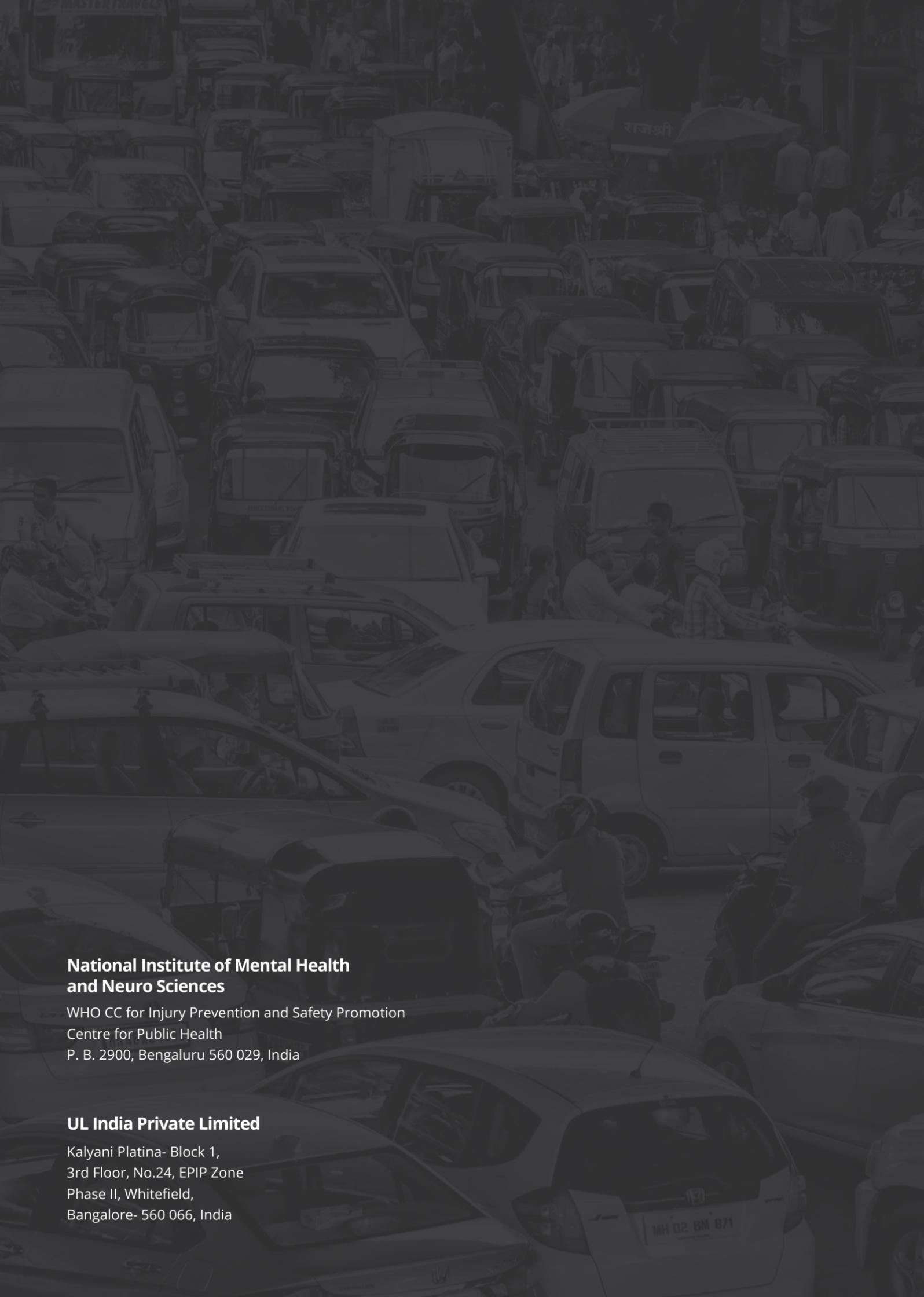
India being a federal state, the roles and responsibilities in road safety is the shared responsibility between centre and the state. Hence, there needs to be a framework for activities at the central level with corresponding activities at the state level. Most significantly, as health, transport and safety, including road safety, is the direct responsibility of Indian states, the need for such a framework at the state level is critical and essential. Furthermore, implementation of many activities in road safety needs to be seen across 624 Indian districts with well-coordinated strategies. This requires strong institutional mechanisms with an investment by governments and international agencies in road safety. As there is no single solution that works for all; a wide range of activities are required to strengthen road safety at national and state levels. Within a defined framework, prioritization of activities should be considered at the highest level by concerned authorities based on global understanding, evidence available, existing expertise and capacity, required finances, and current administrative and legislative framework. Since safety should be an essential component of India's growth in coming years, "Safety and Mobility" should be the focus in the interest of road users. This can only happen, if road safety is recognized as science and given importance in the coming years.

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