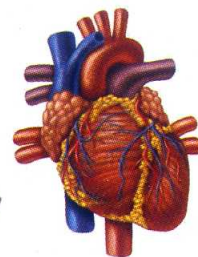
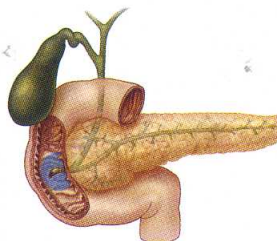
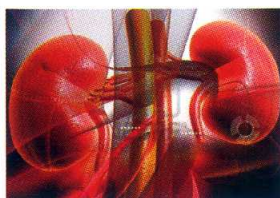


Academic Wing of the Association of Physicians of India
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Non-Communicable Diseases in India: Burden & Prevention 2013



Editor
Ashok Kumar Das

ISBN No : 978-1-62154-618-4



Non-Communicable Diseases in India: Burden & Prevention 2013

" A broad mind, a generous heart, an unflinching will, a quiet steady determination, an inexhaustible energy and a total trust in one's mission – this makes a perfect doctor."

The Mother
Sri Aurobindo Ashram, Pondicherry

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Ashok Kumar Das

ISBN No : 978-1-62154-618-4

Road Traffic Deaths, Injuries and Disabilities in India: Public health burden and impact

G. Gururaj

Professor and Head
Department of Epidemiology
WHO Collaborating Centre for Injury Prevention & Safety Promotion
National Institute of Mental Health & Neuro Sciences
Bangalore – 560 029, India

Email : epiguru@yahoo.com and guru@nimhans.kar.nic.in

Key words:

Road traffic injuries; Mortality; morbidity; Disability; Road safety management; prevention; trauma care; rehabilitation; policies and programmes

Summary

An estimated 1, 60,000 persons (1, 33,938 as per official reports) died due to road crashes in India in 2010. Millions were hospitalized and thousands ended up with disabilities. Loss of a bread earner or a source of support is irreparable for the affected families. Nearly 80 % of these deaths and injuries occurred among young people in productive age groups and predominantly men. Pedestrians, two wheeler riders and pillions and cyclists were the major categories among deaths and injuries. Brain and upper / lower limbs were commonly injured. The economic loss due to road crashes is an estimated INR.55, 000 crores or 3 %of GDP (at 2004 prices) every year. The psychosocial suffering of people has been huge and difficult to quantify even with advanced research methodologies.

Global experience reveals that road crashes are predictable and preventable. It requires developing safe roads, safe vehicles and, most importantly, making people safe in transport environments. Strong and sustainable mechanisms needs to be developed for prevention, trauma care and rehabilitation through institutional approaches. There is need for strong road safety policies and programmes, a lead agency to coordinate activities, capacity strengthening, human resources, dedicated funding, strong advocacy, implementing scientific interventions, along with monitoring and evaluation. The 4 'E's of Engineering, Enforcement, education and Emergency care needs to be addressed through an intersectoral approach to achieve good results. Health sector and professionals need to take leadership role for preventing road crashes, developing trauma care systems and implementing rehabilitation schemes. Road deaths and other injuries in India are publicly glaring, while road safety is professionally lacking and politically missing. Developing and implementing strong road safety programmes in India needs a change in 'mindset' by moving from 'reactive approaches' to 'proactive approaches'.

Introduction

Indian society is passing through major epidemiological transition, demographic changes and societal transformation since the last 2 decades. The rapid urbanization, industrialization, globalization and migration along with other changes have resulted in motorisation with increasing number of vehicles on Indian roads. This increasing motorisation in the absence of clearly defined road safety policies and programmes has been responsible for increasing number of road deaths and injuries. The problem is likely to increase and situation will worsen, if, road safety is not given urgent priority.

Apart from Road Traffic Injuries (RTIs), motorisation and urbanization are also linked to other health problems. In India, NCDs and injuries account for more than 3/4th of deaths and disabilities (Patel et al, 2011). Greater reliance on motorized travel has reduced walking and cycling, thereby contributing for greater occurrence of obesity and related NCDs. Increasing air pollution has resulted in higher numbers of respiratory diseases and noise pollution is resulting in more numbers of auditory problems. The larger effects of motorisation are also linked to major environmental changes. The increased stress of driving leads to increasing occurrence of stress related disorders like hypertension, diabetes, anxiety, depression, alcohol abuse and other health conditions.

Motorisation and transportation patterns

The country's population increased from 846 million in 1991 to 1.21 billion in 2011 (1990-2010) (<http://pib.nic.in/newsite/erelease.aspx?relid=67672>). Nearly half of India's population is in the age group of 15-59 years, with children and elderly constituting 42% and 7%, respectively. Only 30% of India's population lives in urban areas and is expected to reach 473 million in 2021 and 820 million by 2051. The total road length in India is approximately 3.3 million kilometers with national high ways accounting for ~ 70,548 kms (MORTH, 2009). The national highways passing through millions of villages account for only 2% of total road

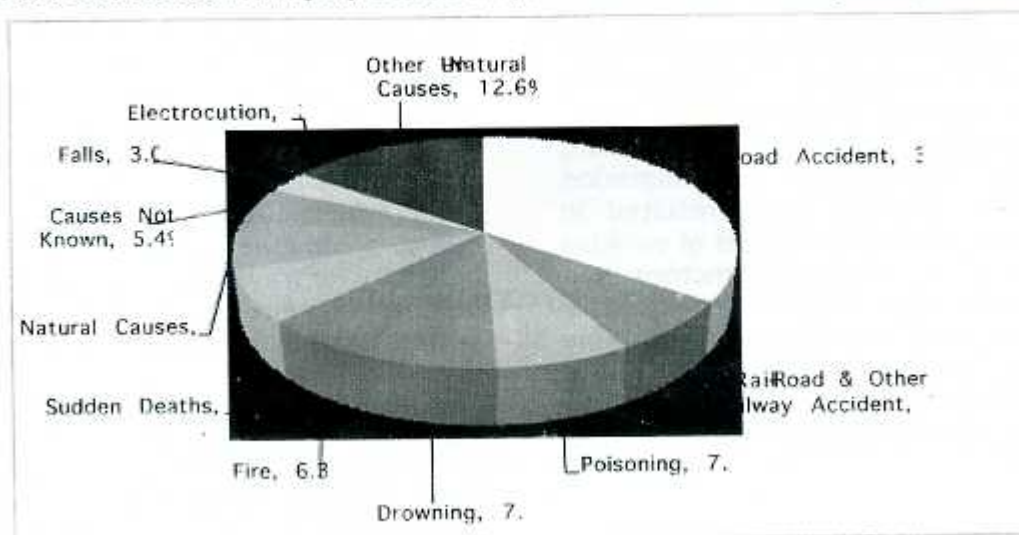
network, nearly 40% of transport of goods and approximately 40 % of road deaths . The total number of vehicles increased by 3 fold from 37 million in 1997 to 114 million by 2010 with 2 wheelers alone accounting for 73 % of total registered vehicles. The annual average growth rate for cars and two wheelers is about 10 % in India (MORTH, 2009). The rapid motorisation is due to a combination of factors like increasing necessity for travel, easy availability, increasing purchasing power, poor public transportation systems and inability to afford cars.

The road use patterns are influenced by a variety of social, economic, cultural attitudes and practices. The road user behaviour is a product of factors like age, gender, socioeconomic status, education, occupation, travel needs, transportation mode and others (apart from his/her knowledge, attitudes, beliefs and practices). It is also influenced by the prevailing systems, safety regulations and norms along with importance given for safety, and thereby to people's lives. Studies reveal that personal modes of transport are more than 80 % in some cities studied, while public transport has been <1% of total traffic at peak hours (Mohan D, 2004). Independent studies reveal that pedestrians, two wheelers and public transport vehicles are in large numbers on both urban and rural Indian roads (World Bank 2005 , BATF 2005, Gururaj G 2006 and Mohan D 2004). A high proportion of travel in India is by walking, cycling or on two wheelers, as still majority cannot afford cars .

Burden of Injuries

In 2010, nearly 6,00,000 persons died (accidental - 3,84,649 persons ; suicides - 1,34,218 ; other violence - 41726) due to injuries with nearly 70 % of these occurring in less than 45 years, and among men(NCRB 2010) . Considering underreporting, it is estimated that a million deaths occur annually due to injuries in India (Gururaj 2005).Among accidental deaths, RTIs contributed for 35 % of total deaths (Figure 1). An increase of 50 % was noticed during 2000 – 2010 and 8 % compared to 2009 with a national injury mortality rate of 52 / 1, 00,000 population per year.

Figure 1: Distribution of injury deaths as per external causes of injuries, NCRB, 2010



Health burden of RTIs

Globally, RTIs contribute for over 1.2 million deaths and more than 50 million hospitalisations (WHO, 2004). In India, 1, 61,736 persons died and 4, 75,000 were injured in transport

accidents during 2010 as per official reports; 82 % of deaths being due to RTIs. RTIs increased by 61% during the decade and 2.1% as compared to 2009. The trend of fatal RTIs reveals that RTIs increased from 43,005 in 1980 to 1,34,000 by 2010 (figure 2a & 2b).

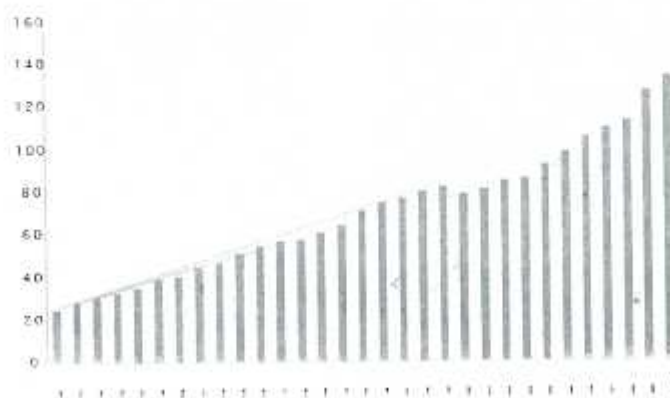


Figure 2a: Trend of road traffic fatalities, 1980-2010 (,000s)

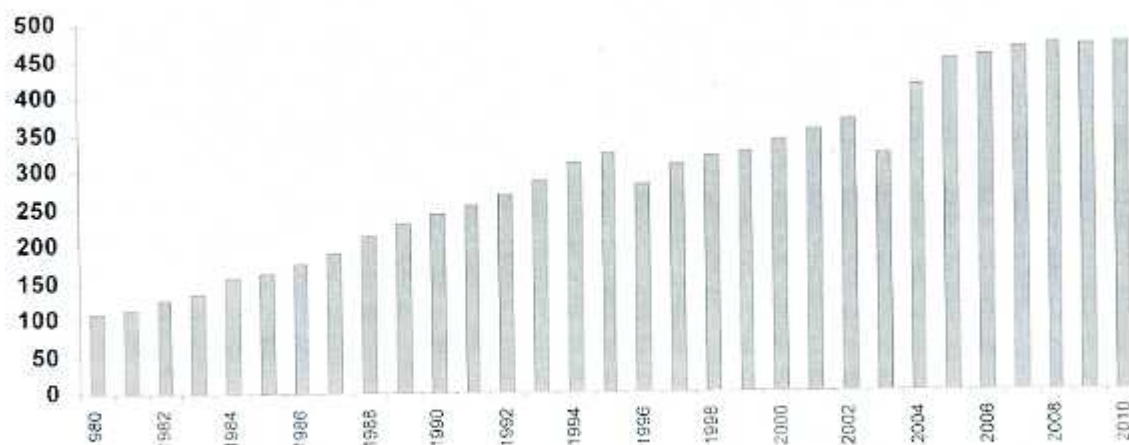


Figure 2b: Trend of road injuries, 1980-2010 (,000s)

Between 1970 and 2010, the number of crashes increased by 4 times, with more than 7 fold increase in injuries, 8 fold increase in fatalities against the backdrop of about 64 fold increase in vehicles and 3 fold increase in road length (MORTH 2009 and NCRB 2010). The RTI mortality rate in India for 2010 was 110 / million population and 1200 / million vehicles per year.

Non-fatal RTIs

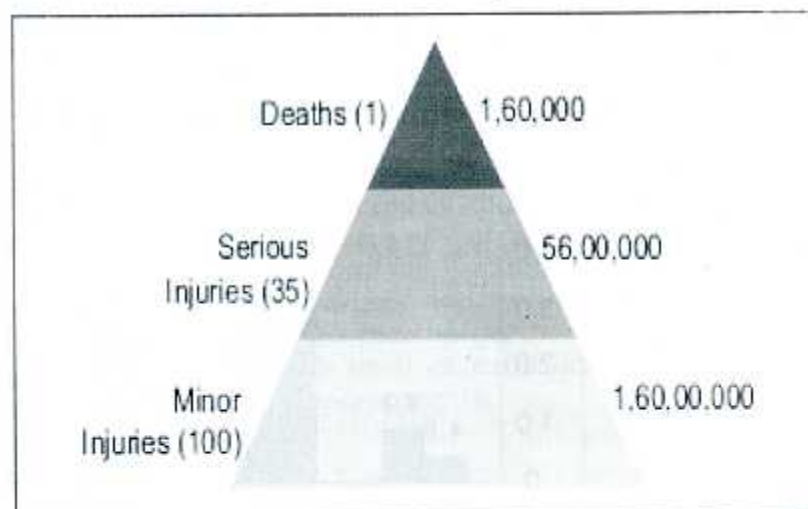
Deaths are only the tip of the iceberg in road crashes. For every death, nearly 30 to 50 persons are hospitalised and 100's seek emergency care for minor injuries. The Bangalore road safety and injury prevention programme (BRSIPP) showed that while 5667 non fatal injuries were reported to the police, 26862 persons were registered in just 25 hospitals of the City in 2009 (Gururaj et al 2010). The ratio of deaths: hospitalisations: minor injuries were 1:35:100. The programme revealed that 25% of emergency room registrations, 10% of admissions and 20% of deaths were due to injuries. RTIs in particular, contributed for 9% of casualty registrations, 3.5% of hospital admissions and 7.5% of deaths. Several other Indian studies have revealed that RTIs alone accounts for nearly 1/4th of emergency room registrations. The incidence of non fatal RTIs in Hyderabad was estimated to be 207 per 1000/year. Verma and Tiwary in Delhi noticed that 31% of injuries were due to RTIs (Dandona et al 2008). Varghese and Mohan (2003) reported

the ratio between critical, serious and minor injuries to be 1:29:69. Thus, the number of persons hospitalised in India could vary between 8 - 10 million (minor injuries among 16 - 20 million) and are difficult to estimate in the absence of nationwide hospital based studies.

Underreporting of RTIs and injuries

Road deaths and injuries are underreported due to a number of reasons. The actual number of road deaths and injuries in India could be much higher than official numbers due to underreporting (Panel 1). The study in Bangalore reported that road deaths and injuries are underreported by 5-10% and more than 50%, respectively (Gururaj et al, 2000). A population survey covering 20,000 households and 96,000 individuals from urban and rural Bangalore reported an annual RTI mortality rate of 240/million population, much higher than the figures reported by police statistics (Gururaj and Suryanarayana, 2004). Dandona et al (2008) from Hyderabad city, reported RTIs related mortality rates of 380 / 1,00,000 (95% CI: 17.5-58.8) and observed that RTIs were three times more than the officially reported figures. Three of the recently completed verbal autopsy injury studies have also indicated the higher occurrence of injuries (Singh RB et al 2005, Gajalakshmi and Peto, 2007 Joshi R et al, 2006). In view of these observations, the actual number of RTI deaths is estimated to be in the range of 1, 60,000-1, 75,000 (Figure 3).

Figure 3 : India RTI pyramid, 2010



With current situation prevailing, it is estimated that globally, road deaths will move from the current 9th position to the 5th position as the leading cause of death in the years to come. In India, two of the estimates predict that nearly 250,000 persons will die due to road crashes by 2030, if urgent measures are not implemented (Kopits and Cropper 2003, Mohan D 2010).

Impact of RTIs

With decline of communicable diseases, RTIs and other injuries will be major causes of disabilities in India. Disabilities due to RTIs result in poor quality of life and limitation in activities of daily living among survivors depending on the extent, nature and severity of injury. Data indicate that nearly 1/3 of the disabilities in India are due to injuries with ¼ of these being due to RTIs (Gururaj 2006). The Bangalore TBI study showed that 18% of hospital discharged brain injured persons had disabilities affecting information processing, speech, memory and activities of daily living, at the end of two years (Gururaj et al 2005). In Hyderabad, Dandona, et al estimated the disability rate due to RTIs rate to be 35 per 100000 (Dandona et al 2008).

The economic losses globally are estimated to be \$ 518 billion per annum and \$ 65 billion in low and middle income countries (WHO 2004). Recent estimates from Ministry of Transport indicate the losses to be around 3% of GDP per year (MORTH 2009). Mohan D (2004), in a review of RTIs in India, estimated the annual economic losses to be approximately Rs. 55000 crores every year (at 2004 prices). A hospital based study indicated the median expenditure of hospital stay for injury patients was Rs. 40000 with 68% of inpatients spending between Rs. 25000 – Rs. 100000 from their pocket (Pallavi 2010).

Majority of road crash victims in India also belong to poor and middle income households.

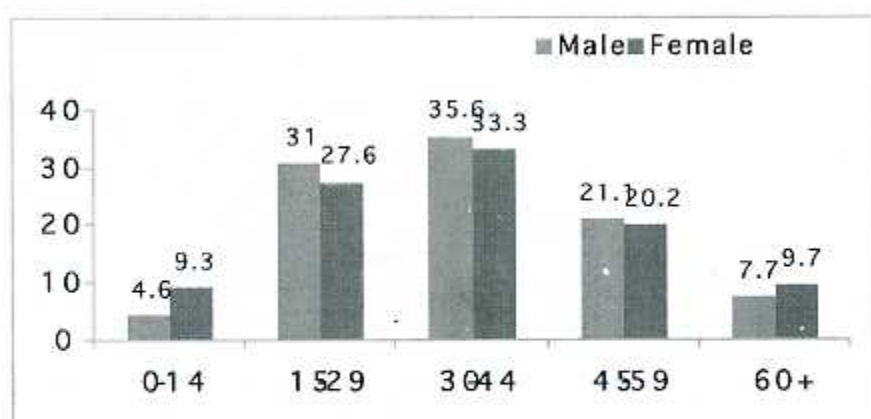
Studies from Bangalore and Hyderabad (Gururaj and Suryanarayana 2004, Dandona et al 2008) have shown that poor people have greater exposures and thereby more likelihood of crashes as they are unprotected in road environments. Further, they also have limited or no accesses to quality trauma care since they cannot afford higher costs, especially in the unregulated private sector.

The social, psychological and emotional impact of RTIs is also huge, apart from the fact that the pain and suffering are difficult to measure. Loss of schooling, work, family leisure activities are all difficult areas to quantify. The brain injury study at NIMHANS showed that 14% of children and 18% of workers could not attend school and jobs, respectively, for more than 6 months (Gururaj et al 2005). Nearly 10-15% of children missed school for longer periods of time after an injury. Nearly 1/3 of rural and 20% of urban employed persons could not return to their previous jobs after a road crash. Nearly 50% of the families had made heavy loans, sold assets, or pawned their belongings to meet financial needs after the crisis (Aeron Thomas 2004).

Age and Gender

All studies in India including NCRB data conclusively prove that the ratio of males: females are in the ratio of 4:1. NCRB data indicate that nearly 5.3 % of fatalities were in children less than 14 years and 65 % of deaths occurred in 15-44 years (Figure 4).

Figure 4: Distribution of RTI deaths as per age and gener (%), 2010

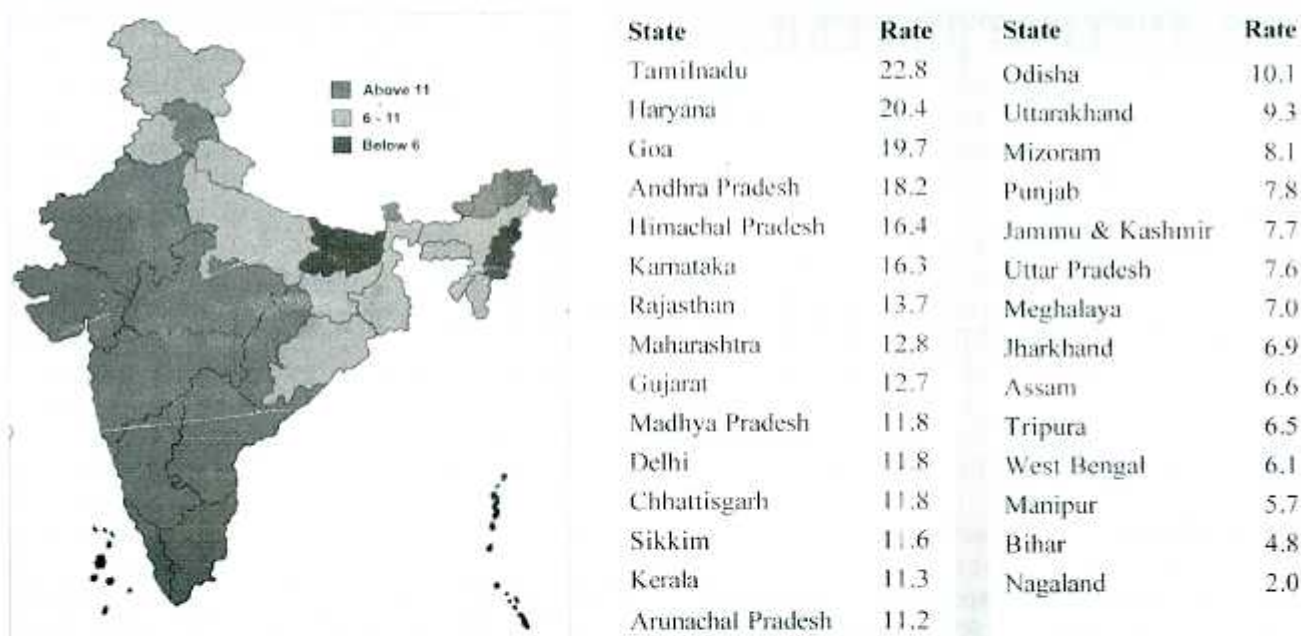


RTIs across Indian States and cities

There is significant variation in the number of deaths and injuries across Indian states, districts, and Cities. Indian states and cities that are motorizing rapidly and with reasonably good economic growth are also registering increasing road deaths due to absence of accompanying

safety policies and programmes (Figure 5). Nearly half of road deaths are reported from the states of Andhra Pradesh, Maharashtra, Tamil Nadu, Kerala and Uttar Pradesh. In 2010, Indian cities with population of more than one million contributed for 14% of total RTIs deaths, with the rest occurring in emerging grade B cities or rural areas (NCRB 2010).

Figure 5: State wise distribution of RTI deaths in India 2010 (Normal average 11.5/100,00 population)



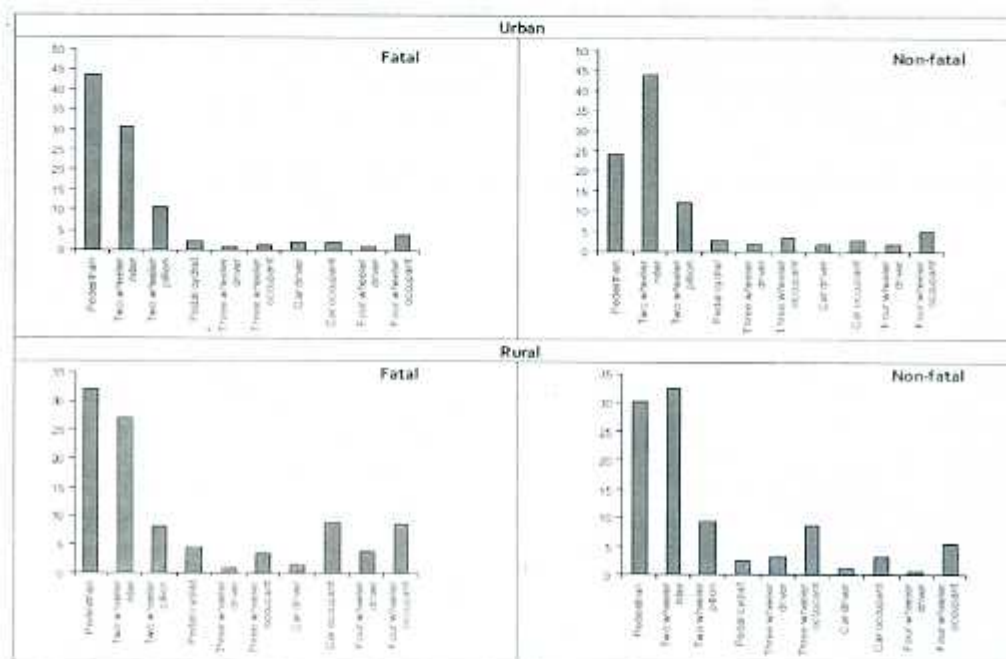
Indian Highways

National highways, contribute for 2% of total road net work, carry 40% of total traffic and contribute for 30-40 % of fatalities. In 2009, national highways accounted for 29% of total crashes and 36% of deaths, while state highways contributed for 26% of total crashes and 28% of deaths (MORTH 2009). Data from BRSIPP indicate that 28% of RTI deaths were due to crashes occurring on highways, while the rural data indicate 50% of deaths to be on the state highways (Gururaj et al 2010). Several factors contribute for increasing number of highway related deaths that are based on nature of vehicles, type of roads, movement of people, presence of traffic generators, visibility issues, speed differentials, and other factors.

Vulnerable road users

In sharp contrast to the situation in the high income countries, pedestrians, two wheeler riders and pillions, and cyclists account for nearly 80% of those killed and injured on Indian Roads. Data from three years of the BRSIPP showed that 75 to 85% of injured and killed were in the above mentioned categories (Figure 6) (Gururaj et al 2011). This is in accordance with data from individual studies and at variance with data from official reports (colliding vehicle is included and not the injured). The involvement of pedestrians and two wheelers are directly related to their larger numbers in the society and high level of exposure in heterogeneous traffic environments.

Figure 6 : Distribution of road user categories in fatal and nonfatal RTIs, urban and rural Bangalore, 2008-10.



Injury patterns

Data clearly indicate that nearly 60 % of brain injury deaths are due to RTIs with fractures of upper and lower limbs being extremely common (Gururaj et al 2005, 2010). Injury to vital parts can result in sudden death with common reasons being hemorrhage and shock along with sepsis. Data from 3 years of BRSIPP showed that 30-35% of deaths occur at crash site, 10-20% en-route to hospital, nearly 50% in the hospital and few after discharge from hospital due to late complications.

Understanding road crash mechanisms

Road crashes are complex events that occur due to interaction of human beings, vehicles and the road environment. The collision between man, vehicle and objects results in generation of energy that is transferred to the human being, and when this exceeds the body threshold, it results in damage to one or more organs. The Haddon matrix developed in 1970s provides a frame work for understanding the role and involvement of person, vehicle and the environment before, during and after the crashes (Haddon 1968). The public health approach in the health sector helps in understanding the magnitude of the problem,

identification of the risk factors, guiding development of appropriate interventions and examining whether implemented interventions can work effectively (Mohan D 2006). The safe systems approach has shifted the emphasis from addressing individual components to developing safe systems that accommodate human vulnerability and fallibility. This recognises that developing systems is crucial to see that crashes do not occur, and even if it occurs, results in no or minimal damage. It recognises the need for making traffic environments less hazardous with the overall focus being safe roads, safe vehicles and safe people (WHO 2010).

Causes of road crashes in India

Despite a greater understanding of the mechanisms of road crashes, it is still considered by many as 'accidents', implying that causes are unknown and no action can be taken. The increased risk of occurrence of road crashes is directly related to the probability of an event in the presence of risk factors or absence of protective factors. In many of the official reports, driver faults, carelessness and rash- negligent driving are reported as causes in more than 90% of fatal crashes. The world report on Road

Traffic Injury prevention has identified several factors that influence exposures to risk, crash environment, determine severity and those that influence severity of post crash. In India, the precise contributing factors for road crashes are not known due to absence of good quality multidisciplinary research. However, some of the recent studies indicate the following factors to be responsible for road crashes (Gururaj 2006 and 2011, Mohan D 2004).

- The contribution of different road types and conditions are not clearly known in India. However, it is clear that roads favoring higher speeds and excessive speeding by drivers are a major cause for majority of the fatal deaths and those resulting in serious injuries.
- Despite the proven effectiveness of helmets, many Indian states are yet to notify helmet legislation. Even in Indian cities with helmets laws, it is only partial covering only the rider, and visible only in central urban areas. Data from Bangalore indicates that only 50% of the riders 10% of pillion wear proper helmets indicating the poor status of enforcement.
- Even though seat belt laws are included in the Indian motor vehicles act, most of the cars do not have seat belts; even when it is present, people do not use them. Observational survey in Bangalore revealed that only 27% of drivers were wearing seat belts.
- Alcohol increases the risk of deaths and injuries by affecting vision, coordination, reflexes, judgement and decision making. With increasing availability of alcohol and vigorous promotion by the industry, increasing number of people are driving under the influence of alcohol on Indian roads. Studies have shown that nearly 1/3 of the crashes occur during night time and a 3rd of these are related to alcohol.
- With nearly a third of road crashes occurring during night time, visibility of people, vehicles and dangerous situations on roads are important associated factors for road crashes. Data is not available in this regard in India.
- The presence of large number of pedestrians on roads, their small size and poor visibility makes them highly vulnerable for road crashes. Collision of pedestrians with heavy vehicles like buses and trucks results in instantaneous death or severe injuries. Lack of pedestrian

facilities like safe footpaths, walking and crossing spaces and failure of people to use the same even in the presence of such facilities makes them highly vulnerable for crashes.

- Trauma care is a determining factor between a crash and a death. In India, trauma care is more an urban phenomenon and large parts of rural India do not have access to quality trauma care. Studies have shown that lack of first aid, absence of triage, improper referrals, delays in transportation, lack of facilities, absence of man power in hospitals, failure to reach a definitive hospital and lack of preparedness of hospitals contribute for poor outcomes in crashes.
- Nearly, half the patient's discharged alive from hospitals require short term and long term rehabilitation services. However, this discipline is yet to develop in a systematic way in the Indian region due to lack of awareness, manpower, facilities and coordination.

Strategic approaches for road safety

Road safety management is complex and challenging and requires a vision, mission, and focus with political commitment and scientific approaches. Like all programmes, road safety needs to have policy, programme, goals and objectives, structure, coordination, funding, implementing strategies, monitoring and also evaluation. It requires a dedicated agency to guide, coordinate, implement, monitor, fund and evaluate to implement road safety (ERSO 2006, WHO 2004). Road safety policies, human and financial resources, advocacy, dedicated and targeted programmes, capacity building of policy makers, scientific choice of interventions, and others are to be implemented. Undoubtedly, data and research form the corner stones on which road safety needs to be built. An intersectoral approach is the key to interventions with judicious combination of education, enforcement, vehicle and road engineering and emergency care. Trauma care should be seen as a continuum of activities aiming at getting the injured person to the right place at the right time for the right treatment. Rehabilitation needs to start from the time of patient being in the hospital till he is returned to optimal states of functioning. Some of the important interventions that can significantly reduce road deaths and injuries in India include

- Strengthening and expanding safe, reliable and cost effective public mass transportation systems.
- Mandatory installation of speed governors (tacho meters) in all heavy and medium size public and private vehicles along with auto doors in all buses.
- Increasing visibility of vehicles through use of reflectors on front and back of all vehicles and encouraging day time running of head lights.
- Bringing design changes for motor cycles to make them more stable and crash resistant in terms of breaking, lighting, better speed control, anti skid features and others.
- All possible passive and active mechanisms to reduce speeds in urban areas, rural areas and highways and near all traffic generators; speed standards need to be developed for this purpose.
- Separation of traffic and pedestrians on all possible roads, especially on high speed roads.
- Traffic calming in all urban areas, on highways and near traffic generators through road engineering measures.
- Scientific design and application of pedestrian facilities to facilitate walking and crossing.
- Mandatory safety audits on all repaired and newly built roads.
- Mandatory helmet laws for riders and pillion of motorized two wheeler vehicles with immediate notification and higher level of enforcement in all states of India.
- Strict enforcement of drink driving laws in a random, visible and uniform way
- Mandatory use of seat belts for all car occupants.
- Strict implementation of 'no cell phone use', while driving.
- Implementation of graduated driver licensing programs for drivers of all vehicles.
- Imposing strict legal penalty for drug users.
- Strengthening trauma care practices with improved facilities in district hospitals and community health centres (general hospitals) along with availability of basic first aid facilities in primary health centres.
- Safe transportation of individuals through common access numbers
- Introducing triage at all levels to refer and manage patients with varying severity in different levels of hospitals.

- Training of all doctors and para medical personnel in basic trauma life support programs.
- Trauma audits to be introduced in all medical college hospitals and apex tertiary referral care centres.
- Strengthening rehabilitation programs at district level with appropriate man power, technology and support systems.

Most importantly, all implemented interventions needs to be monitored and evaluated for efficiency, effectiveness, sustainability and cost effectiveness. The real indicator of change should be reduced deaths and injuries. (In addition, removal of all medico legal hurdles is essential, as it will promote good data, improve trauma care and eliminate unhealthy practices.)

Role health sector in road safety and injury prevention

The objectives of health care are to promote health, prevent illness, impart care and improve quality of life. In road safety and injury prevention, these objectives will be to promote safety, prevent injuries, provide timely care and improve quality of life of those afflicted. Health sector spends enormous amount of resources on investigation, hospitalization, management, rehabilitation, judicial processes, documentation and several other components. With a greater emphasis on prevention and early care, much of this burden could be reduced. In recent years, health sector has taken active roles of catalysts, facilitators and advocates in prevention through number of strategies. Health sector and professionals need to reorient their role and extend beyond the provision of acute and rehabilitative care into the areas of prevention through policies and programmes in India. Specific activities which health sector can undertake include (WHO 2007)-

- a. Improving data collection systems and building capacity for data analysis and management along with making data available for everyone to act.
- b. Building organised systems of emergency and prehospital care.
- c. Developing integrated trauma care systems by addressing equity in health care.
- d. Organising delivery of rehabilitation services for critically injured.
- e. Strengthening capacity of policy makers in health and related sectors to scientifically address the RTI and injury burden through

policies and programmes.

- f. Building human resources for road safety and injury prevention through variety of training programmes.
- g. Identifying key interventions that work based on understanding of injuries
- h. Facilitating national and state plans for road safety.
- i. Strengthening existing or new legislations for road safety and injury prevention
- j. Supporting a public health approach for prevention of RTIs and other injuries
- k. Conducting advocacy and awareness activities, and
- l. Monitoring and evaluation through data on effectiveness of interventions and changing trends.

Summary

Road deaths and injuries will continue to increase in India, if systematic mechanisms are not put in place. This need not happen at a time when sufficient knowledge exists for prevention and control of road crashes. The Decade of Action for Road Safety is a historic opportunity for India to develop a framework for action which could ultimately save significant number of lives across the ten-year period. The goal of the Decade is to stabilize and then reduce the number of lives lost. The "pillars" of activities are - building road safety management capacity, improving the safety of road infrastructure and broader transport networks, further developing the safety of vehicles, enhancing the behaviour of road users, and Improving post-crash care (http://www.who.int/roadsafety/decade_of_action/en/index.html accessed on Nov 27 2011). It is time to set in place strong mechanisms for saving lives on Indian roads.

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