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# Innovative solutions and accountability for safe roads

Dr. A.Jagadeesh babu, Director – Professor, Vestal Academy of I.T.& Management.

G.N.T. Road, Vatluru; Eluru. 534 007. West Godavari Dist. Andhra Pradesh. India.

***Abstract :*** *National reports published annually by Transport Research Wing of the Ministry of Road Transport & Highways and National Crimes Records Bureau of Ministry of Home Affairs, Government of India describe national statistical trends and normalized indicators of road accidents, injuries & fatalities. This article highlights trends, indicators, interstate comparisons and the latest characteristics of road traffic accidents in India. While the official road traffic fatality data may be close to the actual number, the injury data are gross underestimates. As per bibliometric analysis, India contributed only 0.7 per cent papers on road traffic injuries and had less than one article on road traffic injuries per 1,000 road traffic related deaths. To be effective, policies on injury prevention and safety must be based on local evidence and research. Health professionals and their professional bodies across wide disciplines need to take an initiative for the same with active commitment.*

***Keywords:*** *National statistics, road traffic accidents, road traffic injuries, road traffic fatalities*

## Introduction

A Road Traffic Accident (RTA) can be defined as, 'An event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved. Thus RTA is a collision between vehicles; between vehicles and pedestrians; between vehicles and animals; or between vehicles and geographical or architectural obstacles.' Road traffic accidents are a human tragedy. They involve high human suffering and socioeconomic costs in terms of premature deaths, injuries, loss of productivity, and so on.

During 2008, Road Traffic Injuries (RTI) ranked fourth among the leading causes of death in the world. Nearly 1.3 million people die every year on the world's roads and 20 to 50 million people suffer non-fatal injuries, with many sustaining a disability as a result of their injury. Road traffic injuries are the leading cause of death among young people aged 15-29 years and cost countries 1-3% of the gross domestic product (GDP).

Ninety-one percent of the world's fatalities on the roads occur in low-income and middle-income countries, even though these countries have approximately half of the world's vehicles. Half of those dying on the world's roads are 'vulnerable road users': Pedestrians, cyclists, and motorcyclists. Only 28 countries, representing 416 million people (7% of the world's population), have adequate laws that address all five behavioural risk factors (speed, drink-driving, helmets, seat-belts, and child restraints). If no action is taken, road traffic crashes are predicted to result in the deaths of around 1.9 million people annually by 2020. Hence the goal of the United Nations' Decade of Action for

Road Safety 2011- 2020 is to save five million lives.

In India, the motor vehicle population is growing at a faster rate than the economic and population growth. The surge in motorization coupled with expansion of the road network has brought with it the challenge of addressing adverse factors such as the increase in road accidents. According to the World Health Organization (WHO), road traffic injuries are the sixth leading cause of death in India with a greater share of hospitalization, deaths, disabilities and socio-economic losses in the young and middle-aged population. Road traffic injuries also place a huge burden on the health sector in terms of pre-hospital and acute care and rehabilitation.

During 2011, a total of 4,97,686 road accidents were reported by all States/UTs. The proportion of fatal accidents in the total road accidents has consistently increased since 2002 from 18.1 to 24.4% in 2011. The severity of road accidents measured in terms of persons killed per 100 accidents has also increased from 20.8 in 2002 to 28.6 in 2011.

Table 1: Number of road accidents and number of persons Involved: 2002 to 2011

| Year | Number of accidents | | Number of persons | | Accident severity* |
|---|---|---|---|---|---|
| | Total | Fatal | Killed | Injured | |
| 2002 | 40,7497 | 73,650 (18.1) | 84,674 | 4.08,711 | 20.8 |
| 2003 | 406726 | 73,589 (18.1) | 85,998 | 4,35,122 | 21.1 |
| 2004 | 429910 | 79,357 (18.5) | 92,618 | 4,64,521 | 21.5 |
| 2005 | 439255 | 83,491 (19.0) | 94,968 | 4,65,282 | 21.6 |
| 2006 | 460920 | 93,917 (20.4) | 1,05,749 | 4,96,481 | 22.9 |
| 2007 | 479216 | 1,01,161 (21.1) | 1,14,444 | 5,13,340 | 23.9 |
| 2008 | 484704 | 1,06,591 (22.0) | 1,19,860 | 5,23,193 | 24.7 |
| 2009 | 486384 | 1,10,993 (22.8) | 1,25,660 | 5,15,458 | 25.8 |
| 2010 | 499628 | 1,19,558 (23.9) | 1,34,513 | 5,27,512 | 26.9 |
| 2011(P) | 497686 | 1,21,618 (24.4) | 1,42,485 | 5,11,394 | 28.6 |

P: Provisional, Source: Information supplied by States/UTs (Police Departments), Figures within parentheses indicate share of fatal accidents to total accidents *Accident Severity: No. of Persons killed per 100 accidents

Road accident cases in the country have marginally decreased by 0.02% during 2012, while the casualties in road accidents in the country have increased by 1.3% during 2012; as compared to 2011.

**The Trends:** From Fig.5, between 1970 and 2011, the increase in the road network was by 4 times to 4.69 million km, in the number of vehicles by 100

times to 142 million, in the road accidents by 4.36 times, in the RTFs by 9.83 times, and in the no. of injured by 7.30 times. Fatal traumatic brain injuries were seen in 68.73% of the cases. In China, the total number of RTFs are in falling, while in India they are on the rise.

**The Increasing Severity:** The high proportion of fatal accidents and the high fatalities / 100 accidents compared to previous years implies increasing severity. This may be due to high vehicle density, high speeds of modern vehicles, coupled with drink-driving responsible for 70 % of RTFs in Mumbai and Delhi, non-wearing of helmets increasing the risk of fatality by about 40% and the risk of severe injury by 70%, non-wearing of seat belts increasing the risk of fatality by 25-75%[20], weak regulation, poor driving skills, fatigue, faulty road geometry, poor road condition, lack of pedestrian and bicycle friendly road design and lack of civic sense.

**The Initiatives:** A National Highway Accident Relief Service Scheme (NHARSS) has been taken up by the MORTH to reduce the RTFs on National Highways. The existing excellent PPP initiative of **'108 GVK EMRI-State Government Emergency Response Service'** being run on PPP model by 14 states (including AP) and 2 Union Territories is of immense value reaching 372 million people with 5460 ambulances saved 355126 lives since 2005 up to October 2011 due to their 18 minute average response time to reach 13 million emergencies, i.e., within the golden hour[28]. It is pathetic that about 80 % of bystanders would hesitate to take the RTA victim to the hospital, for fear of lack of supportive legal environment and possible police harassment.

**The Accident Burden:** The no. of RTFs and road injuries are reported as 142485 and 511394 respectively indicating their proportion as 1:3.6. But epidemiological evidence suggests the realistic ratio much higher at about 1:85. About 52 % of the RTA victims are in the age group 25-65 years. For India, the Disability Adjusted Life Years (DALYs,accounting for quality of life reduced due to a disability, and lifetime lost due to premature mortality) due to RTAs are 7.34 million in 2002 as per WHO. RTA losses cost India about 3% of its GDP, i.e., about $20 billion. In addition, there are phenomenal socio economic costs and decline in quality of life of the dependents of the accident victims. RTAs are leading to 70 million injuries and 20 million hospitalizations and occupy more than 30% of the country's hospital beds, a crippling burden on the country's already overburdened health system.

The utility of allocating resources for health care interventions based on Quality Adjusted Life Years (one QALY-one year of life in perfect health that would be added) may need debate. A judicious combination of DALYs for assessing the loss of potential benefits to the family and nation had a person been not injured/dead, and QALYs to assess the cost/benefit ratio of a resource allocation for reduction/prevention of injury related morbidity/death etc. to himself and his kin will make it an interesting research study.

## Andhra Pradesh – A Comparison

### Table 3: RTA status in 5 high risk states in India

AP stands 5th in India in RTAs at 8.9 %, 3rd in fatalities at 10.6 %, 3rd in injured at10.9 %, despite only 7.05 % of India's

population. In India, projects co-funded by Bloomberg Philanthropies and the Global Road Safety Facility[11] are focused on NHs and SHs across the four states of Andhra Pradesh, Assam, Gujarat and Karnataka under the International Road Assessment Programme (iRAP), which involve risk mapping of selected roads and Star Rating them from 1 to 5 (increasing safety) considering 50 road attributes.

The following Table gives the normative indicators for the RTAs and RTFs in 3 states in India for analysis.

Table 4: Road accident data in Andhra Pradesh and Tamil Nadu-2011

| State | No. of accidents | No. of road fatalities | No.killed/. 1 lakh popn | No. killed/10000 vehicles | No.killed/ 10000 km of Roads | No.killed/100 accidents (Severity) |
|---|---|---|---|---|---|---|
| Andhra Pradesh | 44165 | 15165 | 17.9 | 14.9 | 637.2 | 34.3 |
| Karnataka | 44731 | 8971 ↑ | 14.7 | 9.0 | 318.4 | 20.1 |
| TamilNadu | 65873 | 15422 | 21.4 | 9.9 | 801.8 | 23.4 |
| **India** | **497686** | **142485** | **11.8** | **10.0** | **383.2** | **28.6** |
| | | | | | | |

The above Table indicates RTFs in AP are high compared to Karnataka and all-India, but lesser compared to those of Tamil Nadu. The RTF rate per 10,000 vehicles and the accident severity in AP is very high compared to that in Karnataka, Tamil Nadu and all-India. The no. of persons killed per lakh population is also very high at 17.9 against 11.8 for India. The lengths[18] of NHs and SHs in AP is 4537 km and 10491 km constituting only 1.9 % and 4.4% of total road network in AP respectively, but they account for 33.7% and 27.4%[7]of the total RTFs in AP, against 37.15% and 27.4% for India. This signifies the crucial importance of improving safety on Highways through coordinated, multi-sectoral interventions. Tamil Nadu has announced its Road Safety Policy in 2007, followed it up with a Road Safety Action Plan, set up a Road Safety Fund and deployed a GIS based Road Accident Data Management System (RADMS) in 2009 in 1400 police stations and identified 3000 accident prone spots.

The higher fatality rates in these cities vis-à-vis national rates may be due to modern high speed vehicles unsuitable for city roads, improper road geometry, tardy enforcement of traffic rules, public apathy for 5 key risk factors, and lack of zebra crossings/pelical signals at junctions. Wayanad district in Kerala decided to conduct a road safety audit focusing attention on the reasons for accident, vulnerable locations, analysis on reasons for past accidents and measures to prevent accidents.

Enhancing the share of people using Public Transport, which is presently between 31 to 43% in the above cities

compared to the desired 70%[30] as also envisaged in the National Urban Transport Policy (NUTP)[19] of the Govt. of India which emphasizes 'moving people – not vehicles' and NMT.

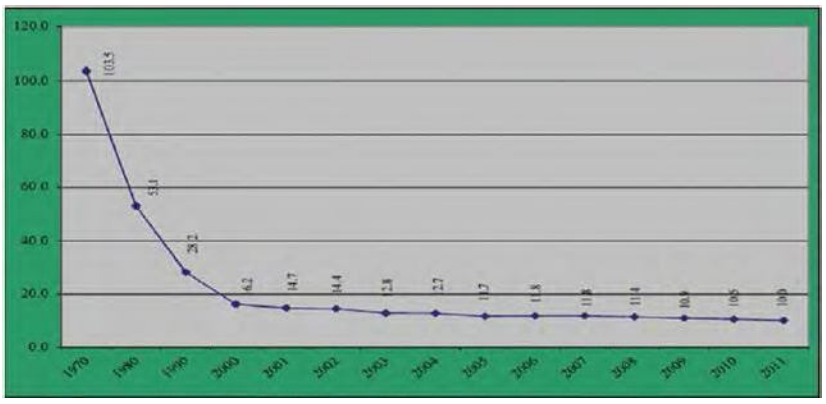
### Normalized indicators of road accidents, injuries and fatalities

### All India averages

To get an appropriate measure of the incidence of accidents, the normalized/standardized accident rates for India have been worked out in terms of the number of accidents /injuries /fatalities (a) per lakh persons (b) per ten thousand motor vehicles and (c) per ten thousand kilometres of road length. A significant decline in the number of accidents per ten thousand motor vehicles is discernible from 814.4 in 1970 to 35.1 in 2011. There has been more than a three-fold increase in the number of persons injured per lakh of population from 13 in 1970 to 42.3 in 2011, while persons killed per lakh of population jumped four-fold from 2.7 in 1970 to 11.8 in 2011. Exposure of population to road accidents leading to deaths and injuries largely depends on the amount of travel undertaken, defined as the number of trips, the distance traveled or time in the road environment, number of motor vehicles and the amount of motorized traffic, and so on.

As regards the number of persons injured and killed per 10,000 vehicles the decline has been dramatic. To some extent, the decline in this parameter has been brought about by improvement in vehicle crashworthiness and occupant protection. The number of persons injured per 10,000 vehicles has declined from 500 in 1970 to 36 in 2011. Similarly, the number of persons killed per 10,000 vehicles in the country has also fallen from about 104 in 1970 to 10 in 2011

### Number of persons killed per ten thousand vehicles during 1970-2011




The rate of deaths per thousand vehicles has decreased marginally from 1.3 in 2008 to 1.0 in 2012, even as the number of vehicles in the country has increased by 58.3% and the quantum of road accidents has increased by 5.8% during the same period.

### Inter-state comparisons

provides a share of the top five States in India with regard to the total number of road accidents, persons killed, and persons injured in road accidents against a backdrop of their share in India's motor vehicle population.

Latest characteristics of road traffic accidents in India

During the calendar year 2012, Tamil Nadu has reported the maximum number of road accidents (67,757) accounting for 15.4% of such accidents in the country. Although Maharashtra had the highest number of registered vehicles in the country, the highest number of deaths due to road accidents during the years were reported in Tamil Nadu (11.6%) followed by Uttar Pradesh (10.9%), Andhra Pradesh (10.8%) and Maharashtra (10.0%). The rate of accidental deaths per thousand vehicles was highest in Bihar and West Bengal at 1.9 each followed by Himachal Pradesh (1.8), Andhra Pradesh (1.5) and Jammu and Kashmir (1.5) as compared to 1.0 at the national level. The rate of deaths per 100 cases of road accidents was the highest in Nagaland (133.3), followed by Punjab (75.8) and Mizoram (70.0) as compared to 31.6 at the national level. The deaths in Jammu and Kashmir, Nagaland, Uttar Pradesh and Andhra Pradesh, due to road accidents were reported to be 69.6, 67.5, 53.5 and 51.9% respectively.

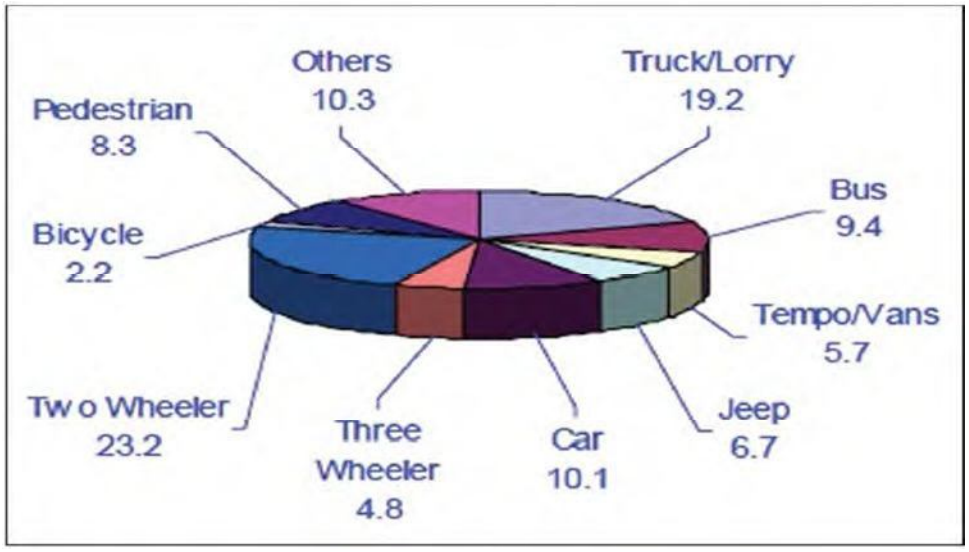
The term 'mega city' refers to cities that have a population of at least 10 lakhs as per the Population Census of 2011. The highest cases of road accidents were reported in Chennai (9,663), which resulted into 8,628 injuries and 1,401 deaths, followed by Delhi (city) (5,865 cases, 5,563 injuries and 1,527 deaths) and Bengaluru (5,508 cases, 4,527 injuries and 725 deaths), among the 53 mega cities. However, 97.6% accidental deaths in Lucknow followed by 81.2% accidental deaths in Asansol were due to road trafficaccidents.

Classification of Roads: National Highways accounted for 30.1% of the total road accidents and 37.1% of the total number of persons killed in 2011. State Highways accounted for 24.6% of the total accidents and a share of 27.4 % of the total number of persons killed in road accidents in 2011.

Spatial distribution: In 2011, the total number of accidents that occurred in rural areas (53.5%) was more than that in the urban areas (46.5%). Rural areas had more fatalities (63.4%) than urban areas (36.6 %). The number of persons injured was also more in rural areas (59.4 %), as compared to urban areas (40.6%). Age and gender of accident victims: The detailed age profile of accident victims other than the drivers, for the year 2011, revealed that the age group between 25 and 65 years accounted for the largest share, 51.9%, of total road accident casualties, followed by the age group between 15 and 24 years, with a share of 30.3%. More than half of the road traffic casualties were in the wage-earning age group. Only 15% of the road accident victims were females during the calendar year 2012.

Mode of Transport: During 2012, road traffic accidents shared 35.2% of the accidental deaths; 23.2% of the victims of road accidents were occupants of 'two wheelers'. Although the break-up of total government and private vehicles is not available, it is pertinent to note that the majority of victims were traveling in private vehicles. During 2012, Delhi city, among the 53 mega cities, accounted for 16.1% of the deaths of pedestrians', 10.0% deaths due to car accidents and 9.5% deaths due to two wheelers.

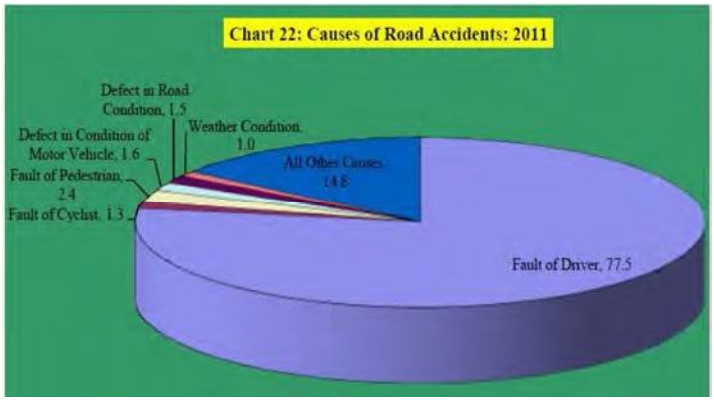
Figure : Road accident deaths by various modes of transport during 2012




Month of occurrence: In 2012, the month-wise distribution of road accidents has also shown more accidents during the month of May (8.8%) followed by the month of April (8.74%) and January (8.72%), while the least number of road accidents were reported in the month of September. Tamil Nadu, Maharashtra and Karnataka which accounted for 15.4, 10.3% and 10.1% of road accidents in the country, respectively have also reported the maximum number of road accidents during each month of the year at the national level.

Time of occurrence: In 2012, 16.7% of the cases of road accidents were reported to have occurred between 1500 hours and 1800 hours (day), followed by 16.6% between 1800 hours and 2100 hours (night) and 6.3% between 0000 hours to and 0300 hours (night).

Causes: The major human factors that contribute to the potency of road accident causation include drunken drivers, indecisiveness, fatigue, distraction, and confusion. In addition, in most of the cases the drivers are found to be inexperienced, risk takers, impulsive, aggressive, casual and unaware of the road signals. During 2011, driver's fault (77.5%) was the singlemost important factor responsible for accidents, as revealed by an analysis of road accident data by the Ministry of Road Transport and Highways.




Causes of Road Accident in India,

**From the above figure, it is seen that the fault of the driver contributes to an overwhelming 77.5% of the RTAs in India and there is a general lack of sensitivity to the *value of life* of a fellow being in our country compared to others.**

**1.Driver Related** – Over-speeding[7], drink-driving[7],[12], [13],[14], over-loading[7], overtaking on bridges/culverts, mobile phone use, fatigue, neglect of traffic signals, negligence, disregard to road signage and value of life, inadequate training, old age, improper eye-sight etc.

**2.Vehicle Related –** High vehicle density, lack of speed locks, overloading and overcrowding, unsafe vehicle design, poor operating and maintenance condition, defective/lack of automatic door locks and emergency windows, non availability of breaking hammer near windows, non-display of safety instructions, lack of reflective signage on rear and sides of vehicles etc.

**3.Operator Related** - Lack of safety vision, mission and implementation, proper permits, owner/lease agreements, insurance, pollution certificates, load protruding, maintenance management, vehicle safety auditing, proper training and sensitization to drivers, cleaners and mechanics in emergency management like response, reporting and coordination with regulators, provision of necessary GPS, RFID systems for real-time tracking of the vehicles, flouting of safety norms like lack of second driver in long distance travels, provision of fire extinguishers, public address system, awareness video, lack of established systems or communication with public regarding safety in Private or Public Transport Operators displaying passenger safety provisions/Safety Manual/Safety Plan/Citizen's Charter in their websites.

**4.Vehicle Manufacturer** - Non-adaptation of modern high speed vehicle design to suit Indian road and traffic conditions, passenger behavior, operation and maintenance systems and practices, software, sensors and hardware, lack of speed governors, faulty central locking system, lack of GPS enablement, occasional flames etc. though Volvo company claims installation of Electronically-controlled Brake System in its Volvo 9400 bus.

**5.Road Engineering and Signage Related** – Lack of road signage (indicating speed limits, blind curves, sudden change in carriageway/alignment), reflective

sticking at bridges, culverts, dividers/medians, speed breakers/rumble strips, service roads, junction improvement, cat eyes, crash barriers, guide stones proper signaling at junctions in cities and rural areas on Highways, load limits, lay-byes, road and culvert alignments, direction and diversion boards etc., poor

maintenance of road infrastructure, damaged shoulders and even base course on some NHs, old/damaged bridges etc.

6.Regulator/ Government Related – Non-enforcement of rules relating to issue of vehicle permits, fitness certificates, driving licenses, speed limits, drink-driving, helmets, seat belts, child restraints, safety provisions, overloading, load protruding, road geometry, road maintenance, highway patrolling, ambulance services, trauma care, liquor shops, vehicle testing centres, drivers' training and refreshment rooms, benchmarking safety levels, road safety audit, certification systems, vehicle record maintenance at toll gates, creation of awareness, legal and police apathy to good samaritans, rating of operators, public disclosure, non-availability of Highway Patrol Vehicles, Highway Ambulances and Trauma Care supposed to be available every 50 KM of Highway, low flash point of Indian diesel at 350C enabling diesel from fuel tank to catch fire even at ambient temperatures. The proposed Road Safety Authority (RSA) is awaiting a legal shape by the AP Government.

7.Public Related – Lack of civic sense, diligence, enquiry, sensitivity to safety of self and other road users, compliance to speed limits, traffic regulations and road signage, drink-driving, mobile phone use, rash driving, overtaking, overloading etc.

Limitations of the available statistics Details of traffic crashes are not available at the national level. Even as the official road traffic fatality data may be close to the actual number, the injury data are gross underestimates.

In addition to the above-mentioned national reports, findings of independent hospital and population-based research studies related to road traffic accidents in India are also available.

The spectrum of injuries from road crashes varies from instant death to those requiring only first aid. The most common sources of RTI data are from police and hospitals. The majority of deaths are reported to the police due to their medicolegal nature, prosecution concerns, and compensation needs. A few deaths and a majority of injuries are not reported to the police due to several reasons. A study in Bangalore compared police and hospital deaths and found underreporting of 5% for deaths and more than 50% for serious injuries.

## Conclusions

A bibliometric analysis was done to document injury literature published in low- and middle-income countries, and also to quantify literature on road traffic injuries by countries before and after the World Health Day on Road Safety celebrated in April 2004. On neoplasm there were 280 articles published per million population, whereas, for road traffic injuries, the rate was four-fold articles per million population. India, the second-most populous country in the world, contributed only 0.7% articles on road traffic injuries and had less than one article on road traffic injuries per 1,000 road traffic-related deaths. The percentage of change in articles on road traffic injuries for the period 2004-2007

in comparison to period 2001-2004 in India.

To be effective, policies on injury prevention and safety in developing countries must be based on local evidence and research, and designed to suit the social, political, and economic circumstances found in developing countries. As a result, strategies to increase research itself must develop alongside steps to stimulate policymakers and practitioners to demand and use researchevidence.

Strengthening and undertaking research on the public health burden and impact, understanding the risk factors, characteristics of trauma, and measuring the impact of interventions through well-designed public health and clinical research methods (trauma registry, surveillance programs, hospital- and population-based studies etc.) is the need of the hour. Health professionals and their professional bodies across wide disciplines need to take an initiative for the same, with active commitment.

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