

Vol 4 / Issue 2 / April-June 2014

International Journal of Critical Illness & Injury Science

Connecting Cells, Clinics and Communities across Continents

Official Publication of International Network of
Critical Illness and Injury Trial Experts

www.ijciis.org

The 2014 Academic College of Emergency Experts in India's INDO-US Joint Working Group (JWG) White Paper on "Developing Trauma Sciences and Injury Care in India"

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ABSTRACT

It is encouraging to see the much needed shift in the understanding and recognition of the concept of "burden of disease" in the context of traumatic injury. Equally important is understanding that the impact of trauma burden rivals that of nontraumatic morbidities.

Subsequently, this paradigm shift reinstates the appeal for timely interventions as the standard for management of traumatic emergencies. Emergency trauma care in India has been disorganized due to inadequate sensitivity toward patients affected by trauma as well as the haphazard, nonuniform acceptance of standardization as the norm. Some of the major hospitals across various regions in the country do have trauma care units, but even those lack protocols to ensure that all trauma cases are handled by those units, largely owing to lack of structured referral system.

As a first step to reform the state of trauma care in the country, a detailed overview is needed to gain insight into the prevailing reality. The objectives of this paper are to thus weave a foundation based on the statistical and qualitative burden of trauma in the country; the available infrastructure of trauma care centers equipped to deal with trauma; the need and scope of standardized protocols for intervention; and most importantly, the application of these in shaping educational initiatives in advancing emergency trauma care in the country.

Key Words: Trauma, emergency medicine, trauma burden in India, trauma care centers

PROLOGUE

India is in transition from a largely agriculture based to an industry- and technology-focused economy. It is the largest country in the South-Asian region with a very high youth and middle-aged population, which given the changing economy, has largely adopted mechanized transport. This invariably has started an ever-increasing

problem of vehicular traffic similar to other nations undergoing rapid economic growth. This spurt in vehicular density, however, has been so rapid that there has been little time spent by citizens and policy makers alike, on safety parameters associated with such high levels of mechanization. Trauma, hence, has been largely ignored and underestimated partly because there is a paucity of published literature addressing the burden of

Access this article online

Website: www.ijciis.org

DOI: 10.4103/2229-5151.134151

Quick Response Code:



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injury that has a substantial effect on morbidity, short- and long-term disability, as well as mortality.

There are various factors contributing to the present scenario of trauma in India – both rural and urban India. The morbidity of rural trauma is augmented by the fact that the most common modes of transportation are bicycles and motorbikes. Traumatic injuries involving animals – horses, buffalo, cow, and bull – are almost exclusively seen in rural areas and on the associated highway networks. There is an absence of sufficient supervision over the public transportation system. The attitude of the public is devoid of a basic sense of safe driving, as exemplified by the high prevalence of driving without routine seatbelt use. The younger generation casually violates traffic laws and frequently disregards existing speed limits, a phenomenon especially common among the users of two-wheelers. Another disconcerting phenomenon is the widespread neglect for the use of protective gear such as helmets. Consequently, these behaviors have cumulatively resulted in an increase in RTAs, Road Traffic Accidents injuries, disabilities and deaths. This is accompanied by a staggering increase in the socioeconomic burden, depletion of human resources, as well as emotional and psychological trauma on caregivers. As a result, the already overly taxed healthcare delivery system is put under additional strain.

It is not as if the development of trauma care in India has significantly lagged compared to global standards. Over the years, the number of Trauma Centers has increased with adequately equipped units distributed in different corners of the country based in and around major cities. There are two major weak links in the trauma-care setup in the country: First, the absence of effective linkage of these major trauma centers in cities to each other and to similarly competent prehospital trauma stabilization networks and second, the total disconnect of these tertiary level urban set-ups from rural territories where even basic trauma care is lacking. Thus, India especially faces major challenges in injury prevention, prehospital care, and rehabilitation of residual disabilities within the demographic segment.

To improve this state of affairs, we need a national program linking multidisciplinary trauma care system towards a preplanned, comprehensive, and coordinated injury response system that includes all facilities with the capability to care for the injury spectrum. Indispensable components of this system include primary trauma care at a grassroots level, encompassing prehospital care, hospital care, rehabilitation, system administration, trauma care capacity building including education and training, as well as trauma care evaluation and quality improvement. Additionally, the participation of the community in counseling and behavior change communication (BCC) is paramount for success.

This document encompasses the overall status of trauma burden, care services and the wide gaps in addressing research issues. The purpose is to introspect and take a holistic approach to reduce the burden of morbidity and mortality due to trauma.

THE SAGA ON ROADS

In the global estimates of 1998, injury accounted for 16% and road traffic injuries (RTIs) were the ninth leading cause of the burden of morbidity, fifth in the developed countries, whereas tenth in developing countries. The most commonly affected group was men in the productive years of life. The burden from domestic and nondomestic injuries is increasing relentlessly worldwide, and in developing countries in particular. In India, trauma was estimated as the seventh leading cause of mortality, where four-fifths of the deaths occur on the country's roads.^[1]

In India, more than three-fourths of all registered vehicles are motorized two- or three-wheelers in 2004 with four-wheelers in the minority. A study by the Indian Council of Medical Research in 2006–2007 revealed that two-wheeler riders were the most frequently injured, accounting for nearly one-third of all road traffic victims.^[2] By 2020, RTIs are predicted to be the third leading cause of morbidity surpassing leading communicable diseases.^[3] The experts in this field have estimated a colossal economic cost up to 1.5 % of the gross national product in the low- and middle-income countries and 2% in the high-income countries; the cumulative global financial cost approximates US\$500 billion and in developing and transitional countries about US\$60 billion per year.^[4] Additionally, the indirect costs are difficult to account for and include untold social and psychological consequences of trauma. Many families of trauma victims bear the financial burden of both acute and long-term medical care with the additive loss of wages of the disabled family member.^[5] Emergency care related to motor vehicular collisions are common in India and about one-fifth of all injury-related care in the healthcare facilities are linked to trauma.^[6] The World Health Organization (WHO) predicts that by 2020, RTIs will account for nearly 550,000 deaths due to the ongoing, rapid socioeconomic and demographic transition coupled with growing urbanization in India. As part of this new paradigm, RTIs will hold the fifth position as major killers.^[7,8]

The lack of governmental investment in trauma prevention is the other vital component of this multifactorial challenge. The gaps unfurled have been hitherto unwatched by the proponents of national policies that road safety was not a priority. An appropriate agenda and intervention response to prevent road mishaps is

not feasible in the absence of comprehensive national data that involves a scientific public health approach. Population-based data on RTIs in India is necessary to appropriately plan and execute strategies to mitigate death and disability. Immediate steps are required to limit the loss of life and productive resources. Surveillance systems must be strengthened to prevent pedestrian injury. We have to generate a dependable, precise and sufficient homogeneous national database on injury and outcomes for the planning of effective prevention and intervention programs.^[9,10] Researchers from Hyderabad conducted a study on the use of driving licenses, helmet, driver behavior, and technical condition of vehicles. The results were shocking; 11% had not obtained a drivers' license and 21% were using a license without taking the mandatory driving test. Among the two-wheeler drivers, 70% reported none to occasional use of a helmet. Sixty percent stated that they violated traffic laws at least once within the last quarter of the year.^[11]

RISK FACTORS

Social, cultural, and behavioral factors lead to an unsafe lifestyle that places the population at risk of trauma including but not limited to falls (common in children and the elderly), agricultural injuries, firearm injuries, poisonings, burns, drowning, suicide attempts, homicides, and natural and man-made catastrophes.

Absence of a vision on road planning: A major risk factor

A major risk factor associated with RTIs at the systems level is the absence of urban planning. One example includes areas where high-speed and slow-speed traffic are not segregated. Compounding this is the lack of regard for the pedestrian and riders of nonmotorized transport vehicles. Traditionally, road safety was assumed to be the responsibility of the police and transportation sector.

The potential value of "prevention" in road traffic accidents using a safety-first approach was underestimated for long till the financial burden of treating trauma was realized from analyzing hospital records. The impact of this prevention would be much higher if the responsibility of this safety-first approach was not limited to just vehicle drivers but also to pedestrians themselves with avoidance of high-risk activities like walking on road edges instead of footpaths, letting children walk unassisted, rushing through moving traffic while in a hurry in crossing roads, listening to music while on the road, etc. This is of particular importance because it is the unprotected pedestrian rather than the vehicle driver who is usually worse hit as the victim in any event of a road traffic accident involving them.^[7,12,13]

Alcohol

Alcohol impairs decision making, resulting in the inability to perceive hazardous circumstances. A noteworthy number of RTIs in India involve alcohol use as seen in RTI reports in the police and hospital emergency department.^[14] Alcohol also influences diagnosis, management and recovery from traumatic brain injuries (TBIs), including prognosis.^[15] Blood alcohol concentration (BAC) of 0.05 g/dl produces 1.83 times greater risk of traffic collision than zero BAC.^[16] Laws featuring lower BACs (between 0 and 0.02 g/dl) for young/novice drivers may be associated with a reduction in the number of RTIs along with enforced sobriety checkpoints and random breath testing. Additional benefits accrue in the long run from deterring drunk driving.^[17-19] The Indian Government uses both random breath testing and police checkpoints to enforce the law. Breath and blood testing of all drivers involved in crashes are also performed. However, the degree of enforcement appears to be limited due to logistical deficiencies. Although young or novice drivers are at a much higher risk of having a RTI under the influence of alcohol, there is no special BAC limit for them in any country in South-East Asia except Thailand.^[2]

Helmets

Indian research on helmet use reported that among drivers of two-wheelers, up to one-third did not have a helmet. Moreover, among those who had a helmet, approximately half did not use it regularly or were not wearing their helmet in the approved manner, which were not adequate to reduce the risk of serious injury. Studies have shown that mandatory helmet laws increase helmet-wearing rates and reduce TBI.^[11, 20-22]

Seat belts and child restraints

Overall, vehicle safety belt use reduces RTI morbidity and mortality by approximately 50%. Consistent use of child restraints is also proven effective in prevention of infant mortality on roads.^[23-25]

Speed limits

Vehicle speed is related in a dose-response fashion to RTIs; the faster the vehicle, the greater the injury. An increment of 1 km/h in mean traffic speed results in approximately a 3% increase in injury from RTIs and 5% increase in grave consequences.^[26]

Insufficient implementation

India has national laws on seat belt use that are applicable for both front- and rear-seat occupants. No national speed limit legislation exists. However, there is legislation at the state level, but with insufficient enforcement of the laws.^[2,7]

Unintentional injuries

Unintended injuries are a global problem that should receive the utmost consideration, especially in India

where rapid urban development has put people at a risk greater than expected. Road Traffic Accidents, burns, poisoning, and drowning are responsible for nearly half of the total injury occurrences. A great majority of burns are domestic with females as victims of domestic chores in the low socioeconomic conditions. Furthermore, due to stress and exhaustion of the women folk, the children and elderly population are not looked after in poorer families leading to more injuries in these extremes of life. Poisoning fatalities are up to 5% with many cases due to household agents stored inappropriately. Our country also has high rates of female drowning mortality due to unsafe practices such as drawing water from deep wells or rivers, bathing in or near riverbanks. Socioeconomic status is associated with the unsafe behaviors, which leads to injury.^[20]

Different Indian studies have recorded injury-related events including fall among elderly population. Every year 30% of people over the age of 65 sustain injuries following falls with the number rising to 40% in those aged over 70 years. Older people who live in a nursing home fall more often than those living in the community; 35% of living in long-term care institutions fall each year; 40% have recurrent falls. Fractures are seen more frequently in females and in the urban population at 20%. Twenty-four percent had three or more falls. Death from falls is approximately 40% of all injury deaths; fatal falls rates increase exponentially with age for both sexes, with the highest rates for those elder than 85 years.^[27] Environmental risk factors include improper lighting, slippery or uneven ground surface, assistive devices, misplaced furniture, pets and footwear. Old age-related falls are considered a common cause of death and disability in people aged 65 or more.^[28,29]

Age is an independent risk factor for injury with vulnerability to falls due to changes in vision, hearing, muscle strength, coordination, stability and reflexes with medical comorbidities affecting the balance and gait with side effects from poly-pharmacy.^[30-32]

The WHO estimates that injury kills one million children per year. In India, approximately 15% of deaths, and up to a fourth of hospital admissions in children, are due to injury. For every death, 30–40 children are hospitalized and discharged with varying level of disability. Minor injuries tend to be unreported. RTIs are the leading cause of death and hospitalization, with a higher level in male children (79%) in the 14- to 18-year age group (33%). Domestic falls are the second leading cause for injury and hospitalization among children. The outcomes of these disabilities significantly affect the long-term growth and development as seen via a poor academic performance. This leads to socioeconomic hardships and psychosocial disabilities that are unable to be quantified. It is essential to understand the burden, patterns, determinants and

outcomes to formulate effective child safety policies and programs.^[33-37]

Unaccounted for burden

The Transport Research Laboratory study commissioned by the Global Road Safety Partnership (GRSP) focused on the contribution and consequences of RTIs. Even in absence of a clear picture on the economic conditions of the victims involved in a RTI, the study could correlate poverty with higher mortality. This is important because in remote areas of India, the poverty level is high. The people are not financially well off, and the victims succumb to death or they are brought dead to the emergency department. By and large, the overall economic cost to many of the families leads to postinjury ruin, as the victims are usually the main or the only source of income. Furthermore, in the absence of any transparent policy of training and re-training, there remains insecurity in having the ability to return to the victim's earlier job with income protection.^[2] Consequently, the injury thereby causes an enormous economic burden to individual and their family in terms of loss of income, which ultimately is reflected in the loss of GDP of the country.

In addition to economic strain, the injured, their dependents and their caregivers often face psychological consequences of trauma, which are not quantifiable. To estimate accurately, the overall cost of injury, one must account for not only the economic and psychological burden, but also the hidden cost that include, travel time lost due to RTI, the nonproductive days of the caregivers, and the downstream rehabilitation costs.^[38] With the inability to quantify these losses, the estimates made do not come close to the actual burgeoning burden of trauma.

Prehospital trauma care

Emergency medical services (EMS) are new to India even in the metropolitan cities. Ambulances from both the public and private sectors are not well equipped or staffed by well-trained personnel capable of managing prehospital care. There is an absence of a well-designed first responders system with responsibly not clearly defined between different public and private stakeholders. This inefficiency of overlap between stakeholders combined with large, unaccounted for gaps, has led to almost a third of patients succumbing to death prior to hospital and only one-fifth receiving any medical care within an hour.^[6,39]

Medical science has gifted us with the knowledge and competency to save lives even after grave injury. But the injured actually have to make it to the hospital to receive this care.^[40] The EMS at the injury site before reaching the hospital improves the survival rates and outcomes. As described by the tri-modal distribution of mortality in trauma, the second peak of deaths that occur within minutes to a few hours postinjury are the focus

of prehospital and emergency room care. These patients have an increase in salvage ability in the *golden hour* or 'platinum 10 min'.^[41-43] Researchers have concluded that up to one-third of fatalities due to RTI can be avoided by implementation of a comprehensive trauma system, by providing interventions focusing on life-threatening injuries.^[44]

To minimize the vulnerable condition of the family, in particular, and community, in general, systematic interventions have to be implemented at the site of the injury by first responders. The methods of Airway Breathing Circulation (ABC) care and recognition of hemodynamic instability should be the aim of initial resuscitation.^[45,46] The reality of the situation is that people tend to be apathetic^[47] or play a scoop-and-run approach utilizing the vehicle at hands breadth to reach the nearest health facility.^[47] Although the fact remains that the scoop-and-run approach is in fact one of the most recommended first steps of emergency trauma care; the issue in India remains the sheer lack of formal training to citizens and traffic police on handling the victims of trauma - which most cases can worsen the extent of injuries primarily sustained by the victim.

To compound the delay, all the injury victims have to be registered as a *police case* before or during management and in the absence of rights and responsibilities of bystanders and health personnel, often the *victims of injury* are entangled as the *victims of situation* leading to a delay in prehospital and hospital trauma care.^[48]

Hospital-based trauma care in the government hospitals in India

In India, conventionally, injury victims are offered medical care by government hospitals, private hospitals, and a huge number of private medical practitioners and institutions. Government hospitals generally offer care as reasonable stakeholders, but the quality of service is not homogeneous. Tertiary care teaching hospitals provide a reasonable level of emergency care. District hospitals often lack trained staff, adequate infrastructure, and supply of consumables.^[7] Triage is rarely practiced, as there are no dedicated trauma surgeons and very few designated trauma centers in India. Moreover, orthopedic surgeons share major responsibilities in over half of these facilities.^[49] In the rest, the accountability is not precisely defined. With ambiguity of responsibility amongst specialists, clinical decisions are often delayed and poly-trauma cases are vulnerable to suboptimal team management. Characteristically, the trauma care in the hospitals is provided in the casualty department. Working in this department is rarely by choice for the medical graduates. Formal training in trauma care is neither offered nor obligatory there.^[7] Doctors posted in the casualty departments often rotate from various specialties such as surgery, orthopedics, and medicine and

have little commitment to trauma care.^[50] In the absence of policies delineated care of the injured, the junior most staff manages the most seriously injured citizens. The specialists and super-specialists on duty are reluctant to care for the injured and lack incentive to train the inexperienced, junior and nonspecialist general duty doctors. Thoughts have been given in recent times to recognize trauma care as an important super-specialty discipline.

Status of existing prehospital care systems in India

There have been sincere efforts at establishing ambulance networks in some parts of India, especially in states covered by the 108 network infrastructure. It functions as a public-private partnership, so that the cost is largely borne by the government while the private provider handles the operational aspect of the service.

The service started with a primary aim to arrange for the patient to be transported to the nearest major hospital in the event of an emergency, and to be able to provide initial stabilization en-route. The providers operate two types of ambulances, basic and cardiac. A driver and a trained attendant, either a nurse or a medic staff the basic ambulance. The cardiac ambulance is manned by a doctor in addition to the others. The basic ambulance is stocked with only an oxygen cylinder, while the cardiac ambulance is stocked with emergency equipment sometimes even a portable defibrillator. The weak link remains: The present prehospital care set-up is largely geared for handling medical emergencies, and not traumas.

Prehospital trauma management fundamentally relies on standardized protocols that are highly time-sensitive algorithms. Mechanism of injury, associated vehicle/property damage, scene safety for rescuers and extent of difficulty in extrication are crucial determinants of the outcome of a traumatic event.

Correct immobilization of the spine and urgent transport of critically injured patients with attempts to start the stabilization process of the patient en-route are keys to prehospital trauma care.

Given the acuity of trauma, including burns, the only way to ensure accurate and adequate prehospital care is using preset standard protocols. The golden hour often translates into platinum ten minutes, especially when dealing with catastrophic events like tension pneumothorax, head injury threatening herniation, injury to vertebrae or exsanguination. These protocols classify injuries in a predictable pattern of signs and symptoms, so that examination and life-saving interventions can be done in minutes on-site or en-route. These protocols are also the best way to train paramedical staff who are expected to man the ambulances and minimize on-site time to reach the nearest hospital expeditiously.

Protocols also help to identify equipment, like spinal boards and cervical collars, which need to be a part of the ambulance to care for a trauma patient. This is an area where cost can be prohibitive in the Indian settings. However, it is still possible to create cheaper functional alternatives. Recognizing the need for this equipment is the critical first step.

Hospital-based trauma care across hospitals in India

Private sector hospitals located in urban areas are equipped with modern devices. They offer services at a price that sometimes hinders people from getting care. Caregivers are given a choice after initial stabilization to transfer to a government sector hospital where the staff often lacks special training in trauma. The ultimate outcome of the patient is vulnerable.

Advanced infrastructure that is expensive and prohibitive accounts partially for higher survival rates and optimum outcome among injured cases in developed countries. Improvements in outcome are also seen with organization of trauma care services.^[51,52] The Government of India established the Jai Prakash Narayan Apex Trauma Center (JPNATC) at the All India Institute of Medical Sciences (AIIMS) in New Delhi as a step towards providing quality trauma care at a facility that models for other institutions and centers providing trauma care in the country.

Holistic trauma care that reduces morbidity, mortality and disability are essentially nonexistent in our country.^[53] We shall not dream of countless trauma care outlets with a heavy financial outlay. Instead, an upgrade of the existing infrastructure is the cost-effective approach. Time bound training of man power in the EMS and hospital care should be an additional priority. Thus, establishment of a network of institutions providing optimum trauma services with legislative backup will be the building blocks of an essential trauma care system.^[54]

The concept of public-private partnership (PPP) blends best of both worlds, where government and private enterprises successfully work together for primary health care delivery in India.^[55] Emergency Management and Research Institute (EMRI), a PPP model, provides prehospital emergency care free of cost with the creation of a single emergency toll free number, '108' with a network of hospitals that are cooperating to stabilize the patient free of charge. Furthermore, there is a provision of emergency management training for first responders, the first of its kind in India, the establishment of standards for EMS staff, equipment and a training model. The system is operational in only two states in India, Andhra Pradesh and Gujarat.^[56]

Emergency care in rural India

From the preindependence era, a network of comprehensive healthcare delivery system has been

present in rural India. Primary health centers with sub-centers are the basic functional unit for providing primary health care. Secondary care is provided at the district hospitals. Tertiary level care is at the teaching and nonteaching hospitals at the cities. In parallel, the private sector provides mainly primary care. The entire group serves as the primary care providers in the event of injury with their limited skill and, knowledge and resources to render reasonable trauma care.

Disasters and emergency care in India

Disasters have become part of life in India with regular cyclone, flood, earthquake, and landslide. In the absence of a well-drilled EMS and trauma care service, there is a huge loss of life and residual disabilities from the disasters. Furthermore, there is a lack of coordination and communication between the multiple stakeholders, which further cannot utilize the scarce resources. Vested interests prevail to take political leverage in this precarious situation in the name of medical care.^[48]

Problem of reporting

There is a tendency to provide an underestimated report of injury from the administration for reasons better understood to them. This leads to misjudgment of the depth of the problem. Moreover, the case definition of injury or RTI is often misleading. This along with the lack of sensitization of the protectors of law and order disturbs the comprehensive reporting processes. Researchers from the national capital note that the rates of morbidity, disability, and mortality due to RTI were 18.5, 3.4, and 0.4 - much higher than comparable global data.^[57,58]

Developing injury surveillance and trauma registries in India

Reliable information related to injuries and their outcomes are not available in our country in the absence of a comprehensive national trauma database. Trauma Registries are an integral part of methodology of trauma systems for the collection of data and assessment of outcome and has been proven instrumental in developed countries. A trauma registry will provide a comprehensive, scientific tool to process data and analyze the epidemiological and research gap between developed countries and India.

TREAT-INDIA, the Trauma Registry Pilot program was initiated by the University of South Florida's Department of Emergency Medicine (EM). Structured by Scientist Laxminarayan Rajaram, the USF trauma registry was tested as a pilot in 2010 at various medical college hospitals throughout India. Data were collected on predesigned proforma after ethics committee approval was ascertained. The objective of the pilot study was to assess the applicability and feasibility of the research methodology. The pilot study provided an accessible and applicable method for developing a trauma registry in

India. It allowed a concrete layout to adopt the registry and assessed the challenges and diversity of system adaptation.

In February of 2011, the analysis of trauma data collected using the Trauma Registry Data Collection Sheet along with analysis of trauma data from multiple locations was presented in a collaborative meeting in New Delhi with officials from both the Ministry of Health and Family Welfare, Government of India (MOHFW-GOI) and the Center for Disease Control and Prevention, (CDC), Atlanta, USA. It was entitled '*Developing a Roadmap for Injury Prevention and Control in India*'.

The data set from a tertiary care hospital in Central India for example revealed that 58% of trauma victims were in the age group of 20–30 years of age. Nearly half (45%) were agriculture and manual laborers. The most common place of injury was the road or highway (72%) with most patients arriving directly from the site of incident (81%). Nineteen percent of injuries were from fall from height while RTIs were (including motor cycle accident) 55%. The most common mode of transport to the hospital was personal vehicle. In fact, only four cases were transported by ambulance. The time between the patient's arrival at the triage area, and the time the patient was seen, was less than 5 min in almost all cases (98%). In 73% of the cases, a nurse was the initial care provider. Fifty-four percent of patients were triaged as *Emergent*, with life or limb-threatening injury.

The data on TBI analyzed from Acharya Vinoba Bhawe Rural Hospital, Wardha, Datta Meghe Institute of Medical Sciences was collected using the parameters based on the WHO guidelines, '*Standards for Surveillance of Neurotrauma*'. All the consecutive patients admitted to the neurosurgical facilities with the history suggestive of TBI were enrolled in the study. The total number of patients with TBI was 414 with a mean age of 33.5 years and 79% of the patients were males. Twenty-five percent were in the age group of 20–30 years, followed by 16% in the 30–40 years of age. Children (7%), aged 6–10 years, and adolescents (10%), aged 11–20 years also comprised almost 20% of TBIs. Alarming, 11% of TBI patients were younger than 10 years of age and almost one in four (24%) of the patients were less than 20 years of age. The mortality rate was 8% and did not vary significantly in the different age groups. Fatalities among females were higher than males, though not significantly. The month of June had the most number of TBIs at 34% followed by March at 19%. Among the modes of trauma, the most common was RTI at 57% with most incidents occurring on the highway. Alcohol was involved in 9% of the cases. Computed tomography (CT) scan findings were normal in 45% of patients and subarachnoid hemorrhage was noted in only 6%. Most of the associated injuries were minor and included

bruises (40%), abrasions (51%) and cuts (45%). A few had major associated injuries, such as ear, nose, or throat bleeding (2%) and extremity fractures (5%). Ten percent of patients required resuscitation at the time of admission. The mean duration for hospital stay was 5.4 days.

The data on deaths due to trauma at Indira Gandhi Government General Hospital, Puducherry demonstrated that the cause of death of the 205 trauma patients was confirmed by autopsy. Eighty-seven percent of the victims were males and age ranged from 7 to 90 years, while female's age ranged from 3 to 80 years. The greatest number of males ($n = 39$, 19%) was in the age group of 40–50 years. The majority of victims were in the productive age group of 20–50 years ($n = 117$, 57%). One-tenth of the deaths were children less than 10 years of age (3%) and adolescents (7%). Overall, fatality rates among different age groups were not significantly different. Falls were the major mechanism of injury ($n = 59$, 29%) and highway injury was reported as the most common location of injury ($n = 125$, 61%). There was no significant variability in occurrence by day of the week. The number of deaths during the afternoon to midnight was higher compared to the morning time. But this difference was not significant. The TBI data from a tertiary care rural teaching hospital in central India showed that TBI patients had a mean age of 33.5 years with half the patients in the age of 20–40 years, and 1 in 10 patients were younger than 10 years of age and nearly a quarter were less than 20 years of age. Overall, 1 in 10 required resuscitation on admission with mean duration of hospital stay 5.42 days and a mortality rate of 8%. Though 79% were male victims, females were more likely to die from their TBI. The greatest number of cases were reported in June (34%), followed by in March (19%). The RTI were the most common injury mechanism (57%) predominately occurring on highways (58%). Alcohol was associated in 1 in 10 cases. The rate of major associated injuries like ear, nose or throat bleeding was 2% and extremity fractures were 5%. Life threatening CT scan findings such as subarachnoid hemorrhage was noted in 1 in 20 cases.^[59]

In another study from south India, it was found that patients presenting directly from the site of injury, injury to the diaphragm, though rare still in RTIs, was caused most commonly by blunt trauma and assault with knife in penetrating trauma. Roentgenograms were positive in 51% of cases though the most common reason for a false negative was massive hemothorax. CT scans improved the rate of positivity to 63%. Twenty-five percent of diaphragmatic injuries were diagnosed intraoperatively irrespective of initial X-ray findings. Laparotomy alone was sufficient in the majority of cases. The defects were predominantly on the left side with a mean defect size greater with a blunt mechanism. Associated injuries were noted in 92%. The stomach was most affected in penetrating injuries and the spleen

in blunt trauma. Empyema was the most common complication. The mortality rate, 13% in penetrating injury was significantly lower than the 60% rate in blunt injury. Mean Injury Severity Score (ISS) was significantly related to fatal outcomes irrespective of mechanism.^[60]

The above scrutiny was done from data obtained independently and researchers concluded that collection of information through an active and well-organized trauma registry forms the basis of quality trauma care. The data can be used not only for setting up protocols and internal quality review meetings but also could contribute toward use of accreditation, verification, and designation of trauma centers.

There are still many challenges in implementing the trauma registry in India. The software must be able to store a large amount of data with an International Classification of Diseases (ICD) Coding system backup and additional data processing and analysis tools. Furthermore, sufficient funding and manpower are needed. The results of this pilot study are encouraging in terms of many variables inevitably missed by other means of data collection.

Morbidity and mortality scores

Globally, the ICD is extensively used to compare mortality data. But in the case of poly-trauma the coding is marred with confusion that needs additional severity scoring. We can modify the existing software by converting administrative codes to severity scores to code the data more accurately.^[61,62] The revision of ICD is in the works by the WHO and researchers are working to update and standardize the ICD scoring system to reduce its limitations on injury scoring.^[63,64]

The training of emergency medicine in India

The Medical Council of India (MCI) recognized EM as a distinct specialty as of 2009. A number of medical colleges have planned to start a post-graduate (PG) program and are approaching the MCI for permission. Since the EM and Trauma Sciences are closely related, the growth of trauma sciences is acting as a stimulant to develop EM in India. The victory of trauma care depends on a prompt and precise comprehensive and accessible EMS. The INDO-US Emergency and Trauma Collaborative is working on various initiatives to catapult this development.^[48]

In South-East Asian countries including India, the teaching/training/learning in health is pursued in a disconnected manner; the learners fail to recognize the risk factors that produce the trail of events leading to an injury. They are taught in such a didactic manner that learners fail to internalize the concept of early recognition with earliest optimum intervention to alter

the natural history and affect prognosis in the most cost-effective way. Even during the educational process of noncommunicable diseases, we fail to see any methodical approach to injury science based on the epidemiological triad. Even in the fields of Epidemiology, Community Medicine and Family Medicine has a lax approach with the presumption that injury care is in the domain of orthopedics, neurosurgery, and other surgical disciplines.

A much awaited resolution is needed for a holistic training, not only in all the streams of health sciences but also in schools of health care with more dedicated personnel in the field of operational research in injury epidemiology. This is a well-known bottle neck that has been the subject of a handbook on undergraduate training, published by WHO.

Recently, the Medical Education Unit, University College of Medical Sciences (UCMS) and Guru Teg Bahadur Hospital (GTBH), Delhi, framed a multidisciplinary pedagogical Module on Injury Prevention and Control (2013) for undergraduate students with attendance by multiple departments, Anesthesia, Community Medicine, Ophthalmology, Orthopedics, Medicine, Pediatrics, Psychiatry, and Surgery.^[65,66]

A Medical PG degree (MD) in EM has been added in the Schedule to PG Medical Education Regulation, 2000 of the Medical Council of India (MCI). Masters Degree programs in EM and other academic PG courses are also budding up in India and currently over 10 MCI-recognized programs are conducting PG training in EM in addition to a DNB in EM being started this year as per the National Board of Examination (NBE) stated on their website.^[67,68]

Trauma care training in India – the need for differentiating orthopedic trauma surgical training and general surgical-based trauma care training

The Government of India continues to invest in the development of trauma centers and systems. So it is imperative that trained trauma specialists be commissioned to man these trauma centers. Dedicated Trauma Surgeons/Physician/Nurses/Technicians/ Researchers have to work hand-in-hand to develop this new horizon of science in India. Currently there are initiatives to get the MCI to approve a super-specialty course in Trauma and Critical Care (MCh).

Across the world, Trauma Surgery Training is a super-specialty training program and has two different streams namely Surgical Trauma Care and Orthopedic Trauma Surgery. PGs (MS/DNB) from Surgery can pursue a super-specialty course (MCh/DNB) in Surgical Trauma Care and PGs (MS/DNB) from orthopedics can pursue a super-specialty course in Orthopedics Trauma Surgery (MCh/DNB).

The MCI is working on guidelines to bring a specialization in Trauma Care while NBE already has a Fellowship in Trauma Care. The point to note here, however, is that there has to be a differentiation between Ortho and Surgical Trauma care while creating the curriculum and training in this specialization.

The other pieces are neuro-trauma care and pediatric trauma care. There is enough exposure to trauma care as a part of neurosurgical and pediatric surgical training. At the MS/DNB level the accrediting agencies namely MCI and NBE will have to mandate trauma rotations and training to PG surgical residents to manage and conduct acute interventions and then provide appropriate referrals to higher centers of care as needed. This is a well-known practice in Western nations, as no country is immune from geographical areas with a paucity of super-speciality trained surgeons.

We have to look at the big picture and the future of Academic Trauma Training, which is still in its infancy, in India. Taking the appropriate steps will ensure the nurturing of a vibrant science and a competent surgeon for the future.

Initiatives are also ongoing to introduce certification in Trauma Nursing. Additionally, there is a need for reorientation of the specialties of Physical Medicine and Physiotherapy in the direction of trauma care from the conventional approach of predominantly chronic pain alleviation.

The Advanced Trauma Life Support course by the American College of Surgeons is now being taught in India with the AIIMS being the index-training site. The Advanced Clinical Trauma Nurse Course being taught on analogous lines by the AIIMS. With the above initiatives, India can look for a future where there will be trained Emergency Physicians, Trauma Surgeons, and Nurses to manage all emergencies, including trauma.

Neuro-trauma care at nonneurosurgical health facilities

The TBI is a critical public health problem that affects millions worldwide, and is expected to outshine quite a few causes of mortality and morbidity by the year 2020.^[69] The TBI is neurosurgical emergencies (intracerebral hemorrhage and subarachnoid hemorrhage) that require specialized neurosurgical care.^[70,71] There are challenges to TBI management secondary to the limited resources designated to neurosurgical care in India. It is an under assessed problem. Furthermore, there is a wide spectrum of facilities available to treat neurosurgical cases in the developing world. In India, neurosurgeons work in difficult conditions in some situations, while others are privy to facilities comparable to the global standards.^[71-75] Such facilities are not widely available and with the

unavailability of EMS in most LMICs, the time interval before TBI patients are managed, and contributes to the increase in morbidity and mortality.^[45,71,74,76,77] The care of these patients can be simply improved and secondary injury prevented with the implementation of the ABC algorithm.^[78] Availability of the operating theater for neurosurgical intervention is also crucial.

To facilitate this, in hospitals where there are no trauma surgeons, neurosurgeons should train nonneurosurgeons in case selection for the emergency interventions. To further facilitate the use of standardized protocols for the management of TBI is necessary to identify operative procedures that can be safely performed by nonneurosurgeons, that is, extradural hematomas, chronic subdural hematomas, intracranial pressure (ICP) monitoring, external ventricular drainage, etc.^[78]

These capacity-building approaches should be broad and intermingled with hands-on-training with the objectives of procedural competency for nonneurosurgeons. Emphasis must be placed on the need to learn relevant neurological examination techniques, to detect major clinical abnormalities, manage critically ill neurosurgical patients, and to master basic neurosurgical techniques.

The short-term training should focus on recognition of the presence of any operable lesions and training to recognize clinical signs of increased ICP, identification of localizing signs, basic knowledge to interpret CT scans, and to evaluate for the need to transfer to a neurosurgical center. Whether it should be combined with residency training or a separate short-term certification course, needs to be discussed at a larger forum.

While preparing peripheral centers to handle the neurosurgical emergencies by nonneurosurgeons, there will be a need to identify the infrastructure for a referral pattern to the regional coordinating centers.

A positive change is possible, as it has been well recognized that majority of TBIs are minor in nature, and most of the patients do not require neurosurgical intervention and can be managed nonoperatively with good outcome, even in the absence of dedicated neurosurgical facilities.^[71,74,79,80]

It has been recognized that many simpler procedures, such as insertion of ventriculostomies or ICP monitors can be successfully performed by nonneurosurgeons. Despite this, there is still a debate whether the indications were always appropriate and if the information gathered was used as effectively, had a neurosurgeon been interpreting it.^[81]

International and national mindset on injury science
Political determination with unrelenting efforts can decrease injury related problems. Yet, road safety is a

shared responsibility between different stakeholders. A holistic approach looks at the organization and interaction between the three basic elements- the roads, vehicles, and road users in order to identify where there is potential for intervention. In particular, the systems approach recognizes that humans make mistakes and as such, a safe road traffic system is one that accommodates their weakness.

The World Health Organization

The World Health Day in 2004 focused on road safety with the slogan *Road Safety is No Accident* to emphasize the role of public health in the prevention of RTIs with six recommendations for action on road safety at a national level; which were outlined as follows:^[82]

- Identify a lead agency in the government to guide the National Road Safety Effort
- Assess the problem, policies and institutional settings relating to RTI and the capacity for RTI prevention in each country
- Prepare a national road safety strategy and plan of action
- Allocate financial and human resources to address the problem
- Implement specific actions to prevent road traffic crashes, minimize injuries and their consequences, and evaluate the impact of these actions
- Support the development of national capacity and international cooperation.

Millennium development goals

One of the Millennium Development Goals (MDG) aimed to reduce extreme poverty. We cannot overlook the well acceptable tell-tale truth that deaths and disabilities on road due to RTI have roles to play in increased global poverty as 70 million people are dragged below the poverty line as a result of injury on road. The proponents of MDG could have vision and mission on this glaring truth to prevent millions of unnecessary deaths and downstream poverty.^[83]

UN decade of action for road safety 2011–2020

The United Nations (UN) recognized the hazard of the RTI crisis, announcing a *Decade of Action for Road Safety 2011–2020* with a 100 governments working to limit road deaths by 2020 to prevent a projected five million deaths. Until RTIs are recognized as a global killer comparable to HIV/AIDS, tuberculosis or malaria, the issue will remain debated, ignored and underfunded.^[84] The change toward recognition is empowering the movement and resources allocated to prevent RTIs.

National rural health mission

The National Rural Health Mission (NRHM) has arranged for the basic care of injury at the primary healthcare level to deliver first-contact health care. The ambulances are equipped to provide prehospital care and transfer to hospital. The Integrated Disease Surveillance Project of

the Ministry of Health and Family Welfare recognizes the problem and plans to include an injury module as a component.^[82,85]

Planning commission of India

A study by the Planning Commission in 2002 put the social cost of road accidents in India at Rs. 55,000/- crores annually (at 2000 prices), that is, about 3% of the GDP. Yet, the outlay of expenditures was meager until the 10th 5-year plan. Deaths from road crashes were more than double compared with the total number of deaths due to all the major killer diseases including tuberculosis, HIV/AIDS, and malaria in 2004, in India. Still there is no national program unlike other countries and the annual outlay is remains inadequate even in the 5-year plan.^[85,86]

Developing pediatric trauma care and pediatric emergency medicine In India

Pediatric trauma care is a fairly complex area, not just at a clinical level where doses and equipment sizes need to be accurately calibrated for weight and age of the child, but also the practical aspects of dealing with a pediatric patient on the field and in the hospital.

It can be nearly impossible to verbally elicit complaints from pediatric patients and signs may be unclear as physical examination is usually resisted by the child given the pain, panic and especially the presence of strangers. Accompaniment of a parent or trusted caretaker at the site is a prerequisite for handling a conscious pediatric patient who is injured. In most cases, efforts need to be directed at getting a quick primary judgement of the situation at hand, and shift the patient to a definitive care setting as soon as possible, where more reliable investigative modalities can be used to gauge the actual condition of the patient and appropriate management can be initiated accordingly.

Clinical care of pediatric patients, especially in the prehospital settings, is a logistic challenge as it involves duplication of equipment, separate pieces of pediatric sizes, charts indicating pediatric dosages of emergency drugs etc.

Immobilization and transport of the conscious pediatric patient is also often very difficult to manage. Children are also prone to more severe injuries than adults, not only because they are often passive and helpless recipients of trauma especially during accidents, but also because their delicate bodies and their experimental approach toward their surroundings can turn the most routine objects into potential causes of injury.

Another serious and often overlooked aspect of pediatric trauma is that of child abuse. With a greater incidence in the female child, especially in India, this abuse can take varying forms and extents of severity, including sexual

abuse. Although this can often continue for long periods till it is actually discovered, a high degree of suspicion about the pattern of injuries, blotchy or changing history and overall behavior of the child in the presence of family or care takers is required for early detection when presenting as pediatric trauma.

There is, hence, overall a much greater need to develop specific set of protocols for pediatric trauma care, which will come under the purview of pediatric surgery and in the expertise of pediatric surgeons.

The development of pediatric EM will involve a leap of change in attitudes, sensitivity and preparedness of our prehospital and hospital settings in India to deal with pediatric emergency patients. Around the world, pediatric EM is a super-specialty discipline, which is pursued by qualified PGs from EM as well as pediatrics. As a part of PG training both pediatric and EM PG students get experience in taking care of pediatric emergency patients but as a discipline, pediatric EM is a separate super-specialty field across the world.

The concept of a dedicated Children's Hospitals is just beginning to take shape in India. Most hospitals have only a department of pediatrics, and many hospitals have graduated to having pediatric intensive care units, but work needs to be done in developing pediatric EM. It is not very difficult, as pediatrics is already a niche branch in itself. Pediatricians have already made a headway into pediatric critical care and neonatology, so the super specialty of pediatric EM could be a possibility in the near future.

Indian council of medical research

The ICMR as a biomedical institution has placed trauma research on its primary agenda as part of its 12th 5-year plan. Apart from financial support to extramural research programs that generate scientific knowledge on the basic, epidemiological and socioeconomic aspects related to injuries and trauma, the ICMR promotes capacity building, training and knowledge exchange programs and policy matters on prevention and reduction injuries as a nodal agency. National and international exchange of ideas and collaborative studies addressing trauma as a major public health problem are part of the activities of the ICMR. In the 12th 5-year plan, the ICMR is planning to undertake a multi-centric task force study on creating a Registry of Trauma Shock and Emergencies.

Census of India 2011

A number of new categories for the Census of 2011 have been introduced in order to better capture and analyze the data on eight types of disabilities as opposed to the five previously included in the Census of 2001. The information is being collected on general disability categories - namely, disability in seeing, in hearing, in speech, in movement, mental retardation, mental illness,

any other and multiple disability. Unfortunately, injury-related disabilities were overlooked.^[87]

National crime records bureau

In the present scenario in India, records on crime-related injuries are maintained mainly by the National Crime Records Bureau (NCRB). The data from the District Crime Records Bureau (DCRBx) is collected by the State Crime Records Bureau (SCRBx) and sent to NCRB regularly. In addition, information from megacities (population of 10 lakh or more as per the latest census) is collected separately. From the first edition of *Accidental Deaths and Suicides in India*, which began publication in 1967 and continues to date, all have been digitalized and made accessible on the NCRB website for all stakeholders. These reports constitute the only, and most comprehensive, data available for the Government of India policy makers, NGOs, researchers, and the public at large. Accidental deaths have been classified by causes into two broad groups, attributable to nature and not attributable to nature. The former group contains causes like avalanches, cold and heat exposure, tornados, starvation and thirst, earthquakes, epidemics, floods, heatstroke, landslides, lightning, torrential rain, and other natural causes. The latter group includes causes such as air crashes, structural collapse, drowning, explosions, falls, fires, sudden deaths, poisonings, traffic accidents and other causes. Within this information bank, RTI deaths by month and time of occurrence are available. Details of professional, educational and social profile of suicide victims are noted including bankruptcy, suspected or illicit relations, cancellation or nonsettlement of marriage, not having children, illness, death of dear ones, dowry dispute, divorce, failed in examination, family problems, property dispute, unemployment and others. Therefore, in absence of a nationally representative, age specific data, we have to depend on the NCRB report. Unfortunately, the largest part of the accidental deaths were between 15 and 44 years that accounted for more than half (59.9%) of all persons killed in accidents in India during 2012.^[88,89]

Ministry of health and family welfare

The Ministry of Health and Family Welfare, Government of India has taken up an ambitious plan to establish trauma care centers along the national highways to provide medical care and referrals to equipped healthcare facilities to deliver improved care for injury victims. During 11th 5-year plan, these trauma care health facilities were designated as level I, II, III, and IV.

A memorandum of understanding has been signed with the State Governments to implement and sustain the mission.

“To identify healthcare facilities along the golden quadrilateral and north-south, east-west corridors,

upgrade the identified and designate centers, to establish a life support ambulance system, to eliminate gaps in human resource availability, to devise a curriculum for training emergency medical care for nursing staff and paramedics, to establish communication links, to assist the states in development of an appropriate trauma referral system, to develop, implement and maintain a State-wide and National Trauma Registry, to improvise, monitor and evaluate the efficiency of the Trauma Care System and finally, to widen the scope of injury science for our subcontinent".^[90,91]

What needs to be done?

There are many urgent priorities stemming from this ambitious action plan. First, we have to upgrade the ICD-based diagnosis system by improving the existing infrastructure and equipment of secondary and tertiary care hospitals. We need to invest in new and improved physical resources for prehospital care and communication systems, and provide well-trained staff at all levels of care from prehospital to definitive trauma care. All personnel involved must understand the critical needs of the injured patients. It is an utmost priority to make doctors and paramedics competent with well-trained prehospital services and tertiary level teaching hospitals. A holistic approach is required that embraces human and physical resources and the dedicated organization that includes optimum land use and planning, setting safety standards for vehicles, designing infrastructure while maintaining the mind set of protection of pedestrians and motorcyclists, promoting safe public transport, and campaigning for lifestyle improvement with multi-disciplinary collaborations.

We have to enforce the driving license system, mandatory use of a helmet, traffic laws, and standards for vehicle condition and speed limits to reduce the mortality and morbidity of RTIs. India should have and strictly enforce the law on drunk driving with clear legal definitions and BAC limits set at or below 0.05 g/dl. Additional BAC limits, below 0.02 g/dl, should be considered for the young or novice drivers. Motorcycle helmets should comply with the national standard and should be enforced for all population, and especially for children. The use of front and rear seat belts should be mandatory. Firm implementation of transparent road safety policy and effective interventions with reliable information systems are urgently required. Moreover, there is a need for education and maintenance of knowledge related to risk factors behind common household-related injuries, with a focus on prevention and reduction of the risk of unintentional domestic injury and corresponding behavioral changes.

The improvement and organization of trauma services and systems is a cost-effective way of optimizing patient outcome and is achievable in almost any setting.

Behavioral change communication programs have to be implemented to raise public awareness regarding key safety areas that include information on avoiding drinking and driving, enforcing speed limits, along with the reasons for enforcing the law.^[2] Haryana was the first Indian state that established Haryana Highway Patrol for Road Safety in 2000.^[87]

Presently, overall records of injury-related data are being officially collected by the NCRB as an independent network, not directly linked with any central or state government healthcare delivery system. Laws related to injury need to be revised and not treated as a predominately medico-legal matter, which tends to lead toward underreporting even in cases of serious injuries, especially of patients who can provide pay-for-service medical care.^[65]

Political determination with continuing efforts from the community can help control injury related problems. Road safety is, however, a shared responsibility between diverse stakeholders. A holistic approach to road safety looks will encompass multi-sectoral coordination, with interaction between the three basic elements – the roads, vehicles, and road users in order to identify potential for intervention. A systems approach recognizes that humans make mistakes and as such a safe, road traffic system is one that accommodates this weakness.

The MCI has permitted the training of 40,525 medical students in 345 medical colleges annually in their undergraduate medical education courses. The graduate medical school curriculum is training students to undertake the responsibilities of a first contact physician, capable of looking after the preventive, curative, and rehabilitative aspect of medicine.^[92,93]

We propose to the MCI that it makes it mandatory for all medical institutes offering medical education to establish distinct Departments of EM with the faculty pattern maintained as with the mainstream departments (c.f. Department of Medical Education). Concurrently, the National Academy of Medical Sciences (NAMS) needs to direct hospitals and health care facilities, who are conducting any of the Diplomate National Board (DNB) courses, to establish a dedicated and distinct Department of EM. Consequently, it provides an immediate platform for nearly 400 EM programs to be established across the country and will help the citizens of India.

Along similar lines, MCI and NAMS have to mandate in the (MS/DNB) orthopedic and general surgery curriculum academic exposure and training on surgical and orthopedic trauma care and the critical care management of trauma patients. There is a need for a separate (MCh/DNB) super-specialty training program in surgical and orthopedic trauma care. These are

two distinct disciplines with distinct abilities and a single surgeon cannot manage or conduct these surgeries simultaneously. Again, it is imperative that such efforts are conducted in the spirit of multi-disciplinary collaborative framework, with the best-trained physicians in their respective specialties, starting with the EM experts, and culminating with rehabilitation medicine specialists.^[94]

Role of individual accreditation of emergency departments

The National Accreditation Board for Hospital and Healthcare Organizations (NABH) has been a major driving force pushing the quality revolution in the country. The concept of having standards set by a team of experts and encompassing aspects of the functionality of a hospital including infrastructure, departmental process flow, required documentation and human resource allocation. These parameters are applied to the hospital at large. However, as departments grow, the need to develop specialized accreditation criterion seems imperative. The National Accreditation Board for Laboratories (NABL) is an example where laboratories submitted proforma to become accredited within the hospital even if the hospital did not apply for accreditation by the NABH.

The ED is in itself akin to a miniature hospital dealing with acute care round-the-clock. The workings, and thus the quality of care delivered in the ED depend largely on various ancillary services. Hence, in an attempt to measure the performance of the ED, it is paramount to define these parameters that constitute the components required for a well-functioning ED.

It is crucial to set up standard operating protocols wherever possible, as there is a diverse mix of clinical and para-clinical teams that interact in the ED.

This builds a strong case for developing an individualized accreditation program and board for the ED that would lay down standards and performance evaluation for quality.

Role of a national emergency number

This concept deserves a specific mention in this paper not only because of the obvious enormous impact it can have on streamlining trauma response networks throughout the country, but also the fact that the Indian government has already taken cognizance of this need. Consequently, significant deliberations have been started by the government and key institutes in emergency care, especially in respect of how to actually setup and operate this emergency response network in India.^[95] Experts have specially made recommendations in a comprehensive white paper^[96] on two important aspects: The first being the need for

an Integrated National Emergency Response System that is controlled by the government on the medley of private players as it is presently the case; and secondly the need to plan extensively for the Postcall response network - the linkage between the call centers and actual prehospital care provider networks including not only ambulances, but also the police and fire departments to ensure a coordinated response to an emergency call.

KEY RECOMMENDATIONS OF THE 2014 ACEE INDO-US JOINT WORKING GROUP ON “DEVELOPING TRAUMA SCIENCES AND INJURY CARE IN INDIA”

The ACEE-INDUS-JWG was constituted with a core team of experts in trauma and injury care from India and the United States of America. The team exhaustively reviewed the current burden of trauma in India, studied the challenges, delineated opportunities, chalked out initiatives to provide better preventive strategies and advance the care of trauma patients at health care facilities across India.

There are varied mechanisms of Injury. The injury could be intentional or unintentional and the event could be natural or manmade. The mechanisms could range from road traffic crash, burns, violence, falls, and mass casualty events to name a few. Overall, the main fundament in addressing the burden of Injury in a highly diverse and populated country like India is to make provisions to adopt a multi pronged approach with a national initiative at the helm of leadership.

The recommendations are:

1. Create a national injury control and prevention program (NICPP)

The NICPP should encompass national initiatives of implementing social marketing strategies to promote and encourage prevention of Injuries across the spectrum. Examples of such initiatives are promoting use of helmets, seat belts, child proofing houses, promoting diligence in safety of women and children etc. Occupational Safety should be a part of NICPP.

The program should also facilitate collection of Data on Injuries by forming a “National Injury Surveillance System” which gathers and compiles specific Injury related data from various sources like National Crime Records Bureau and Health Care Facilities. This system will help modify and create regulations and policies to improve Injury Prevention and Care.

Additionally NICPP should collaborate with the other National initiatives like the Mental Health Program to

come up with joint strategies to tackle mental trauma and post traumatic psychological disorders by identifying them early and treating them. This will prevent further damage and enhance integrated care.

The NICPP should implement its various initiatives by involving Non Governmental Organizations across the country to forge ahead its mission. The Model of Public Private Partnership for Progress is unique and should be adopted across the nation during the implementation of this program.

A special focus needs to be the prevention of violence involving women, children as well as vulnerable populations like the economically challenged or citizens with special needs. Care of injured patients in the above category should be an integral part of the objectives of NICPP.

2. Create a clinical trauma registry to track care of trauma patients at hospitals

Working on the lines of nations across the world, the Leadership of India should work closely with the Indian Council for Medical Research (ICMR) and advance the creation of a Comprehensive Registry of Trauma Patients. The Clinical Registry should actively collect data on Trauma patients with respect to their clinical parameters, the care provided as well as the outcomes of care. The data can be gathered from health care facilities across the country where comprehensive trauma care is available.

The Clinical Registry will be different from the Injury Surveillance System as it will specifically address and monitor clinical care of patients. This valuable clinical data will help in creating trauma treatment guidelines to help physicians across India to treat injured patients with evidence based guidelines from India.

3. Strengthening the education in specialities of emergency medicine (EM) and trauma surgery (TS)

There is an immediate need to strengthen the MD/DNB programs in Emergency Medicine and also carefully develop advanced MCh/DNB (Sub Speciality/Super Speciality) programs in trauma surgery with a separate specialized training on trauma given to General Surgeons and Orthopaedic Surgeons during and after their specializations. Additionally Injury Critical Care training should be stressed in the training curriculum of Emergency Medicine and General Surgery. The lack of trained faculty to lead these programs is a major challenge and this need to be addressed comprehensively. Intense focus should be placed on Faculty Development Programs in EM and TS.

4. Incorporating emergency neurosurgery training into general surgery training programs

The post graduate programs in General Surgery have to formulate curriculums to incorporate sufficient exposure

to acute Neurosurgery. This will help train the general surgeons to care for head injury patients if and when they are working in resource challenged settings and there is an unavailability of Neurosurgeons. Additionally certificate training programs should be created for currently practising surgeons to learn emergency neurosurgery skills to take care of head injury patients.

5. Developing the speciality of paediatric emergency medicine and building paediatric emergency trauma centres

The development of the advanced speciality of Paediatric Emergency Medicine and creation of speciality paediatric emergency trauma centres should be done on a war footing. Care of children is a specialized field and its needs special attention as children are not small adults and physiology and pathology varies.

6. Mandating life support certification

Working in lines of the nations with advanced health care, India can adopt the strategy to mandate Cardiac, Paediatric, Neonatal and Trauma Life Support Training to all health care workers across medical facilities in India. The onus of tracking current certification and recertification can be regulated and be laid upon the shoulders of the individual doctors/nurses and the institution with which they are associated. Lack of certification or recertification should lead to disciplinary actions. Governmental Relationships can be established with agencies like American Heart Association and American College of Surgeons to help create these national initiatives from an INDO-US partnership perspective. Currently training in these areas is being done by independent contracting and is fragmented and driven by few across India. There is a need for this to be incorporated by the Government and modify it for the whole country.

7. Funding research in injury sciences and emergency medicine

There is a need for Translational Research to receive encouragement and annually renewable funding to help support the implementation of innovative interventional ideas by clinical, basic science and public health researchers across Institutions in India. A special focus should be made to fund research to take the discoveries of the bench side to bedside and beyond. Funding ideas to study point of care diagnostics, emergency treatments and public health research to identify and correct injury aetiologies should receive special focus.

8. Strengthening pre-hospital emergency care and creating a single emergency number

The government should start the process of creating uniformity in Emergency Ambulance Services across India and work on developing the infrastructure to start and sustain services related to creating a Single

Emergency Response number. Experts have specially made recommendations in a comprehensive INDO-US white paper regarding creating a Single Emergency Number.^[96]

9. Regulations, laws and accreditations

Government should play an active role in creating strict Laws, Regulations and Guidelines to streamline processes and rules to be followed by for Institutions and Individuals in creating services at hospitals and providing trauma care at an individual level.

10. Injury prevention education at school levels and safety training at work place

There should be close collaboration between various concerned ministries to incorporate and regulate Injury Prevention Education at a School level and also Safety Education at Work Place. This should be important component of NICPP.

11. Build global alliances to advance local agenda

Countries and agencies across the world have invested heavily in building trauma and injury prevention programs. Alliances with agencies like National Institutes of Health (USA), Centres for Disease Control and Prevention (USA), American Heart Association, American College of Surgeons and the INDO-US Emergency and Trauma Collaborative can definitely accelerate the process of implementing progressive strategies to prevent injuries and treat injured patients across India. Creating International Joint Working Groups like the INDO-US JWG created by the Academic College of Emergency Experts in India will bring experts together who will strategize, advice and work with the lawmakers to advance of the growth of trauma healthcare, Injury Prevention and Emergency education and research in India.

CONCLUSIONS

In summary, this white paper focuses principally on the magnitude of the problem, risk factors, management and impact of traumatic injury in India. We also discuss the role of a trauma care team that will be integral in both implementation and practical organization of upcoming facilities, with the goal of improving patient outcomes. The national response to injury cannot and should not be different from other public health responses that require commitment from both governmental and professional organizations. The momentum of the response to traumatic injury as a national crisis requires serious attention, and we must search for effective strategies to minimize this pandemic. The commitment from the political leaders in countries, and from policy makers in the CDC, WHO, World Bank, United Nations and the international community has provided a platform on which we can work together. The Indian government has to recognize traumatic injury as an important health

and development issue and intensify support for both prevention and system-wide response.

National safety promotion and injury prevention requires an integrated and coordinated vision from all stakeholders, beginning with the concerned ministries and departments and ending with individual caregivers.

Since trauma has a multitude of cause, interventions will need to include an integrated approach to optimize results. Road safety and home safety should be given high importance to reduce pediatric deaths and injuries. Several proven interventions are provided in related fact sheets and public health alerts.

Once lost, health and well-being cannot be restored or purchased. We have to realize that after managing morbidities from the diseases, tomorrow we will have to ponder over innumerable injury-related disabilities, if we cannot think beyond the conventional outlook today.

We have to send a general call exclaiming that 'People's Health is in the People's Hands' as every citizen must take responsibility and play a role to prevent and reduce the burden of traumatic injuries. How many billions of injuries will it take to make us realize that time has come to take action!

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Cite this article as: Pal R, Agarwal A, Galwankar S, Swaroop M, Stawicki SP, Rajaram L, *et al.* The 2014 Academic College of Emergency Experts in India's INDO-US Joint Working Group (JWG) White Paper on "Developing Trauma Sciences and Injury Care in India". *Int J Crit Illn Inj Sci* 2014;4:114-30.

Source of Support: Nil, **Conflict of Interest:** None declared.

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