

## The Burgeoning Public Health Crisis: Demand Analysis and Market Opportunity for Advanced Trauma Systems in the Developing World

Globally, the causes of mortality will experience significant shifts over the next twenty years. Non-communicable diseases such as cardiovascular disease and cancer will continue to account for the majority of deaths (75 percent) worldwide with the rise of an ageing middle class in low- to middle-income countries. Communicable diseases and conditions receiving significant public health attention such as HIV, tuberculosis, and maternal and child health, however, will experience large declines as causes of death. For example, the World Health Organization (WHO) projects that HIV will peak in 2012 with 2.4 million deaths but HIV deaths will decline by 50 percent in 2030 to 1.2 million with the continued availability of antiretroviral drugs.

An unfortunate but increasing number of deaths will occur as a result of injuries, i.e., road traffic deaths, self-inflicted injuries and violence. The primary driver of this growth in injuries will be road traffic deaths as vehicle growth mirrors economic growth in many low- to middle-income countries. Over the next twenty years, the WHO projects an 85 percent increase in road traffic accidents resulting in over 2.4 million deaths and many more millions who will experience permanent and severe disability.

Injury and trauma have increasingly become leading causes of death and disability globally. While trauma has not garnered attention similar to other public health issues such as AIDS, the statistics relating to trauma and injury are staggering:

- Violence and injury result in nearly 6 million deaths each year, accounting for 9 percent of global mortality. This represents more deaths than AIDS, tuberculosis, and malaria combined!
- While only accounting for 9 percent of mortality, injuries account for 16 percent of all disability.
- The leading causes of death for people 15-29 are injury-related: road traffic injuries, suicides, homicides, drowning, burns, war violence, poisonings, and falls.
- Road traffic crashes kill 1.2 million people per year and up to 50 million are injured or disabled. Road traffic accidents are expected to double over the next twenty years.

**Exhibit I** highlights these shifts and delineates the increase in mortality caused by injuries and violence.

In many instances, urbanization and economic development have far outpaced the health care infrastructure necessary to manage injuries caused by development, thus impacting countries ability to manage traumatic injuries. As such, nearly ninety percent of trauma deaths occur in low- to middle-income countries, and death from potentially treatable injuries is six times more likely in low- to middle-income countries than high-income countries. Studies have directly correlated mortality rates with a country's financial status. Treatable, life-threatening injuries are six times more likely to die in a low-income setting (36 percent mortality) than in a high-income setting (6 percent mortality). **Exhibit II** depicts the occurrence of injury-related mortality by regions. Injury and mortality are the greatest in Southeast Asia Region (SEAR) and the Western Pacific Region (WPR) and lowest in the Eastern Mediterranean (EMR) and the Americas (AMR).



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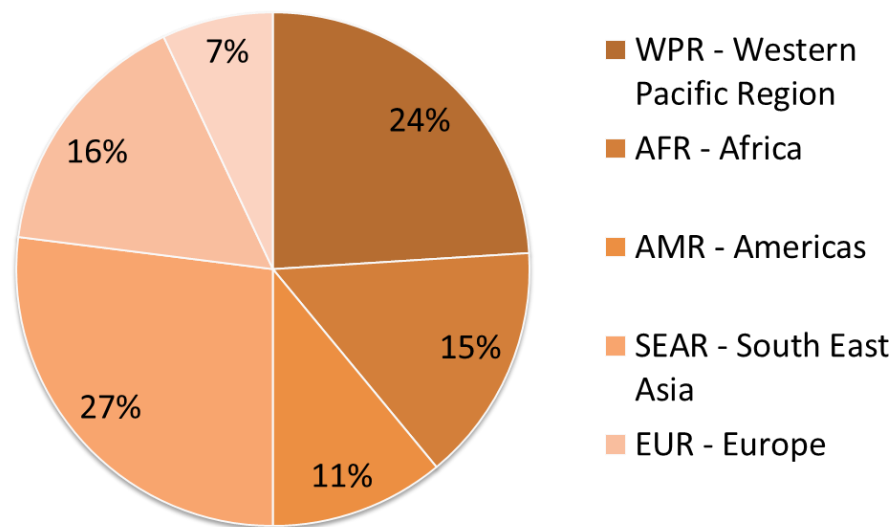
**Exhibit I: Prevalence of Disease or Injury: 2004 vs. 2030**

2004			2030		
Disease or injury	Deaths (%)	Rank	Deaths (%)	Disease or injury	
Ischaemic heart disease	12.2	1	14.2	Ischaemic heart disease	
Cerebrovascular disease	9.7	2	12.1	Cerebrovascular disease	
Lower respiratory infections	7.0	3	8.6	COPD	
COPD	5.1	4	3.8	Lower respiratory infections	
Diarrhoeal diseases	3.6	5	3.6	Road traffic injuries	
HIV/AIDS	3.5	6	3.4	Trachea, bronchus, lung cancers	
TB	2.5	7	3.3	Diabetes mellitus	
Trachea, bronchus, lung cancers	2.3	8	2.1	Hypertensive heart disease	
Road traffic injuries	2.2	9	1.9	Stomach cancer	
Premature and low birth weight	2.0	10	1.8	HIV/AIDS	
			12	1.5	Self-inflicted injuries
Self-inflicted injuries	1.4	16	16	1.2	Violence
Violence	1.0	22			



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## Exhibit II: Injury Mortality by Region



China and India have among the greatest injury-related mortality, hence the high representation in the Southeast Asian region. These countries face many challenges related to providing trauma and critical care services. Many of India's injuries are driven by road traffic accidents.

According to the numbers:

- India's 400,000 road crashes result in 85,000 deaths and 1.2 million seriously injured patients.

- India has one of highest accident rates per thousand vehicles in the world. Road traffic deaths could reach 555,000 annually by 2020.
- Road traffic deaths are second only to cardiovascular disease in terms of public health burden in India.

India's ability to treat these patients is best described as immature. India's trauma care systems are in a nascent state of development. Industrialized cities, rural towns, and villages co-exist with a variety of health care facilities and almost a complete lack of organized trauma care.<sup>1</sup> While injury is a major public health issue, the government and medical community have failed to recognize the role of trauma and injury.

Some of the current challenges include:

- Failure to enact legislation prompting access to life saving treatment for trauma patients.
- Under-skilled professionals in pre-hospital and hospital care.
- Lack of coordination between private and public hospitals.
- Skill challenges (no dedicated trauma surgeons).
- Lack of rehabilitation.

These structural issues have resulted in sub-standard access to care and poor outcomes: thirty percent of patients die before they reach a hospital and the time between the accident and treatment averages

<sup>1</sup> Joshipura, M. "Trauma Care in India: Current Scenario," *World Journal of Surgery* (2008): doi 10.1007/s00268-008-9634-5.

six hours. Trauma is expected to become India’s third leading cause of death by 2020.<sup>2</sup>

China, even larger in size and population, is also facing challenges from a trauma perspective. Over 100,000 people die each year from trauma and nearly 5 million more are injured. China’s exploding economy and infrastructure projects will exacerbate the problems. WHO predicts that China will experience the largest increase in traffic-related fatalities (92 percent) in that region. Compared to India, China’s emergency system is more advanced in large- and medium-sized cities, yet challenges exist:

- The Emergency Medical System only reaches half of the population.
- The quality of training for physicians and other emergency personnel varies widely and lacks standards.
- The paramedic profession in China does not exist. Pre-hospital care is run by doctors, nurses, and drivers.
- Misaligned roles in pre-hospital care (over and under-qualified physicians and nurses).

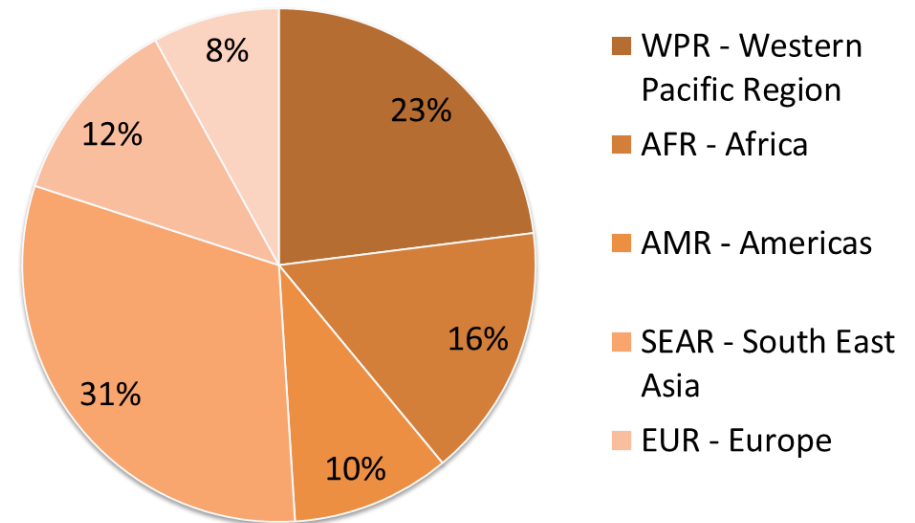
### The Cost of Trauma

The toll of trauma can be accounted for in both human and financial terms. WHO calculates the cost of death and disability through the Disability Adjusted Life Years metric (DALYs). DALYs are defined as one lost year of “healthy life” as a result of the premature mortality

<sup>2</sup> “Worldwide Injuries and Violence,” last modified June 20, 2011, <http://www.cdc.gov/injury/global/>.

and disability.<sup>3</sup> In 2000, WHO estimated that over 182 million years of “healthy life” were lost due to injury and disability on a global basis. In India, road traffic accidents are projected to reach over 15 million DALYs by 2020. **Exhibit III** is a regional breakdown of DALYs.

**Exhibit III: Regional Distribution of DALYs Lost**



The death and disability resulting from injury has a negative economic impact. For example, the total cost of China’s road traffic accidents is estimated at 3 to 6 percent of their Gross Domestic Product (GDP). Estimates for India’s estimated economic loss of activity are approximately 3 percent of GDP. A significant portion of injuries are

<sup>3</sup> The overall burden of disease is assessed using the disability-adjusted life year (DALY), a time-based measure that combines years of life lost due to premature mortality and years of life lost due to time lived in states of less than full health.

best treated through surgical procedures, but resources in many countries are scarce and in some cases completely deficient. More studies are beginning to capture, through cost effectiveness analysis, the benefits of trauma interventions, and more specifically surgical intervention. A recent analysis of a trauma hospital in Cambodia examined the operating costs and the effectiveness of trauma care for nearly 1,000 patients. The study demonstrated that surgical activity in response to traumatic injuries averted 1,355 DALYs each month. On average, it cost roughly \$104,000 per month to maintain the hospital, equating to just under \$78 per DALY averted. While \$78 may not represent a significant dollar figure in the US healthcare systems, it is meaningful in many of the low to middle-income countries where the majority of trauma occurs. Additionally, surgical procedures compare quite well from a cost perspective to other highly lauded public health interventions. For example, antiretroviral therapy costs range between \$350 and \$500 per DALY averted and vaccination programs cost between \$42 and \$250 per DALY averted. Thus, surgery has a significant role to play in managing the growing public health burden of injury and trauma in a cost effective manner.

On a global scale, the world community has coalesced to tackle issues such as disease, pollution, and malnutrition through an organized approach resulting in many improvements. Injury and trauma, however, are still often viewed as a local issue not amenable to organized systems of care. “Gradually, however, trauma and its many manifestations are gaining more attention as a global problem requiring urgent, coordinated, and well organized measures.”<sup>4</sup> The benefits of a systems approach in trauma are well documented. Well-

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<sup>4</sup> Leppäniemi, A.K. “Global Trends in Trauma,” Trauma (2004): doi 10.1191/1460408604ta314oa.

organized trauma systems have decreased mortality among all treated trauma patients by 15 to 20 percent and decreased medically preventable deaths by 50 percent. While the world community has reacted somewhat lethargically to trauma as a public health issue, trauma is becoming more widely recognized as a major public health concern. As conflict, economic growth, and infrastructure projects such as the development of a highway system in China progress, there will be an increased recognition and demand for trauma services.

Looking forward, a number of trends that will drive the need for trauma services:

- Increase of the incidence of trauma.
  - Traffic accidents
  - Self-inflicted injuries
  - War and terrorism
- Emphasis on prevention and public health focus of trauma.
- Rapid access to new information and technology.
- Prevention and essential care versus high-tech solutions.
- Organizational aspects of trauma care, i.e. trauma systems, trauma teams, and trauma centers.

### **Trauma Care Needs**

Communities throughout the world possess varied levels of trauma and critical care skill sets ranging from highly advanced to totally deficient. There is consensus among major health organizations such as WHO and the International Association for Trauma Surgery and Intensive Care (IATSIC) that extensive gaps in trauma services exist.

Trauma services are needed in the following areas:

### **Practitioner Training**

Practitioners, primarily physicians and nurses, are in need of both basic and advanced training. While technology is advancing and will assist in the provision of trauma care, the training of essential care providers to access basic trauma and utilize basic technology is in high demand. In some countries, doctors do not receive any specialized trauma care training and in other countries continuing education is ignored. The literature also consistently highlights the dearth of qualified trauma and intensive care nurses. Nurses play a very important role in smaller, rural hospitals, so their skill level is even of greater import. Rehabilitation services are also consistently lacking, especially specialty services such as speech pathology.

### **Performance Improvement**

Performance improvement programs such as morbidity and mortality, preventable deaths, and complications are examples of performance improvement programs needing enhanced focus. In many countries, trauma cases are integrated into broader quality improvement programs, but less common to have trauma specific quality improvement program.

### **Hospital Development, Inspection, and Accreditation**

All countries have some mechanism for monitoring hospitals, some with very rudimentary measures and others more complex. The process in high-income countries is fairly well-established, but low to middle-income countries need technical support in establishing and verifying their facilities. The industrialization of cities and towns is enhancing this need.

### **System Building, Integration, and Management**

Highly-functioning trauma systems have many levels of support to ensure the best available level of patient care. However, throughout the world, varying degrees of infrastructure support exist. One critical area requiring particular focus is pre-hospital care. In some countries, pre-hospital care does not exist at all, and in other countries it is only available in large urban centers. Coordinating care and establishing protocols for pre-hospital care is challenging, yet necessary. Additionally, protocols for inter-hospital transfers are needed in many locations. Uniting these services are communication and transportation systems which need refining. Finally, monitoring and evaluating trauma programs through established data collection systems is the key to ensuring quality care and improving care process over time.

*Last updated September 2011*



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