

THE BURDEN OF TRAUMATIC BRAIN INJURY IN ASIA: A CALL FOR RESEARCH

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ABSTRACT

Traumatic Brain Injury (TBI) is a significant public health problem worldwide and is predicted to surpass many diseases as a major cause of death and disability by the year 2020. The majority of TBI cases (60%) are a result of road traffic injuries, followed by falls (20-30%), and violence (10%). In comparison to all other global regions, Asia has the highest percentage of TBI-related outcomes as a result of falls (77%) and other unintentional injuries (57%). For example, among hospital-based victims in Bangalore 24% of all injuries were a result of TBI - an incidence of 120 per 100,000; while in Yemen, domestic events were found to be a leading cause of TBI with an overall prevalence rate of 219 per 100,000. Many countries in Asia are experiencing a rapid surge in urbanization, motorization and economic liberalization leading to an increased risk for TBI. As a result, TBI is a public health problem that requires appropriate attention from researchers and policy-makers regionally through the development of ongoing surveillance programs and the implementation of effective, evidence-based interventions.

Injuries are among the top 15 causes of death in all age groups less than 60 years old with road traffic injuries (RTI), self-inflicted injuries and violence consistently among the leading 15 causes of death.¹ In 2002, injuries were responsible for killing 4.5 million adults, or 1 in 10 of total adult deaths.¹ In addition to being a major cause of mortality, injuries are also associated with increased disability and morbidity. According to the World Health Organization, the Disability Adjusted Life Years (DALYs) losses are higher for low-income countries due to injuries for nearly all causes and Traumatic Brain Injury (TBI) is an important and often critical sequel of these injuries.²

TBI is a significant public health problem worldwide and is predicted to surpass many diseases as a major cause of death and disability by the year 2020.² There is some data to indicate that the majority of TBI cases (60%) are as a result of RTI, followed by falls (20-30%), and violence (10%).³ Cost studies from high-income countries such as the U.S. which attempt to incorporate the lost earnings of injured individuals and their caregivers, indicates national expenditures of \$56.3 billion annually related to TBI.⁴ A

systematic review of Pubmed/Medline only identified one recent paper portraying the global burden of TBI which, together with the lack of standardized definitions for TBI, and limited reporting systems in many countries renders data for this important health outcome scarce.⁵

As many Low and Middle Income Countries (LMIC) face rapid economic transition with increasing motorization and urbanization, non-communicable diseases, including injuries, are becoming a leading cause of mortality and morbidity. LMIC face a higher preponderance of risk factors for TBI yet often do not have the health care capacity to deal with the associated health outcomes. The significant disability associated with TBI also places a considerable burden on health systems in these countries and therefore knowledge of the epidemiological profile of TBI and the development of preventive measures to alleviate this burden is vital, particularly in limited resources settings. This paper provides a review of available data from Asia on TBI and makes the case for greater investments in research and interventions for TBI.

HIGH GLOBAL AND REGIONAL BURDEN

The burden of injuries, as a result of all causes, is high in the Asian region with RTI and self-inflicted injuries both within the top ten causes of mortality.^{6,7} While region specific data from Asia is somewhat limited, the Global Burden of Disease Study, which subcategorizes Asia into India, China and Other Asia and Islands (OAI) gives some indication as to the burden of TBI in the region.⁸ Data from this study focused on two major TBI-related outcomes - fractured skull and intracranial injury (Table 1) and demonstrates the high incidence of overall TBI-related health outcomes as a result of road traffic accidents, falls and violence. India had highest rates of intracranial injury from road traffic, falls and other injuries (Table 1).

The second leading cause of TBI-related outcomes in India was falls with an incidence rate three times that of the overall global rate (13.3 per 100,000). The OAI region was found to have identical rates of short term intracranial injury as a result of road traffic accidents as the world rate of 106 per 100,000. Males in India were seen to sustain a higher rate of injuries as a result of falls with an incidence rate of 50.3 per 100,000. Similarly in OAI, males had a higher incidence of short-term intracranial injuries as a result of violence (54.1 per 100,000) than the global average (43 per 100,000).

In comparison to all other regions in the Global Burden of Disease study (such as Established Market Economies, Former Socialist Economies of Europe, Sub-Saharan Africa, Latin America & Caribbean, and the Middle Eastern Crescent), Asia has the highest percentage of TBI-related outcomes as a result of falls (77%), unintentional injuries (57%) and road traffic accidents (48%). Asia accounted for only 3% of all TBI-related injuries as a result of war, however given that this data emanated from the 1990s, the effects of the Afghan and Iraq wars on TBI incidence would not have been reflected in these figures. TBI, as a result of these two wars, has been identified as an important cause of morbidity and mortality.⁹

SELECTED NATIONAL DATA

Individual country data further highlights the burden of TBI in specific parts of Asia. TBI is a leading cause of mortality, morbidity, and socioeconomic losses in India.¹⁰ Injuries are the 7th leading cause of mortality in India and 78% of these deaths are due to RTI alone.¹¹ TBI was found to account for 24% of all injuries among hospital based victims in Bangalore with an incidence of 120 per 100,000.¹² Conservative estimates from India indicate that nearly 1.6 million individuals will sustain TBI and seek hospital care annually.¹⁰ RTI are the leading cause of TBI

Table 1: Incidence rates (per 100,000) of Traumatic Brain Injury related outcomes (fractured skull, short and long term intracranial injury) by cause in the Asian Region.

Cause	Injury Sustained	Incidence Rates (per 100,000)			
		India	China	OAI	World
Road Traffic Accident	Fractured Skull	0.9	0.5	0.8	0.8
	Intracranial Injury Short Term	119	63	106	106
Falls	Fractured Skull	5.9	2.1	4.4	2.9
	Intracranial Injury Long Term	42.6	7.7	13.7	13.3
Other Unintentional Injuries	Intracranial Injury Long Term	9.8	6.8	7.7	7.2
Violence	Fractured Skull	0.3	0.3	0.4	0.5
	Intracranial Injury Short Term	28	25.4	34.6	43
	Intracranial Injury Long Term	1.4	1.3	1.7	2.2
War	Intracranial Injury Long Term	0	0	0.9	3.8

Source: Global Burden of Disease Study 2002 (OAI = Other Asia and Islands).

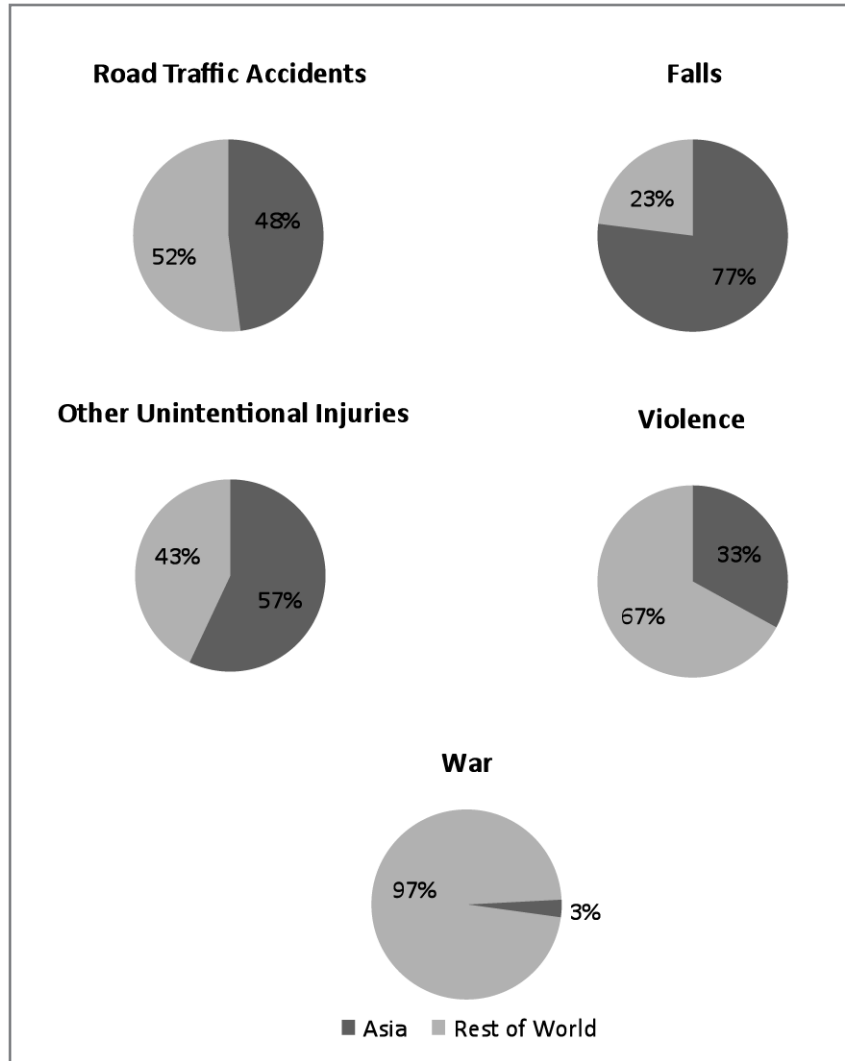


Figure 1: Distribution of Traumatic Brain Injury Related Outcomes by Cause in Asia. Outcomes include: Long- and short-term intracranial injury, fractured skull.

Source: Global Burden of Disease Study 2002 (Asia = India, China & Other Asia and Islands).

in India accounting for 45-60% of TBI, and falls account for 20-30% of TBI, paralleling the findings from the Global Burden of Disease Study.⁸

A prospective case-study from Eastern China indicates that TBI are the leading cause of traumatic injury in China with traumatic injury itself being the 5th leading cause of mortality in adults less than 40 years old.¹³ 61% of these TBI were related to RTI; of these approximately one-third were motorcyclists, 31% pedestrians, and motor-vehicle passengers accounted for only 14%. The motorcycle has become one of the most popular forms of transport in China accounting for 63% of all registered vehicles by

2001; a substantial increase from only 23% in 1987.¹⁴ As a result, motorcycle related TBI has become a serious public health problem in China which needs to be addressed in order to prevent further increases in rates of TBI in the most populous country in the world.

Data from other parts of Asia and the Middle East is both scarce and not easily available. TBI was also found to be highly prevalent from a case-study in Yemen which demonstrated a prevalence rate of 219 per 100,000. Home-based causes (including falls and domestic violence) were the dominant cause, and RTI the second leading cause of TBI.¹⁵

Table 2: Proposed Research Agenda on Traumatic Brain Injury for Asia

- Quality epidemiological data on the burden of TBI in region and specific countries.
 - Economic analysis of the cost of TBI to national economies.
 - Intervention trials for reducing TBI in LMIC and improving their management.
 - Cost-effectiveness of TBI interventions.
 - Operations and systems research on integration of TBI-related interventions into existing national health systems.
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EFFECT ON VULNERABLE POPULATIONS

Males have been found to account for over two-thirds of all unintentional injuries in LMIC reflecting the greater exposure of males to risk factors for injuries.¹⁶ Such gender differences have also been found with TBI in the Asian region. Of a total of 260,000 patients admitted with head injury in Lahore, Pakistan between 1995-1999, 75% were males.¹⁷ This parallels the National Health Survey of Pakistan which reported a higher incidence of overall unintentional injuries amongst males.¹⁸ Similarly in Singapore, 78% of cases in a prospective study looking specifically at gender differences in outcome following severe TBI, were male.¹⁹ Males were also found to have higher incidence rates of TBI in China with a ratio of 2.5:1 in rural China.²⁰

Further studies from the region highlight the burden of TBI on vulnerable children in Asia. Over 875,000 children die every year as a result of injuries, disproportionately affecting LMIC, where 13% of the total burden of disease among children less than 11 years old has been attributed to injuries.^{21,22} Ongoing surveillance of children under the age of 15 years hospitalized as a result of TBI in Kashmir reported that the highest incidence of TBI occurred in children between the ages of 6-10 years old, with males being more affected than females.²³ RTI and falls were the two leading causes of TBI among this population, with more than 50% of falls occurring in the 4-6 year age group. An 8 year study of 56 hospitals in Taiwan also showed similar patterns of injury among the pediatric TBI group with a male to female ratio of 1.6:1; with RTI accounting for 47% and falls for 40% of cases.²⁴ Further disaggregation of data revealed that of all RTI-related TBI, the majority were caused by motor-cycles followed by pedestrian injuries and bicycle injuries.

Irrespective of the cause, non-fatal TBI results in extensive disability with both financial and social consequences. Access to tertiary neurosurgical and rehabilitation care is limited in rural environments and in the poorest regions of the world. In India, nearly one million persons would require rehabilitation services at any given point in time for TBI consequences.⁵ In a follow-up of 425 subjects at four months post discharge, it was observed that 43% had different post-traumatic sequel ranging from headache to a wide spectrum of behavioral problems.²⁵ It is estimated that although over 80% of the world's people with disabilities live in LMIC, but only 2% have access to rehabilitation services.²⁶ This lack of service calls for comprehensive rehabilitative facilities based on trained manpower to enable and empower people affected by TBI to have an increased quality of life.

DISCUSSION

Many countries in Asia are experiencing a rapid surge in economic liberalization leading to increased risk factors for TBI in the region.⁵ The increased exposure to risk factors coupled with health systems that are often not able to provide adequate treatment and rehabilitation services to TBI patients, creates a 'double risk'. The lack of national epidemiological data on TBI and the dated global data from the nineties, both reflect a serious gap in health information systems for Asia. The economic consequences of TBI are reported to be enormous, and yet estimates of the cost of TBI within Asia could not be found in the literature. Given the preventable nature of TBI, it is important to elucidate the true burden of disease in Asia in order to tailor specific prevention programs aimed at alleviating this increasing epidemic.

The pre- Iraq and Afghan war nature of the available global data may heavily underestimate the current pattern of TBI, deemed the "signature" injury of the Iraq war among both civilians and military personnel in Asia.²⁷ The increased incidence of TBI cases among these populations results in severe long-term disability including emotional problems and residual physical disabilities which need to be addressed through appropriate rehabilitation services.²⁸ Furthermore, access to national and local data on TBI is limited; unless information is shared on websites or published, it is not accessible to the global pool of knowledge.

Based on the development trends from the region, economic progression is likely to lead to a predictable pattern of increasing TBI burden. And yet preventive or curative interventions are not being implemented nationally in Asian countries. Appropriate data can help direct resources to developing health systems in the

region which can address the need for preventable, neurosurgical, and rehabilitation services for TBI. We present a proposed research agenda for TBI in Asia which incorporates important aspects of disease prevention that should be addressed (Table 2).

Ongoing surveillance to follow trends in incidence, risk factors, causes, and outcomes for TBI is imperative if this silent epidemic is to be prevented from escalating. Only with good data can the next step of developing effective, scientifically sound strategies to prevent TBI be taken. We welcome further dialogue and hope that research investments in Asia will promote critical TBI research.

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