

# Trauma systems development challenges the conventional medical hierarchy

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## INTRODUCTION

Trauma has contributed significantly to the rise of 21<sup>st</sup> Century non-communicable disease. The consequences of severe injury permeate all aspects of a person's life including physical capacity, relationships, education and employment. These effects, in turn, have dramatic societal and economic impacts on a local, national and global scale. Accessible, effective trauma care that results in reduced mortality and improved functional outcome is a current global imperative in addressing this emerging burden of disease. However, this approach presents a challenge to traditional medical models.

Trauma is one of the leading causes of mortality and morbidity in India. Currently death from injury in India is a leading cause of years of productive life lost and the leading cause of death for those under 35 years old<sup>1</sup>. The national injury burden is growing and the ongoing rise in the trauma burden is mostly in the form of road traffic accidents. India has 1% of the total vehicles in the world yet accounts for 6% of total road accidents globally. There are approximately 400,000 road traffic accidents in India each year, resulting in 100,000 deaths and 1.2 million individuals who are seriously injured<sup>1</sup>.

The overall impact of trauma is exaggerated by the lack of integrated emergency healthcare<sup>2</sup>. Whilst pre-hospital care at road accident sites in India remains inconsistent and unreliable, at least 14 states have introduced pre-hospital emergency medical systems (EMS) over the last 5 years. Whilst pre-hospital care evolves, there often remains minimal medical intervention at the scene and long delays to hospital. When patients are transferred to hospital, they are often taken to the nearest hospital, regardless of the hospital's capabilities

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for dealing with trauma. Furthermore, there is often no pre-hospital notification of the pending hospital arrival of trauma patients. Attendance to a trauma patient is often delayed and triage may be ineffectual or performed by non-clinical staff. In the majority of Indian hospitals there is no trauma team or callout system in place, and hence no interdisciplinary approach to trauma reception. This single system approach to care becomes problematic when dealing with patients with severe multi-system injuries<sup>3</sup>.

This has occurred because hospitals have developed as associations of specialised medical and nursing care. Integration of infrastructure and diagnostic services has supported the delivery of complex and detailed treatments that can usually be rendered by sub-specialist groups. This is evidenced by the variety of sub-specialty departments that are part of large hospital structures. These sub-specialties are to a large extent self-contained and follow vertical lines of referral.

However, the changing burden of disease has challenged this traditional, self-contained model. By 2030 the four leading disease burdens worldwide are predicted to be unipolar depressive disorders, ischemic heart disease, road traffic accidents and cerebrovascular disease<sup>4</sup>. All of these conditions are characterized by sudden and unpredictable demands requiring immediately accessible, systemized and multidisciplinary approach to care.

International establishment of Trauma Systems and Trauma Centers has helped address the injury burden by providing prompt, specialist trauma care. The traditional self-contained, vertical approach is outdated, counterproductive - and remains a major barrier to implementation of integrated trauma care. Effective therapy for the severely injured is facilitated by an interdisciplinary and integrated (horizontal) approach to undifferentiated trauma with input from various hospital professional groups, specialist units and departments (see figure 1). Neurotrauma is the greatest contributor to

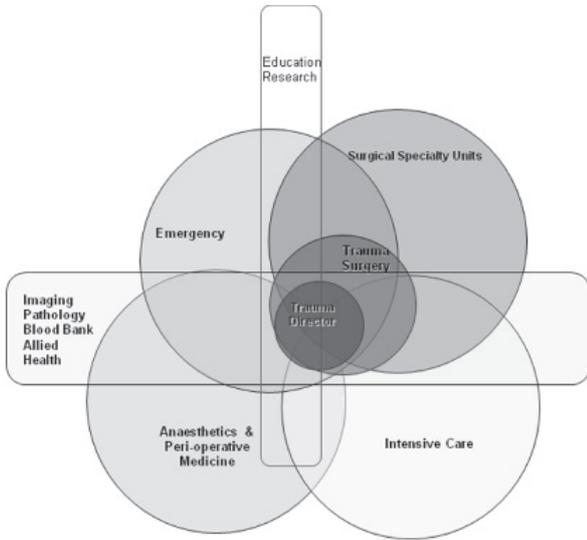


Fig 1: Alfred Hospital Melbourne Trauma Service Model

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## DELIVERY OF TRAUMA CARE

The World Health Organization (WHO) Essential Trauma Care (EsTC) project advocates a spectrum of activities to decrease trauma morbidity and mortality (6). This comprises surveillance and basic research to prevention programs and effective trauma management strategies. Understandably much weight has been placed on preventive strategies (e.g. speed limits, seatbelts, alcohol breath-testing). However, there are also major gains to be made by addressing trauma management, particularly in the initial reception and resuscitation upon arrival to hospital.

Evidence indicates that people with life-threatening - but potentially treatable - injuries are up to six times more likely to die in a country with no organized trauma system than in one with an organized, resourced trauma system<sup>5</sup>.

Unsurprisingly, trauma care is expensive and this proves challenging for addressing trauma delivery and management in all countries. Ironically, the burden of trauma is often disproportionately higher in developing regions. Mortality rates for injured patients (ISS > 9) in cities at different economic levels have demonstrated notable disparities in pre-hospital and in-hospital mortality. The mortality rate rose from 35% in a high-income setting to 55% in a middle-income setting to 63% in a low-income setting. An over-arching goal should be implementation of low-cost, high-efficacy systems to make trauma management and treatment available to all injured patients regardless of location (WHO). Population-based studies demonstrate a 20% or greater reduction in mortality following Trauma System establishment<sup>6</sup>.

Traditionally trauma units have always been surgical in nature. The philosophy of trauma care has previously been centered on the concepts of the “golden hour” and the declaration that “trauma is a surgical disease”<sup>7</sup>. Yet increasingly it is recognised that trauma is no longer confined to a single discipline. In the 21<sup>st</sup> century, an effective Trauma System can be defined as comprising “an integrated, protocol-driven system of care which monitors and addresses prevention, notification, prehospital care, hospital reception and resuscitation, surgical care, in-hospital care and rehabilitation”<sup>8</sup>.

55-91% of the reported errors that contribute to preventable death occur during trauma reception and resuscitation<sup>7</sup>. To ensure integration of hospital trauma care, successful Trauma System development requires a horizontal, interdisciplinary approach rather than the traditional medical model of an hierarchal vertical approach.

## THE MOVEMENT TOWARDS AN INTEGRATED, HORIZONTAL APPROACH TO TRAUMA CARE

Adoption of this multidisciplinary, horizontal approach has previously been advocated within other medical specialties, for example in stroke management and during global infectious disease epidemics such as HIV. In these circumstances, management extends beyond sub-specialty units to incorporate community health practitioners, other medical specialties, surgical units and palliative care.

With less penetrating injury and rising rates of blunt trauma, there is an increased need for non operative intervention. The ageing population is likely to have added medical co-morbidities requiring regular specialist medical input. As a result of this shift, only a minority of injured patients undergo emergency surgery<sup>8</sup>. We are entering an era where major trauma is less an operative disease, but rather a multi-system disease. Diagnostic trauma laparotomies are performed less frequently due to the increased use of imaging. Negative laparotomy rates were high prior to the introduction of FAST scanning during the emergency reception and resuscitation phase of trauma care. The practice of trauma surgery has evolved from frequent “emergency” laparotomies to routine and protocol-driven management in the emergency department and on the ward. It is likely that many of those “lifesaving” trauma laparotomies from the early days of our trauma care were unnecessary<sup>8</sup>.

The same argument applies to neurotrauma. Adherence to guidelines published by the Brain Trauma Foundation and Congress of Neurological Surgeons in 2007 for the surgical management of traumatic brain injury has assisted greatly in differentiating operative and non-operative neurotrauma patients<sup>9</sup>. The guidelines methodology involved a multidisciplinary review of all neurotrauma literature from 1975 to the time of manuscript preparation. It is a useful adjunct to clinical decision-making especially in countries without specialized trauma units and neurosurgery support.

A significant proportion of severe traumatic brain injury patients will not require decompressive neurosurgical procedures. However, they will require intracranial pressure monitoring with a ventricular drain or intraparenchymal cerebral pressure monitor. They will all invariably require ventilatory and circulatory support with ICP monitoring and drainage in the intensive care unit. For example, in 2009 there were 636 patients with a severe brain injury (Abbreviated Injury Scale score 3 or greater)<sup>9</sup>, admitted to The Alfred Trauma Center in Melbourne, Australia – a Major Adult Trauma Service within an integrated Victorian State Trauma System<sup>10</sup>. There was an associated 11% mortality rate. Yet there was only an 18% operative rate with 77 craniotomies and 36 craniectomies. An established trauma system not only ensures that all of the patient’s injuries are identified and treated but also that neuro-protective measures are carried out on entry into the hospital and not only when

the patient arrives in the intensive care unit. Emergency Medicine specialization and improvements in emergency nurse education have developed in response.

India leads the world in preventable trauma burden. In response, many members of the Neurotrauma Society of India have recognized and then pioneered this integrated approach to trauma in India. They have argued for the development of systems of trauma care as a principle goal of the Society. An integrated approach to trauma care – and in particular neurotrauma care – has been commendably advanced by the Neurotrauma Society of India and its members through research and education. Neurotrauma Society members have been eminent in developing pre-hospital services, improving emergency care, hospital reception and resuscitation, operative and peri-operative care and the provision of intensive care. Ultimately they have championed the establishment of trauma systems at a local, state and national level.

Obstacles remain. Challenging the traditional approaches in Medicine (and the hierarchal vertical system it embodies) requires data, clarity of purpose and persistence. However, Medicine is eclectic, adaptive and receptive to adopting ideas that demonstrate significant improvements in patient outcomes. The establishment of Trauma Systems is one of those ideas.

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