Available online at www.sciencedirect.com
ScienceDirect
The Surgeon, Journal of the Royal Colleges of Surgeons of Edinburgh and Ireland
www.thesurgeon.net

Review

Restructuring an evolving Irish trauma system: What can we learn from Europe and Australia?

I. Balasubramanian[*], *H.M. Mohan, R.J. Whelan, F. McDermott, D.C. Winter*

Department of Surgery, St Vincent's University Hospital, Elm Park, Dublin 4, Ireland

ARTICLE INFO

Article history:
Received 31 March 2015
Received in revised form
23 July 2015
Accepted 13 August 2015
Available online 3 September 2015

Keywords:
Trauma systems
Trauma models
Major trauma

ABSTRACT

Aim: Major trauma is a leading cause of mortality and disability. Internationally, major trauma centres and comprehensive trauma networks are associated with improved outcomes. This study aimed to examine selected international trauma systems in Europe and Australia to identify common themes that may aid reconfiguration of the Irish trauma service.

Methods: An electronic search strategy was utilised using Medline, and a search of the grey literature using Google and Google Scholar. Search terms included "trauma systems", "trauma care", "major trauma centre" and "trauma network". Relevant articles were reviewed and data summarised in a narrative format.

Results: Republic of Ireland currently lacks designated major trauma centres and surrounding trauma networks. Lessons from international models and data from the on-going national trauma audit may guide reconfiguration. Well-functioning trauma systems internationally bear striking similarities, and involve a hub and spoke model. This model has a central major trauma centre, surrounded by a co-ordinated trauma network with trauma units. Concentration of major trauma into high volume centres is key, but these centres must be adequately resourced to deliver a high quality service. Investment in and co-ordination of prehospital care is essential to overcome geographical impediments to centralising trauma care. Funding of rehabilitation infrastructure and resources is also an integral part of a well-functioning trauma system. Trauma outcome data is key to informing trauma system design, with dissemination of this data and public engagement critical for change.

Conclusion: International models of trauma care provide valuable lessons for countries currently in process of reconfiguring trauma services.

* *Corresponding author*. Tel.: +353 876458029.
E-mail address: ibalasubramanian@rcsi.ie (I. Balasubramanian).

http://dx.doi.org/10.1016/j.surge.2015.08.002

Introduction

Major trauma is the fourth-leading cause of mortality in the European Union (EU), and causes over 5 million deaths per year worldwide.[1,2] Globally, over 15% of all ill-health is attributable to injury. Major trauma is the leading cause of death in those under 40.[3] It is projected that by 2020 the burden of injury due to road traffic collisions (RTCs), war and violence will increase steeply, accounting for one in every ten deaths.[4] Furthermore, it is estimated that for each trauma death, up to fifty further patients suffer serious injury or permanent disability. This has huge implications for health services, as these patients require both acute inpatient care and extensive long-term rehabilitation.[5] The estimated cost of management of trauma in EU is estimated to be around 78 billion euro per year.[1] This does not include societal knock-on effects such as unemployment, loss of earnings, loss of productivity and reduced quality of life. This review aims to examine international experience of trauma system design and compare this to ROI's evolving trauma system. The primary focus of this review is on major trauma.

Definition of major trauma

Major trauma describes serious and often multiple injuries where there is a strong possibility of death or disability.[6] Formal trauma scoring systems can be used to define serious injury, e.g. an Injury Severity Score (ISS) >15.[7] However, these scores are less accurate in patients with diminished physiological reserve such as the elderly-an injury may be described as major trauma even with lower ISS scores.[8,9] Differences in defining major trauma and recording outcome data can be highly relevant when comparing data internationally. For example, Polinder et al. compared health outcomes following injury in 6 European countries and found that Austria lost the largest number of Disability-Adjusted Life Years (DALYs) due to injury, followed by Denmark and ROI. The number lost was much lower in the Netherlands and UK. (Table 1). However, this paper acknowledged the lack of standardised reporting of trauma data between countries in the study. This limits comparison between countries and highlights the need for clarity and standardisation of outcome measures in trauma reporting.[10] (see Table 2).

Table 2 – Comparison of demographics between countries.

Country	Population	Population density	Major trauma centres
Ireland	4.6 million	67 per sq./km^2	0
Norway	4.9 million	15 per sq./km^2	4
England	53 million	413 per sq./km^2	26
Victoria, Australia	4.9 million	25 per sq./km^2	3

Aims

The primary aim of this paper is to review a selection of European and Australian trauma systems, comparing their relative strengths and weaknesses. The second aim is to examine the current Irish trauma system and evaluate what can be learned from the international experience of trauma.

Methods

This is a narrative review of current trauma systems in selected countries and regions in Europe (France, England, Norway, Scotland) and Victoria, Australia. These countries were chosen to represent a cross-section of international trauma systems in the developed world, at different stages of evolution and reconfiguration. Strengths and weaknesses of these trauma systems were examined. To assess data on international trauma systems, an electronic search strategy was utilised using Medline, and a search of the grey literature using Google and Google Scholar. Search terms included "trauma systems", "trauma care", "major trauma centre" and "trauma network". Relevant articles were reviewed and data summarised in a narrative format. Publically available data on the Irish trauma system were obtained and condensed from relevant reports and published papers.

Results

Trauma was once called "the neglected disease of modern society".[11] Since then, trauma systems have evolved internationally in efforts to improve delivery of trauma care. Trauma

Table 1 – Trauma incidences of countries – adapted from Polinder et al.[10]

Country	Absolute numbers			Per 1000 inhabitants		Mortality rate
	Incidence		Deaths	Incidence		
	Non admitted ED patients	Hospitalised Patients		Non-admitted ED patients	Hospitalised patients	
Austria	483 269	187 225	8798	39.6	21.7	1.9
Denmark	650 125	99 618	6824	115.1	15.4	4.0
Ireland	115 696	58 196	3206	23.7	12.5	2.0
Netherlands	1 100 455	102 768	10 378	63.6	5.2	1.9
Norway	417 309	66 962	4962	79.7	12.9	3.3
England	5 755 936	632 179	33 078	105	9.1	1.3
Wales	323 606	48 266		97.3	12.3	