



## Do trauma systems work? A comparison of major trauma outcomes between Aberdeen Royal Infirmary and Massachusetts General Hospital



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### ABSTRACT

Trauma is an important matter of public health and a major cause of mortality. Since the late 1980s trauma care provision in the United Kingdom is lacking when compared to the USA. This has been attributed to a lack of organisation of trauma care leading to the formation of trauma networks and Major Trauma Centres in England and Wales. The need for similar centres in Scotland is argued currently. We assessed the activity of two quite different trauma systems by obtaining access to comparative data from two hospitals, one in the USA and the other in Scotland. Aggregate data on 5604 patients at Aberdeen Royal Infirmary (ARI) from 1993 to 2002 was obtained from the Scottish Trauma Audit Group. A comparable data set of 16,178 patients from Massachusetts General Hospital (MGH). Direct comparison of patient demographics; injury type, mechanism and Injury Severity Score (ISS); mode of arrival; length of stay and mortality were made. Statistical analysis was carried out using Chi-squared and Cochran–Mantel–Haenszel.

There were significant differences in the data sets. There was a higher proportion of penetrating injuries at MGH, (8.6% vs 2.6%) and more severely injured patients at MGH, patients with an ISS > 16 accounted for nearly 22.1% of MGH patients compared to 14.0% at ARI. ISS 8–15 made up 54.6% of ARI trauma with 29.6% at MGH. Falls accounted for 50.1% at ARI and 37.9% at MGH. Despite the higher proportion of severe injuries at MGH and crude mortality rates showing no difference (4.9% ARI vs 5.2% MGH), pooled odds ratio of mortality was 1.4 (95% confidence interval 1.2–1.6) showing worse mortality outcomes at ARI compared to MGH.

In conclusion, there were some differences in case mix between both data sets making direct comparison of the outcomes difficult, but the effect of consolidating major trauma on the proportion and number of severely injured patients treated in the American Level 1 centre was clear with a significant improvement in mortality in all injury severity groups.

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### Introduction

Trauma is an important matter of public health and a major cause of death and permanent disability. Globally, the World Health Organisation estimates trauma to account for around 11% of deaths annually [1]. Trauma is also a leading cause of death in the

UK. In 2010, there were 17,201 injury related deaths in England and Wales. Interestingly, deaths from falls now outnumber transport related deaths [2]. Similar data is recorded in Scotland and in 2010 there were over 350,000 emergency hospital admissions, 58,000 of which were due to an unintentional injury. These represent 1 in 19 deaths in children and 1 in 40 deaths in adults. There were over 1300 trauma related deaths in Scotland in 2010 [3].

Traumatic injury can be defined using a number of trauma scoring systems. The commonly used scoring systems include: the

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Abbreviated Injury Score (AIS), the Injury Severity Score (ISS), the Revised Trauma Score (RTS) and the Trauma and Injury Severity Score (TRISS) [4]. Injury severity using these scoring systems can be classified by anatomy, mechanism, physiology and comorbidity [5]. These are invaluable tools to stratify trauma into minor, moderate and major categories and therefore help in the evaluation of trauma service provision through audit as well as defining which patients could benefit from specialist trauma care. Trauma scores can also be used to evaluate and draw comparison between datasets from different hospitals, regions and countries. Therefore it is imperative that trauma is recorded correctly and consistently.

Due to the division of the Health Service in the UK there are two bodies involved in trauma registration. In England and Wales, the Trauma Audit and Research Network (TARN) has been in operation since 1990 while in Scotland the Scottish Trauma Audit Group (STAG) was established in 1991. Trauma registries have been implemented in the United States since the mid 1970s, around the same time that trauma centres were being developed [5–7]. These centres and registries have been most influential in the establishment of trauma centres in the USA and beyond [8].

It has been shown since the late 1980s that trauma care provision in the United Kingdom is lacking when compared to the USA [9]. Indeed, further comparison in 2007 showed no improvement, with mortality rates higher in the UK compared with the USA [10]. These inadequacies in major trauma outcomes have been attributed to a lack of organisation of trauma care and led to several studies examining the British system. As a result, the Royal College of Surgeons of England (RCS) produced a report in 2009 providing guidance concerning to the establishment of a major trauma network within the UK with certain hospitals meeting their requirement becoming Major Trauma Centres. These centres are similar in structure and function as the American College of Surgeons Committee on Trauma (ACSCOT) definition of a Level 1 Trauma Centre [11]. In April 2012 this began to be put in place with the Department of Health in England and Wales announced the opening of 22 new Major Trauma Centres. Trauma systems centred around Level 1 Trauma Centres have been employed in the USA for decades leading to significantly lower morbidity and mortality rates [12–15] and it has been estimated that these new centres could save up to 600 lives per year in the UK [16].

Recently, the Royal College of Surgeons in Edinburgh also produced a report, which could lead to the creation of Major Trauma Centre(s) in NHS Scotland [17]. However, Scotland's relatively small population and geography present specific challenges. Also, the incidence of major trauma in Scotland is difficult to estimate with accuracy. The most recent Scottish audit

of trauma by STAG estimated the total number of major trauma at 761 cases per year but is probably closer to 900–1000 cases per year, based on comparison to the previous audit cycle 1992–2002 [3]. Currently the debate in Scotland surrounds whether or not Scotland can justify or requires the establishment of a complex trauma network and recognised Level 1 Trauma Centres, similar to those that have been recently established in the rest of the UK. In light of these potential changes to the Scottish health care system, this study aims to compare trauma care provision and outcomes in a Scottish Hospital (Aberdeen Royal Infirmary) with that of a long established large Level 1 Trauma Centre in the USA (Massachusetts General Hospital).

## Methodology

Aggregate data was acquired from the Scottish Trauma Audit Group (STAG) with permission from both STAG Clinical Lead at ARI and Information Services Division of NHS Scotland. Data from both audit cycles was obtained. The first audit cycle, 1993–2002, included 5604 patients while the most recent cycle, 2011–2012 included 90 patients. This study used the first audit cycle data only. Data points obtained from STAG included: number of patients by: year; gender; age; type of injury, mechanism of injury, severity of injury and body regions injured; mode of arrival, day of attendance and time of attendance; respiratory rate, systolic blood pressure and Glasgow Coma Scale on attendance; triage area, and consultant attendance; length of inpatient stay and outcome. STAG set inclusion criteria are described elsewhere [3]. Similar data from the same time period were obtained from the Trauma Registry at MGH where the Institutional Review Board approved the study. Both institutions used AIS version 1990 (revised 1998).

Demographic comparisons were first made with reference to injury. The numbers of patients were compared by age and gender. The types of injuries were compared in terms of: type of trauma, blunt vs penetrating; mechanism of injury; and injury severity between the two hospitals. Crude mortality rates were compared between both hospitals. It was discovered that elderly patients with isolated hip fractures were included in the MGH Trauma Registry but excluded from STAG audit, therefore these were excluded from the US dataset for analysis while differences in the pattern of injury were not excluded as they represent the normal pattern of trauma seen at each centre. Statistical analyses of differences in these parameters were made using Chi-Squared test for categorical data and Cochran–Mantel–Haenszel test, taking  $p < 0.05$  as statistically significant. The statistical programs EpiCalc 2000 (Brixton Health, London, UK) and SPSS (Chicago, IL, USA) were used.

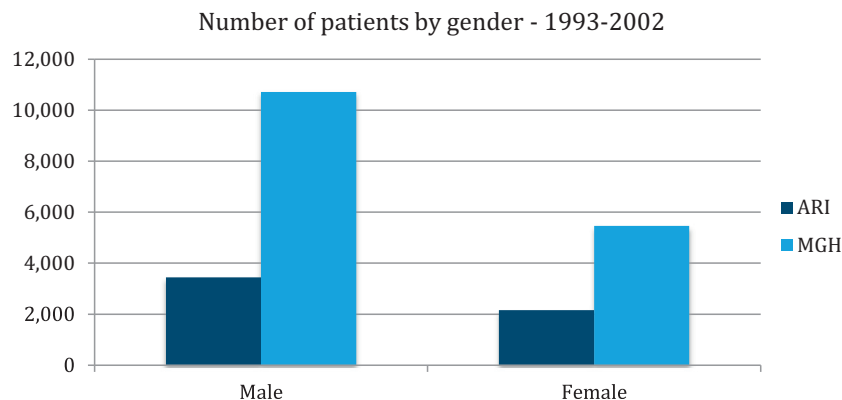


Fig. 1. Number of patients by gender presenting with traumatic injuries to ARI and MGH – 1993–2002.

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