



Full length article

Are prehospital deaths from trauma and accidental injury preventable? A direct historical comparison to assess what has changed in two decades



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ABSTRACT

Background & objectives: In 1994, Hussain and Redmond revealed that up to 39% of prehospital deaths from accidental injury might have been preventable had basic first aid care been given. Since then there have been significant advances in trauma systems and care. The exclusion of prehospital deaths from the analysis of trauma registries, given the high rate of those, is a major limitation in prehospital research on preventable death. We have repeated the 1994 study to identify any changes over the years and potential developments to improve patient outcomes.

Methods: We examined the full Coroner's inquest files for prehospital deaths from trauma and accidental injury over a three-year period in Cheshire. Injuries were scored using the Abbreviated-Injury-Scale (AIS-1990) and Injury Severity Score (ISS), and probability of survival estimated using Bull's probits to match the original protocol.

Results: One hundred and thirty-four deaths met our inclusion criteria; 79% were male, average age at death was 53.6 years. Sixty-two were found dead (FD), fifty-eight died at scene (DAS) and fourteen were dead on arrival at hospital (DOA). The predominant mechanism of injury was fall (39%). The median ISS was 29 with 58 deaths (43%) having probability of survival of >50%. Post-mortem evidence of head injury was present in 102 (76%) deaths. A bystander was on scene or present immediately after injury in 45% of cases and prior to the Emergency Medical Services (EMS) in 96%. In 93% of cases a bystander made the call for assistance, in those DAS or DOA, bystander intervention of any kind was 43%.

Conclusions: The number of potentially preventable prehospital deaths remains high and unchanged. First aid intervention of any kind is infrequent. There is a potentially missed window of opportunity for bystander intervention prior to the arrival of the ambulance service, with simple first-aid manoeuvres to open the airway, preventing hypoxic brain injury and cardiac arrest.

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Introduction

In 1994, Hussain and Redmond revealed that up to 39% of prehospital deaths from accidental injury might have been preventable had basic first aid care been given [1]. Their study was prompted by the 1988 Royal College of Surgeons (RCS) retrospective study of 1000 trauma deaths reporting on the management of patients with major injuries [2]. The RCS report highlighted significant deficiencies in the management of seriously injured patients and concluded that up to one third of hospital trauma deaths could have been prevented had the response from the emergency health system been optimal. Their report however

excluded deaths that occurred outside of the hospital; the assumption being that such deaths would be inevitable. Hussain and Redmond explored whether this assumption was correct.

Over the two decades since their study there have been significant changes made to improve the care of the injured patient. Development has been driven by a series of reports from the RCS and the British Orthopaedic Association [3] and journal papers that highlighted deficiencies and underperforming areas in UK trauma care [4–6]. Following the National Confidential Enquiry into Patient Outcomes and Death (NCEPOD) 2007 report “Trauma: who cares?” which identified major deficiencies in both organisational and clinical elements of trauma care [7], there has been a significant push towards developing regional trauma networks [3]. From April 2012, a network based Major Trauma System has been introduced across England and these changes have already been shown to have impacted positively upon patient outcome [8].

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Within these changes have been major advances in prehospital trauma care. The prehospital ambulance Emergency Medical Service (EMS) systems have evolved with the aim of improving performance and outcomes in the prehospital phase in key areas including new techniques, tools and procedures. These include airway management, circulatory access, control of bleeding, physiological monitoring, scoring systems and training [9]. Where death is clear, according to agreed guidelines, paramedics are also now able to declare death at the scene.

Profound changes have also occurred in the nature of, and population affected by, trauma. Analysis of major injury over the last two decades within the UK by the Trauma Audit and Research Network (TARN) demonstrates an increase in the mean age of patients affected and a change in the predominant mechanism of injury from road traffic injury to low falls [10]. Rigorous analysis of hospital trauma care by TARN continues to drive progress and, following a major European collaborative effort, the uniform use of standardised inclusion and exclusion criteria, data variables and definitions have enabled accurate comparison of performance between trauma registries [11].

The exclusion of prehospital deaths from the analysis and scrutiny of trauma registries is a major limitation to the development of prehospital research [11]. Despite developments and the scrutiny of the general trauma population, remarkably little is known about changes in the demographic of the victims, nature or preventability of prehospital traumatic death. Since Hussain and Redmond's 1994 study highlighting the preventability of prehospital deaths, only one study has made this topic its focus in the UK [12]. Death from trauma remains the leading cause of death for patients in the first four decades of life [13] and a significant percentage of deaths following trauma occur in the prehospital phase. A recent large retrospective cohort study of trauma deaths in seven Western US regions showed 37% of deaths to occur within the prehospital phase [14] but figures up to 86% have been reported [15]. In a recent study by Bakke et al., of the 86% of traumatic death occurring in the prehospital phase, the major causes identified were unchanged and remained suicide and road traffic injury. Preventable deaths are an important performance indicator [16] and measure of health service quality [17]. Analysing preventable deaths can also aid the development of mitigation strategies, improve delivery of care [18] and identify new strategies for treatment, equipment, training, and technology [19]. The prehospital care community must ensure equal rigour is applied to its research as is applied to hospital trauma to identify areas for improvement, drive change and improve outcomes.

We, and others [20,21], are of the opinion that there is still a critical period between the point of injury and the arrival of the EMS, where there remains an opportunity for early intervention to save life. Within this period, which we refer to as the therapeutic vacuum, there is potential for simple first-aid manoeuvres to open the airway and possibly prevent hypoxic brain injury and cardiac arrest [1,22], apply external pressure on areas with visible profuse blood loss [20,21] and prevent hypothermia [20,21].

Aim

The principal aim of the study was to assess the nature of prehospital deaths from trauma and accidental injury and their cause, two decades after the original published analysis, and identify whether there have been changes in the nature, cause and preventability of death. The secondary aim was to identify what type of interventions might prevent prehospital deaths from injury, improve patient outcome and inform first aid and prehospital education.

Methods

In order to facilitate a direct historical comparison, this study replicated the methodology described by Hussain and Redmond [1].

All sudden, unexplained and violent or unnatural deaths that occur in the UK are referred to Her Majesty's (HM) Coroner for the jurisdiction within which the death occurs for investigation. We wrote to several of HM Coroners in and around the area covered in the original study detailing the study and requesting their support. HM Senior Coroner for Cheshire agreed to provide access to support the study by granting access to all relevant records in his jurisdiction. Ethical approval for this study was obtained from the University of Manchester Research Ethics Committee.

We retrospectively reviewed the inquest record for deaths due to injury within the Cheshire jurisdiction, occurring in a three-year period, and referred to the Coroner for investigation. Deaths occurring between 1st January 2011 and 31st December 2013 were chosen to ensure analysis of recent deaths whilst also allowing time for the completion of each inquest. We examined in detail the full inquest, including the Coroner's report, police and ambulance statements, witness reports, the pathologist's report and the post mortem record. The inclusion criteria were deaths within the specified three-year period occurring in the prehospital phase of care from traumatic or accidental injury. Deaths were categorised as found dead (FD), where injury was not witnessed and death was declared immediately on discovery of the body. Deaths were categorised as dead at scene (DAS) where bystanders were present at the time of injury or prior to death but the patient was not transported. Deaths were categorised as dead on arrival (DOA) where death occurred following transportation from scene but prior to hospital or when declared within the Emergency Department (ED) without successful return of spontaneous circulation. Exclusion criteria were: death in hospital, deaths due to hanging and drowning (the mechanism of death is asphyxia and not injury) and deaths from injury in the community which occurred following discharge from hospital, following treatment of the injury, on an end of life pathway or advanced care plan e.g. not for resuscitation. Deaths investigated by the Coroner occurring overseas but resident in Cheshire were also excluded since they did not reflect the UK system.

For those deaths that met the inclusion criteria, cases were anonymised and given a unique study number, and data recorded using a standardised data sheet. Data on age, gender, dominating type of injury, mechanism of injury, intention of injury and prehospital EMS times were collected using the definitions agreed by the European Trauma Registries [11].

Using the autopsy report, a list of injuries sustained, airway patency, information on co-morbidities, presence of alcohol or other drugs at the time of death and cause of death was compiled. Information on how the injured was discovered and if a bystander was present was also extracted from available reports and statements, including details on the call for assistance and whether any first aid intervention of any kind was attempted. The call for assistance was not considered as physical intervention and was recorded separately. Any bystander intervention to help the injured was recorded as first aid. Best estimates were made from the available information on time from injury to discovery and the time from discovery to the call for assistance.

Injuries were coded using the Abbreviated Injury Scale (AIS). A single author (GO) received training in AIS coding by the American Association of Automotive Medicine (AAAM) and coded all injury data. Hussain and Redmond used AIS-1990 to code their injury severity data; the Injury Severity Scores (ISS) and probability of survival (Ps) estimations were calculated from these. To enable direct accurate historical comparison, the now historical AIS-1990

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