



**ARE PREHOSPITAL
DEATHS FROM TRAUMA
AND ACCIDENTAL INJURY
PREVENTABLE?
A SUMMARY REPORT**

Research, Evaluation and Impact

#DontStopat999

ARE PREHOSPITAL DEATHS FROM TRAUMA AND ACCIDENTAL INJURY PREVENTABLE? A SUMMARY REPORT

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Research, Evaluation and Impact, British Red Cross

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Foreword

In 1994 Dr Hussain and Professor Anthony Redmond completed a study which looked at the worryingly high number of people that were dying from accidental and traumatic injuries before they reached a hospital. They wanted to know if there were circumstances under which these deaths might have been prevented. At the British Red Cross, we have long believed that knowing just a few basic first aid skills can give someone the power to save a life. So, 22 years later, we have asked the question again.

Working with Professor Redmond, we have learnt that tragically, the situation in 2016 is much the same. When a person is injured, many well-meaning people will rush to call 999 but few go on to provide first aid while they wait for help to arrive. We believe that most people lack the skills and confidence to do more. We know that people generally want to help but the fact that they are not equipped to step forward can lead to unnecessary deaths.

There are two simple but life-saving first aid skills which we'd like everyone to learn: open a person's airway by placing them on their side with their head tilted back, and put pressure on bleeding wounds.



More people knowing basic first aid and being ready to use it will save lives, so we are working hard to open people up to new ways of learning throughout their lifetime. We have two smartphone apps available, one covering a range of easy-to-learn first aid and one focusing on the specifics of keeping babies and children safe. We also have a range of courses available to help people learn as little or as much first aid, as and when they want.

Crucially, we are also working with the government to call for first aid to be taught in schools, for it to be part of the driving test, and for it to be integral to public health strategies.

If we can encourage people to learn enough to step forward and do whatever they can to help, many more lives could be saved.

A handwritten signature in black ink that reads "M J Adamson".

Michael Adamson
Chief Executive, British Red Cross

Executive summary

The British Red Cross has a humanitarian vision: a world where everyone gets the help they need in a crisis.

As a strategic objective: 'For those with an increased risk of experiencing a crisis, and to develop individual and community resilience, our education offer will ensure all those reached are more confident and willing to act.'

In 1994, Hussain and Redmond conducted a study of the prehospital deaths in North Staffordshire between 1987 and 1990. They revealed that up to 39 per cent of these prehospital deaths from accidental injury might have been preventable with the provision of basic first aid.

As a first aid provider, we were keen to re-examine whether the number of deaths that may have been preventable with the provision of basic first aid has altered since the original study. In line with our strategic objective, we were also keen to address whether the nature and cause of injury has changed.

Therefore, we commissioned research, under the supervision of the original author (Professor Anthony Redmond), to repeat the 1994 study on a contemporary sample of coroners' records. The first study used the same historic methods of analysis. The second study refined the analysis to account for a more recent method of calculating the probability of survival. Both studies analysed case records.

The first objective of this research was to examine whether there had been a change in the nature, cause and preventability of death since the original 1994 research. The second was to identify which, if any, interventions might reduce the number of preventable deaths, with a view to informing first aid education.

The studies showed that the percentage of potentially preventable or preventable deaths remains high and unchanged since 1994, and while calls for assistance were made in up to 93 per cent of cases, first aid intervention of any kind was not as frequent.

A bystander or passer-by was on scene during, immediately after or in the minutes after the point of injury in up to 52 per cent of cases. However, when those found dead are excluded, a first aid intervention was attempted in between 43 and

57 per cent of cases. This is despite the injured potentially being alive at this stage. This presents an opportunity to help, but is often a missed opportunity.

Both studies also showed that the mechanism of injury has changed, in line with trends observed in other studies. The number of deaths from falls increased, whereas the number of road deaths decreased, but remains significant.

The research makes several recommendations.

Recommendations for the first aid training community, which includes the Red Cross:

- > Encourage action to be taken by bystanders, beyond calling for the emergency services.
- > Increase understanding that doing something is simple but life-saving:
 - maintain an open airway to keep the person breathing by turning the person on their side and tilting their head back;
 - put pressure on a bleed to stop the flow of blood.
- > Further explore the motivation to proceed with first aid interventions or not.



- > Continue to test out different ways of teaching first aid education.
- > Continue to use our knowledge and expertise to identify areas with a high risk of first aid emergency.
- > Consider examining the role of the call handler in supporting the bystander to perform first aid.
- > Government education departments, schools, teachers, young people and others should champion first aid learning, integrating it into existing subjects and whole-school approaches.
- > The Welsh Government should integrate first aid learning into planned changes to the Welsh curriculum.

Recommendations for the Red Cross:

- > Seek to lead, along with academic colleagues, the prehospital research community to reach a consensus on what is considered 'preventable'.
- > Consider exploring our role in responding to falls.

Recommendations for decision-makers and policymakers:

- > First aid should be mandatory in school curricula in England, Northern Ireland, Scotland and Wales.

- > The Department for Transport should make attendance at a practical first aid course mandatory to acquire a driving licence in the UK.
- > The Department for Transport should include bystander first aid as a key intervention in its Road Safety Statement (2015).
- > The departments for health and relevant national and local public bodies across the UK should work with the Red Cross to ensure that all have the opportunity to learn first aid.



1 Background

First aid education at the British Red Cross

The British Red Cross helps millions of people in the UK and around the world prepare for, respond to and recover from emergencies.

As a member of the Red Cross and Crescent Movement, which is the world's largest provider of first aid education and training, we provide learning in first aid, disasters and emergencies, and humanitarian values.

We offer a variety of first aid training and resources, including high-quality face-to-face education, free online resources for young people and teachers at primary- and secondary-school level, as well as putting life-saving tools into people's pockets through our free first aid phone apps.

Overall we aim to develop effective education to reduce the harmful impacts of crises, including the skills needed to reduce harm and save lives. We aim to change behaviours and attitudes so that more people will take humanitarian action by stepping forward to help.

The Red Cross has a humanitarian vision: a world where everyone gets the help they need in a crisis.

As a strategic objective: 'For those with an increased risk of experiencing a crisis, and to develop individual and community resilience, our education offer will ensure all those reached are more confident and willing to act.'

To help achieve this strategic objective, the Red Cross strives for advancements in education through a strengthened evidence base, by developing its first aid offer and underpinned pedagogy, alongside influencing change through its advocacy priorities. These developments not only reflect the wider external context of first aid education but have also influenced this context.

The late 1970s saw a burgeoning interest in prehospital care – specifically, managing the patient in the first stage of the chain of survival, where actions and events in each stage of their journey contribute to their chance of survival (Hsieh 2016).

These events include:

- > early access to the emergency cardiac care system by recognising sudden cardiac arrest quickly and calling 911
- > early cardiopulmonary resuscitation (CPR) by those nearest to the sudden cardiac arrest i.e. bystanders
- > early defibrillation of ventricular arrhythmias
- > early advanced-level care by trained professionals (Hsieh 2016).

What is Everyday First Aid and why is it important?

This interest in prehospital care led to the use of the relevant learning from clinical research to create a first aid training offer and saw the development of the inaugural first aid manual.

Set against a backdrop of clinically focused research, the offer of first aid centred on decision-making pathways – arguably containing complex information and assessment criteria – which we now understand does not give the general public confidence to act in an emergency.

It was not until 2010 that a new 'formula for survival', which acknowledged the importance of both effective education and local implementation

of that education, was articulated in scientific literature (Søreide et al. 2013). This highlighted the importance of the bystander being adequately equipped to step forward and be willing to help, through skills and confidence, to step forward and help. The realisation of the critical role of the first person on the scene also drew attention to the lack of data and insight into what makes good first aid education – that is, education which empowers the learner to act effectively and gives them the confidence to do so.

A 2016 survey of 600 members of the general public (British Red Cross, unpublished) asked a series of questions related to their confidence and willingness to act in a number of first aid emergencies:

- > **confidence** to act when someone was unconscious but breathing, unconscious and not breathing, or bleeding severely
- > **willingness** to act when someone they **knew** was unconscious but breathing, unconscious and not breathing, or bleeding severely
- > **willingness** to act when someone they **did not know** was unconscious but breathing, unconscious and not breathing, or bleeding severely.

The survey revealed that confidence was a greater issue than willingness in all three emergency scenarios.

With an ambition to reach the general population – but with the public displaying little confidence – and a need to position first aid as a public health issue, a new strategy for first aid was required.

Based on the experiential/facilitation approach which has gained currency in the last 10 years, the Everyday First Aid approach was developed in line with current good educational practice which allows for flexibility in delivery and firmly roots its teaching methodology in active learning. This approach encompasses:

- > flexibility in its approach to delivery, allowing a greater variety of people to learn first aid
- > appreciation of the ways in which adults and young people learn and the influences on their learning
- > a variety of teaching resources, including a mobile app

- > placement of the learner at the centre, and making the experience as relevant and empowering for them as possible.

The Red Cross monitors the effectiveness of education by measuring learner confidence before and after sessions. This allows us to scrutinise our own delivery as education providers and to implement continuous improvement. Research is also undertaken to examine the effectiveness of different pedagogies with different audiences to inform our education strategy.

Understanding where, why and how death and injury occur, and the likelihood that first aid interventions could have made a difference, is central to our efforts.

Are prehospital deaths from accidental injury preventable?

In 1988, a Royal College of Surgeons (RCS) retrospective study of 1,000 trauma deaths reported on the management of patients with major injuries (Saleh 1989). The RCS report concluded that up to one-third of hospital trauma deaths could have been prevented, if the response from the emergency health system had been optimal. In other words, something could or should have been done to alter the final outcome for the patient. However, the report did not include deaths that occurred outside hospital. This exclusion implies a perceived inevitability of death occurring prior to receiving professional help.

Challenging this assumption, Hussain and Redmond (1994) conducted a study of the prehospital deaths from accidental injury in North Staffordshire between 1987 and 1990. They revealed that up to 39 per cent of these deaths might have been preventable with the provision of basic first aid.

Dean et al. (2014) report that 37.1 per cent of the people attended to by the emergency services who die do so before reaching hospital, with the remainder dying in hospital. The time period before hospitalisation is, therefore, critical. It is during this time, prior to professional intervention, when the public is in a position to intervene with basic first aid, and this intervention may well be life-saving. Oliver and Walter (2016) refer to the prehospital period as the ‘therapeutic vacuum’.

As a first aid provider, we are keen to re-examine whether the number of deaths that may have been preventable with the provision of basic first aid

has altered since the original study. In line with our strategic objective, we are also keen to address whether the nature and cause of injury have changed.

External context

Educational setting

Given the lack of action by bystanders found in Hussain and Redmond’s original study (1994), the authors recommended that “training in basic first aid should be compulsory in schools” (p.1079). Despite widespread public support for such a move and campaigns run by the Red Cross and others¹ to make first aid mandatory in all state-funded secondary schools in England, this goal of mandatory first aid has not been realised.

In England, first aid does feature in the recommended Personal, Social, Health and Economic (PSHE) education curriculum, but this is not a statutory subject and is not widely taught to a high standard, according to the House of Commons Education Committee (2015). The Committee and other Committee Chairs recently recommended making PSHE compulsory (Commons Select Committee 2016), but the UK Government decided not to do so (Morgan 2016).

PSHE is not the only route through which to teach first aid. It could be taught in a variety of other existing subjects or cross-cutting curricula, including Physical Education and as an after-school activity. Furthermore, publicly funded academies present an opportunity to increase the teaching of first aid since, as they continue to increase in number and now form almost half of all secondary schools (Parliament UK 2015b), they do not need to follow the curriculum, although they must teach “a broad and balanced curriculum” (Department for Education 2015, p.38). Academies may, therefore, be well placed to incorporate whole-school approaches and could embrace first aid as part of a broader theme, such as health and well-being, across various aspects of school life.

Education is a devolved matter; therefore, different approaches are adopted across the UK. Wales has a similar curriculum to England’s, with first aid optional within the statutory Personal and Social Education (PSE) (Department for Children,

¹ These include ‘Pupil Citizen Lifesaver’ (2013) and ‘Every Child a Lifesaver’ (2015), the latter a collaboration with St John Ambulance and the British Heart Foundation in support of Teresa Pearce MP’s private members’ bill (Parliament UK 2015a).

Education, Lifelong Learning and Skills 2008). However, a new curriculum is currently being developed in Wales. Pioneering schools have been tasked with developing the new curriculum, which will abolish key stages and move closer to the Scottish model, where there is less formal assessment. Key themes in the proposed curriculum include Health and Well-being, within which first aid could fit (Welsh Government 2016). Health and Well-being is also present in Scotland's 'Curriculum for Excellence' for all ages (Education Scotland 2010). Personal Development and Mutual Understanding (PDMU) at primary level and Learning for Life and Work at secondary level are relevant subjects for first aid to be taught in the Northern Irish curriculum (Council for the Curriculum, Examinations and Assessment 2007).

In England, only 24 per cent of secondary schools teach first aid – even though surveys have revealed that the overwhelming majority of teachers, parents and young people across the UK believe they should learn first aid in school (British Heart Foundation, British Red Cross, St John Ambulance 2015):

- > 97 per cent of teachers think it is vital for young people to learn essential first aid skills in school.
- > 95 per cent of parents agree that first aid should be taught at secondary school.
- > 97 per cent of children aged 11 to 16 agree they should be taught first aid, saying it should either definitely or probably be taught at secondary school.

In Europe, first aid is mandatory in Denmark, France, Germany, Italy and Norway for secondary-school students (IFRC 2015). In Spain and France first aid is also compulsory for primary-school children. As a result, in Norway, for example, around 95 per cent of the population are educated in first aid (ibid.).

Road deaths

"...every road death and serious injury is a tragedy that leaves a life ruined and a family shattered." (Department for Transport British Road Safety Statement 2015, p.10)

Hussain and Redmond (1994) reported that the main cause of death, in their study, was injuries sustained on the road. However, in the 22 years since their report, changes have been observed in the mechanism of injury, with the number of road deaths declining in the UK.

The Department for Transport (DfT) British Road Safety Statement (2015) notes that around 1,700 people die from road deaths per year in the UK (based on deaths between 2012 and 2014), and that from 2005 to 2014, the number of road deaths fell by 45 per cent, with 2013 seeing the fewest deaths on Britain's roads since records began in 1927. One of the reasons for this is noted as "better trauma care" (ibid. p.9).

The reduction in the number of road deaths is a huge success, but variations in risk do occur. Younger drivers are said to be "four times more likely to be killed or seriously injured compared with car drivers aged 25 or over" (ibid. p.14). However, older drivers and passengers are "more likely to die or sustain a severe injury than a younger adult in an accident of the same impact" (ibid. p.14).

It is clear from the Statement that road safety management remains a priority. However, there are also a number of opportunities for first aid education that do not currently feature in the Statement, which speaks of the need for a wider approach to saving lives than road safety alone – specifically, the opportunity to educate drivers and the ability of statutory and non-statutory organisations to respond in the event of an incident.

Among the key priorities outlined in the Statement are:

- > "Ensuring that the driver testing and training regime prepares new drivers for a wide range of real-life driving conditions and situations;
- > Continuing our THINK! campaign to provide road user education and influence behaviour in a targeted and engaging way;
- > Working in partnership with public- and private-sector bodies and civil society organisations to save lives" (ibid. p.6-7).



In addition, the five pillars of the United Nation's 2010 Global Plan for the Decade of Action for Road Safety 2011–2020 (WHO, 2010) include the following: "Post-Crash Response: Working with the emergency services and NHS [national health services] to ensure that collisions are effectively responded to and investigated."

However, apart from safety awareness through education there is no suggestion made that the public, including those involved in or witness to a road traffic collision, have a role to play in saving lives.

This is surprising, given that many other European nations require new drivers to learn first aid through a practical test in order to qualify for a licence, thereby increasing the likelihood that they will be able to respond with basic but life-saving skills during an emergency situation on the road, or indeed in other situations (IFRC 2015). This is the case in the Czech Republic, Germany, Hungary, Norway and Switzerland, among other countries (House of Commons Hansard 2016).

Since Hussain and Redmond's report in 1994, the Driving Theory Test has contained a number of first aid questions. However, despite Hussain and Redmond's recommendation (p.1079), first aid has not become a compulsory practical element of the driving test.

In March 2016 Will Quince MP introduced a private members' bill under the Ten-Minute Rule in the UK Parliament, which proposed attending a four-hour practical first aid course with an approved provider as a minimum requirement for attaining a driving licence (House of Commons Hansard 2016). While the bill did not have sufficient time to progress during the parliamentary calendar, it has helpfully raised the profile of the issue and given impetus for change.

Health and social care – falls

The UK's population is ageing fast. More than 1 in 12 of the population is projected to be aged 80 or over by mid-2039 (ONS 2015), and a large elderly population means an increase in the number of accidental injuries from slips, trips and falls (Oliver 2013).

By 2032, 11.3 million people are expected to be living on their own – more than 40 per cent of all households (The King's Fund 2012). This has implications for responding to accidental injury, such as falls in the home, given there may not be a bystander present to help. Indeed, the number of people over 85 living on their own and likely to be vulnerable to falls is expected to grow from

573,000 to 1.4 million by 2032 (ibid.). Support is, therefore, vital.

The changes in demographics mean demand is growing for health and social care (Parliament UK 2013). While it has long been recognised that prevention is better than cure, the UK's health and social care system has largely focused on reacting to crises rather than preventing them (HM Government 2012).

All parts of the UK have taken steps to shift the balance of care towards prevention. In 2014 the ambition to shift towards a truly preventative system in England was enshrined in law. Section 2 of the Care Act places a new duty on local authorities to ensure the provision of services that prevent, reduce or delay the need for care and support (HM Government 2014). The law is clear: while the ambition is always to prevent crises, we cannot prevent every crisis. Prevention is, therefore, also about ensuring the resources are in place to reduce the negative impact of crises.

At the same time in Scotland, legislation was passed which integrated health and social care (Scottish Government 2014a). The Public Bodies (Joint Working) Act (Scotland) 2014 set out the duties and responsibilities for integration and outlined it as a key driver in delivering transformational change with person-centred care and prevention at its core (Scottish Government 2014b).

In Wales, The Social Services and Well-being (Wales) Act 2014 provides the legal framework for improving the well-being of people who need care and support, and carers who need support, and for transforming social services in Wales (Welsh Government 2016). The Act is designed to encourage a renewed focus on prevention and early intervention (Welsh Government 2014).

Transforming Your Care in Northern Ireland has been the key policy driver in shifting care towards prevention (Northern Ireland Executive 2016). It sets out a vision for improving care for people in Northern Ireland by supporting people to live as independently and healthily as possible, for as long as possible (Health and Social Care Board 2011).

Given the changes in the external context since 1994 – changes to both trauma care and the nature of injury – the Red Cross commissioned the original author (Professor Anthony Redmond) and colleagues (Dr Govind Oliver and Dr Darren Walter) at the Humanitarian and Conflict Response Institute (HCRI) at the University of Manchester, UK, to conduct a revised version of the original 1994 study.



2 Design

While commissioning the study, the researchers reported that a different approach to the analysis of probability of survival was required. They proposed a refined methodology to account for updates to both the Abbreviated Injury Scale (AIS) and the calculation of the probability of survival. As these adaptations meant a direct historical comparison would not be possible, we decided to commission two related studies. Study one used the same methodology as the original 1994 study and applied this to more recent coroners' records. Study two used the updated AIS and calculation for the probability of survival. Both analysed case records.

Both studies are authored by Oliver, Walter and Redmond and, at the time of publishing this summary report, have been submitted to a specialist journal for publication.



3 Study one

Research objectives and methodology

Research objectives

The first objective of this research was to examine whether there had been a change in the nature, cause and preventability of death since the original 1994 study. The second was to identify which, if any, interventions might reduce the number of preventable deaths, with a view to informing first aid education.

Methodology

This study replicated the methodology described in Hussain and Redmond (1994).

Several of Her Majesty's (HM) coroners² were contacted with details of the study and a request for their support. After securing

² All sudden, unexplained and violent or unnatural deaths that occur in the UK are referred to a coroner for the jurisdiction within which the death occurs for investigation.



support from HM Senior Coroner for Cheshire and receiving ethical approval from the University of Manchester Research Ethics Committee, the researchers retrospectively reviewed inquest records.

The inquest records reviewed covered all deaths from injury referred to the coroner between 1 January 2011 and 31 December 2013, and included the coroner's report, police and ambulance statements, witness reports, the pathologist's report and the post-mortem record. The three-year period was chosen to allow for the completion of inquests.

Data collected included: injuries sustained, neurological injury, airway obstruction, co-morbidities and the presence of alcohol/other drugs. Details as to whether a bystander was present, how the injured was discovered and whether any first aid intervention was made³ were also noted, alongside an estimate of time from

injury to discovery and the time from discovery to the call for assistance.

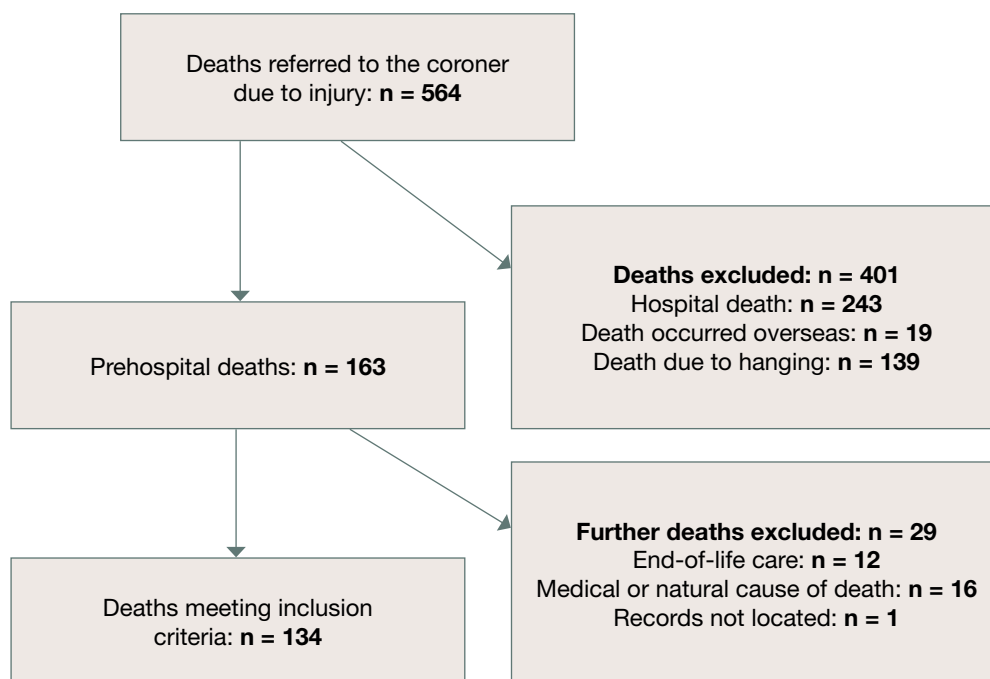
The inclusion criteria for the study were that deaths were from traumatic or accidental injury, within the three-year time frame and occurred prior to hospitalisation. Figure 1 details both inclusion and exclusion criteria.

Analysis

For each death, the following analysis was conducted to generate the probability of survival:

- > In accordance with the AIS-1990, injuries were ranked on a scale of one to six, with one being minor, five severe and six a non-survivable injury (Brohi 2007a). The AIS-1990 was used to ensure comparison to the 1994 study.
- > From the AIS-1990, the Injury Severity Score (ISS) was calculated, which allows for an

3 The call for assistance was not classified as a first aid intervention.

FIGURE 1. FLOW DIAGRAM DETAILING INCLUSION AND EXCLUSION OF CASES FOR STUDY ONE

overall score as a result of multiple injuries. Each injury was allocated to one of six body regions (head, face, chest, abdomen, extremities (including pelvis), external) (Brohi 2007b). The three most severely injured body regions had their score squared and added

together to produce the ISS score, which ranges from 1 to 75 (TARN 2016).

- > Probability-of-survival estimations were calculated using Bull's probits (Bull 1975).⁴

⁴ In 1975 Bull used the ISS to re-analyse the data on 1,333 victims of road traffic accidents treated as inpatients at Birmingham Accident Hospital in 1961. He used probit analysis to linearise the mortality data in separate age groups and showed a good correlation between the ISS and the probability of survival when this North American method was applied to a British population. 'Bull's probits' have been used by several other authors to identify preventable deaths from injury.



4 Study two

Research objectives and methodology

Research objectives

The first objective of this research was to examine the nature, cause and probability of survival in a cohort of prehospital deaths. A second objective was to identify which, if any, interventions might reduce the number of preventable deaths, with a view to informing first aid education.

Methodology

Several HM coroners⁵ were contacted with details of the study and a request for their support. After securing support from HM Senior Coroner for Cheshire and HM Senior Coroner for Manchester (City) and receiving ethical approval from the University of Manchester

⁵ All sudden, unexplained and violent or unnatural deaths that occur in the UK are referred to a coroner for the jurisdiction within which the death occurs for investigation.

Research Ethics Committee, the researchers retrospectively reviewed inquest records.

The inquest records reviewed covered all deaths from injury referred to the coroner between 1 January 2011 and 31 December 2013, and included the coroner’s report, police and ambulance statements, witness reports, the pathologist’s report and the post-mortem record. The three-year period was chosen to allow for the completion of inquests.

Data collected included: injuries sustained, neurological injury, airway obstruction, co-morbidities and the presence of alcohol/other drugs. Details as to whether a bystander was present, how the injured was discovered and whether any first aid intervention was made⁶ were also noted alongside an estimate of time from injury to discovery and the time from discovery to the call for assistance.

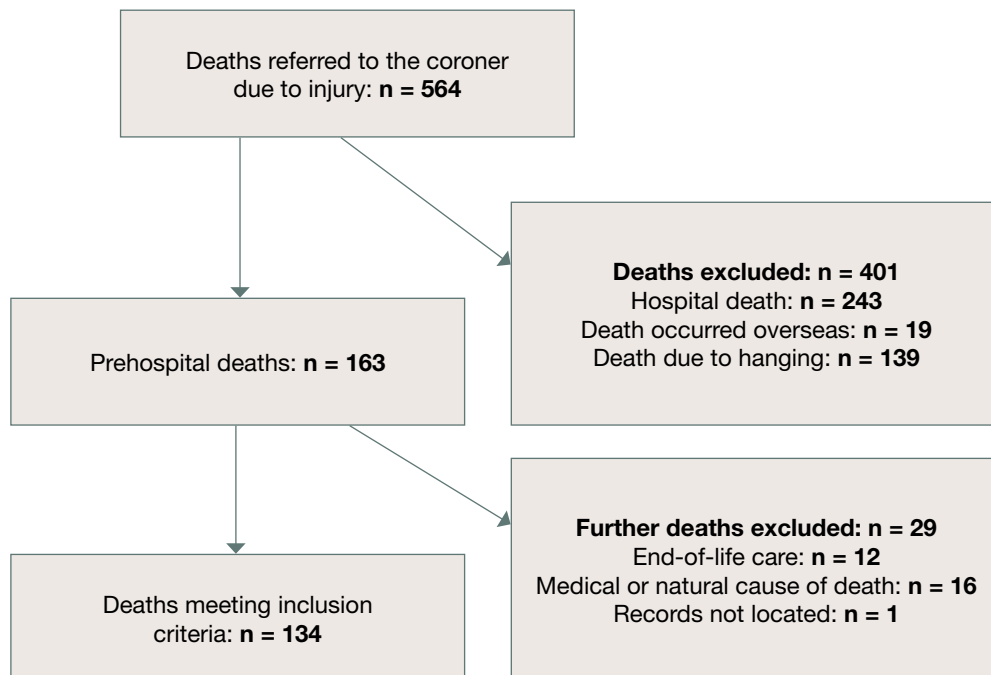
The inclusion criteria for the study were that deaths were from traumatic or accidental injury, within the three-year time frame and occurred prior to hospitalisation. Figure 2 details inclusion and exclusion criteria for Cheshire, and Figure 3 details the same for Manchester (City).

Analysis

For each death, the following analysis was conducted to generate the probability of survival:

- > First, in accordance with the AIS-2005 (update 2008), injuries were ranked on a scale of one to six, with one being minor, five severe and six a non-survivable injury (Brohi 2007a). The AIS-1990 was used to ensure comparison to the 1994 study.
- > From the AIS-2005 (update 2008), the ISS was calculated, which allows for an overall score as a result of multiple injuries. Each injury was allocated to one of six body regions (head, face, chest, abdomen, extremities (including pelvis), external) (Brohi 2007b). The three most severely injured body regions had their score squared and added together to produce the ISS score, which ranges from 1 to 75 (TARN 2016).
- > Probability-of-survival estimations were calculated using TARN’s Ps14 calculator, although this calculation has not been validated for a prehospital model.

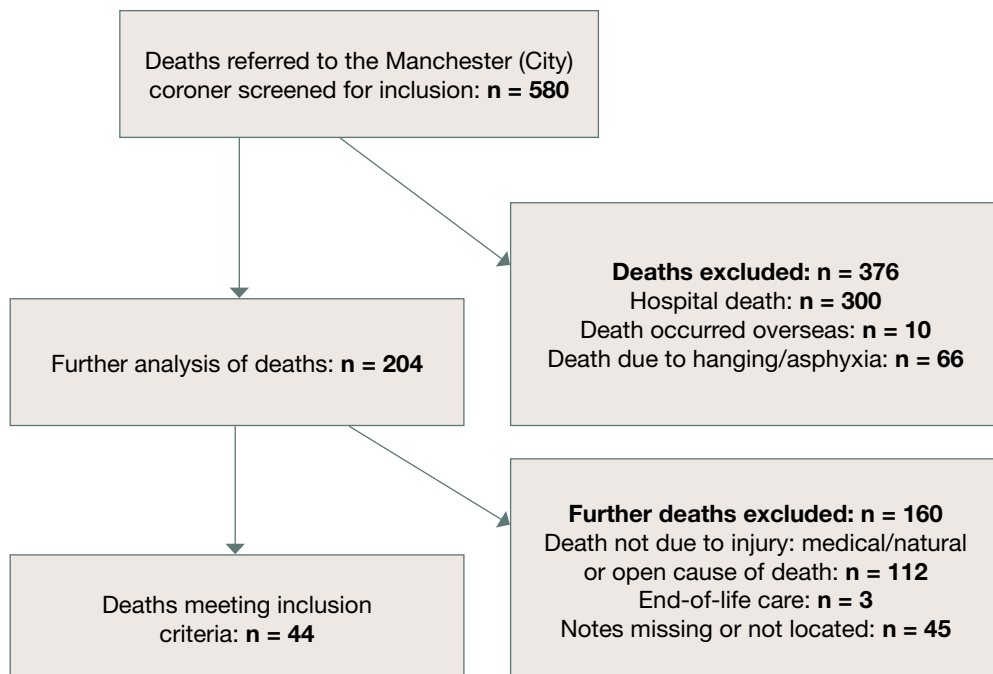
FIGURE 2. FLOW DIAGRAM DETAILING INCLUSION AND EXCLUSION OF CASES (CHESHIRE)



6 The call for assistance was not classified as a first aid intervention.



FIGURE 3. FLOW DIAGRAM DETAILING INCLUSION AND EXCLUSION OF CASES (MANCHESTER (CITY))





5 Key findings

Literature review

At the start of the research, a systematic literature review was conducted to examine the heterogeneity in terminology and methodology across studies into preventable prehospital trauma deaths (see Oliver and Walter 2016 for the full report). This review revealed inconsistencies in both the methodologies employed and the terminology used to define 'preventable' deaths. The studies were also inconsistent in their inclusion of those dead at the scene or dead on arrival in their analysis.

These inconsistencies affirmed for the authors that no key research could be used as a comparator to the revised 1994 study (study one). They also concluded that research into preventability in the therapeutic vacuum, which occurs prehospital (before professional intervention), will be inhibited without homogeneity in the methodologies and terminologies of prevention. There is, therefore, a need for the research community to reach consensus on prevention in the prehospital space.

Study one

Sample characteristics

One hundred and thirty-four deaths met the inclusion criteria, which is slightly fewer than the 1994 study (n = 152).

While gender was broadly comparable between both studies (110 male and 42 female vs. 106 male and 28 female in the previous study), the current sample was older than in the original study, with a mean age of 53.6 years compared to 41.9 years. However, these trends are in line with existing research, where the average age of death from injury increased from 36.1 years in 1990 to 53.8 years in 2013 (Kehoe et al. 2015). Furthermore, a gender difference is also observed in the proportion of deaths from injuries, with a higher proportion of male deaths from injury (1 in 8) than female (1 in 14) (WHO 2008).

Time of death

Table 1 displays the available data related to whether the injured person was found dead, dead at the scene or dead on arrival:

- > 46.3 per cent (n = 62) of the injured were found dead, where the injury was not witnessed, and death was declared immediately on discovery of the body
- > 43.3 per cent (n = 58) were dead at the scene, where bystanders were present at the time of injury or prior to death

10.4 per cent (n = 14) were dead on arrival, where death occurred following transportation from the scene but prior to hospitalisation or when declared within the emergency department.

Mechanism of injury

The majority of deaths in the current study were as a result of accidental (unintentional) injury (71.6 per cent, n = 96). There were fewer road traffic

collisions (RTCs)⁷ in the present study (27.6 per cent, n = 37) than previously (56.6 per cent, n = 86), though it is clear that this cause of injury still accounts for a sizeable proportion of overall deaths. The proportion of those who died after the RTC was similar for both studies: 45.9 per cent (n = 17) car occupants vs. 43.0 per cent (n = 37) previously, and 29.7 per cent (n = 11) pedestrians vs. 25.6 per cent (n = 22) previously. This is similar to current statistics for road deaths in Great Britain, with car deaths accounting for 44 per cent and pedestrian deaths for 24 per cent of road deaths (DfT 2015).

In contrast to the decrease in the number of RTCs, the number of falls was observed to have increased as a main mechanism of injury in the present study (38.8 per cent, n = 52 vs. 15.1 per cent, n = 23). Of these falls, 48.1 per cent (n = 25) were as a result of a low-energy fall (at the same level) and 51.9 per cent (n = 27) a high-energy fall (above body height). This increase in the number of falls is in line with findings from Kehoe et al. (2015) that show that the most common cause of injury has shifted from RTCs (59.1 per cent in 1990) to low-level falls (39.1 per cent in 2013).

Deaths from falls were analysed further, and it was observed that this cohort was more likely to be male (36 male vs. 16 female) and older, with an average age of the deceased at 64.7 years (interquartile range 46 to 82). In 88.5 per cent of cases, the fall was accidental.

Based on the coroner's records, being found dead after a fall was more frequently observed than dead at the scene or dead on arrival – 71.2 per cent, 23 per cent and 5.7 per cent, respectively. Of the 12 who were dead at the scene, all but one had either a bystander present or there within a minute, and the three who were dead on arrival at hospital all had a bystander present immediately or within minutes.

Of those found dead, 22 of the 37 were aged 71 years or over, and none of the 22 had a bystander or passer-by present within hours.

It is noteworthy that significantly more hangings were observed in the current study than in 1994. The proportion of hangings rose from 9 per cent (n = 30) of the original study sample to 25 per cent (n = 139) in this present study (p<.05).

Table 1. Status of injured person on discovery

	Cheshire % (number)
Found dead	46 (62)
Dead at the scene	43 (58)
Dead on arrival	10 (14)

Note: Some figures are rounded down

⁷ Including motor vehicle injury, motorcycle injury, bicycle injury and pedestrian; excluding other traffic (ship, aircraft, train).

Calculating the probability of survival

The average ISS was 38.3. Twenty-nine deaths in both the current and previous study had an ISS of 75 (the maximum possible and considered not survivable). An ISS greater than 15 is considered a major trauma. In the current study, 22 deaths had an ISS of less than 15, compared to 14 in the previous study.

The probability of survival remained high in both studies. In 1994, 39.5 per cent (n = 60) of cases had a probability of survival greater than 50 per cent, compared to 43.3 per cent of people in the present study (n = 58).

The presence of airway obstructions alone was lower in the present study (19.4 per cent, n = 26) than previously (58.6 per cent, n = 89). In addition, of these 26 deaths, 20 (76.9 per cent) also had a neurological injury, which is similar to the proportion in the previous study (79.8 per cent, n = 71). Overall, neurological injury was noted in 102 deaths (76.1 per cent). Similarly, in 1994, 113 deaths were associated with neurological injury (74.3 per cent).

Bystander presence

Data on the presence of a bystander, and how the call for assistance was made, were not collected in the original 1994 study. This was addressed in the current study, as it allows for speculation around the moments after injury and the possibility for first aid intervention.

A bystander was on the scene during or immediately after the point of injury in 44.8 per cent of deaths (n = 60).⁸ For an additional 20 people (14.9 per cent), a bystander was on the scene between minutes and an hour later. A passer-by was on the scene before the emergency services in 95.5 per cent of cases.

The average time taken for the emergency services to arrive after call-out was 8.2 minutes

(median 6 minutes), although these data were only available for 50 cases. However, this time frame adds to the only detail we have about the therapeutic vacuum – in 95.5 per cent of cases a passer-by was with the injured person, but without professional support.

The majority of calls for assistance were made by a bystander or passer-by (85.1 per cent, n = 114), and in 11 cases (8.2 per cent) by someone involved in the incident.

When we exclude those who were found dead, a first aid intervention was attempted in 43.1 per cent (n = 31) of cases. When including those found dead, in only two additional cases was an intervention attempted.

Types of intervention which might help

Although the presence of airway obstruction alone was slightly lower in the current study than previously, the presence of neurological injury and neurological injury with airway obstruction was similar between the studies. Therefore, the original recommendation from 1994 – to maintain airways as an important intervention – still stands.

However, the current study places greater emphasis on the need to provide ventilatory intervention when a head injury has occurred, particularly due to the subsequent physiological response to brain injury, known as impact brain apnoea. If the airway is supported during this time, then death from prolonged apnoea may be avoided (Wilson et al. 2016). Oliver and Walter (2016) note that this critical phase of a head injury takes place in the first 10 minutes, although they also state that this is an arbitrary time reference (Atkinson 2000).

The authors of the present study note the importance of the role of the bystander or passer-by in supporting the airway and controlling bleeding.

8 The time from injury to discovery is a subjective assessment of the time from the point of injury to someone being on the scene, based on the available evidence.

Study two

Sample characteristics

One hundred and thirty-four deaths from the Cheshire data met the inclusion criteria, and forty-four from Manchester (City).

While there were significantly more accidental deaths in Cheshire than in Manchester (City) (71.6 per cent vs. 54.5 per cent, $p < .05$), gender (79 per cent vs 77 per cent male) and age (53.6 years vs. 48.2 years) were comparable.

The average age observed in the current study reflects trends in the hospital trauma population, where the average age of death from injury is 53.8 years (Kehoe et al. 2015). Furthermore, a gender difference is also observed in deaths from injuries, with a higher proportion of male deaths from injury (1 in 8) than female (1 in 14) (WHO 2008), albeit from a global population.

Time of death

Table 2 displays the available data related to whether the injured person was:

- > found dead, where the injury was not witnessed, and death was declared immediately on discovery of the body
- > dead at the scene, where a bystander were present at the time of injury or prior to death, or
- > dead on arrival, where death occurred following transportation from the scene but prior to hospitalisation or when declared within the emergency department.

Mechanism of injury

Significantly more deaths in Cheshire were accidental ($p < 0.05$), and fewer due to assault ($p < 0.05$), than in Manchester (City). Traumatic brain injury was noted in 76 per cent of Cheshire cases, compared to 66 per cent of those in Manchester (City).

The main mechanism of injury for both Cheshire and Manchester (City) deaths was falls (39 per cent and 45 per cent, respectively). Of these falls, the Manchester (City) coroner's reports reveal a higher proportion of deaths by high-energy falls than in Cheshire (85 per cent and 52 per cent, respectively, $p < 0.05$).



In contrast, fewer deaths were observed as a result of motor vehicle injury;⁹ these deaths accounted for 27.6 per cent ($n = 37$) in Cheshire and much fewer in Manchester (City) (15.9 per cent, $n = 7$). This cause of injury, however, still accounts for a sizeable proportion of overall deaths.

The proportion of those who died after a RTC was reversed for the two cohorts. In Cheshire, 45.9 per cent ($n = 17$) of those deceased following an RTC were car occupants, and 29.7 per cent ($n = 11$) were pedestrians, compared to 29 per cent ($n = 2$) car occupants and 43 per cent ($n = 3$) pedestrians in Manchester (City). However, the lower numbers in Manchester (City) are likely to have shaped this finding. Certainly the Cheshire data are more aligned with current statistics for road deaths in Great Britain, with car deaths accounting for 44 per cent and pedestrian deaths for 24 per cent of road deaths (DfT 2015).

Overall, this pattern of injury is in line with external research, which notes that the most common cause of death from injury has shifted from RTCs (59.1 per cent in 1990) to low-level falls (39.1 per cent in 2013) (Kehoe et al. 2015).

Calculating the probability of survival

The average ISS was similar for both cohorts – 38.2 for Cheshire and 36.1 for Manchester (City). However, 29 Cheshire deaths had an ISS of 75 (the maximum possible and considered not survivable), compared to 7 in Manchester (City). In addition, 21 Cheshire deaths and 5 Manchester (City) deaths had an ISS of less than 15, which does not qualify as a major trauma.

9 Including motor vehicle injury, motorcycle injury, bicycle injury and pedestrian; excluding other traffic (ship, aircraft, train).

Table 2. Status of injured person on discovery

	Cheshire % (number)	Manchester (City) % (number)
Found dead	46 (62)	48 (21)
Dead at the scene	43 (58)	34 (15)
Dead on arrival	10 (14)	18 (8)

Note: Some figures are rounded down

Using the WHO (2008) definition of potentially preventable or preventable (based on an estimated probability of survival of 25 to 50 per cent and greater than 50 per cent, respectively), 45 per cent of Cheshire deaths and 59 per cent of Manchester (City) deaths were potentially preventable or preventable.

Bystander presence

Information on the presence of a bystander, and how the call for assistance was made, allows for speculation around the moments after injury and the possibility for first aid intervention. A bystander was on the scene during or immediately after the point of injury in 45 per cent of deaths ($n = 60$) in Cheshire and 43 per cent ($n = 19$) in Manchester (City).¹⁰ A passer-by was on the scene within minutes in an additional 7 per cent ($n = 9$) of cases in Cheshire and 5 per cent ($n = 4$) in Manchester (City). Furthermore, a bystander or passer-by was on the scene prior to the emergency services in 96 per cent of Cheshire deaths and 86 per cent of Manchester (City) deaths.

In Cheshire, the mean average time taken for the emergency services to arrive after call-out was 8.4 minutes (median 6.5 minutes).¹¹ In Manchester (City) the average time was 8.1 minutes (median 7 minutes).¹²

The vast majority of calls for assistance were made by someone directly involved in the incident, a bystander or a passer-by (93 per cent in Cheshire and 86 per cent in Manchester (City)).

Excluding those found dead, a first aid intervention was attempted in 43 per cent of the remaining cases in Cheshire and 57 per cent in Manchester (City).

Types of intervention which might help

Given the high incidence of traumatic brain injury, the current study places greater emphasis on the need to provide ventilatory intervention when a head injury has occurred, particularly due to the subsequent physiological response to brain injury, known as impact brain apnoea. If the airway is supported during this time, then death from prolonged apnoea may be avoided (Wilson et al. 2016).

Oliver et al. (2016) go on to note that traumatic brain injury is the commonest mode of death following traumatic injury and that the critical phase of a head injury takes place in the first 10 minutes, although they also note that this is an arbitrary time reference (Atkinson 2000).

¹⁰ The time from injury to discovery is a subjective assessment of the time from the point of injury to someone being on the scene, based on the available evidence.

¹¹ Based on data from 50 records.

¹² Based on data from 36 records.



6 Conclusions

This report summarises the findings from a literature review (Oliver and Walter 2016) plus two empirical studies currently submitted to a specialist journal for publication by Oliver, Walter and Redmond.

The overall aim of this programme of research was to examine whether there has been a change in the nature, cause and preventability of death since the original 1994 research (study one), and whether there has been a change in the preventability of death, using a more recent calculation of the probability of survival (study two).

Literature review

Changes to the care of injured patients have been significant, improving on the deficiencies noted across a range of reports (Sleat and Willett 2011; Yates et al. 2002). However, trauma registries – the measures used to audit and monitor performance – have yet to extend into what Oliver and Walter (2016) refer to as the ‘therapeutic vacuum’.

The therapeutic vacuum occupies the prehospital space between the emergency occurring and professional help being provided. Without the development of indicators to measure activity during this period, there remains a perception of the inevitability of death in this space and a lack of a clear definition of what is meant by prevention in the prehospital space (*ibid.*).

The nature and cause of death

All studies, including the 1994 original, had a comparable sample in relation to gender; however, age at death from injury had increased to the same average age observed in other research (see Kehoe et al. 2015).

Both studies showed that the mechanism of injury has also changed, in line with trends observed in other studies. The number of deaths from falls increased, whereas the number of road deaths decreased. However, the proportion of car occupants and pedestrians dying from injuries sustained on the road remained comparable to the 1994 study, which suggests that the vulnerability of the driver in particular remains high.

Although outside the scope of this research, there was a significant increase in the number of hangings observed compared to the 1994 study. UK suicide rates have fluctuated over the past 30 years. According to the ONS (2016a), in 2010 the rate was 10.2 per 100,000 population, compared to 13.2 in 1990. However, the proportion of suicides in the UK from hanging, strangulation and suffocation has increased. Between 2002 and 2012, this proportion rose from 45 per cent to 58 per cent for men, and from 26 per cent to 36 per cent for women. It was not the intention of the current studies to explore suicide or the variables that might explain its incidence, such as location, personal factors and demography. However, there is room for future research to examine the apparent increase found in this study and what factors might have influenced this trend.

Preventability of death

It is clear that little has changed in terms of the percentage of people whose death may have been preventable, although the mechanism of injury has changed.

When compared to the 1994 study findings, using the same historic analysis for probability of survival,

study one found that 43.3 per cent of people had a probability of survival greater than 50 per cent, compared to 39.5 per cent in the 1994 study. When the more recent analysis method was used to calculate the probability of survival, study two found that between 45 per cent and 59 per cent of deaths were potentially preventable or preventable according to WHO definitions (2008).

The percentage of potentially preventable or preventable deaths remains high and unchanged since 1994 and, although calls for assistance were made in up to 93 per cent of cases, first aid intervention of any kind was infrequent.

A bystander or passer-by was on the scene during, immediately after or in the minutes after the point of injury in up to 52 per cent of cases. However, when those found dead are excluded, a first aid intervention was attempted in between 43 and 57 per cent of cases. This is despite the injured potentially being alive at this stage. This presents an opportunity to help, but is often a missed opportunity.

The authors of the studies had only the coroners' records from which to collect data and did not examine the role of the emergency call handlers in supporting people who have dialled 999 to perform first aid. Therefore, no assumption can be made as to the content of these telephone calls; however, an exploration of these conversations would be an interesting route for future research.

The interventions which the authors suggest could be beneficial during the therapeutic vacuum are supporting the airway and controlling bleeding. This aligns with the skills that members of the public wish to learn. In an online survey of 1,035 individuals who were interested in learning first aid but had neither attended a course in the last year nor worked in a place where they were required to have first aid training, the top five emergencies they wanted to be taught the skills to respond to were: heart attack, unconscious and not breathing, unconscious and breathing, bleeding heavily, and choking (adult) (Flood and Campbell 2014).

In practice, therefore, there is a need to turn those interested in first aid into those who attend training and then act in an emergency. The key issue is how to motivate people to learn and act.

Our knowledge of the bystander effect helps us understand why people do or do not act in an emergency. This phenomenon has received much research attention and, as such, has resulted in

a range of reasons for action or inaction. Early research into this social phenomenon proposed that a diffusion of responsibility was the key reason why people do not act (Latane and Darley 1968a). However, our understanding has grown, and we now understand action to be also affected by the context in which the emergency takes place, including how our perception of how much alike we are to those injured (referred to as belonging to the/our 'in-group') influences our decision to act (Levine et al. 2002 and 2005; Levine and Crowther 2008). While we cannot deduce the nature of the relationship between bystanders and the deceased in the studies reported herein, the fact that the bystander was on the scene immediately or within minutes suggests that there is a likelihood that they may well have known the deceased. And yet these people still did not always provide basic first aid.

Looking specifically at the two main causes of death – road deaths and falls – there are clearly missed opportunities to provide first aid. In their review of the available literature, Hall et al. (2013) found evidence to suggest that drivers are more willing to stop at the scene of an accident if they are trained in first aid. Furthermore, Arbon et al. (2011) found that among 773 respondents, 11 per cent had provided first aid in a RTC and, of those, 75 per cent were travelling in the vehicle involved. They also found that first aid training increased the likelihood of them owning a first aid kit or pocket mask. And while our own Everyday First Aid training methodology encourages learners to make use of everyday items and, therefore, does not rely on ownership of a first aid kit, Arbon et al.'s findings point to a readiness and a motivation to act. This suggests that drivers, when trained, are well placed to respond to injuries which occur on the road.

The circumstances surrounding deaths from falls are different from those for road deaths. The deceased were older, and nearly three-quarters were found dead. The findings fit with data which suggest a growth in the size of the elderly population and the number of people living alone (The King's Fund 2012). Unlike road deaths, a passer-by or bystander seems less likely to

be nearby immediately, so while it is still vitally important to ensure that the 25 per cent of people found injured and possibly alive are found by a person trained in first aid, a different additional strategy is also required to aid the remaining 75 per cent. There may well be opportunities to prevent falls or, when falls happen, a swifter way to raise the alarm to bring about a first aid intervention at the earliest opportunity.

Previous Red Cross research (White and McNulty 2011) has shown that first aid can make communities more resilient; therefore, there may well be value in exploring how best community members can support each other – especially those who are living alone.

Assistive technology has become increasingly popular to support people with health and care needs – including frailty – who live alone (Department of Health 2013). A popular form is 'push button care', where help can be called for by pressing a button on a pendant or wrist strap. The device is connected to a telephone landline and a power supply via a simple unit installed in the home. Once activated, the unit dials an operator who instantly responds and contacts a friend, family member or neighbour who holds a key. If none of the named responders are available, then the operator will dispatch a member of their team. Immediate emergency assistance can also be requested.

Though this research has shown that the proportions of deaths from injury which might have been survivable have remained unchanged in the past 20 years or more, it is important to note that the studies do not report on the levels of first aid training received by the bystander or passer-by and their reasons for intervening or not. Furthermore, the studies do not examine whether intervention would have been affected by the mechanism of injury and the level of the emergency – would instances of first aid intervention have been higher in those with injuries that were not as traumatic? Despite these limitations, however, it is important to address the findings raised in these studies in future research and make recommendations for the future.



7 Recommendations

The following calls for recognition are drawn from the evidence found in this research. They apply to the Red Cross, the wider first aid training community, politicians, policymakers and others.

Recognition

- > That the proportion of potentially preventable deaths from major trauma has remained high and unchanged in 20 years, with many more people calling 999 but not all performing simple first aid when their actions could potentially have saved someone's life.
- > That first aid is an essential life skill and should be part of everyone's basic education and integral to public health strategies, with opportunities to learn throughout one's lifetime, particularly for those most at risk of experiencing a crisis.
- > That the number of deaths from falls has increased as a main mechanism of injury, while the number of road deaths has decreased.

Recommendations for the first aid training community, including the Red Cross

- > Encourage bystanders to take action beyond calling for the emergency services. The following powerful messages contained in this research should be embedded within training and awareness-raising campaigns:
 - It is not enough to call the emergency services and do nothing else.
 - Doing something is simple but life-saving: maintain an open airway to keep the person breathing by turning the person on their side and tilting their head back; put pressure on a bleed to stop the flow of blood.
- > Further explore people’s motivation to proceed with first aid interventions or not, particularly the relationship between deceased and bystander, as this was not established in the current study. This exploration would form an evidence-based understanding of the behavioural change required to alter current behaviour.
- > Continue to test out different ways of teaching first aid education, such as blended learning, to ensure that our first aid training meets the needs of different learners.
- > Continue to use our knowledge and expertise to identify areas with a high prevalence of single, older households, and prioritise those communities for first aid education in order to boost community resilience, and potentially prevent death and improve outcomes should community members be present to help.
- > Consider examining the role of the call handler in supporting the bystander to perform first aid.

Recommendations for the Red Cross

- > Seek to lead, along with academic colleagues, the prehospital research community to reach consensus on what is considered ‘preventable’ in the prehospital therapeutic vacuum. Given the reputation of the Red Cross within the national and international first aid community, we are in an excellent position to draw on our substantial networks to help create space for this debate

and to advocate for acceptance of the outcome alongside established Utstein criteria.¹³

- > Consider exploring our role in responding to falls, and how this might be an issue among our own service users, 89 per cent of whom are 65 years or older and predominantly receiving our service because they have been recently discharged from hospital. Therefore, they may be particularly vulnerable to falls.

Recommendations for decision-makers and policymakers

Overall

The UK, Scottish and Welsh Governments, the Northern Ireland Executive and relevant statutory bodies should ensure that the existing mechanisms allow for first aid education to be available – for example, through schools, driving tests and public health initiatives.

Schools

- > First aid should be mandatory on school curricula in England, Northern Ireland, Scotland and Wales.
- > Government education departments, schools, teachers, young people and others should champion first aid learning, integrating it into existing subjects and whole-school approaches, such as
 - Physical Education and PSHE education (England)
 - Health and Well-being (Scotland)
 - PSE (Wales)
 - PDMU and Learning for Life and Work (Northern Ireland)
 - during assemblies, tutor time or extended learning time.
- > The Welsh Government should integrate first aid learning into planned changes to the Welsh curriculum, due to be implemented in 2018 and obligatory for schools by 2021.

¹³ This refers to a uniformed way of collecting data.



Driving tests

- > The DfT should make attendance at a practical first aid course with an approved provider mandatory to acquire a driving licence in the UK.
- > The DfT should include within its Road Safety Statement (2015) bystander first aid as a key post-crash response that can reduce the number of people killed or injured on the road.

Public health

- > Departments for health and relevant national and local public bodies across the UK should work with the Red Cross and others to ensure that those most vulnerable to trauma and accidental injury, such as falls, and their community support networks (family, friends, carers and neighbours) have the opportunity to learn first aid.



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