The University Of Sheffield.

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BritishRedCross

# Basic first aid for common injuries and illnesses in adults

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*The British Red Cross provides first aid education to the public. It endeavors to ensure that the education it provides is as relevant and effective as possible. It has a responsibility to contribute to the global body of evidence that supports the development of first aid guidelines and a strategic mandate to support the International Federation of the Red Cross and Red Crescent Societies with first aid education. This research has been commissioned and funded to support these responsibilities, and the findings will be used to support the strategic development of first aid education worldwide.*

EMRiS Emergency Medicine Research in Sheffield

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# Introduction.

## Background

This report is the result of a commissioned piece of research by the British Red Cross. Contact between the School of Health and Related Research and the British Red Cross regarding a study that could review the existing evidence for the use of basic first aid measures by the public and their impact on patient outcomes. After initial discussion, a project outline was drafted for approval that comprised two parts:

1) A review of existing literature regarding the evidence supporting the impact that first aid has on patients and also of the use of first aid education.
2) An empirical patient based study.

This report presents the findings from this study.

## 1. Literature Review.

A review of the published literature on first aid was undertaken to summarise the current research available. The databases Medline (via the OVID Technologies interface; www.gateway.ovid.com) and The Cochrane Library (www.thecochranelibrary.com) were searched comprehensively for published studies relating to the clinical efficacy of basic first aid treatments for the management of cardiac arrest, heart attack, a burn or scald, external bleeding and suspected fracture of a limb. In addition, evidence regarding the efficacy of first aid education was also searched for and collected.

A ‘basic first aid treatment’ for the above conditions was defined as an intervention outlined by the British Red Cross (BRC), one of the primary providers of first aid training to the lay public worldwide (1), which represents what could be expected to be delivered by a non-healthcare professional with minimal training (1). For the purpose of this article a ‘first aider’ is defined as a non-healthcare professional who has received some kind of formal training in first aid, however basic, from a recognised training body such as the BRC (1).

Search terms relating to the clinical conditions (e.g. chest pain, angina, myocardial infarction), the interventions (e.g. first aid, bystander, 999, 911) and education were employed and modified during the search. Articles regarding first aid performed by healthcare-professionals were excluded, except where literature on non-healthcare professional first aid interventions was lacking and evidence from studies of healthcare professional interventions had been used to derive first aid guidelines (1, 2). In which case, these and similar studies have been included for illustrative purposes.

All searches were limited to the English language. Articles from 1946 onwards were included in the search due to the suspected limited number of publications on the subject. Literature reviews, randomised trials, observational studies and qualitative investigations were included, as were animal studies. Reference searching was also employed. The search yielded 83 articles, 67 of which were selected for review after application of the inclusion and exclusion criteria.

## Cardiac arrest

A Cardiac Arrest (CA) is the termination of cardiac mechanical activity (3) and it is most often due to Ischaemic Heart Disease (IHD) (4). The pathophysiology consists of cardiac arrhythmia with impaired cardiac output and subsequent systemic ischaemia and metabolic cell death (5). In Europe the annual incidence of Emergency Medical System (EMS) treated Out of Hospital Cardiac Arrest (OHCA) is 38 per 100,000 population. However, survival to hospital discharge is only around 10% (4). Hence OHCA represents a major public health problem (6).

As cerebral hypoxic injury starts to occur within 3 minutes of CA, timely interventions are necessary to achieve a successful outcome. These are conceptualised in the 'Chain of Survival': early recognition of CA and call for help, early Cardiopulmonary Resuscitation (CPR), early defibrillation and post-resuscitation care (4). The BRC recommends that as a minimum intervention in responding to CA the first aider should check if the casualty is breathing, call EMS and deliver Continuous Compression Cardiopulmonary Resuscitation (CCC) (7). Thus the first aider should be able to facilitate the first two links in the 'Chain of Survival': early recognition and call for help and early CPR (1).

Recognition of CA can prove challenging for the non-healthcare professional. Since CA results in cerebral hypo-perfusion, syncope is an early sign (4). However, checking the carotid pulse is an imprecise method for confirming the absence of circulation (1, 8). The absence of breathing may be used, but is complicated by the presence of agonal gasps: occasional gasps of air that are initially present in up to 40% of victims (1, 4). Training first aid providers and emergency medical dispatchers to recognise agonal breathing as part of their 'checking for signs of circulation' significantly increases recognition of cardiac arrest and subsequent initiation of CPR (9, 10). Therefore it is advised that non-healthcare professionals are trained to commence first aid for CA if the victim is unconscious and not breathing normally rather than not breathing at all (1, 4, 11).

CPR is the performance of chest compressions, with or without ventilations, in an attempt to restore spontaneous circulation (3). It may produce enough blood flow for

the brain and myocardium to maintain temporary viability before professional care givers are able to administer defibrillation (12) (a controlled electric shock given to restore normal heart rhythm (13)) and increases long term survival rates in OHCA by 2-3 times (14-17). To have this effect, CPR must start as soon as possible and must occur along with EMS access (12). Evidence suggests that any interruptions to chest compressions during CPR can have detrimental effects on survival (18). Therefore, debate exists as to whether CPR should include mouth-to-mouth ventilations (1).

In the majority of animal studies of CA, CCC had equivalent or improved outcomes compared to CPR with ventilations (standard CPR) (1, 16, 18). However, in asphyxiation and paediatric models, as well as those in which compressions went on for longer than 4 minutes, standard CPR was superior (16, 19). The poorer performance of CCC in these situations represents metabolic cell death due to decreasing blood oxygen saturation which is not replenished by ventilations (19, 20). These results may have implications for asphyxia originated (e.g. drowning) and paediatric CAs (commonly of non-cardiac origin) as well as prolonged CAs (19). In addition, unlike in animals, the human upper airway does not stay open spontaneously to allow passive ventilations (which occur as the ribcage is moved inwards and outwards by the chest compressions). Therefore this effect may be compounded in humans, meaning CCC will be less efficacious than is predicted by animal models (8, 20). Nevertheless CCC was superior to no CPR at all in all of these animal models (20).

In 6 observational trials comparing CCC to standard CPR in OHCA no difference, or an improvement, in survival to hospital discharge and neurological outcome was observed (1, 19). In a meta-analysis of three studies of EMS dispatcher directed CPR, CCC was associated with a 2.4% increase in survival compared to standard CPR (1, 21). However, results are not consistent and in three other observational studies, standard CPR had a greater impact on survival (16, 22, 23). In addition, as predicted in the above animal studies, it has been noted that for prolonged (>15 minutes) (16, 23), paediatric (23, 24) and non-cardiac originated CAs (23) standard CPR showed improved survival (1, 16, 23, 24). This has implications for locations

where ambulance response times are over 15 minutes (20). As well as this, many of the above studies compared CCC to the pre-2005 CPR guidelines consisting of a 15:2 ratio of compressions to ventilations. Therefore, since guidelines now call for a 30:2 ratio, these findings may no longer be relevant and further studies are required (20, 21). Notwithstanding these observations, and considering that in all trials CCC was better than no compressions at all, 4 recent reviews on this topic have concluded that CCC is acceptable for adult OHCA (1, 11, 19, 24) but that standard CPR should be provided if the first aider is competent to deliver it (24).

### *Summary*

Non-healthcare professionals should be trained to commence first aid for CA if the victim is unconscious and not breathing normally, rather than not breathing at all so that they are not deterred by the presence of agonal gasps. CPR may produce enough blood flow for the brain and myocardium to maintain temporary viability before professional care givers are able to administer defibrillation. While evidence suggests that CCC may not be suitable for asphyxia originated, paediatric or prolonged (>15 minutes) CAs, it is acceptable for adult OHCA, but standard CPR should be provided if the first aider is competent to deliver it.

## Heart Attack

Acute Myocardial Infarction (AMI) is the most significant consideration in those suffering chest pain, sequelae of which include shock, CA and death (1). Approximately 124,000 people suffer an AMI in the UK each year and cardiovascular disease is estimated to cost the UK economy around £30 billion annually (25). Therefore with cardiovascular disease a major cause of mortality, disability and ill health in the general population, first aid treatment of AMI has the potential to positively impact on both public health and the economy (26-28). In the event of someone suffering from chest pain the BRC recommends that as a minimum the non-healthcare professional ensure the person is sitting and call EMS immediately (7).

There is little scientific evidence to support the practice of sitting someone down who is suffering a heart attack. Rather, the recommendation is made on the basis of

expert opinion (1). Individuals suffering from chest pain of cardiac origin may develop hypotension and an altered level of consciousness due to decreased cardiac output (4). In this case, being in a seated position may prevent them from falling and sustaining further injury (1).

For those whose chest pain is caused by ST-segment-elevation myocardial infarction (STEMI), which indicates blockage of a major coronary artery, reperfusion therapies to restore blood supply to the myocardium must be achieved without delay (4). The beneficial effect of these treatments is significantly higher in those patients presenting to hospital within 2 hours of symptom onset (29, 30). EMS can facilitate initiation of treatment and rapid transport to hospital for further treatment (1). The four studies identified in the literature search which related to this topic found that use of EMS significantly reduced the odds of delayed arrival at hospital by between 35% (31) and 65% (32), and significantly reduced delay in the administration of reperfusion therapy compared to those who did not use EMS (33, 34). Therefore, calling EMS enables earlier hospital arrival and administration of reperfusion therapies, thereby reducing myocardial damage and improving prognosis (30).

### *Summary*

No evidence could be found for the recommendation that someone suffering chest pain is bought into a sitting position, however, expert opinion and symptoms resulting from AMI make this a necessary part of first aid for chest pain. Early contact with EMS in response to chest pain leads to improved patient outcomes for those suffering AMI due to earlier arrival in hospital and administration of reperfusion therapies.

## Burn or Scald

Burn injuries are a common cause of morbidity and mortality worldwide (35, 36). In the UK 250,000 people suffer a burn injury each year, with 175,000 of these attending an Emergency Department with their injury (36). The BRC recommends that the affected area is cooled under cold running water for at least 10 minutes before being covered with cling film or a clean plastic bag (7).

Cooling a burn or scald may reduce oedema formation, infection rates, the depth of injury and the need for grafting, as well as inducing analgesia and promoting more rapid healing (2). Previous reviews of first aid for burns and scalds (2, 37) have identified a large number of research articles dating back to 1956. These found that cooling of thermal burns with cold tap water immediately after the injury is sustained and continuing at least until pain is relieved is the most efficacious approach. Application of ice or ice water was found to lead to additional tissue injury (2). However many of these studies measured only short-term outcomes, such as effect on pain and oedema, and had not looked at the effects of different cooling strategies on re-epithelialisation (regrowth of damaged skin) and scar formation, which represent the most important outcomes to patients (37). In addition the optimum temperature and duration of cooling with water was unclear (2, 37). The most recent research has investigated the optimum temperature and duration of water cooling using porcine models and has measured important long term outcomes.

Consistent with the findings of previous studies (2) Cuttle et al found that deep dermal partial thickness burn injuries treated for 20 minutes with 15$^{O}$C or 2$^{O}$C water had better outcomes in terms of re-epithelialization, scar histology, and scar appearance compared to those treated with water at 0$^{O}$C (38). In a similar study Venter et al found that in those porcine models treated with water at 1-8$^{O}$C more necrosis in deep dermal wounds was demonstrated than in those not cooled at all, while those treated with water at 12-18$^{O}$C suffered less necrosis than uncooled wounds and subsequently healed faster (39).

An investigation into the optimal duration and period of delay before treating burn injuries found that the immediate application of 15$^{O}$C running water for 20 minutes duration resulted in the greatest improvement in re-epithelialisation over the first 2-weeks and decreased scar tissue at 6 weeks. Longer application did not improve results but application for as little as 10 minutes duration and up to 1 hour delay still provided some benefit (40). Therefore, taken together with previous research (2), this evidence suggests that a burn or scald is cooled immediately for 20 minutes under cold running water of ideally between 12-18$^{O}$C (2, 38-40). However, further

research from case studies in humans would be desirable since much of the evidence presented is from porcine models in controlled environments.

Cling film is often recommended as a suitable dressing for burns following cooling (2, 7). Little evidence could be found to demonstrate the effectiveness of cling film as a suitable barrier following initial cooling of a burn or scald. However, anecdotal evidence suggests that cling film is a suitable dressing since it is widely available, transparent (enabling subsequent assessment for any signs of infection) and less painful to remove than other dressings, such as gauze (41-43).

### *Summary*

Cooling of thermal burns with cold tap water is supported by a large body of evidence which demonstrates that it may induce analgesia, reduce the need for grafting and promote more rapid healing. The optimal temperature of water used for cooling is between 12-18$^{O}$C and the application should ideally occur without delay and for at least 10 minutes duration. The suitability of cling film as a dressing is supported by anecdotal evidence.

## External bleeding

The control of an acute traumatic haemorrhage can be considered one of the most basic first aid procedures. When carried out early enough this single action can be of the utmost importance in determining the outcome for a casualty (44). However, despite this it is an issue which has been poorly explored within the medical literature and there are few studies objectively examining the efficacy of methods of haemorrhage control in the pre-hospital setting (44, 45). The BRC recommends that pressure is put on the wound with whatever is available while EMS is called (7).

No studies were identified concerning the first aid management of external bleeding. Three studies are available which assess the efficacy of direct pressure to control bleeding from an open wound in the pre-hospital setting as carried out by healthcare professionals. Naimer and Chemla (44) used a retrospective case series to investigate haemorrhage control using adhesive elastic bandages applied over 4 x 4 inch gauze pads and wrapped around the affected body part with sufficient tightness to stop the haemorrhage. This method stopped the bleeding in all reported cases

with no complications (44). A non-randomised observational case series regarding victims of traumatic amputations found that those casualties treated with direct pressure using elastic bandages suffered less on going bleeding from their traumatic amputation, had higher admission haemoglobin and higher survival rates compared to those treated with tourniquets (2). In the third study, using simulated wounds in a human model it was found that manual compression produced significantly greater pressure on open wounds compared to field dressings and elastic adhesive dressings. The pressure produced was well above that required to stop a haemorrhage (46). However, as stated above, in all three of these studies pressure was applied by trained medical personnel as opposed to a non-healthcare professional first aider (1) and the only 2 studies carried out in the field used elastic bandages to apply pressure, not manual compression (2, 44). While manual compression carried out by a trained professional was found to give sufficient pressure to stem a haemorrhage in an experimental model (46) it is not clear if the same would be true for a non-healthcare professional in a real case.

Since evidence regarding the use of direct pressure to control external haemorrhage in the pre-hospital setting is limited to that outlined above, articles identified in the literature search which investigated the use of manual compression to control bleeding in the hospital setting were also reviewed (as they have been in previous reviews of first aid used to derive guidelines (1, 2)). Five articles, four randomised controlled trials and one literature review, which investigated the efficacy of methods to control bleeding following invasive cardiovascular procedures, including coronary angiography and percutaneous coronary interventions, found that manual compression was effective to control the external haemorrhage that results from these operations (47-51). However, wounds from these minimally invasive procedures are likely to be quite different from those found in the pre-hospital setting and therefore extrapolation from this evidence must be made with caution.

Although manual compression of a wound is relatively safe, it can be time consuming and the duration required to effectively inhibit bleeding is highly variable (50). The pressure generated is not consistent and can be well above that necessary, causing needless pain to the casualty (46). Due to this, manual

compression can also cause arm fatigue in the person providing first aid (49) meaning that it cannot be implemented for an extended period of time as may be necessary (44). It can also induce vasovagal reflexes resulting in a decrease in heart rate and blood pressure, potentially compounding the effects of acute blood loss (50). These issues, including only using the necessary amount of pressure required, could be addressed in first aid courses.

Whatever procedure is used to control a haemorrhage, first aiders must protect themselves. Any body fluid from a victim should be considered infectious (52). The first aider should encourage the casualty to apply the pressure themselves if they are able to do so (1). Alternatively, the first aider should wear gloves and wash their hands thoroughly following the incident (52). No evidence could be identified regarding the effectiveness of alternatives to the non-latex gloves used by professionals which may be available to the non-healthcare professional at home (e.g. washing up gloves, plastic bags); therefore no comment can be made regarding substitute forms of protection. However at first aid courses non-professionals must be made aware of the risks of infection from body fluids.

### *Summary*

No evidence could be identified regarding the first aid management of external bleeding. Manual compression carried out by trained professionals was found to give sufficient pressure to stem a haemorrhage in an experimental model. Evidence from the hospital setting demonstrates that manual compression is effective at controlling bleeding following invasive cardiovascular procedures. However, extrapolation is required in applying these results to the first aid provider who may have only limited experience and only household items, such as tea towels, to hand. Therefore while manual compression of an open wound constitutes best practice from what evidence is available, further research into the efficacy of direct pressure as performed by first aiders is necessary.

## Suspected fracture of a limb

Fractures are a break in the continuity of a bone (13) and exhibit a range of injury patterns dependent upon the mechanism of the injury, the patient's age and any

premorbid pathology (53). They are often painful and may be associated with bleeding (1). In the case of an open fracture, in which there is a break in the skin overlying the fracture sight, there will be external bleeding (54). While not necessarily life threatening, a fracture can lead to loss of function of a limb or amputation (1).

Fractures represent a common injury and are frequently dealt with in the pre-hospital setting (53). In the UK the calculated fracture incidence is 3.6 fractures per 100 people per year, making them an important public health burden (55). For the first aider assisting someone with an injured extremity the aims of their intervention should be to protect the extremity, to restrict pain and bleeding and to obtain professional support (1). Hence the BRC recommend that the first aider try to immobilise the affected part (with a cushion, items of clothing or, in the case of upper limb injury, the patient's own uninjured arm) to prevent unnecessary movement and to call EMS as soon as possible (7).

No studies were identified concerning the first aid management of a suspected fracture of a limb. Two reviews have been carried out regarding professional pre-hospital care of injured limbs. Lee and Porter (53) state that the use of a splint is essential in the management of lower limb fractures. A splint is used to immobilise the joints above and below the fracture site and serves to reduce pain, blood loss, pressure on surrounding structures and the risk of fat embolization (fat becoming lodged in an artery, restricting blood flow (13)) (53). In the case of a neurovascular deficit being observed in the affected limb (e.g. increased capillary refill time or loss of sensation distally) traction should be applied. Traction helps to realign the limb bones and close venous channels in both open and closed fractures, thus inhibiting blood loss (53). A similar review found that splinting of a limb with an open fracture without realignment can lead to increased pain and neurovascular compromise (54). Therefore, professional treatment of a fractured limb involves stabilisation with a splint and, in the case of open fractures or neurovascular deficit in an angulated fracture, immediate realignment (1, 53, 54, 56).

A number of hospital based studies and one pre-hospital study have found that in the absence of neurovascular complications realignment of a suspected long bone

fracture (i.e. the bones of the limbs) does not significantly reduce pain or shorten healing time compared to simple immobilisation (1, 57). One Cochrane review (57), four randomised controlled trials concerning hip fractures (58-61) and one pre-hospital retrospective descriptive study on femoral shaft fractures (62) found that traction splinting had no significant effect on pain, analgesia use, development of pressure sores or the ease of the operation compared to immobilisation of the fractured limb in a position of comfort. These findings suggest that, in the absence of a neurovascular deficit, traction of an angulated fractured limb is unnecessary and that simple immobilisation, as taught to the first aider, may be all that is required.

A number of reviews have stated that it is not possible to extrapolate the findings of research into the actions of pre-hospital professionals in the treatment of limb fractures to the remit of the first aid provider (1, 2, 63). The National First Aid Science Advisory Board stated that there is no evidence to support the efficacy of realignment of fractured limb bones by first aid providers (2). Hence both in Europe and America reviews of first aid literature have concluded that the non-healthcare professional should assume any injury to a limb could potentially be a fracture and, that while they should manually stabilise the limb in the position found, they should not attempt to realign it (1, 2, 63).

### *Summary*

No evidence could be identified for the first aid management of a suspected fracture of a limb. For the pre-hospital care professional treatment of a fractured limb involves stabilisation with a splint and, in certain cases, immediate realignment. Research suggests that in the absence of neurovascular compromise traction of an angulated fractured limb is unnecessary and that simple immobilisation is all that is required. There is no evidence to support the efficacy of realignment of fractured limb bones by first aid providers. Therefore first aiders should be trained only to immobilise the affected limb and to contact EMS.

## First Aid Education

First aid provided by non-healthcare professionals has the potential to reduce morbidity and mortality from common injuries and illnesses which represent a

significant public health burden (64). In order to achieve a greater first aid response to everyday injuries and illnesses a wider dissemination of first aid skills to the public is necessary (65). Basic first aid training courses must prepare individuals from a variety of backgrounds to provide appropriate and efficacious treatment for a wide range of conditions (66). However, first aid education is under researched and insufficiently documented, meaning current practice is not evidenced based (1).

The greatest number of first aid education research articles pertain to CPR. Approximately only one-third of patients suffering an OHCA receive spontaneously-delivered bystander CPR (14). Since the majority of CAs occur at home, and yet bystanders in these situations are less likely to have attended a CPR course (67, 68), training should focus on those who live with sufferers of IHD (8, 68). Audio and video self-instruction with manikin practice have been found to be at least as effective as instructor led courses (69-71) and video instruction of CCC of as short a duration as 60 seconds improves peoples' CPR skills (69, 72). Therefore, self-directed training with manikin practice for family members of those with IHD along with television adverts for the general public could increase the rate of bystander CPR.

In a number of studies CCC has been found to be easier to learn, retain and perform compared to standard CPR, and this includes EMS dispatcher led CPR (8, 16, 19). In some communities the introduction of CCC has also been associated with an increase in the rate of bystander CPR (6). These findings may be due to the decreased stress CCC puts on the first aid provider compared to standard CPR (19). With common reasons for not performing standard CPR being a feeling of panic (40%) and fear of not being able to perform it correctly (9%) (73) the teaching of CCC may be a more efficacious option (1, 19, 24). However, CCC leads to quicker rescuer fatigue with reductions in the effectiveness of chest compressions (20, 74, 75). This may be an issue for the elderly (76) who are the most likely to witness a CA (68).

With regards to first aid for chest pain, individuals frequently fail to call EMS (30). Previous studies from across the globe have identified a number of factors that

influence the lay-person's decision to call EMS in response to chest pain and other symptoms of AMI. Some of these factors are contradictory, such as older age (33, 77, 78) and previous experience of heart disease (26, 33, 78, 79), suggesting that the context of the study may influence the results. Some, such as lack of health insurance (77), may not be relevant to the UK. However, some relevant and consistent findings do exist. A range of cognitive/appraisal factors, including the belief that chest pain would subside (77, 80, 81), belief that self-transport would be faster (80), and belief that the correct way to call EMS was through a General Practitioner (81), decreased EMS use. Severity of chest pain (78), presence of a bystander (82, 83), symptom onset outside of the home (82), match between expected and actual symptoms (27, 82, 84), and previous training regarding the symptoms of AMI (33) were found to increase use of EMS. These findings suggest that training regarding the symptoms of AMI, as well as the correct way to access EMS, might increase EMS use.

Education programs to increase use of EMS in response to chest pain in the USA have, however, shown mixed results. Fogle et al (85) carried out a workplace intervention, which included posters, leaflets and weekly e-mail competitions and Tullman et al (86) trialled one-to-one education sessions with elderly sufferers of IHD and their families. Both of these local educational interventions significantly increased awareness of the need to call EMS in response to chest pain (85, 86). However, an 18-month mass media education program on AMI in 10 US cities found that while the program increased knowledge of symptoms and signs, this did not translate into a significant increase in EMS use (34, 87). Therefore it could be that small and focused educational campaigns are necessary to increase the appropriate first aid response to chest pain.

Despite the fact that a large body of evidence exists for the correct first aid approach to the treatment of burn and scald injuries research from a number of countries demonstrates that the public is unclear on how to provide initial treatment (36, 88-90). In a UK emergency department only 30% of patients who presented with a burns injury had received adequate first aid before attendance (36). Comparable studies in New Zealand (88, 89) and Vietnam (90) had similar findings. Individuals

from ethnic minorities were more likely to perform inappropriate first aid, such as applying tooth paste or butter (36). This evidence suggests that public education on first aid for burns is necessary in many countries and should be accessible by ethnic minorities (36).

In contrast to education for symptoms of heart attack, two large educational campaigns on the correct first aid measures for the treatment of burns conducted in New Zealand both proved successful (91, 92). In the first, extensive multi-media coverage (including television, radio and newspaper advertisements) increased adequacy of burn injury first aid and decreased inpatient admissions and surgical procedures for burns (91). Another study which targeted those from non-English speaking backgrounds in New Zealand found that while their media intervention initially produced a drop in the need for grafting following a burn, after 5 years this effect had decreased (92). Therefore, large educational campaigns for burns first aid could prove successful in other parts of the world but may need to be repeated on a regular basis for this knowledge to be retained (91, 92).

Barriers to the performance of first aid following training include the bystander effect and deterioration of skills. The bystander effect refers to the decreased likelihood of an individual to intervene in a critical situation when passive bystanders are present and the situation appears ambiguous (93). It explains why training in first aid does not in itself lead to increased helping behaviour (64, 93, 94). Two trials have investigated the effects of training to overcome the bystander effect in first aid education. One found that such training significantly increased helping rates compared to first aid training alone (64) and the other did not (95). Training to overcome the barriers to action in critical situations could form a vital part of first aid education if the right approach could be found (1, 8, 64).

Retention of first aid skills has been investigated previously (1). In a study of first aid responders at work it was found that CPR skills showed signs of deterioration after only 30 days (66). This could explain why, amongst the public, training within 5-years is a significant predictor for non-healthcare professional bystander CPR performance (73) and mean that continuing education is necessary for first aiders to be able to

utilise their skills (1). First aid education syllabuses could include the importance of refresher courses to encourage people to retrain (68). However, individuals may still be effective enough to save a life regardless of how long it has been since their last training; therefore people should not be put off if they cannot commit to regular retraining (8).

The use of mobile phones has been explored as one way to overcome a lack of first aid knowledge in the general public. Ertl et al tested a Personal Digital Assistant (PDA) that presented step-by-step instructions on first aid for severe bleeding and cardiac arrest. The untrained helpers using the PDA device gave close to optimal care and performed better quality CPR than those not given the device (96). EMS dispatcher audio directions complemented by a mobile phone video demonstration of CPR have also been found to significantly improve CPR performance in non-healthcare professionals (97). Such digital treatment protocols are now available on mobile phones (98, 99) and have the potential to increase administration of first aid without the need for formal training (96).

### *Summary*

In CPR training, audio and video self-instruction with manikin practice has been found to be at least as effective as instructor led courses and video instruction of CCC of as short a duration as 60 seconds improves peoples' CPR skills. Mass media educational campaigns of first aid for burns have been successful, that for the treatment of heart attack may require a more local and focused educational approach. If first aid knowledge is to be implemented successfully first aid courses should be followed up with refresher sessions and include training to overcome the barriers to action in critical situations. Digital first aid treatment protocols available via mobile phone have the potential to increase administration of first aid without the need for formal training.

## Conclusion

Apart from research into bystander CPR, clinical evidence for the efficacy of first aid interventions is scarce. Extrapolation from evidence relating to professional pre-hospital interventions has been used to derive guidelines for non-healthcare professionals, especially for the treatment of external bleeding and fractures. Due to professionals' greater knowledge, experience and access to specialist equipment, these extrapolations may prove incorrect. Specific clinical evidence for bystander first aid treatments is required if such interventions are to have a greater impact on health outcomes.

First aid education is under researched and insufficiently documented meaning current practice is not evidenced based. Further work is needed comparing different educational approaches when instructing non-healthcare professionals in first aid to identify the most efficacious approach to teaching each skill.

Little information could be identified which examined what first aid is actually being used, where non-healthcare professionals get their first aid knowledge from, and the effect of these interventions on patient outcomes.

## 2. Empirical study of the use and impact of first aid by patients attending a large UK Emergency Department.

### Aims and Objectives

The research question in this proposed study was:

For patients attending the emergency department with an emergency medical problem, what non-professional care was provided prior to contact with healthcare services and how did this impact on patient outcomes?

This study aim was:

To undertake a prospective study of patients attending one large UK emergency department of non-professional first aid interventions used for a given set of medical conditions and measuring subsequent health outcomes.

### Methodology

A period of prospective data collection at the Sheffield Teaching Hospitals Trust emergency department (ED) was undertaken which covered five main medical emergencies:

- Unconscious person not breathing
- Suspected heart attack – chest pain
- Bleeding from a wound
- Burn or scald
- Suspected broken bone – we proposed excluding hip fracture patients in this group

### Target population

Adult patients attending the ED or minor injury unit with area at more of the eligible presenting conditions listed above over the data collection period were included in the study. Routine data sources (e.g. ED records, ambulance service records) were utilised where possible to access information about the patient, their presenting

problem and the circumstances surrounding it, their management in the pre-hospital setting and when in the hospital, and their outcome.

Where possible, patients and where relevant, their relatives and carers were invited to provide information regarding the initial management of their acute problem.

Only first aid interventions provided by non-professionals in the pre-hospital setting will be considered as an eligible intervention.

## Time period of data collection:

Data collection proceeded using set data collection periods over a maximum of a 4 week period which covered all days of the week and times of day. A Latin Square design was applied to planning data collection periods and ensuring complete coverage across each day of the week and the majority of the 24 hour day.

## Data collection included:

1. Review of ED and where relevant ambulance service records to identify:
    - Patient characteristics
    - Place, day and time of incident
    - Presenting complaint
    - First aid measures being used in the initial management of the problem – details of timing, type of intervention and patient response
    - Treatments given in the ED
    - The patient disposition

2. Follow up of patient outcomes: using routine data, patients included in the initial data collection were tracked to record six week outcomes such as death, hospital admission, hospital reattendance – either planned or unplanned

3. Patient / carer survey. The survey was developed in conjunction with the BRC and our patient advisory group – the Sheffield Emergency Care Forum. Where appropriate and possible routine data was supplemented with survey information collected at the time of attending the ED to:

- Record a pain score on each patient
- Ascertain details relating to the use of first aid measures at the time of the incident either by the patient, or by a second party. This will include details of the intervention provided, timing of the intervention and patient response to it.

Where patients were too sick, or unable to agree to being questioned, they were excluded from this part of the study.

## Researchers

Data was collected in real time by a team of medical students present in the ED purely for the purpose of the study. They were trained in how to complete the data collection tools, how to approach patients for inclusion in the study and how to enter the data into the study database.

## Patient outcomes

For each condition included in the study, there was a set of outcome measures by which determined the value of first aid procedures. These were as follows:

1. Unconscious person not breathing

- Survival up to 6 weeks.
- Readmission within 7 days.

2. Suspected heart attack

- Total time from onset of symptoms to calling ambulance
- Total time from onset of symptoms to receiving percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction patients (STEMI)
- Total time from onset of symptoms to receiving other treatments for non-STEMI (e.g. thrombolysis)
- Time to investigation in non-MI patients
- Readmission within 7 days.

3. Bleeding heavily from a wound

- Requirement for resuscitation (e.g. with iv fluids, blood)
- Requirement for admission to hospital
- Readmission within 7 days.

4. Burn or scald

- Pain score on attendance at the ED
- Requirement for admission to hospital
- Requirement for specialty review (e.g. burns or plastic surgery)
- Post-burn infection rate
- Readmission within 7 days.

5. Suspected broken bone

- Pain score on attendance at the ED
- Requirement for an orthopaedic intervention e.g. manipulation of fracture, fixation of fracture
- Readmission within 7 days.

## Data analysis

### *Sample size*

The cohort of patients we collected data on included those patients with the relevant presenting complaint where first aid was applied and those where it was not. It was anticipated that we would collect data on n=100 patients with each of the presenting conditions except for the “unconscious person not breathing”. In this case, we did not expect to achieve n=100 cases, and therefore all eligible cases were included of this presenting condition over the study period of four weeks.

### *Data handling and analysis*

An online bespoke database was designed in order to record all data collected. Data was entered into the database for subsequent analysis by the research team.

The analysis was to compare:

1. All conditions where first aid applied with those where it is not applied
2. Index conditions separately to identify where first aid might be having most impact
3. Conditions according to their severity and whether first aid was applied or not
4. Types of first aid used to ascertain common first aid approaches and attempt to link successful patient outcomes with common approaches in order to make recommendation to the BRC for the development of their first aid training programme.

## Ethical issues

This study was undertaken as an audit of care in the emergency department. This was done with the full approval of staff within the emergency department, and in conjunction with the clinical audit and governance procedures of the Trust.

It was anticipated that were ethical approval required, the study would be subject to a significant time delay, and would risk not being achievable within the funding framework due to the stringent requirements of UK research and development bodies.

## Piloting the data collection tool

A period of piloting took place prior to the main study in which the data collection tool was tested for ease of completion, consistency and use and ability to identify eligible patients. Minor amendments were made to the data collection tool following this process.

## Results

A total of 652 eligible patients were entered in to the study, the majority of which had been seen at the main ED (86.0%). Most patients presented with a suspected broken bone (56.4%), self presented to the ED (74.4%) and were subsequently discharged from the ED (71.0%). Pain scores recorded varied from 0 – 10 with the commonest score being 7 (see Table 1). Table 2 presents the demographic information about our patient cohort, 54% were male with an age range of 16-95 years.

**Table 1: Descriptive statistics**

| **Nature of participation** | n | % |
|---|---|---|
| Regular NGH ED | 531 | 81.4 |
| Hallamshire Minor Injuries Unit | 91 | 14.0 |
| Pilot study | 30 | 4.6 |
| | | |
| **Condition** | | |
| Suspected cardiac arrest | 12 | 1.8 |
| Suspected heart attack | 129 | 19.8 |
| Bleeding from wound | 141 | 21.6 |
| Burn or scald | 26 | 4.0 |
| Suspected broken bone | 368 | 56.4 |
| | | |
| **Number of conditions recorded** | | |
| 0 | 3 | 0.5 |
| 1 | 622 | 95.5 |
| 2 | 27 | 4.1 |
| | | |
| **Arrival mode** | | |
| Emergency ambulance | 151 | 23.2 |
| Self-presenting | 485 | 74.4 |
| Other | 6 | 0.9 |
| Not recorded | 10 | 1.5 |

| **Pain score** | n | % |
|---|---|---|
| 0 | 44 | 6.7 |
| 1 | 19 | 2.9 |
| 2 | 37 | 5.7 |
| 3 | 46 | 7.1 |
| 4 | 59 | 9.0 |
| 5 | 72 | 11.0 |
| 6 | 87 | 13.3 |
| 7 | 99 | 15.2 |
| 8 | 80 | 12.3 |
| 9 | 40 | 6.1 |
| 10 | 40 | 6.1 |
| Not recorded | 29 | 4.4 |
| Mean | 5.5 | |
| SD | 2.7 | |
| **Pain recorded by:** | | |
| Data collector | 544 | 83.4 |
| Doctor | 5 | 0.8 |
| Triage nurse | 4 | 0.6 |
| Paramedic | 67 | 10.3 |
| No information | 3 | 0.5 |
| No pain score | 29 | 4.4 |

| **Disposition** | | |
|---|---|---|
| Discharged | 463 | 71.0 |
| Admitted to ward | 25 | 3.8 |
| Outpatient | 107 | 16.4 |
| Died | 35 | 5.4 |
| Did not wait for treatment | 9 | 1.4 |
| Other | 8 | 1.2 |
| Not recorded | 5 | 0.8 |

## Table 2: Demographic data

| ***All conditions combined*** | | | ***Bleeding from wound*** | | |
|---|---|---|---|---|---|
| Male | 355 | 54.4% | Male | 91 | 64.5% |
| Female | 297 | 45.6% | Female | 50 | 35.5% |
| Age: mean | 45.0 | | Age: mean | 41.5 | |
| Age: SD | 21.2 | | Age: SD | 19.9 | |
| Age: Minimum | 16 | | Age: Minimum | 16 | |
| Age: Maximum | 95 | | Age: Maximum | 89 | |
| ***Suspected cardiac arrest*** | | | ***Burn or scald*** | | |
| Male | 8 | 66.7% | Male | 15 | 57.7% |
| Female | 4 | 33.3% | Female | 11 | 42.3% |
| Age: mean | 76.4 | | Age: mean | 40.4 | |
| Age: SD | 10.0 | | Age: SD | 12.5 | |
| Age: Minimum | 64 | | Age: Minimum | 16 | |
| Age: Maximum | 95 | | Age: Maximum | 74 | |
| ***Suspected heart attack*** | | | ***Suspected broken bone*** | | |
| Male | 68 | 52.7% | Male | 193 | 52.4% |
| Female | 61 | 47.3% | Female | 175 | 47.6% |
| Age: mean | 58.2 | | Age: mean | 40.9 | |
| Age: SD | 20.5 | | Age: SD | 19.8 | |
| Age: Minimum | 17 | | Age: Minimum | 16 | |
| Age: Maximum | 94 | | Age: Maximum | 93 | |

## Table 3: Time to First Aid

| | |
|---|---|
| *Min* | 0 seconds |
| *Max* | 35 days |
| *Mean* | 6 hours 27 mins |
| *SD* | 46 hours 48 mins |
| *Lower quartile* | 59 seconds |
| *Median* | 9 mins 59 seconds |
| *Upper quartile* | 1 hour 0 mins 0 seconds |
| *N* | 368 |

**Table 4: Type of first aid undertaken.**

| First aid undertaken... | n | % |
|---|---|---|
| ***All conditions combined*** | | |
| Approved first aid | 242 | 37.1 |
| Other first aid | 189 | 29.0 |
| No first aid | 212 | 32.5 |
| Unclear | 9 | 1.4 |
| ***Suspected cardiac arrest*** | | |
| Approved first aid | 4 | 33.3 |
| Other first aid | 8 | 66.7 |
| No first aid | 0 | 0.0 |
| Unclear | 0 | 0.0 |
| ***Suspected heart attack*** | | |
| Approved first aid | 56 | 41.9 |
| Other first aid | 39 | 30.2 |
| No first aid | 30 | 23.3 |
| Unclear | 6 | 4.7 |
| ***Bleeding from wound*** | | |
| Approved first aid | 78 | 55.3 |
| Other first aid | 35 | 24.8 |
| No first aid | 26 | 18.4 |
| Unclear | 2 | 1.4 |
| ***Burn or scald*** | | |
| Approved first aid | 12 | 46.2 |
| Other first aid | 7 | 26.9 |
| No first aid | 6 | 23.1 |
| Unclear | 1 | 3.8 |
| ***Suspected broken bone*** | | |
| Approved first aid | 94 | 25.5 |
| Other first aid | 118 | 32.1 |
| No first aid | 156 | 42.4 |
| Unclear | 0 | 0.0 |

Table 3 shows the mean time to first aid treatment was 6 hours 27 minutes with a wide variation between immediate treatment and 35 days.

Table 4 shows whether the BRC approved first aid was used, some other type of first aid or no first aid was applied. Overall there was a fairly even distribution of first aid types applied, with some variation noted when this is broken down by presenting complaint.

**Table 5: Views of patients regarding level of helpfulness of first aid treatments.**

| Was the first aid helpful? | n | % |
|---|---|---|
| ***All conditions combined*** | | |
| Yes | 202 | 46.9 |
| No | 118 | 27.4 |
| Don't know | 48 | 11.1 |
| Not recorded | 63 | 14.6 |
| ***Suspected cardiac arrest*** | | |
| Yes | 1 | 8.3 |
| No | 3 | 25.0 |
| Don't know | 1 | 8.3 |
| Not recorded | 7 | 58.3 |
| ***Suspected heart attack*** | | |
| Yes | 31 | 33.3 |
| No | 30 | 32.3 |
| Don't know | 20 | 21.5 |
| Not recorded | 12 | 12.9 |
| ***Bleeding from wound*** | | |
| Yes | 72 | 62.6 |
| No | 21 | 18.3 |
| Don't know | 13 | 11.3 |
| Not recorded | 9 | 7.8 |
| ***Burn or scald*** | | |
| Yes | 8 | 40.0 |
| No | 4 | 20.0 |
| Don't know | 2 | 10.0 |
| Not recorded | 6 | 30.0 |
| ***Suspected broken bone*** | | |
| Yes | 100 | 46.7 |
| No | 65 | 30.4 |
| Don't know | 18 | 8.4 |
| Not recorded | 31 | 14.5 |

The majority of first aid was felt by patients to be helpful overall (46.9%), with some variation in opinion regarding usefulness when broken down by presenting complaint (see Table 5).

**Table 6: Identity of person delivering first aid.**

| Who was the first aider? | n | % |
|---|---|---|
| ***All conditions combined*** | | |
| Self | 243 | 56.4 |
| Non-specialist other | 90 | 20.9 |
| Trained first aider | 21 | 4.9 |
| Health professional | 18 | 4.2 |
| Not recorded | 59 | 13.7 |
| ***Suspected cardiac arrest*** | | |
| Self | 0 | 0.0 |
| Non-specialist other | 5 | 41.7 |
| Trained first aider | 1 | 16.7 |
| Health professional | 0 | 0.0 |
| Not recorded | 6 | 50.0 |
| ***Suspected heart attack*** | | |
| Self | 43 | 46.2 |
| Non-specialist other | 28 | 30.1 |
| Trained first aider | 1 | 1.1 |
| Health professional | 8 | 8.6 |
| Not recorded | 13 | 14.0 |
| ***Bleeding from wound*** | | |
| Self | 67 | 58.3 |
| Non-specialist other | 25 | 21.7 |
| Trained first aider | 10 | 8.7 |
| Health professional | 6 | 5.2 |
| Not recorded | 7 | 6.1 |
| ***Burn or scald*** | | |
| Self | 13 | 65.0 |
| Non-specialist other | 3 | 14.0 |
| Trained first aider | 0 | 0.0 |
| Health professional | 0 | 0.0 |
| Not recorded | 4 | 20.0 |
| ***Suspected broken bone*** | | |
| Self | 133 | 62.1 |
| Non-specialist other | 34 | 15.9 |
| Trained first aider | 10 | 4.7 |
| Health professional | 6 | 2.8 |
| Not recorded | 31 | 14.5 |

The study aimed to focus on non-healthcare professional delivered first aid and achieved this most of the time, but some first aid delivered by health professionals

did get recorded. Overall, the majority of first aid was provided by patients themselves (56.4%), but again this varied a little between the conditions under investigation (Table 6). In a few cases it was not clear who had delivered the first aid.

**Table 7: Disposition of patients from the emergency department**

| **Admitted from A & E?** | n | % |
|---|---|---|
| ***All conditions combined*** | | |
| Yes | 107 | 17.0 |
| No | 523 | 83.0 |
| Subsequently re-admitted? | 24 | 3.8 |
| ***Suspected cardiac arrest*** | | |
| Yes | 3 | 25.0 |
| No | 9 | 75.0 |
| Subsequently re-admitted? | 0 | 0.0 |
| ***Suspected heart attack*** | | |
| Yes | 53 | 42.1 |
| No | 73 | 57.9 |
| Subsequently re-admitted? | 14 | 11.1 |
| ***Bleeding from wound*** | | |
| Yes | 19 | 13.8 |
| No | 119 | 86.2 |
| Subsequently re-admitted? | 4 | 2.9 |
| ***Burn or scald*** | | |
| Yes | 4 | 15.4 |
| No | 22 | 88.5 |
| Subsequently re-admitted? | 0 | 0.0 |
| ***Suspected broken bone*** | | |
| Yes | 33 | 9.2 |
| No | 327 | 90.8 |
| Subsequently re-admitted? | 6 | 1.7 |

As already stated, the majority of patients did not get admitted to hospital following their ED attendance (83%). A total of 17% of patients were admitted to hospital and Table 6 shows how this varies by condition with cardiac arrest and suspected heart attack patients having a greatest chance of admission. Table 7 also records the readmission rates of patients with a related condition within 7 days of initial hospital attendance. Again this varied by condition, with an overall rate of 3.8% which increased to 11.1% for suspected heart attack patients.

## Table 8: Proportion of patients reattending within 42 days*

| ***All conditions combined*** | n | % |
|---|---|---|
| Any follow-up appointment (planned or unplanned) | 321 | 51.0 |
| Unplanned re-attendance | 26 | 4.1 |
| Any subsequent admission (whether initially admitted or not) | 33 | 5.2 |
| ***Suspected cardiac arrest*** | | |
| Any follow-up appointment (planned or unplanned) | 2 | 66.7 |
| Unplanned re-attendance | 0 | 0.0 |
| Any subsequent admission (whether initially admitted or not) | 0 | 0.0 |
| ***Suspected heart attack*** | | |
| Any follow-up appointment (planned or unplanned) | 97 | 77.0 |
| Unplanned re-attendance | 5 | 4.0 |
| Any subsequent admission (whether initially admitted or not) | 16 | 12.7 |
| ***Bleeding from wound*** | | |
| Any follow-up appointment (planned or unplanned) | 52 | 37.7 |
| Unplanned re-attendance | 7 | 5.1 |
| Any subsequent admission (whether initially admitted or not) | 6 | 4.3 |
| ***Burn or scald*** | | |
| Any follow-up appointment (planned or unplanned) | 16 | 61.5 |
| Unplanned re-attendance | 2 | 7.7 |
| Any subsequent admission (whether initially admitted or not) | 1 | 3.8 |
| ***Suspected broken bone*** | | |
| Any follow-up appointment (planned or unplanned) | 166 | 46.1 |
| Unplanned re-attendance | 15 | 4.2 |
| Any subsequent admission (whether initially admitted or not) | 10 | 2.8 |

*Excludes patients who died in A&E, those who self-discharged, or whose disposition was unknown

Overall, there was a reattendance rate of 51%, of which the majority was for chest pain patients. There was an unplanned reattendance rate of 4.1% which is an unsurprising rate. A small proportion of patients had a hospital admission following their initial A&E attendance (5.2%), most of these were with chest pain related problems. Length of hospital stay varied from 3 to 41 days with an overall median length of stay of 3 days.

## Table 9: Patients reported as dead within 42 days of attendance

| Mortality at 42 days | n | % |
|---|---|---|
| Dead | 13 | 2.0 |
| Alive | 635 | 97.4 |
| Not recorded | 4 | 0.6 |

Of the 13 deaths, 12 were the same patients who were admitted following suspected cardiac arrest. Of these, ten died before leaving A&E (including one who was brought in dead); the other two were admitted to a ward, but died after 1 day and 5 days respectively. The other death was following a suspected broken bone and 27 days' stay in the hospital.

## Source of first aid knowledge

There were a range of different responses to the question of where the first-aider gained their first aid knowledge. Of 322 responses, they are categorised together as seen in Table 10. The commonest source of knowledge was bystander advice, followed by common sense.

## Table 10:Source of first aid knowledge

| SOURCE | n | % |
|---|---|---|
| Bystander advice[1] | 120 | 37.3 |
| Common sense/instinct | 70 | 21.7 |
| Health care provider services (999/NHSD) | 40 | 12.4 |
| Experience (of previous injury/condition) | 25 | 7.8 |
| First aid course | 23 | 7.1 |
| Medical professional advice | 14 | 4.3 |
| Written advice (BRC) | 9 | 2.8 |
| Television | 6 | 1.9 |
| Own professional knowledge | 5 | 1.6 |
| Family member advice | 4 | 1.2 |
| Pain reduction | 2 | 0.6 |
| Learned at school | 2 | 0.6 |
| Internet | 1 | 0.3 |
| Unknown | 1 | 0.3 |

[1]Bystanders not recorded as being medical professionals or other specialists

## Links between first aid and outcomes

Analyses were undertaken to try and investigate links between the use of frist aid and patient outcomes.

This analysis uses one of two independent variables:

- Whether approved first aid was applied (versus either non-approved or no first aid)
- Whether approved first aid was applied within a three-minute timescale of the incident

All analyses controlled for age and sex of the patient, and for whether or not multiple conditions were recorded (other than for suspected cardiac arrest, where no patients had multiple conditions). Analyses were conducted for each condition separately. Where results are not shown, this is due to there being insufficient cases for the model to be estimated (particularly in the conditions with small sample sizes, and for first aid within a three-minute timescale).

Overall, approved first aid was applied in 242 cases (37.1% of the total). Of these cases, the time it took until first aid was applied is known in 237 cases. Of these 237 cases, it was applied within three minutes on 91 occasions (38.4%). By condition, this broke down as shown in table 11. The highest proportion of patients receiving treatment within three minutes was the burn group. The quickest to apply first aid were trained first aiders, with the slowest being the patient themselves (table 12)!

**Table 11:Use of approved first aid measures within three minutes**

| **Condition** | Applied within 3 minutes? | | | |
|---|---|---|---|---|
| | Yes | | No | |
| Suspected cardiac arrest | 2 | 50.0% | 2 | 50.0% |
| Suspected heart attack | 12 | 22.6% | 41 | 77.4% |
| Bleeding from wound | 50 | 62.5% | 30 | 37.5% |
| Burn or scald | 9 | 81.8% | 2 | 18.2% |
| Suspected broken bone | 20 | 20.8% | 76 | 79.2% |

**Table 12: Time to apply first aid by provider**

| Condition | Median time to first aid |
|---|---|
| Self | 15 minutes 0 seconds |
| Non-specialist other | 9 minutes 59 seconds |
| Trained first aider | 4 minutes 59 seconds |
| Health professional | 11 minutes 0 seconds |

### *Hospital admission as outcome*

This was assessed by logistic regression with the binary variable of whether or not the patient was admitted as the outcome. Odds ratios and associated p-values are shown in the following table:

**Table 13:Odds of hospital admission by use of first aid.**

| | Any approved first aid | | Approved first aid within 3 minutes | |
|---|---|---|---|---|
| **Condition** | Odds ratio | p | Odds ratio | p |
| Suspected cardiac arrest | - | - | - | - |
| Suspected heart attack | 0.992 | .984 | 0.582 | .498 |
| Bleeding from wound | 1.901 | .262 | 1.008 | .991 |
| Burn or scald | 1.391 | .238 | 1.000 | 1.000 |
| Suspected broken bone | 0.745 | .512 | 1.474 | .648 |

Table 13 shows no significant effect from first aid, there is no evidence of patients receiving approved first aid (whether within 3 minutes or not) being more or less likely to be admitted to hospital following their attendance at A&E.

### *Re-admission as outcome*

This was assessed by logistic regression with the binary variable of whether or not the patient was re-admitted as the outcome. Odds ratios and associated p-values are shown in Table 14.

**Table 14:Odds of hospital readmission by the use of first aid**

| | Any approved first aid | | Approved first aid within 3 minutes | |
|---|---|---|---|---|
| **Condition** | Odds ratio | p | Odds ratio | p |
| Suspected cardiac arrest | - | - | - | - |
| Suspected heart attack | 1.829 | .381 | 0.376 | .449 |
| Bleeding from wound | - | - | - | - |
| Burn or scald | - | - | - | - |
| Suspected broken bone | 5.046 | .148 | 2.647 | .645 |

The results show no significant effects: there is no evidence of patients receiving approved first aid (whether within 3 minutes or not) being more or less likely to be re-admitted.

### *Follow-up attendance as outcome (planned or unplanned)*

This was assessed by logistic regression with the binary variable of whether or not the patient had any kind of re-attendance at the hospital, including planned, unplanned, admissions and outpatients appointments, as the outcome. Odds ratios and associated p-values are shown table 15.

**Table 15:Odds of hospital reattendance by use of first aid**

| | Any approved first aid | | Approved first aid within 3 minutes | |
|---|---|---|---|---|
| **Condition** | Odds ratio | p | Odds ratio | p |
| Suspected cardiac arrest | - | - | - | - |
| Suspected heart attack | 1.226 | .669 | 1.008 | .993 |
| Bleeding from wound | 1.242 | .571 | 0.735 | .537 |
| Burn or scald | 4.251 | .258 | - | - |
| Suspected broken bone | 1.480 | .112 | 1.223 | .694 |

The results show no significant effects: there is no evidence of patients receiving approved first aid (whether within 3 minutes or not) being more or less likely to have follow-up attendances.

### *Unplanned follow-up attendance as outcome*

This was assessed by logistic regression with the binary variable of whether or not the patient had any unplanned re-attendance (whether another emergency

department visit or a re-admission) as the outcome. Odds ratios and associated p-values are shown in table 16.

**Table 16: Odds of unplanned hospital reattendance by use of first aid**

| | Any approved first aid | | Approved first aid within 3 minutes | |
|---|---|---|---|---|
| **Condition** | Odds ratio | p | Odds ratio | p |
| Suspected cardiac arrest | - | - | - | - |
| Suspected heart attack | 0.327 | .330 | - | - |
| Bleeding from wound | 1.058 | .945 | 2.273 | .523 |
| Burn or scald | - | - | - | - |
| Suspected broken bone | 1.148 | .813 | 6.524 | .080 |

The results show no significant effects: there is no evidence of patients receiving approved first aid (whether within 3 minutes or not) being more or less likely to have unplanned follow-up attendances.

### *Length of stay as outcome*

This was assessed by negative binomial regression (due to the distribution of the length of stay variable) with the total number of nights spent in hospital as the outcome. Untransformed regression coefficients and associated p-values are shown in table 17.

**Table 17:Impact of first aid on hospital length of stay**

| | Any approved first aid | | Approved first aid within 3 minutes | |
|---|---|---|---|---|
| **Condition** | Beta | p | Beta | p |
| Suspected cardiac arrest | - | - | - | - |
| Suspected heart attack | 0.394 | .228 | -0.666 | .288 |
| Bleeding from wound | -1.254 | .052 | -3.182 | .031 |
| Burn or scald | - | - | - | - |
| Suspected broken bone | -0.517 | .320 | -1.101 | .283 |

The results show one significant effect: there is evidence that, when suffering bleeding from a wound, patients who have approved first aid within three minutes of the injury are likely to have a shorter stay in hospital. This may be reflected in other first aid interventions, however, as this was not within the scope of the study, further research in this area is required. This effect is based upon only 13 cases (9 receiving

first aid within three minutes, six of whom were not admitted and the other three for one night only; of the four who did not receive such first aid, two were not admitted and two stayed for two nights each). As such, it should be treated with extreme caution, particularly as no multiple testing correction has been applied here.

### *Pain scores as outcome*

This was assessed by multiple regression with pain scores given by the patients as the outcome. Pain scores were only recorded for the latter three conditions. OLS regression coefficients and associated p-values are shown in table 18.

**Table 18:Impact of first aid treatment on pain scores**

| | Any approved first aid | | Approved first aid within 3 minutes | |
|---|---|---|---|---|
| **Condition** | Beta | P | Beta | p |
| Bleeding from wound | 0.442 | .347 | -0.192 | .762 |
| Burn or scald | -1.577 | .405 | -1.219 | .773 |
| Suspected broken bone | 0.001 | .996 | 0.672 | .279 |

The results show no significant effects: there is no evidence of patients receiving approved first aid (whether within 3 minutes or not) giving higher or lower pain scores.

### *Whether first aid was perceived as helpful or not as outcome*

This was assessed by logistic regression with the binary variable of whether or not the patient considered the first aid they had received to be helpful as the outcome. This was only recorded for the latter three conditions. Odds ratios and associated p-values are shown in table 19.

**Table 19: Odds of first aid being perceived as helpful**

| | Any approved first aid | | Approved first aid within 3 minutes | |
|---|---|---|---|---|
| **Condition** | Odds ratio | p | Odds ratio | p |
| Bleeding from wound | 13.275 | .000 | 0.437 | .354 |
| Burn or scald | - | - | - | - |
| Suspected broken bone | 1.526 | .206 | 1.319 | .641 |

There is a curious significant effect here. If approved first aid was received by someone bleeding from a wound, they are far more likely to perceive that as helpful than someone receiving other first aid (odds ratio 13.275). However, there is no difference between those receiving that first aid within 3 minutes and everyone else.

## Discussion

This is the first prospective study to evaluate the use of bystander first aid for common emergency conditions. The study consisted of a literature review and an empirical study collecting data from a large urban emergency department in the UK.

## Literature review

The review was conducted on the value of first aid in the management of for the management of cardiac arrest, heart attack, a burn or scald, external bleeding and suspected fracture of a limb. In addition, evidence regarding the efficacy of first aid education was also searched for and collected.

The Cochrane Library and Medline were searched comprehensively for published studies in the English language from 1946 onwards relating to first aid education and the clinical efficacy of basic first aid treatments, as outlined by the British Red Cross. Sixty-seven of the 83 articles identified were selected for review.

**Table 20: Summary of articles selected for review along with results**

| Category | Results |
|---|---|
| Cardiac arrest | • While continuous compression CPR is easier to learn it is not suitable for asphyxia originated or prolonged cardiac arrests. |
| Chest pain | • Calling '999' in response to chest pain leads to improved patient outcomes.<br>• Individuals frequently fail to respond to chest pain appropriately and mass education campaigns have proved unsuccessful. |
| Burn/scald | • Immediate cooling of thermal burns with cold running water may reduce the need for grafting.<br>• Media campaigns prompting this intervention have improved patient outcomes. |
| External haemorrhage | • No evidence identified regarding first aid management. |
| Suspected fracture | • No evidence identified regarding first aid management. |
| Education | • First aid courses should include refresher sessions and training to overcome barriers to action.<br>• Treatment protocols available via mobile phone have the potential to increase administration of first aid. |

The literature review concluded that clinical evidence for the efficacy of first aid interventions is lacking. Extrapolation from evidence relating to professional pre-hospital interventions has been used to derive first aid guidelines, especially for external haemorrhage and suspected fractures. Evidence for the efficacy of bystander first aid treatments is required if such interventions are to have a greater impact on health outcomes.

**Prospective study to explore the link between the use of first aid and patient outcomes following emergency medical events**

Over a 3 week period, data was collected from a large urban Emergency Department in the UK for 652 patients attending with any one of 5 emergency medical conditions. Patients or their carers were asked if the British Red Cross recommended first aid

was undertaken, or if not, if any other interventions were provided. Pain scores were recorded along with time interval between incident occurring and first aid provision. Patient outcomes were retrieved for a 6 week period.

The study was unable to demonstrate convincing benefit from the use of first aid in terms of survival, hospital admission, readmission or reattendance, pain or perceptions of usefulness when comparing any use of first aid measures with that applied along the British Red Cross recommended guidance.

The study findings show a need for increasing the public's awareness of British Red Cross recommended first aid, although the long-term benefits of administering recommended first aid are not shown in this study. Possible reasons for this could be the lack of information available from patients at the time of attendance at the ED and the difficulty of obtaining this data. Further research, including both qualitative and quantitative elements are required in order to assess the long-term effects of public delivered first aid interventions.

## Limitations

This study was limited to one emergency department in the UK, and hence the results may not be generalisable to other emergency department settings. However, we have no reason to assume that the patients attending this emergency department are significantly different in their presentation from other patients. The study sought to describe the current state of first aid use in patients attending the emergency department. Further work would be needed to develop interventions that might be helpful in increasing the use of and appropriateness of use of first aid by the public. The study did not have a formal sample size calculation, and therefore may be underpowered to identify significant differences should they exist.

## Summary

This study has increased the knowledge about the use of first aid by the public in the UK. Further research is needed to identify possible impacts of first aid measures and advice given.

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## List of Abbreviations

| | |
|---|---|
| AMI | Acute Myocardial Infarction |
| BRC | British Red Cross |
| CA | Cardiac Arrest |
| CCC | Continuous Compression Cardiopulmonary Resuscitation |
| CPR | Cardiopulmonary Resuscitation |
| EMS | Emergency Medical Service |
| IHD | Ischaemic Heart Disease |
| OHCA | Out of Hospital Cardiac Arrest |
| PDA | Personal Digital Assistant |

# Prospective study to explore the link between the use of first aid and patient outcomes following emergency medical events

## DATA COLLECTION TOOL:

Tick which case this patient applies to:

Unconscious person not breathing

Suspected heart attack – chest pain

Bleeding from a wound

Burn or scald

Suspected broken bone

Complete the following:

<u>Patient characteristics</u>

Patient name:

Gender:

DOB:

Postcode:

Mode of arrival at hospital: (use hospital coding)

Date:

Time of presentation:

<u>Incident characteristics</u>

Presenting complaint: front of card and ? coding

Pain score: 0 1 2 3 4 5 6 7 8 9 10

(scored at earliest time possible from arrival – triage nurse recorded: Y?N?

*Investigations:*

Lab

Xray

*Treatments:* ? coding

Disposition: coding on card?

Admit – ward / ITU

Discharge

Outpatient

Other

First aid measures being used in the initial management of the problem – details of timing, type of intervention and patient response

*Additional outcomes* such as death, hospital admission, hospital reattendance – either planned or unplanned

*1. Unconscious person not breathing*

Survival up to

Arrival in the ED

Admission to hospital

6 weeks

*2. Suspected heart attack*

Total time from onset of symptoms to calling ambulance

Total time from onset of symptoms to receiving percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction patients (STEMI)

Total time from onset of symptoms to receiving other treatments for non-STEMI (e.g. thrombolysis)

Time to investigation in non-MI patients

*3. Bleeding heavily from a wound*

Requirement for resuscitation (e.g. with iv fluids, blood)

*4. Burn or scald*

Requirement for specialty review (e.g. burns or plastic surgery)

Post-burn infection rate

5. *Suspected soft tissue injury*

Requirement for an orthopaedic intervention e.g. manipulation of fracture, fixation of fracture

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