Improving survival after out-of-hospital cardiac arrest
Adopting the Institute of Medicine’s strategies could save hundreds of thousands of lives worldwide

Jerry P Nolan professor1, Gavin D Perkins professor2, Jasmeet Soar consultant3

1University of Bristol and Royal United Hospital, Bath BA1 3NG, UK; 2University of Warwick and Heart of England NHS Foundation Trust, Coventry, UK; 3Southmead Hospital, North Bristol NHS Trust, Bristol, UK

Sudden cardiac arrest results in millions of deaths worldwide each year and is a leading cause of premature death, with large disparities in survival between less privileged and more privileged groups.1 Despite this, there has been relatively little attention given to policies and strategies to improve the outcomes of cardiac arrest.

Cardiac arrest is commonly associated with low survival rates and poor functional outcome in survivors, but recent data show that both are improving.2 3 Nevertheless, there remains much scope for communities to improve outcomes to match those in the best performing places.4 The US Institute of Medicine’s report on strategies to improve survival from cardiac arrest is therefore timely.5 It focuses on five areas: cardiopulmonary resuscitation (CPR) and the use of automated external defibrillators (AEDs); emergency medical systems and hospital systems of resuscitation care; national cardiac arrest statistics; resuscitation research; and future treatments and strategies for improving outcomes. The main recommendations are familiar to those involved in healthcare systems and quality improvement. They include establishing a national cardiac arrest registry, fostering a culture of action through public awareness and training, enhancing the capabilities and performance of emergency medical systems, setting accreditation standards for hospitals and healthcare systems, adopting continuous quality improvement programmes, accelerating research into new treatments, and creating a national cardiac arrest collaborative.

The English and Scottish initiatives to improve survival from out-of-hospital cardiac arrest include many of the recommendations in the IOM report. Both set bold targets—England aiming to save 1000 lives a year for the next five years4 and Scotland an extra 1000 lives by 20205 through community education and action.

Measuring processes and patient outcomes can help quantify whether change has led to improvement and enable comparisons between settings. Internationally agreed templates for recording cardiac arrest data already exist to enable comparisons.6 Some national registries of cardiac arrests already collect these data—for example, the out-of-hospital cardiac arrest outcomes project and the national cardiac arrest audit in the UK.

Chain of survival
The chain of survival (figure) provides a framework for improving outcome. The first link—early recognition (two thirds of out-of-hospital cardiac arrests are witnessed) and calling for help—requires training the public to recognise cardiac arrest (unresponsive and not breathing normally) and immediately call the emergency services. Call dispatchers must also be trained to quickly recognise the possibility of cardiac arrest and instruct the caller to provide compression-only CPR, unless the caller is already trained in conventional CPR. Bystander CPR at least doubles the chance of survival,8 and one way to increase rates is to use mobile phone positioning systems to dispatch nearby lay volunteers.9

In the UK a bystander starts CPR in about 40% of cases.10 Campaigns to train more people in the technique are fundamental to increasing survival from out-of-hospital cardiac arrest. Countries with the highest bystander rates teach it to schoolchildren, and the “kids save lives” campaign, endorsed by the World Health Organization, aims to put CPR on the school curriculum.

The presenting cardiac arrest rhythm is shockable (ventricular fibrillation or pulseless ventricular tachycardia) in about a quarter of patients, 25–30% of whom survive to hospital discharge. The remainder of cases are non-shockable—asystole in about 50% and pulseless electrical activity in about 25% of cases—and have much poorer survival (less than 5%).2 3 The
third link in the chain of survival, early defibrillation for shockable rhythms can be strengthened through public access to AEDs, allowing a bystander to deliver the first shock before an ambulance arrives. Defibrillation within 3–5 minutes of collapse can produce survival rates of 50–70%.11

Increasing use of public access defibrillators in the Netherlands has been associated with improved survival.12 Lay rescuers, alerted by text messages, can retrieve a nearby AED and take it to the person affected.13 The use of an onsite AED doubles neurologically intact survival compared with no defibrillation, but the benefit is reduced if the defibrillator has to be brought from elsewhere.14 In North Holland, AEDs are used in 60% of out-of-hospital cardiac arrests; in a UK study, they were used in fewer than 2% of arrests before an ambulance arrived.15

The role of many commonly used advanced resuscitation interventions is uncertain. For example, large randomised controlled trials have shown that routine use of mechanical chest compression devices does not improve outcome.16 Ongoing trials are studying the role of adrenaline (PARAMEDIC 2: the Adrenaline Trial, ISRCTN 73485024), amiodarone and lidocaine (ALPS study, NCT01401647), and tracheal intubation (AIRWAYS-2 ISRCTN 08256118 and PART NCT02419573).

Developments in the final link in the chain, post-resuscitation care, are also contributing to improved survival. Most notable are the increasing use of primary percutaneous coronary intervention in patients with ST elevation in the post-arrest 12 lead electrocardiogram, use of targeted temperature management, and multimodal prognostication in patients who are comatose after cardiac arrest.17

The next International Liaison Committee on Resuscitation consensus on CPR science with treatment recommendations will be published in October. These systematic reviews form the basis for simultaneously published resuscitation guidelines, including those from the American Heart Association, European Resuscitation Council, and Resuscitation Council (UK).18 These guidelines should reinforce the principles in the Institute of Medicine report. The institute’s strategies to improve survival from cardiac arrest can save hundreds of thousands of lives. Policy makers around the world should review these findings because now is the time to act.

Competing interests: We have read and understood BMJ policy on declaration of interests and declare the following interests: JPN is editor in chief of Resuscitation and vice-chair of the European Resuscitation Council; he has received National Institute for Health Research grants for clinical trials in cardiac arrest. GDP and JS are both editors of Resuscitation. GDP is cochair of the International Liaison Committee on Resuscitation, has received National Institute for Health Research grants for clinical trials and health service research in cardiac arrest, and is lead for the UK national out of hospital cardiac arrest project funded by British Heart Foundation and Resuscitation Council (UK). JS is chair of the advanced life support task force of the International Liaison Committee on Resuscitation and has received a National Institute for Health Research programme development grant for cardiac arrest studies.

Provenance and peer review: Commissioned; not externally peer reviewed.

1 Berdowski J, Berg RA, Tijssen JG, Koster RW. Global incidences of out-of-hospital cardiac arrest and survival rates: Systematic review of 67 prospective studies. Resuscitation 2010;81:1479-87.
2 Chan PS, McNally B, Tang F, Kellermann A, Group CS. Recent trends in survival from out-of-hospital cardiac arrest in the United States. Circulation 2014;130:1876-82.
3 Wissenberg M, Lippert FK, Foste K, et al. Association of national initiatives to improve cardiac arrest management with rates of bystander intervention and patient survival after out-of-hospital cardiac arrest. JAMA 2013;310:1377-84.
4 Perkins GD, Lockey AS, de Belder MA, Moore P, Wiesenberg P, Gray H. National initiatives to improve outcomes from out of hospital cardiac arrest in England. Emerg Med J 2015; doi:10.1136/emermed-2015-204847.
5 Institute of Medicine Committee on the Treatment of Cardiac Arrest. Strategies to improve cardiac arrest survival. A time to act. National Academies Press, 2015.
6 Scottish Government. Out-of-hospital cardiac arrest: a strategy for Scotland. 2015. www.gov.scot/Publications/2015/03/7484.
7 Perkins GD, Jacob I, Nadkarni VM, et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update of the Utstein resuscitation registry templates for out of-hospital cardiac arrest. Resuscitation (forthcoming).
8 Hasselblad-Av I, Riva D, Heitz J, et al. Early cardiopulmonary resuscitation in out-of-hospital cardiac arrest. N Engl J Med 2015;372:2307-15.
9 Ringh M, Rosenqvist M, Heffenren J, et al. Mobile-phone dispatch of laypersons for CPR in out-of-hospital cardiac arrest. N Engl J Med 2015;372:2316-25.
10 Perkins GD, Lall R, Quinn T, et al. Mechanical versus manual chest compression for out-of-hospital cardiac arrest (PARAMEDIC): a pragmatic, cluster randomised controlled trial. Lancet 2015;385:947-55.
11 Vakounzalad TD, Roz DJ, Nichol G, Clark LI, Spalte DW, Hardman RG. Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos. N Engl J Med 2000;343:1206-9.
12 Blom MT, Beesems SG, Homma PC, et al. Improved survival after out-of-hospital cardiac arrest and use of automated external defibrillators. Circulation 2014;130:1868-75.
13 Zijlstra JA, Stegkis R, Radijk F, Smeekes M, van der Worp WE, Koster RW. Local lay rescuers with AEDs, alerted by text messages, contribute to early defibrillation in a Dutch out-of-hospital cardiac arrest dispatch system. Resuscitation 2014;85:1444-9.
14 Berdowski J, Blom MT, Bardzi A, Tan HL, Tijssen JG, Koster RW. Impact of onsite or dispatched automated external defibrillator use on survival after out-of-hospital cardiac arrest. Circulation 2011;124:2225-32.
15 Gates S, Quinn T, Deakin CD, Blair I, Couper K, Perkins GD. Mechanical chest compression for out of hospital cardiac arrest: systematic review and meta-analysis. Resuscitation 2015;84:917-7.
16 Sandroni C, Carius A, Cavallaro F, et al. Prognostication in comatose survivors of cardiac arrest: an advisory statement from the European Resuscitation Council and the European Society for Intensive Care Medicine. Resuscitation 2014;85:1779-89.
17 Nolan JP, Hazinski MF, Acker R, et al. Part I. Executive summary: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. Resuscitation (forthcoming).

Related links

thebmj.com

- Read more cardiology articles at bmj.com/cardiology

© BMJ Publishing Group Ltd 2015