



Consensus Paper on Out-of-Hospital Cardiac Arrest in England

Date: 16th October 2014

Revision Date: 16th October 2015

Introduction

The purpose of this paper is to bring some clarity to the analysis of data associated with out-of-hospital cardiac arrest (OHCA) in England. This will help us to agree the scale of the problem, ensure that realistic targets for improvement can be set and the impact of interventions assessed.

Incidence of OHCA in England

In England in 2013 the Emergency Medical Services (EMS) attempted to resuscitate approximately 28,000 cases of OHCA.¹ There are many more cases of OHCA where the EMS do not attempt resuscitation because on their arrival the EMS assess the victim to be beyond resuscitation. This is because the victim has been dead for several hours, or has suffered severe trauma which is not compatible with life, or because the opportunity to start resuscitation was not taken sooner while the EMS were on their way. If more bystanders had the confidence and skills to call 999 quickly, deliver effective cardiopulmonary resuscitation (CPR) until the EMS arrive, and when appropriate use a public access defibrillator, the number of cases where the EMS could attempt resuscitation would increase.

Approximately 80% of OHCA occur at home and 20% in public places.² Only about 20% are in a 'shockable rhythm' (i.e. treatable by defibrillation) by the time the EMS arrive.² Survival is much more likely when a shockable rhythm is present.³ The proportion of people in a shockable rhythm could be increased if more cardiac arrest victims received immediate and effective CPR from bystanders.

Therefore more immediate 999 calls and immediate CPR given by bystanders could increase the number of people who receive CPR by the EMS. This will increase the number of people who are given a chance of surviving, and ultimately increase the number of people who do survive when they are given CPR.⁴

Survival rates from OHCA in England:

The average overall survival to hospital discharge from 28 000 EMS-treated OHCA in England is 8.6%.¹ This is significantly lower than for populations in other developed countries: North Holland 21%⁵, Seattle 20%⁶ and Norway 25%.³ Although these figures have to be interpreted with caution as there are some differences in the way that figures are presented, there is clear potential to improve survival rates in the UK.

Improving survival rates from out of hospital cardiac arrest is a major priority for the Resuscitation Council (UK), the British Heart Foundation and NHS England. This was identified by the Department of Health in the Cardiovascular Disease Outcomes Strategy (2013).

Evidence-based interventions to improve survival rates from OHCA:

Countries with the highest rates of OHCA survival are those which have strengthened all 4 links in the chain of survival:



The current rate of initial bystander CPR in England is reported as being 43%⁷ (compared, for example, to 73% in Stavanger, Norway during 2006-20083). However, this includes some situations where the bystander initiated CPR without having to be instructed to do so, as well as situations where the bystander initiated CPR following the instruction of the emergency medical dispatcher after calling 999. The latter situation may result in a delay of up to several minutes before the victim receives CPR. Such delays could be minimised if more members of the public were able and willing to recognise cardiac arrest and attempt CPR immediately.

There are limited data on the current rate of bystander defibrillation with a public access defibrillator (PAD) following an OHCA. One study in the South of England reported bystander defibrillation in 1.74% of OHCA cases.⁸ When someone has a cardiac arrest, every minute without CPR and defibrillation reduces their chances of survival by 7–10 per cent.^{9,10,11} Rates of bystander CPR and PAD use in the UK are believed to be low for a number of reasons:

- *Failure to recognise cardiac arrest*
- *Lack of knowledge of what to do*
- *Fear of causing harm (such as breaking the victim's ribs) or being harmed (acquiring infection from a stranger when giving rescue breaths)*
- *Fear of being sued*
- *Lack of knowledge of the location of PADs*
- *No access to a PAD at the time of the cardiac arrest*

As the chain of survival illustrates, a person is most likely to survive an OHCA in the following circumstances:

- *Their cardiac arrest is either witnessed by a bystander or the victim is discovered immediately after collapsing*
- *The bystander calls 999 immediately*
- *The bystander delivers effective CPR without delay*
- *The cause of the cardiac arrest is a sudden disturbance of heart rhythm, which may be caused by a heart attack or may be due to another heart condition, sometimes an inherited heart condition*
- *The cardiac arrest is due to a 'shockable' rhythm disturbance (ventricular fibrillation or ventricular tachycardia)*
- *There is a PAD close by which another bystander can fetch*
- *The bystanders use the PAD without delay*
- *The EMS arrive very quickly (within minutes of being called)*

Frequently asked questions

Q. What is the total number of cardiac arrests in England?

A. The total number of cardiac arrests in England is unknown.

Before quoting any figure it is important to define what is meant by 'cardiac arrest'. In everyone who dies (for example from advanced conditions such as cancer or the final stages of severe lung disease, heart disease or kidney disease) the heart will stop as part of the process of dying. Attempting to restart the heart with CPR would provide no benefit in such situations.

A figure of 60,000 OHCA's per year in the UK is often quoted. This is probably derived from a report by the Ambulance Services Association¹² which identified 57,345 OHCA's in 2006, of which 25,143 received attempted CPR by the EMS and 32,202 who did not. It is uncertain how many of those 32,202 people would have received CPR from the EMS if they had been called earlier and/or if bystanders had given CPR whilst waiting for the EMS to arrive. The total figure of 60,000 is also compatible with the reported incidence of cardiac arrest in Europe of 1/1000 of the population per year.¹³

The most important number to consider is the total number of cardiac arrests from which the person may have a chance of surviving if someone starts a resuscitation attempt immediately. This remains uncertain but is likely to be greater than the number of cardiac arrests in which the EMS currently attempt resuscitation (28,000 in England in 2013).

Q. Why is it important to deliver CPR as well as defibrillation?

A. Each link in the chain of survival is important. Calling 999 immediately ensures that emergency professional help is on the way as quickly as possible – the person is unlikely to survive without receiving expert help as soon as possible at the scene, en route to hospital and after arrival.

CPR increases the chances of surviving because it keeps some blood circulating to vital organs such as the brain and the heart itself. It also increases the likelihood of the heart remaining in a 'shockable' rhythm rather than deteriorating to a 'non-shockable' rhythm (referred to in lay terms as a "flat line"). This matters because a cardiac arrest victim is more likely to survive if their heart is in a 'shockable' rhythm from which it may be possible to shock them out of cardiac arrest with a defibrillator. Given the random occurrence of cardiac arrest, it is relatively rare for anyone to have a cardiac arrest right next to a defibrillator in a public place. Delivering CPR promptly and effectively is therefore crucial, at least until a defibrillator arrives (and often also immediately following defibrillation), if the person is to survive. This is true even in the case of in-hospital cardiac arrests where defibrillators are more often readily available. It should be noted that 80% of cardiac arrests occur at home where defibrillators are not usually available, but calling 999 immediately and delivering effective CPR at home can still save lives.

Q. If we had more defibrillators in public places would more people survive an OHCA?

A. Public access defibrillators (PADs) are most likely to be used (and used effectively) in places used or attended by large numbers of people. Cardiac arrest is more likely in some such places (for example large railway stations and airports) than in others.¹⁴ It makes sense to ensure that all such places have PADs readily available. In other places where cardiac arrests may occur less frequently and be more widely spread out it makes sense to try to have enough PADs to allow rapid access to a nearby defibrillator for as many cardiac arrest victims as possible.

Public access defibrillators are an important part in the chain of survival but they are not the only part. 80% of cardiac arrests occur at home, where defibrillators are not usually available, but calling 999 immediately and delivering effective CPR at home can still save lives. Defibrillation with a PAD can save lives from OHCA when the cardiac arrest rhythm is 'shockable'. Currently only 20% of cardiac arrest victims are in a 'shockable' rhythm when the EMS arrive. This figure could be increased if more cardiac arrest victims received immediate, effective CPR from bystanders. Prompt access to a PAD may allow treatment of a shockable rhythm before the arrival of the EMS in situations where that opportunity would have been lost before their arrival.

Is hands-only CPR as good as full CPR that includes mouth-to-mouth ventilation?

A. In a cardiac arrest, it is better for a bystander to do something rather than nothing. Some people are untrained or unwilling to deliver 'rescue breaths' (mouth-to-mouth ventilation). If the bystander is trained and willing to deliver rescue breaths effectively as well as chest compressions they should do so as this remains the recommended treatment. If not, it is better to deliver 'hands-only CPR' (i.e. chest compressions) immediately and without interruption, rather than doing nothing or attempting 'rescue breathing' ineffectively.

Q. Would every cardiac arrest victim survive if they had effective CPR and defibrillation?

A. No. The most common cause of a cardiac arrest is a 'heart attack' (acute myocardial infarction). In that situation survival will not only depend on being resuscitated from rhythm disturbance causing the cardiac arrest, but also on the amount of heart muscle that has been damaged by the heart attack, how quickly the person receives treatment for that and how well they respond to treatment.

Survival from a cardiac arrest is also dependent on the underlying state of health of the victim. If the person already has important medical conditions (for example severe lung or heart disease or advanced cancer) when they suffer a cardiac arrest, their chance of CPR leading to survival will be much less than if their health had been good.

Survival is also less likely in the event of major trauma and shock following blood loss caused by injury, for example in a road traffic accident.

Q. How many public access defibrillators are in England?

A. Nobody knows, because there is no systematic arrangement in place to record the location of all PADs. In July 2014 the British Heart Foundation committed to fund the setting up of a national PAD database for use across the whole of the UK. However, this is only part of the solution. It is crucial to increase public awareness of:

- *cardiac arrest*
- *how to recognise it*
- *the need to call 999 immediately*
- *the need to start CPR immediately*
- *the fact that PADs can be used safely by anyone.*

If this happens we can expect more people to intervene quickly and effectively in the event of a cardiac arrest, resulting in more lives saved.

References

1. www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators/.
2. London Ambulance Service Cardiac Arrest Annual Report 2012/2013 [www.londonambulance.nhs.uk].
3. Lindner TW, Soreide E, Nilsen OB, Torunn MW, Lossius HM. Good outcome in every fourth resuscitation attempt is achievable-An Utstein template report from the Stavanger region. *Resuscitation* 2011; 82:1508-13.
4. Waalewijn RA, Tijssen JGP, Koster RW. Bystander initiated actions in out-of-hospital cardiopulmonary resuscitation: results from the Amsterdam Resuscitation Study (ARREST). *Resuscitation* 2001; 50:273-279.
5. Grasner JT, Herlitz J, Koster RW, Rosell-Ortiz F, Stamatakis L, Bossaert L. Quality management in resuscitation--towards a European cardiac arrest registry (EuReCa). *Resuscitation* 2011; 82:989-94.
6. Division of Medical Services Public Health - Seattle & King County 2013 Annual Report to the King County Council. <http://www.kingcounty.gov/healthservices/health/ems/reports.aspx>.
7. Perkins GD. Data on file. OHCA database.
8. Deakin CD, Shewry E, Gray H. Public access defibrillation remains out of reach for most victims of out-of-hospital sudden cardiac arrest. *Heart* 2014; 100:619-623.
9. Holmberg M, Holmberg S, Herlitz J. Incidence, duration and survival of ventricular fibrillation in out-of-hospital cardiac arrest patients in Sweden. *Resuscitation* 2000; 44:7-17.
10. Larsen MP, Eisenberg MS, Cummins RO et al. Predicting survival from out-of-hospital cardiac arrest: a graphic model. *Ann Emerg Med* 1993; 22:1652-8.
11. Valenzuela TD, Roe DJ, Cretin S, Spaite DW, Larsen MP. Estimating effectiveness of cardiac arrest interventions: a logistic regression survival model. *Circulation*. 1997; 96:3308 -3313.
12. Ambulance Service Association. National Out-of-Hospital Cardiac Arrest Project 2006.
13. de Vreede-Swagemakers JJ, Gorgels AP, Dubois-Arbouw WI et al. Out-of-hospital cardiac arrest in the 1990s: a population-based study in the Maastricht area on incidence, characteristics and survival. *J Am Coll Cardiol* 1997; 30:1500-1505.
14. Colquhoun M. National database of Automated External Defibrillator (AED) use. https://www.resus.org.uk/pages/Reports/Report-National_database_of_AED_use.pdf.

Other relevant published papers:

Murakami Y, Iwami T, Kitamura T, Nishiyama C, Nishiuchi T, Hayashi Y, Kawamura T and the Utstein Osaka Project. Outcomes of Out-of-Hospital Cardiac Arrest by Public Location in the Public-Access Defibrillation Era. *JAMA* 2014; doi: 10.1161/JAHA.113.000533.

Wissenberg M, Lippert FK, Folke F, Weeke P, Hansen CM, Christensen F, Jans H, Hansen PA, Lang-Jensen T, Olesen JB, Lindhardsen J, Fosbol EL, Nielsen SL, Gislason GH, Kober L, Torp-Pedersen C. 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(13):1377-1384. doi:10.1001/jama.2013.278483.