Time Matters

A review of the quality of care provided to patients aged 16 years and over who were admitted to hospital following an out-of-hospital cardiac arrest

SUMMARY

NCEPOD

Improving the quality of healthcare

Time Matters

A review of the quality of care provided to patients aged 16 years and over who were admitted to hospital following an out-of-hospital cardiac arrest

A report published by the National Confidential Enquiry into Patient Outcome and Death (2021)

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The Medical and Surgical Clinical Outcome Review Programme is commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP). HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing, and National Voices. Its aim is to promote quality improvement in patient outcomes. The Clinical Outcome Review Programmes, which encompass confidential enquiries, are designed to help assess the quality of healthcare, and stimulate improvement in safety and effectiveness by systematically enabling clinicians, managers, and policy makers to learn from adverse events and other relevant data. HQIP holds the contract to commission, manage and develop the National Clinical Audit and Patient Outcomes Programme (NCAPOP), comprising around 40 projects covering care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual projects, other devolved administrations and crown dependencies www.hqip.org.uk/national-programmes.

Contents

Introduction

Reducing deaths from cardiovascular disease is a key NHS priority[1-5] and NCEPOD has previously reported on the care of people with in-hospital cardiac arrests in the 2012 report '*Time to Intervene?*'.[6]

The incidence of out-of-hospital cardiac arrest (OHCA) in the UK is approximately 60,000 per year[7] and UK ambulance services attempt resuscitation in an estimated 30,000 people per year.[8] Figures from England alone have shown considerable variation in both the rate of return of spontaneous circulation (ROSC) at hospital handover (13-27%) and the rate of survival to hospital discharge (2.2%-12%).[9] This means that, on average, fewer than one in ten people in the UK survive an OHCA. When compared with the performance reported by international exemplar healthcare systems (where OHCA survival rates include 21% [Seattle, USA], 21% [Netherlands], and 25% [Norway]), even the best UK-reported outcomes could be improved.[10-12]

In the 2013 Department of Health Cardiovascular Disease Outcomes Strategy, it was estimated that if the survival rate in England could be increased to between 10% and 11%, more than 1,000 lives would be saved each year. If survival rates could be improved to match Norway's healthcare system, for example, a further 3,250 lives could be saved annually.[13,14]

The four links in the OHCA 'Chain of Survival'[15] are:

1. Early recognition of cardiac arrest and call for help
2. Early bystander cardiopulmonary resuscitation (CPR)
3. Early defibrillation
4. Early advanced life support and standardised post-resuscitation care

Since 2013, the Out-of-Hospital Cardiac Arrest Outcomes (OHCAO) Registry has been collecting comprehensive data annually covering the first three links in the 'Chain of Survival' from ambulance services in England for both children and adults.[14] Registry data have shown improvements over time in the rates of bystander CPR and early defibrillation. These remain important targets for improvement in OHCA survival, particularly in the context of the COVID-19 pandemic where data from countries that experienced an early surge in cases shows an increased frequency of OHCA, a reduction in bystander CPR, longer delays to intervention and worse hospital outcomes.[16,17] Data from the registry have been provided to NCEPOD, and are presented later in this section to set the scene for the in-hospital care that has been reviewed by NCEPOD.

The fourth link in the 'Chain of Survival' requires trained individuals to provide advanced life support and includes the subsequent in-hospital care of OHCA once ROSC has been achieved. The lack of an ICD-10 code for OHCA makes it difficult to identify this group of patients retrospectively on routine national data collections.

The fourth link in the chain also includes percutaneous coronary intervention (PCI) for acute coronary syndromes (ST-elevation [STEMI] and non-ST-elevation [nSTEMI] myocardial infarction).[18] Improved access to PCI is one factor that has resulted in more people surviving an OHCA, but not all hospitals where patients with an OHCA are admitted have PCI services.[19] The British Cardiovascular Intervention Society (BCIS) data from 2016, recorded that 1,558 people who were ventilated following OHCA, underwent primary PCI.[19] Furthermore, data from the Intensive Care National Audit & Research Centre (ICNARC) indicate that around 5,000 patients are admitted to intensive care units (ICU) in England, Wales and Northern Ireland following an OHCA, spending an average of five days there. PCI may occur before ICU admission or while on ICU, with variation in practice between centres.[20]

Non-cardiac causes of cardiac arrest must also be considered, investigated and treated. Patients without coronary artery disease may require assessment by a heart rhythm specialist and some will receive implantable cardioverter-defibrillators (ICDs).[21]

In the ICU, targeted temperature management is recommended for at least 24 hours after OHCA and hyperthermia (temperature greater than 37.5°C) should be avoided for 72 hours after ROSC.[15,22]

For patients who are comatose, neurological prognosis should be assessed using a multi-modal approach, and decisions regarding neurological prognosis deferred until at least 72 hours after ROSC.[15] Some survivors have neurological impairment and require early neurorehabilitation to maximise their functional status. The median length of stay in hospital for survivors of OHCA admitted to ICU is 20 days.[23] It has been recommended that there should be protocols for OHCA available in hospitals, including decision aids for when and where to admit, duration of ICU stay, prognostication, withdrawal of life-sustaining treatment and organ donation.[24] Increases in survival rates and improvements in the quality of life after surviving an OHCA, can be realised by better immediate responses to OHCA and optimal early hospital treatment.[25] This NCEPOD study was therefore designed to identify opportunities to improve the organisation of services and the clinical care of patients following an OHCA, to enhance the overall quality of care they receive.

Executive summary

Aim

The aim of this study was to identify variation and remediable factors in the processes of care provided to patients over the age of 16 years admitted to hospital following an out-of-hospital cardiac arrest (OHCA).

Method

Data were collected to review the clinical care delivered to patients from the time of an OHCA to discharge from hospital or death. Only patients with a sustained return of spontaneous circulation (ROSC) for at least 20 minutes, were included. Review of the clinical pathway included the community and emergency service response, hospital admission, and inpatient care, in particular cardiac and critical care services. Data were also collected to assess organisational aspects of care within acute hospitals.

Key messages

The five key messages here, agreed as the primary focus for action, have been derived from the report's recommendations (see pages 16-18 and Appendix 1).

1. Bystander Cardiopulmonary Resuscitation (CPR)
Ongoing strategies are needed at a population level to ensure that people who sustain an OHCA are treated rapidly with high quality resuscitation, including defibrillation, through a co-ordinated network of accessible and identifiable public access devices.

2. Advance treatment plans
When advance treatment plans are in place, they should be documented using a standard process (such as the ReSPECT form) to ensure that people receive treatments based on what matters to them and what is realistic. Effective communication between all parts of the healthcare system, including, primary care, community services, ambulance services and acute hospitals is then needed to ensure that appropriate decisions are made, irrespective of time or location.

3. Prediction of survival
No single factor is accurate enough for clinical decision-making at the time of admission to hospital following an OHCA. Time is needed to ensure an accurate assessment of prognosis can be made. Neurological prognosis is particularly difficult to assess, and this should be delayed for at least 72 hours after return of spontaneous circulation.

4. Targeted temperature management
Elevated temperature is common following an OHCA and is associated with a worse prognosis, but this can be improved by accurate, active temperature control. The current approach in clinical practice appears to be inconsistent and a more active approach is needed.

5. Rehabilitation
Physical, neurological, cardiac and emotional impairment following an OHCA can all affect quality of survival, and patients benefit from targeted rehabilitation and support. In some areas of the UK there is no provision of these services. These gaps should be closed by local clinical teams and commissioners working together.

Key messages aimed at improving the care of people admitted to hospital, with a return of spontaneous circulation, following an out-of-hospital cardiac arrest (OHCA)

PRE-HOSPITAL CARE

MESSAGE 1. BYSTANDER CARDIOPULMONARY RESUSCITATION, INCLUDING USE OF PUBLIC ACCESS DEFIBRILLATORS, IMPROVES OUTCOME

Patients whose OHCA was **witnessed** had a **2.5x greater chance of survival to hospital discharge** compared with an unwitnessed OHCA	**35.5%** (145/409) patients in this study who received **bystander CPR survived** to **hospital discharge** compared with **20.0%** (21/105) patients who did not	A **public access defibrillator** was used on **16.9%** (28/166) of the patients where a defibrillator was used. 18 of the 28 patients were discharged home

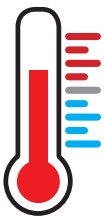
IN-HOSPITAL CARE

MESSAGE 2. STANDARDISING ADVANCE TREATMENT PLANS HELPS PATIENTS RECEIVE REALISTIC TREATMENT BASED ON THEIR WISHES E.G. 'DO NOT ATTEMPT CARDIOPULMONARY RESUSCITATION' (DNACPR) DECISIONS

3.2% (21/661) of patients had a **DNACPR** decision in place **prior** to the admission and a further **48.9%** (323/661) had a DNACPR decision made **during** the **admission**	An **electronic system** for **advanced care directives that included DNACPR** decisions was in place in **36.5%** (65/178) of hospitals	**Integration** of electronic systems with **ambulance** services was in place in **23/65** hospitals and with **general practice** in **36/65** hospitals

MESSAGE 3. DELAYING THE ASSESSMENT OF NEUROLOGICAL PROGNOSIS BY AT LEAST 72 HOURS AFTER THE RETURN OF SPONTANEOUS CIRCULATION AIDS DECISION-MAKING

Formal prognostication took place in **48.0%** (134/279) of patients where it was indicated	**Timing** of neuroprognostication was **not appropriate** for **19.8%** (26/131) of patients in the view of the case reviewers	The final assessment of **neurological prognosis** was made **<72 hours** after hospital admission for **57/84** patients



MESSAGE 4. ENSURE GOOD TEMPERATURE CONTROL IS USED FOLLOWING AN OHCA AS UNCONTROLLED TEMPERATURE IS ASSOCIATED WITH A WORSE OUTCOME

A **policy** for **targeted temperature management** was available in **77.8%** (130/167) of hospitals	**41.4%** (104/253) patients admitted to **intensive care** within 24 hours of return of spontaneous circulation, **did not receive targeted temperature management** when it was indicated	**Temperature management** was rated as **'good'** in only **18.7%** (41/219) of patients and as **'poor or unacceptable'** in **57.5%** (126/219) patients

ONGOING CARE

MESSAGE 5. PROVIDE ONGOING PHYSICAL, NEUROLOGICAL, CARDIAC AND EMOTIONAL SUPPORT TO ENSURE GOOD QUALITY OF LIFE FOR SURVIVORS OF AN OHCA

71.1% (133/187) of OHCA survivors were assessed for **physical rehabilitation**	**29.4%** (55/187) of OHCA survivors were assessed for **neurological rehabilitation**	**59.0%** (72/122) of OHCA survivors were offered **cardiac rehabilitation** (where applicable)	**20.0%** (21/105) of OHCA survivors were offered **psychological review**

Recommendations

Line of sight between the recommendations, key findings and existing supporting evidence

Suggested groups to action the recommendation are shown in italics after each one, this is a guide only, not exhaustive. ***The term 'healthcare professionals' includes but is not limited to: doctors, surgeons, nurses, general practitioners, physiotherapists, speech and language therapists and occupational therapists***		**# represents the number of the supporting key finding and the page number in the main report**	**Associated guidelines and other related evidence**
1	Implement whole population strategies to increase the rate of cardiopulmonary resuscitation (CPR) by bystanders and the use of public access defibrillators. ***Target audiences: Public health departments of all UK countries and Crown Dependencies****, with support from the Resuscitation Council UK*	**CHAPTER 2 – PAGE 27** #12. 145/409 (35.5%) patients who received bystander CPR survived to hospital discharge compared with 21/105 (20.0%) patients where bystander CPR was not administered **CHAPTER 2: PAGE 28** #15. A public access defibrillator (PAD) was used in 28/166 (16.9%) of the patients where a defibrillator was used #16. When a public access defibrillator (PAD) shock was delivered, 18/28 patients were discharged to their usual place of residence with a further 6/28 transferred to another hospital for ongoing care	*https://www.resus.org.uk/library/2015-resuscitation-guidelines/adult-basic-life-support-and-automated-external* *https://www.resus.org.uk/about-us/news-and-events/rcuk-statement-covid-19-guidance-bystander-cpr* *https://www.bhf.org.uk/how-you-can-help/how-to-save-a-life* *https://gov.wales/public-attitudes-towards-bystander-cpr-and-defibrillation-preliminary-findings* *https://gov.wales/out-hospital-cardiac-arrest-plan*

2	Put effective systems in place to share existing advance treatment plans (such as ReSPECT*) between primary care services, ambulance trusts and hospitals so that people receive treatments based on what matters to them and what is realistic in terms of their care and treatment. ***Target audiences: Local commissioners**, with support from primary care, ambulance trusts and care home providers*	**CHAPTER 2: PAGE 22** #6. 21/661 (3.2%) patients had a 'do not attempt cardiopulmonary resuscitation' (DNACPR) decision in place prior to the admission #7. At 65/178 (36.5%) hospitals an electronic system was in place for advanced care directives that included DNACPR decisions #8. Where electronic systems existed, integration with ambulance services was included in 23/65 hospital systems and in general practice in 36/65	
3	Do not use a single factor such as time to the return of spontaneous circulation, blood lactate or pH to make decisions about organ support or interventions in critical care. No single factor on admission accurately predicts survival after an out-of-hospital cardiac arrest. ***Target audiences: All clinicians** who see patients after an out-of-hospital cardiac arrest and relevant clinical directors*	**CHAPTER 7: PAGE 71** #74. For those patients who achieved ROSC in less than 20 minutes, 68/136 (50.0%) patients survived. For those patients in which sustained ROSC took longer than 20 minutes to achieve, 9/143 (6.3%) survived **CHAPTER 7: PAGE 72** #75. 4/35 patients with an initial lactate of >14 mmol/L survived. The highest lactate level noted in a survivor was 19.8 mmol/L	
4	Optimise oxygenation for patients with a return of spontaneous circulation as soon as possible after hospital admission, by: • Measuring arterial blood gasses • Prescribing oxygen • Documenting inspired oxygen concentration (or flow rate) and • Monitoring oxygen saturation • Adjusting inspired oxygen concentration to achieve an arterial oxygenation saturation target of 94–98% ***Target audiences: All clinicians** who see patients after an out-of-hospital cardiac arrest and relevant clinical directors*	**CHAPTER 4: PAGE 38** #29. 172/319 (53.9%) patients were hyperoxaemic on their arrival to the emergency department with an oxygen saturation of >98% #30. A blood gas analysis was performed in 383/416 (92.1%) patients in the emergency department - in 236/383 (61.6%) patients, this was an arterial blood gas and in 97/383 (25.3%) patients, it was a venous blood gas analysis	
5	On admission after an out-of-hospital cardiac arrest, prioritise patients for coronary intervention, in line with the European Society of Cardiology current guidelines, because a primary cardiac cause for their cardiac arrest is likely. ***Target audiences: All clinicians** who see patients after an out-of-hospital cardiac arrest and cardiology leads*	**CHAPTER 5: PAGE 46** #38. 111/412 (26.9%) patients were taken to the cardiac catheter laboratory during their admission #39. The case reviewers considered that there was a delay in the patient going to the catheter laboratory in 26/105 (24.8%) instances **CHAPTER 5: PAGE 47** #40 For 57/107 (53.3%) patients taken to the cardiac catheter laboratory, coronary revascularisation was indicated	*https://cprguidelines.eu/sites/573c777f5e61585a053d7ba5/content_entry5f8e9d3b4c848637d1e4d1a5/5f8f00124c848608eee4d1cd/files/Draft_ERC-ESICM_GL2020_PostResusCare_for_posting.pdf*

6	Use active targeted temperature management during the first 72 hours in critical care to prevent fever (temperature over 37.5^{O}C) in unconscious patients after an out-of-hospital cardiac arrest. ***Target audiences: Critical care leads*** *and critical care clinical staff* *See also the Resuscitation Council UK guidelines*	**CHAPTER 6: PAGE 56** #53. A policy for targeted temperature management was available from 130/167 (77.8%) hospitals #54. A temperature control device which uses a feedback loop was available at 67/137 (48.9%) hospitals **CHAPTER 6: PAGE 57** #55. Clinicians reported that 172/350 (49.1%) patients admitted to critical care had TTM **CHAPTER 6: PAGE 58** #57. 104/253 (41.4%) patients admitted to intensive care with a best GCS lower than 13 within 24 hours of ROSC, did not receive TTM **CHAPTER 6: PAGE 59** #58. When TTM was used, the patient's temperature still rose above 37.5^{O}C in 16/75 patients in the first 24 hours, 19/64 between 24 and 48 hours and 19/46 between 48 and 72 hours **CHAPTER 6: PAGE 60** #59. Case reviewers rated the temperature management as 'good' in only 41/219 (18.7%) patients and as 'poor' or 'unacceptable' in 126/219 (57.5%) #60. Case reviewers considered that the approach to temperature management was 'poor' or 'unacceptable' in a greater proportion of patients when TTM was not used (48/113; 42.5% vs 78/106; 73.6%)	*www.resus.org.uk/library/2015-resuscitation-guidelines/guidelines-post-resuscitation-care#1-the-guidelines*
7	Assess neurological prognosis in unconscious patients after an out-of-hospital cardiac arrest, using at least two of the following methods: • Clinical assessment • Imaging • Neurophysiological assessment (including electroencephalogram, to exclude subclinical seizures and improve accuracy) • Biomarkers ***Target audiences: Critical care leads*** *and critical care clinical staff*	**CHAPTER 6: PAGE 55** #51. 108/407 (26.5%) patients had documentation of a seizure #52. EEG was used as part of the prognostication process for 56/128 (43.8%) patients and in 43/67 patients where seizure activity was noted **CHAPTER 6: PAGE 64** #64. CT was the most common imaging modality used for neurological prognostication (97/134; 72.4%) #65. In 30/134 (22.4%) patients, no imaging modality was used for neuroprognostication #66. EEG was used for neurological prognostication in 55/134 (41.0%) patients	*www.resus.org.uk/library/2015-resuscitation-guidelines/guidelines-post-resuscitation-care#1-the-guidelines*
8	Delay the final assessment of neurological prognosis after an out-of-hospital cardiac arrest until AT LEAST 72 hours after return of spontaneous circulation AND the effects of sedation and temperature management can be excluded. This will ensure a reliable assessment. Repeat the assessment if there is any doubt. ***Target audiences: Critical care leads*** *and critical care clinical staff* *See also the Resuscitation Council UK guidelines*	**CHAPTER 6: PAGE 62** #61. Formal prognostication took place in 134/279 (48.0%) patients **CHAPTER 6: PAGE 65** #62. The average time to the final assessment of neurological prognosis was 72 hours (median 70.3 hours) #63. In 57/84 patients, the final assessment of neurological prognostication was made less than 72 hours after hospital admission **CHAPTER 6: PAGE 66** #67. Case reviewers considered that the timing of neuroprognostication was not appropriate for 26/131 (19.8%) patients	*www.resus.org.uk/library/2015-resuscitation-guidelines/guidelines-post-resuscitation-care#1-the-guidelines*

9	Actively explore the potential for organ donation in all patients after an out-of-hospital cardiac arrest and return of spontaneous circulation, who have a planned withdrawal of life sustaining treatment. ***Target audiences: Critical care leads*** *and critical care clinical staff* ****Note the different legal positions in the UK countries***	**CHAPTER 7: PAGE 76** #83. Organ donation was considered and documented for 127/255 (49.8%) patients who died #84. For 114/124 (91.9%) patients, a specialist nurse in organ donation was involved #85. In the instances where organ donation was considered, it occurred in 28/125 (22.4%) patients #86. There were 21/122 (17.2%) sets of case notes reviewed where the case reviewers considered that organ donation could have been considered, but it was not	*https://www.organdonation.nhs.uk/uk-laws/*
10	Identify all survivors of an out-of-hospital cardiac arrest who would benefit from **physical** rehabilitation before hospital discharge and ensure this is offered to them. ***Target audiences: The clinical team caring for the patient after an out-of-hospital cardiac arrest****, supported by the physiotherapy service lead*	**CHAPTER 7: PAGE 75** #79. 133/187 (71.1%) survivors were assessed for physical rehabilitation	*https://cprguidelines.eu/sites/573c777f5e61585a053d7ba5/content_entry5f8e9d3b4c848637d1e4d1a5/5f8f00124c848608eee4d1cd/files/Draft_ERC-ESICM_GL2020_PostResusCare_for_posting.pdf* *https://www.nice.org.uk/guidance/CG83/chapter/1-Guidance#23-months-after-discharge-from-critical-care*
11	Identify all inpatient survivors of an out-of-hospital cardiac arrest who would benefit from **cardiac** rehabilitation before hospital discharge and ensure this is offered to them. ***Target audiences: The clinical team caring for the patient after an out-of-hospital cardiac arrest****, supported by the cardiac rehabilitation service lead.* ***Commissioners****, where these services are not already in place*	**CHAPTER 5: PAGE 46** #41. The case reviewers considered that there was room for improvement in cardiac care in 78/404 (19.3%) patients **CHAPTER 5: PAGE 48** #42. In 130/151 (86.1%) hospitals, survivors of OHCA were routinely assessed by a heart rhythm specialist prior to discharge #43. Clinicians reviewing the records in their own hospital found evidence of a heart rhythm specialist review in 131/196 (66.8%) patients **CHAPTER 7: PAGE 75** #81. Cardiac rehabilitation was offered, where this was applicable, to 72/122 (59.0%) survivors within three months of discharge	*https://cprguidelines.eu/sites/573c777f5e61585a053d7ba5/content_entry5f8e9d3b4c848637d1e4d1a5/5f8f00124c848608eee4d1cd/files/Draft_ERC-ESICM_GL2020_PostResusCare_for_posting.pdf* *https://www.nice.org.uk/guidance/CG83/chapter/1-Guidance#23-months-after-discharge-from-critical-care*
12	Identify all inpatient survivors of an out-of-hospital cardiac arrest who would benefit from **neurological** rehabilitation before hospital discharge and ensure this is offered to them. ***Target audiences: The clinical team caring for the patient after an out-of-hospital cardiac arrest****, supported by the neurological rehabilitation service lead.* ***Commissioners****, where these services are not already in place*	**CHAPTER 7: PAGE 73** #76. It was reported from 70/106 (66.0%) of hospitals that routine assessment of neurological outcome was undertaken prior to a patient being discharged following admission for an OHCA **CHAPTER 7: PAGE 75** #80. 55/187 (29.4%) survivors were assessed for neurological rehabilitation	*https://cprguidelines.eu/sites/573c777f5e61585a053d7ba5/content_entry5f8e9d3b4c848637d1e4d1a5/5f8f00124c848608eee4d1cd/files/Draft_ERC-ESICM_GL2020_PostResusCare_for_posting.pdf* *https://www.nice.org.uk/guidance/CG83/chapter/1-Guidance#23-months-after-discharge-from-critical-care*

13	Identify all inpatient survivors of an out-of-hospital cardiac arrest who would benefit from **psychological** intervention before hospital discharge and support and ensure this is offered to them. ***Target audiences: The clinical team caring for the patient after an out-of-hospital cardiac arrest***, *supported by the clinical psychology service lead.* ***Commissioners****, where these services are not already in place*	**CHAPTER 7: PAGE 74** #77. In hospitals from which an answer was received, neurorehabilitation was not available in 22/121 (18.2%) hospitals and psychological support was not available in 63/123 (51.2%) **CHAPTER 7: PAGE 75** #82. 21/105 (20.0%) survivors were offered psychological review. Notably it was not known if psychological review was offered to 92/218 (42.2%) survivors	*https://cprguidelines.eu/sites/573c777f5e61585a053d7ba5/content_entry5f8e9d3b4c848637d1e4d1a5/5f8f00124c848608eee4d1cd/files/Draft_ERC-ESICM_GL2020_PostResusCare_for_posting.pdf* *https://www.nice.org.uk/guidance/CG83/chapter/1-Guidance#23-months-after-discharge-from-critical-care*

Method and data returns

Study Advisory Group

A multidisciplinary group of clinicians was convened to define the objectives of the study and advise on the key questions. The Study Advisory Group (SAG) comprised healthcare professionals in emergency medicine, cardiology, acute medicine, critical care, anaesthetics and paramedics, and lay/patient representatives. This group steered the study from design to completion.

Study aim

To identify variation and remediable factors in the processes of care provided to patients over the age of 16 years admitted to hospital following an out-of-hospital cardiac arrest (OHCA).

Objectives

The SAG identified a number of objectives that would address the primary aim of the study. These included:

- Phases and consistency of care
- Pre-hospital, emergency department and cardiac pathways
- Critical care
  - Method/frequency of temperature control
  - How and when prognostication was undertaken
  - Withdrawal of treatment
- Assessment by heart rhythm specialists
- Availability of rehabilitation support
- Agreed management protocols and adherence to them

Study population and sampling criteria

Inclusion

- Adult patients (aged 16 years and older) who arrived in hospital after sustaining an OHCA and achieved subsequent sustained return of spontaneous circulation (ROSC) for more than 20 minutes.

Exclusion

- Patients admitted to hospital following an OHCA and ROSC, but where the OHCA was due to trauma, drowning, drug overdose or poisoning.
- Patients whose cardiac arrest occurred during inter-hospital transfers or on acute NHS hospital premises.

Sampling criteria

- All patients meeting the inclusion criteria from 1st January to 31st December 2018, inclusive, were notified to NCEPOD.
- From the whole group, a maximum of nine patients per hospital were randomly selected and data on their care collected.

Hospital participation

NHS hospitals in England, Scotland, Wales and Northern Ireland were expected to participate, as well as public hospitals in the Isle of Man, Guernsey and Jersey.

Data collection

Spreadsheet

A pre-set spreadsheet was provided to every local reporter to identify all patients meeting the study inclusion criteria during the defined time period. From this initial cohort, the sampling for inclusion into the study took place.

Questionnaires
Two questionnaires were used to collect data for this study: a clinician questionnaire for each patient and an organisational questionnaire for each participating hospital.

Clinician questionnaire
This questionnaire was sent to the named consultant caring for the patient at the time of their admission to hospital/ emergency department episode, post-OHCA. Information was requested on the patient's presenting features, initial response, management in critical care (including temperature management and prognostication), cardiology input, discharge, follow-up and organ donation.

Organisational questionnaire
The data requested in this questionnaire included information on the services provided for patients post-OHCA, guidelines and policies relevant to the care of patients sustaining an OHCA, and the availability of specific investigations and interventions.

Case notes
Copies of case note extracts were requested for peer review:

- Ambulance service notes / patient report form (PRF)
- Emergency department clerking proforma / records
- All inpatient annotations including medical and nursing notes
- Critical care notes / charts
- Operation/procedure notes
- Computed tomography (CT) / magnetic resonance imaging (MRI) scans / electrocardiogram (ECG) reports
- Anaesthetic charts
- Observation, fluid balance and drug charts
- Haematology / biochemistry / microbiology results
- Blood gas reports
- Consent forms
- Datix or other serious incident reports
- Autopsy report if applicable
- Do not attempt cardiopulmonary resuscitation forms/ treatment escalation forms
- Discharge letter / summary

Peer review of the case notes and questionnaire data

A multidisciplinary group of case reviewers comprising consultants, trainees and clinical nurse specialists from: cardiology, anaesthesia, intensive care medicine, acute medicine, emergency medicine, interventional radiology and specialist nursing was recruited to peer review the case notes and associated clinician questionnaires.

Questionnaires and case notes had all patient identifiers removed by non-clinical staff at NCEPOD before being presented to the group. Each set of case notes was reviewed by at least one reviewer within a small multidisciplinary meeting using a semi-structured electronic questionnaire. At regular intervals throughout the meeting, the Chair allowed a period of discussion for each reviewer to summarise their cases and ask for opinions from other specialties or raise aspects of the case for discussion.

The grading system below was used by the case reviewers to grade the overall care each patient received:

- **Good practice:** A standard that you would accept from yourself, your trainees and your institution
- **Room for improvement:** Aspects of **clinical** care that could have been better
- **Room for improvement:** Aspects of **organisational** care that could have been better
- **Room for improvement:** Aspects of both **clinical and organisational** care that could have been better
- **Less than satisfactory:** Several aspects of clinical and/or organisational care that were well below the standard that you would accept from yourself, your trainees and your institution
- **Insufficient data:** Insufficient information submitted to NCEPOD to assess the quality of care

Information governance

All data received and handled by NCEPOD complied with all relevant national requirements, including General Data Protection Regulation 2016 (Z5442652), Section 251 of the NHS Act 2006 (PIAG 4-08(b)/2003, App No 007), PBPP (1718-0328) and the Code of Practice on Confidential Information.

Each patient was allocated a unique NCEPOD number. The data from all questionnaires were submitted through a dedicated online application. Prior to any analysis taking place, the data were cleaned to ensure that there were no duplicate records and that erroneous data had not been entered. Any fields that contained data that could not be validated were removed.

Data analysis

Following cleaning of the quantitative data, descriptive data summaries were produced. Qualitative data collected from the case reviewers' opinions and free-text answers in the clinician questionnaires were coded, where applicable, according to content to allow quantitative analysis. The data were reviewed by NCEPOD clinical co-ordinators and a clinical researcher and researcher to identify the nature and frequency of recurring themes.

Data analysis rules

Small numbers were supressed if they risked identifying an individual.

Any percentage under 1% has been presented as <1%.

Percentages were not calculated if the denominator was less than 100 except for comparison of percentage across a group.

If data were not displayed in a table or figure the text has been referenced with '(data not shown)'

Anonymised case studies have been used to illustrate particular themes.

The findings of the report were reviewed by the SAG, case reviewers, NCEPOD Steering Group including clinical co-ordinators, trustees and lay representatives prior to publication. In addition the recommendations were independently edited and the report proofread by two external proof readers.

Data returns

Clinical data

In total 9,422 patients were identified as meeting the study inclusion criteria (Figure 1.1). Up to nine patients per hospital were randomly selected for review of their care. This resulted in 1,469 patients being included in the initial sample. A total of 423/1,469 (28.8%) patients were excluded as they did not meet the study inclusion criteria when the case notes were reviewed locally. The most common reason for exclusion was that sustained ROSC was not achieved. For the remaining sample, 699/1,046 (66.8%) completed clinician questionnaires were included in the analysis and a representative sample of 416/1,046 (39.8%) sets of notes were peer reviewed by the case reviewers.

Organisational data

Organisational questionnaires were returned from 182/220 (82.7%) hospitals.

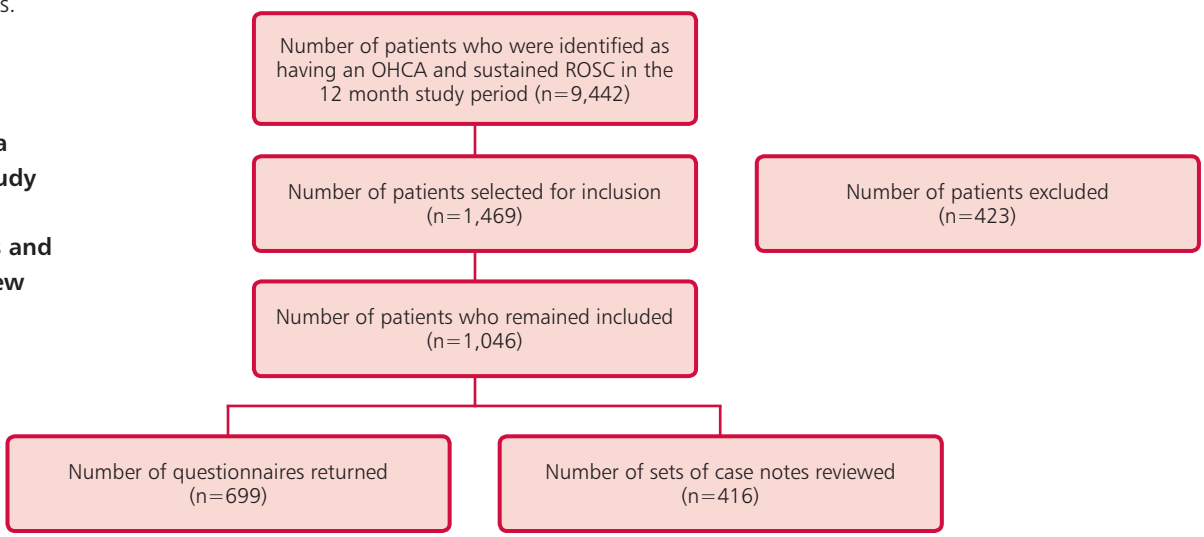


Figure 1.1 Data returns and study inclusion for questionnaires and case note review

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