

OHCAR

Out of Hospital Cardiac Arrest Register
Ireland

Annual Report 2015



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Executive Summary

All Out-of-Hospital Cardiac Arrest Register (OHCAR) patients

In 2015, there were 2,219 incidences recorded, this equates to 48 incidences per 100,000 persons.

Of the data available-

- Most events occurred in an urban area (n=1,416/2,090, 68%)
- Males accounted for the majority of all events (n=1,517/2,216, 68%)
- The median age was 67 years, ranging from <1 - 102
- Most patients were presumed to be of a medical aetiology (n=1,953/2,219, 88%)
- The majority of incidences occurred in the home (n=1,528/2,208, 69%)
- Half of all cases were witnessed by a bystander (n=1,059/2,127, 50%)
- Seventy four percent of bystanders that had witnessed an event, would initiate Cardio-Pulmonary Resuscitation (CPR)
- Defibrillator pads were applied prior to the arrival of the Emergency Medical Services in 17% of cases (n=359/2,121)
- Thirty five percent of patients had defibrillation performed (n=747/2,153), of these 18% had first shock performed before EMS arrival (n=133/738)
- Twenty one percent of cases (n=452/2,147) presented in a shockable rhythm, Ventricular Fibrillation (VF) being the most common
- 747 out of 2,153 patients were defibrillated (35%)
- Of the 747 cases that had defibrillation attempted, 305 (41%) were initially unshockable
- Advanced airways was used in 63% of cases (n=1,349/2,150) with 73% of patients having a cannula inserted (n=1,613/2,219)
- Sixty nine percent of patients would receive epinephrine (n=1,524/2,211)
- Twenty six percent of cases would experience Return of Spontaneous Circulation (ROSC) pre-hospital (n=559/2,160)
- Eighteen percent of patients would have ROSC on arrival at hospital (n=389/2,145)
- A total of 148 patients were discharged alive giving a survival rate of 6.7% (n=148/2,209)
- Survivors were more likely to be –
 - Younger than non-survivors, with a presumed medical aetiology
 - Have had a witnessed event, having collapsed in a public, urban area
 - Receive bystander CPR
 - Be in a shockable rhythm on presentation
- Ninety two percent of surviving patients had good to moderate neurological function on discharge from hospital (n=103/112).

Utstein Group

- A total of 299 patients were classed as adults (> 18), bystander witnessed, in a presumed medical aetiology and presented in a shockable rhythm (299/2219, 13.5%)
- Fifty percent of this comparator group achieved ROSC pre-hospital (n=147/299)
- Twenty seven percent were discharge alive from hospital (n=79/297)
- Ninety five percent had a good CPC (n=59/63).

Introduction

The National Out-of-Hospital Cardiac Arrest Register (OHCAR)

The National Out-of-Hospital Cardiac Arrest Register (OHCAR) project was established in June 2007 in response to a recommendation in the *“Report of the Task Force on Sudden Cardiac Death”*¹. The need for OHCAR has been reinforced in the policy document *“Changing Cardiovascular Health”*² and the *“Emergency Medicine Programme Strategy”*³. Since 2012, OHCAR has become one of a small number of OHCA registries in Europe with national coverage. Many other European countries operate out of hospital cardiac (OHCA) arrest registers with partial geographical and/or intermittent coverage.

OHCAR governance and organisation

OHCAR is hosted by the Department of Public Health Medicine in the HSE West (North West region) and is jointly funded by the Pre-Hospital Emergency Care Council (PHECC) and the National Ambulance Service (NAS). It is administered and supported by the Department of General Practice, School of Medicine, NUI Galway.

The OHCAR Steering Group is responsible for ensuring that the aims of OHCAR are fulfilled and for advising on its organisation and direction. The Steering Group includes representatives from all four supporting organisations. The Steering Group met five times from November 2015 to December 2016. The membership as per December 2016 is:

- Dr. Peter Wright, Director of Public Health Medicine, HSE West (NW area) (CHAIR)
- Prof. Gerard Bury, UCD Centre for Immediate Care
- Dr. John Dowling, North West Immediate Care Programme
- Dr. Conor Deasy, Consultant in Emergency Medicine, Cork University Hospital
- Ms. Jacqueline Egan, Programme Development Officer, PHECC
- Dr. Joseph Galvin, Cardiologist, Mater Hospital
- Prof. Andrew Murphy, Department of General Practice, NUI Galway
- Dr. Cathal O'Donnell, Medical Director, National Ambulance Service
- Mr. Gerry Clarke, Operational Support and Resilience Manager, NAS
- David Hennelly Clinical Development Manager, National Ambulance Service, HSE
- Dr. David Menzies CFR Ireland & Consultant in Emergency Medicine St Vincent's University Hospital & Clinical Lead, Emergency Medical Science, UCD, Centre for Emergency Medical Science
- Mr. Martin O'Reilly, District Officer, EMS Support Officer, Dublin Fire Brigade
- Ms. Siobhan Masterson, National Project Manager, Out of Hospital Cardiac Arrest Strategy, National Ambulance Service, HSE & HRB Research Fellow, Department of General Practice, NUI Galway
- Mr. Martin Quinn, OHCAR Manager

The OHCAR Manager reports directly to the OHCAR Director (Director of Public Health Medicine) and is accommodated in the Department of Public Health Medicine, HSE North West and the Discipline of General Practice, NUI Galway. The OHCAR Manager is guided in his work by the Steering Group and also receives academic support from the Discipline of General Practice, NUI Galway. The OHCAR Manager is assisted by Research Assistant Mr. Stephen Daly, and HSE NAS Paramedic Ms. Claire Mulligan, as OHCAR Administrator.

Aim of OHCAR

The overall aim of OHCAR is to facilitate improved outcomes from out of hospital cardiac arrest (OHCA) in Ireland by way of

- Collecting information on the population who suffer an OHCA and the circumstances of the arrest
- Collecting information on the pre-hospital treatment of OHCA patients
- Registering the survival of OHCA patients
- Establishing a sufficiently large patient database to enable identification of the best treatment methods for OHCA, and organisation of services
- Providing regular feedback to service providers.

Inclusion criteria

OHCAR registers “all patients who suffer a witnessed or unwitnessed out-of-hospital cardiac arrest in Ireland which is confirmed and attended by Emergency Services and resuscitation attempted”. A resuscitation attempt is defined as performance of CPR and/or attempted defibrillation. Incidents attended by the Emergency Services where resuscitation is not attempted due to obvious signs of death, injuries incompatible with life, or a ‘do not resuscitate’ order are *not* included in OHCAR. The current scope does not include patients who suffer an OHCA and who are not attended at any stage by Emergency Services. This means that a sub-group of patients are likely to be excluded from OHCAR, most notably cases attended by a GP where resuscitation is attempted but death is confirmed, and the ambulance is stood down by the GP.

Source of OHCAR data

The primary source of OHCAR data are Patient Care Records (PCRs) and ambulance dispatch data from the two statutory ambulance services, the National Ambulance Service (NAS) and the Dublin Fire Brigade (DFB). OHCAR has data sharing agreements with other organisations including the Dublin Airport Authority, Red Cross, Civil Defence and Irish Coastguard and Order of Malta, but presently almost all data is provided from statutory services.

At present, the valuable work being done by community first responder groups (CFRs) is not fully reflected in OHCAR data. These groups are usually community based and voluntary. OHCAR is working to find ways of capturing and recording this information for further analysis.

Acute hospitals in Ireland provide information on survival status and Cerebral Performance Category (CPC) score ^a.

Data collection

OHCAR collects data using the internationally agreed Utstein dataset ⁴.

National Ambulance Services: PCRs are collected from ambulance stations on a monthly basis, scanned electronically and stored on a central database by IMSCAN (Ireland) Ltd. PCRs for OHCA incidents are prioritised by NAS staff and fast-tracked in order to facilitate OHCAR. IMSCAN enter OHCAR data elements onto a preliminary database file and forward this and copies of the electronic PCRs to OHCAR. Following validation, OHCAR staff upload the data onto the OHCAR database.

^aCerebral Performance Category (CPC) score is an assessment score developed to assess both traumatic and anoxic cerebral injuries.

OHCAR receives NAS dispatch data monthly from the National Emergency Operations Centre (NEOC) in Tallaght and this data is added to each record in the OHCAR database.

Dublin Fire Brigade (DFB): PCRs are sourced by DFBs EMS support Unit and data is provided to OHCAR on a quarterly basis in a summarised electronic format. These records are integrated with data from the DFB dispatch centre. Electronic copies of DFB PCRs are also sent to OHCAR to enable validation to be carried out.

Hospitals: OHCAR has a data sharing agreement with all hospitals who receive OHCA patients except Crumlin Our Lady's Children's Hospital. Collection of data from hospitals is facilitated by a range of hospital staff including administrators, resuscitation officers, clinical nurse managers and consultants.

Data completeness and quality control

The Utstein guidelines state that, "organisers of out-of-hospital cardiac arrest (OHCA) registries should implement monitoring and remediation for completeness of case capture"⁴. OHCAR operates a 'missing case search' system, which is performed on a monthly basis and again annually in order to identify cases that are not processed through the OHCAR data collection system and hence not reported to OHCAR directly⁹. Missing case identification was introduced to OHCAR during 2012 and 2013 and a comprehensive systematic process has been in operation since January 2014.

The accuracy and completeness of data elements of each OHCAR case is vital to the usefulness of the register. Responsibility for accurate and comprehensive data recording lies with the emergency practitioners who attend the OHCA scene. OHCAR works with NAS and DFB to enhance completeness by providing quarterly reports which include a summary of the availability of some core data elements. NAS then devises and circulates OHCAR summary reports to ambulance stations on a quarterly basis, DFB also provide each practitioner access to their quarterly reports. The purpose of this is to highlight the importance of data completeness and to stimulate greater compliance.

The following data quality checks are undertaken:

- Case duplicate searches
- Checking for inconsistent and/or conflicting data values
- Validation of initial data entries and against OHCAR inclusion criteria.
- Clinical expertise is provided on a case by case basis by members of the OHCAR Steering Group when required

OHCAR reporting to Service Providers

Monthly/quarterly summary reports

OHCAR has provides monthly summary reports of OHCAR cases and outcomes of Utstein comparator cases to the National Ambulance Service ^b. In addition, quarterly summary reports are also provided. The outcomes of the Utstein comparator group in the quarterly reports are a component of the NAS key performance indicators.

^bThe Utstein comparator subset (comparator subset) includes patients considered to have the greatest chance of survival i.e.: adults (i.e. greater than seventeen years of age); presumed medical aetiology; bystander witnessed; initial shockable rhythm

Quarterly regional reports

OHCAR provides detailed regional quarterly reports to the NAS. These include descriptive data elements and outcome variables at regional level and constitute the data source for reports circulated by NAS to stations via the ONELIFE initiative, which is a NAS run quality improvement programme. A quarterly report is provided to DFB with outcome data and descriptive information. OHCAR Annual reporting is done on the geographical regions of West, South and combines the DFB with the Eastern NAS region.

OHCAR meetings and representations

- EMS Gathering 8th – Killarney June 2016
- EuReCa Two Meeting: Reykjavik September 2016
- ERC congress: Reykjavik September 2016
- OHCAR steering group meetings November 2015, January 2016, May 2016 and September 2016

OHCAR presentations

- “The importance of CFR in OHCAR”. National Cardiac First Responder Conference, Tullamore, March 2015.

OHCAR Research

Research projects approved by OHCAR Steering Group Dec 2015 – Sept 2016:

Principal Investigator	Title
Dr. Richard Tanner	<i>Resuscitation of out of hospital cardiac arrests in the older population survival rates and the factors influencing survival (In Press)</i>
Prof. Gerard Bury	<i>Medical Emergency Responder Integration and Training Three (MERIT3). Utilisation of a novel Ambulance Service alerting system to prompt GP first responders to nearby cardiac arrests.</i>

European Registry of Cardiac Arrest Study TWO (EuReCa TWO)

Following on from the success of EuReCa ONE⁵, EuReCa TWO was launched in Reykjavik, Iceland in September 2016. EuReCa TWO is a study of the European Resuscitation Council (ERC) and is a prospective, multi-centre, three month survey of epidemiology, treatment and outcome of patients suffering an out-of-hospital cardiac arrest in Europe. OHCAR will provide OHCA data for incidents in Ireland during 2017 to the EuReCa TWO study. The OHCAR Director is the EuReCa Two National Coordinator for Ireland and Siobhan Masterson is part of the EuReCa TWO Study Management Team. OHCAR representatives have regularly attended EuReCa meetings with the other National Coordinators and the Study Management Team.

Ireland and the EuReCa ONE study

- In October 2014, Ireland participated in the EuReCa ONE study – a one month survey of OHCA cases in 27 countries across Europe ^{10,5}
- Ireland was one of only seven countries that contributed data for the entire country for the study period
- During the study period the rate of OHCA where resuscitation was attempted per 100,000 population per year in Ireland was similar to the overall EuReCa ONE rate (44 vs. 49 respectively)
- ROSC was achieved pre-hospital in 29% of all EuReCa ONE study cases. The proportion of ROSC in Ireland during the study period was 26%. The overall EuReCa ONE proportion of ROSC at arrival to hospital was 25%. In Ireland the proportion was 16%
- During EuReCa ONE, the percentage of patients discharged alive in Ireland was 5.9% while the proportion for the overall study population was 10.3%

Utstein Subgroup

- The proportion of ROSC in the EuReCa ONE Utstein subgroup was 57% compared with 58% in the Irish Utstein subgroup for the study period
- The proportion of survival to discharge alive across Utstein patients in collaborating countries was 30% compared with 33% of the Irish Utstein subgroup.

A geographic model for improving out-of-hospital cardiac arrest survival in Ireland

Ms Siobhan Masterson commenced a three year HRB Research Training Fellowship in January 2015 entitled 'A geographic model for improving out-of-hospital cardiac arrest survival in Ireland'.

Research Consortium

The OHCAR Research Consortium is a forum established by the OHCAR Steering Group. The aim of the consortium is to foster and support researchers and research in out-of-hospital cardiac arrest. The group has met twice since its inception.

OHCAR Publications

Since the issuing of the 2014 OHCAR Annual Report, the following papers have been published:

- Masterson S, Cullinan J, Teljeur C, Vellinga A. The Spatial Distribution of Out-of-Hospital Cardiac Arrest and the Chain of Survival in Ireland: An Analysis across the Urban-Rural Spectrum. *Irish Geography* 2016; **In press**
- Masterson S, Cullinan J, McNally B, et al. Out-of-hospital cardiac arrest attended by ambulance services in Ireland: first 2 years' results from a nationwide registry. *Emergency Medicine Journal* 2016; **33**: 776-81
- Masterson S, Jensen M. *Complying with Utstein guidelines: Comprehensive case identification in the Irish national out-of-hospital cardiac arrest register. *Resuscitation* 2016; **100**: e3. *Joint lead authors

Appendix 1 includes a list of publications with OHCAR involvement to date.

Future developments in OHCAR

OHCAR datahub

A centralised web enabled database is required to improve the data capture, efficiency of operating the register and data quality of OHCAR. NAS is implementing an electronic PCR and funding has been secured to develop an OHCAR database which will be aligned with the electronic PCR system.

Missing cases and data quality

Approximately 12% of OHCAR were identified via missing case searches in 2015. OHCAR is working with NAS and DFB to communicate the importance of timely and comprehensive reporting of cases to OHCAR.

Data accuracy and completeness can be improved by encouraging emergency practitioners who attend the scene and dispatchers to give a complete and accurate account of the OHCA event. It is expected that the use of electronic PCRs, more comprehensive dispatch data and electronic data from defibrillators will enhance OHCAR data quality when they are implemented.

Research

OHCAR now has four years of national OHCA data. The growing database increases the capacity for research. The following research activities are planned:

- EuReCa TWO. The European Resuscitation Council (ERC) plan to conduct a three month study in 2017 similar in design to EuReCa ONE. OHCAR will contribute national data to this project
- The OHCAR Research Consortium and OHCAR Steering Group will continue to support ongoing research and foster new ideas for OHCA research.

RESULTS – all OHCA cases 2015

INCIDENCE

In 2015, a total of **2,219** OHCA resuscitation attempts were attended by the National Ambulance Service, Dublin Fire Brigade and Dublin Airport Authority. Of these, 88% were reported directly to OHCAR and 12% were identified during missing case searches. This equates to 48 OHCA resuscitation attempts per 100,000 persons during 2015, (up from 43/100,000 in 2014). In Europe, the incidence of out-of-hospital cardiac arrest is estimated at between 38 and 86 per 100,000 per year.^{6,7}

The majority of OHCA incidents were presumed to be of medical aetiology (43/100,000 persons/year) compared to a small proportion of cases of non-medical aetiology (6/100,000 persons/year). The West Area reported the highest incidence at 54/100,000 persons/year. (Total population figures from 2011 Census of Population⁸)



Figure 1: Incidence of OHCA with resuscitation attempts per 100,000 in 2015

URBAN RURAL DIFFERENCES

The geographical coordinates of incidence locations were identified using the HSE application 'Health Atlas'. Of the 2,090 incidents that could be geocoded, the majority of incidents occurred in urban areas (n=1,416; 68%) while 674 incidents occurred in rural areas (32%). A total of 129 cases (5.8%) could not be geocoded due to insufficient address data or because the event occurred during ambulance transport. The incidence of cases per 100,000 cases was 44/100,000 in urban areas and 39/100,000 in rural areas.

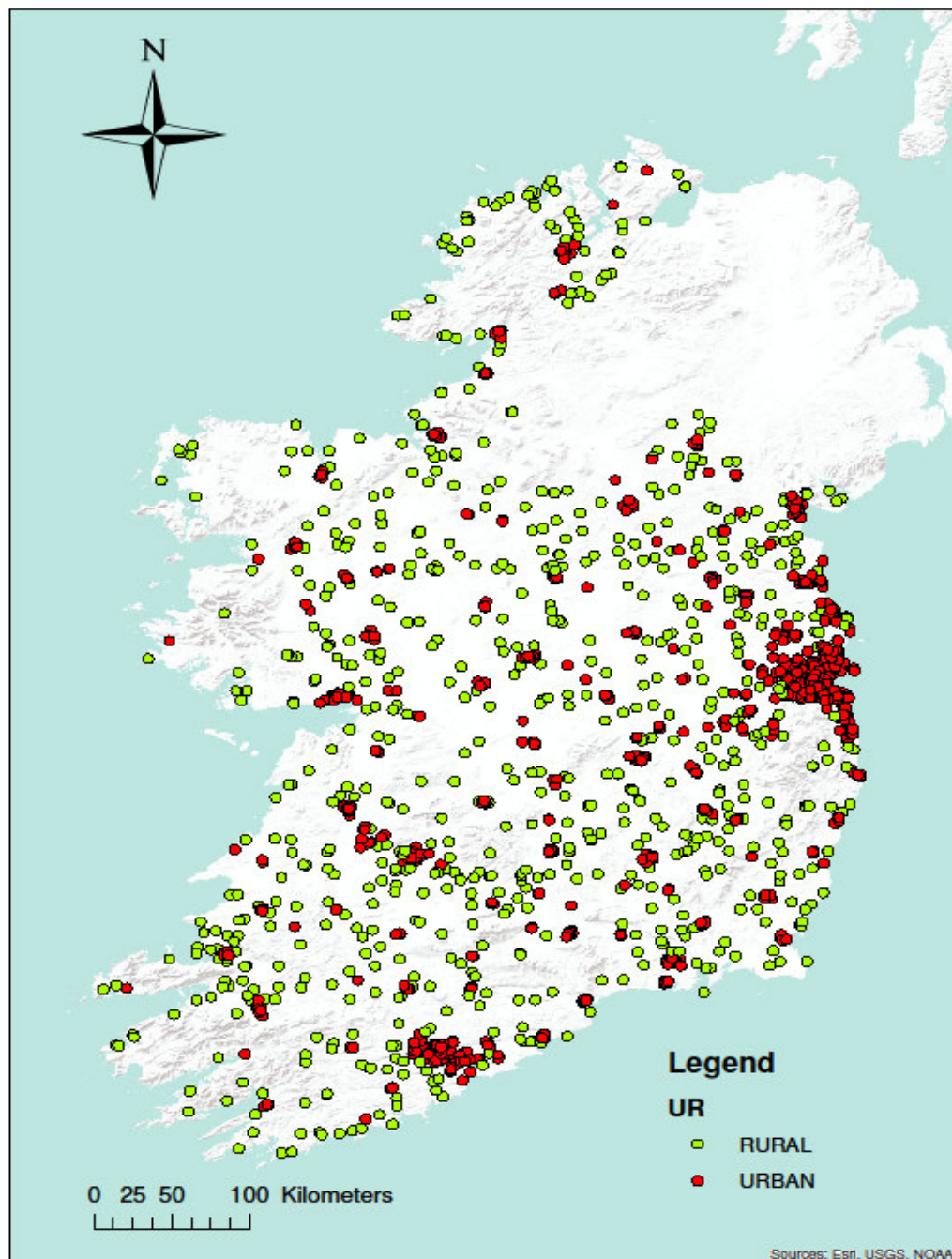


Figure 2: Geographical location of OHCA incidents with rural/urban classification

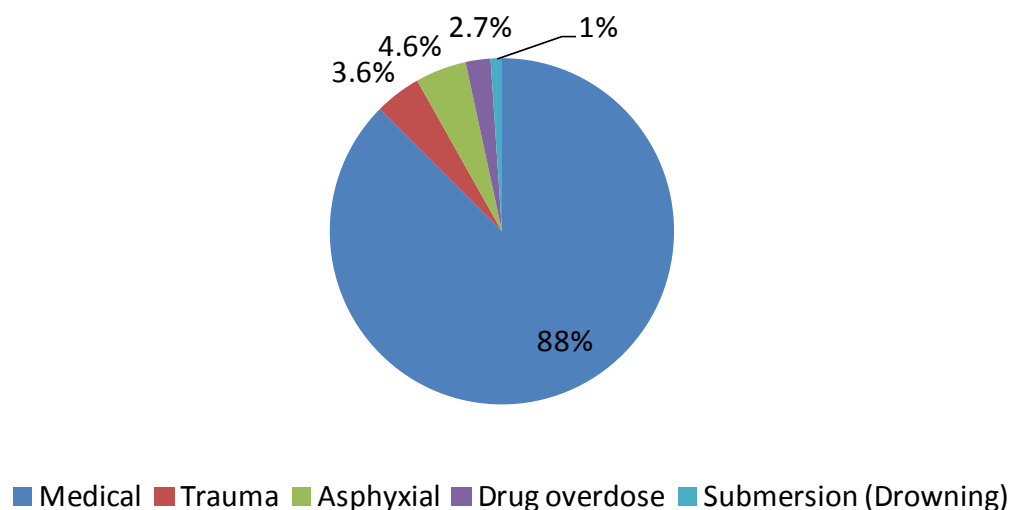
PATIENT DEMOGRAPHY

- 1,517 patients were male (68%) and 699 were female (32%). Gender was not specified for three patients
- Patients ranged in age from less than one to 102 years old (median age 67 years). Age was missing for 50 patients
- The median age for females was 69 years and 67 for males
- The median age of patients in urban and rural areas was 70 years and 69 years respectively.

PRESUMED AETIOLOGY

- The majority of incidents were presumed to be of medical aetiology (n=1,953/2,219; 88%). This category includes cardiac aetiologies, other medical aetiologies and unknown aetiologies
- Non-medical aetiologies included: Trauma (n=80, 3.6%); asphyxial i.e. hanging, foreign body airway obstruction and other external asphyxiations (n=103, 4.6%); submersion (n=23, 1%) and drug overdose (n=60, 2.7%)
- Of all OHCA cases, 87% of male patients had a presumed medical aetiology compared to 90% of female patients
- The median age of patients with a presumed medical aetiology was **69 years and 37 years** for all other aetiologies.

Figure 3: Presumed aetiology (n=2,219)

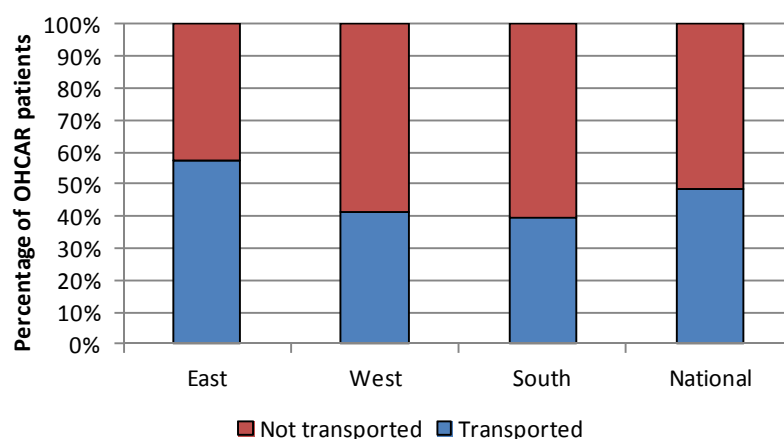


There was no significant difference between the proportion of OHCA cases in rural (90%; n= 606/674) and urban (88%; n= 1,239/1,416) settings for presumed medical aetiology.

TRANSPORT TO HOSPITAL

- Just under half of patients were transported to either an Emergency Department or a cardiac catheterisation laboratory (n=1,074; 48%)
- The percentage of patients who were transported to hospital was 41% in the West, 58% in the East and 39% in the South
- Patients in urban areas were more likely to be transported than patients in rural areas (58% vs. 31%; $p<0.01^c$).

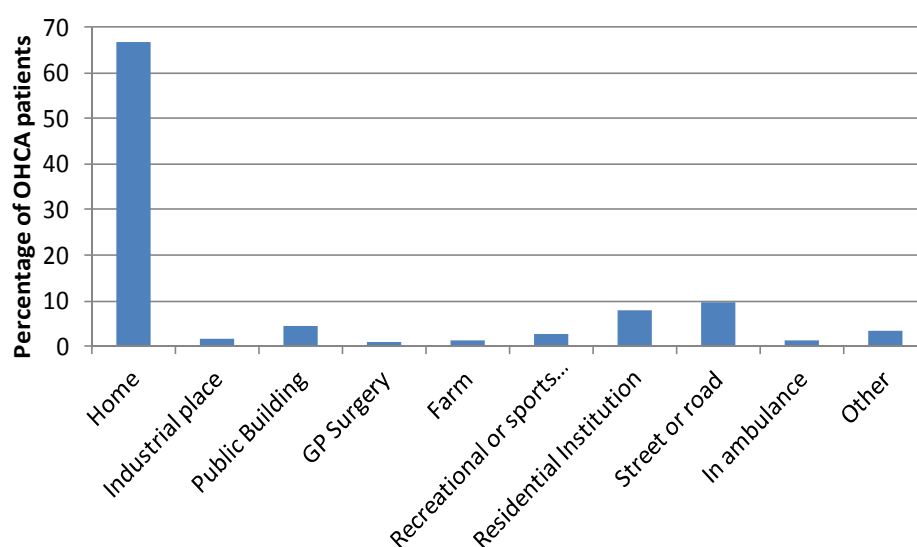
Figure 4: Proportion of patients transported to hospital by NAS area and nationally



EVENT LOCATION

- As shown in Figure 6, of the 2,208 cases for which data was available, two-thirds of incidents occurred at home (n=1,528; 69%)
- In urban settings, a higher proportion of patients collapsed in a public place compared to rural settings (22% vs. 20%; $p=0.302$).

Figure 5: Incident location (n=2,208)

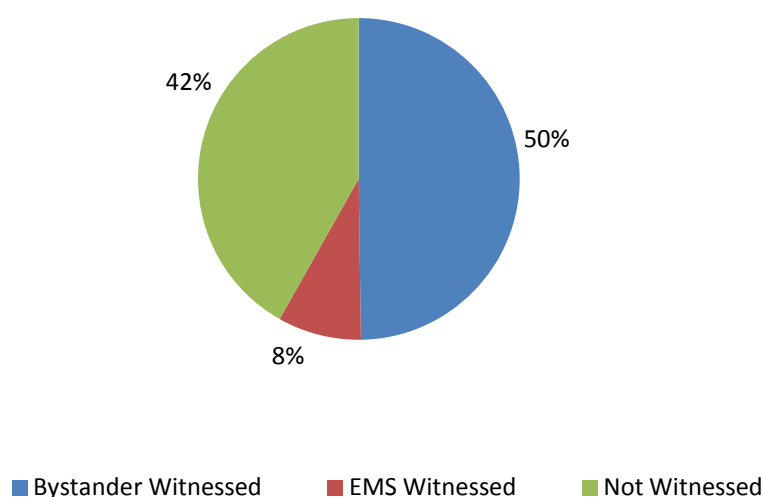


^c The Chi-square test was used to test for statistically significant differences between proportions of cases. A chi square result with a p-value of less than 0.05 was considered to indicate a significant difference in proportions.

WITNESS STATUS

- Of the 2,127 events for which data was available, 1,059 incidents (50%) were witnessed by a bystander and 179 events (8%) were witnessed by Ambulance Service personnel (EMS witnessed). A total of 889 (42%) incidents were not witnessed. Data was missing for 92 incidents
- From data available, a total of 773 events were witnessed in an urban location, 669 events by a bystander (87%), and 104 by the EMS (13%)
- From data available, a total of 397 events were witnessed in a rural location, 337 events by a bystander (85%), and 60 by the EMS (15%).

Figure 6: Witnessed status (n= 2,127)



CALL RESPONSE INTERVAL

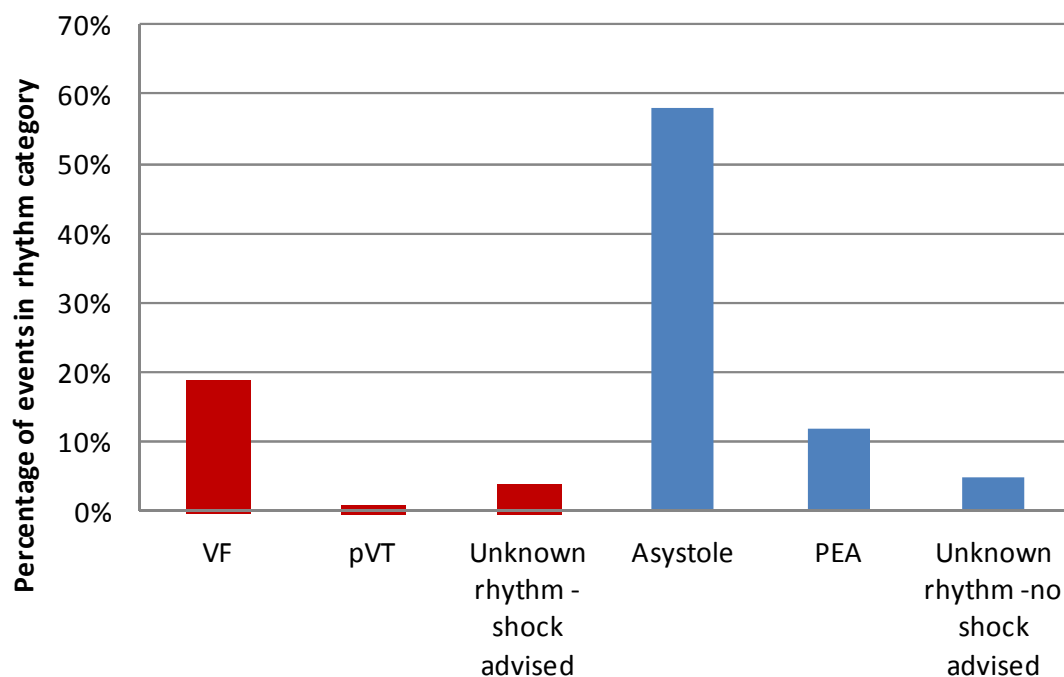
As per the Utstein definition⁴, the call response interval (CRI) is the time from the call received at the dispatch centre to arrival of EMS at the scene. Only CRIs for non-EMS witnessed cases are included in this analysis. At present CFR groups which are activated by the NAS and DFB, do not have their response times robustly captured, and therefore not included in the response intervals reported. As call response interval is not normally distributed, the median value for each category is given:

- All non-EMS witnessed cases 13 minutes (interquartile range 9-20 minutes)
- Rural non-EMS witnessed cases 19 minutes (interquartile range 14 -26 minutes)
- Urban non-EMS witnessed cases 10 minutes (interquartile range 7–15 minutes)
- Utstein comparator group 12 minutes (interquartile range 8-19 minutes).

FIRST MONITORED RHYTHM

- Of the 2,151 cases for which data was available 451 patients (21%) were in a shockable rhythm at time of first rhythm analysis. Patients with a presumed medical aetiology accounted for 96% (n = 435) of all cases that were initially shockable ($p < 0.001$)
- The percentage of patients presenting in a shockable rhythm did not vary between urban and rural settings (20%)
- Asystole was the most common initial rhythm, accounting for 55% (n = 1,211) of all cases. Ventricular Fibrillation (VF) was the second most common initial rhythm at 15% (n = 331) followed by Pulseless Electrical Activity (PEA) at 13% (n = 282).

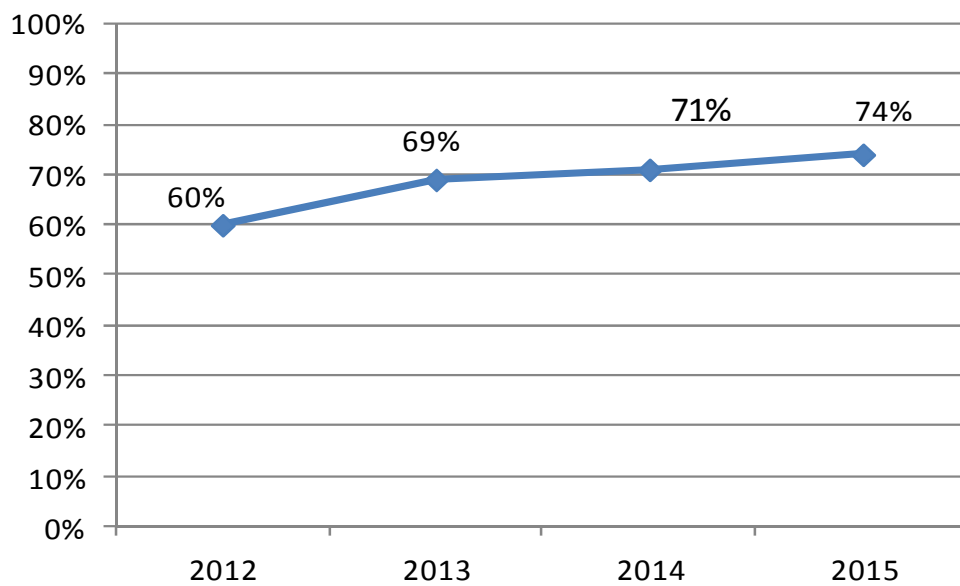
Figure 7: First monitored rhythm (n= 2,151)



BYSTANDER CPR

- Of the 2,040 cases that were not EMS-witnessed, data on bystander CPR was available for 1,961 cases. Bystander CPR was attempted in 74% of these cases. **This is an increase of 3% from 2014 , and 14% since 2012**
- A higher proportion of patients in a rural setting received bystander CPR (514/614) compared to urban settings (891/1,307) (84% vs. 68%; $p<0.001$)).

Figure 8: Percentage of patients receiving bystander CPR before EMS arrival, years 2012 – 2015



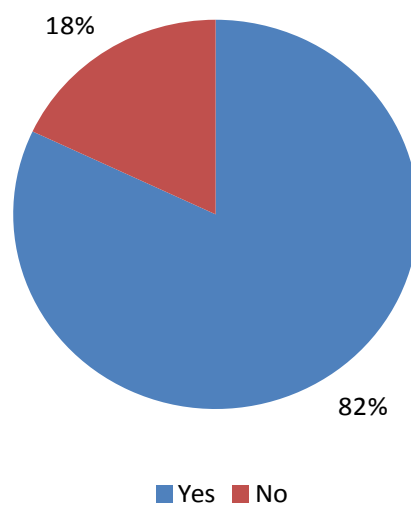
MECHANICAL CPR

- Of 2,021 cases for which data was available, the use of a mechanical CPR device was reported in 370 cases (18%). This compares to 4.6% of cases in 2014 (n=91).

DEFIBRILLATION

- Of the 2,153 patients for whom data was available, 747 had defibrillation attempted (35%), a decrease from 38% in both 2013 and 2014
- In the 738 cases for which identity of assistance was available, the first shock was delivered before ambulance services arrived in **133 cases (18%), an increase of 2% from 2014 (n=114/727)**
- In the 2,121 cases where defibrillator pads were applied and data available, the pads were applied before EMS arrival in **359 cases (17%), an increase of 2% from 2014 (n=290/1912).**

Figure 9: Defibrillation attempted before Ambulance service arrival (n= 738)



In the 133 cases where first shock was delivered by someone before EMS arrival, the identity of the person who delivered the first shock was as follows:

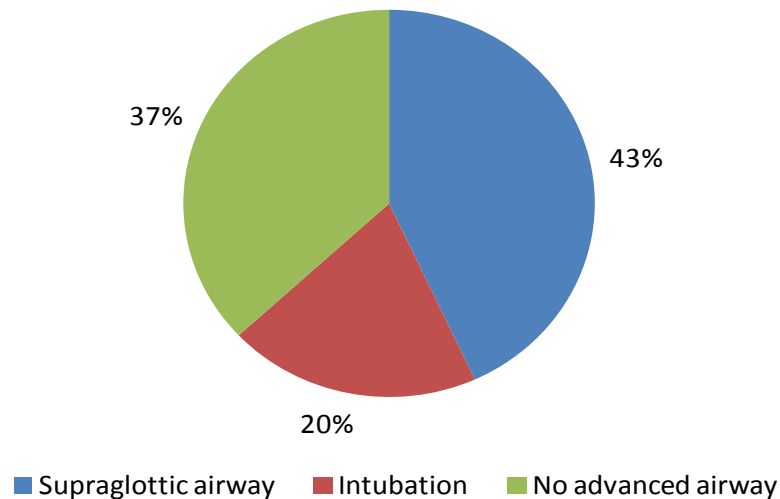
- Doctors (32%, n=42)
- CFR group members (30%, n=40)
- Members of the general public (20%, n=26).

A total of 305 patients converted to a shockable rhythm during resuscitation. Of these patients, 176 were initially in asystole, 63 had PEA, (rhythm type not specified for the remaining 66 patients). A higher proportion of patients in urban settings converted to a shockable rhythm (rural 35%; 99/297 vs. urban)

ADVANCED AIRWAY ADJUNCTS

- Of the 2,150 cases for which data was available, advanced airway techniques i.e. supraglottic airway device or intubation were used in 1,349 cases (63%)

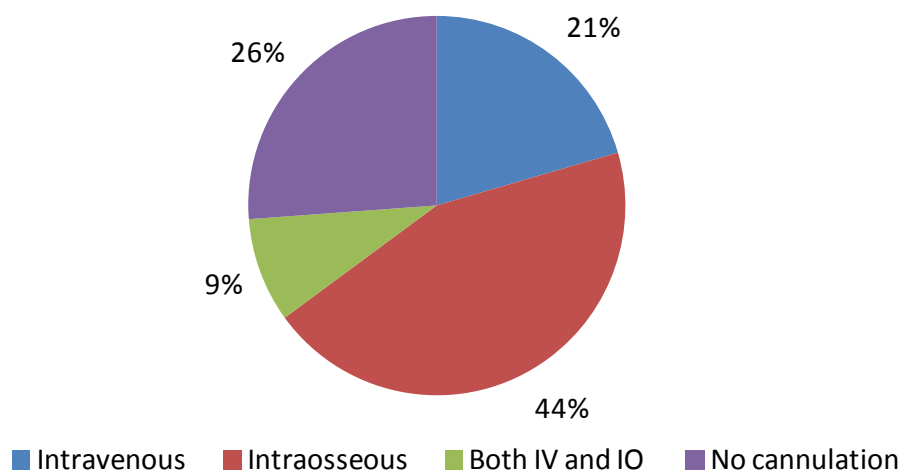
Figure 10: Adjunct airway management (n=2,144)



CANNULATION

- Of the 2,219 cases for which data was available, cannulation was performed in 1613 cases (73%)
- Intraosseous cannulation only was performed in 44% of cases (n=970), while intravenous cannulation only was performed in 448 cases (20%). A combination of both techniques was used in 195 cases (9%).

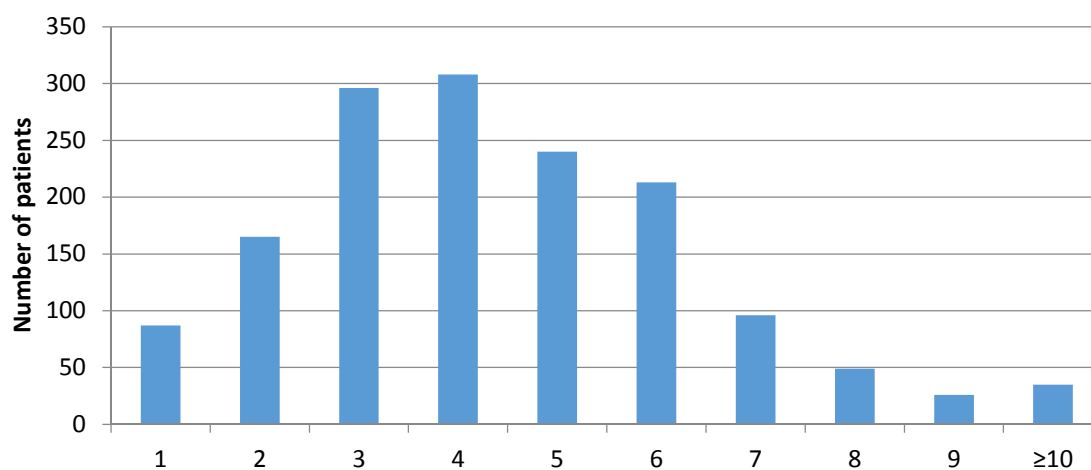
Figure 11: Cannulation method (n=1,613)



CARDIAC ARREST MEDICATION

- Of the 2,211 cases for which data was available, epinephrine was administered in 1,524 cases (69%)
- Data on the number of epinephrine doses given to each patient was available for 1,515 patients. The number of doses given ranged from one to nineteen.

Figure 12: Number of Epinephrine doses (1:10,000) (n=1,515)



ROSC AT ANY STAGE

- Of the 2,160 cases for which data was available, 26% had return of spontaneous circulation (ROSC) at some stage pre-hospital (n=559). **This is a difference of 1% since 2014.** Data on ROSC was missing for 59 patients
- Of the 2,035 cases available 28% occurred in the urban setting (n=390/1,416) compared to 21% (n=142/674) in a rural setting ($p<0.001$).

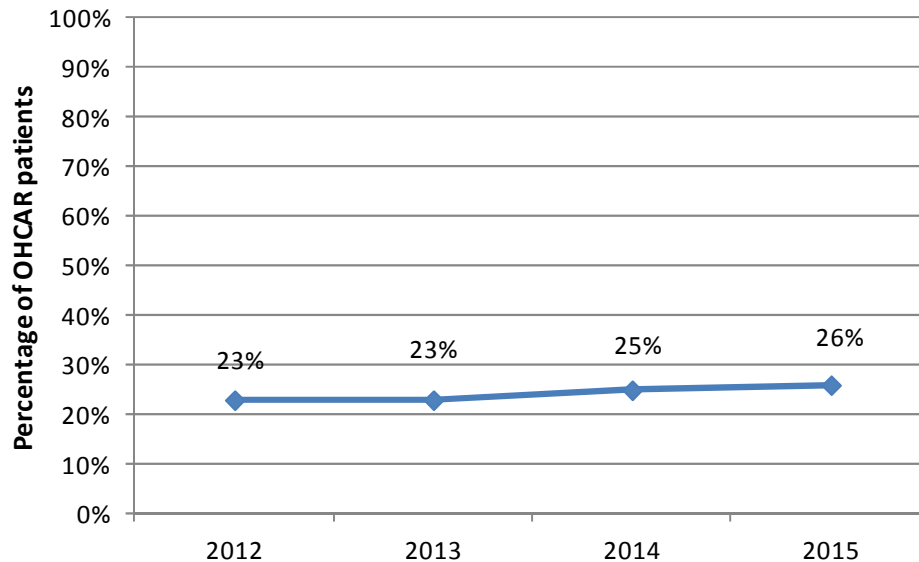


Figure 13: ROSC at any stage pre-hospital, all patients. Years 2012 – 2015 (n=2,512)

ROSC ON ARRIVAL AT THE EMERGENCY DEPARTMENT

- Of the 2,145 patients for whom data was available, 389 (18%) had ROSC on arrival at the Emergency Department (ED). Data was missing for 74 patients
- Patients in an urban setting were significantly more likely to have ROSC on arrival at ED compared to patients in a rural setting (20% vs. 14% ($p<0.014$)).

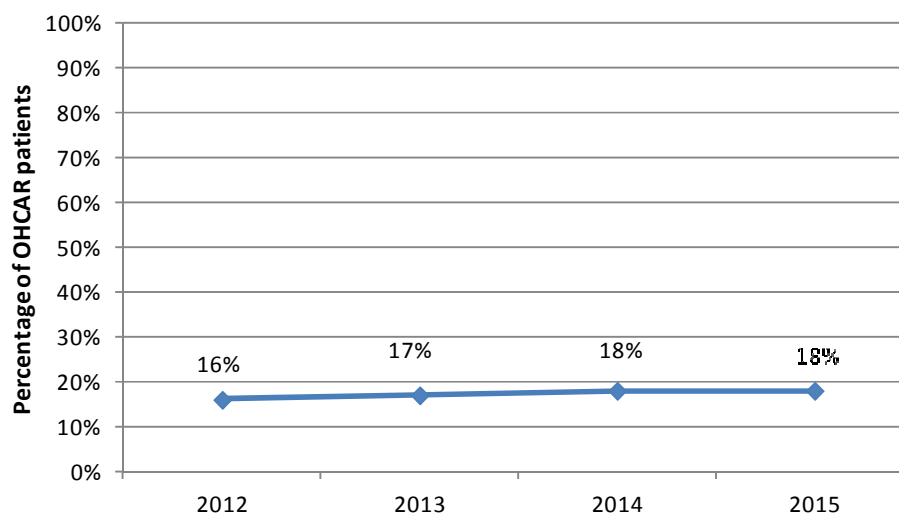


Figure 14: ROSC at ED, all patients. Years 2012 – 2015 (n=2,325)

DISCHARGED ALIVE FROM HOSPITAL

From the 2,209 cases for which data was available-

- There were 148 patients discharged alive from hospital (n=148/2,209, **6.7%**). Data on ten patients who were transported to hospital could not be obtained.

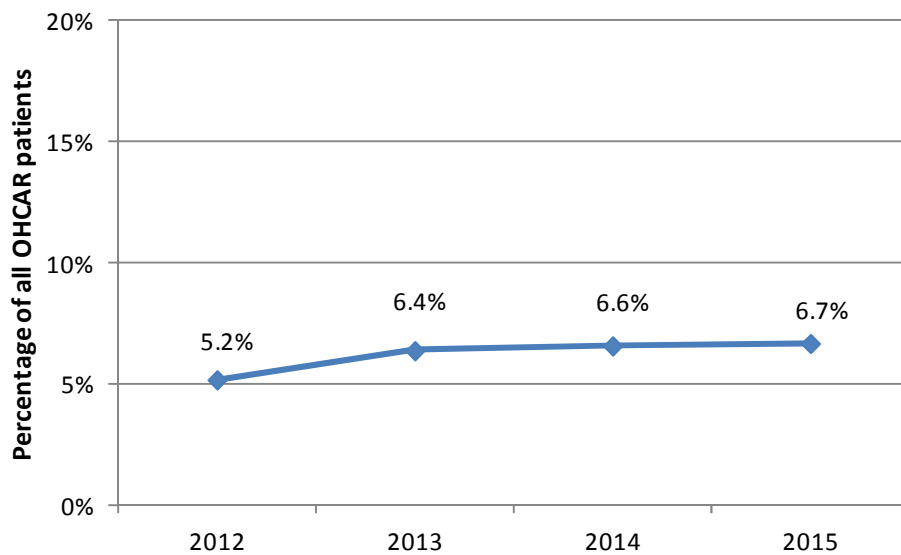


Figure 15: Percentage survival to discharge, all patients. Years 2012 – 2015 (n=490)

- Surviving patients were younger than non-surviving patients (median age 59 years vs. 68 years (p<0.001))
- Survival in the presumed medical aetiology group was 7% (n=136/1,953) compared with 4.5% (n=12/266) in the non-medical group (p≤0.001). The presumed aetiology was medical for 92% of survivors
- Of the 480 patients known to have collapsed in a public location, 89 survived to hospital discharge (18.5%), compared to 56 out of 1,709 patients known to have collapsed in a private location (3.3%). A total of 60% of survivors collapsed in a public place
- Survival of patients who collapsed in an urban vs. a rural setting was 7.3% (n=103/1,416) vs. 5.9% (n=40/674) (p=0.267). The location of collapse was urban for 72% of survivors
- Survival of patients with a shockable first rhythm was 27.2% (n=123/452) compared with 1.2% (n=21/1,707) in the non-shockable group (p≤0.001). The first monitored rhythm was shockable in 85% of survivors
- In the non-EMS witnessed group of survivors (n=105)
 - 91% had a witnessed arrest
 - 90% received bystander CPR, **an increase of 6% from 2014**
 - 40% (n=41), had defibrillation attempted (defibrillator pads applied) prior to EMS arrival, **an increase of 2% from 2014**
 - 34%(n=36) were shocked before EMS arrival, **an increase of 3% from 2014.**

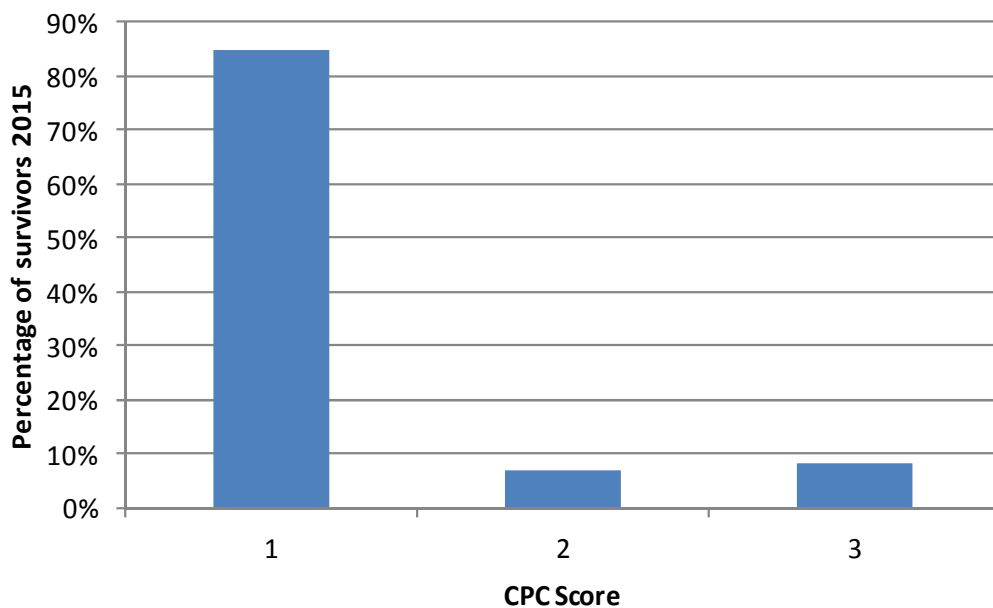
NEUROLOGICAL FUNCTION AT DISCHARGE

- As previously described, the Cerebral Performance Category (CPC) Score is an instrument developed to assess both traumatic and anoxic cerebral injuries. It is classified as a core Utstein data element for recording of both in and out-of-hospital cardiac arrest patients
- The CPC score has five categories:
 - CPC 1: Good cerebral performance
 - CPC 2: Moderate cerebral disability: conscious, sufficient cerebral function for independent activities of daily life
 - CPC 3: Severe cerebral disability: Dependent on others for daily support because of impaired brain function
 - CPC 4: Coma or vegetative state
 - CPC 5: Brain death.

CPC score data was available for 112 surviving patients. Of the patients for whom data was available-

- 86% (n=95) had a CPC score of 1 i.e. a good cerebral performance
- 7% (n = 8) had a CPC score of 2 i.e. a moderate degree of cerebral disability
- 6% (n = 9) had a CPC score of 3 or higher, indicating severe disability.

Figure 16: Cerebral Performance Score at discharge for surviving patients (n=112)



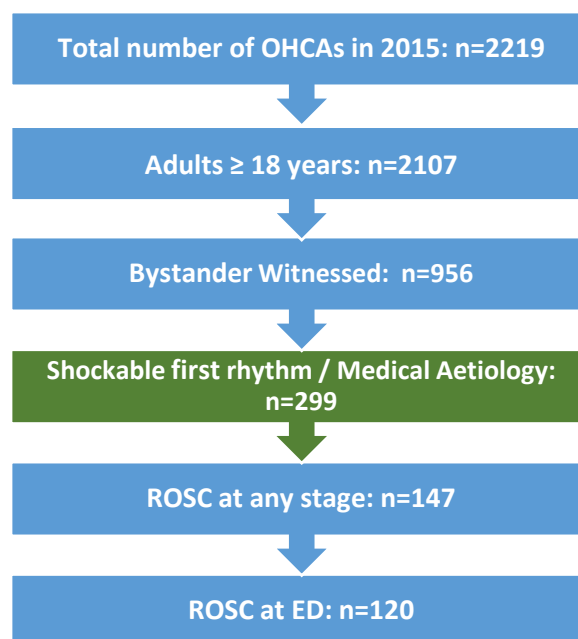
Utstein Comparator Subset 2015

The Utstein comparator subset includes the following subgroup of patients

- Adult (i.e. greater than seventeen years of age)
- Presumed medical aetiology
- Bystander witnessed
- First monitored rhythm shockable

There is wide variation of circumstances around a cardiac arrest and patient characteristics. Using the comparator subset allows for a more cohesive comparison of patients outcomes between systems and time periods.

Figure 17: Flowchart of the 2015 comparator subset and ROSC outcomes

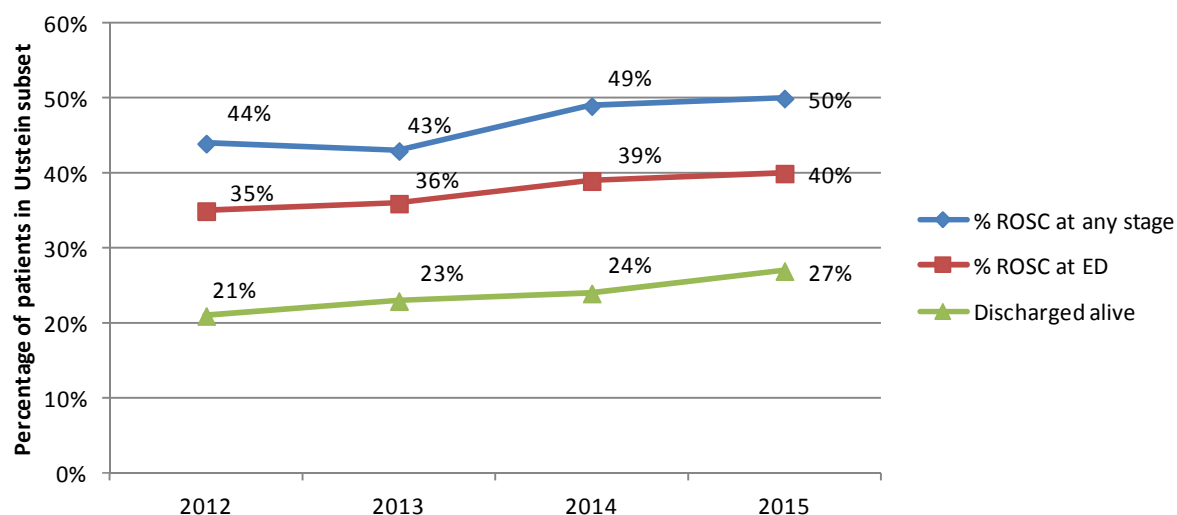


In 2015, the comparator subset included 299 patients and accounted for 13.5% of all OHCAs (299/2,219).

OUTCOMES

- 50% of patients (n=147) achieved ROSC at some stage pre-hospital (data missing for four patients)
- 40% of patients (n=120) had ROSC on arrival at the Emergency Department (data missing for 8 patients)
- 27% of patients (n=79/297) were discharged alive from hospital (data missing for two patients)
- Of the 63 survivors for whom CPC was available, 59 patients had a CPC score of one or two (95%).

Figure 18: Outcomes in the Utstein comparator group years 2012 - 2015



Case Characteristics

- Of those patients who collapsed in an urban setting, 30% survived (n=60) compared with 20% (n=17) in a rural setting (p=0.108). Of those patients who collapsed in a public location, 41% survived (n=52) compared to 16% in a private location (n=26). 82% of cases were recognised as cardiac arrest at the time of ambulance dispatch (n=242) (data missing for 4 cases)
- Bystander CPR was performed for 95% of survivors
- Of the 79 patients that survived, 47% (n=37) defibrillation was attempted before Ambulance Service arrival.

OHCAR Key messages 2015

All OHCA patients:

- There were 2,219 OHCAR cases in 2015
- The number of patients discharged alive in 2015 was 148. The percentage overall survival was **6.7%, (n=148)**
- 92% of surviving patients had good or moderate cerebral function on discharge from hospital (CPC of 1 or 2)
- The percentage of patients who achieved ROSC at any stage pre-hospital was 26% and ROSC on arrival at hospital was 18%
- In line with previous years, surviving patients were more likely to:
 - Be younger than non surviving patients
 - Have a presumed medical aetiology
 - Have collapsed in a public, urban location
 - Have a witnessed arrest
 - Present in a shockable rhythm
 - Receive bystander CPR
- Bystander CPR in the non EMS witnessed group of patients was **74%**, an increase from 71% in 2014
- Defibrillation was attempted before EMS arrival at the scene in **18%** of incidents, this is an increase of two percentage points from 2014.

Utstein Comparator Subset:

- In 2015, there were 299 patients in the Utstein comparator subset
- One hundred and twenty patients (40%) had ROSC on arrival at Hospital
- A total of 79 patients in this subset were discharged alive in 2015 (27%)
- Surviving patients were more likely to collapse in an urban and public location
- A total of **47%** of surviving patients, had defibrillation attempted prior to ambulance arrival.

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Appendix 1 - OHCAR publications

Masterson S, Jensen M. Complying with Utstein guidelines: Comprehensive case identification in the Irish national out-of-hospital cardiac arrest register. *Resuscitation*. Jan 16 2016, doi:10.1016/j.resuscitation.2015.12.018.

Moran, Patrick S., et al. "Cost-effectiveness of a national public access defibrillation programme." *Resuscitation* 91 (2015): 48-55.

Masterson, S., et al. "Urban and rural differences in out-of-hospital cardiac arrest in Ireland." *Resuscitation* 91 (2015): 42-47.

Gräsner, Jan-Thorsten, and Siobhán Masterson. "EuReCa and international resuscitation registries." *Current opinion in critical care* 21.3 (2015): 215-219.

Wnent J*, Masterson S*, Gräsner JT, Böttiger BW, Herlitz J, Koster RW, Rosell Ortiz F, Tjelmeland I, Maurer H, Bossaert L. EuReCa ONE - 27 Nations, ONE Europe, ONE Registry: a prospective observational analysis over one month in 27 resuscitation registries in Europe - the EuReCa ONE study protocol. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2015, 23(1), p.1.

*Joint lead authors

Masterson, Siobhán, et al. "General practitioner contribution to out-of-hospital cardiac arrest outcome: A national registry study." *European Journal of General Practice* (2014): 1-7.

Nishiyama, Chika, et al. "Apples to apples or apples to oranges? International variation in reporting of process and outcome of care for out-of-hospital cardiac arrest." *Resuscitation* 85.11 (2014): 1599-1609.

Gräsner, Jan-Thorsten, Bernd W. Böttiger, and Leo Bossaert. "EuReCa ONE—ONE month—ONE Europe—ONE goal." *Resuscitation* 10.85 (2014): 1307-1308.

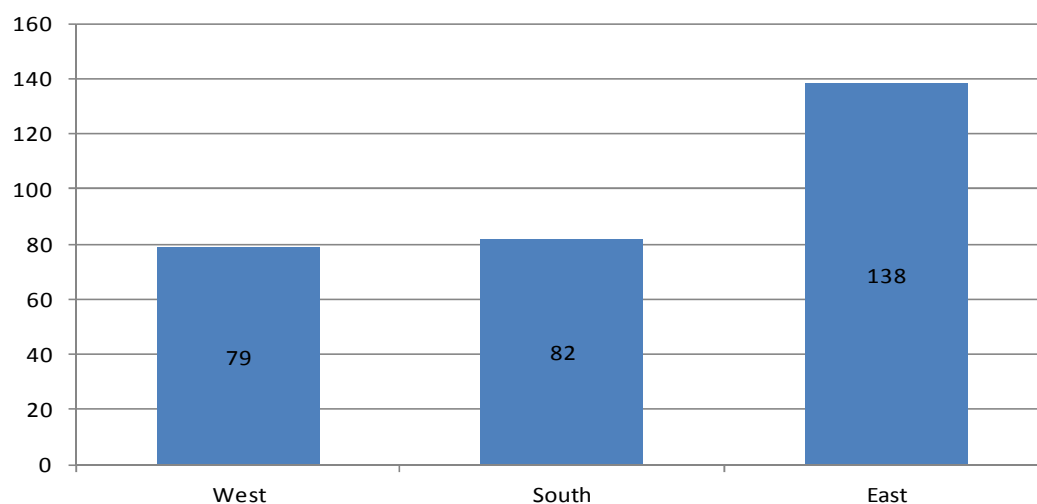
Masterson, S., et al. "Out-of-hospital cardiac arrest (OHCA) survival in rural Northwest Ireland: 17 years' experience." *Emergency Medicine Journal* (2010): emj-2009.

Masterson S, Cullinan J, McNally B, et al. "Out-of-hospital cardiac arrest attended by ambulance services in Ireland: first 2 years' results from a nationwide registry" *Emergency Medicine Journal* (2016) August 2nd 2016 doi:10.1136/emmermed-2015-205107.

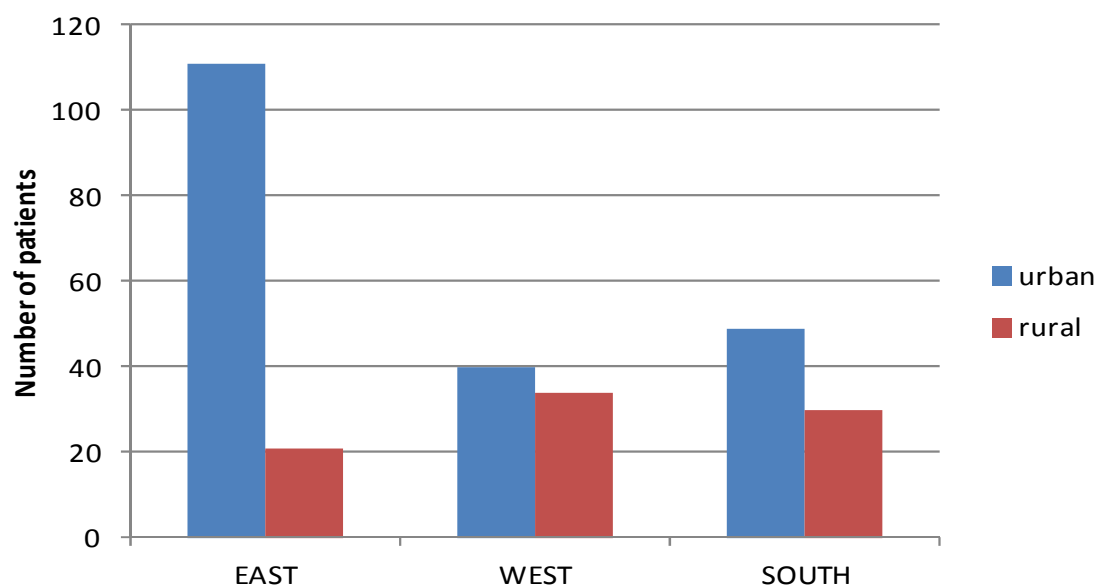
Appendix 2

OHCAR comparator subset 2015 – Area results

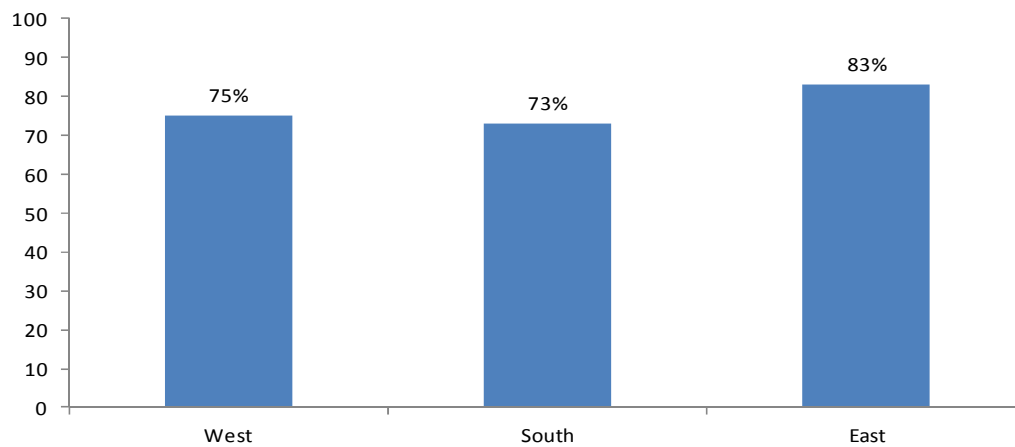
Number of OHCAR patients in the Utstein group by region (n=299)



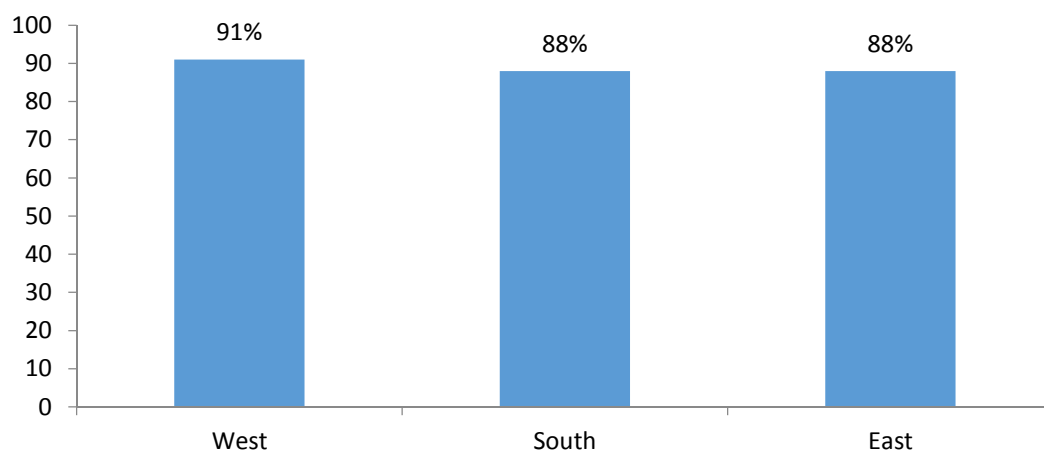
Urban/rural incident location by region (n=285):



Dispatcher recognition of cardiac arrest at time of ambulance dispatch (n=234):



Percentage of cases with bystander CPR:



ROSC at any stage, ROSC at ED and discharge alive:

