



Out-of-Hospital Cardiac Arrest Register



# National Ambulance Service

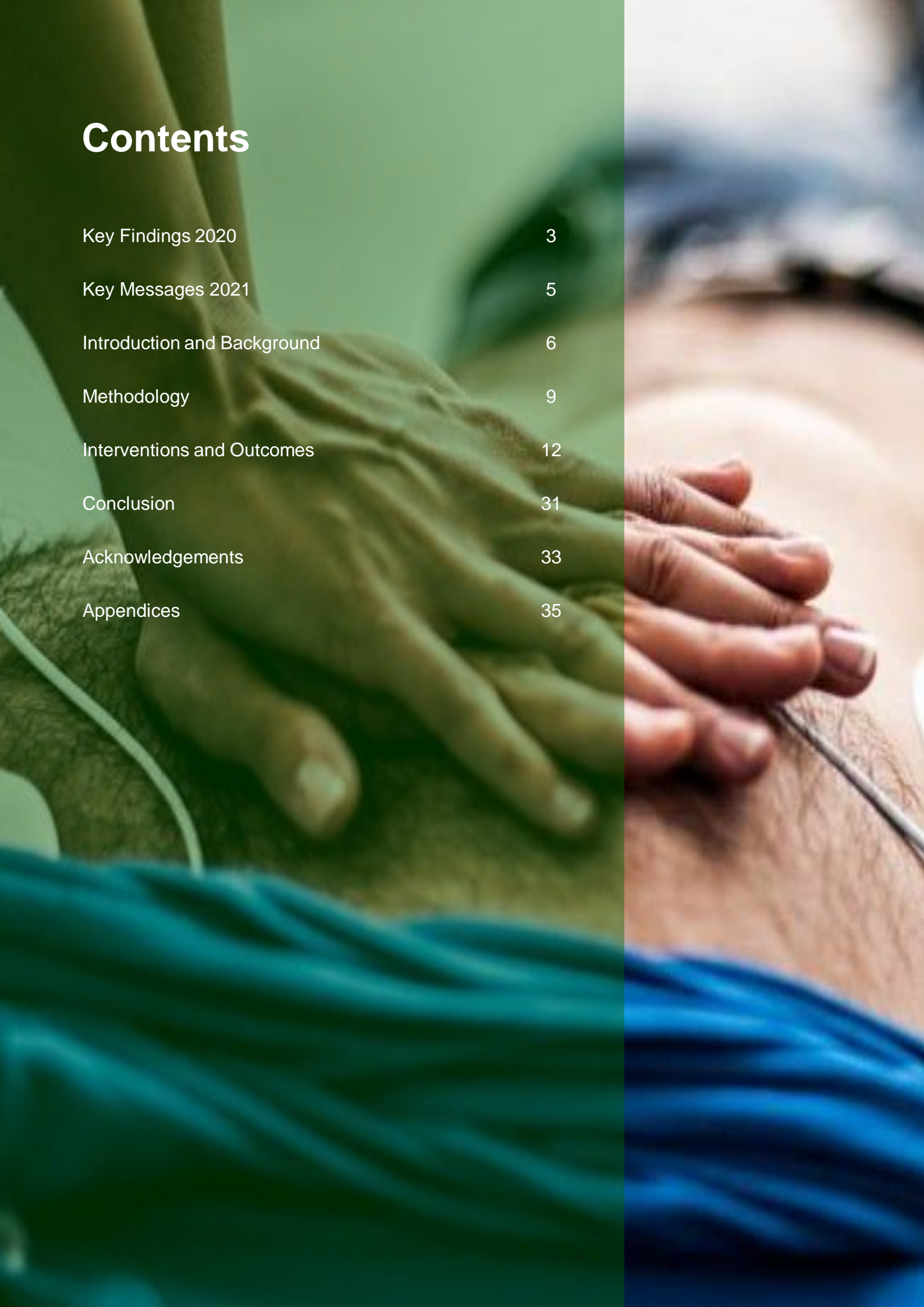
## Out-of-Hospital Cardiac Arrest Register Annual Report 2021

October 2022



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# Key findings 2021

## Out-of-Hospital Cardiac Arrest Register

### Demographics

**2,906**

out-of-hospital cardiac arrest incidents were recorded as treated by Emergency Medical Service



**33%**  
Female patients



**67%**  
Male patients

81%

Private setting\*

74%

Occurred in the home

19%

Public setting

\* includes 'home', 'farm' or 'residential institution'

### Emergency Medical Services

**81%**

Cardiac arrest recognition by emergency call takers

**29%**

Defibrillation performed

**55%**

Advanced airway use

**67%**

Epinephrine administered

**34%**

Transported to hospital

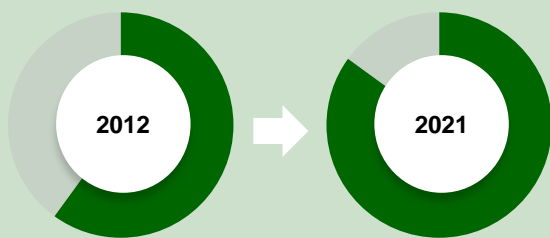
**14%**

EMS witnessed cases survived

# Key findings 2021

## Out-of-Hospital Cardiac Arrest Register

### Community Involvement

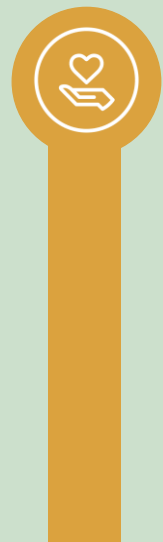


Since 2012, bystander CPR\* has increased from 60% to 85%.

\* Cardio Pulmonary Resuscitation  
\*\* Emergency Medical Services

6.7% defibrillated before EMS\*\* arrival (n = 194)

54 out of 194 people survived



### Post Cardiac Arrest Outcome

6.1%

returned home to their communities

97%

of survivors were recorded as having a good neurological outcome

25%

of patients in the Utstein comparator group survived to hospital discharge

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# Key messages 2021

## Out-of-Hospital Cardiac Arrest Register

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### Overall Patient and Event Characteristics

- **2,906** out-of-hospital cardiac arrest incidents recorded on OHCAR (61 per 100,000 population in 2021)
  - **57%** occurred in an urban area
  - **67%** Male
  - Median age **67** years (interquartile range 53 – 78)
  - **85%** presumed medical cause
  - **74%** happened in the home
  - **85%** Bystander CPR attempted
  - **50%** Bystander witnessed
  - **6.7%** of patients had defibrillation attempted pre EMS arrival
  - **16%** had sustained ROSC to Hospital arrival

### Non EMS Defibrillation

- In 2021, of all cases where an initial shockable rhythm was found, **non-EMS defibrillation** occurred in **35%** of cases
- Non-EMS responders defibrillated **198 patients**, of whom **54 survived (27.8%)**
- Of all survivors of OHCA in 2021, **54 (30.3%)** resulted from non-EMS defibrillation

### Survivors - Patient and Event Characteristics

- **178** patients survived
- **6.1%** discharged alive
- **152** had good to moderate neurological function on discharge

### Utstein Group

- **13%** of patients were in the Utstein Group
- **48%** ROSC pre-hospital
- **37%** ROSC on arrival at hospital
- **25%** were discharged alive

<sup>a</sup>Definition of urban is matched with the CSO definition of a settlement i.e. defined as having a minimum of 50 occupied dwellings, with a maximum distance between any dwelling and the building closest to it of 100 metres, and where there is evidence of an urban centre <sup>15</sup>.

<sup>b</sup> The Utstein subgroup includes patients who are >17 years, with presumed medical aetiology, bystander witnessed event and an initial shockable rhythm.



## **Introduction and Background**

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# Introduction and Background

## Out-of-Hospital Cardiac Arrest Register

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**“ The Out of Hospital Cardiac Arrest Register (OHCAR) aims to improve outcomes in Ireland by continuous performance measurement and feedback to service providers and the broader community.**

### 1.0 Introduction - OHCAR and COVID-19

The Coronavirus (COVID-19) first emerged during December 2019, and By December 2021, this contagious virus had been confirmed in over 278 million people, and has been linked to over 5.4 million deaths globally (WHO, 2021) <sup>1</sup>.

During 2021, the advice given by the HSE on dealing with a suspected COVID positive patient included the mandatory use of personal protective equipment (gloves, facemask, gown and eye protection). Due to the risk of spreading the virus during aerosol generating procedures, which includes cardiopulmonary resuscitation, the International Liaison Committee on Resuscitation (ILCOR) <sup>2</sup> advised against these procedures.

People stayed at home more during the year due to lockdown and various appeals to them to do so. This had the potential to influence the locations of out – of – hospital cardiac arrests occurring in public locations. These events would therefore be witnessed by fewer bystanders. These factors could negatively affect cardiac arrest outcomes. OHCAR contributed data to HSE guidance regarding CPR and Do-not-attempt resuscitation decision making during the COVID pandemic <sup>3</sup>.



**“ The Chain of Survival has 4 steps and can be implemented by any member of the public, supported over the phone by the HSE National Ambulance Service (NAS) 112/999 team.**

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

The OHCAR project was established in June 2007 in response to a recommendation in the “*Report of the Task Force on Sudden Cardiac Death*” <sup>4</sup>. The need for OHCAR was also emphasised in the policy document “*Changing Cardiovascular Health*” <sup>5</sup> and the “*Emergency Medicine Programme Strategy*” <sup>6</sup>. OHCAR is one of six OHCA registries in Europe with full national coverage.

**“ The Register in Ireland is funded by the National Ambulance Service as a means of quality assuring and quality improving the care provided in this extreme emergency by ambulance services in Ireland.**

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# Introduction and Background

## Out-of-Hospital Cardiac Arrest Register

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### 1.2 The OHCAR Steering Group and Governance

OHCAR is hosted by the Department of Public Health Medicine in the Health Service Executive (HSE) North West region, and is funded by the National Ambulance Service (NAS). It is guided by the OHCAR Steering Group (Appendix 1).

### 1.3 The Aim of OHCAR

The aim of OHCAR is to support improved outcomes from OHCA in Ireland by:

- Collecting information on the population who suffer OHCA and the arrest circumstances
- Collecting information on the pre-hospital treatment of OHCA patients
- Monitoring the survival to hospital discharge of OHCA patients
- Establishing a sufficiently large patient database to enable identification of the best treatment methods for OHCA and optimum organisation of services
- Providing regular feedback to service providers
- Facilitating research on best practice nationally and internationally using OHCAR data

***“ OHCAR helps the National Ambulance Service, the Dublin Fire Brigade and the Dublin Airport Authority to measure their performance in relation to cardiac arrest treatment processes and survival and identify any opportunities that may exist to improve outcomes.*”**

### 1.4 OHCAR reporting to Service Providers

OHCAR is used to provide data for the 'ROSC at Hospital' monthly clinical Key Performance Indicator for NAS, and also to provide detailed regional quarterly reports. These include descriptive data elements and outcome variables at regional level and constitute the data source for reports circulated by NAS to stations for the ONELIFE initiative, which is a NAS run quality improvement programme.

A quarterly report is provided to Dublin Fire Brigade (DFB) with outcome data and descriptive information. OHCAR Annual reporting is undertaken on the geographical regions of West, South and combines the DFB with the Eastern NAS region.

### 1.5 Ireland and the EuReCa Studies

EuReCa TWO was launched in September 2016. OHCAR has provided National OHCA data for incidents in Ireland to the EuReCa TWO study, which covered 28 European countries with a population of almost 179 million people. Ireland was one of only four countries that contributed data for the entire country for the study period.

Data collection commenced on the 1st of October 2017 until the 31<sup>st</sup> of December 2017. The EuReCa TWO study was published in 2020<sup>7</sup>. In October 2014, Ireland participated in the EuReCa ONE<sup>8,9</sup> study – a one-month survey of OHCA cases in 27 countries across Europe. Ireland was one of only seven countries that contributed data for the entire country for the study period.





## Methodology

# Methodology

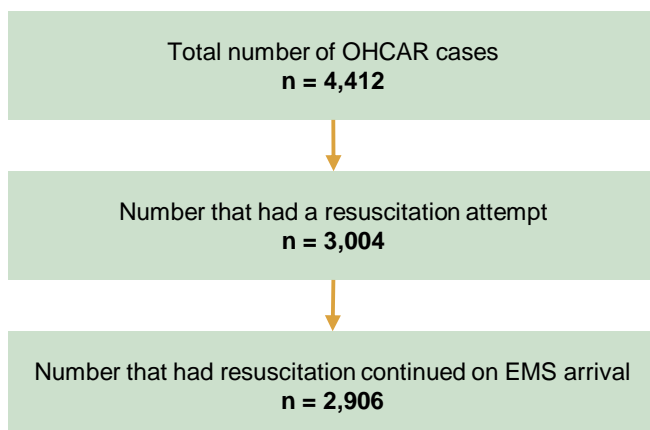
## Out-of-Hospital Cardiac Arrest Register

### 2.0 Methods

#### 2.1 Inclusion / Exclusion Criteria

OHCAR records “all patients who suffer a witnessed or un-witnessed out-of-hospital cardiac arrest (OHCA) in Ireland which is confirmed and attended by Emergency Medical Services (EMS) and resuscitation attempted or confirmed by the EMS” (Figure 1). A resuscitation attempt is defined as performance of cardiopulmonary resuscitation (CPR) and/or attempted defibrillation where there is evidence of a cardiac arrest rhythm. In 2021, OHCAR worked with the EMS to quantify the numbers of confirmed cardiac arrests where no attempt at resuscitation was undertaken by the EMS because of the recognition of established indicators of death, on arrival. This Annual Report provides for the first time an indication of the numbers and proportion of OHCA cases where EMS resuscitation is indicated. Unless stated otherwise, the denominator for most of this report is therefore the 2,906 OHCA cases in which resuscitation was undertaken or confirmed by the EMS and in which registry data has been compiled; where occasional missing data has occurred, the denominator is use is reported.

**Figure 1: Inclusion Criteria**



#### 2.2 Source of OHCAR Data

The primary sources of OHCAR data are Patient Care Records (PCRs) and 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 (DAA), Red Cross, Civil Defence, Irish Coastguard and Order of Malta, but almost all data is provided from statutory services. At present, the work undertaken by Community First Responder (CFR) groups is not fully captured in OHCAR data.

#### 2.3 Data Collection

OHCAR collects data in the format of the internationally agreed Utstein dataset <sup>10,11</sup>.

**National Ambulance Service:** NAS introduced electronic PCRs (ePCR), and during 2021 OHCAR identified all cases via the ePCR system. Following validation, OHCAR staff uploads the data onto the OHCAR database. 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:** PCRs are sourced by DFB's EMS Support Unit and data are provided to OHCAR on a quarterly basis in a summarised electronic format. These records are integrated with data from the DFB East Region Command Centre in Townsend Street. Electronic copies of DFB PCRs are also sent to OHCAR to enable case validation.

**Hospitals:** OHCAR has a data sharing agreement with all hospitals who receive OHCA patients except Our Lady's Children's Hospital, Crumlin. Data collection from hospitals is facilitated by various hospital staff, including administrators, resuscitation officers, clinical nurse managers and consultants. Acute hospitals provide information on survival status and Cerebral Performance Category (CPC) score <sup>12,13</sup>.

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

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# Methodology

## Out-of-Hospital Cardiac Arrest Register

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### 2.4 Aetiology

As per the Utstein definition, where there is no evidence of another cause, e.g. trauma, asphyxiation, drug overdose cases were presumed to be of medical aetiology

### 2.5 Data Quality Management

The Utstein guidelines state that, “organisers of OHCA registries should implement monitoring and remediation for completeness of case capture”<sup>11</sup>. The quality of data variables for 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 data quality by providing quarterly reports which include a summary of the availability of some core data elements. NAS then produces and circulates OHCAR summary reports to ambulance stations on a quarterly basis. DFB also provide each practitioner access to their quarterly reports.

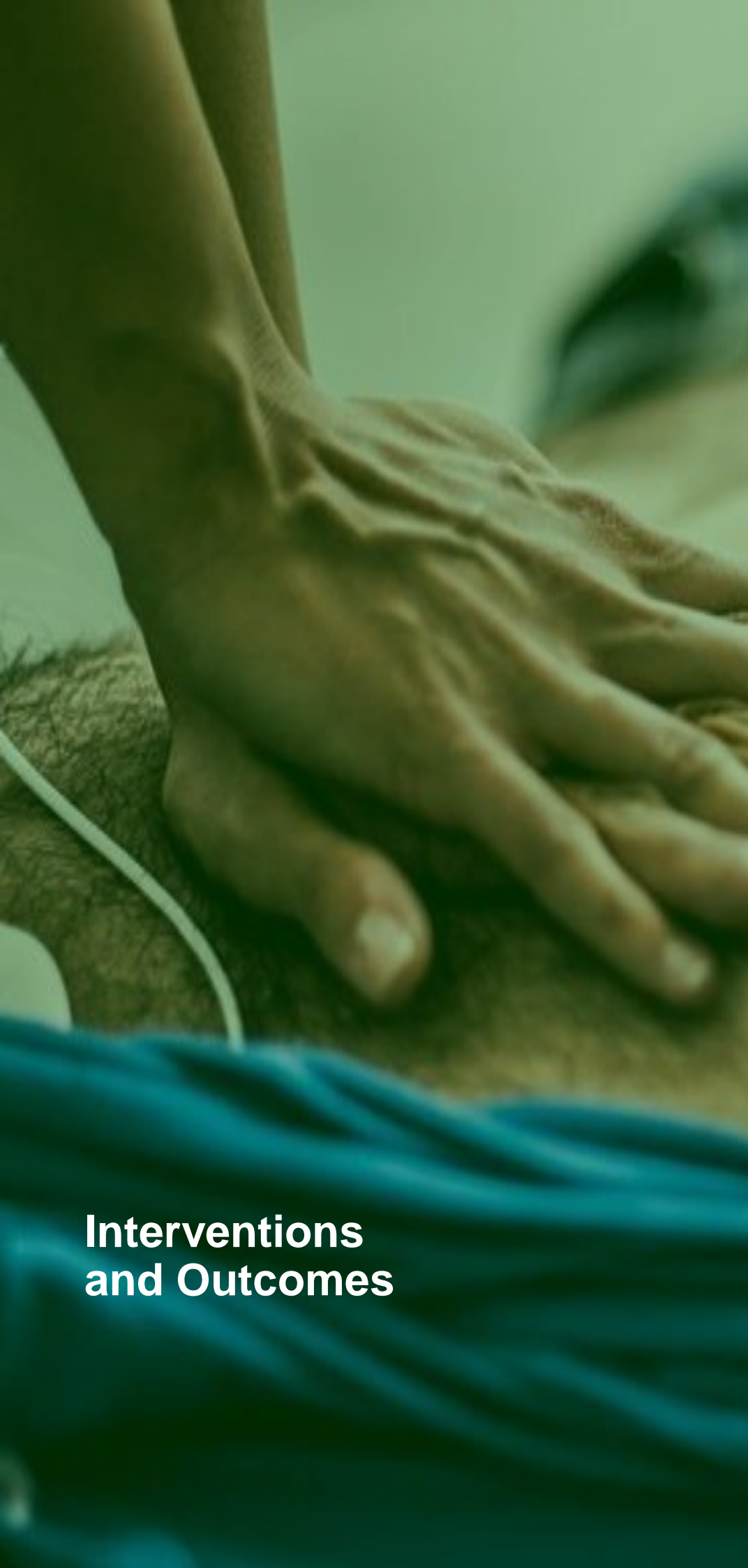
The following data quality checks are also undertaken:

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

### 2.6 Statistical Analysis

Data analysis was performed using IBM SPSS version 27. In all cases  $p < 0.05$  was used as the level of statistical significance. Where appropriate, relationships between categorical values were expressed in percentages and examined by the Chi square test for significance<sup>14</sup>.





**Interventions  
and Outcomes**

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# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

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**“ Last year 178 patients survived their out-of-hospital cardiac arrest to leave hospital alive, 97% with moderate to good neurological outcome.**

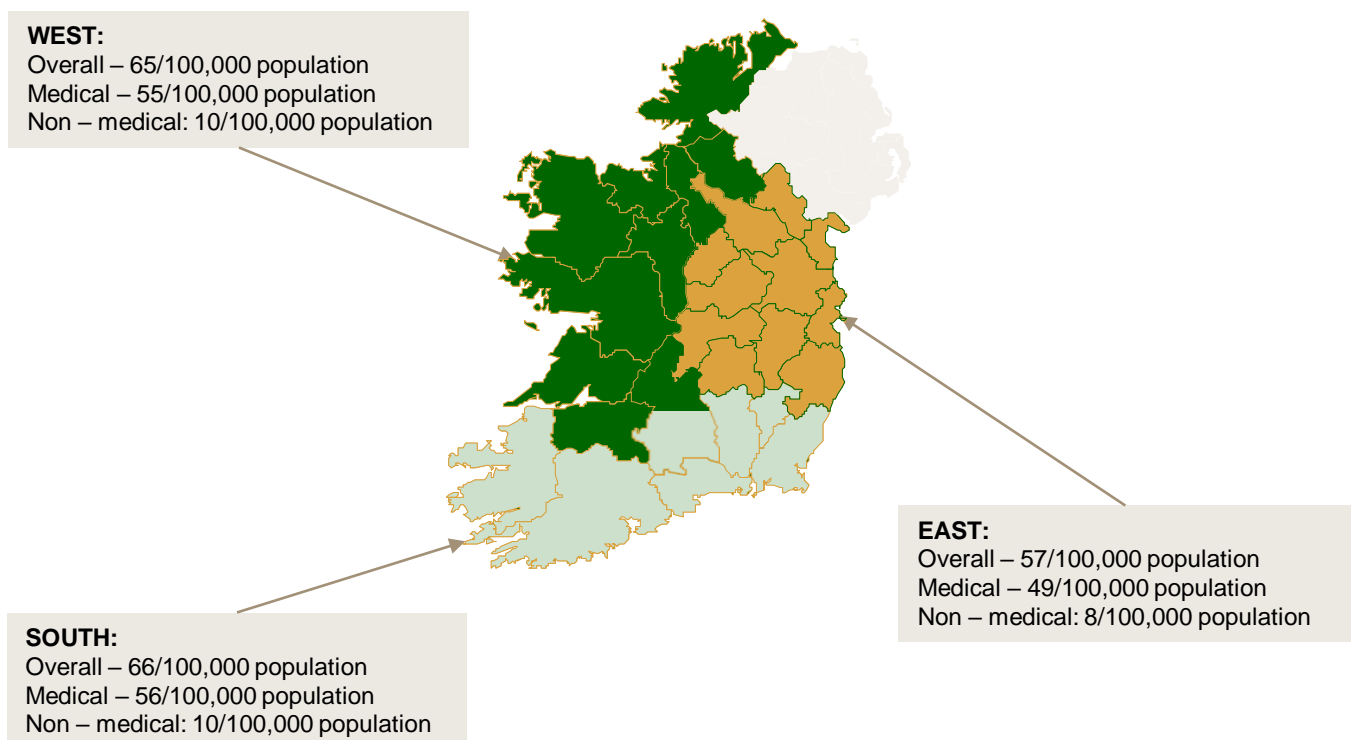
### 3.0 Results for 2021

#### 3.1 Incidence

In 2021, a total of **2,906** OHCA were attended where resuscitation was reported to have been attempted by NAS, DFB, DAA or bystanders, and continued by the EMS. This equates to 61 OHCA resuscitation attempts per 100,000 in 2021 <sup>15</sup>, (57/100,000 East, 66/100,000 in the South and 65/100,000 in the West. In Europe, the estimated incidence of OHCA ranges between 27 and 91 per 100,000 per year <sup>16</sup>.

In 2021, the majority of OHCA incidents were presumed to be of medical aetiology (52/100,000 persons) compared to a small proportion of cases of non-medical aetiology (trauma, asphyxia, drug overdose or submersion) (9/100,000 persons). The HSE South Area reported the highest incidence at 66/100,000 persons (Map 1) <sup>d</sup>.

**Map 1: Incidence of OHCA with resuscitation attempts in 2021**



# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

“ Responders, who are not members of the Emergency Medical Services, can make all the difference when an out of hospital cardiac arrest occurs

### 3.2 Geographical Distribution of Incidents

The geographical coordinates of incident locations were mapped using the HSE application ‘Health Atlas’ (<https://www.healthatlasireland.ie/>). Map 2 highlights that the majority of cases occurred in urban areas. The classification of an urban area matches with the Central Statistics Office (CSO) definition of a settlement i.e. defined as having a minimum of 50 occupied dwellings, with a maximum distance between any dwelling and the building closest to it of 100 metres, and where there is evidence of an urban centre <sup>15</sup>.

- 57% of cases occurred in an urban area (n=1,668/2,711); 195 cases could not be geocoded due to insufficient data or the event having occurred during ambulance transport (149 and 46 respectively)
- Case incidence was 50/100,000 in urban areas and 73/100,000 population in rural areas.

**Map 2: Geographical distribution of OHCAR Incidents with settlement / non – settlement classification**



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# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

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**“ Responders include a wide range of trained volunteers (both lay and health care professionals), off-duty Emergency Medical Service (EMS) staff and members of the public who encounter an emergency and are prepared to provide care.**

### 3.3 Demographics

- 1,959 patients were male (67%)
- Patients ranged in age from less than one to 100 years old (median age 67 years, interquartile range (IQR) 53 – 78)
- Females were older than males (70 years (IQR 54 – 81) vs. 66 years (IQR 52 – 77) respectively), ( $p < 0.001$ )
- Females were more likely to collapse in a private setting (homes or residential institutions) than males ( $n = 834/941$ , 89% v 1,532/1,959, 78%), ( $p < 0.001$ ).

### 3.4 Community First Responders

In December 2021 there were 275 Community First Responder (CFR) groups in 26 counties linked with NAS; however there were only 137 active CFR resources. The CFR group members are predominantly made up of lay people with an interest in providing life-saving support in their communities, and receive training prior to activation from the NAS National Emergency Operations Centre.

The CFR groups operate on a voluntary basis and are trained in basic life support and the use of defibrillators. They are co-ordinated locally by volunteers, work under the auspices of the National Ambulance Service policy, and are dispatched by ambulance control.

**“ Community First Responders are an integral part of dealing with an emergency in the community in that they provide vital lifesaving CPR and defibrillator treatment to patients while an ambulance is on route. Anyone interested in becoming a Community First Responder can visit [www.becomeacfr.ie](http://www.becomeacfr.ie) and get in touch. There is currently a need for additional Community First Responders right around the country and you will be given the essential training required. We would also like to see additional Community First Responder Schemes established where they are needed.**

# Interventions and Outcomes

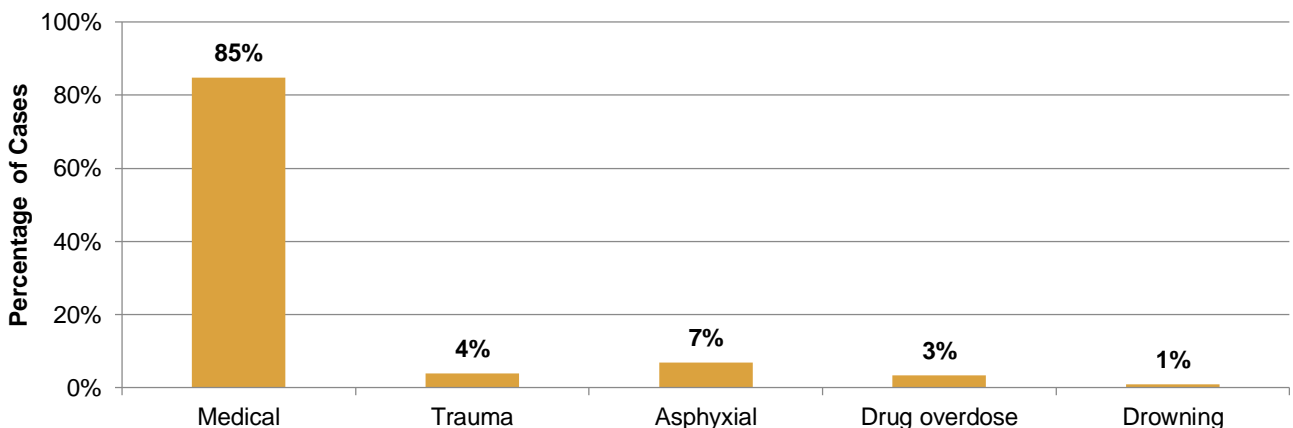
## Out-of-Hospital Cardiac Arrest Register

**“ In 2021, of all cases where an initial shockable rhythm was found, non-EMS defibrillation occurred in 35% of cases. Non-EMS responders defibrillated 198 patients, of whom 54 survived (27.8%). This achievement emphasises the importance of these groups of responders and provides valuable evidence for their impact within the community. ”**

### 3.5 Presumed Aetiology

- 85% of incidents were presumed to be of medical aetiology (n=2,465/2,906)
- Non-medical aetiologies included (Figure 2):
  - 7% asphyxia (n=202)
  - 4% trauma (n=113)
  - 3% drug overdose (n=99)
  - 1% submersion (n=27)
- 83% of male patients had a presumed medical aetiology (n=1,634/1,959) compared to 88% of female patients (n=827/941), (p<0.003).
- Patients with a presumed medical aetiology were significantly older than all other aetiologies (70 years vs. 42 median years respectively).

**Figure 2: Presumed aetiology (n=2,906)**





# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

### 3.6 Call Response Interval

As per the Utstein definition<sup>10</sup>, the call response interval (CRI) is the interval from the time the emergency call was received at the dispatch centre to arrival of EMS at the scene.

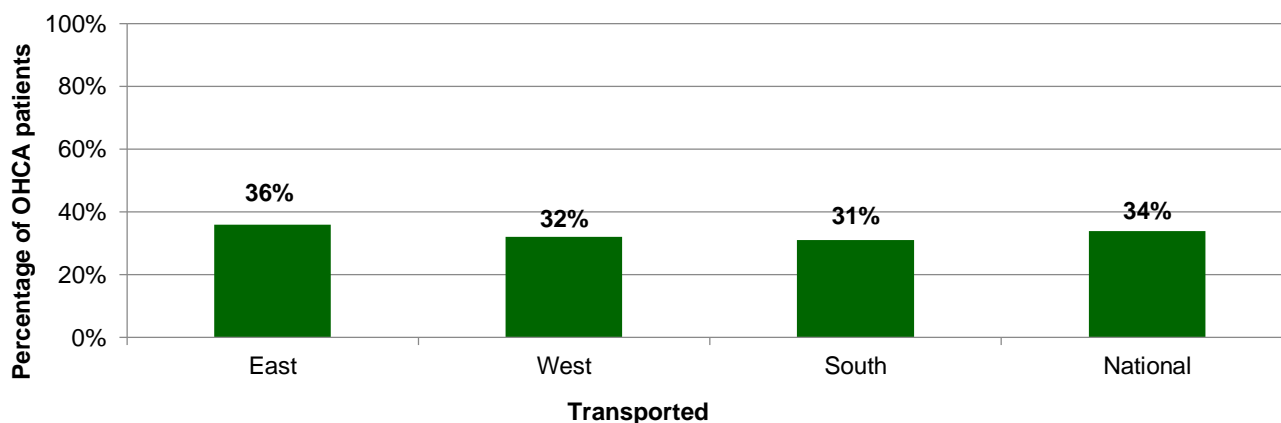
Only the CRI for non-EMS witnessed cases are included in this analysis (n=2,537/2,843). As CRI is not normally distributed, the median value for each category is given:

All non EMS witnessed cases	14 minutes (IQR 9 – 21 minutes)
Rural non EMS witnessed cases	20 minutes (IQR 14 – 26 minutes)
Urban non EMS witnessed cases	11 minutes (IQR 8 – 16 minutes)
Utstein comparator group	14 minutes (IQR 9 – 20 minutes)

### 3.7 Transported to Hospital

- 34% of patients were transported to either an Emergency Department or a cardiac catheterisation laboratory (n=980)
- The percentage of patients who were transported to hospital was 36% in the East, 32% in the West, and 31% in the South, (Figure 3)
- Patients in urban areas were more likely to be transported than in rural areas (38% vs. 23%, p<0.001).

**Figure 3: Proportion of patients transported to hospital by EMS area and nationally**



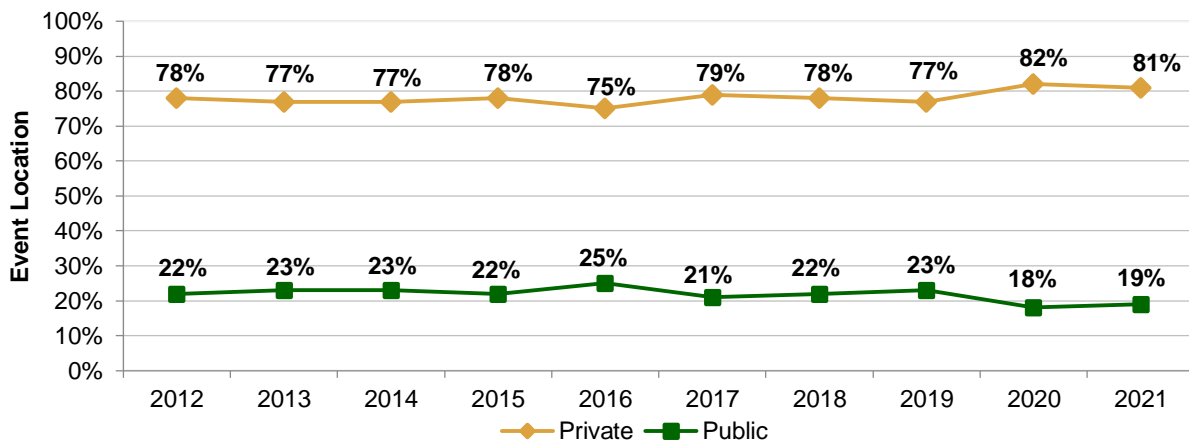
# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

### 3.8 Event Location

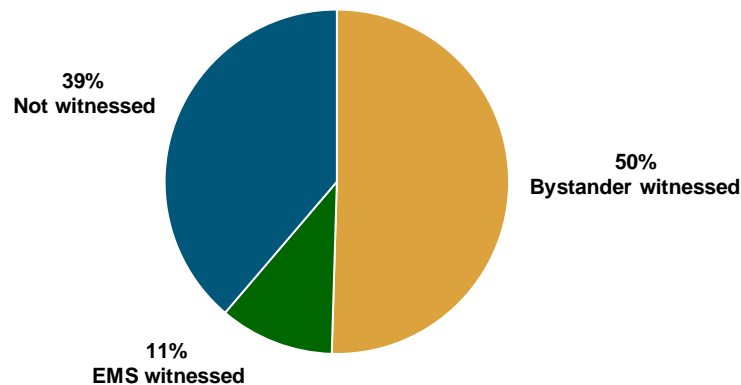
- 74% of incidents occurred in the home (n=2,151)
- 81% of incidents occurred in a private setting (home, farm or residential institution (n=2,369) (Figure 3)
- 19% of cases occurred in a public setting (industrial place, public building, GP surgery, recreational or sports place, street or road, in the ambulance, and other places such as rivers, lakes or piers (n=537) (Figure 4)
- In urban areas, a similar proportion of patients collapsed in a public place compared to rural areas (15% vs. 14%), (p<0.327).

**Figure 4: Event Location**



### 3.9 Witness Status

- 50% of all cases were bystander witnessed (n=1,435/2,843), (Figure 5)
- 50% of urban cases were bystander witnessed (n=803/1,619) and 53% of rural cases were bystander witnessed (n=553/1035).



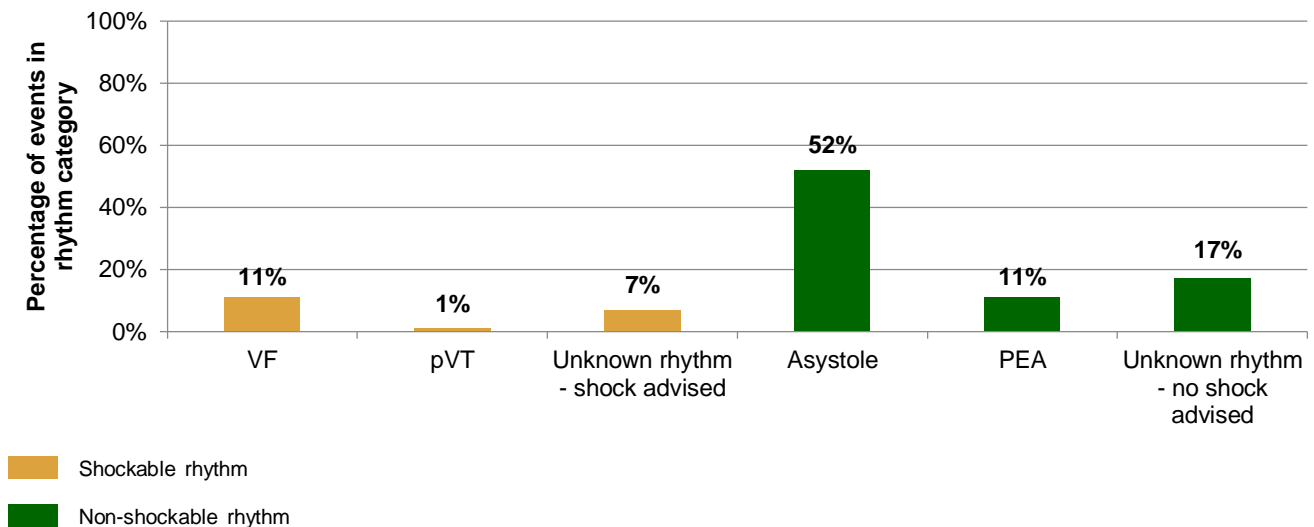
# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

### 3.10 First Monitored Rhythm

- 19% of cases were in a shockable rhythm at time of first rhythm analysis (n=554/2,906), (Figure 6)
- 33% of cases that were in an initially shockable rhythm were defibrillated by bystanders pre-EMS arrival (n=183/554). Of these;
  - 39% had ROSC at hospital arrival (n=71/183)
  - 29% were discharged alive (n=53/183)
- The initial rhythm was asystole in 50% of cases (n=1,467/2,820).

**Figure 6: First monitored rhythm (n = 2,820)**



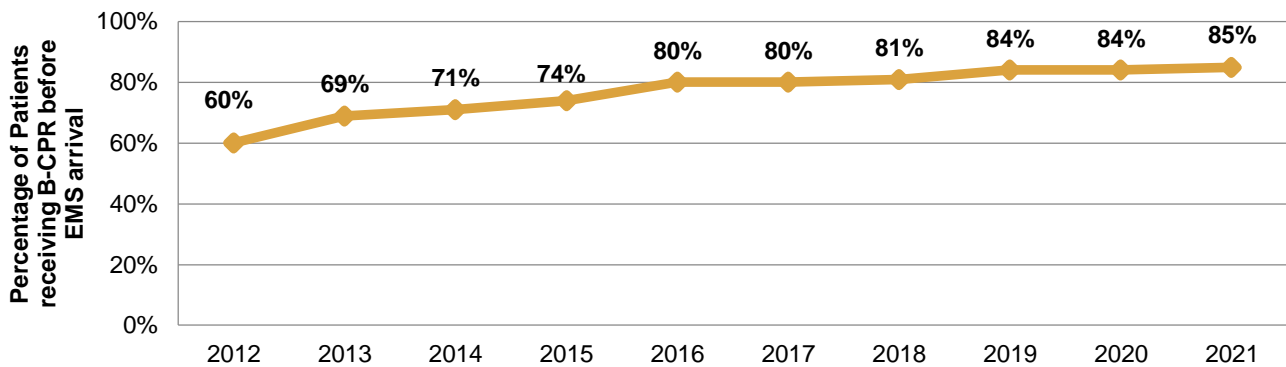
# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

### 3.11 Bystander CPR

- Bystander CPR was attempted in 85% of non-EMS witnessed\* cases (n=2,154/2,537).

**Figure 7: Percentage of patients receiving B-CPR before EMS arrival, years 2012 – 2021**



- In the subgroup of patients that had a bystander witnessed collapse (n=1,435) 86% (n=1,239) of patients had bystander CPR (B-CPR) attempted.
- A higher proportion of cases in a rural area received B-CPR (n=870/1,035) compared to an urban area (n=1,197/1,614) (84% vs. 74%; p<0.001)
- A higher proportion of cases in a private location received B-CPR (n=1,799/2,307) compared to a public location (n=380/530) (78% vs. 72%; p<0.001).

The proportion of cases that received public B-CPR increased from 67% in 2020 to 72% in 2021.



### 3.12 Mechanical CPR

- 50% of cases had Mechanical CPR performed (n=1,396/2,766)

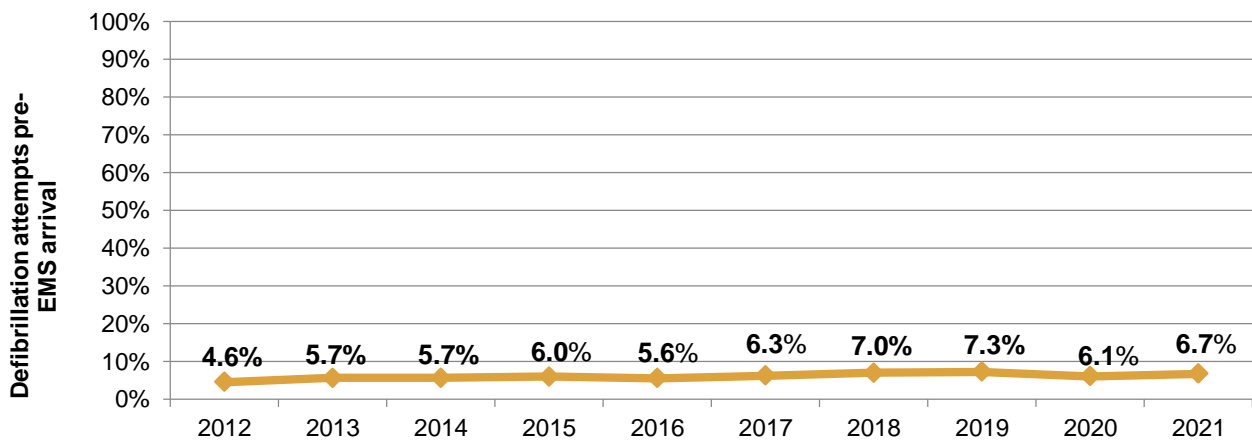
# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

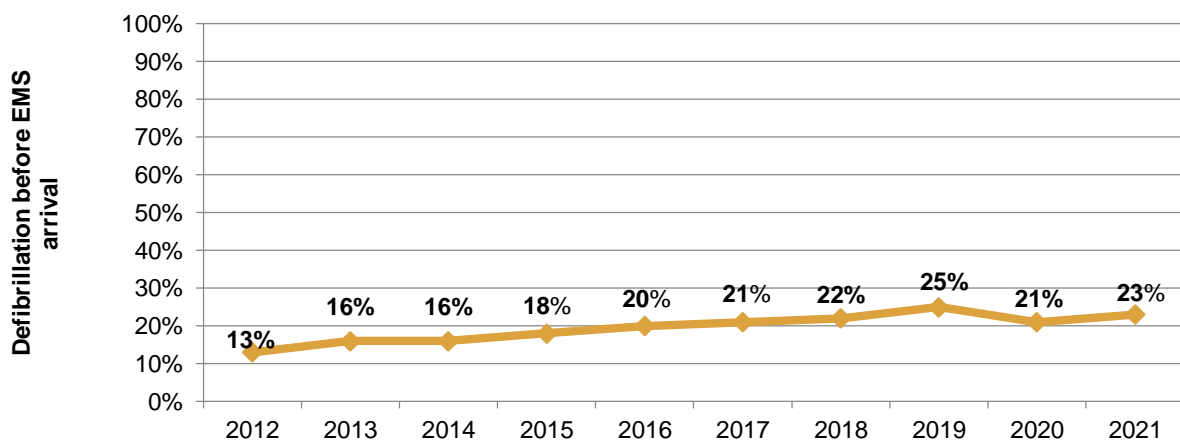
### 3.13 Defibrillation

- 19.6% of cases had an initial shockable rhythm (554 patients)
- 29% of cases had defibrillation attempted at any point (n=837/2,906)
- 6.7% of defibrillation attempts were made pre-EMS arrival (n=194/2,906) (Fig. 8)
- Of the 554 patients with an initial shockable rhythm, 194 (35%) were defibrillated by non-EMS sources
- Of the 837 patients who had defibrillation attempted:
  - 268 had the pads applied pre-EMS arrival (32%)
  - 194 had the first shock delivered pre-EMS arrival (23%) (Figure 9).

**Figure 8: Defibrillation attempts pre-EMS arrival – all cases**



**Figure 9: Defibrillation attempts pre-EMS arrival – all cases**



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# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

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### First shock delivered before EMS arrival

In the 194 cases where first shock was delivered before EMS arrival, the identity of the person who delivered the first shock was as follows:

- Members of the general public (26%, n=50)
- Doctors (16%, n=32)
- Basic Life Supporter (BLS) / Cardiac First Responder (CFR) trained (22%, n=42)
- Local Fire services (10%, n=20)
- Voluntary Services (11%, n=22)
- Nurses (8%, n=15)
- Members of An Garda Síochána (7%, n=13).

### Conversion to shockable rhythm during resuscitation

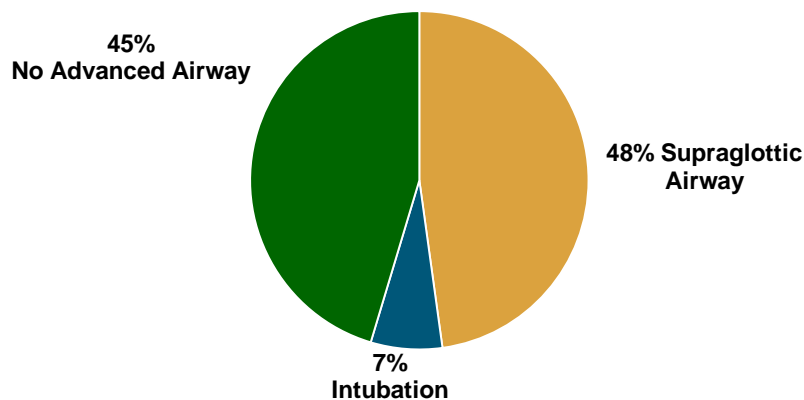
A total of 300 patients (10.3%) converted to a shockable rhythm during resuscitation. Of these:

- 54% were initially in asystole (n=161/300)
- 21% were initially in PEA (n=64/300)
- Rhythm type not specified for the remainder.

### 3.14 Advanced Airway Adjuncts

- In 55% of cases, advanced airway adjuncts were used, i.e. supraglottic airway device or intubation (n=1,536/2,811), (Figure 10).

**Figure 10: Adjunct airway management (n=2,811)**



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# Interventions and Outcomes

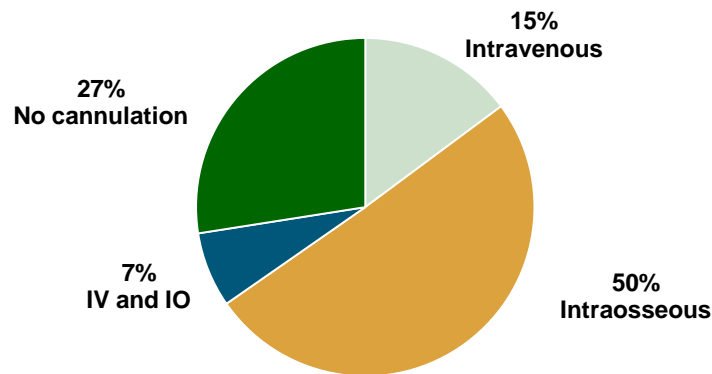
## Out-of-Hospital Cardiac Arrest Register

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### 3.15: Cannulation

- 73% of cases had cannulation performed (n=2,115/2,906)
  - 50% of cases had intraosseous cannulation (n=1,453/2,906)
  - 15% had intravenous only cannulation (n=427/2,906)
  - 7% had a combination of both techniques (n=207/2,906)
  - 27% of cases were not cannulated (n=791/2,906) (Figure 11).

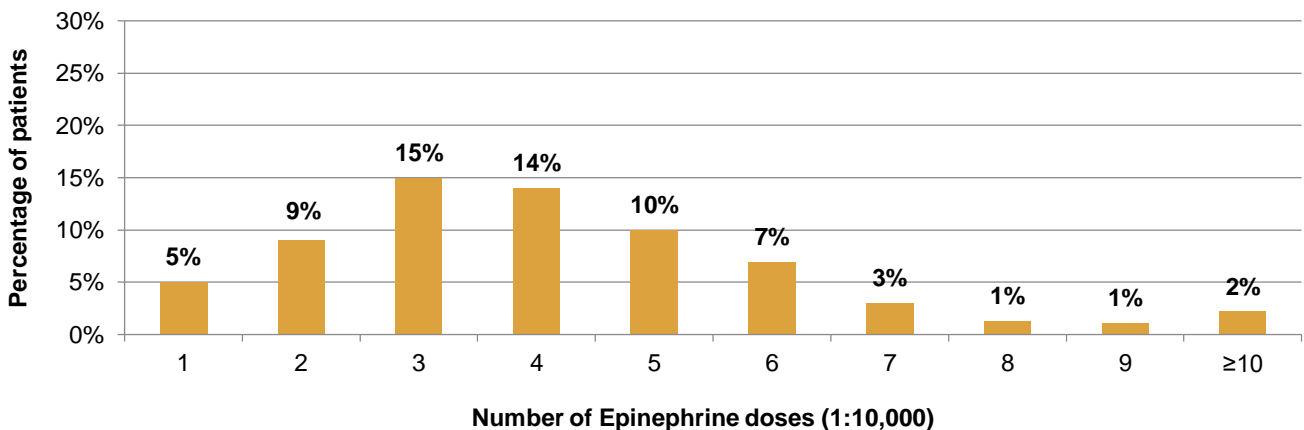
**Figure 11: Cannulation method (n=2,906)**



### 3.16: Cardiac Arrest Medication

- 67% of cases had epinephrine administered (n=1,952/2,906); the number of doses given ranged from 1 to 29 (Figure 12).

**Figure 12: Percentage of Epinephrine doses (1:10,000) (n=1,952)**



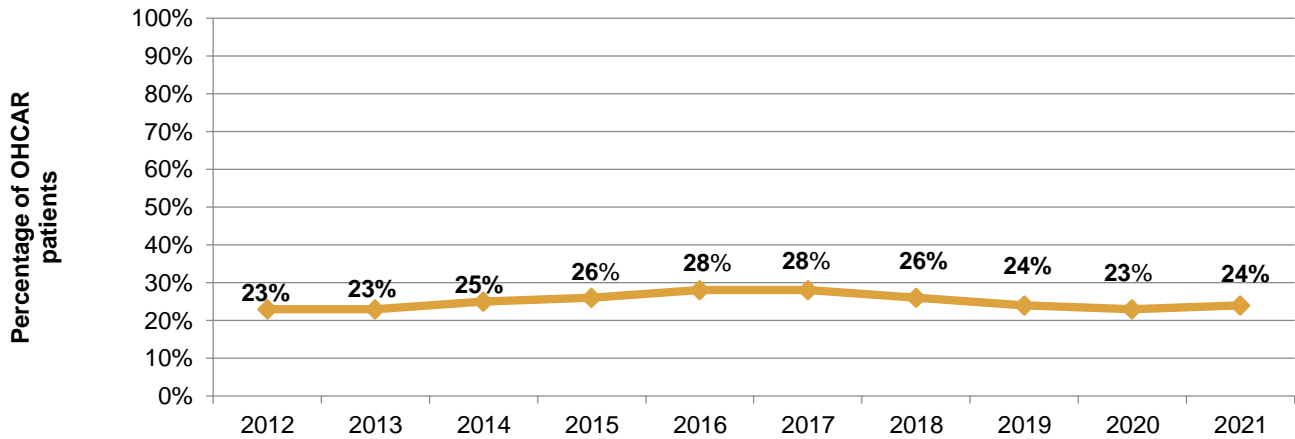
# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

### 3.17: ROSC at any stage

- 24% of cases had ROSC at some point (n=704/2,906) (Figure 13)
- 26% of cases that occurred in an urban area achieved ROSC, compared with 20% in a rural area (n=441/1,668 vs. n=211/1,043 p<0.001).

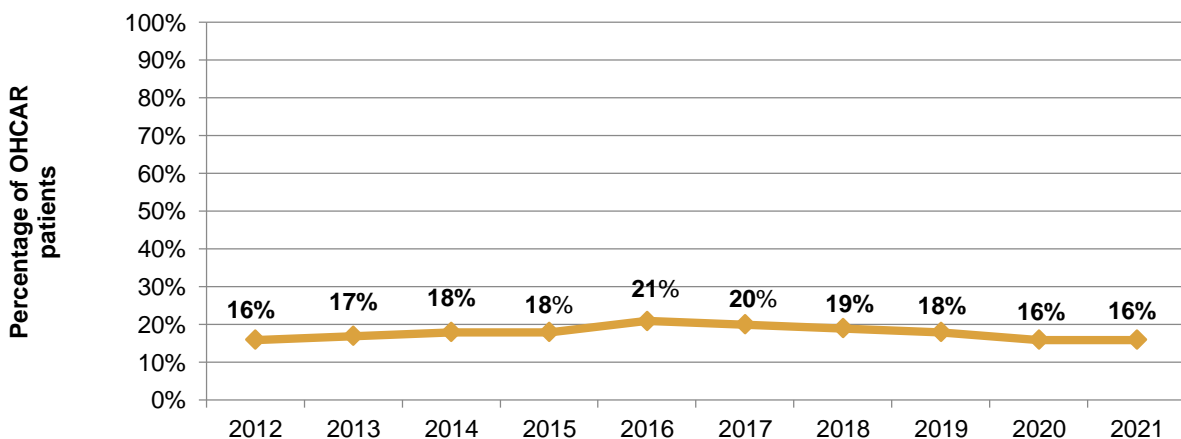
**Figure 13: ROSC at any stage pre-hospital, all patients. Years 2012 – 2021**



### 3.18: ROSC on Hospital arrival

- 16% of cases had ROSC on hospital arrival (n=463/2,906) (Figure 14)
- ROSC on hospital arrival was more likely to occur in an urban area compared to a rural area (18% vs. 12%; p<0.001).

**Figure 14: ROSC at Hospital arrival, all patients. Years 2012 – 2021**





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# Interventions and Outcomes

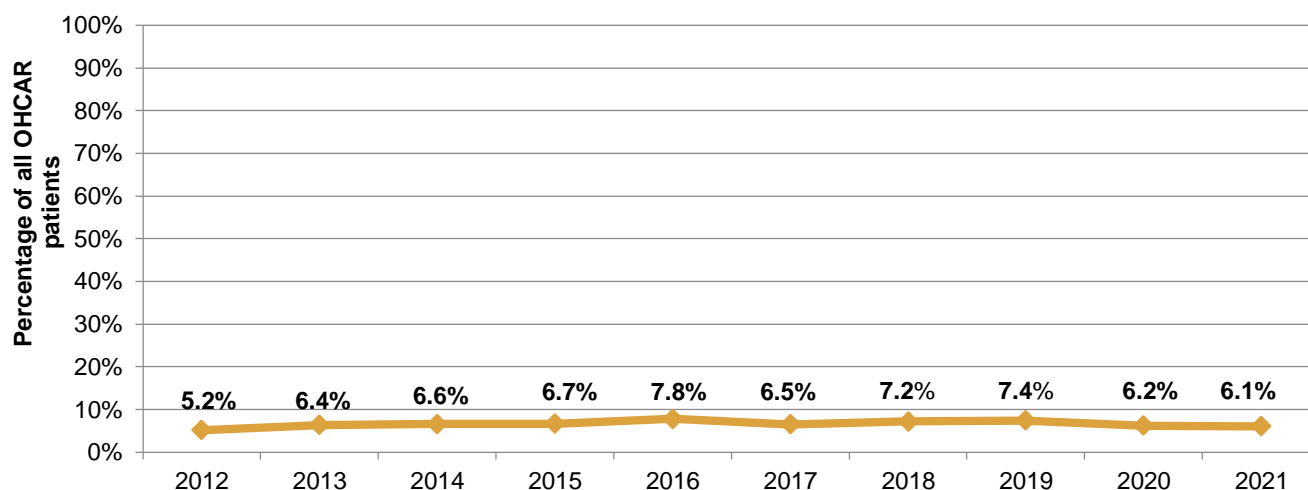
## Out-of-Hospital Cardiac Arrest Register

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### 3.19: Discharged alive from Hospital

- Data on 11 patients who were transported to hospital could not be obtained
- A total of 178/2,895 patients were discharged alive from hospital (6.1%) (Figure 15).

**Figure 15: Percentage survival to discharge, all patients. Years 2012 – 2021 (n=1,535/23,176)**



#### Comments on 2021 data

- Surviving patients were younger (median age 61 years, IQR 50 – 71) than non-surviving patients (median age 66 years, IQR 47 – 77 years, ( $p \leq 0.001$ ))
- The presumed aetiology was medical for 93% of survivors
- Survival in the presumed medical aetiology group was 7% ( $n=165/2,465$ ) compared with 3% ( $n=13/441$ ) in the non-medical group ( $p=0.0010$ )
- 16% of patients who collapsed in a public location survived ( $n=88/537$ ), compared to 4% of patients who collapsed in a private location ( $n=90/2,369$ ), ( $p \leq 0.001$ )
- 6.3% of patients who collapsed in an urban area survived ( $n=105/1,668$ ), compared to 5.5% of patients that collapsed in a rural area ( $n=57/1,043$ ), ( $p \leq 0.001$ )
- 81% of survivors had an initial shockable rhythm ( $n=145/178$ ), (Figure 16)
- 18% of survivors had an initial non-shockable rhythm ( $n=33/178$ ).

# Interventions and Outcomes

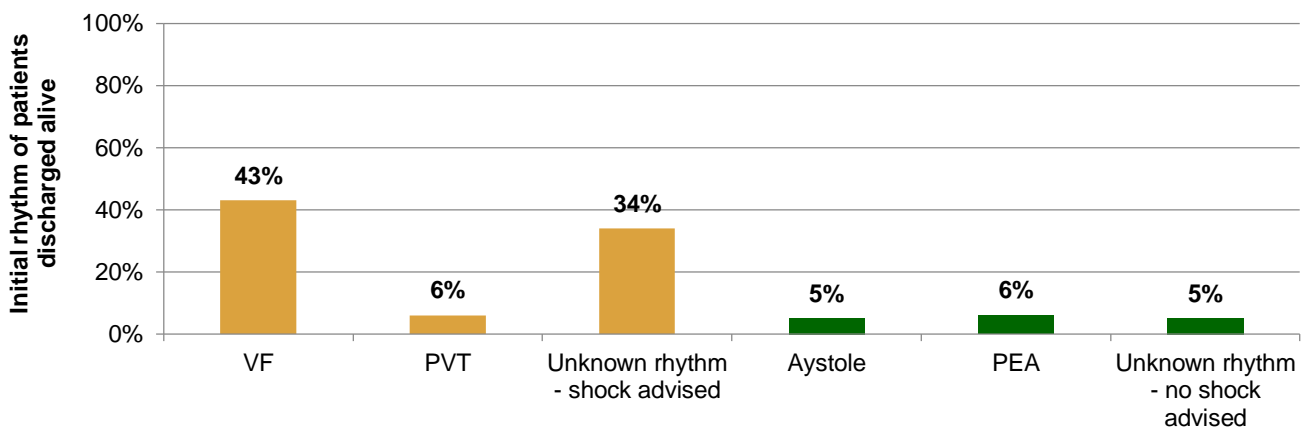
## Out-of-Hospital Cardiac Arrest Register

**“ Responders, who are not members of the Emergency Medical Services, can make all the difference when an out of hospital cardiac arrest occurs**

### Non – EMS defibrillation

- Non-EMS responders include a wide range of trained volunteers (both lay and health care professionals), off-duty EMS staff and members of the public who encounter an emergency and are prepared to provide care. In each of these groups, recognition of OHCA, ability to deliver good quality CPR and access to an AED can make all the difference, as this report demonstrates
- In 2021, of all cases where an initial shockable rhythm was found, non-EMS defibrillation occurred in 35% of cases
- Non-EMS responders defibrillated 198 patients, of whom 54 survived (27.8%)
- Of all survivors of OHCA in 2021, 54 (30.3%) resulted from non-EMS defibrillation
- This achievement emphasises the importance of these groups of responders and provides valuable evidence for their impact within the community
- It is striking that an initial shockable rhythm was found in only 19% of all cases, highlighting the need for earlier recognition of collapse and quick access to an AED.

**Figure 16: Percentage of survivors categorised by first analysed rhythm**



- In the non-EMS witnessed group of survivors (n=132)
  - 88% had a witnessed arrest
  - 89% received bystander CPR
  - 48% (n=63), had defibrillator pads applied prior to EMS arrival
  - 41% (n=54) were shocked before EMS arrival
- In the EMS-witnessed group, 14% of patients survived (n=44/306)
- In the subgroup of EMS-witnessed patients that were adults, with presumed medical aetiology, with an initial shockable rhythm, 56% of patients survived (n=35/63).

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# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

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### 3.20: Neurological function at discharge

The CPC <sup>12</sup> 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 cardiac arrest patients. The CPC score has five categories:

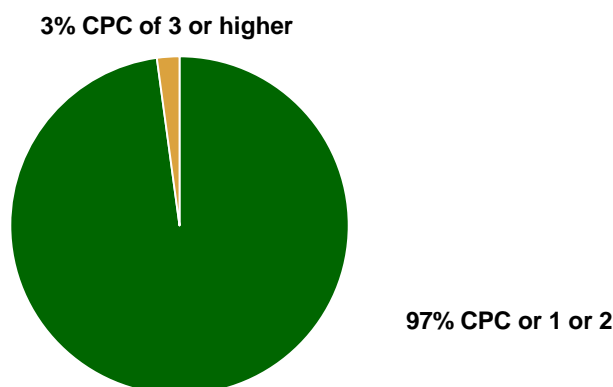
- 1) Good cerebral performance
- 2) Moderate disability: conscious, sufficient cerebral function for independent living
- 3) Severe disability: dependent on others for daily support
- 4) Coma or vegetative state
- 5) Brain death.

CPC score data was available for 157 surviving patients (Figure 17):

- 97% (n=152) had a score of 1 or 2
- 3% (n=8) had a score of 3 or higher

N.B. Data on CPC score was missing for 12% of surviving patients.

**Figure 17: CPC score at discharge**



### 3.21: OHCA in the under 35 age group

- 9% of cases were recorded as being <35 years of age (n=273/2,906)
  - 43% were of a presumed medical aetiology (n=118/273)
  - 13% were caused by trauma (road traffic accident, gunshot, stabbing, crush injuries or fall) (n=35/273)
  - 15% of cases resulted from a drug overdose (n=40/273)
  - 56% of cases were unwitnessed (n=149/266)
  - 11% were initially shockable (n=30/273)
  - 8.4% survived to Hospital discharge (n=23/273)

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# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

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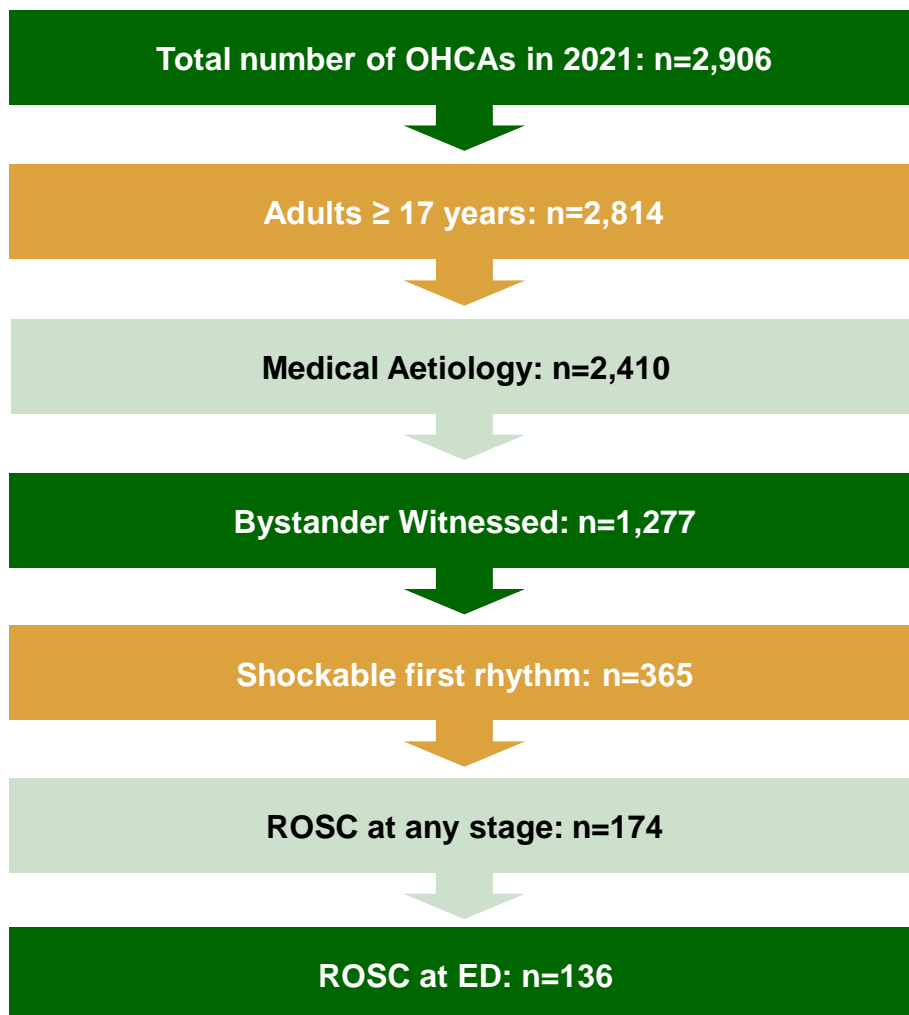
### 3.22: Utstein Comparator Subset

The Utstein comparator subset includes the following subgroup of patients

- Adult (i.e. older than seventeen years)
- Presumed medical aetiology
- Bystander witnessed arrest
- First monitored rhythm shockable.

There is wide variation of circumstances around a cardiac arrest and patient characteristics. Using the Utstein comparator subset allows for a more standardised comparison of patient outcomes between systems and time periods (Figure 18).

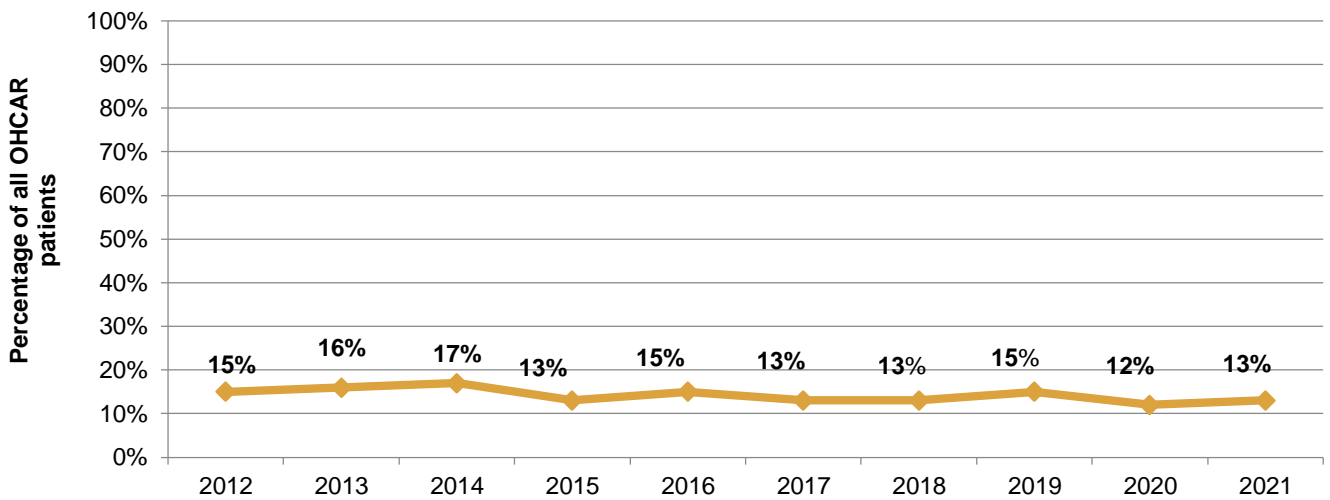
**Figure 18: Flowchart of the 2021 Utstein comparator subset and ROSC outcomes**



# Interventions and Outcomes

## Out-of-Hospital Cardiac Arrest Register

Figure 19: Utstein comparator subset 2012 – 2021



In 2021, the Utstein comparator subset included 365 patients and accounted for 13% of all OHCAR cases (365/2,906) (Figure 19).



# Interventions and Outcomes

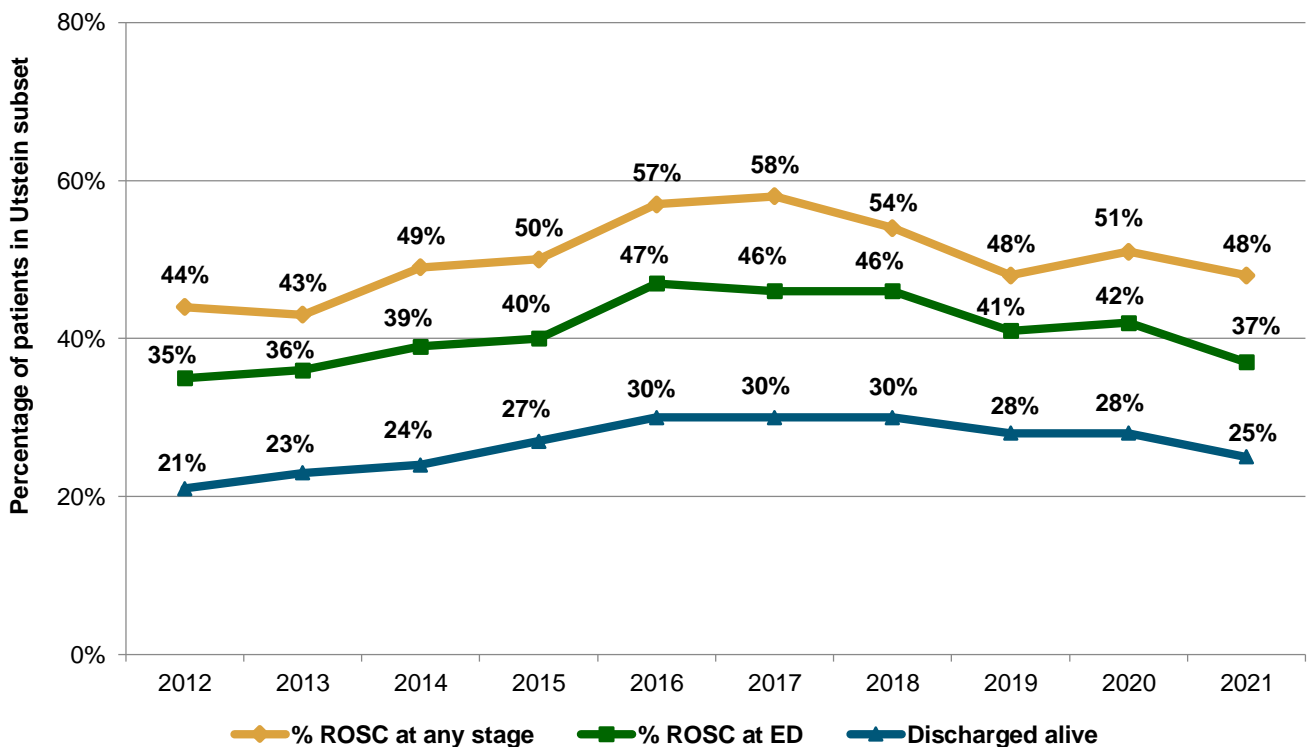
## Out-of-Hospital Cardiac Arrest Register

### 3.23: Utstein Comparator Subset Outcomes

- 48% of patients (n=174/365) achieved ROSC at some stage before hospital arrival
- 37% of patients (n=136/365) had ROSC on arrival at the ED
- 25% of patients (n=91/365) were discharged alive from hospital (Figure 20)
- Of the survivors for whom CPC was available, 96% had a CPC score of one or two (n=78/81).

N.B. Data on CPC score was missing for 11% of surviving Utstein patients.

**Figure 20: Outcomes in the Utstein comparator subset, years 2012 – 2021**



#### Case Characteristics

- Of those patients who collapsed in a public location, 42% survived (n=52/123) compared to 16% in a private location (n=39/242) (p=0.001)
- 91% of cases were recognised as cardiac arrest at the time of ambulance dispatch (n=329/363)
- Bystander CPR was performed on 89% of survivors
- 47% of the patients who survived had defibrillation attempted before ambulance service arrival (n=43/91). The estimated median time from 'time of collapse' to 'time of first shock administered' was 5 minutes (n=28/43, IQR 1 – 6).



**Conclusion**

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# Conclusion

## The Future of Out-of-Hospital Cardiac Arrest Register

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### 4.0 Conclusion

Since the last OHCAR Annual Report, the Bystander CPR has increased to 85%. Defibrillation before EMS arrival was attempted in only 6.7% of all patients. In the subgroup of patients who had defibrillation attempted (n=837), there has been an increase in attempted defibrillation before EMS arrival, from 21% to 23%. ROSC before hospital arrival was 24%, ROSC on arrival at hospital was 16% and the absolute number of patients discharged alive from hospital increased to 178.

In the Utstein group the ROSC prior to hospital arrival was 48%, ROSC at Hospital arrival was 37% and discharge alive was 25%. In line with previous years, surviving patients were more likely to be younger, have a presumed medical aetiology, have collapsed in a public, urban location, have a witnessed arrest, present in a shockable rhythm, and received bystander CPR.

### 4.1 OHCAR Research

*Research projects approved by OHCAR Steering Group July 2021 – July 2022:*

Principal Investigator	Title
Prof. Gerard Bury	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.
Dr. Maria Kehoe	Potential Donor Feasibility Study
Siobhán Masterson PHD	EuReCa THREE
Dr. Gregory Offiah	Out of Hospital Cardiac Arrest – benefits of coronary angiography when ROSC is achieved
Dr. Siobhán Masterson	Cohort study of the impact of the COVID-19 pandemic on the rate and incidence of bystander cardiopulmonary resuscitation (CPR) after out-of-hospital cardiac arrest
Mr. John Walsh	Organ Donation Transplant Ireland (ODTI) /NOCA Development of Potential Donor Audit for Ireland

### 4.2 Future developments in OHCAR

OHCAR has worked closely with NAS in implementing an electronic PCR system. This is fully operational and has facilitated a more efficient and streamlined transfer of data relating to an OHCA. Information is available to OHCAR immediately, aiding data processing and the generation of reports to service users in a short timeframe. OHCAR is in the process of updating its database which will be aligned with the electronic PCR system.





## Acknowledgements

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# Acknowledgements

## Out-of-Hospital Cardiac Arrest Register

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The OHCAR Steering Group wishes to acknowledge the contribution made to the report from the following sources:

**NAS** - Emergency Medical Technicians, Paramedics, Advanced Paramedics, Aero-Medical Crews, National Emergency Operations Centre, NAS Clinical Information Manager, NAS Clinical Development Manager, NAS National Director, NAS Clinical Director.

**DFB** - Emergency First Responders, Emergency Medical Technicians, Paramedics, Advanced Paramedics, East Region Communications Centre, District Officer EMS Support, Assistant Chief Fire Officer EMS Operations, DFB Clinical Director.

**First Responders** - All CFR Group Members, First Aid Responders, Irish Coast Guard, An Garda Síochána, Order of Malta, St. John Ambulance, Red Cross, Private Ambulance Crews, Voluntary First Responders, Bystanders, Doctors, Nurses, Local Fire Services, and Civil Defence.

**Hospitals** - Beaumont - Dr. Peadar Gilligan; ED consultant, Dr. Darragh Mathews. Cork University - Linda Evans, CHAIR Registration Officer, Kathleen Twomey, RTO. Our Lady of Lourdes, Drogheda – Rosemarie Faulkner and Claire Jordan, RTOs. Galway University – Siobhain Trowell, Applications section Officer. James Connolly Memorial, Blanchardstown - Anne Regan, RTO. University Hospital Kerry - James Hanlon, RTO. Letterkenny University - the Death Registration Office. Limerick University - Marie O’Hora, Anne McNulty & Ciara Cahill, RTOs. Mater Misericordiae University - Bernie Morgan and Orla Gaynor, RTOs. Mayo University - Liz Casey, R & EWS RTO. Midland Regional Hospital, Mullingar - Patricia Geraghty, ED secretary. Midland Regional Hospital, Portlaoise – Lloyd McGree, ED CNM3. Portiuncula University - Joe Fahy, RTO. South Tipperary General – Liz Ryan & Aoife Walsh, RTOs. St. James’s - Brendan O’Hagan. St. Vincent’s University - Statistics Department. Tallaght University - Catherine Markham, Cardiology Audit Nurse. University Hospital Waterford – Tracey Slattery, RTO. Wexford General - Frances Hore, ED secretary.

**National Office of Clinical Audit** – Aisling Connolly, Communications & Events Lead.



**Appendices**

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# Appendix 1

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# Appendix 2

## OHCAR Steering Group

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### OHCAR Steering Group

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, and met four times between September 2021 to September 2022.

*The membership at September 2022 is:*

- Professor Conor Deasy, Professor of Emergency Medicine, University College Cork and Consultant in Emergency Medicine, Cork University Hospital (OHCAR Chair)
- Professor Gerard Bury, Director, UCD Centre for Emergency Medical Science
- Dr. John Dowling, General Practitioner, North West Immediate Care Programme
- Mr. Joe Fahy, Resuscitation Officer, Portiuncula University Hospital
- Dr. Joseph Galvin, Consultant Cardiologist, Mater Hospital
- Mr. David Hennelly, Clinical Development Manager, National Ambulance Service
- Siobhán Masterson PhD, National Project Manager, Out-of-Hospital Cardiac Arrest Strategy, National Ambulance Service Lead for Clinical Strategy & Evaluation & Honorary Research Senior Lecturer, University of Galway
- Dr. David Menzies, Chair, CFR Ireland & Consultant in Emergency Medicine, St Vincent's University Hospital & Clinical Lead, Emergency Medical Science, UCD, Centre for Emergency Medical Science
- Professor Andrew Murphy, Foundation Professor, Discipline of General Practice, University of Galway
- Professor Cathal O'Donnell, Clinical Director, National Ambulance Service
- Mr. Michael O'Reilly, Assistant Chief Fire Officer, Dublin Fire Brigade
- Mr. Martin O'Reilly, District Officer, EMS Support Officer, Dublin Fire Brigade
- Ms. Bridget Clarke, National Ambulance Service Lead for Out of Hospital Cardiac Arrest Strategy & Associated Programmes
- Mr. Martin Quinn, OHCAR Manager, National Ambulance Service.

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# Appendix 3

## Meetings and Publications

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### OHCA Meetings, Representations and Publications

- The OHCA Strategy Governance Implementation Steering Group Meeting, "OHCA and the OHCA Strategy", Ashbourne 31 March 2022
- Irish Association of resuscitation Training Officers Conference, Mullingar 8<sup>th</sup> April 2022
- ERC Conference, Antwerp 16<sup>th</sup> – 17<sup>th</sup> June 2022
- Respond 2022, 17<sup>th</sup> September 2022

### Publications using OHCA data or supported by OHCA

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, <https://doi:10.1016/j.resuscitation.2015.12.018>.

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# Appendix 3

## Meetings and Publications

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### Publications using OHCAR data or supported by OHCAR (contd.)

Masterson S, Teljeur C, Cullinan J, Murphy AW, Deasy C, Vellinga A (2017). The Effect of Rurality on Out-of-Hospital Cardiac Arrest Resuscitation Incidence: An Exploratory Study of a National Registry Utilizing a Categorical Approach. *The Journal of Rural Health*; epub.

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H. Maurer, S. Masterson, IB. Tjelmeland, JT. Gräsner, R. Lefering, BW. Böttiger, L. Bossaert, J. Herlitz, RW. Koster, F. Rosell-Ortiz, GD. Perkins, J. Wnent; When is a bystander not a bystander anymore? A European Survey. *Resuscitation* (2018), <https://doi.org/10.1016/j.resuscitation.2018.12.009>

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# Appendix 3

## Meetings and Publications

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### Publications using OHCAR data or supported by OHCAR (contd.)

Baldi, E.; Grieco, N.B.; Ristagno, G.; Alihodžić, H.; Canon, V.; Birkun, A.; Cresta, R.; Cimpoesu, D.; Clarens, C.; Ganter, J.; Markota, A.; Mols, P.; Nikolaidou, O.; Quinn, M.; Raffay, V.; Ortiz, F.; Salo, A.; Stieglis, R.; Strömsöe, A.; Tjelmeland, I.; Trenkler, S.; Wnent, J.; Grasner, J.; Böttiger, B.; Savastano, S.; The Automated External Defibrillator: Heterogeneity of Legislation, Mapping and Use across Europe. New Insights from the ENSURE Study. J. Clin. Med. 2021, 10, 5018.  
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# Appendix 4

## OHCAR Utstein Comparator Subset 2021 – Regional Results

Figure 1: Number of OHCAR patients in the Utstein group by region (n=365)

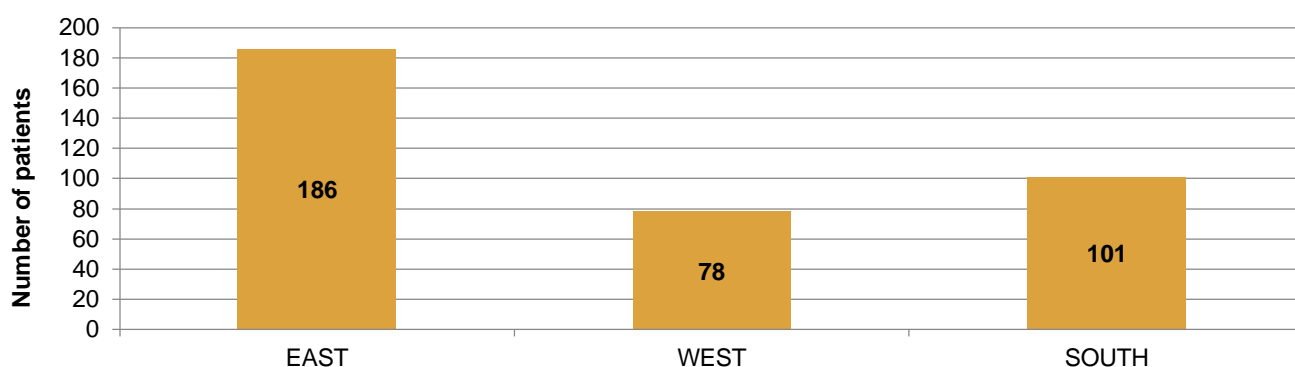


Figure 2: Number of OHCAR patients in the Utstein group by region (n=365)

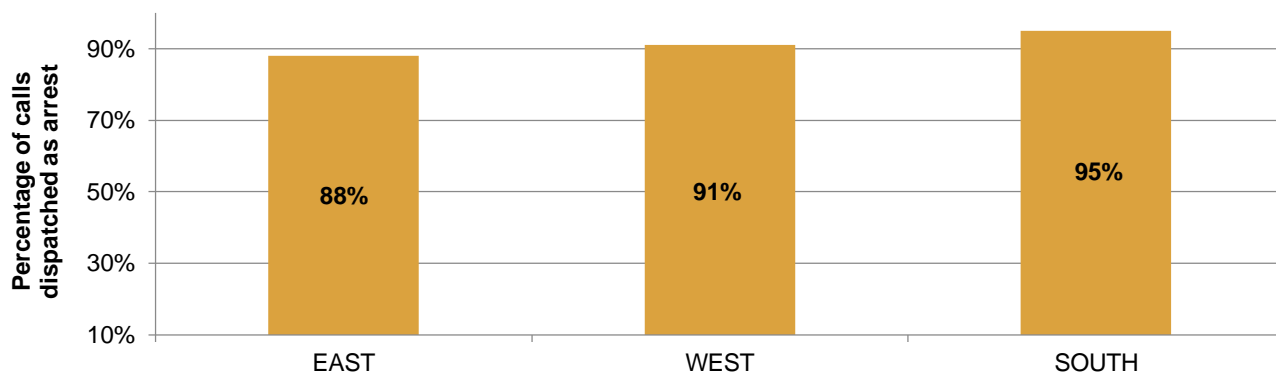
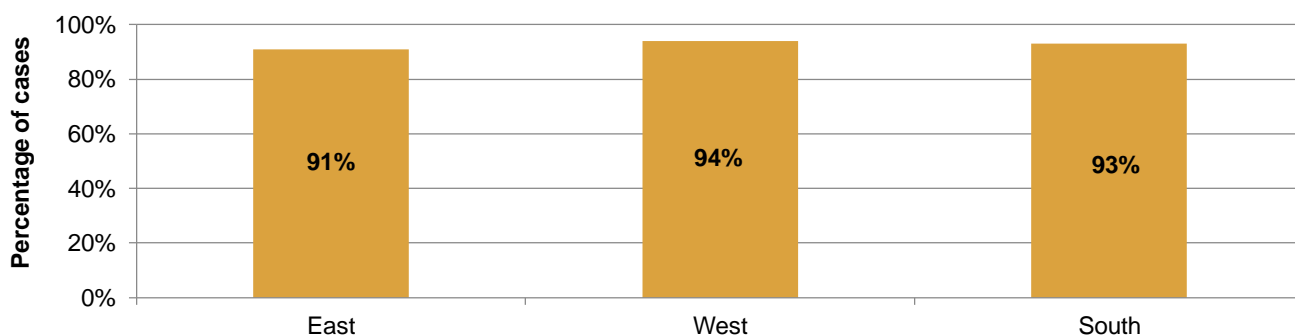


Figure 3: Percentage of Utstein cases with bystander CPR:



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# Appendix 5

## Abbreviations

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Acronym	Term
B-CPR	Bystander Cardiopulmonary Resuscitation
BLS	Basic Life Supporter
CFR	Community First Responder
CPC	Cerebral Performance Category
CPR	Cardiopulmonary Resuscitation
CRI	Call Response Interval
CSO	Central Statistics Office
DAA	Dublin Airport Authority
DFB	Dublin Fire Brigade
ED	Emergency Department
EMS	Emergency Medical Services
ePCR	Electronic Patient Care Record
ERC	European Resuscitation Council
EuReCa	European Registry of Cardiac Arrest
GP	General Practitioner
HRB	Health Research Board
HSE	Health Service Executive
IQR	Interquartile Range
NAS	National Ambulance Service
OHCAR	Out-of-Hospital Cardiac Arrest Register
PCR	Patient Care Records
PEA	Pulseless Electrical Activity
PHECC	Pre-Hospital Emergency Care Council
pVT	Pulseless Ventricular Tachycardia
ROSC	Return of Spontaneous Circulation