

# SCOTTISH OUT-OF-HOSPITAL CARDIAC ARREST DATA LINKAGE PROJECT: 2017/18 RESULTS



## Contents

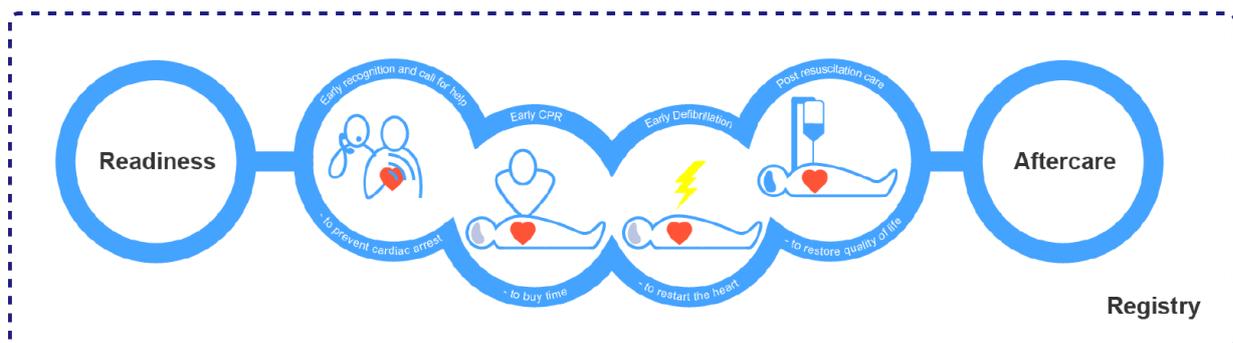
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|---|----|
| Contents.....   | 2  |
| Preface.....  | 3  |
| Thanks .....  | 4  |
| Authors.....  | 4  |
| Improving Outcomes from OHCA – Where we are now .....       | 5  |
| Background.....   | 6  |
| Summary of main findings .....                              | 6  |
| Out-of-Hospital Cardiac Arrest Data for 2017/18 .....       | 7  |
| Number of worked arrests .....                              | 7  |
| Data Linkage.....   | 7  |
| Demographics.....   | 8  |
| Initial rhythm, Bystander CPR and Survival .....            | 10 |
| Initial rhythm .....  | 10 |
| Bystander CPR .....   | 11 |
| ROSC and Survival.....                                      | 13 |
| Number of OHCA Survivors per million of the population..... | 14 |
| Discussion.....   | 15 |
| References.....   | 18 |
| Correspondence and enquiries.....                           | 19 |

## Preface

This is the third report summarising outcomes after Out-of-Hospital Cardiac Arrest (OHCA) in Scotland. OHCA continues to be a significant challenge with an average of 67 people - almost a double-decker busload - being resuscitated in the community each week.

The key to increasing the number of people who survive without loss of function is to improve our system of care - starting with bystanders in the community, and continuing until after a return home from hospital. This system is summarised below using the metaphor of the 'Chain of Survival'. Our Chain includes links for community readiness to act in the event of sudden cardiac arrest, early recognition and call for help, early cardiopulmonary resuscitation (CPR), early defibrillation, post-resuscitation care and aftercare to ensure recovery continues after leaving hospital.

This report tracks key patient outcomes from Scotland's Strategy for OHCA as strategy partners attempt to optimise implementation of the 'Chain of Survival' across the country<sup>1</sup>. In our previous work, we identified significant differences in the incidence of, and also in survival outcomes related to, OHCA and the Scottish Index of Multiple Deprivation (SIMD). We have again included headline figures relating to OHCA and SIMD.



**The 'Augmented Chain of Survival' showing the elements required to save lives after OHCA<sup>1</sup>.**

## Thanks

As always, this work represents the dedication and sustained effort of a range of individuals. We would like to publicly acknowledge the contribution of the following people in enabling the production of this report, whilst mindful of the help of many others who are not listed here.

### **Kerry Morgan and Connie Smith**

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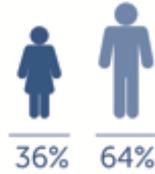
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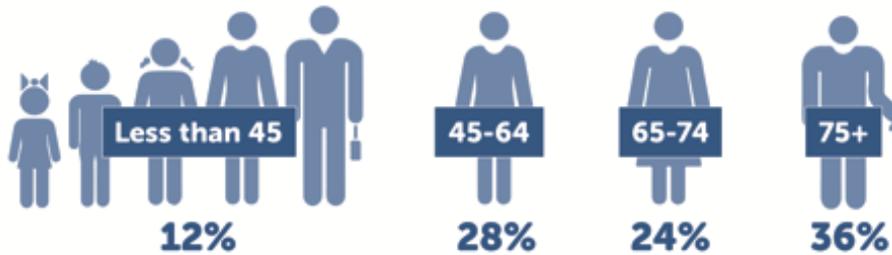
## Improving Outcomes from OHCA – Where we are now

### Improving Outcomes from OHCA Where we are now

Average number of OHCA  
**3,500 per year**



OHCA can affect people of all ages at any time



\*Baseline figures from 2011-2015 prior to the launch of Scotland's Strategy for OHCA in March 2015.

## Background

The data contained in this report sits in the context of our previous OHCA work and was collated using the same methodology<sup>2</sup>.

This report presents results for 2017/18 analysis including data from 1st April 2017 to 31st March 2018. Findings for the 2017/18 period have been put in the context of data from previous years including 2011/12 to 2016/17. This innovative work has linked complex datasets in order to report on OHCA in Scotland. As such, the results should be treated as provisional whilst the data and methodology are still in development. It should be noted for time series analysis that 2013/14 data has been excluded from the analysis due to incomplete data. This data will be updated in due course.

## Summary of main findings

- The number of patients with OHCA that had resuscitation attempted in the community was stable at 3,484 (compared to 3,455 in 2016/17) while data linkage completion continues to improve with 88.7% of OHCA cases linked in 2017/18 (compared with 73.0% in 2011/12).
- There has been little change in the mean age of OHCA patients (66 years) or the male vs female split (64% vs 36%).
- Bystander CPR rates have increased to 55.5% in 2017/18 compared with 49.9% in 2016/17, and more patients had a pulse on arrival at hospital than in previous years with 'Return of Spontaneous Circulation' (ROSC - all rhythms) up to 23.3% in 2017/18 from 20.2% in 2016/17.
- Survival at 30 days was unchanged at 8.3% of all worked arrests in 2017/18 compared to the previous year. Expressed as the number of survivors per million of the Scottish population, this was 53 survivors/million in 2017/18 which shows a sustained increase when compared to 45 survivors/million in 2014/15, the year before the official launch of the Strategy.
- People living in most deprived quintile (SIMD1) continue to have around twice as many OHCA as those in the least deprived quintile (SIMD5). Arrests in SIMD1 areas happen at a younger age (8 years younger on average) and are more likely to be fatal than those occurring in SIMD5. People in less deprived areas (SIMD5) are more likely to receive bystander CPR (60% in SIMD5 vs 56% in SIMD1). They are also more likely to have an initial cardiac rhythm treatable with defibrillation (31.7% SIMD5 vs 25.5% SIMD1).

## Out-of-Hospital Cardiac Arrest Data for 2017/18

### Number of worked arrests

'Worked arrests' are those non-traumatic OHCA where resuscitation was attempted by the Scottish Ambulance Service (SAS). This number forms the denominator for all subsequent outcome calculations. There are a number of reasons why SAS may not attempt resuscitation including obvious death, or the confirmation that resuscitation was not the patient's wish - for example by the presence of a 'do not attempt CPR' order as part of an anticipatory care plan. Table 1 below shows the number of worked arrests has increased gradually from 2,692 patients in 2011/12 to 3,484 in 2017/18.

**Table 1: Number of worked arrests and proportion linked**

| Time Period | Number of OHCA cases resuscitated by the Scottish Ambulance Service | Number of cases in the linked dataset | Proportion of cases which were linked (%) |
|-------------|---|---------------------------------------|---|
| 2011/12     | 2,692   | 1,966                                 | 73.0                                      |
| 2012/13     | 3,047   | 2,306                                 | 75.7                                      |
| 2014/15     | 3,277   | 2,634                                 | 80.4                                      |
| 2015/16     | 3,142   | 2,648                                 | 84.3                                      |
| 2016/17     | 3,455   | 2,991                                 | 86.6                                      |
| 2017/18     | 3,484   | 3,090                                 | 88.7                                      |

*Table 1 showing the number of OHCA cases resuscitated by the Scottish Ambulance Service each year between 2011/12 and 2017/18. Complete data for 2013/14 was not available and is omitted.*

### Data Linkage

The collection and preparation of data contained in this report follows the same methodology of our previous report: Initial Results of the Scottish Out-of-Hospital Cardiac Arrest Data Linkage Project <sup>2</sup>.

In brief, the SAS provided data on all OHCA incidents where resuscitation was attempted during the reporting period. Where possible, the patients involved in each incident were linked to survival outcome data via their Community Health Index (CHI) number by the Information Services Division, NHS National Services Scotland. In addition, measures such as the Scottish Index of Multiple Deprivation (SIMD)<sup>3</sup> were applied to the dataset to allow further analysis.

The proportion of linked arrests has increased from 73.0% in 2011/12 to 88.7% in the 2017/18. Figure 1 below shows the gradual increase in the number of worked arrests each year. It also shows a gradual improvement in the number of these cases which have been linked to clinical outcomes via the CHI number.

**Figure 1: Proportion of worked OHCA included in linked dataset**

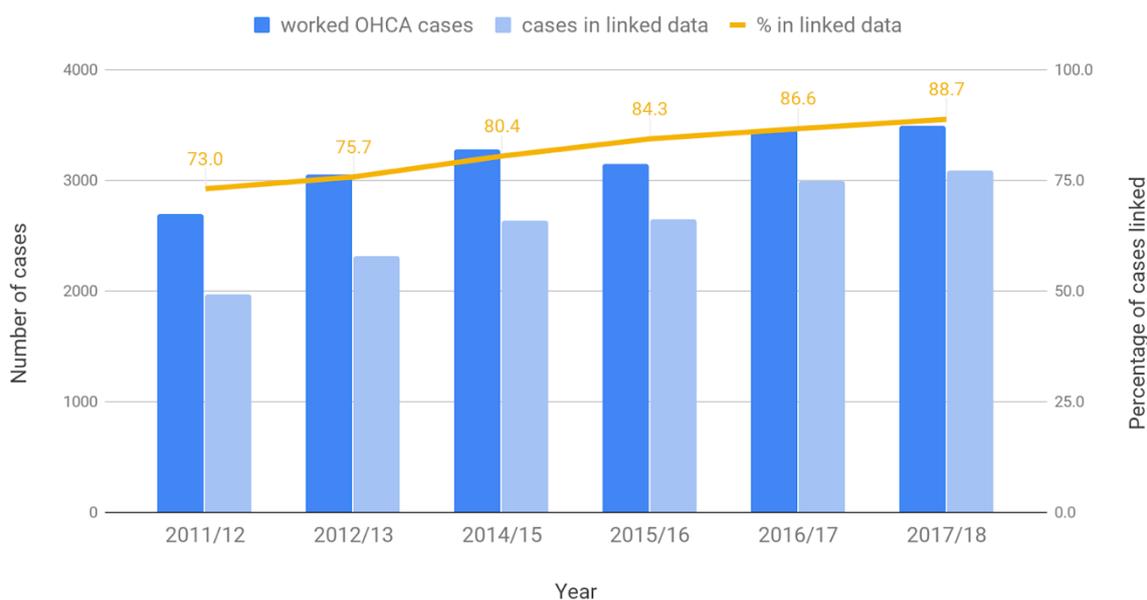


Figure 1 showing the number of worked OHCA cases which were linked to outcome data each year between 2011/12 and 2017/18. Complete data for 2013/14 was not available and is omitted.

## Demographics

Table 2 below shows there has been little change in the baseline demographics of patients with worked OHCA since 2011/12. The average (mean) age of patients in 2017/18 was 66 years compared with 67 years in 2011/12, while the proportion of males was 64% in 2017/18 compared to 63% in 2011/12.

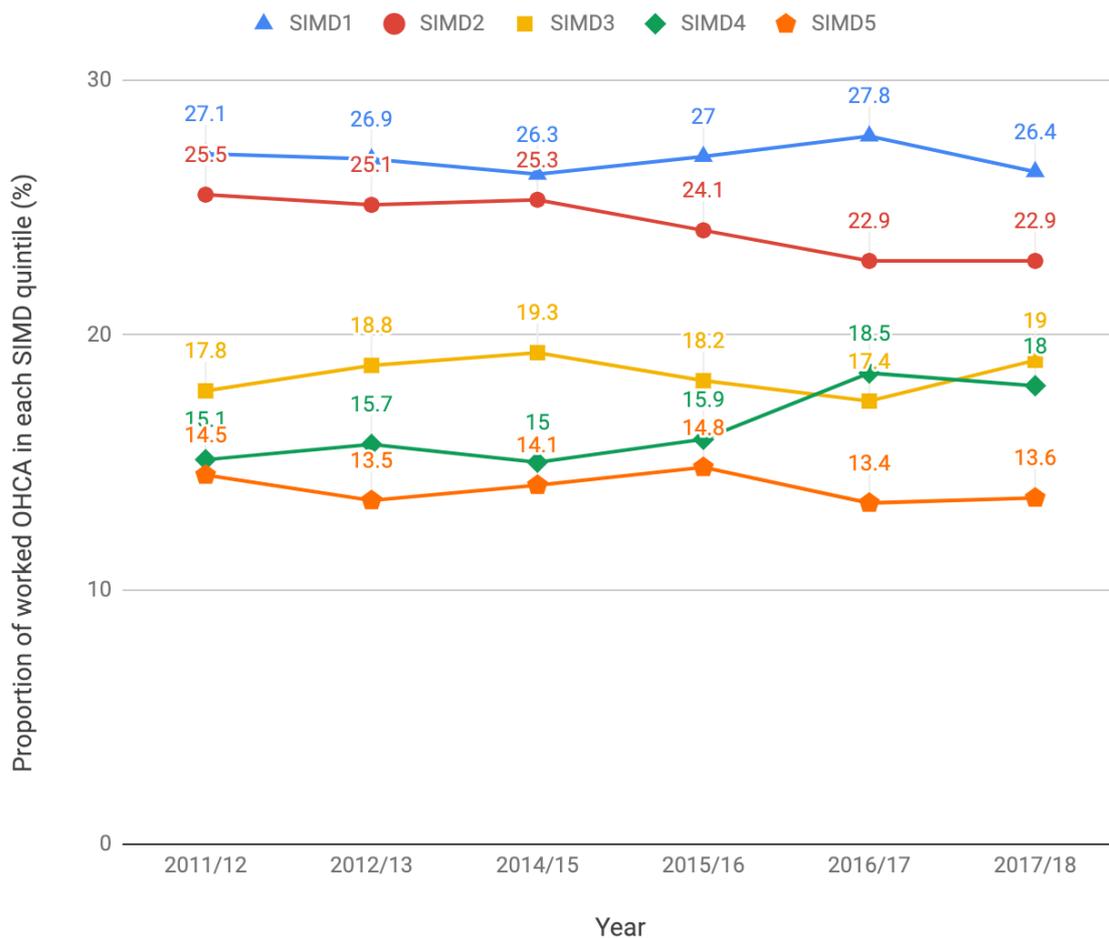
**Table 2: Characteristics of worked OHCA cases**

| Period included | 2011/12     | 2012/13     | 2014/15     | 2015/16     | 2016/17     | 2017/18     |
|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Age (mean, SD)  | 67.4 (17.8) | 67.8 (17.7) | 68.0 (17.6) | 67.7 (17.0) | 66.1 (18.2) | 66.4 (17.7) |
| Males (%)       | 62.7        | 62.9        | 61.9        | 62.1        | 63.3        | 64.3        |
| SIMD (%)        |             |             |             |             |             |             |
| Quintile 1      | 27.1        | 26.9        | 26.3        | 27.0        | 27.8        | 26.4        |
| Quintile 2      | 25.5        | 25.1        | 25.3        | 24.1        | 22.9        | 22.9        |
| Quintile 3      | 17.8        | 18.8        | 19.3        | 18.2        | 17.4        | 19.0        |
| Quintile 4      | 15.1        | 15.7        | 15.0        | 15.9        | 18.5        | 18.0        |
| Quintile 5      | 14.5        | 13.5        | 14.1        | 14.8        | 13.4        | 13.6        |

Table 2 showing the characteristics of worked OHCA cases by the SAS each year between 2011/12 and 2017/18. Complete data for 2013/14 was not available and is omitted.

Additionally, the significant difference in the distribution of OHCA across SIMD quintiles remains the same. There has been little variation in the proportion of OHCA in each SIMD quintile over time, with SIMD1 (most deprived) containing roughly double the number of arrests compared to SIMD5 (least deprived), see figure 2 below.

**Figure 2: Proportion of OHCA in each SIMD quintile over time**



*Figure 2: The line graph shows the proportion of worked OHCA in each SIMD quintile between 2011/12 and 2017/18. Complete data for 2013/14 was not available and is omitted.*

The age of OHCA patients in each quintile has also remained stable between 2011/12 and 2017/18 with those in SIMD1 having a cardiac arrest around 8 years earlier than their contemporaries living in SIMD5 areas, see figure 3.

**Figure 3: Age of worked arrests in each SIMD quintile, before and after the launch of Scotland’s Strategy for OHCA**

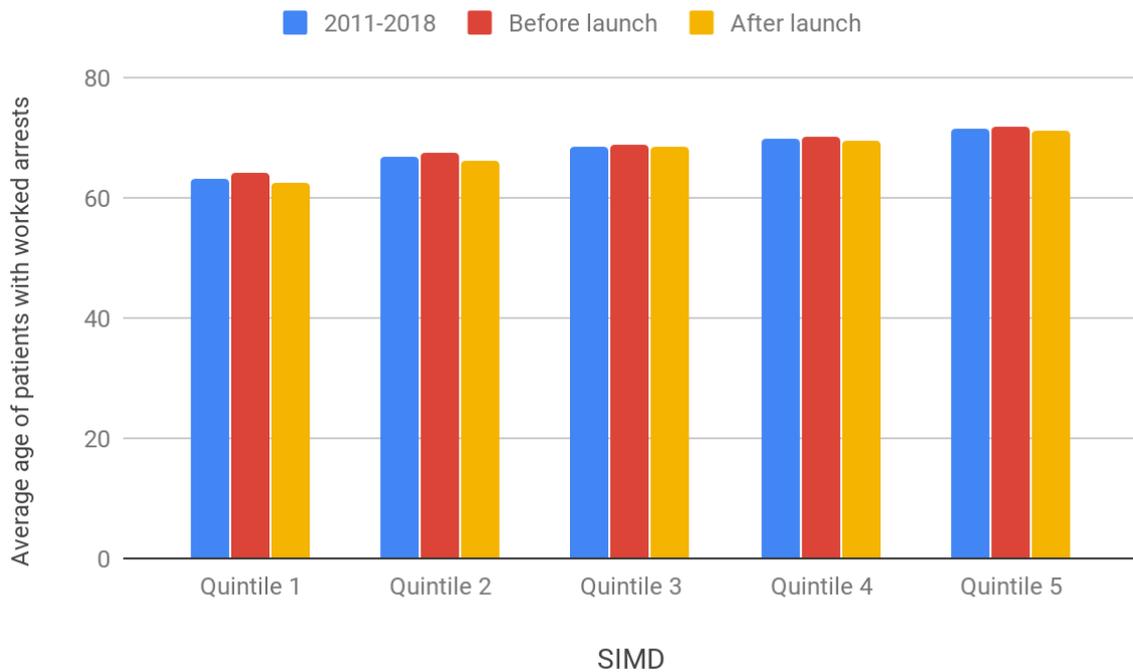


Figure 3 shows the mean age of patients with worked arrests in each SIMD quintile. Figures are shown for the whole period of 2011/12-2017/18, the period before the launch of the Strategy (2011/12-2014/15) and the period after the launch (2015/16-2017/18).

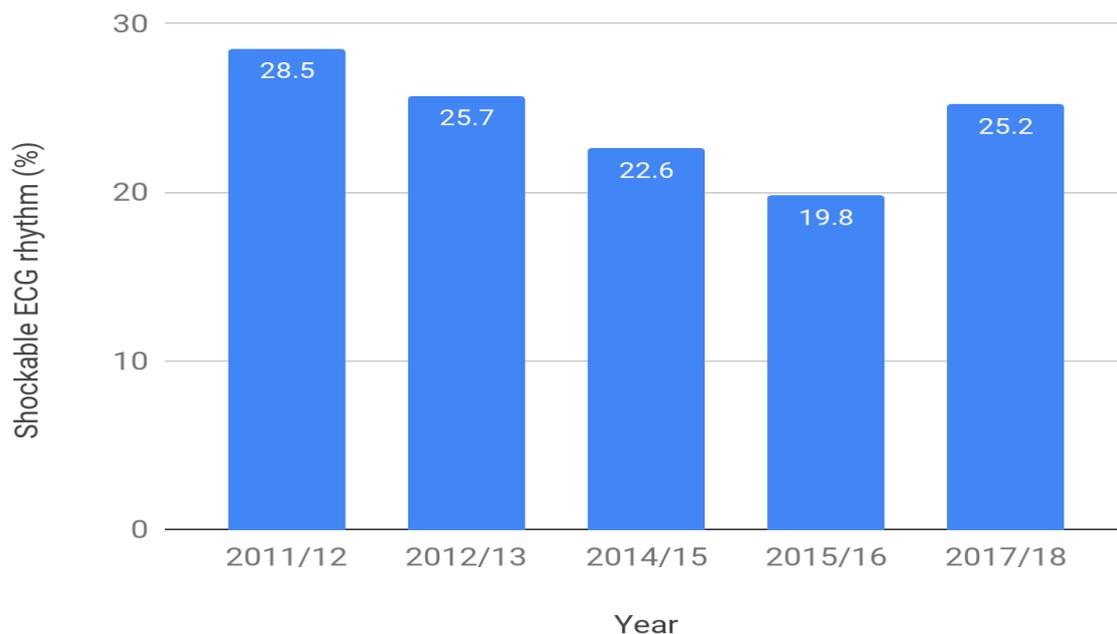
## Initial rhythm, Bystander CPR and Survival

### Initial rhythm

The initial heart rhythm recorded on the ECG (Electrocardiogram) on arrival of SAS is significant. A patient may have a shockable rhythm (ventricular fibrillation or ventricular tachycardia), treated by delivering an electric shock using a defibrillator, or non-shockable rhythm (asystole or pulseless ventricular activity and bradycardia). The initial treatment and prognosis depends on presenting heart rhythm, with better survival after OHCA with shockable rhythm. In 2017/18, data was available for 93.4% of worked OHCA included in the linked dataset. A shockable initial rhythm was recorded in 25.2% of worked OHCA cases.

Figure 4 shows how this compares with previous years.

**Figure 4: Proportion of OHCA with shockable initial ECG rhythms**

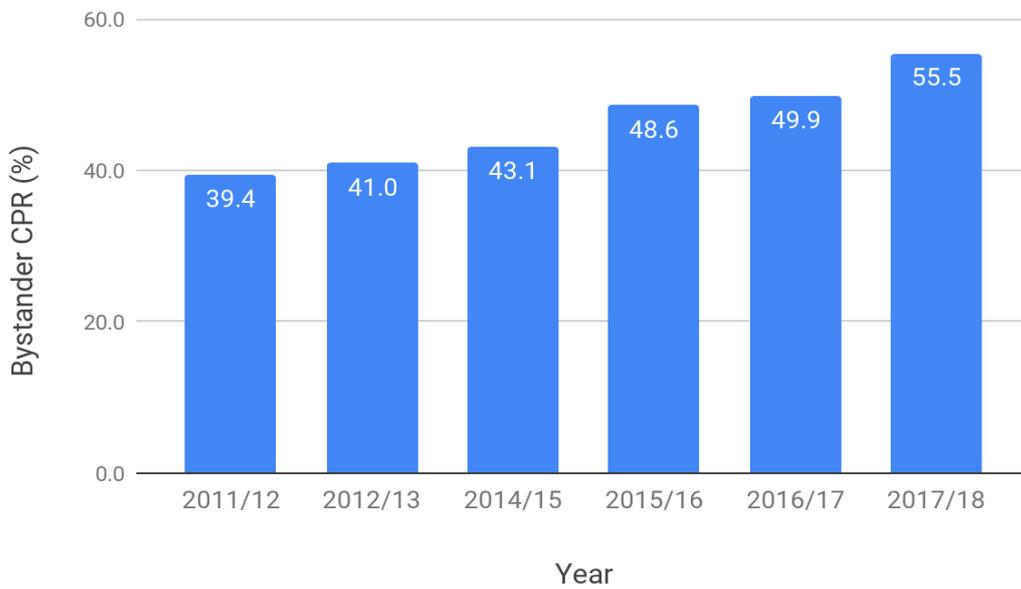


*Figure 4: Shows the proportion of OHCA with a shockable initial rhythm (ventricular fibrillation or pulseless ventricular tachycardia) recorded on arrival of the Scottish Ambulance Service 2011/12 to 2017/18. Complete data for 2013/14 and 2016/17 was not available and is omitted.*

### **Bystander CPR**

Whether or not a member of the public performs chest compressions (CPR) on a patient while awaiting the arrival of the ambulance service is the most important modifiable factor determining survival after OHCA. Promoting bystander CPR is a key element of Scotland's Strategy for OHCA<sup>1</sup>. The proportion of OHCA with bystander CPR is therefore a very important metric for tracking progress. In 2017/18 bystander CPR was recorded as taking place on arrival of SAS personnel in 55.5% of cases. Figure 5 below shows the steadily increasing rate of bystander CPR since 2011/12.

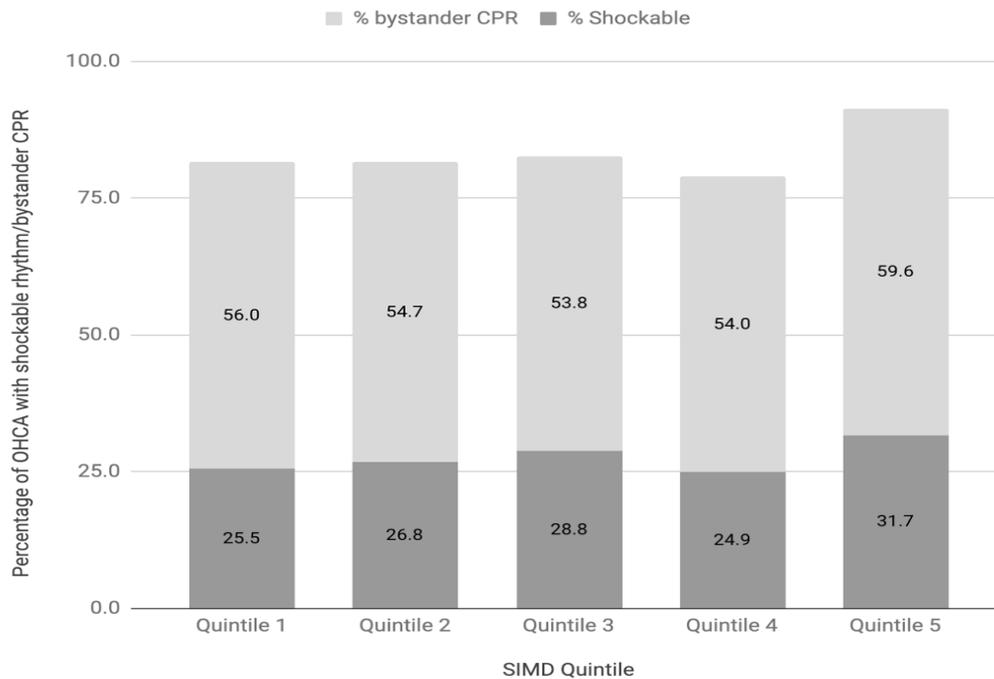
**Figure 5: Proportion of OHCA where bystander CPR was performed**



*Figure 5: Shows the proportion of OHCA where bystander CPR was performed prior to the arrival of the Scottish Ambulance Service 2011/12 to 2017/18. Complete data for 2013/14 was not available and is omitted.*

Figure 6 shows the proportion of arrests in each SIMD quintile who had an initial shockable rhythm and those who received bystander CPR in 2017/18.

**Figure 6: Proportion of worked OHCA with shockable rhythm, bystander CPR, ROSC and 30-day survival for each SIMD quintile in 2017/18**



*Figure 6: Shows the proportion of worked OHCA in each SIMD quintile who had a shockable initial ECG rhythm (dark columns) and who received bystander CPR (stacked lighter columns) in 2017/18.*

### ROSC and Survival

The key clinical outcome after OHCA is patient survival. This can be expressed in a range of ways. An important intermediate measure is Return of Spontaneous Circulation (ROSC). Definitions for ROSC vary. The Scottish Ambulance Service records ROSC if a patient regains a palpable pulse which is sustained until arrival at the Emergency Department. This is sometimes referred to as ‘survival to hospital’ or ‘number of hearts restarted’. ROSC does not equate to survival. In this document we report an overall ROSC rate for OHCA, including shockable and non-shockable rhythms.

The definition of ‘survival’ used in this report is survival to 30 days after OHCA. We have defined survival as the proportion of worked OHCA where patients were still alive at 30 days. It is important to note that worked arrests which were not linked to outcome data have been assumed to be deaths and included in the denominator when calculating survival rates. This approach was taken deliberately to avoid over-inflation of survival figures, and is not universally adopted by groups reporting OHCA data. A more detailed discussion of the methodology we have used can be found here<sup>24</sup>. In 2017/18 ROSC occurred in 23.3% of cases, while 8.3% of OHCA patients survived to 30 days. This is shown in Figure 7.

**Figure 7: Proportion of worked arrests which had ROSC, and the proportion of people who survived to 30 days after OHCA**

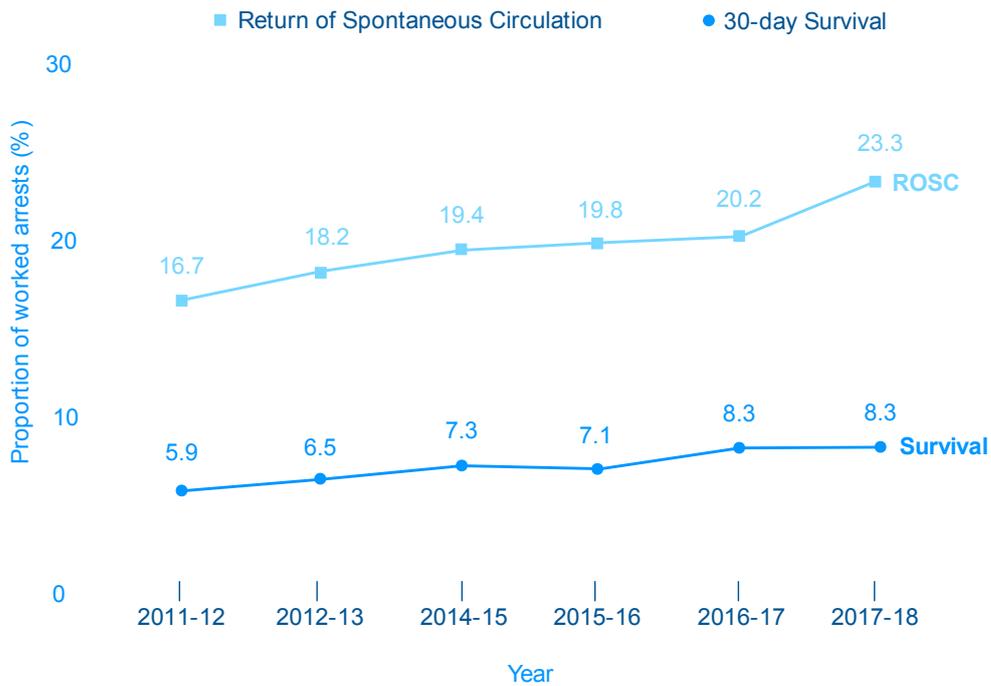


Figure 7: Shows the proportion of OHCA where the patient had a pulse on arrival at hospital (ROSC), and the proportion of OHCA patients who were alive at 30 days, 2011/12 to 2017/18. Complete data for 2013/14 was not available and is omitted.

### Number of OHCA Survivors per million of the population

Another method of describing survival after OHCA is to measure the number of 30-day survivors per million of the population. The advantage of this approach is that it measures the actual number of survivors, and is less susceptible to variations in data interpretation which can skew the ‘worked arrests’ denominator when calculating the proportion of worked OHCA who survive to 30 days. Population figures for this calculation are derived from mid-year estimates from National Records of Scotland. Figure 8 shows the 30-day survival per million of the population and reported bystander CPR rates for all worked arrests from 2011/12 - 2017/18. Figure 8 has also been annotated to show key milestones in improving the Chain of Survival in Scotland, including the launch of the OHCA Strategy in March 2015.

**Figure 8: Number of 30-day survivors after OHCA per million of the population and proportion of OHCA receiving bystander CPR**

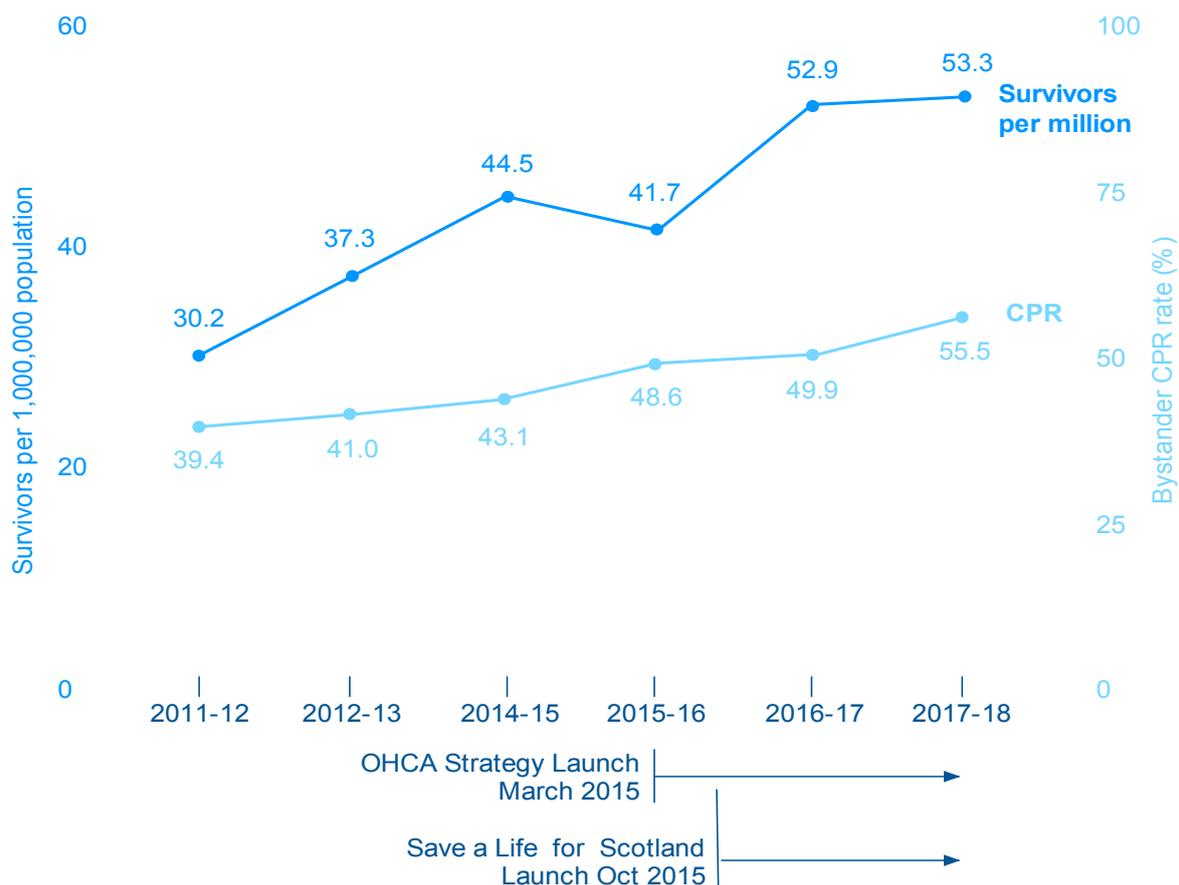


Figure 8: Shows the number of 30-day survivors per million of the population (dark blue line) and the rate of bystander CPR 2011/12 to 2017/8 (light blue line). Complete data for 2013/14 was not available and is omitted.

## Discussion

The number of patients with OHCA that had resuscitation attempted in the community during 2017/18 was stable at 3,484 (compared to 3,455 in 2016/17). The proportion of incidents where data linkage is completed continues to improve - being possible for 88.7% of OHCA cases in 2017/18. This is likely to represent continued improvement in data recording by the Scottish Ambulance Service and improves the quality of information included in this report.

The key demographic descriptors of people having OHCA remains the same as in previous years. There were no changes in the mean age of OHCA patients (66 years) or the male vs female split (64% vs 36%). People living in the most deprived quintile (SIMD1) continue to have around twice as many OHCA as those in the least deprived (SIMD5). Arrests in SIMD1 areas happen at a younger age (8 years younger on average) and are more likely to be fatal

than those occurring in SIMD5. People in the least deprived quintile (SIMD5) are more likely to receive bystander CPR (60% in SIMD5 vs 56% in SIMD1) and to have an initial cardiac rhythm treatable with defibrillation (31.7% SIMD5 vs 25.5% SIMD1).

Significantly, bystander CPR rates have increased to 55.5% in 2017/18 compared with 49.9% in 2016/17. This is likely to be due several factors. At the time of writing the Save a Life for Scotland partnership have equipped more than 300,000 people in Scotland with CPR skills, and coordinated a range of social marketing initiatives<sup>5</sup>. Additionally, the Scottish Ambulance Service have implemented a range of improvements to enhance telephone support for bystander CPR.

Overall there has been an increase in the number of patients who had a pulse on arrival at hospital than in previous years with 'Return of Spontaneous Circulation' (ROSC) up to 23.3% in 2017/18 from 20.2% in 2016/17. However there was no significant change in 30-day survival. The reason for this is unclear, though the relationship between ROSC and 30-day survival is affected by a range of factors including pre-hospital resuscitation (e.g. the use of epinephrine) and in-hospital post-resuscitation care.

As we have pointed out in previous reports, the proportion of OHCA calls where resuscitation was attempted is variable<sup>2</sup>. The threshold for attempting resuscitation has been found to vary significantly between ambulance services, which is one of the factors making the reliance on worked arrests as the denominator for calculating survival problematic<sup>6</sup>.

As the age and size of the population of Scotland is increasing the Scottish Ambulance Service is frequently called to deal with patients in the terminal stages of illness in their own homes. This patient group pose significant challenges in anticipatory care planning. Initiatives such as the Chief Medical Officer's 'Realistic Medicine', Health Improvement Scotland's 'What Matters to You' and the Scottish Government's '2020 Healthcare Strategy' set a priority of providing the right care to the patient in the right setting. With this in mind, the Scottish Ambulance Service is engaging with partners to develop safeguards and processes aimed at ensuring that these individuals and their carers are not exposed to inappropriate and distressing resuscitation attempts in the event of a cardiac arrest.

In response to this issue, the Global Resuscitation Alliance (an international body focused on implementation of the chain of survival in OHCA<sup>7</sup>) have suggested that reporting number of survivors per million of the population may be a better way to structure outcome data than calculating the proportion of 'worked arrests'<sup>8</sup>. We have therefore included 30-day survivors per million of the population in our report.

This work continues to update our previous report on the initial results of the Scottish OHCA data linkage project. Our figures summarise the progress of all of the Strategy partner organisations against delivery of the OHCA Strategy<sup>1</sup>. The data presented here show that the complex system of care summarised in the Chain of Survival has continued to improve in 2017/18. We have increased bystander CPR rates, a higher proportion of patients regaining a pulse after initial prehospital resuscitation and better quality OHCA data. Although the number of individuals surviving to 30 days after OHCA has remained stable compared to 2016/17, we would expect this crucial outcome figure to increase going forward, as a result of continued successful system optimisation.

Further updates from the data linkage project will be published during the course of the strategy.

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ISBN 978-1-78781-452-3 (web only)

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The Scottish Government  
St Andrew's House  
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EH1 3DG

ISBN: 978-1-78781-452-3 (web only)

Published by The Scottish Government, January 2019

Produced for The Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA  
PPDAS500926 (01/19)

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