

SCOTTISH OUT-OF-HOSPITAL CARDIAC ARREST DATA LINKAGE PROJECT: 2018/19 RESULTS



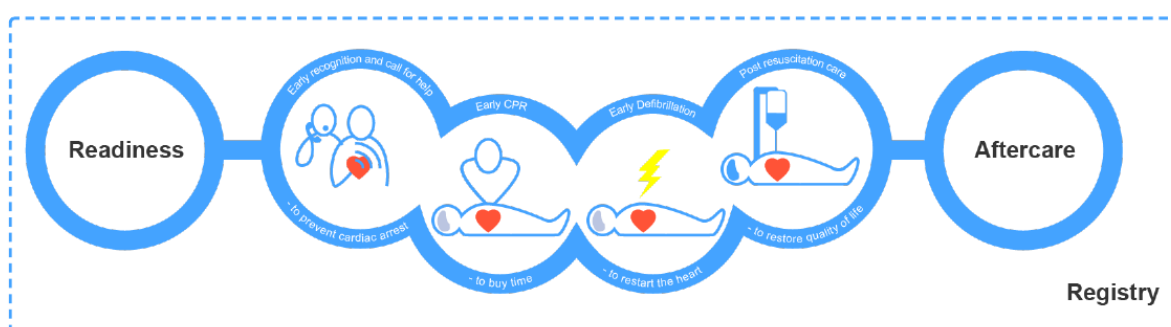
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Preface

This is the 4th report detailing outcomes after Out-of-Hospital Cardiac Arrest (OHCA) in Scotland and includes data from 1st April 2018 to 31st March 2019. We join with countries all over the world in attempting to reduce the loss of life after sudden cardiac arrest in our communities and recognise with the international community that the key to success is optimising the whole system of care - this requires partnership. This document contains positive findings indicating that we are making progress. For the first time we have measured overall survival after OHCA at over 10%. We are grateful to all of the organisations who are helping deliver Scotland's Strategy for OHCA and it is to their credit that our strategy is widely recognised as an excellent example of partnership working.

We are pleased to report significant improvements in bystander CPR rates and survival across the country. We are also mindful that improvement has been greatest in our more affluent communities and this requires a clearer understanding of underlying causes and targeted action. These figures represent the situation at the end of the penultimate year of our strategy as we take stock of where we started and make plans together to improve survival even further. We look forward to reaching for higher hanging fruit in the next phase.



The 'Augmented Chain of Survival' required to save lives after OHCA¹.

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.

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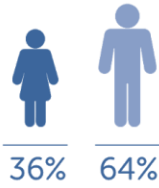
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Improving Outcomes from OHCA

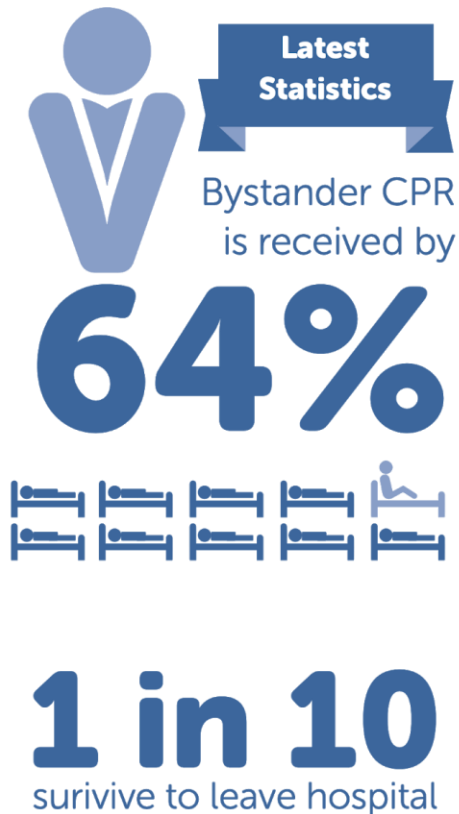
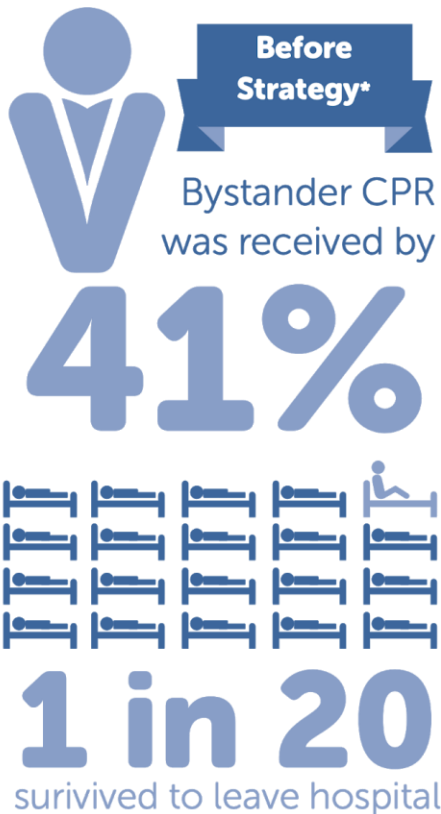
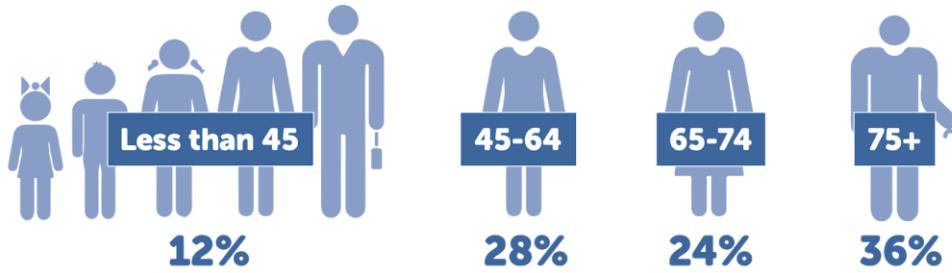
Where we are now

Average number of OHCA

3,200 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

Summary of main findings for 2018/19

- The number of patients with OHCA where resuscitation was attempted by the Scottish Ambulance Service was lower in 2018/19 at 3,115 compared to 3,484 in 2017/18. The data linkage completion rate was similar to the previous year with 86.2% of incidents linked.
- The mean patient age (66 years) and the male/female split (64% vs 36%) remain stable.
- The percentage of OHCA occurring in each of the SIMD quintiles has remained similar with 15% of arrests occurring in SIMD 5 (least deprived) compared with 26% in SIMD 1 (most deprived).
- CPR familiarisation through the Save a Life for Scotland Partnership continues to increase yearly since its inception in October 2015 with numbers currently sitting at 519,861 face-to-face contacts.
- Bystander CPR rates increased to 64.0% in 2018/19 compared with 55.5% in 2017/18 and the percentage of patients with 'Return of Spontaneous Circulation' rose to 30.3% compared to 23.3% in 2017/18.
- Survival at 30 days has increased to 10.2% of all worked arrests in 2018/19 compared to 8.3% from the previous year. Expressed as the number of survivors per million of the Scottish population, this equates to 59 survivors/million, an increase from 53 survivors/million in 2017/18.
- Deprivation continues to have a significant effect on the likelihood of receiving bystander CPR. Those in the most deprived quintile (SIMD 1) are 12.6% less likely to receive bystander CPR compared to those in the least deprived areas (SIMD 5). When adjusted for sex, age and urban/rural location, those in SIMD 1 areas are 19% less likely to receive bystander CPR compared to SIMD 5 areas.
- There was a trend towards increased use of public access defibrillators by bystanders during 2018/19.

Out-of-Hospital Cardiac Arrest Data for 2018/19

Number of worked arrests

BOX 1

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 (i.e. the patient shows obvious signs of having been dead for some time) and/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.

Figure 1 below shows the number of worked arrests has increased gradually from 2,692 patients in 2011/12 to 3,115 in 2018/19.

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 ². 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, components such as the Scottish Index of Multiple Deprivation (SIMD)³ were applied to the dataset to allow further analysis.

The percentage of linked arrests has increased from 73.0% in 2011/12 to a peak of 88.7% in 2017/18. In the 2018/19 dataset, 86.2% of SAS incidents were linked to survival outcome data. The remainder were assumed to be deaths (a worst case assumption) and included in the denominator for the calculation of the percentage of survival.

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: Percentage of worked OHCA cases included in linked dataset

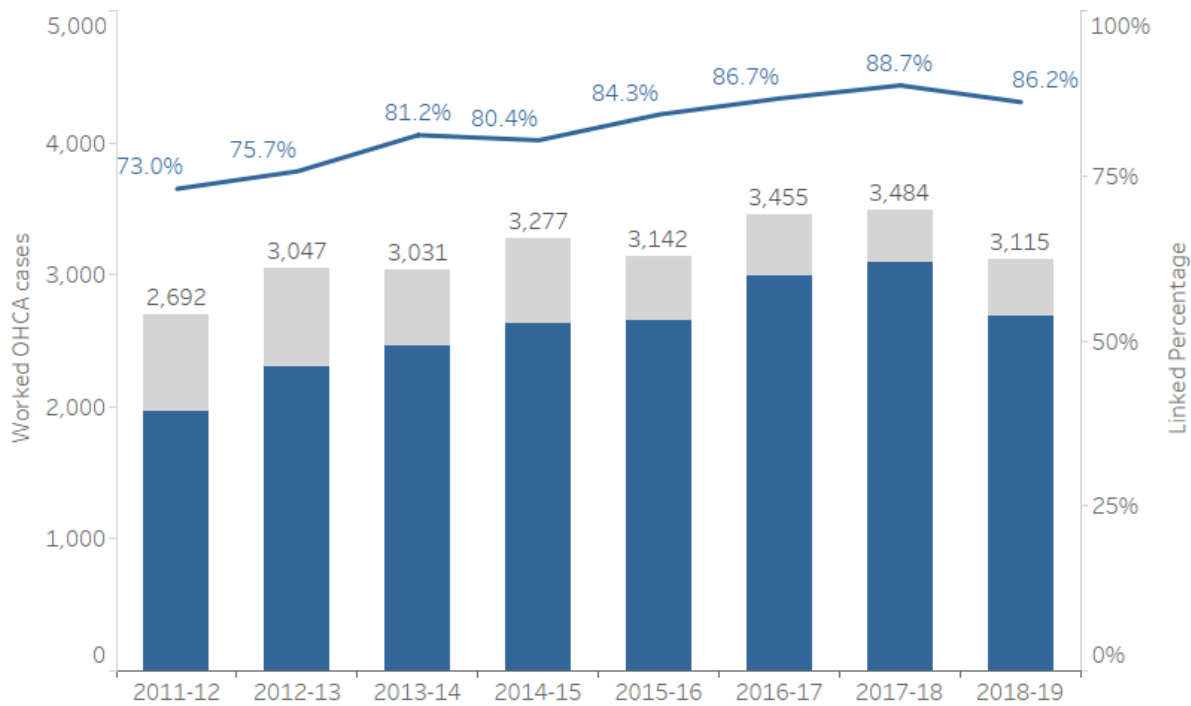


Figure 1: Bars show the number of worked OHCA cases, including the number linked to outcome data (blue shade) and the percentage of linked cases (blue line), 2011/12 and 2018/19.

Patient characteristics

Table 1 demonstrates the stability of baseline characteristics of patients with worked OHCA since 2011/12. The average (mean) age of patients in 2018/19 was 66 years compared with 68 years in 2011/12, while the percentage of males was 64% in 2018/19 compared to 63% in 2011/12. The percentage of OHCA occurring in each of the SIMD quintiles has also remained similar with 15% of arrests occurring in SIMD 5 (least deprived) in 2018/19 compared with 26% in SIMD 1 (most deprived).

Table 1: Baseline characteristics of worked OHCA cases

Period	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Age (SD)	67.5 (17.8)	67.8 (17.7)	66.3 (17.7)	68.0 (17.6)	67.7 (17.0)	66.1 (18.2)	66.4 (17.7)	65.8 (17.8)
Males % (missing)	62.7 (0)	62.9 (3)	63.2 (195)	61.9 (5)	62.1 (7)	63.3 (4)	64.3 (4)	64.1 (11)
SIMD %								
1	27.1	26.9	27.2	26.3	27.0	27.8	26.4	26.1
2	25.5	25.1	23.3	25.3	24.1	22.9	22.9	24.2
3	17.8	18.8	19.2	19.3	18.2	17.4	19.0	18.1
4	15.1	15.7	16.8	15.0	15.9	18.5	18.0	16.6
5	14.5	13.5	13.4	14.1	14.8	13.4	13.6	14.9
(missing)	(28)	(37)	(236)	(79)	(89)	(146)	(239)	(263)

Table 1 shows the baseline characteristics of worked OHCA cases by the SAS each year between 2011/12 and 2018/19.

Initial rhythm, Bystander CPR and Survival

BOX 2

Initial heart rhythm

The initial heart rhythm recorded on the Electrocardiogram (ECG) on arrival of SAS is important. A patient may have a shockable rhythm (ventricular fibrillation or ventricular tachycardia) treatable 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 2018/19, initial heart rhythm data was available for 94.9% of worked OHCA included in the linked dataset. A shockable initial rhythm was recorded in 29.7% of worked OHCA cases. Figure 2 shows how this compares with previous years.

Figure 2: Percentage of worked OHCA cases with shockable initial ECG rhythm

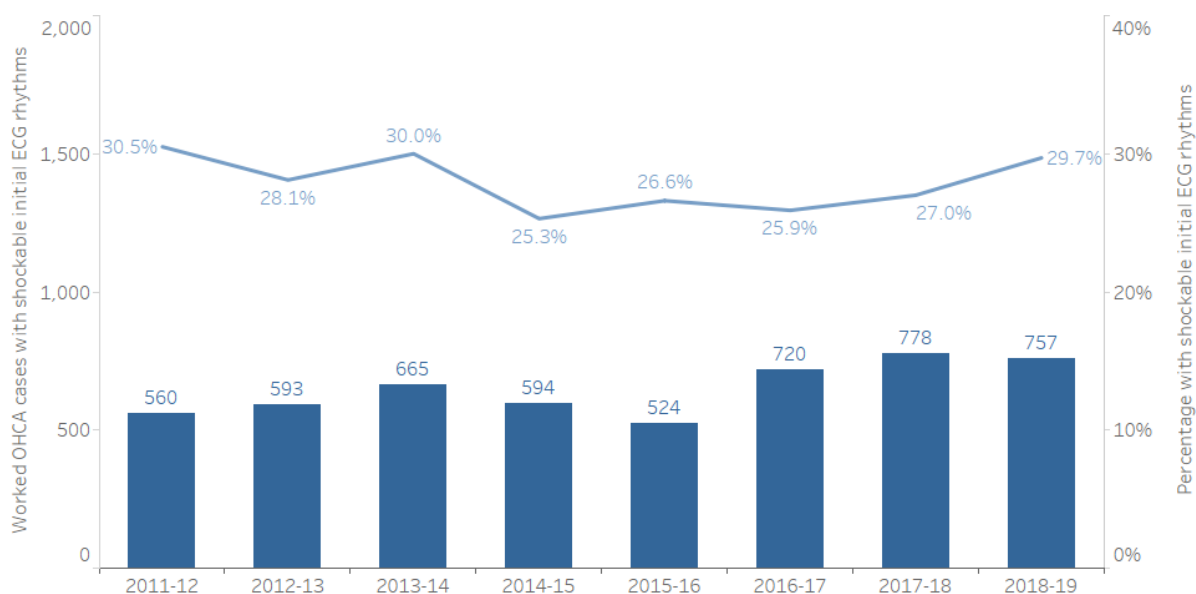


Figure 2: Shows the number of worked OHCA cases with a shockable initial rhythm (ventricular fibrillation or pulseless ventricular tachycardia) recorded on arrival of the Scottish Ambulance Service (blue bars) and the percentage of OHCA cases with shockable initial ECG rhythm (blue line), 2011/12 to 2018/19.

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 OHCA¹. The percentage of OHCA with bystander CPR is therefore a very important metric for tracking progress. In 2018/19 bystander CPR was recorded as taking place on arrival of SAS personnel in 64.0% of cases. Figure 3 below shows the steadily increasing rate of bystander CPR since 2011/12.

Figure 3: Percentage of worked OHCA cases where bystander CPR was performed

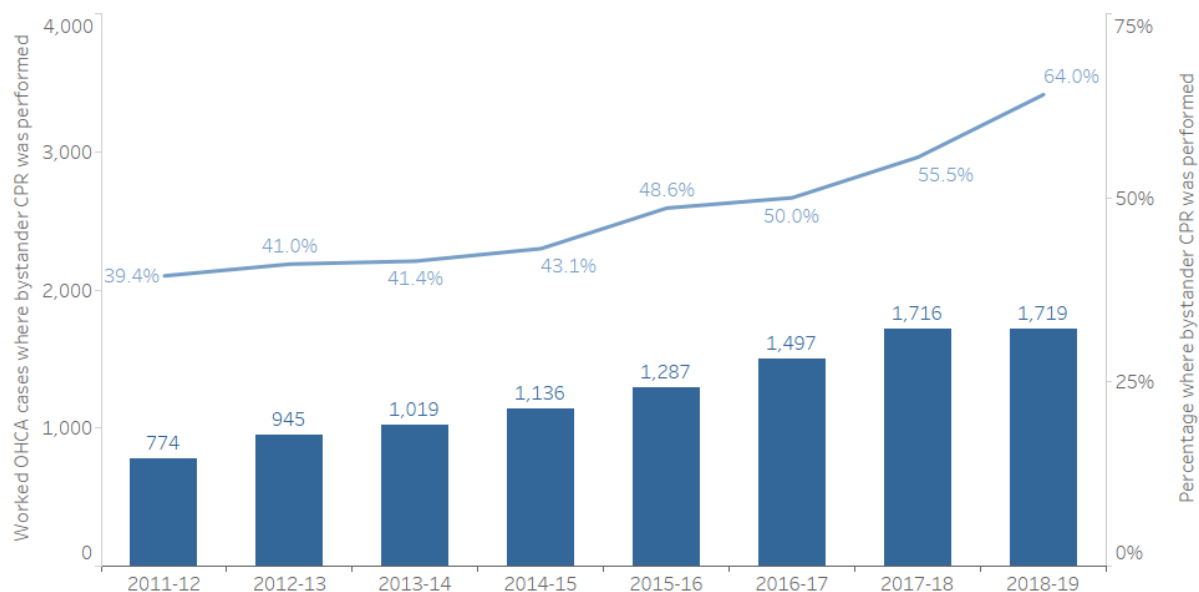


Figure 3: Shows the number of worked OHCA cases where bystander CPR was performed prior to the arrival of the Scottish Ambulance Service (blue bars) and the percentage where bystander CPR was performed (blue line), 2011/12 to 2018/19.

Save a Life for Scotland

A key driver of the increase in bystander CPR is the activity of the Save a Life for Scotland (SALFS). The SALFS partnership is composed of emergency services, third sector organisations, community responder groups, Scottish Government and academic partners.

Increasing the incidence of bystander CPR is the cornerstone of improving outcomes as prompt bystander CPR can increase the likelihood of survival after OHCA by as much as three times. As part of Scotland's 2015 OHCA strategy, the SALFS partnership aimed to tackle Scotland's low bystander CPR rate by equipping the Scottish public with CPR skills. CPR familiarisation has been rolled out across schools, communities and workplaces by the partner organisations, who have successfully reached the Strategy aim of familiarising 500,000 people with CPR skills - a year earlier than planned. Figure 4 demonstrates the increasing number of people equipped with CPR skills by the SALFS partnership since 2015. (Further information on the SALFS partnership and how to get 'CPR ready' can be found at www.savealife.scot).

Figure 4: Number of people receiving face-to-face CPR familiarisation from Save a Life for Scotland

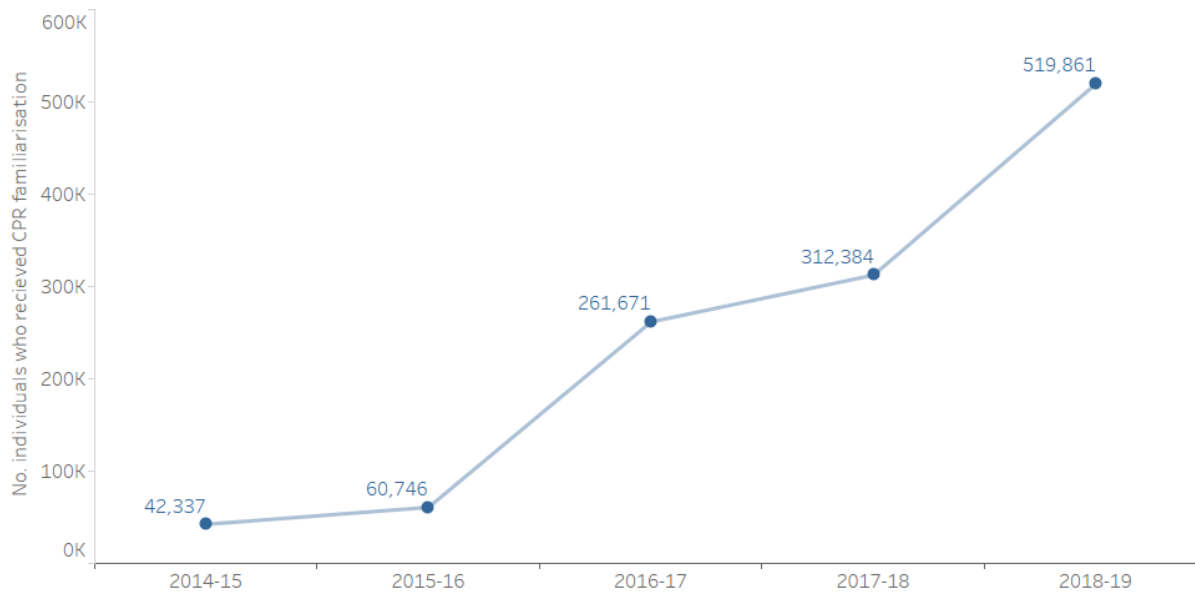


Figure 4: Shows the number of people receiving face-to-face CPR familiarisation from the Save a Life for Scotland partners since its inception in October 2015

Public Access Defibrillators

The use of public access defibrillators (PAD) by members of the public prior to the arrival of the ambulance service can reduce the time to delivery of a defibrillator shock and increase chance survival⁴. Although PADs are very effective when deployed in a timely fashion, international experience is that most OHCA patients do not have PAD applied. Bystander defibrillator usage as low as 1.74% have been observed in the literature⁵. The updating of the Scottish Ambulance Service electronic patient record in 2017 allowed improved capture of data reflecting PAD use by the public. Figure 5 shows the number of recorded uses of PAD at worked arrests during 2018/19 with a trend towards increased PAD deployment over time.

Figure 5: Percentage of worked OHCA cases where a Public Access Defibrillator was used

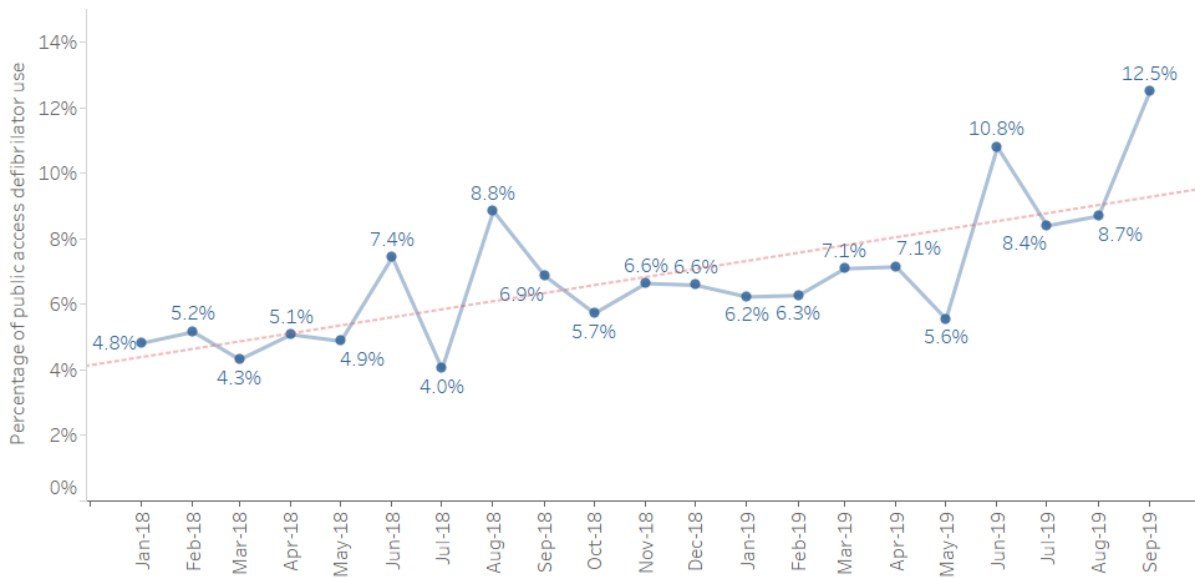


Figure 5: Shows the percentage of OHCA worked arrests where SAS recorded that a Public Access Defibrillator had been used, January 2018 to September 2019.

ROSC and Survival

The key clinical outcome after OHCA is long term patient survival. An important precursor to this is Return of Spontaneous Circulation (ROSC).

BOX 3

Return of Spontaneous Circulation (ROSC)

Definitions for ROSC vary. The Scottish Ambulance Service record 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.

BOX 4

Survival

The definition of ‘survival’ used in this report is survival to 30 days after the date of the OHCA. We have counted survival as the percentage of worked arrests where patients were still alive at 30 days. Worked arrests which were not linked to outcome data have been assumed to be deaths and included in the denominator when calculating survival rates. A more detailed discussion of the methodology we have used can be found here²⁶.

In 2018/19 ROSC occurred in 30.3% of worked OHCA cases, with 10.2% of these patients surviving to 30 days. This is shown in Figure 6.

Figure 6: Percentage of worked OHCA cases with ROSC, and the percentage of people who survived to 30 days

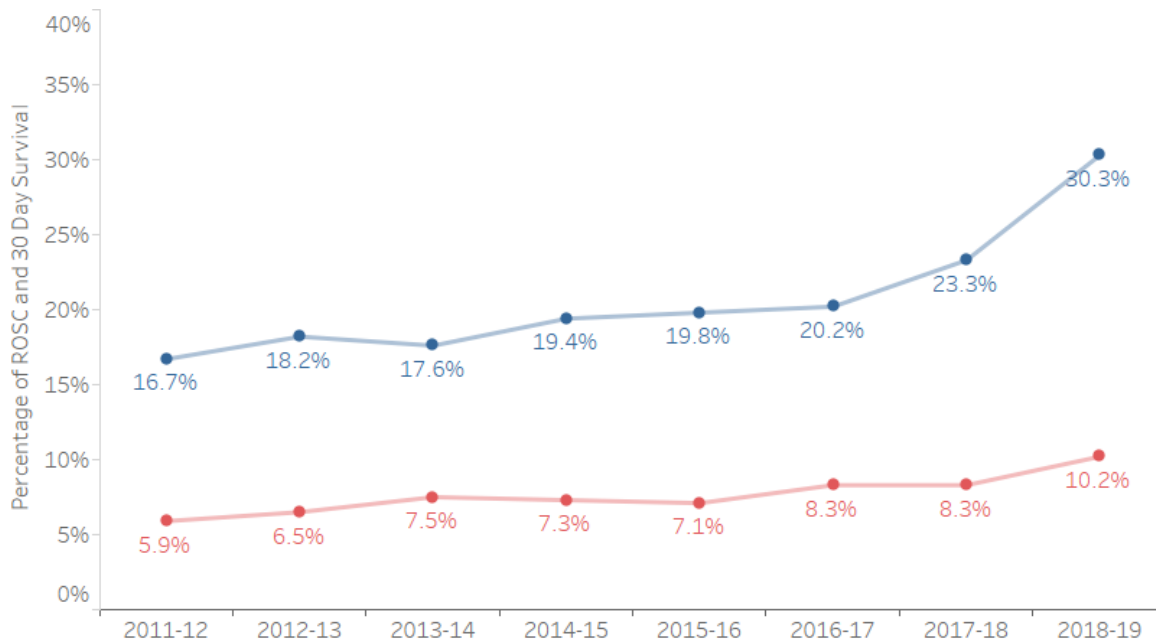


Figure 6: Shows the percentage of worked OHCA cases where the patient had ROSC (blue line) and those who survived to 30 days (red line) , 2011/12 to 2018/19.

Survival for shockable versus non-shockable rhythms

BOX 5

The Utstein Comparator

The Utstein templates aim to provide uniformity to OHCA data definitions. Analysis of the ‘Utstein comparator group’ (bystander witnessed cardiac arrest with an initial shockable heart rhythm) attempts to allow some adjustment for case mix⁷.

Appendix 1 contains tables showing a comparison of bystander CPR rates, ROSC rates and survival for patients with shockable versus non-shockable rhythms. In 2018/19 the ROSC rate for the shockable rhythm cohort rose to 47.0% from 39.1% the previous year. Survival to 30 days was 25.9% in the Utstein Comparator group in 2018/19, up from 21.9% in 2017/18.

Figure 7: Number of worked OHCA cases with a shockable initial ECG rhythm, and the percentage of which survived to 30 days

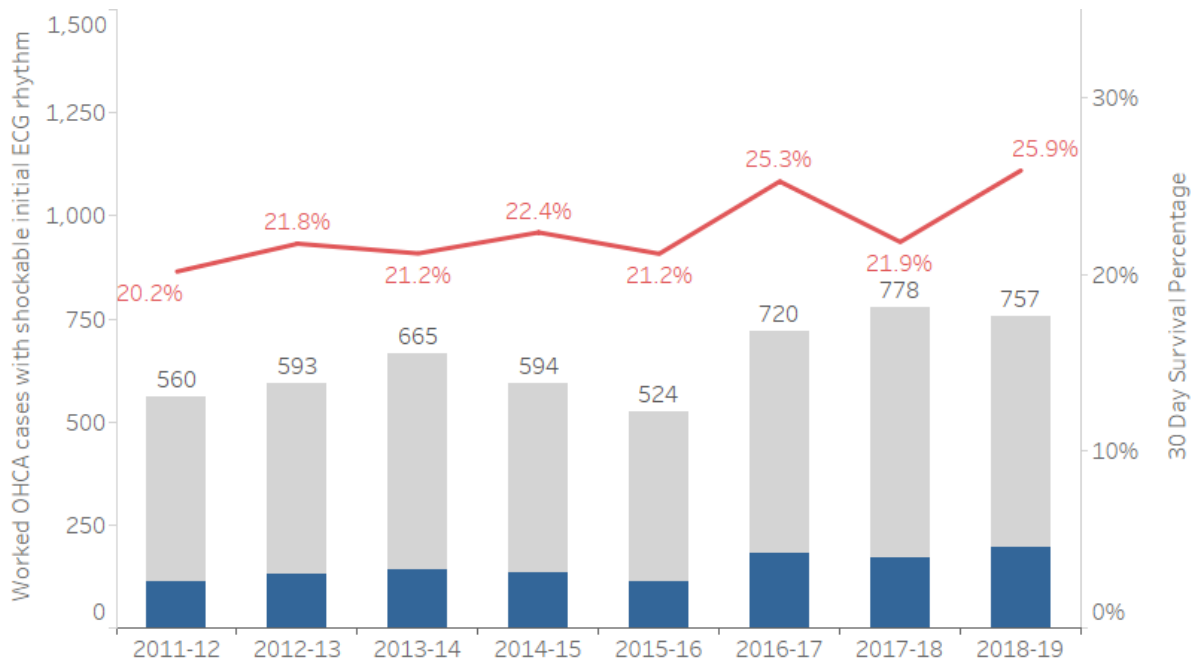


Figure 7: Shows the number of worked OHCA cases where the patient had a shockable initial ECG rhythm (blue shade in bar are 30 day survivors) and the percentage who survived to 30 days (red line), 2011/12 to 2018/19. Note: these data include linked incidents only.

Figure 8: Number of worked OHCA cases with a shockable initial ECG rhythm, and the percentage where bystander CPR was performed

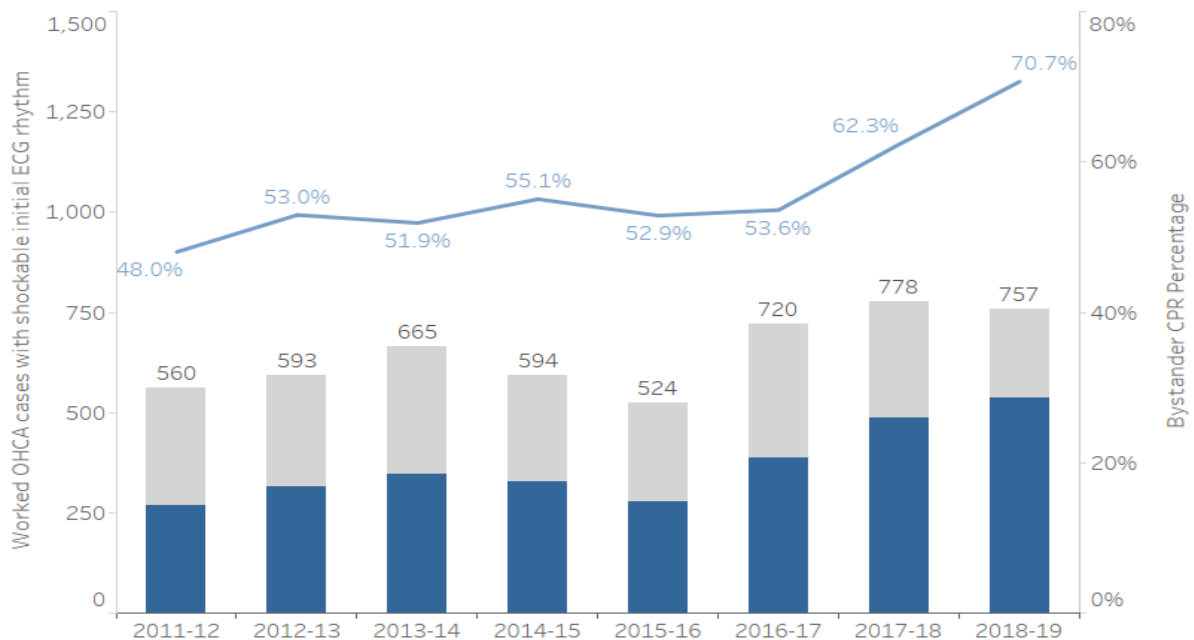


Figure 8: Shows the number of worked OHCA cases where the patient had a shockable initial ECG rhythm (blue shade in bar received bystander CPR) and the percentage where bystander CPR was performed (blue line), 2011/12 to 2018/19. Note: these data include linked incidents only.

Figure 9: Number of worked OHCA cases with a non-shockable initial ECG rhythm, and the percentage of which survived to 30 days

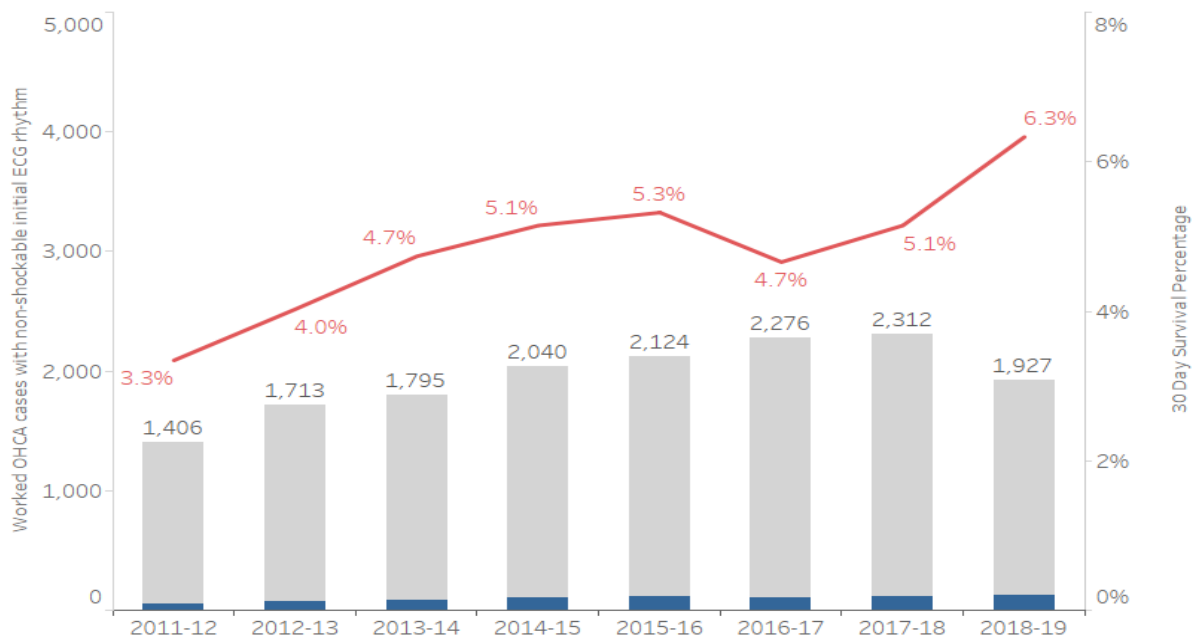


Figure 9: Shows the number of worked OHCA cases where the patient had a non-shockable initial ECG rhythm (blue shade in bar are 30 day survivors) and the percentage who survived to 30 days (red line), 2011/12 to 2018/19. Note: these data include linked incidents only.

Figure 10: Number of worked OHCA cases with a non-shockable initial ECG rhythm, and the percentage where bystander CPR was performed

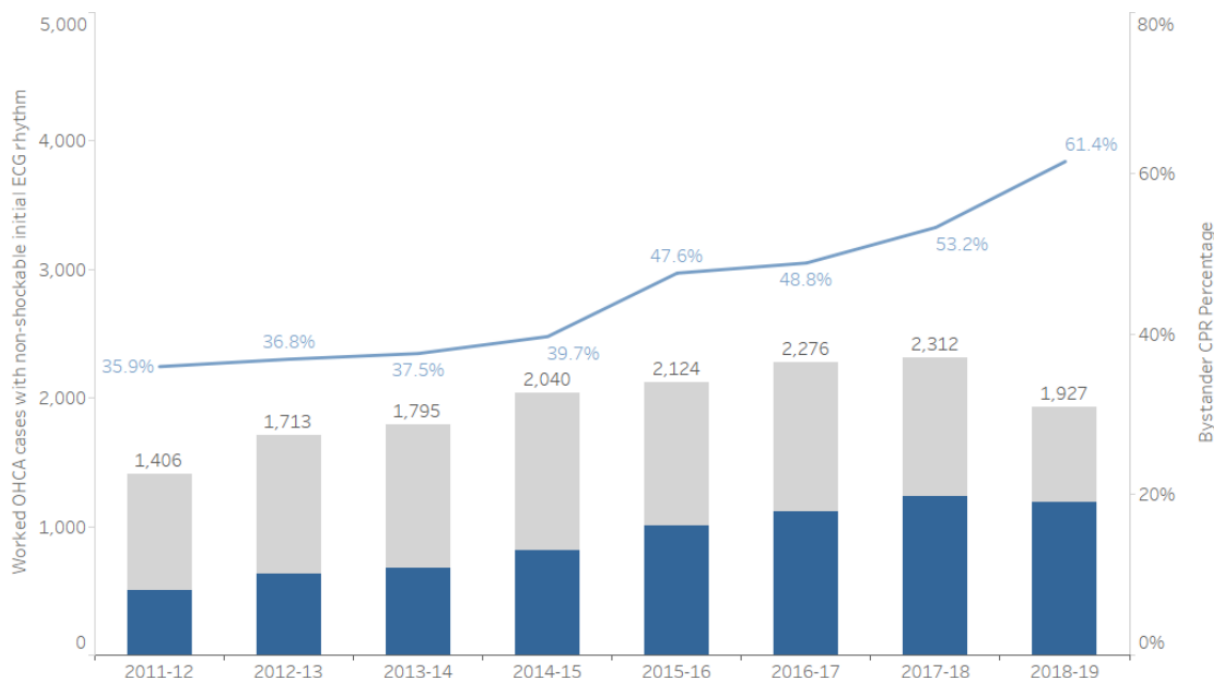


Figure 10: Shows the number of worked OHCA cases where the patient had a non-shockable initial ECG rhythm (blue shade in bar received bystander CPR) and the percentage where bystander CPR was performed (blue line), 2011/12 to 2018/19. Note: these data include linked incidents only.

ROSC and 30 day survival have increased fairly steadily year on year for both types of cardiac arrest with shockable rhythms having a much higher rate of survival. This difference is in keeping with the international literature and reflects differences in the reversibility of the underlying cause of cardiac arrest in the two groups^{8 9}. It is notable that those presenting in a non-shockable rhythm appear less likely to have received bystander CPR. This raises the possibility that lack of bystander action in this group of patients means that shockable VF rhythms may deteriorate to non-shockable asystole by the time the ambulance service arrives.

Number of OHCA Survivors per million of the population

A useful 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 gives an indicator which is unaffected by the percentage of all arrests attended by the Emergency Services which are 'worked'. Variation in the worked arrest percentage can skew the denominator when calculating the more traditional figure of the percentage survival to 30 days. National population figures for our calculation are derived from Mid-Year Population estimates from National Records of Scotland.

Figure 11 shows the 30 day survival per million of the population and reported bystander CPR rates for all worked arrests from 2011/12 - 2018/19.

Table 2: 30 day survival per million population

Year	No. 30 day survival	Mid-Year Population	Rate per million
2011/12	160	5,299,900	30.2
2012/13	198	5,313,600	37.3
2013/14	226	5,327,700	42.4
2014/15	238	5,347,600	44.5
2015/16	224	5,373,000	41.7
2016/17	288	5,404,700	53.3
2017/18	289	5,424,800	53.3
2018/19	318	5,438,100	58.5

Mid-Year Population estimates from National Records of Scotland and based on estimates of population at the middle of the year e.g. 2011/12 - population is at June 2011.

Figure 11: Number of 30 day survivors after OHCA per million of the population

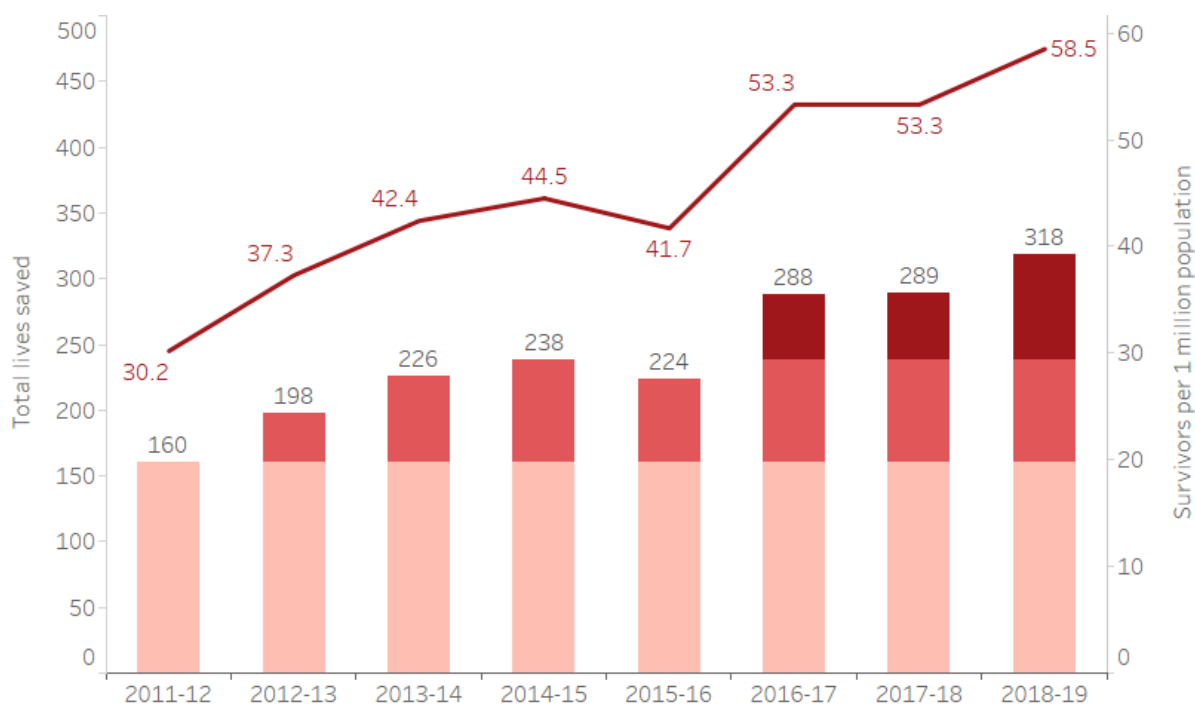


Figure 11: Shows the number of 30 day survivors per million of the population, 2011/12 to 2018/19 (red line). Columns show the absolute number of lives saved with the lower section of each showing baseline number of 30 day survivors in 2012, middle sections representing additional lives saved after the start of initial improvement work and the top section showing the impact of the OHCA Strategy launch in March 2015.

Scottish Index of Multiple Deprivation and OHCA

SIMD and 30-day survival

Analysis of Scottish OHCA outcomes has already shown that people living in more deprived areas are more likely to experience an OHCA and that patients from deprived areas are also less likely to survive following OHCA.

We have made a series of comparisons of OHCA survival between different groups using logistic regression techniques. This makes it possible to adjust for factors - for example age, sex and deprivation - that might differ between sub-groups and confound any associations. Logistic regression techniques adjust for these factors enabling us to make like-for-like comparisons. Appendix 2 shows figures for occurrence of OHCA and mean patient age by SIMD quintile. In addition the unadjusted figures for percentages of 30 day survival, bystander CPR and shockable rhythm are also given.

Examining trends over time, the likelihood of 30 day survival is increasing for those living in all types of community in Scotland, however there has not been a significant change in the gap between outcomes in the most deprived communities compared to the least deprived areas.

Comparing the likelihood of 30-day survival in quintiles 1 and 5 reveals that those patients living in the SIMD 1 (most deprived) are 30% more likely to die within 30 days of OHCA compared to those in SIMD 5 (least deprived), $p=0.001$. When adjusting for sex, age and urban/rural location, the effect of deprivation becomes stronger. With a like-for-like patient comparison, those living in areas of highest deprivation are 59% more likely to die within 30 days of OHCA compared to those in areas of lowest deprivation, $p<0.001$.

SIMD and bystander CPR

Deprivation also has a significant effect on the likelihood of receiving bystander CPR. As anticipated, the likelihood of receiving bystander CPR has improved with time in keeping with 30-day survival. Rates of bystander CPR have improved in all deprivation quintiles over time, however there still remains a significant difference between the least and most deprived quintiles. Those in the most deprived quintile are 12.6% less likely to receive bystander CPR compared to those in the least deprived areas. After adjusting for sex, age and urban/rural location the effect of deprivation becomes stronger. Those in the most deprived quintile are 19% less likely to receive bystander CPR compared to the least deprived quintile, $p<0.001$. Additionally those in SIMD 2 are 10% less likely to receive bystander CPR compared to those in SIMD 5, $p=0.030$. There is not a significant difference in likelihood of bystander CPR between those in SIMD 3 & 4 compared to the least deprived quintile, ($p>0.05$).

The tables in Appendix 2 show unadjusted figures for 30 day survival and bystander CPR comparing SIMD quintiles. SIMD 1 (most deprived) and SIMD 5 (least deprived) are compared below.

Figure 12: Percentage of worked OHCA cases surviving to 30 days, comparing SIMD 1 and SIMD 5 quintiles

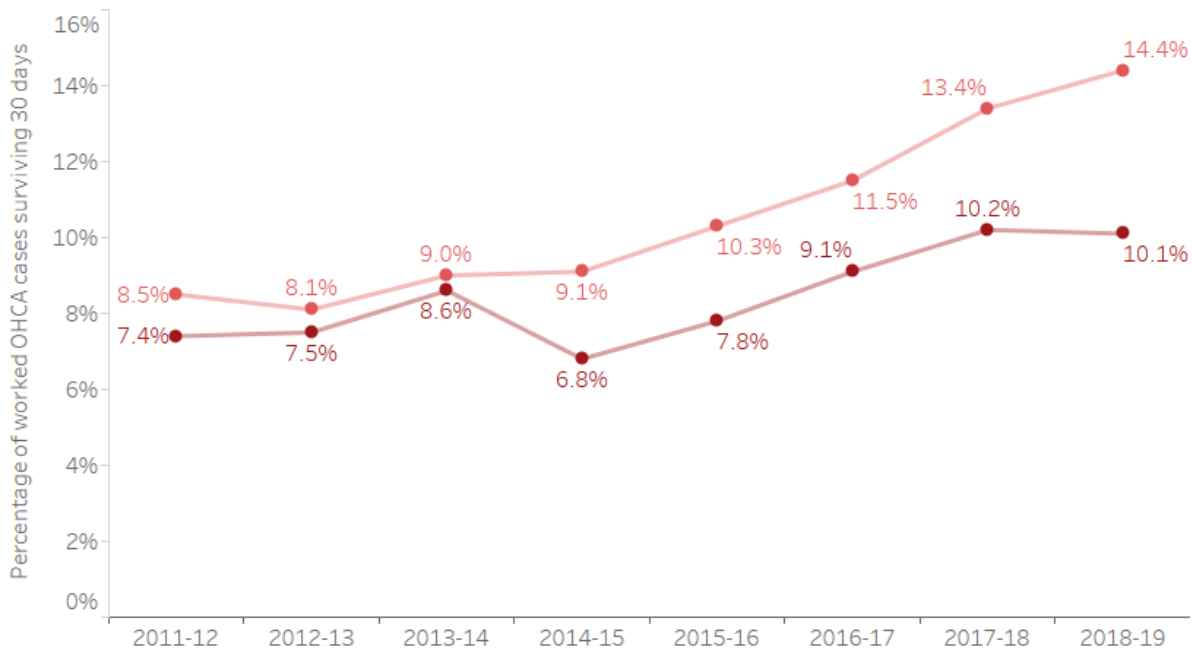


Figure 12: Shows the percentage of worked cases surviving to 30 days by SIMD 1 (dark red) and SIMD 5 (light red) from 2011/12 to 2018/19. Note: these data include linked incidents only.

Figure 13: Percentage of worked OHCA cases receiving bystander CPR, comparing SIMD 1 and SIMD 5 quintiles

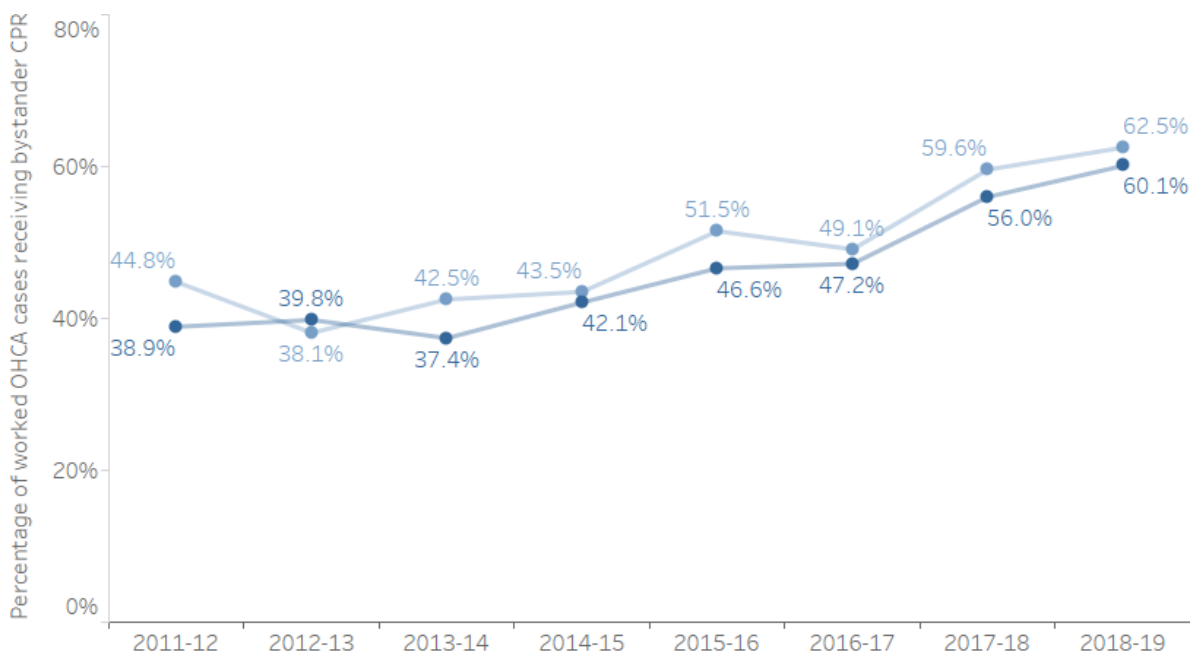


Figure 13: Shows the percentage of worked OHCA cases receiving bystander CPR by SIMD 1 (dark blue) and SIMD 5 (light blue) 2011/12 to 2018/19. Note: these data include linked incidents only.

Discussion

This year we measured a decrease in OHCA, recording 3,115 worked arrests compared to 3,484 in 2017/18. Whilst this is a modest change, this may reflect an increasing emphasis across the healthcare system on anticipatory care planning and improved end of life care. Our ability to link ambulance service data to clinical outcomes via the Community Health Index was similar to the previous year with 86.2% of incidents linked. As with previous reporting, we have counted the unlinked incidents as deaths and added them to the denominator for the calculation of percentage survival (unless otherwise indicated). We did this in an attempt to be as transparent as possible, but recognise that this reduces our survival percentage slightly. We have also reported survival per million population in Scotland which avoids the confounding introduced by this type of issue.

The baseline characteristics of our OHCA patients remain stable with a mean patient age of 66 years and the male/female split of 64% vs 36%. The proportion of OHCA occurring in each of the SIMD quintiles has remained similar with 15% of arrests in SIMD 5 (least deprived) compared with 26% in SIMD 1 (most deprived).

Increasing bystander CPR rates has been a key priority for the OHCA strategy partners and it is gratifying to see that bystander CPR rates increased to 64.0% in 2018/19 compared with 55.5% in 2017/18. This improvement is a vindication of sustained effort by the Save a Life for Scotland partnership which has completed CPR familiarisation with over 519,800 face-to-face contacts with the Scottish public since its inception in October 2015. Continuation of this coordinated work will be essential to further improvement in clinical outcomes. This has been accompanied by a trend towards the increased use of public access defibrillators by bystanders during 2018/19.

The proportion of patients responding favourably to initial resuscitation efforts rose with a 'Return of Spontaneous Circulation' rate (all initial rhythms) of 30.3% in 2018/19, up from 23.3% the previous year. This was accompanied by an increase in 30 day survival which exceeded 10% for the first time at 10.2% of all worked arrests in 2018/19 compared to 8.3% the previous year. Expressed as the number of survivors per million of the Scottish population, this equates to 59 survivors/million which shows an increase from 53 survivors/million in 2017/18. In absolute terms this represents 318 individuals leaving hospital alive after OHCA in 2018/19, compared with an average of 209 per year in the 5 years leading up to the official launch of Scotland's Strategy for OHCA (shown in figure 11). The number of individuals surviving OHCA each year in Scotland has doubled since coordinated national improvement work began in 2011/12.

Whilst there has been significant improvement in survival across the whole country the data also shows that improvement has not been as marked for those in our most deprived communities when compared to those living in more affluent circumstances. The area in which you live

continues to have a significant relationship to survival. Those in the most deprived quintile (SIMD 1) are less likely to receive bystander CPR compared to those in the least deprived areas (SIMD 5) and this in turn impacts likelihood of emerging alive at the other end of the Chain of Survival. Those living in the most deprived areas of Scotland are almost 60% less likely to survive an OHCA compared to their more affluent counterparts. This is undoubtedly a multifactorial issue, and reducing this specific manifestation of health inequality is a key priority.

Initiatives such as the Scottish Ambulance Service's national implementation of GoodSAM, adoption of the British Heart Foundation PAD database (The Circuit), innovative use of community cardiac responders (e.g. Grampian's Sandpiper WILDCAT project) and the commitment by Scotland's Local Authorities to teach CPR in schools will all further contribute to enhancing the vital early response to a person in sudden cardiac arrest. With wider engagement from Scotland's communities and their leaders there is a clear opportunity to co-design further initiatives to save more lives.

In few other areas of healthcare is a whole system approach more necessary. Developing a Chain of Survival to deliver the best outcomes for patients after OHCA requires an excellent partnership. Close synergy between those coordinating and directly delivering high quality prehospital response, specialist in-hospital clinical care and the people of Scotland is necessary to improving outcomes. It takes a system to save a life.

References

1. Scottish Government (2015). Out-of-Hospital Cardiac Arrest, A strategy for Scotland, 2015, ISBN: 9781785442407. Available at: <http://www.gov.scot/Publications/2015/03/7484>.
2. Scottish Government (2017). Scottish Out-of-Hospital Cardiac Arrest Data Linkage Project: Initial Results, 2017, ISBN: 9781788511117. Available at: <https://beta.gov.scot/publications/initial-results-scottish-out-hospital-cardiac-arrest-data-linkage-project/>.
3. Scottish Government [Online]. Scottish Index of Multiple Deprivation. Available at: <https://www2.gov.scot/SIMD>.
4. Bækgaard, J.S., Viereck, S., Møller, T.P., Ersbøll, A.K., Lippert, F. and Folke, F., 2017. The effects of public access defibrillation on survival after out-of-hospital cardiac arrest: a systematic review of observational studies. *Circulation*, 136(10), pp.954-965.
5. Perkins, G.D., Lockey, A.S., de Belder, M.A., Moore, F., Weissberg, P. and Gray, H., 2016. National initiatives to improve outcomes from out-of-hospital cardiac arrest in England.
6. Scottish Government (2018). Scottish Out-of-Hospital Cardiac Arrest data linkage project 2015/16 - 2016/17 results, ISBN: 978-1-78851-692-1. Available at: <https://beta.gov.scot/publications/scottish-out-hospital-cardiac-arrest-data-linkage-project-2015-16/>.
7. Perkins, G.D. and Brace-McDonnell, S.J., 2015. The UK out of hospital cardiac arrest outcome (OHCAO) project. *BMJ open*, 5(10), p.e008736.
8. Grunau, B., Reynolds, J.C., Scheuermeyer, F.X., Stenstrom, R., Pennington, S., Cheung, C., Li, J., Habibi, M., Ramanathan, K., Barbic, D. and Christenson, J., 2016. Comparing the prognosis of those with initial shockable and non-shockable rhythms with increasing durations of CPR: Informing minimum durations of resuscitation. *Resuscitation*, 101, pp.50-56.
9. McNally, B., Robb, R., Mehta, M., Vellano, K., Valderrama, A.L., Yoon, P.W., Sasson, C., Crouch, A., Perez, A.B., Merritt, R. and Kellermann, A., 2011. Out-of-hospital cardiac arrest surveillance—cardiac arrest registry to enhance survival (CARES), United States, October 1, 2005–December 31, 2010. *Morbidity and Mortality Weekly Report: Surveillance Summaries*, 60(8), pp.1-19.
10. Global Resuscitation Alliance [Online]. Available at: <https://www.globalresuscitationalliance.org/>.
11. Eisenberg M, Lippert FK, Shin SD, Bobrow B, Castren M, Moore F, et al. Improving Survival from Out-of-Hospital Cardiac Arrest: A Call to Establish a Global Resuscitation Alliance (2016). Available at: <https://foundation915.files.wordpress.com/2016/07/a-call-to-establish-a-global-resuscitation-alliance-2016.pdf>.

Glossary

CHI	Community Health Index
CPR	Cardio-pulmonary Resuscitation. This abbreviation is commonly used for delivery of Chest Compressions, with or without the addition of Rescue Breaths ('mouth-to-mouth', or 'kiss of life').
GRA	Global Resuscitation Alliance www.globalresuscitationalliance.org
ISD	Information Services Division
NSS	National Services Scotland
OHCA	Out-of-Hospital Cardiac Arrest
SAS	Scottish Ambulance Service
Save a Life for Scotland	The SALFS partnership is composed of the following public and third sector organisations: the Scottish Government, Police Scotland, Scottish Fire and Rescue Service, Scottish Ambulance Service, the British Heart Foundation, British Red Cross, St John Scotland, Chest Heart and Stroke Scotland, Royal Life Saving Society, East Neuk First Responders, the University of Edinburgh, St Andrews First Aid, Lucky2BHere, Sandpiper Wildcat, and Joint Forces Command. www.savealife.scot
SIMD	Scottish Index of Multiple Deprivation. https://www2.gov.scot/Resource/0050/00504809.pdf
Utstein template	Consensus reporting guidelines for OCHA data. It originated from an international multidisciplinary meeting held at the Utstein Abbey near Stavanger, Norway, in June 1990
'Worked arrests'	OHCA where resuscitation is attempted by SAS

Appendix 1

Percentage of patients with a shockable rhythm who received bystander CPR, and percentage who survived to 30 days after OHCA

	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18	2018/ 19
30-day Survival (shockable)	113	129	141	133	111	182	170	196
Shockable Rhythm Total	560	593	665	594	524	720	778	757
% 30-day Survival (shockable)	20.2 %	21.8 %	21.2 %	22.4 %	21.2 %	25.3 %	21.9 %	25.9 %
ROSC (shockable)	158	185	210	189	182	271	304	356
Shockable Rhythm Total	560	593	665	594	524	720	778	757
% ROSC (shockable)	28.2 %	31.2 %	31.6 %	31.8 %	34.7 %	37.6 %	39.1 %	47.0 %
Bystander CPR (shockable)	269	314	345	327	277	386	485	535
Shockable Rhythm Total	560	593	665	594	524	720	778	757
% Bystander CPR (shockable)	48.0 %	53.0 %	51.9 %	55.1 %	52.9 %	53.6 %	62.3 %	70.7 %

Percentage of patients with a non-shockable rhythm who received bystander CPR, percentage who survived to 30 days after OHCA

	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18	2018/ 19
30-day Survival (non-shockable)	47	69	85	105	113	106	119	122
Non-Shockable Rhythm Total	1406	1713	1795	2040	2124	2276	2312	1927
% 30-day Survival (non-shockable)	3.34 %	4.03 %	4.74 %	5.15 %	5.32 %	4.66 %	5.15 %	6.33 %
ROSC (shockable)	158	185	210	189	182	271	304	356
Shockable Rhythm Total	560	593	665	594	524	720	778	757
% ROSC (shockable)	28.2 %	31.2 %	31.6 %	31.8 %	34.7 %	37.6 %	39.1 %	47.0 %
Bystander CPR (non-shockable)	505	631	674	809	1010	1111	1231	1184
Non-Shockable Rhythm Total	1406	1713	1795	2040	2124	2276	2312	1927
% Bystander CPR (non-shockable)	35.9 %	36.8 %	37.5 %	39.7 %	47.6 %	48.8 %	53.2 %	61.4 %

Appendix 2

Percentage of worked arrests by SIMD Quintile

SIMD	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18	2018/ 19
Quintile 1	27.1	26.9	26.1	26.3	27.0	27.8	26.4	26.1
Quintile 2	25.5	25.1	24.3	25.3	24.1	22.9	22.9	24.2
Quintile 3	17.8	18.8	18.1	19.3	18.2	17.4	19.0	18.1
Quintile 4	15.1	15.7	16.6	15.0	15.9	18.5	18.0	16.6
Quintile 5	14.5	13.5	14.9	14.1	14.8	13.4	13.6	14.9
Missing (raw numbers)	28	37	263	79	89	146	239	263

Average age by SIMD Quintile

SIMD	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18	2018/ 19
Quintile 1	64.8	64.4	63.4	63.8	64.8	61.7	61.5	62.3
Quintile 2	67.0	67.5	66.6	67.7	66.6	65.7	66.5	64.4
Quintile 3	69.2	68.2	67.2	69.1	68.7	67.7	68.8	67.2
Quintile 4	69.4	70.2	67.8	69.9	70.2	68.8	69.4	69.9
Quintile 5	69.9	72.1	68.5	73.0	72.0	70.7	70.6	70.1

30 Day survival (%) by SIMD Quintile

SIMD	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18	2018/ 19
Quintile 1	7.4	7.5	8.6	6.8	7.8	9.1	10.2	10.1
Quintile 2	8.1	8.1	8.9	9.9	7.8	9.6	8.9	11.6
Quintile 3	10.1	8.9	11.9	11.2	6.5	11.3	7.9	14.1
Quintile 4	6.8	11.8	9.4	8.6	10.5	9.5	9.0	9.2
Quintile 5	8.5	8.1	9.0	9.1	10.3	11.5	13.4	14.4
Missing (raw numbers)	28	37	236	79	89	146	239	263

Bystander CPR (%) by SIMD Quintile

SIMD	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18	2018/ 19
Quintile 1	38.9	39.8	37.4	42.1	46.6	47.2	56.0	60.1
Quintile 2	41.4	38.3	42.0	43.7	48.5	50.3	54.7	65.6
Quintile 3	34.8	44.0	40.0	45.2	50.3	50.6	53.8	64.9
Quintile 4	37.0	45.5	47.1	39.9	44.4	50.9	54.0	62.0
Quintile 5	44.8	38.1	42.5	43.5	51.5	49.1	59.6	62.5
Missing (raw numbers)	28	37	236	79	89	146	239	263

ROSC (%) by SIMD Quintile

SIMD	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18	2018/ 19
Quintile 1	14.1	16.9	17.0	19.6	19.4	20.4	22.3	29.4
Quintile 2	16.6	17.6	20.0	21.2	20.0	21.4	23.5	30.7
Quintile 3	19.4	18.3	21.3	18.9	17.6	19.0	22.7	28.5
Quintile 4	15.4	22.5	18.2	17.8	19.4	20.3	24.2	27.8
Quintile 5	20.3	18.2	16.1	20.2	24.8	26.0	27.8	34.2
Missing (raw numbers)	28	37	236	79	89	146	239	263

Initial Rhythm (%) by SIMD Quintile

SIMD	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18	2018/ 19
Quintile 1	31.1	26.2	25.4	21.6	23.8	22.7	25.5	28.0
Quintile 2	28.2	28.4	32.0	25.7	27.6	24.5	26.8	29.9
Quintile 3	30.3	27.6	31.2	27.2	24.9	28.6	28.8	31.6
Quintile 4	32.4	34.8	35.8	26.8	24.2	30.8	24.9	29.9
Quintile 5	31.4	25.3	34.4	29.3	34.4	28.1	31.7	30.3
Missing (raw numbers)	153	236	454	354	738	352	432	386

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