Scotland's Out-of-Hospital Cardiac Arrest Report 2023-24

Scottish Ambulance Service

Taking Care to the Patient

THE UNIVERSITY *of* EDINBURGH

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Preface

This report is published by the Scottish Ambulance Service on behalf of the Delivery Group for Scotland's Out-of-Hospital Cardiac Arrest Strategy and provides a summary of activity and outcomes after out-of-hospital cardiac arrest (OHCA) in Scotland from 1st April 2023 to 31st March 2024.

This document builds on the baseline data contained in Scotland's Out-of-Hospital Cardiac Arrest Report 2019-22 (Clegg et al., 2022) and should be read in conjunction with Scotland's Out-of-Hospital Cardiac Arrest Strategy 2021-2026 (Scottish Government, 2021) which provides details of our programmes of work to improve outcomes after OHCA.

Who is the intended audience of this report?

The public — one of the central recommendations of the Global Resuscitation Alliance's Ten Programmes is to develop accountability by publishing an annual report of OHCA outcomes (Global Resuscitation Alliance, 2021). This report seeks to do that.

Those interested in variations in healthcare across communities in Scotland — this report seeks to facilitate greater understanding of differences in the system of care for OHCA across the country and stimulate discussion about how we can do better.

Healthcare professionals — those wishing to ensure a data-driven approach to improving the delivery of realistic medical care, as well as those working on the 'front line' who want to understand the performance of the system to which they contribute.

Third sector organisations and policy makers — those who want a deeper understanding of the challenges facing communities across Scotland and how best to deploy resources to meet them.

The resuscitation community — others engaged in building systems to save lives after OHCA who seek to understand our approach to and benchmark against our progress. We present this report to be transparent about our challenges and our progress.

How to read this report

The report is structured to provide a background to the challenge of OHCA, Scotland's Out-of-Hospital Cardiac Arrest Strategy 2021-2026 and key metrics charting the progress of implementation of that strategy (Scottish Government, 2021).

Key clinical outcomes and process measures are given first including 30-day survival, ROSC, bystander CPR and PAD usage. These terms are defined in the appropriate sections. Each measure is shown as a geographic snapshot of the current state of affairs using a funnel plot of data from the last 12 months (April 1st 2023 - March 31st 2024). There are also charts showing the variation of each measure over time. Analysis is provided which highlights progress towards the delivery of the Strategy including examination of key dimensions of inequality and an update on the work of the Save a Life for Scotland Partnership.

Changes to the way we capture and report data

There have been some important changes in the way we have captured and presented the outcome data included in this report. This means that some of the historic figures included (in particular the percentage of 30 day survival) differ from those reported previously. For a fuller explanation see the Appendix at the end of this report.

Timelines

Many of the line graphs in this report are presented as control charts in order to highlight how system elements are changing over time. In each case the average value (mean) is shown by a central dashed line, and upper and lower control limits (at two and three standard deviations) are shown as red dotted lines. In general, control lines can be used to highlight areas that may benefit from further investigation.

Funnel plots

A funnel plot is a scatter plot showing a cross-sectional 'snapshot' in time. We have used funnel plots to illustrate the variation in key OHCA measures across health board areas in Scotland while taking into account the number of arrests that occur within each board. We include two sets of upper and lower boundary lines on each plot, for 95% confidence intervals and 99.7% confidence intervals. These lines can be used to identify data points that may merit closer investigation as they lie outside of what might be expected due to normal variation in the figures.

Scottish Index of Multiple Deprivation (SIMD)

SIMD is the Scottish Government's standard tool for identifying areas in Scotland with concentrations of deprivation by incorporating census data from seven different domains (income, employment, education, housing, health, crime, and geographical access) into a single index (Scottish Government, 2020).

The SIMD is calculated for each of 6,976 data zones in Scotland using census data. Data zones are geographic areas in Scotland each containing a population of between 500 and 1,000 people. Where possible, they have been made to respect physical boundaries and natural communities, have a regular shape and contain similar households. Data zones are then ranked. In this report we have described SIMD using quintiles, with approximately 20% of the Scotland population in each quintile: quintile 1 (SIMD1) has the greatest deprivation while quintile 5 (SIMD5) has the least deprivation. The SIMD can be used to target policies and resources appropriately. It is important to remember that the SIMD is a geographically based measure and identifies deprived areas, not deprived individuals.

For the OHCA described in this report, SIMD is derived from the postcode of the OHCA incident location and uses lookup files from Public Health Scotland (Scottish Government, 2020). Because SIMD varies with each census and changes to data zone boundaries, we have used the date of each OHCA incident to ensure that the relevant SIMD is applied.

COVID-19 restrictions in Scotland

The longitudinal analyses in this report include the timeframe of the COVID-19 pandemic, including 'lockdown' measures enacted in Scotland and the eventual easing of such measures. Throughout the report, time series are marked to indicate the period where 'lockdown' measures were in place between 24th March 2020 and the move to level 3 restrictions on 20th April 2021.

Writing Group

This work includes the work of several individuals. We would like to publicly acknowledge the contribution of the following people in enabling the production of this report, whilst being mindful of the help of many others who are not listed here.

Gareth Clegg, Resuscitation Research Group, Usher Institute, University of Edinburgh; Associate Medical Director, Scottish Ambulance Service; Hon Consultant in Emergency Medicine, Royal Infirmary, Edinburgh; Chair of Save a Life for Scotland and the OHCA Strategy Delivery Group

Benjamin Leung, Honorary Clinical Outcomes Analyst, Scottish Ambulance Service; Research Fellow, Duke Clinical Research Institute

Andrew Kent, Principal Clinical Outcomes Analyst, Scottish Ambulance Service

Steven Short, Programme Lead for OHCA, Scottish Ambulance Service

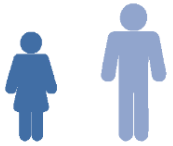
Donald McPhail, Clinical Effectiveness Lead for OHCA, Scottish Ambulance Service

Barry Watson, Clinical Services Transformation Lead, Scottish Ambulance Service

Improving Outcomes from OHCA
Where we are 2023-2024

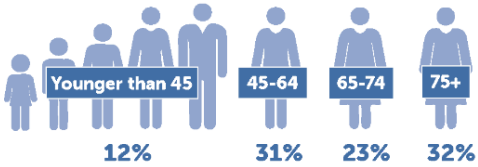
Average number of OHCA

3,752 per year

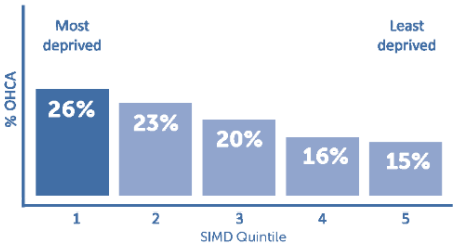


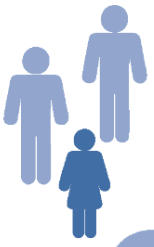
35% 65%

OHCA can affect anyone of any age at any time.



People in the most deprived areas are almost twice as likely to have an OHCA.

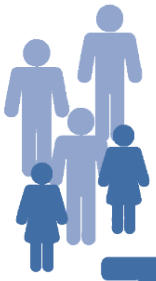




Before Strategy*

Annual number of survivors

225



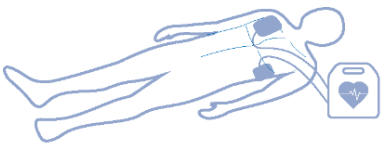
Latest Statistics

Annual number of survivors

361

Public Access Defibrillator deployment before the arrival of the Ambulance Service rose from **2.5%** before the Strategy* to:

10%



1 in 10

Survived to leave hospital after OHCA.

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

Executive Summary 2023-24

- **Number of arrests:** From 1st April 2023 to 31st March 2024 there were 3,752 out-of-hospital cardiac arrests (OHCA) where resuscitation was attempted. This represents an incidence of 683.4 OHCA per million population of Scotland.
- **Survival:** Overall, 30-day survival was 9.6% (Strategy aim 15%), with the number of survivors per million of the population increasing to 66.1 from 56.7 in 2022-23.
- **Shockable rhythms:** Return of Spontaneous Circulation (ROSC) rate in patients with a shockable initial rhythm (Utstein comparator) was 56.5%, with a 30-day survival rate of 29.3%; these figures are the highest recorded since 2011-12.
- **CPR:** Bystander CPR rate was similar to 2022-23 at 62.2% (Strategy aim 85%).
- **PAD use:** The rate of PAD deployment by the public continues to increase and now 10.3% of worked arrests have a PAD in place on arrival of the ambulance service (Strategy aim 20%) compared to 8.8% last year.
- **Inequalities:** Scottish Index of Multiple Deprivation (SIMD) associated inequalities remain. Those living in the most deprived areas in Scotland (SIMD1) are almost twice as likely to have an OHCA and are less likely to be alive 30 days after the event when compared to people living in the least deprived areas in Scotland (SIMD5). Bystander CPR rates are comparable across the socio-economic spectrum, but the disparity in the likelihood of PAD use is widening with those in more deprived communities missing out.
- **Innovation:** continues with initiatives including the promotion of the GoodSAM app by Save a Life for Scotland partners and the initiation of a bystander telephone support service led by Chest Heart and Stroke Scotland.
- **Looking Forward:** As Scotland approaches the final phase of its OHCA Strategy 2021–2026, momentum remains strong. The ambition to save more lives, reduce health inequalities, and strengthen the chain of survival is shared across partners — from emergency services to public health bodies, community groups to individual citizens. Through collaboration, innovation, and a shared sense of purpose, Scotland continues to lead in building a system where more people not only survive OHCA, but recover well and return to their lives.

Introduction — the system of care

A successful response to out-of-hospital cardiac arrest (OHCA) requires a collective effort by many different parties. This system of care starts in the community with the recognition that someone has had a cardiac arrest, and involves the public ('bystanders'), community volunteers, the ambulance service, hospital specialists and eventually the communities that help survivors and their families resume their day to day lives again.

This system is often visualised using a diagram known as the 'chain of survival' (Nolan et al., 2006). This chain starts with bystander recognition of cardiac arrest and a call for help, and ends with post resuscitation hospital care for those whose hearts have been restarted. This is a helpful metaphor, emphasising that a chain is only as strong as its weakest link, and so the chance of surviving OHCA depends on the integrity of each link within the chain of survival.

Figure 1 The Chain of Survival

It is also the case that even before an OHCA occurs, an adequate response requires that the community is prepared. This preparation will take several forms including training community members in cardiopulmonary resuscitation (CPR) and how to recognise and respond to an OHCA, optimising public access defibrillator (PAD) placement and recruiting community members to be volunteer responders e.g. using alerting mechanisms like GoodSAM. When an OHCA occurs, community members need to recognise what has happened and call for help. Bystanders must initiate CPR to keep oxygenated blood flowing through the body, and ideally apply a PAD that can restart the heart. Call handlers in Ambulance Control will give real-time instructions on how to do CPR, direct bystanders to the nearest PAD, and summon volunteer responders in the area who may be able to help. After the arrival of SAS personnel, advanced resuscitation

care will be provided. If initial resuscitation is successful, the patient is taken to hospital for specialist care of the heart and brain before discharge back to the community. Finally, support needs to be available to the patient, their family as well as to bystanders and professionals who responded to and/or witnessed the OHCA in order to maximise recovery and restoration of quality of life.

In order to emphasise both the community readiness and aftercare aspects of the system we have previously extended our chain of survival to include two additional links: 'readiness' and 'recovery' (Scotland et al., 2015; Scottish Government, 2021). Below we have gone further and reformed the linear chain into a circle to draw attention to the fact that a successful journey to recovery after OHCA begins, and ends, in the community.

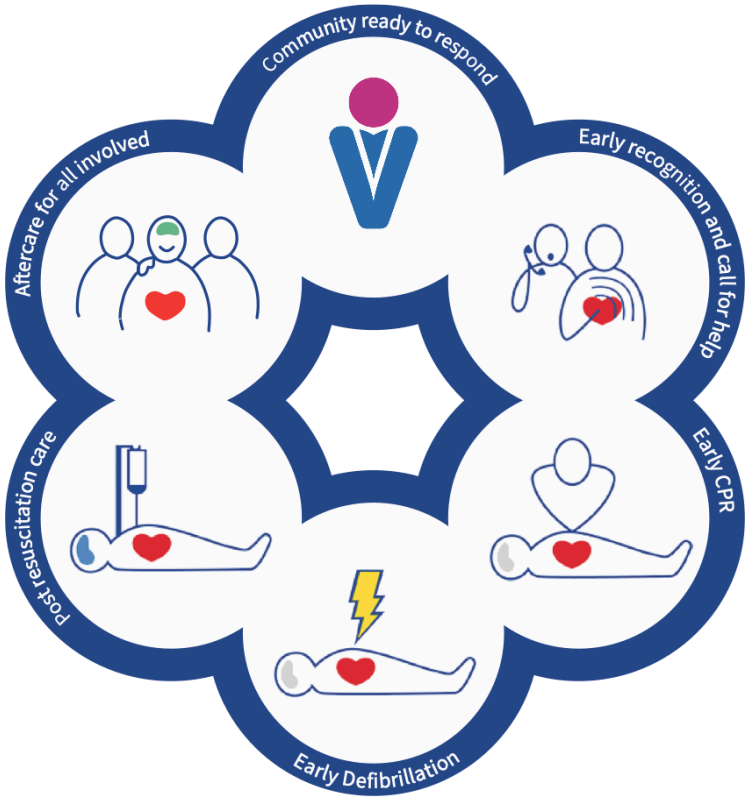


Figure 2 The 'Wheel of Recovery'
The Chain of Survival has been augmented with links for 'Community Readiness' and 'Aftercare', then joined to form a wheel emphasising that effective response to OHCA begins and ends in the community.

Improving the system of care must be done using a variety of approaches to optimise the different elements of the Wheel of Recovery.

Setting the scene

Worked arrests

From April 1st 2023 to March 31st 2024, the Scottish Ambulance Service received 700,838 emergency calls, of which 1.8% were determined by call handlers to be possible out-of-hospital cardiac arrests. On arrival at the scene, the ambulance crew confirmed cardiac arrest in 9,645 cases and attempted resuscitation in 3,752 cases. Cases where resuscitation is attempted are referred to as 'worked arrests' (BOX 1). The number of worked arrests forms the denominator for all subsequent outcome calculations unless otherwise specified.

BOX 1: Worked arrests

'Worked arrests' are OHCA that have a cause which does not involve major physical trauma and where resuscitation was attempted by the Scottish Ambulance Service (SAS). There are a number of reasons why SAS may not initiate resuscitation including obvious death (i.e., the patient shows obvious signs of having been dead for some time) or the confirmation that resuscitation was not the patient's wish (e.g., by the presence of a 'do not attempt CPR' order as part of an anticipatory care plan).

Number of worked arrests

Figure 3 shows the number of worked arrests each year from 2011-12 to 2023-24. The number of worked arrests has risen gradually over the last decade. There were 3,752 worked arrests during the period of this report. In addition the number of worked arrests each calendar month over the duration of this reporting period is also shown in Figure 4. This shows a similar seasonal pattern to previous reports with a spike in activity in December-January. This winter peak in incidence of OHCA is also found in other parts of the world (Bagai et al., 2013; El Sibai et al., 2021; Muller et al., 2020).

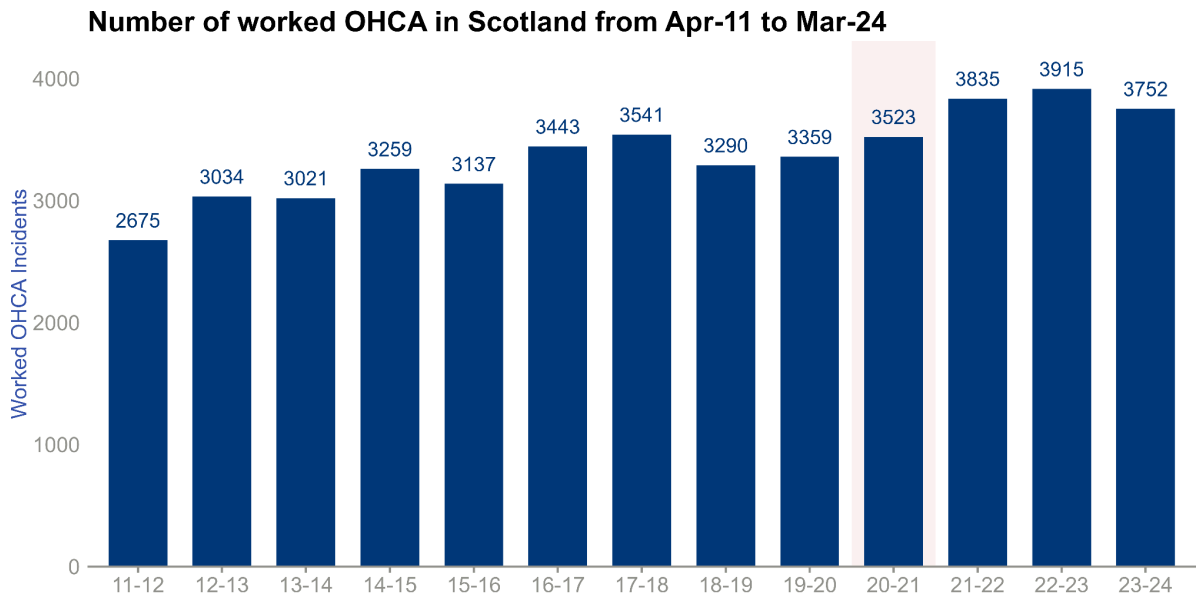


Figure 3 shows the number of worked OHCA in Scotland by year from 2011-12 to 2023-24.

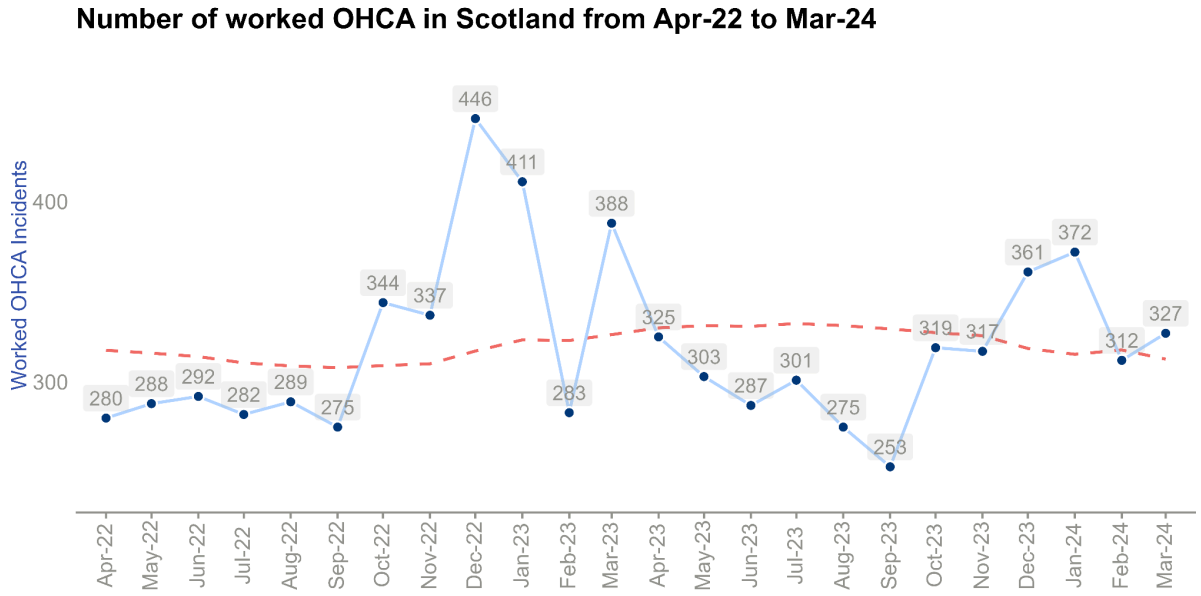


Figure 4 shows the number of worked OHCA in Scotland by month from April 2022 to March 2024.

Proportion of arrests worked

The decision to initiate resuscitation is an important component of care for OHCA. Prompt action by SAS is essential to saving lives, but resuscitation attempts are not always appropriate (BOX 1). Studies have found that the proportion of OHCA which are worked arrests can vary significantly between ambulance services. For example figures from 129 North American EMS services participating in the Resuscitation Outcomes Consortium Epidemiologic Registry showed that overall, 54.8% of arrests had resuscitation attempted by EMS providers, and that this proportion varied from 23.9% to 100% ($p \leq 0.001$) across EMS agencies (Brooks et al., 2017). The charts below show that in Scotland resuscitation was attempted in 26.1% of all OHCA in 2023-24 (Figure 5), which has decreased from a peak of 27.0% in 2021-22. There appears to be variation in the proportion of worked arrests across health boards (Figure 6) with GG&C initiating resuscitating in a smaller proportion of patients found in cardiac arrest and the Borders, Dumfries & Galloway and Grampian trending towards higher rates.

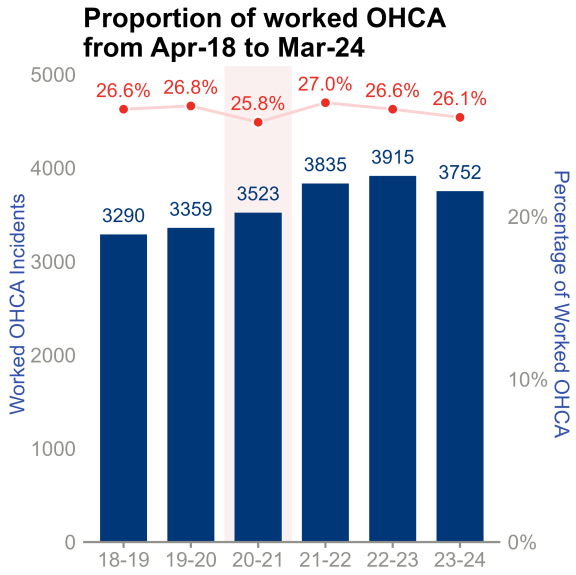


Figure 5 Shows the number of worked arrests by year from 2018-19 to 2023-24 (bar chart). The line graph above this shows what proportion of all confirmed arrests these bars represent.

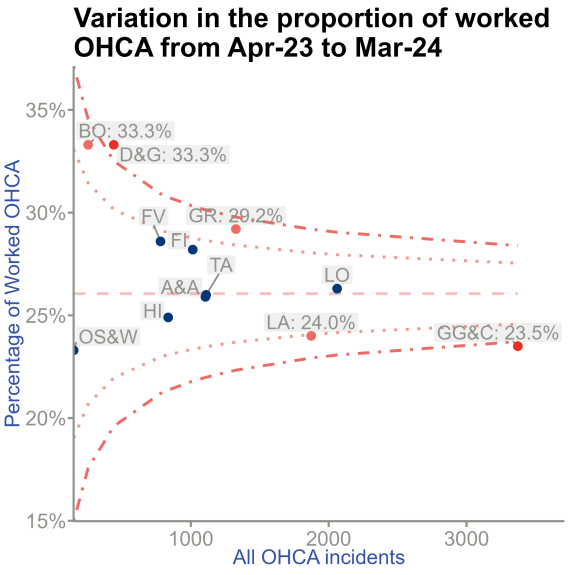


Figure 6 shows a funnel plot of the proportion of worked OHCA for each Health Board across Scotland during the single year 2023-24. The dashed central line shows the national mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

Denominator

It is important to note that the number of non-traumatic worked arrests attended in 2023-24 is used as the denominator for reporting the proportions shown in the rest of this report, unless otherwise explicitly stated. It can be argued that OHCA secondary to hanging or drowning could be considered as traumatic arrests. We have included these patients in our denominator this year and in previous reports, on the grounds that the system of care required to deliver advanced life support to these patients is similar to arrests due to other medical aetiologies.

Data Linkage

In order to report outcome data, cardiac arrest incidents are linked to in-hospital outcomes via the Unscheduled Care Datamart (UCD) as we have described previously (Clegg et al., 2022, 2020, 2019, 2018). Figure 7 shows the number and percentage of worked arrests that were successfully linked. The linkage rate is currently 97%, consistent with previous years. Incidents which could not be linked to outcome data were assumed to be deaths and included in the denominator for the calculation of the percentage of 30-day survival.

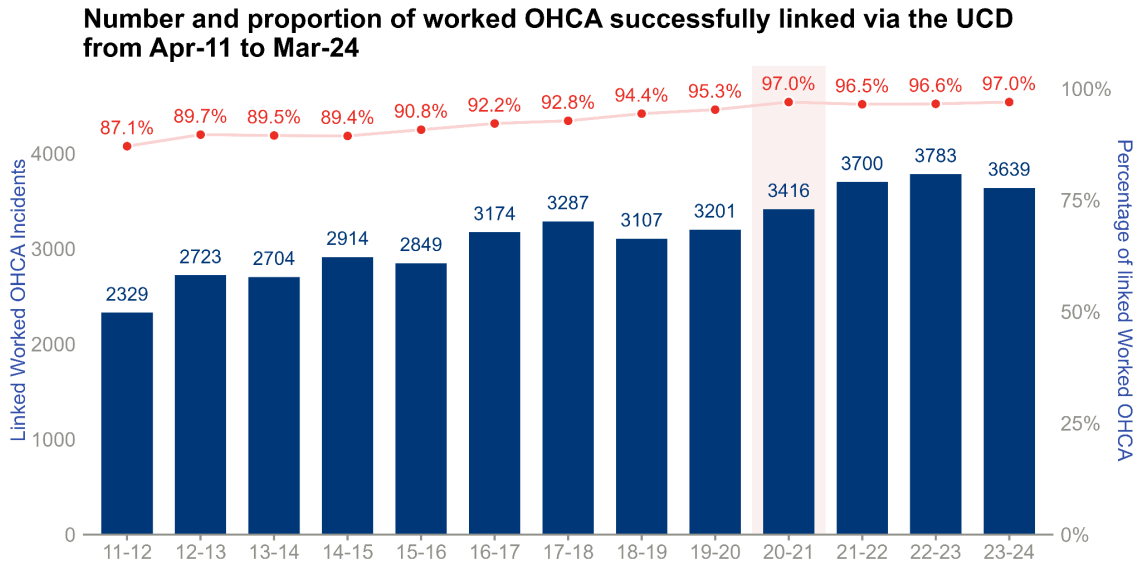


Figure 7 shows the number (bar graph) and percentage (line graph) of worked OHCA which were linked to outcome data via the Unscheduled Care Datamart by year from 2011-12 to 2023-24.

Patient characteristics

The characteristics of patients with worked OHCA have generally remained stable over the last decade (See Appendix for full data table). In 2023-24 the mean age was 64.1 years with males comprising 64.8% of patients. The percentage of patients having their OHCA at a location with the same postcode as their home address was 71%, while the percentage of patients presenting with a shockable initial heart rhythm (BOX 2) was 20.4%. The percentage of worked OHCA in each of the SIMD quintiles was essentially unchanged from previous years, with the most deprived quintile (SIMD1) having the most worked OHCAs and the least deprived quintile (SIMD5) having the least worked OHCAs. Figure 8 shows a visual representation of these data.

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** (i.e., ventricular fibrillation or ventricular tachycardia) which may be treatable by delivering an electric shock using a **defibrillator**, or **non-shockable rhythm** (i.e., asystole, pulseless ventricular activity, or bradycardia). The initial treatment and prognosis depends on the initial heart rhythm: survival is more likely for OHCA with a shockable initial rhythm. The outcomes for patients with a shockable initial rhythm are used as a benchmark for systems of OHCA care.

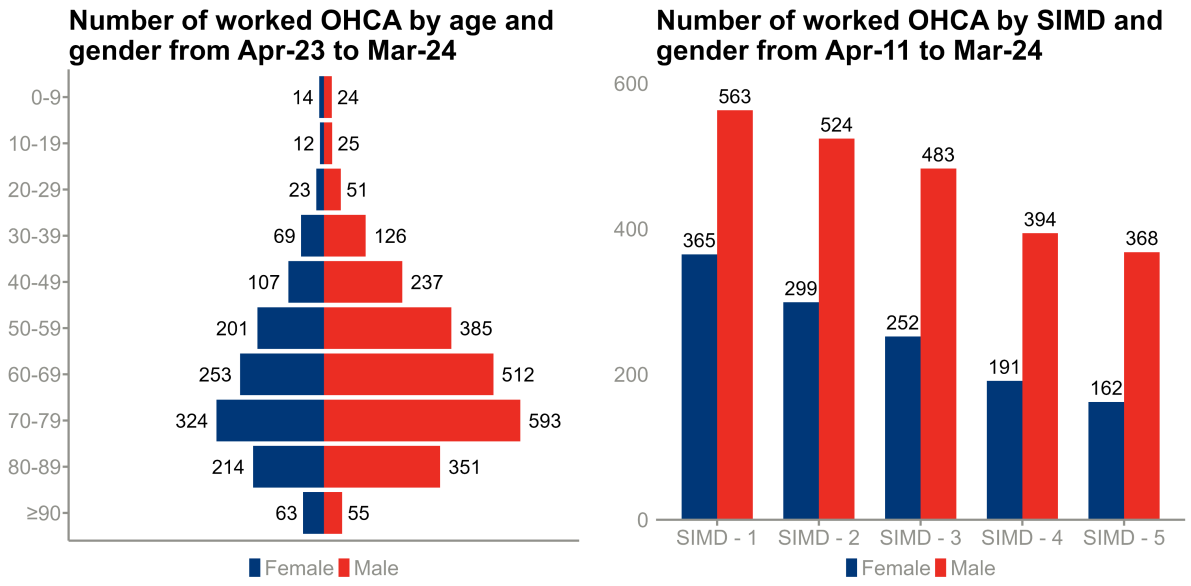


Figure 8 shows the distribution of worked OHCA by age (left panel) and SIMD quintile (right panel) in 2023-24. In both charts the male patient distribution is shown in red and the female distribution in blue.

Key outcome measures

30-day survival

The number of patients still alive at 30 days after their OHCA is commonly used as a proxy for long-term neurologically intact survival (BOX 3). The timeline shown in Figure 9 includes the mean 30-day survival percentage across Scotland from April 2011 to March 2024. Survival peaked at 10.9% in Scotland in 2019, and decreased as the COVID-19 pandemic took hold to a low of 6.8% in 2020-21. There has been some recovery with mean 30-day survival in 2023-24 at 9.6%.

The funnel plot in Figure 10 shows a snapshot of 30-day survival by health board in 2023-24. None of the health boards lies outside the 95% control limits, suggesting that the range of outcomes are within expected variation around the mean. Tables showing 30-day survival data for individual health board areas can be found in the Appendix at the end of this report.

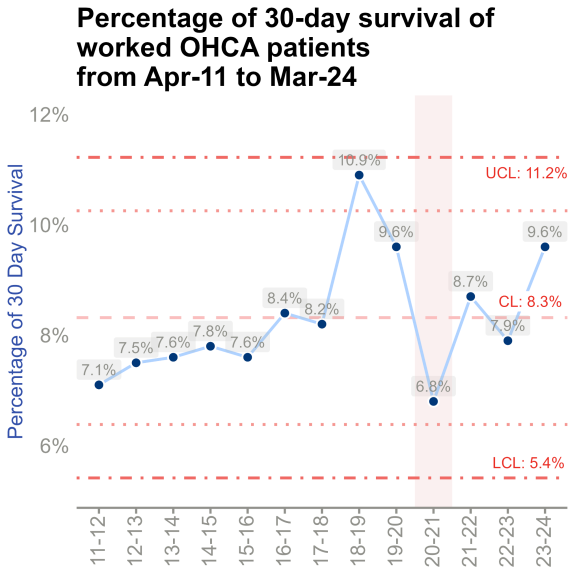


Figure 9 shows the percentage of survival at 30 days after OHCA for the whole of Scotland from 2011-12 to 2023-24. The shaded red area shows the COVID-19 'lockdown' time period. The dashed central line shows the national mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

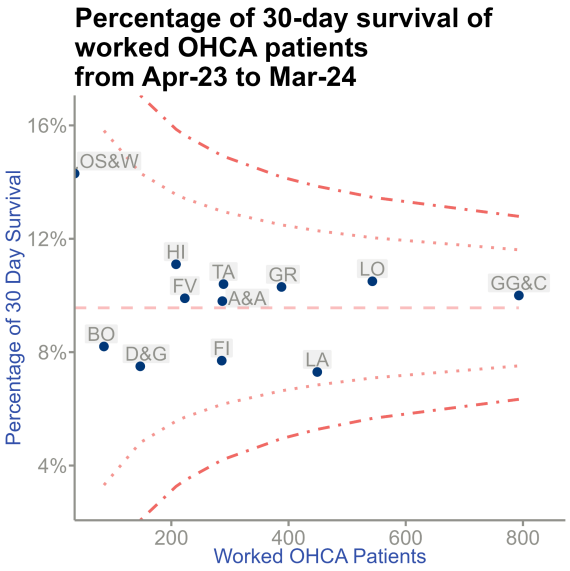


Figure 10 shows a funnel plot of 30-day survival vs the number of worked OHCA per Health Board during the single year 2023-24. The dashed central line shows the national mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

BOX 3: 30-day 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 OHCA where patients were still alive at 30 days. Worked OHCA which were not linked to outcome data have been assumed to be deaths and included in the denominator when calculating survival rates.

Number of 30-day survivors per million of the population

Calculation of the percentage of people with worked OHCA who survive for 30 days is useful for tracking system performance (BOX 4) but is dependent on the denominator value (i.e., the number of worked arrests). Reporting the number of survivors per million of the population is not affected by variation in the proportion of OHCA which are worked arrests and gives a helpful additional measure of the system of OHCA care ("Ten Programs – Global Resuscitation Alliance," 2021). Figure 11 shows that the number of 30-day survivors per million has trended upwards over the past decade, albeit with a dip during 2020-21 as was experienced elsewhere as a result of the COVID-19 pandemic (Bielski et al., 2021).

BOX 4: 30-day survivors per million

Reporting the number of 30-day survivors per million of the population is a useful measure which is not as dependent on rates of initiation of resuscitation. If we assume that the population of Scotland and the incidence of OHCA remain relatively stable, then monitoring the change in the absolute number of 30-day survivors per million is a more useful measure of the system of OHCA care than reporting changes in the proportion of patients who survive after resuscitation is attempted.

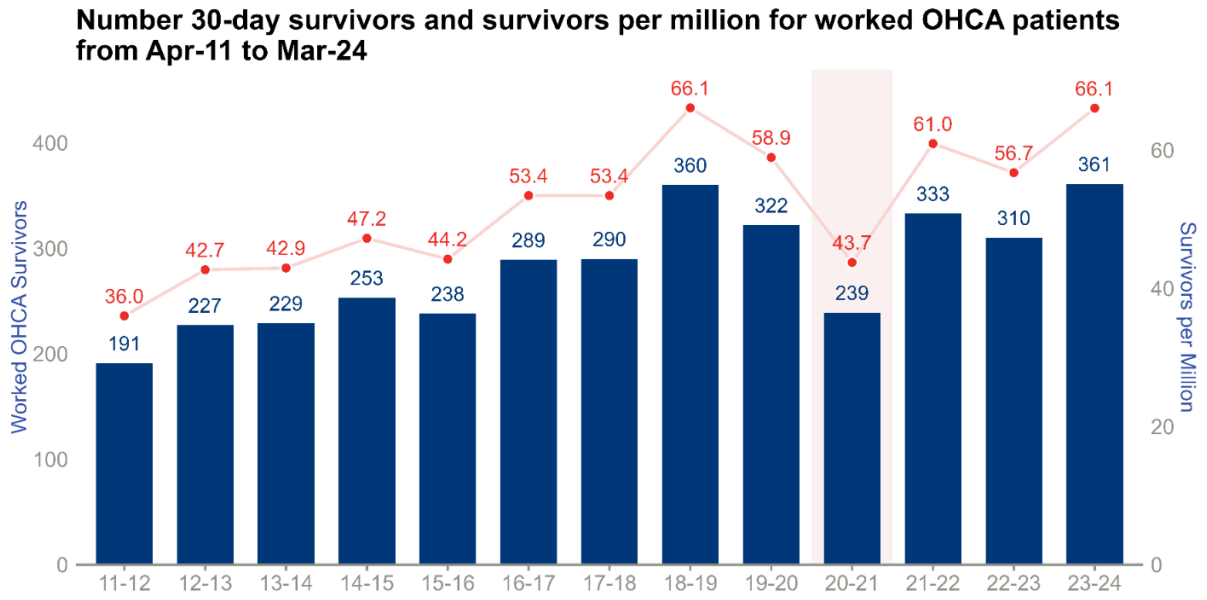


Figure 11 shows the number of patients alive at 30 days after worked OHCA for the whole of Scotland between the years 2011-12 to 2023-24 (blue bars) and the number of 30-day survivors per million of the population (red line).

30-day survival in patients with a shockable initial rhythm — the Utstein Comparator Group

Patients who have a shockable initial rhythm are most likely to survive their OHCA. Examining clinical outcomes for this subgroup of patients is an attempt to allow benchmarking of systems of OHCA care. The 'Utstein Comparator group' provides a benchmark for the emergency medical systems that respond to OHCA (BOX 5). Whilst the majority of patients suffering OHCA do not fall into this group, by focusing on those patients who are most likely to survive, the comparator seeks to eliminate as far as possible all the other variables that influence survival independently of the efficiency of the systems under review.

BOX 5: the Utstein Comparator

The Utstein templates aim to provide uniformity to OHCA data definitions around the world. One element of this is the use of the 'Utstein Comparator group' (bystander-witnessed cardiac arrest with a shockable initial heart rhythm). We have referred to this group as **'patients with a shockable initial rhythm'** in this report.

The proportion of worked OHCA with a shockable initial rhythm was 20.4% in 2023-24. This is similar to recent years, but the overall trend since 2011-12 has been a gradual reduction in the proportion of a shockable initial rhythm with the exception of 2018-20. This is consistent with findings from other areas (Oving et al., 2020).

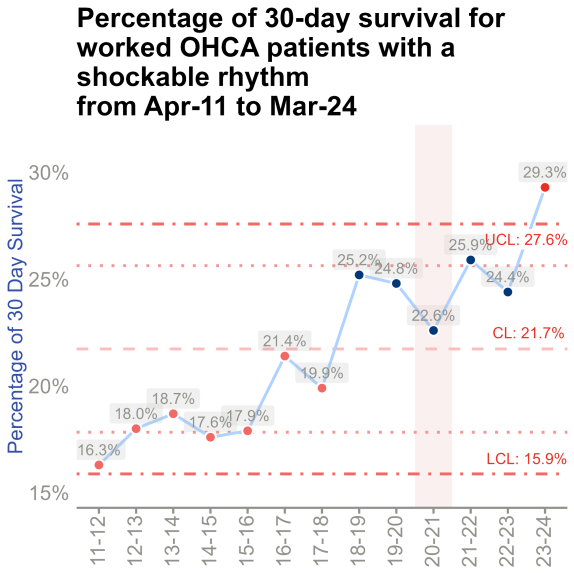


Figure 12 shows the percentage of survival at 30 days after OHCA for patients with an initial shockable rhythm from 2011-12 to 2023-24. The shaded red area shows the COVID-19 'lockdown' time period. The dashed central line shows the overall mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

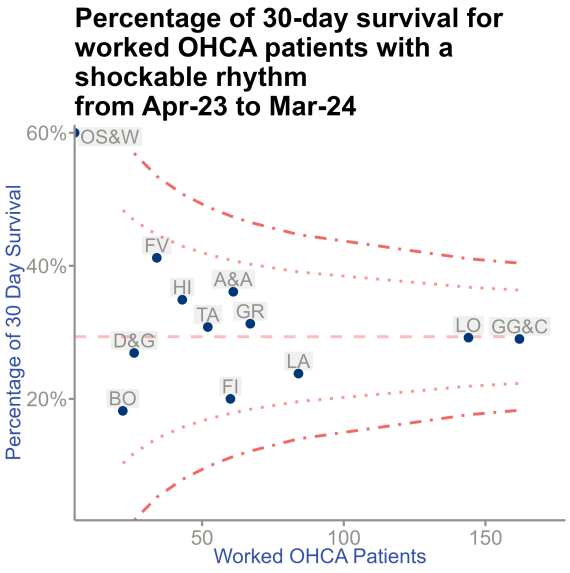


Figure 13 shows a funnel plot of 30-day survival vs number of worked OHCA for patients with an initial shockable rhythm per Health Board during the single year 2023-24. The dashed central line shows the national mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

Figure 12 shows the trend over the last decade in 30 day survival after OHCA presenting with a shockable rhythm. It is notable that almost twice as many patients survived to 30 days in 2023-24 as did in 2011-12. The funnel plot in Figure 13 shows the average survival in this group of patients continued to increase to a high of 29.3% in 2023-24 with no significant variation in survival rate across health boards.

Return of spontaneous circulation (ROSC)

An important precursor to long term, neurologically intact patient survival is return of spontaneous circulation (ROSC) – see BOX 6 for a definition of ROSC. The time series of annual ROSC rates in Figure 14 and the associated funnel plot in Figure 15 shows a steady increase in the mean annual proportion of patients with ROSC, with a mean of

26.5% in 2023-24. Lothian had a comparatively higher proportion of ROSC compared to the national average; there were no statistical differences between the other health boards.

BOX 6: Return of Spontaneous Circulation (ROSC)

Definitions for ROSC vary. The Scottish Ambulance Service records ROSC if a patient with OHCA regains a palpable pulse during resuscitation which is sustained until arrival at the Emergency Department. This includes those patients who are successfully resuscitated by members of the public using Public Access Defibrillators before the arrival of the ambulance service. The proportion of worked OHCA with ROSC is sometimes referred to as **'survival to hospital'** or **'number of hearts restarted'**. ROSC does not equate to 30-day survival.

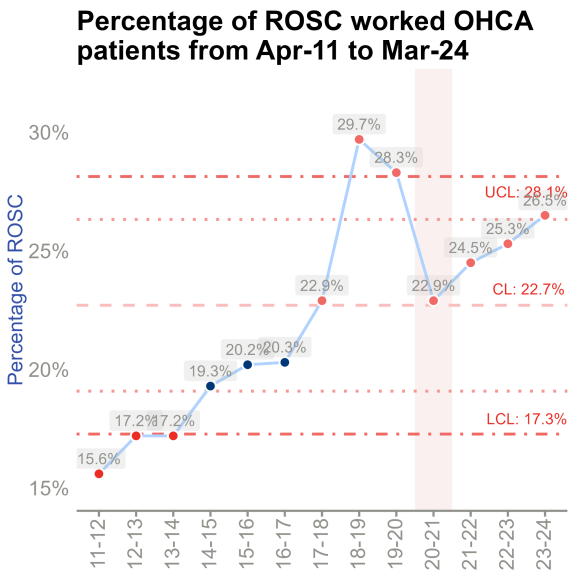


Figure 14 shows the percentage of worked arrests with attained ROSC per year from 2011-12 to 2023-24. The shaded red area shows the COVID-19 'lockdown' time period. The dashed central line shows the overall mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

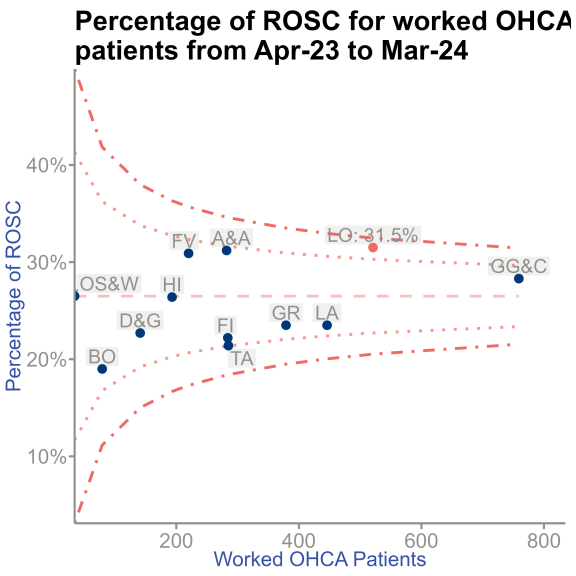


Figure 15 shows a funnel plot of worked OHCA with attained ROSC vs number of worked OHCA per Health Board during the single year 2023-24. The dashed central line shows the national mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

ROSC in patients with a shockable initial rhythm

Examining ROSC rates in OHCA patients with a shockable initial rhythm (i.e., those in the Utstein Comparator group), the timeline in Figure 16 and the funnel plot in Figure 17, show a general pattern consistent with the survival and ROSC charts above. The national average figure for ROSC with an initial shockable rhythm was 56.5%. It is encouraging that more than half of OHCA patients presenting with a shockable rhythm will have a pulse on arrival in hospital. There was no evidence of unexpected variation in Utstein ROSC across health boards.

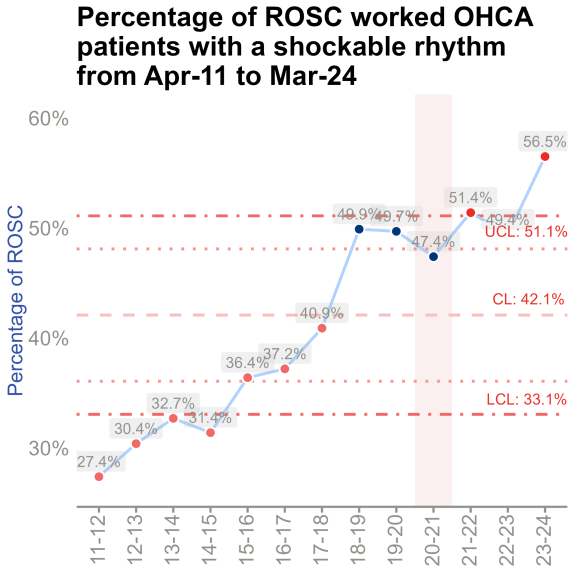


Figure 16 shows the percentage of worked OHCA with a shockable initial rhythm and where ROSC was attained per year from 2011-12 to 2023-24. The shaded red area shows the COVID-19 'lockdown' time period. The dashed central line shows the overall mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

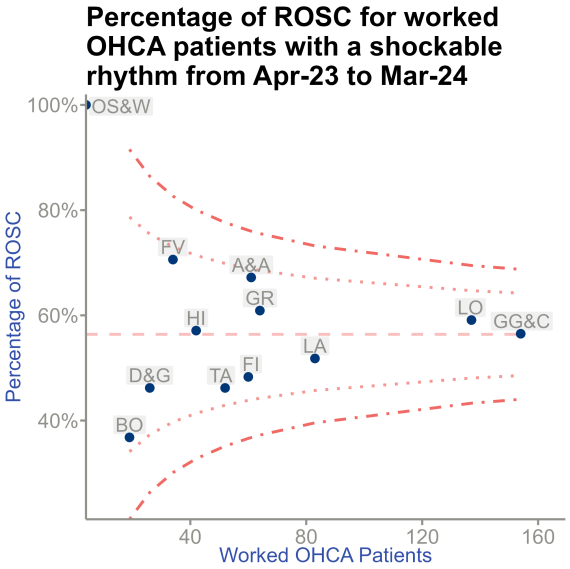


Figure 17 shows a funnel plot of the percentage of worked OHCA with shockable initial rhythm and where ROSC was attained vs the number of worked OHCA with a shockable initial rhythm per Health Board during the single year 2023-24. The dashed central line shows the national mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

Key process measures

The following sections of the report examine key elements in the Wheel of Recovery. These are the processes which need to be in place for successful resuscitation to occur leading to ROSC and 30-day survival.

Bystander CPR

Bystander CPR is one of the few resuscitative interventions consistently demonstrated to make a difference to neurologically intact survival after OHCA (BOX 7). The chances of survival after OHCA in cases where CPR has not been performed are very low.

BOX 7: Bystander CPR

The bystander CPR rate is the proportion of worked OHCA where a member of the public ('bystander') is performing CPR when the ambulance crew arrive. Whilst CPR can include both chest compressions and rescue breaths, the definition of CPR as used in this report is whether any chest compressions were performed.

Figures 18 and 19 below show little change in the proportion of worked OHCA where bystander CPR is ongoing on arrival of the Scottish Ambulance Service on scene, with an overall level of 62.2% in 2023-24. It is of note that the bystander CPR rate in Scotland did not drop during the COVID-19 restrictions: this is shown in Figure 18, and also the month by month timeline in Figure 20. The funnel plot in Figure 19 shows that there is little variation in bystander CPR rates per health board. Tayside has a rate of 55.4% which is just outside the lower 95% control limit and is something we will monitor in future to see if this represents a persisting pattern.

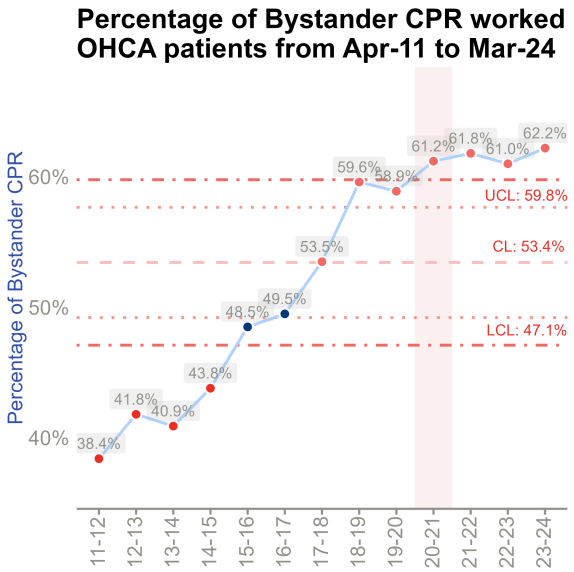


Figure 18 shows the percentage of worked OHCA with bystander CPR performed per year from 2011-12 to 2023-24. The shaded red area shows the COVID-19 'lockdown' time period. The dashed central line shows the overall mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

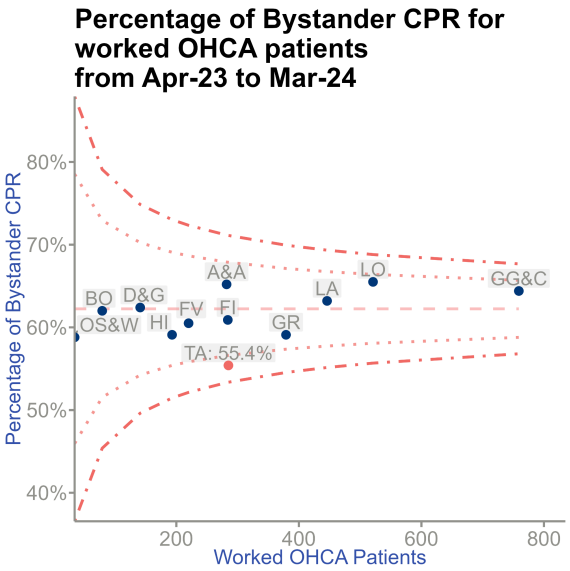


Figure 19 shows a funnel plot of the percentage of worked OHCA where bystander CPR was performed vs the number of worked OHCA per Health Board during the single year 2023-24. The dashed central line shows the national mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

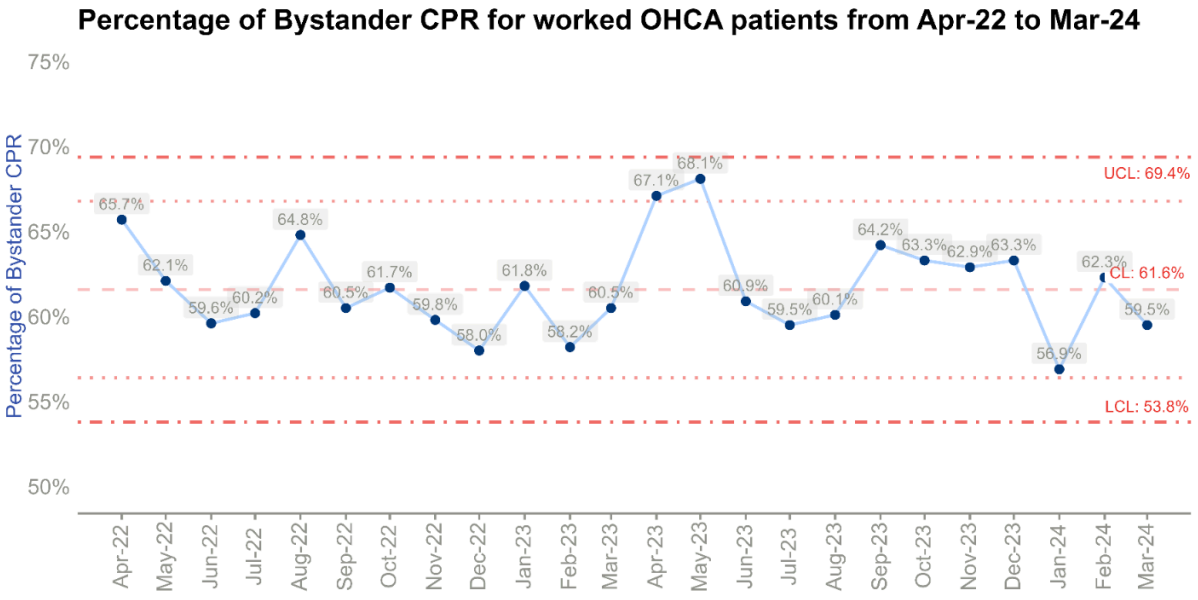


Figure 20 shows the percentage of worked OHCA with bystander CPR performed per month from April 2022 to March 2024. The dashed central line shows the overall mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

Public Access Defibrillator usage

Here we report on the proportion of OHCA where a Public Access Defibrillator (PAD — see BOX 8 for a definition) was applied by a member of the public before the arrival of SAS. Our previous OHCA report included a detailed description of the context of PAD use in Scotland (Clegg et al., 2022). Figure 21 shows that the trend over time continues towards more PAD use, reaching a national mean of 10.3% in 2023-24. The funnel plot in Figure 22 suggests that there is some significant variation in PAD use by health board with Grampian trending towards more use, and Lannarkshire trending towards less frequent use. The higher than average rate of 16.1% in Grampian may be explained by the activity of community cardiac responders (including the Sandpiper WILDCAT cohort) and points to the effectiveness of this approach to increasing community defibrillation. Figure 23 shows the number of PAD registered on the National Defibrillator Network ('The Circuit') per 1,000 population by health board. Here the data suggest that paucity of publicly accessible AEDs may be part of the reason for a lower than expected level of PAD use in Lanarkshire and GG&C for the second year running.

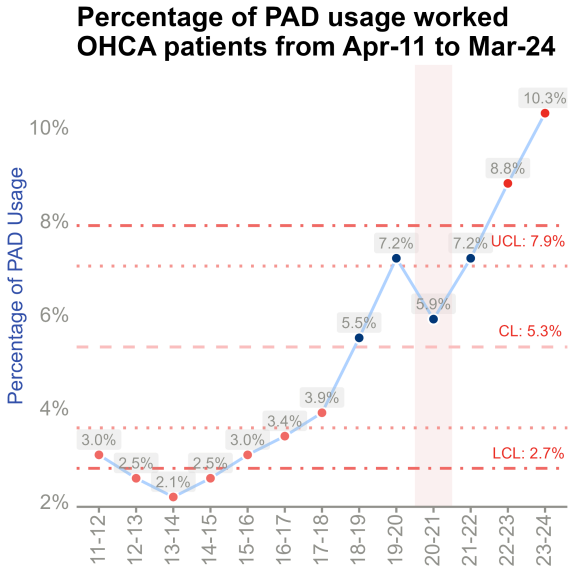


Figure 21 shows the percentage of worked OHCA where a PAD was applied before SAS arrival per year from 2011-12 to 2023-24. The shaded red area shows the COVID-19 'lockdown' period. The dashed central line shows the overall mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

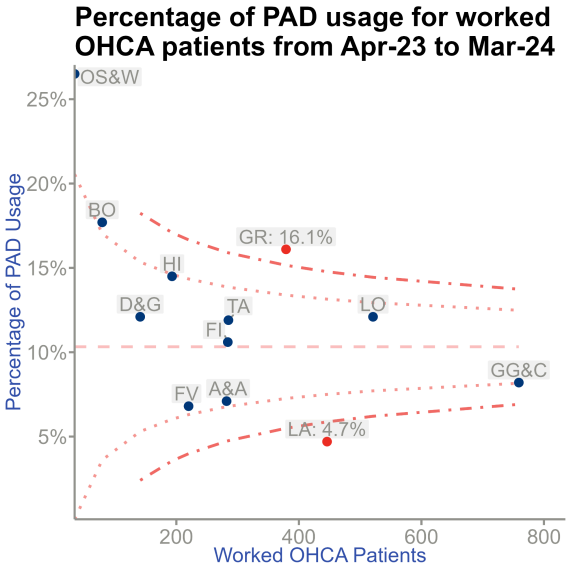


Figure 22 shows a funnel plot of the percentage of worked OHCA where a PAD was applied before SAS arrival vs the number of worked OHCA per Health Board during the year 2023-24. The dashed central line shows the national mean, with the upper and lower 95% and 99.7% control limits shown as dotted red lines.

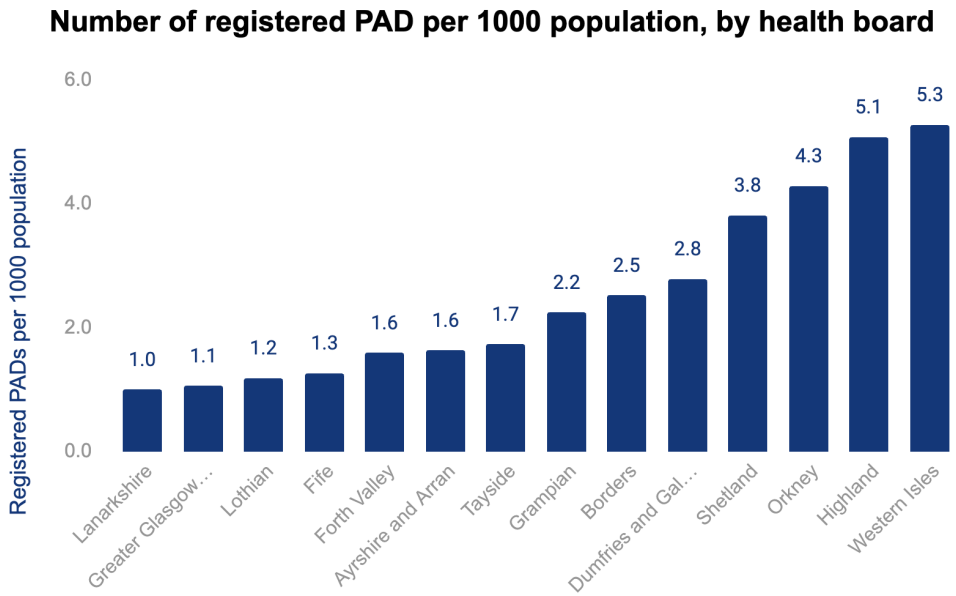


Figure 23 shows the number of Public Access Defibrillators registered on the National Defibrillator Network (the Circuit) per population for each of the health boards in Scotland.

BOX 8: Public Access Defibrillator (PAD)

A PAD is an Automated External Defibrillator (AED) which is available for use by the general public in case of OHCA emergencies. AEDs are used to automatically detect an abnormal cardiac rhythm and deliver a lifesaving shock to reset and restart the heart. PAD should be located in areas where they are likely to be available to treat OHCA, well signposted and registered so that the SAS can direct a bystander to fetch one in an emergency.

Scottish Index of Multiple Deprivation and OHCA

Figures 24-27 illustrate the relationship between survival, bystander CPR, PAD use and SIMD (see the 'How to read this report' section for a description of SIMD).

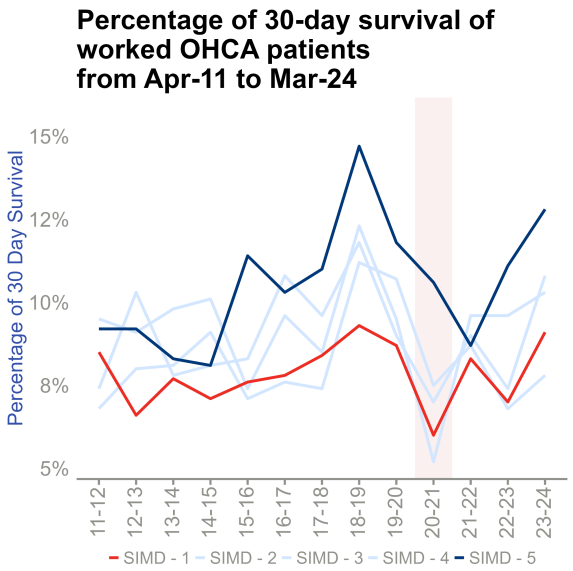


Figure 24 shows the mean annual 30 day survival for all patients with OHCA by SIMD. The shaded red area shows the COVID-19 'lockdown' period.

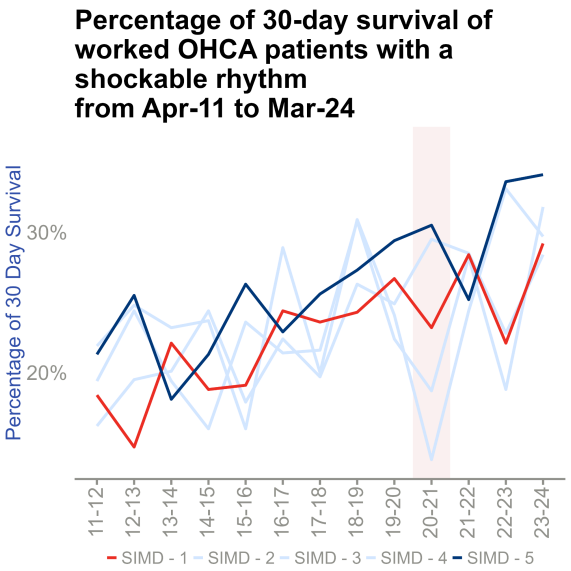


Figure 25 shows mean annual 30 day survival for patients with OHCA and a shockable rhythm by SIMD. The shaded red area shows the COVID-19 'lockdown' period.

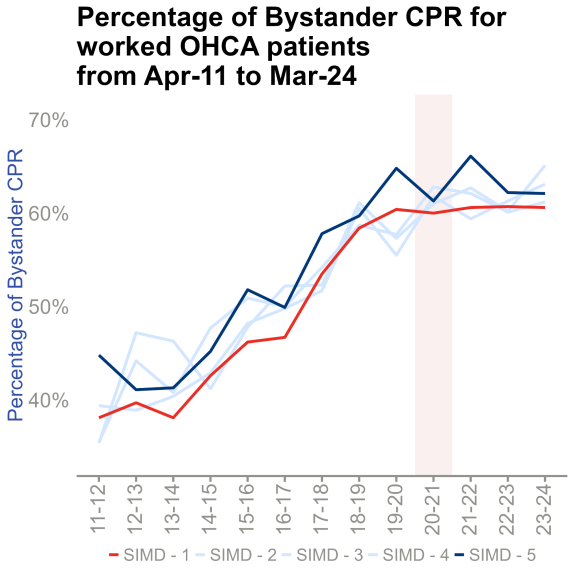


Figure 26 shows the proportion of patients with OHCA receiving bystander CPR, by SIMD. The shaded red area shows the COVID-19 'lockdown' period.

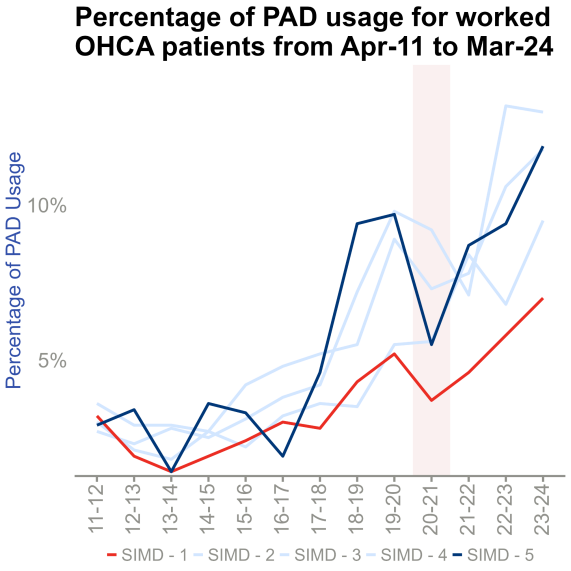


Figure 27 shows the proportion of patients with OHCA where a PAD was used before the arrival of SAS, by SIMD. The shaded red area shows the COVID-19 'lockdown' period.

Figures 24 and 25 show that, in general, those living in the most deprived communities in Scotland are less likely to survive their OHCA compared to those in the least deprived areas. These data are unadjusted, but a recent analysis of OHCA in Scotland showed that after adjustment for age, sex, and urban/rural residency the relative odds of survival in SIMD1 dropped further when compared to SIMD5 (OR 0.56, 95% CI 0.47–0.67 (Bijman et al., 2023a). Examining some of the processes which lead to OHCA survival it is striking that while there is a modest difference in the percentage of patients in SIMD1 receiving bystander CPR compared to SIMD5 (Figure 26), the disparity in PAD use is more marked and appears to be worsening (Figure 27). See the Appendix for data tables relating to these charts.

Initiatives to improve the system of care

Save a Life for Scotland

Save a Life for Scotland (SALFS) is a collaboration between the Emergency Services, third sector organisations, Scottish Government and academic researchers. The partnership is directed by the Resuscitation Research Group at the University of Edinburgh and aims to promote CPR readiness in young people and in communities across Scotland. In order to achieve this SALFS also attempts to shape perceptions of OHCA with an emphasis on giving all communities the opportunity to engage. The campaign aims to equip 1 million people with CPR skills by the end of 2026. An update on progress can be found at www.savealife.scot. Figure 28 shows that as the cumulative number of people trained in CPR by SALFS has increased since its formation in 2014, so too have rates of bystander CPR for OHCA in Scotland.

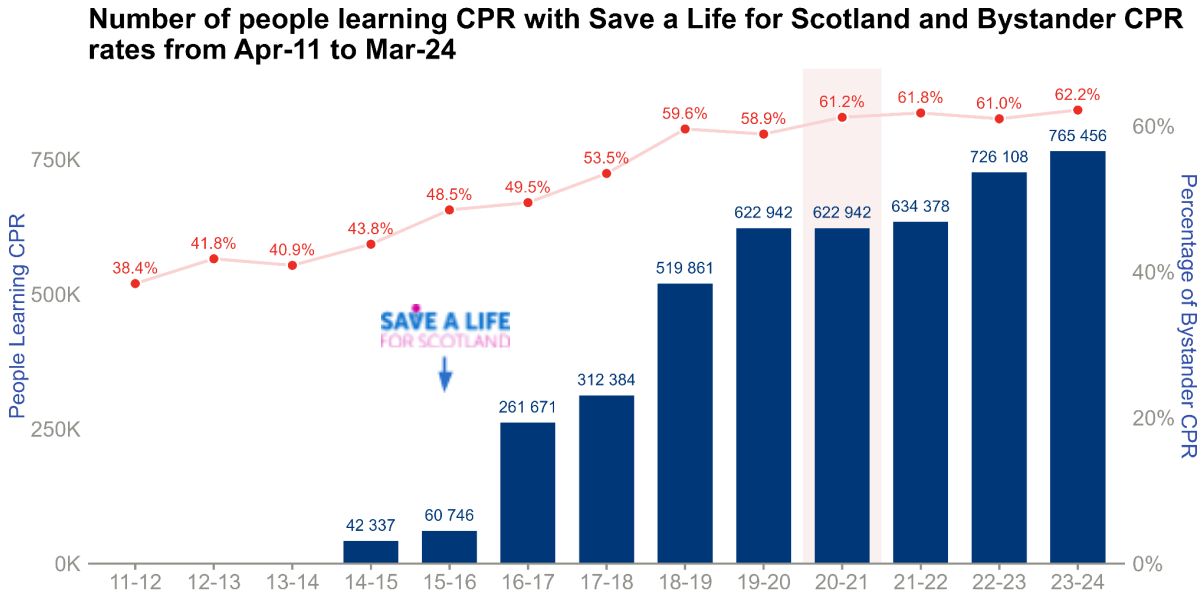


Figure 28 shows the number of people learning CPR and bystander CPR rates in Scotland 2011-12 to 2023-24. Shaded red area shows the COVID-19 'lockdown' period.

GoodSAM

GoodSAM is a crowdsourcing platform used by most UK ambulance services. In Scotland we use the GoodSAM Responder smartphone app to alert registered volunteers to an OHCA which has occurred near their location. A volunteer who is alerted can choose to attend if they are available, and can help perform CPR or fetch a defibrillator while an ambulance is en route. GoodSAM is an effective mechanism for providing vital extra help in the crucial early minutes of a cardiac arrest. To support volunteers, welfare support is offered following the acceptance of an alert.

Figure 29 shows a wallet card advertising GoodSAM in Scotland. Scan the QR code for further information or to sign up. Requirements for volunteering are over 18 years old, photographic ID (e.g., drivers licence, passport), and either online or in-person CPR familiarisation.

A limited deployment of GoodSAM involving only Scottish Ambulance Service staff began in 2019. The system was paused during the COVID-19 pandemic and launched for use by the general public in October 2022. In the reporting period from April 1st 2023 to March 31st 2024, 394 new users were registered by SAS; Figure 30 shows the cumulative number of sign-ups during this period. There are currently 2,452 users visible to the Service. Additionally, there is a small number of other volunteers who have registered directly with GoodSAM who may also be alerted to OHCA in Scotland.

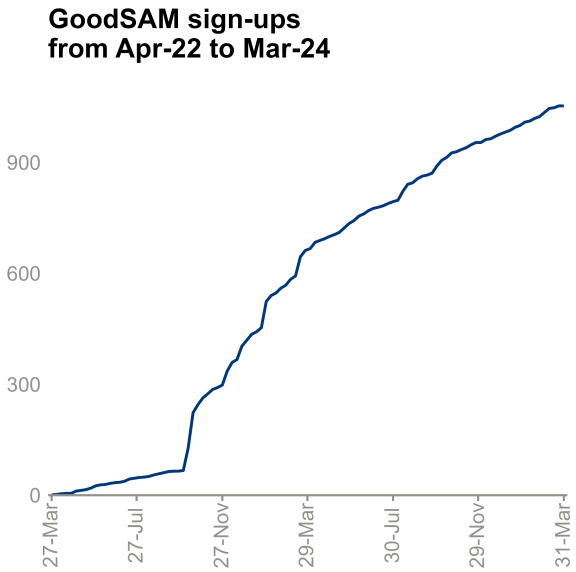


Figure 30 Shows the cumulative number of sign-ups to GoodSAM registered under the Scottish Ambulance Service from April 2022 to March 2024

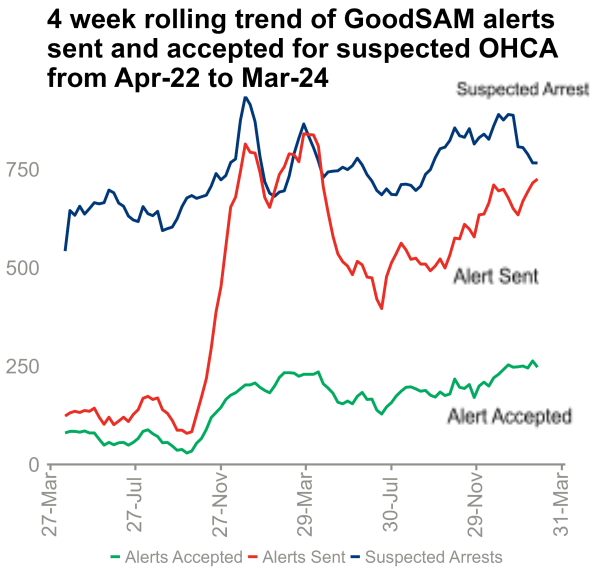


Figure 31 Shows the number of incidents initially coded as OHCA and the GoodSAM response. All lines are shown as a rolling 4 week average.

During 2022-24, 13,068 emergency calls triggered the criteria for GoodSAM alerts with a total of 5,049 alerts being sent through the GoodSAM smartphone app (up to five responders per incident are alerted if they are within a radius of 500 metres). Of those alerts, 1,271 were accepted by a responder. Figure 31 shows the number of calls coded as suitable for GoodSAM by ambulance control (blue line). The number of volunteers on the system within 500 m of the incident who received an alert is shown by the red line (note, up to five alerts per incident may be sent if volunteers are available). The green line at the bottom of Figure 31 shows the number of volunteers who accepted the alert sent to their phone. It can be seen from Figures 30 and 31 that as the number of volunteers registered on the system has increased (Figure 30) the likelihood of a volunteer being available to accept an alert has also risen (Figure 31). The proportion of OHCA where a GoodSAM volunteer has accepted an alert is still relatively modest.

Crowdsourcing apps like GoodSAM are a great way to help communities to take care of each other, but their success is critically dependent on a high enough density of volunteers (Stieglis et al., 2020). Work continues to promote GoodSAM as a platform for alerting CPR-aware volunteers to a nearby OHCA.

Anyone who is CPR-aware can register through www.savealife.scot/goodsam or scan the QR code above in Figure 30. To learn how to do CPR see www.savealife.scot.

Conclusion

In 2023–24, 3,752 out-of-hospital cardiac arrests (OHCA) in Scotland received attempted resuscitation—continuing a stable trend in incidence but the higher absolute number reflecting a revised method for case inclusion (see Appendix). The proportion of OHCA that were 'worked' remains approximately 26%.

Key clinical outcomes showed improvement. Notably, 30-day survival increased to 9.6% (from 7.9%), with 361 OHCA survivors—our highest absolute number since reporting began in 2011–12. Among patients presenting with a shockable rhythm (the Utstein comparator group), 30-day survival reached a record 29.3%, up almost 5% on the previous year, suggesting meaningful improvements across the wheel of recovery.

Process measures also showed incremental progress. Bystander CPR rates increased slightly (to 62.2%) and PAD use by the public rose from 8.8% to 10.3%. These changes suggest modest but meaningful shifts in community readiness and response. Grampian again demonstrated an unexpectedly high proportion of OHCA with public PAD use, likely reflecting its unique well established community cardiac responder network (Sandpiper WILDCATs).

Training and engagement efforts by Save a Life for Scotland (SALFS) continue to scale, with over 750,000 people involved to date. Meanwhile, uptake of the GoodSAM responder app is increasing, yet the proportion of alerts resulting in volunteer attendance remains low—underscoring the need to improve responder density across the country.

Health inequalities remain a persistent and troubling feature. People in our most deprived communities (SIMD1) remain almost twice as likely to experience OHCA as those in the least deprived (SIMD5) and are less likely to survive—an effect that persists even after adjusting for confounders. While bystander CPR rates are similar across the socioeconomic gradient, the disparity in PAD use is widening, compounding inequity in survival outcomes.

As we move into the penultimate year of Scotland's OHCA Strategy 2021–2026, the system shows resilience and progress. However, critical gaps remain: equity of access to early defibrillation, local responder capacity, and post-resuscitation support require sustained innovation and investment. Continued collaboration across sectors will be

essential to meet our strategy targets and ensure that survival is not determined by postcode.

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Appendix

Definitions of OHCA-related terminology

Term	How the term is used in this report
Worked arrests	'Worked arrests' are OHCA that have a cause which does not involve major physical trauma and where resuscitation was attempted by the Scottish Ambulance Service (SAS). This number forms the denominator for all subsequent outcome calculations unless otherwise specified. There are several reasons why SAS may not attempt resuscitation including obvious death (i.e., the patient shows obvious signs of having been dead for some time) or the confirmation that resuscitation was not the patient's wish (e.g., by the presence of a 'do not attempt CPR' order as part of an anticipatory care plan).
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 (i.e., ventricular fibrillation or ventricular tachycardia) which may be treatable by delivering an electric shock using a defibrillator, or non-shockable rhythm (i.e., asystole, pulseless ventricular activity, or bradycardia). The initial treatment and prognosis depend on the initial heart rhythm: survival is more likely for OHCA with a shockable initial rhythm.
30-day 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 OHCA where patients were still alive at 30 days. Worked OHCA which were not linked to outcome data have been assumed to be deaths and included in the denominator when calculating survival rates.
30-day survivors per million	Reporting the number of 30-day survivors per million of the population is a useful measure which is not as dependent on rates of initiation of resuscitation. If we assume that the population of Scotland and the incidence of OHCA remain relatively stable, then monitoring the change in the absolute number of 30-day survivors per million is a more useful measure of the system of OHCA care than reporting changes in the proportion of patients who survive after resuscitation is attempted.
The Utstein Comparator	The Utstein templates aim to provide uniformity to OHCA data definitions. One element of this is the use of the 'Utstein

	Comparator group' (bystander-witnessed cardiac arrest with a shockable initial heart rhythm). We have referred to this group as 'patients with a shockable initial rhythm' in this report.
Return of Spontaneous Circulation (ROSC)	Definitions for ROSC vary. The Scottish Ambulance Service records ROSC if a patient with OHCA regains a palpable pulse during resuscitation which is sustained until arrival at the Emergency Department. This includes those patients who are successfully resuscitated by members of the public using Public Access Defibrillators before the arrival of the ambulance service. The proportion of worked OHCA with ROSC is sometimes referred to as 'survival to hospital' or 'number of hearts restarted'. ROSC does not equate to 30-day survival.
Bystander CPR	The bystander CPR rate is the proportion of worked OHCA where a member of the public ('bystander') is performing CPR when the ambulance crew arrive. Here the definition of CPR is whether any chest compressions were performed with or without rescue breaths.
Public Access Defibrillator (PAD)	A PAD is an Automated External Defibrillator (AED) which is available for use by the general public in case of OHCA emergencies. AEDs are used to automatically detect an abnormal cardiac rhythm and deliver a lifesaving shock to reset and restart the heart. PAD should be located in areas where they are likely to be available to treat OHCA, well signposted and registered so that the SAS can direct a bystander to fetch one in an emergency.
The Circuit - the National Defibrillator Network	The national defibrillator network also referred to as The Circuit, was developed by the British Heart Foundation and provides the NHS ambulance services with information about defibrillators across the UK so that after a cardiac arrest, they can be accessed quickly to help save lives. Registration on the Circuit makes PAD visible to the Scottish Ambulance Service and alerts emergency call handlers that there is a PAD near to an OHCA. To stay 'active' on the database the PAD must have a named individual ('guardian') responsible for regular checking to ensure the defibrillator is 'emergency ready' if needed.

Health Board Abbreviations

Abbreviation	Regional NHS Health Board
A&A	NHS Ayrshire & Arran
BO	NHS Borders
D&G	NHS Dumfries & Galloway
FI	NHS Fife
FV	NHS Forth Valley
GG&C	NHS Greater Glasgow & Clyde
GR	NHS Grampian
HI	NHS Highland
LA	NHS Lanarkshire
OR	NHS Orkney
LO	NHS Lothian
SH	NHS Shetland
TA	NHS Tayside
WI	NHS Western Isles

Glossary of Terms

ACC	Ambulance Control Centre
BHF	British Heart Foundation (www.bhf.org.uk)
Bystander	A lay person involved in assisting someone with OHCA
Cardiac arrest	A condition in which the heart suddenly stops pumping blood around the body
Chain of Survival	The sequence of events required for the best chance of survival after OHCA
CHI	Community Health Index (see https://www.nrscotland.gov.uk/glossary-of-terms)
COVID-19	Coronavirus disease (COVID-19): an infectious disease caused by the SARS-CoV-2 virus
CPR	Cardio-Pulmonary Resuscitation: chest compressions with or without rescue breaths delivered to a person who has suffered a cardiac arrest
Defibrillation	The administration of a controlled electric shock to the heart in order to reset a normal heart rhythm
ECG	An electrocardiogram (ECG) is a simple test used to check the heart's rhythm and electrical activity. Sensors attached to the skin detect the electrical signals produced by the heart each time it beats
GRA	Global Resuscitation Alliance (www.globalresuscitationalliance.org)
Health Board	Healthcare services in Scotland are the responsibility of 14 regional National Health Service (NHS) Boards that report to the Scottish Government. Health board areas are aligned with the area of each local authority that they serve.
Heart Attack	Damage caused by a clot in the arteries supplying blood to the heart muscle — requires emergency treatment in hospital
Non-shockable rhythm	Cardiac arrest may be accompanied by pulseless electrical activity or asystole — these are not treated with defibrillation
OHCA	Out-of-Hospital Cardiac Arrest

PAD	Public Access Defibrillators. AEDs (Automatic External Defibrillators) which are available in the community for use by the public before the arrival of the ambulance service.
Presenting Rhythm	The first ECG rhythm recorded at an OHCA.
ROSC	Return of Spontaneous Circulation. Here, we record ROSC if a patient with OHCA has a pulse on arrival in the Emergency Department.
RRG	Resuscitation Research Group at the Usher Institute in the University of Edinburgh (www.rrg.scot)
SAS	Scottish Ambulance Service (www.scottishambulance.com)
Save a Life for Scotland	SALFS is a campaign which brings together the work of a range of partners committed to saving lives by changing the way we think about OHCA in order to get Scotland CPR ready (www.savealife.scot)
Shockable heart rhythm	The heart rhythm in cardiac arrest may be Ventricular fibrillation or ventricular tachycardia — these are both treated by immediate delivery of an electric shock using a defibrillator
SIMD	Scottish Index of Multiple Deprivation. (https://www.nrscotland.gov.uk/glossary-of-terms#s)
SMR01	Standardised Mortality Ratio 01: a record of episodes of inpatient care
The Circuit	The National Defibrillator Network
UCD	Unscheduled Care Datamart
Utstein	Internationally recognised criteria for uniform reporting of cardiac arrest
Utstein Comparator	Bystander-witnessed cardiac arrests with a shockable initial heart rhythm
VF	Ventricular Fibrillation: a condition in which there is uncoordinated contraction of the heart muscle, which may be corrected by early defibrillation
Worked Arrests	'Worked arrests' are OHCA that have a cause which does not involve major physical trauma and where resuscitation was attempted by the Scottish Ambulance Service (SAS)

Data tables

Summary of worked OHCA by year

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
All Incidents	2675	3034	3021	3259	3137	3443	3541	3290	3359	3523	3835	3915	3752
Incidents matched	2329	2723	2704	2914	2849	3174	3287	3107	3201	3416	3700	3783	3639
Data Linkage %	87.1%	89.7%	89.5%	89.4%	90.8%	92.2%	92.8%	94.4%	95.3%	97%	96.5%	96.6%	97%
Bystander CPR	894	1139	1107	1276	1383	1570	1760	1853	1885	2091	2288	2306	2265
Bystander CPR %	38.4%	41.8%	40.9%	43.8%	48.5%	49.5%	53.5%	59.6%	58.9%	61.2%	61.8%	61%	62.2%
PAD Use	70	67	56	74	86	107	128	171	231	202	267	332	375
PAD Use %	3.0%	2.5%	2.1%	2.5%	3.0%	3.4%	3.9%	5.5%	7.2%	5.9%	7.2%	8.8%	10.3%
ROSC	362	467	465	561	576	645	753	924	907	781	906	956	965
ROSC %	15.6%	17.2%	17.2%	19.3%	20.2%	20.3%	22.9%	29.7%	28.3%	22.9%	24.5%	25.3%	26.5%
30 Day Survivors	191	227	229	253	238	289	290	360	322	239	333	310	361
30 Day Survival %	7.1%	7.5%	7.6%	7.8%	7.6%	8.4%	8.2%	10.9%	9.6%	6.8%	8.7%	7.9%	9.6%

Patient Characteristics by year

Measure	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Avg Age	66.3	66.6	65.6	66.6	66.4	65.4	65.8	64.9	64.6	63.8	64.9	65.2	64.1
Age (Std Dev)	17.8	17.9	17.7	17.9	17.2	18.2	17.7	18.0	18.1	17.6	17.0	16.9	17.6
Shockable Rhythm %	26.9%	25.3%	25.9%	23.0%	24.1%	22.6%	23.5%	26.6%	24.0%	19.6%	20.6%	20.3%	20.4%
Female %	37.2%	36.1%	36.6%	37.5%	37.3%	36.6%	35.8%	36.3%	37.2%	35.4%	34.3%	36.9%	35.2%
Male %	62.8%	63.9%	63.4%	62.5%	62.7%	63.4%	64.2%	63.7%	62.8%	64.6%	65.7%	63.1%	64.8%
Home Location	68.5%	69.1%	69.5%	70.3%	71.5%	72.2%	73.0%	71.2%	73.6%	77.5%	73.7%	74.1%	71.0%
SIMD 1	26.3%	26.1%	27.0%	25.8%	26.7%	28.0%	27.3%	27.3%	28.8%	28.0%	27.0%	26.2%	25.8%
SIMD 2	25.0%	24.6%	22.8%	25.4%	24.0%	23.0%	22.9%	24.5%	24.2%	23.7%	24.2%	23.0%	22.9%
SIMD 3	18.4%	19.2%	19.6%	19.6%	18.9%	18.8%	20.2%	18.4%	18.9%	19.0%	19.5%	20.3%	20.4%
SIMD 4	16.4%	15.9%	17.4%	15.4%	16.3%	16.9%	16.1%	16.4%	14.5%	16.0%	15.6%	16.6%	16.2%
SIMD 5	13.8%	14.2%	13.1%	13.7%	14.1%	13.3%	13.4%	13.5%	13.7%	13.3%	13.7%	13.9%	14.7%

30-day survival by health board, 2023-24

Health board	Worked arrests	30-day survival	30-day survival %	Survival per 100k
Ayrshire & Arran	287	28	9.8%	7.6
Borders	85	7	8.2%	6.0
Dumfries & Galloway	147	11	7.5%	7.6
Fife	286	22	7.7%	5.9
Forth Valley	223	22	9.9%	7.2
Grampian	388	40	10.3%	6.8
Greater Glasgow & Clyde	793	79	10.0%	6.6
Highland	208	23	11.1%	7.1
Lanarkshire	449	33	7.3%	4.9
Lothian	543	57	10.5%	6.2
Orkney, Shetland & Western Isles	35	5	14.3%	20.6
Tayside	289	30	10.4%	7.2

Proportion of worked arrests by SIMD

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
SIMD - 1	26.3%	26.1%	27.0%	25.8%	26.7%	28.0%	27.3%	27.3%	28.8%	28.0%	27.0%	26.2%	25.8%
SIMD - 2	25.0%	24.6%	22.8%	25.4%	24.0%	23.0%	22.9%	24.5%	24.2%	23.7%	24.2%	23.0%	22.9%
SIMD - 3	18.4%	19.2%	19.6%	19.6%	18.9%	18.8%	20.2%	18.4%	18.9%	19.0%	19.5%	20.3%	20.4%
SIMD - 4	16.4%	15.9%	17.4%	15.4%	16.3%	16.9%	16.1%	16.4%	14.5%	16.0%	15.6%	16.6%	16.2%
SIMD - 5	13.8%	14.2%	13.1%	13.7%	14.1%	13.3%	13.4%	13.5%	13.7%	13.3%	13.7%	13.9%	14.7%

30-day Survival by SIMD

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
SIMD - 1	8.5%	6.6%	7.7%	7.1%	7.6%	7.8%	8.5%	9.3%	8.7%	6.0%	8.3%	7.0%	9.1%
SIMD - 2	6.8%	8.0%	8.1%	9.1%	7.1%	7.6%	7.4%	11.2%	10.7%	7.5%	8.7%	6.8%	7.8%
SIMD - 3	9.5%	9.1%	9.8%	10.1%	7.4%	9.6%	8.5%	12.3%	9.5%	5.2%	9.6%	9.6%	10.3%
SIMD - 4	7.4%	10.3%	7.8%	8.1%	8.3%	10.8%	9.6%	11.8%	9.0%	7.0%	9.0%	7.4%	10.8%
SIMD - 5	9.2%	9.2%	8.3%	8.1%	11.4%	10.3%	11.0%	14.7%	11.8%	10.6%	8.7%	11.1%	12.8%

Bystander CPR by SIMD

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
SIMD - 1	38.1%	39.7%	38.1%	42.6%	46.2%	46.7%	53.4%	58.4%	60.4%	60.0%	60.6%	60.7%	60.6%
SIMD - 2	39.4%	38.9%	40.4%	42.9%	48.2%	49.8%	51.7%	60.5%	55.5%	61.8%	59.4%	61.3%	63.1%
SIMD - 3	35.5%	44.2%	40.8%	47.7%	50.9%	50.0%	54.2%	58.7%	57.7%	62.8%	62.1%	60.1%	61.2%
SIMD - 4	35.4%	47.2%	46.3%	41.2%	47.8%	52.2%	52.3%	61.1%	57.3%	61.0%	62.7%	60.2%	65.1%
SIMD - 5	44.8%	41.1%	41.3%	45.2%	51.8%	49.9%	57.8%	59.7%	64.8%	61.3%	66.1%	62.2%	62.1%

PAD deployment by SIMD

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
SIMD - 1	3.2%	1.9%	1.4%	1.9%	2.4%	3.0%	2.8%	4.3%	5.2%	3.7%	4.6%	5.8%	7.0%
SIMD - 2	3.0%	2.1%	1.8%	2.7%	2.2%	3.2%	3.6%	3.5%	5.5%	5.6%	8.4%	6.8%	9.5%
SIMD - 3	3.6%	2.9%	2.9%	2.7%	4.2%	4.8%	5.2%	5.5%	8.9%	7.3%	7.8%	10.6%	11.8%
SIMD - 4	2.7%	2.3%	2.8%	2.5%	3.1%	3.8%	4.2%	7.2%	9.8%	9.2%	7.1%	13.2%	13.0%
SIMD - 5	2.9%	3.4%	1.4%	3.6%	3.3%	1.9%	4.6%	9.4%	9.7%	5.5%	8.7%	9.4%	11.9%

Number and density of registered PAD by health board

Health board	PAD number	Population (2021)	PAD/1000 pop^{n}
Ayrshire and Arran	601	369,360	1.6
Borders	291	115,270	2.5
Dumfries and Galloway	415	148,860	2.8
Fife	472	373,550	1.3
Forth Valley	487	306,640	1.6
Grampian	1,313	586,150	2.2
Greater Glasgow and Clyde	1,125	1,063,960	1.1
Highland	1,211	238,190	5.1
Lanarkshire	660	661,900	1.0
Lothian	1,102	931,730	1.2
Orkney	96	22,390	4.3
Shetland	88	23,070	3.8
Tayside	723	417,470	1.7
Western Isles	139	26,330	5.3

Changes to the way outcome data is captured and presented in the 2023/4 report compared to previous SAS OHCA reporting

The 2023/24 report introduces important refinements in how we are capturing and presenting out-of-hospital cardiac arrest (OHCA) outcome data. Key measures, such as 30-day survival and return of spontaneous circulation (ROSC), continue to be derived via linkage with the Unscheduled Care Datamart, with linkage rates consistently high (97%). Unlinked cases are conservatively assumed to be deaths and are retained in the denominator for survival metrics, maintaining continuity with previous methodology.

A key development this year was the retrospective identification of previously unreported OHCA incidents from earlier years, following improvements in case detection methods. These cases—primarily arrests that had been misclassified or excluded due to coding inconsistencies in the electronic patient report form (ePRF)—have now been incorporated into the dataset. As a result, previously published survival percentages for earlier years may appear lower in this report than in past iterations, due to an increased denominator rather than changes in numerator values. This adjustment enhances the accuracy and completeness of longitudinal analysis but limits direct comparability with figures cited in previous reports.

In addition, the report continues to present outcome data using both relative (% survival) and absolute (survivors per million population) metrics. The latter provides a more stable measure of system performance over time, less sensitive to variation in resuscitation initiation rates. Together, these methodological refinements reflect a commitment to improving transparency, consistency, and the validity of system-level benchmarking.

The charts below summarise the effect of these changes on reported outcome data.

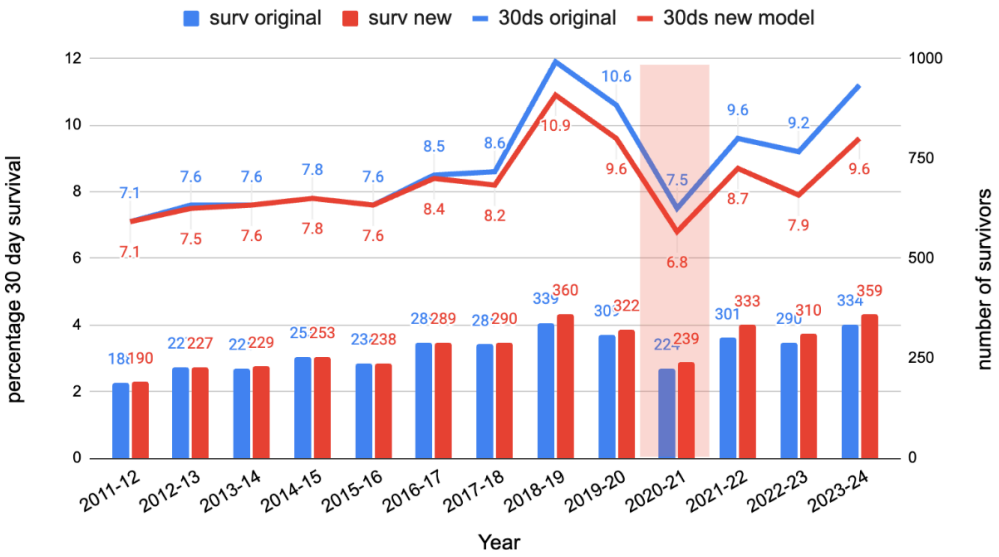

Figure A1 shows the old data model number of worked arrests and percentage 30 day survival in red, and the revised numbers in red. The new model contains more survivors but a lower percentage survival than previously reported.

In Figure A1 the increasing number of worked arrests in the new data model results in a reduction in the percentage of 30-day survival. This effect increases year on year after 2016-17, largely due to an increasing number of incidents where 'ALS 20 mins' is recorded via the recognition of life extinct (ROLE) screen rather than the OHCA MEDICAL route. Conversely, Figure A1 also shows an increase in the absolute number of 30-day survivors in the new data model compared to figures previously reported. This is a result of improvements in the methods used to parse incidents with duplicate incident numbers, and reconcile ePRFs where multiple SAS resources attend the same OHCA incident.