

SCOTTISH OUT-OF-HOSPITAL CARDIAC ARREST DATA LINKAGE PROJECT 2015/16-2016/17 RESULTS



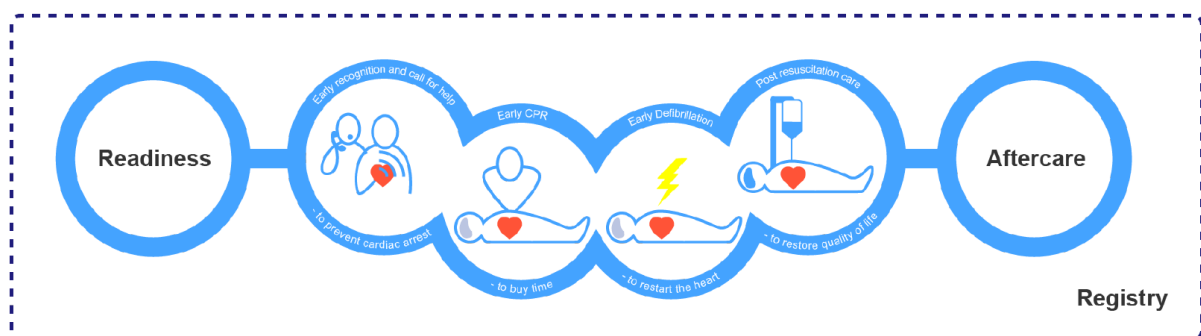
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Scottish Out-of-Hospital Cardiac Arrest data linkage project: 2015/16 – 2016/17 results

Preface to the report: Now in the third year after the launch of Scotland’s Strategy for Out-of-Hospital Cardiac Arrest (the Strategy) in March 2015 we have reviewed the data from 2015-16 and 2016-17 in order to continue to track patient outcomes and measure the impact of efforts to implement the strategic aims.

Strategy partners have implemented a range of initiatives over the last 2 years designed to deliver increased survival after Out-of-Hospital Cardiac Arrest (OHCA) by optimising the Chain of Survival. The figures contained in this report indicate that survival after OHCA is increasing. A key metric - the proportion of patients receiving bystander cardiopulmonary resuscitation (CPR) - has increased since the strategy launch bringing with it a predictable concomitant increase in 30 day survival.

It is important to remember that each of the survival figures contained in this report represents the reality of individual lives saved. We would like to commend all of those who continue to invest time and energy in improving survival and recovery after OHCA in Scotland.



The ‘Augmented Chain of Survival’ showing the elements required to save lives after OHCAⁱ.

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

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Background: The collection and preparation of data contained in this report follow the same methodology of our previous report: *Initial Results of the Scottish Out-of-Hospital Cardiac Arrest Data Linkage Project*ⁱⁱ.

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

This report presents initial results of 2015/16 and 2016/17 analysis from the Scottish OHCA data linkage project. This innovative work has linked complex datasets in order to report on OHCA in Scotland. As such, the results should be treated as provisional whilst the data and methodology are still in development. It should be noted that data from 2013/14 has been excluded from the analysis due to incomplete data. The 2013/14 data will be updated in due course and included in future publications. It should also be noted the reporting periods for the analysis in this report:

- Trends over time analysis has been presented by 1st April – 31st March.
- Pre strategy and post strategy introduction comparisons:
 - 2011 – 2014/15 combined dataset for baseline (i.e. pre strategy introduction) analysis
 - 2015/16 – 2016/17 combined dataset for post strategy introduction analysis

Summary of main findings

- The number of incidents of OHCA resuscitated by SAS has increased from 2692 in 2011/12 to 3455 in 2016/17. The proportion of SAS incidents which could be linked to outcome data also increased from 73.0% in 2011/12 to 86.6% in 2016/17.
- The mean age of OHCA patients, ratio of men to women and the distribution across the Scottish Index of Multiple Deprivation (SIMD) quintiles remains broadly similar from 2011/12-2016/17.
- The proportion of patients receiving bystander CPR has risen from an average of 41.3% between 2011-2014/15 (prior to the introduction of the strategy) to an average of 49.3% in 2015/16- 2016/17.

- The proportion of all OHCA patients resuscitated by SAS who were still alive at 30 days was 6.2% in 2011-14/15 (prior to the introduction of the strategy) and 7.7% in 2015/16-2016/17.

Out-of-Hospital Cardiac Arrest Analysis

- 1. Number of worked arrests:** ‘Worked arrests’ are those OHCA non-traumatic OHCA in patients where resuscitation was attempted by the Scottish Ambulance Service. 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 this was not the patient’s wish (i.e. by the presence of a valid ‘do not attempt CPR’ order as part of an anticipatory care plan). Thresholds for attempting resuscitation have been demonstrated to vary between ambulance servicesⁱⁱⁱ which may make an important difference to survival figures quoted by different services. Figure 1 shows that the number of worked arrests per year in Scotland has gradually increased from 2692 cases in 2011/12 to 3455 in 2016/17. It is unclear why this should be the case. If the explanation for this increase is a significant lowering of the threshold for resuscitation we would expect this to manifest as a greater number of unsuccessful attempts and a reduction in return of spontaneous circulation (ROSC) rates and survival to 30 days. This is not what the data shows (see below).

Figure 1: Number of worked arrests by year

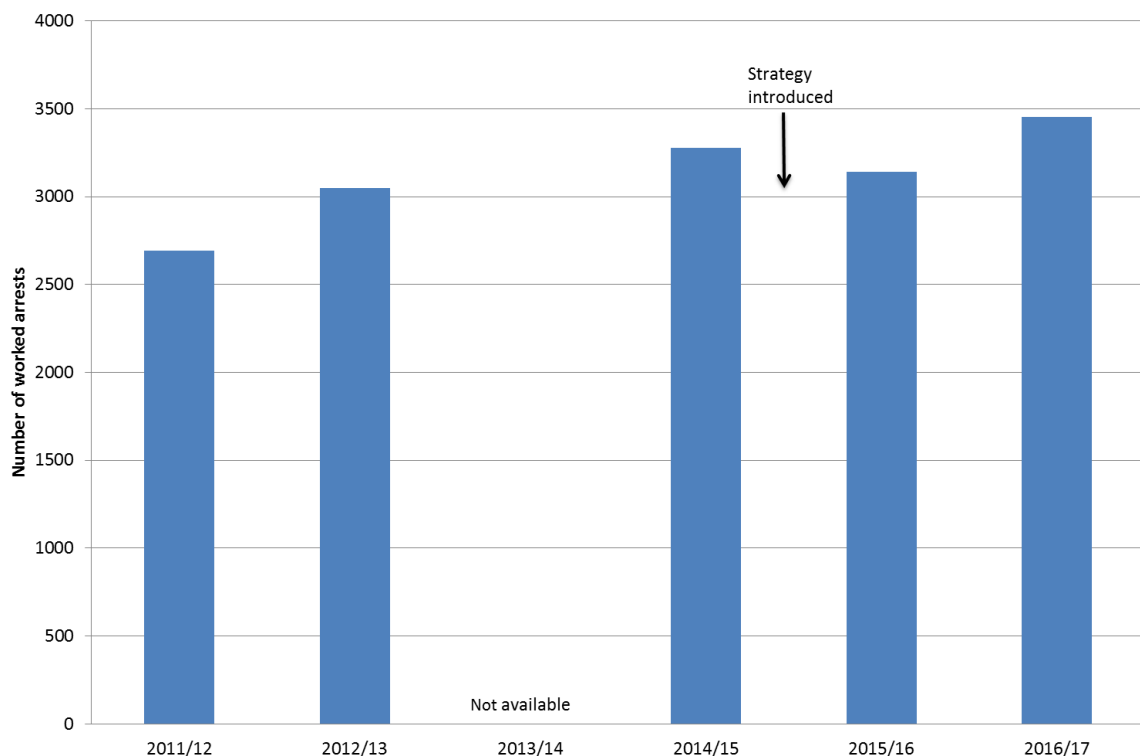


Figure 1: Chart shows the number of worked arrests reported by the Scottish Ambulance Service between 2011/12 and 2016/17. Data for 2013/14 is not currently available.

- 2. Data linkage rate:** The set of worked arrests supplied by SAS were linked to patient records by determining the CHI for each OHCA where available. This was done by querying the Unscheduled Care Datamart followed by an additional bespoke probabilistic matching process. Further detail can be found in the report: **Initial Results of the Scottish Out-of-Hospital Cardiac Arrest Data Linkage Project^{iv}**.

Figure 2 shows the proportion of 'worked arrest' incidents in the SAS dataset which were successfully linked, enabling patient survival to be determined. The linkage rate has steadily increased between 2011/12 and 2016/17 which is likely to represent an increase in the completeness of OHCA incident data recorded by SAS.

It is of note that in our analysis the worked arrest incidents which could not be linked have been treated as deaths. The basis for assuming that almost all of this group were pronounced dead at the scene of the OHCA incident is that arrival at an Emergency Department (ED) would usually result in enough information added to the SAS record to allow linkage. We recognise that there will be a very small group which will remain unidentified in the ED, or who do not have a CHI number. This is a crucially important assumption, as our overall 'worked arrest' denominator for ROSC and survival calculations is not artificially reduced by ignoring this group of patients with incomplete data. It is not always clear that this approach is taken in other centres and can make international comparisons of survival difficult. In addition, the gradual change in linkage rate of our dataset with time makes year on year comparisons less straightforward but would not be expected to distort reported survival figures if our assumptions about the nature of these incidents holds.

Figure 2: Percentage of worked arrests linked

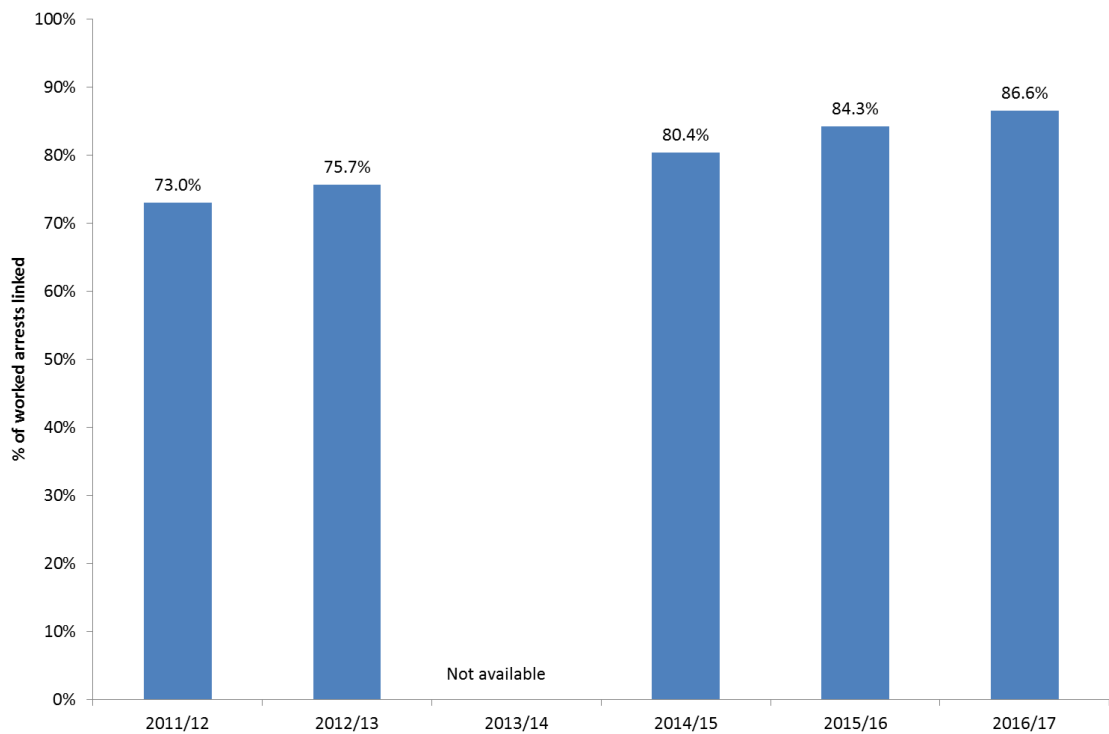


Figure 2: Chart showing the proportion of SAS OHCA incidents which were successfully linked to a CHI number between 2011/12 and 2016/17. Data for 2013/14 is not currently available.

3. Demographics - age, sex, SIMD and location.

There has been little change in the age of patients suffering OHCA over the whole period from 2011-2016/17. The mean age of patients in 2011-2014/15 was 67.7 years, and 66.8 years in 2015/16-2016/17. Figure 3 suggests that this small overall decrease in average age has been a result of a small reduction in the mean age of OHCA patients in the SIMD 1 and SIMD 2 quintiles. Similarly, the sex ratio of patients remains static at 62.2% males in 2011-2014/15, and 62.7% males in 2015/16-2016/17.

Figure 3: Average age of OHCA patients by quintile

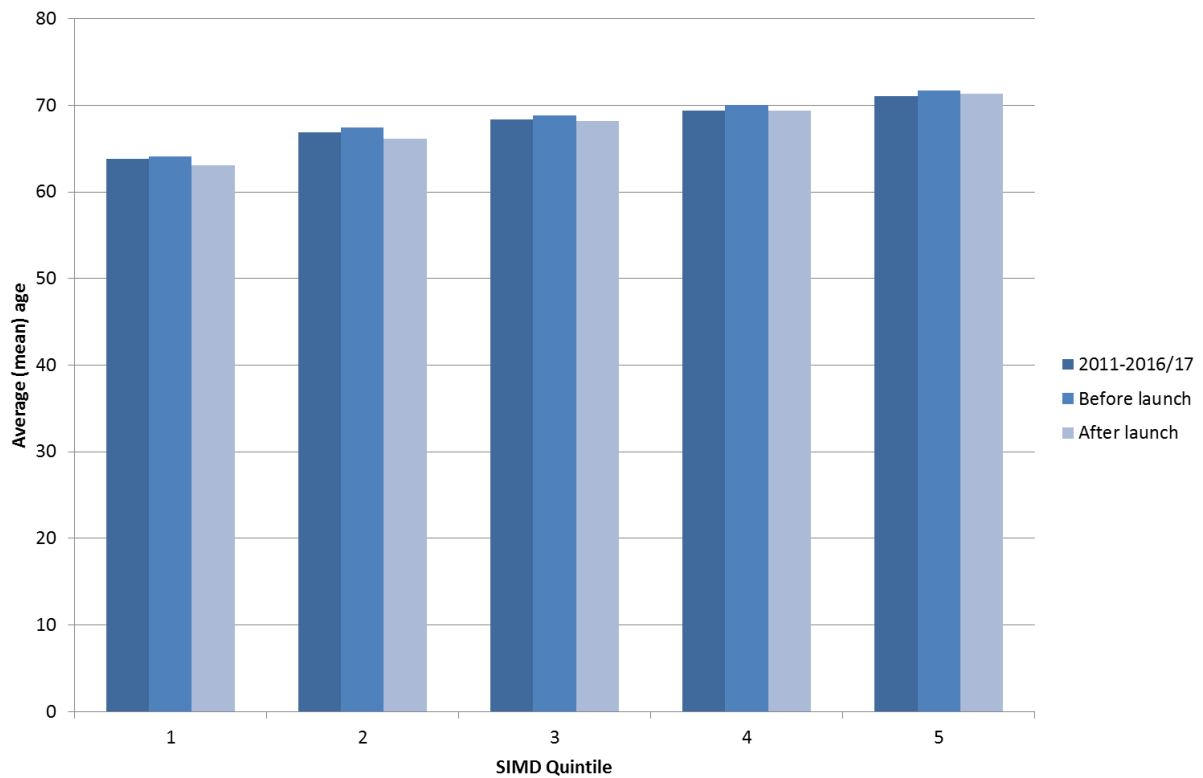


Figure 3 shows the (mean) average age of OHCA patients in each SIMD quintile for the whole dataset 2011-2016/17, before the strategy launch 2011/15 and after the launch 2015/17. Data for 2013/14 is not included. The Scottish Index of Multiple Deprivation (SIMD) is a measure designed to identify area concentrations of multiple markers of deprivation. Scotland is divided into areas called 'datazones', each with a population of around 500 to 1,000 residents. The SIMD ranks the 6,505 datazones that cover Scotland from most deprived (ranked 1) to least deprived (ranked 6,505). These SIMD-ranked datazones can then be split into quintiles reflecting the most deprived 20% of the population (SIMD1) up to the least deprived 20% (SIMD5).

The proportion of OHCA in each of the SIMD quintiles appears to have shifted slightly (Figure 4), but the most deprived sectors of the community continue to be over-represented with SIMD 1 and 2 accounting for over half (50.7%) of all worked OHCA in 2016/17.

Figure 4: Proportion of OHCA patients in each SIMD quintile by year

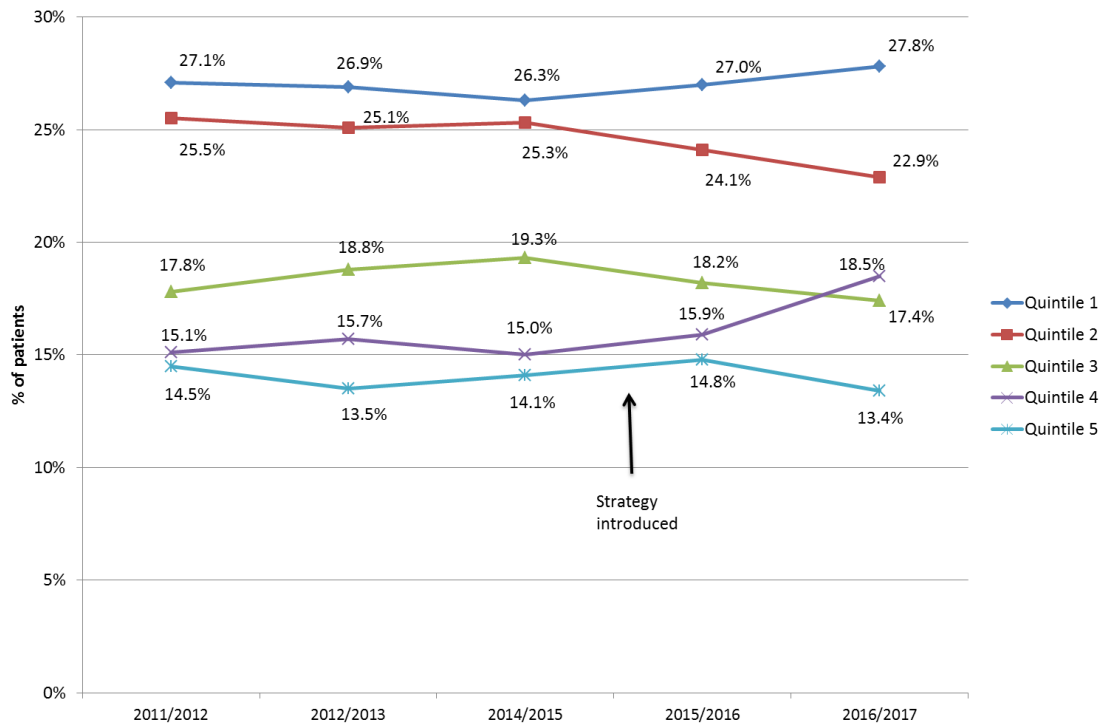


Figure 4 shows the percentage of patients suffering OCHA in each of the SIMD quintiles over time. Data for 2013/14 is not included. SIMD1 contains the most deprived 20% of the population up to SIMD5 which contains the least deprived 20% of the population.

With respect to type of location of OHCA the proportion of incidents occurring in an urban setting was 84% in 2015/16-2016/17, essentially unchanged from 85.2% in 2011-2014/15.

4. Bystander CPR

The rate of bystander CPR is a crucial metric for the impact of the strategy because its profound effect on likelihood of survival and its position early in the Chain of Survival. Data for 2011/12 to 2016/17 show a gradual increase in CPR rates, climbing more steeply after the launch of the Strategy (see Figure 5). Overall the rate has increased from an average of 41.3% in 2011-2014/15 to an average rate of 49.3% in 2015/16-2016/17.

This increase may be attributable to a range of interventions designed to increase public awareness of, and readiness to perform, CPR by the Save a Life for Scotland

partners and others. There have also been changes in the method of bystander CPR data collection with new digital tablets rolled out to SAS in 2017. These changes to the method of data capture may also have affected the reported bystander CPR rate.

5. Survival

Survival to 30 days is perhaps the final arbiter of success of the Strategy. There is a trend towards increasing 30 day survival, but this is very much a 'lag' measure. Better survival is prefigured by a number of 'lead' measures which involve system optimisation across the Chain of Survival. All of the partners involved in implementing the Strategy have worked to improve the elements within their sphere of influence, some of which is captured in the Strategy first year review^v.

Figure 5 shows the relationship between bystander CPR rates, initial resuscitation success indicated by return of spontaneous circulation (ROSC = pulse on arrival in hospital) and survival at 30 days after OHCA. There is a trend towards an increase in ROSC and a parallel increase in 30 day survival. The mean survival in the five years before the launch of the strategy was 6.2%, in the two years after the launch of the Strategy it is 7.7%.

Figure 5: Bystander CPR, ROSC and 30 day survival, by year

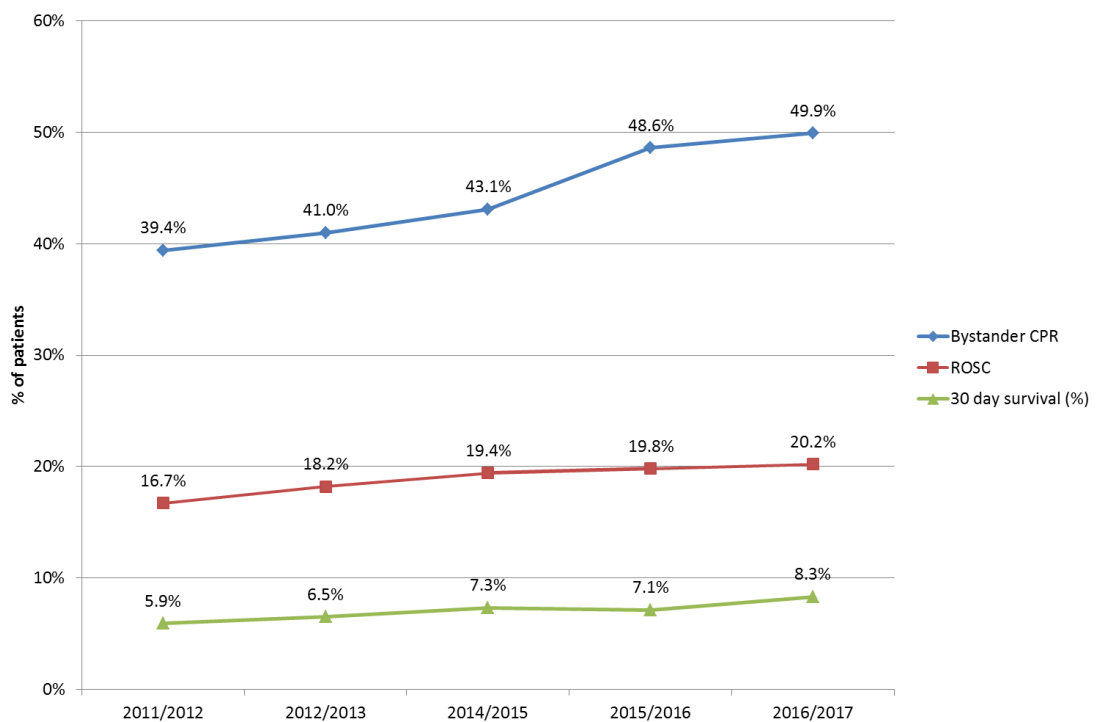


Figure 5 This chart shows the proportion of worked arrests receiving bystander CPR, rate of Return of Spontaneous Circulation (ROSC = pulse on arrival in hospital) and survival at 30 days after OHCA. Data for 2013/14 is not shown.

Figure 6 is another visualisation of the same 30 day survival data. The chart shows a comparison of the calculated 30 day survival after OHCA including all worked arrests and assuming that all unlinked incidents are deaths, compared to the survival rate recalculated after excluding unlinked worked arrests from the dataset. Including all worked arrests in the denominator gives a lower overall survival rate as expected (more deaths), but the two lines remain roughly parallel over time. The gradual narrowing of the gap between them represents the improvement in data linkage, reducing the numerical difference between the denominators in the two datasets. The actual 30-day survival percentage will lie between the two figures, but is probably closer to that reported based on all worked arrests (shown in the lighter line on the following chart).

Figure 6: 30 day survival after OHCA, linked versus all worked arrests as denominator

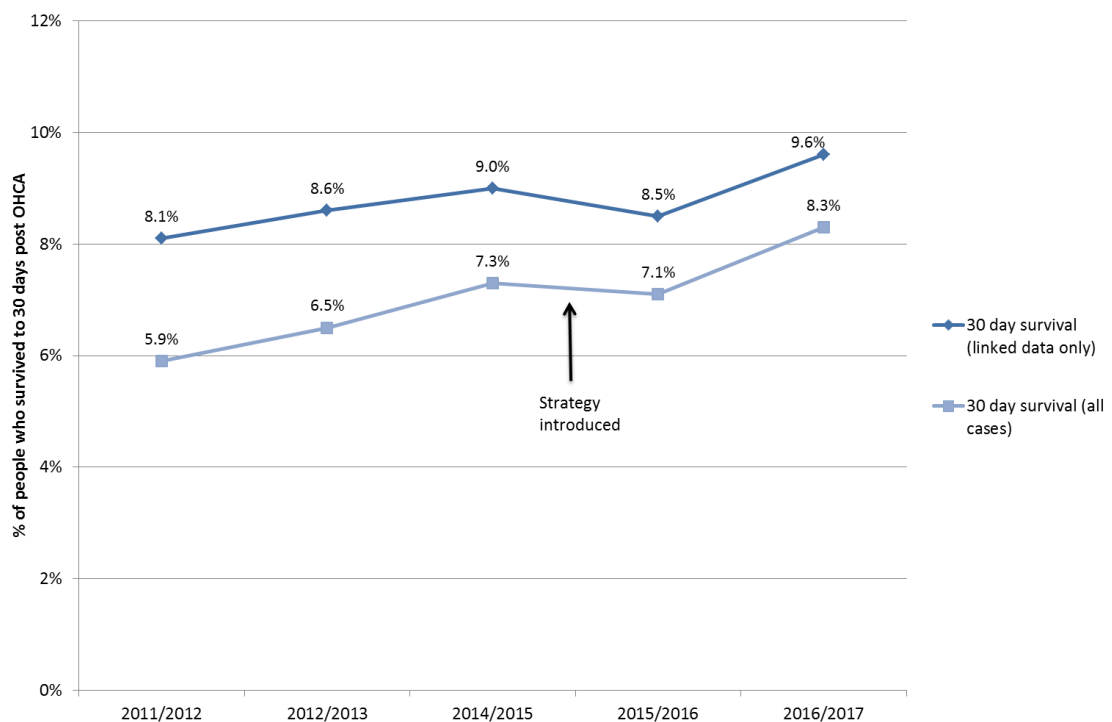


Figure 6 Shows 30 day survival after OHCA illustrating the impact of assuming that all unlinked worked arrests resulted in death (30 day survival (%) all), or disregarding all unlinked worked arrests (30 day survival (%) linked). Data for 2013/14 is not included.

6. Concluding remarks

This work updates our previous report on the initial results of the Scottish OHCA data linkage project. This analysis monitors progress against the OHCA Strategy. Further updates from the data linkage project will be published during the course of the strategy.

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ⁱ Scottish Government (2015). Out-of-Hospital Cardiac Arrest: A Strategy for Scotland [Online] Available at: <http://www.gov.scot/Publications/2015/03/7484> [Accessed at: 02/03/2018]

ⁱⁱ Scottish Government (2017). Initial Results of the Scottish Out-of-Hospital Cardiac Arrest Data Linkage Project [Online] Available at: <http://www.gov.scot/Publications/2017/08/8389> [Accessed at: 02/03/2018]

ⁱⁱⁱ Steven C. Brooks, Robert H. Schmicker, Sheldon Cheskes, Jim Christenson, Alan Craig, Mohamud Daya, Peter J Kudenchuk, Graham Nichol, Dana Zive, Laurie J. Morrison, Variability in the initiation of resuscitation attempts by emergency medical services personnel during out-of-hospital cardiac arrest, Resuscitation, Volume 117, 2017, Pages 102-108

^{iv} Scottish Government (2017). Initial Results of the Scottish Out-of-Hospital Cardiac Arrest Data Linkage Project [Online] Available at: <http://www.gov.scot/Publications/2017/08/8389> [Accessed at: 02/03/2018]

^v Scottish Government (2016) Out-of-Hospital Cardiac Arrest - A Strategy for Scotland Review 2015 – 16 [Online] Available at: <http://www.gov.scot/Publications/2016/11/7733> [Accessed at: 02/03/2018]



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