London Ambulance Service
NHS Trust

Cardiac Arrest Annual Report

April 2023 – March 2024

October 2024

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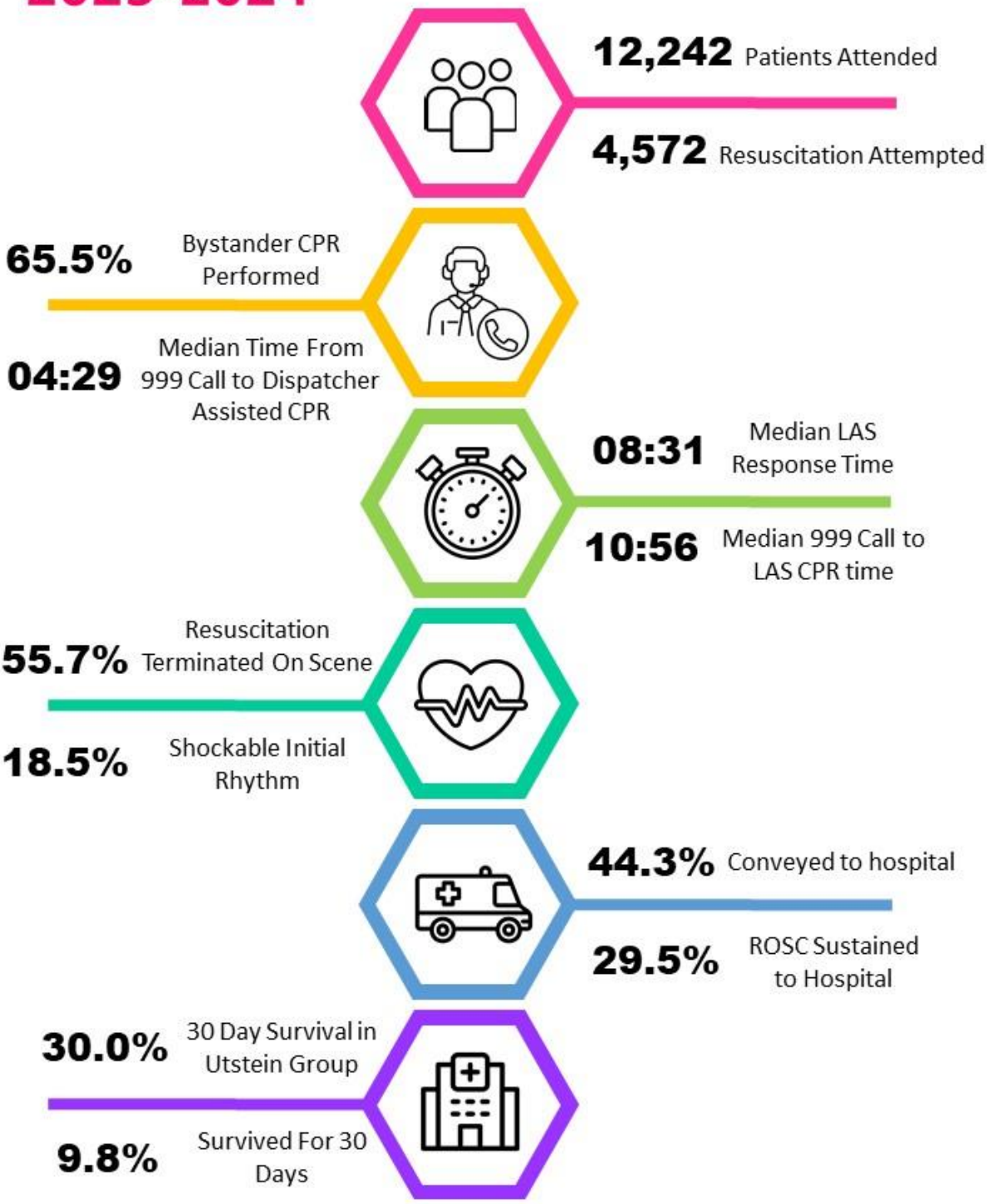
Cardiac Arrest Summary 2023-2024



1. Introduction

From April 1st 2023 to March 31st 2024 the London Ambulance Service NHS Trust (LAS) attended 12,242 patients in cardiac arrest across Greater London. Resuscitation was attempted by LAS clinicians for **4,572 patients** (37.3%). A further 40 patients (0.3%) were successfully resuscitated using public access defibrillators or other non-LAS defibrillators so did not require further resuscitative efforts from the LAS.

Resuscitation was not attempted for 7,630 patients (62.3%): 4,773 (39.0%) were found to have died on arrival of LAS clinicians; 2,460 (20.1%) had a valid Do Not Attempt Cardio-Pulmonary Resuscitation Order (DNAR) or equivalent in place, and 397 patients (3.2%) showed other signs indicating resuscitation attempts would be futile.

Data for this report were obtained from the LAS Clinical Audit and Research Unit's (CARU) Cardiac Arrest Registry which holds clinical and operational information sourced from patient clinical records, Emergency Operations Centre (EOC) Call Logs, the GoodSAM application and the national Patient Demographics Service. Data were collected, and are reported, in line with the Utstein recommendations[1] and were correct at the time of publication.

[1] https://www.resuscitationjournal.com/article/S0300-9572(24)00182-5/fulltext

2. Pre-Arrival Interventions

In this section we provide information on the bystander interventions delivered **before LAS arrived on-scene** to all **12,242 patients** (regardless of whether resuscitation was continued or not by LAS).

2.1. Dispatcher-Assisted CPR

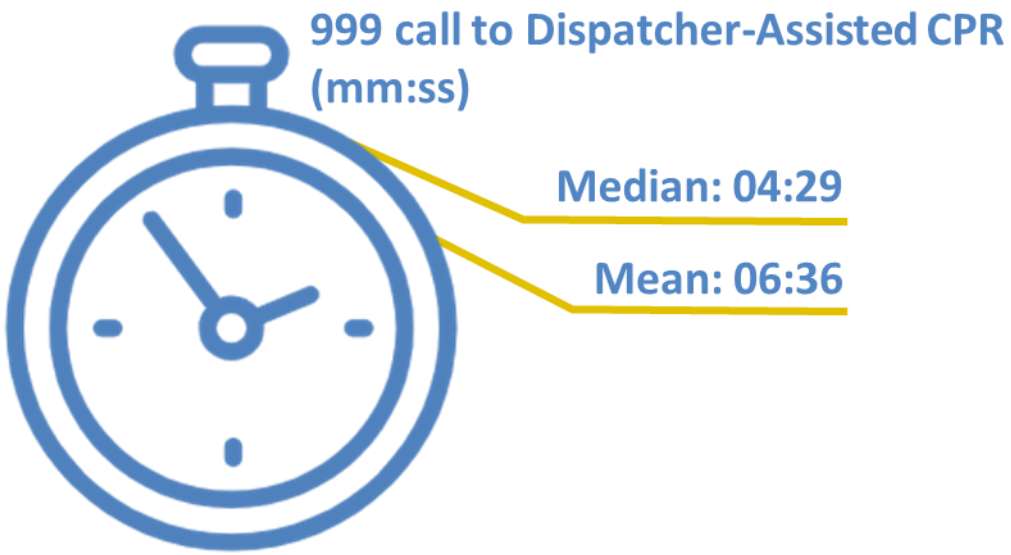


Figure 1: Average time to Dispatcher-Assisted CPR for all patients who received dispatcher-assisted CPR (n=4,431)

- Dispatcher-assisted CPR instructions were given to **36.2%** of patients (n=4,431) which is similar to previous years (34.3% in 2022/23 and 35.8% in 2021/22). It is important to note that some callers may decline CPR instructions, and in certain situations, for example, where the call involves an obvious or expected death, CPR instructions may not be deemed appropriate.

- The median time from the 999 call being connected to the ambulance service to the delivery of dispatcher CPR instructions was **04:29,** which was slightly shorter compared to the previous year (04:41), but almost half a minute longer than in 2021/22 (04:00).

2.2. GoodSam[2] Responders

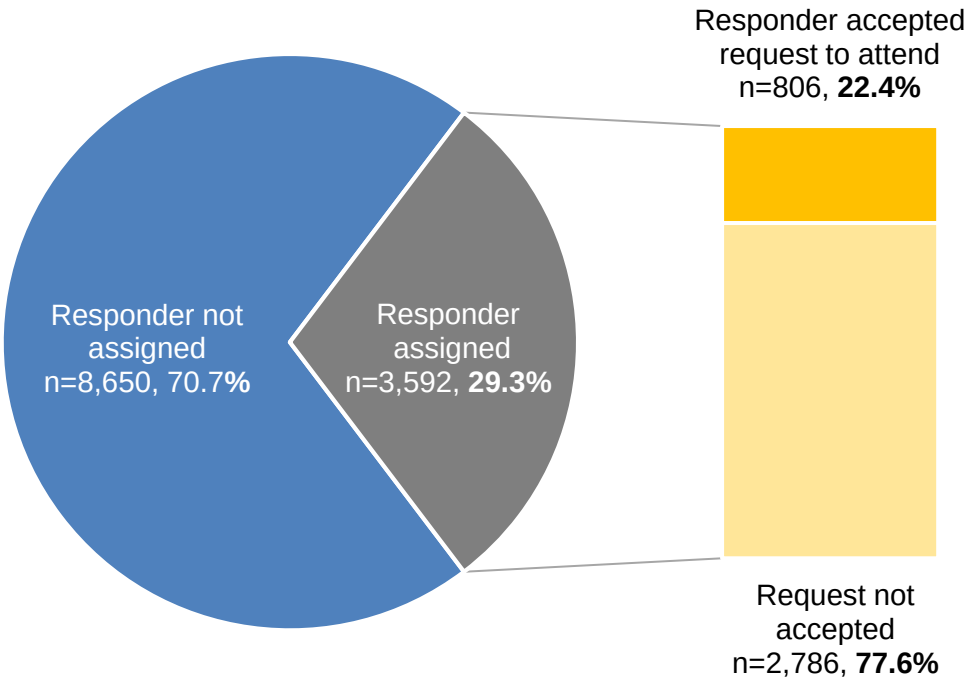


Figure 2: GoodSam responder assignments and acceptance

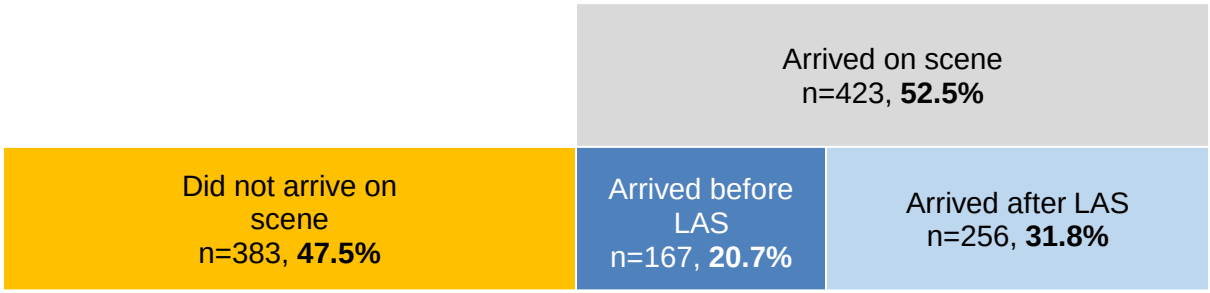


Figure 3: Outcome of GoodSam alerts accepted by a responder*

**Based on the responder 'arrival at scene time' recorded via the GoodSam app*

[2] GoodSam (https://www.goodsamapp.org/) is a mobile phone application that automatically alerts trained volunteer responders of cardiac arrest incidents in their area

- This year GoodSam volunteer responders were alerted to **29.3%** (n=3,592) of cardiac arrest incidents in London. This proportion has continued to increase from 23.7% in 2021/22 and 28.4% in 2022/23.

- Volunteers accepted **22.4%** (n=806) of these alerts, which is also in line with the continuous upward trend (from 16.7% in 2021/22 and 21.1% in 2022/23). However, just under half of responders (n=383, **47.5%**), who accepted the alert, **did not arrive on scene** (2.4% less than last year and 10.7% less compared to 2021/22).

- Where the responders arrived on scene, **20.7%** (n=167) arrived before the first LAS resource (down from 23.7% in 2022/23, but up from 13.5% in 2021/22).

- Resuscitation was continued by our clinicians for 74 patients who had a GoodSam responder arriving before LAS. Of these patients, **28.4%** (n=21) achieved a ROSC that was sustained until hospital arrival, and **9.5%** (n=7) were alive 30 days following the arrest.

2.3. Pre-LAS Defibrillation

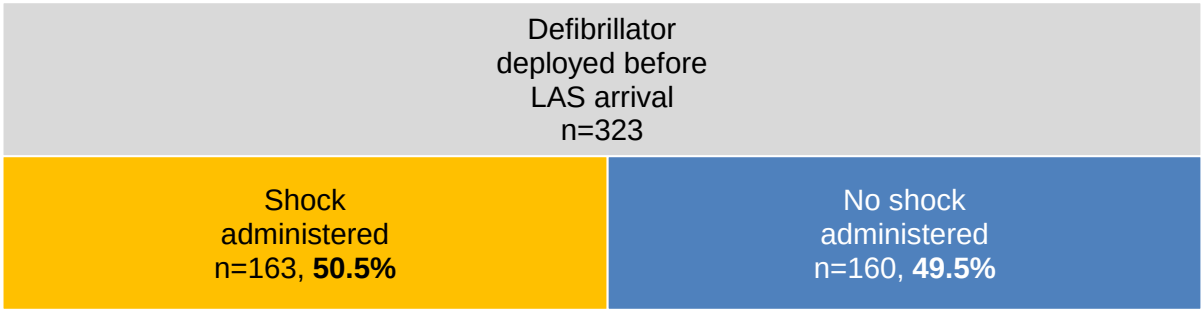


Figure 4: Pre-LAS defibrillator deployment and shock delivery

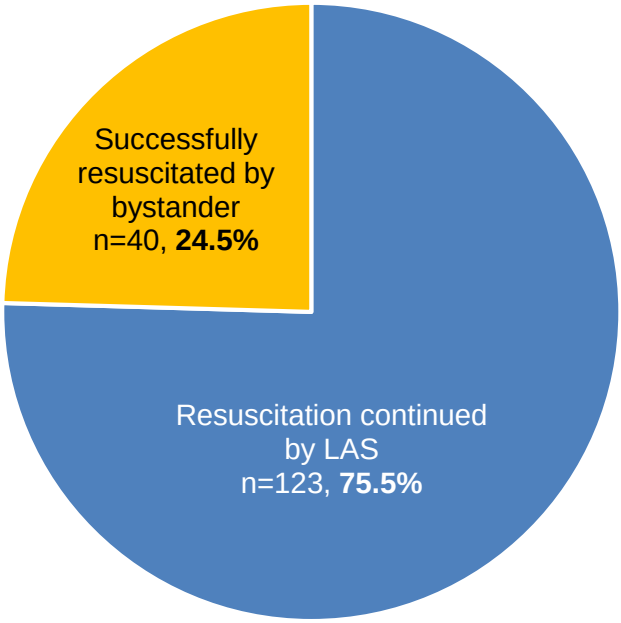


Figure 5: Patients who received a pre-LAS defibrillator shock and were successfully resuscitated before LAS arrival

- **323** patients had a defibrillator applied before LAS arrival, a small decrease compared to 353 in 2022/23 but consistent with 326 pre-LAS defibrillator applications in 2021/22.
- Half of these patients (n=163, **50.5%**) were given at least one defibrillator shock before LAS clinicians arrived on-scene.
- Of the patients who received a pre-LAS defibrillator shock, **40** (24.5%) achieved and maintained ROSC before the LAS clinicians arrived on-scene and therefore further resuscitative efforts were not required. Due to this, these patients have been excluded from the rest of this report.
- Outcomes associated with pre-LAS defibrillation are reported in Appendix 1.

3. LAS Resuscitation

This section contains information about patient demographics and details the care provided to the **4,572** patients in London for whom LAS clinicians attempted resuscitation.

3.1 Profile of Arrests

Gender, n (%)	
Male	3,046 (66.6)
Female	1,513 (33.1)
Unknown	13 (0.3)

Age, mean (median) in years †	
Overall	64 (66)
Male	62 (64)
Female	68 (72)

Location, n (%)	
Private location	3,427 (75.0)
Private address	*3,294 (96.1)*
Care home	*133 (3.9)*
Public Location	1,145 (25.0)

Race, n (%)	
White	1,827 (40.0)
Asian	308 (6.7)
Black	282 (6.2)
Other	97 (2.1)
Mixed	19 (0.4)
Unknown	2,039 (44.6)

Chief complaints at the 999 call, n (%)	
Cardiac arrest	2,611 (57.1)
Unconscious/fainting	427 (9.3)
Breathing problems	357 (7.8)
Falls	196 (4.3)
NHS 111 Transfer	92 (2.0)
Other ‡	889 (19.4)

Table 1: Profile of cardiac arrests where resuscitation was attempted

† Excludes cases with unknown age (n=10), ‡ includes Health Care Professional admissions (n=12)

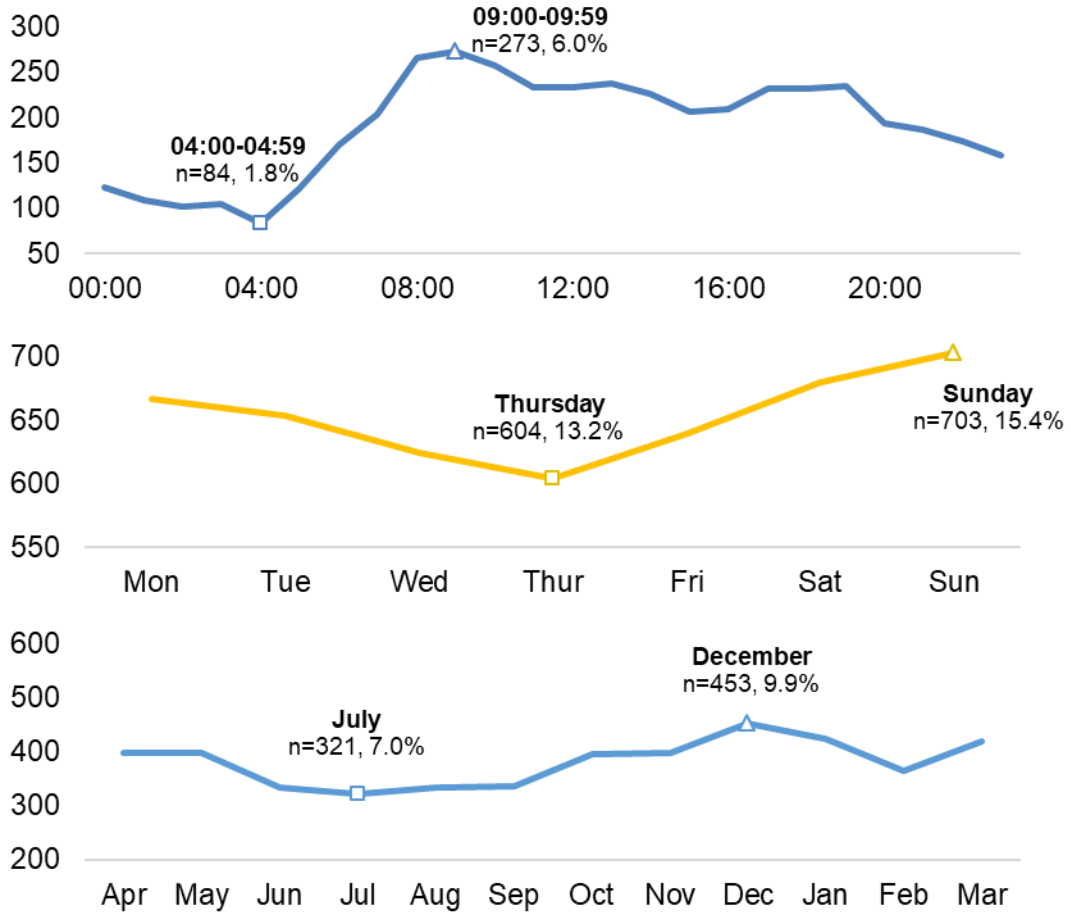


Figure 6: Peak occurrence of cardiac arrests where resuscitation was attempted

The highest and lowest number of incidents in each series are indicated on the chart

- The demographics of patients treated for cardiac arrest in London remains consistent with previous years.
- **57.1%** (n=2,611) of cardiac arrests were identified at the point of the 999 call.
- The number of cardiac arrests attended was the highest in the morning between the hours of **09:00-09:59** which is similar to previously reported findings.
- Most cardiac arrests occurred on a **Sunday** (n=703, 15.4%). As in the previous two years, **December** was the month with the highest number of cardiac arrests (n=453, 9.9%).

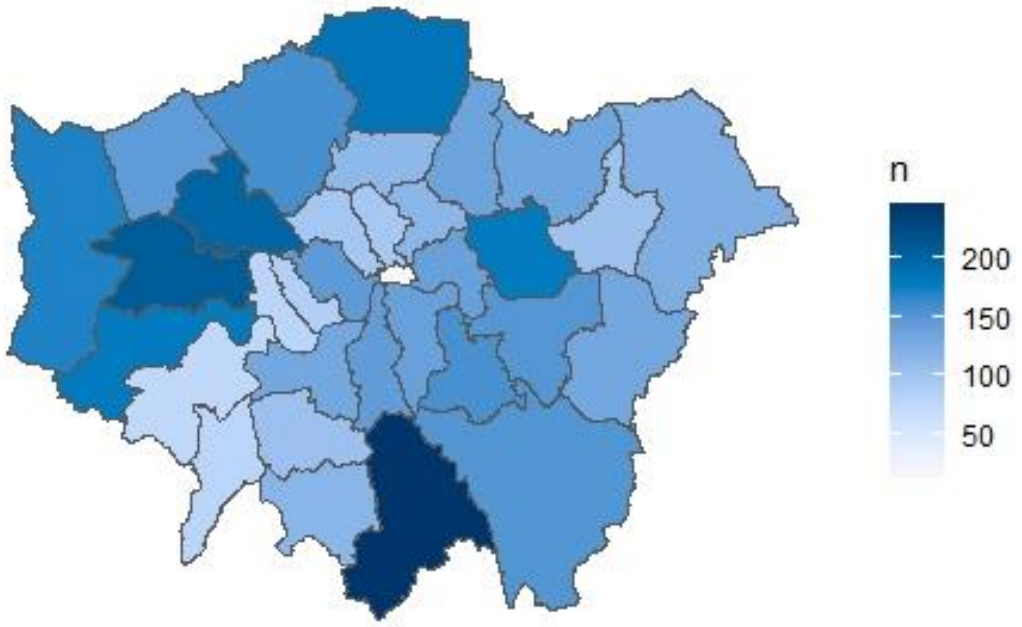


Figure 7: Count of cardiac arrest incidents by Local Authority District*

** Excludes arrests where location information was not available (n=126)*

- There was a considerable geographical variation in the number of cardiac arrests attended across London. The highest number of cardiac arrests occurred in the **London Borough of Croydon** (n=246, 5.5%).

3.2 Call Answering Times

Figure 8 illustrates the call answering times for patients who were later confirmed as being in cardiac arrest and received resuscitation attempts by LAS clinicians. For context, the total number of emergency calls received by our 999 contact centres is also displayed, alongside the last year's figures.

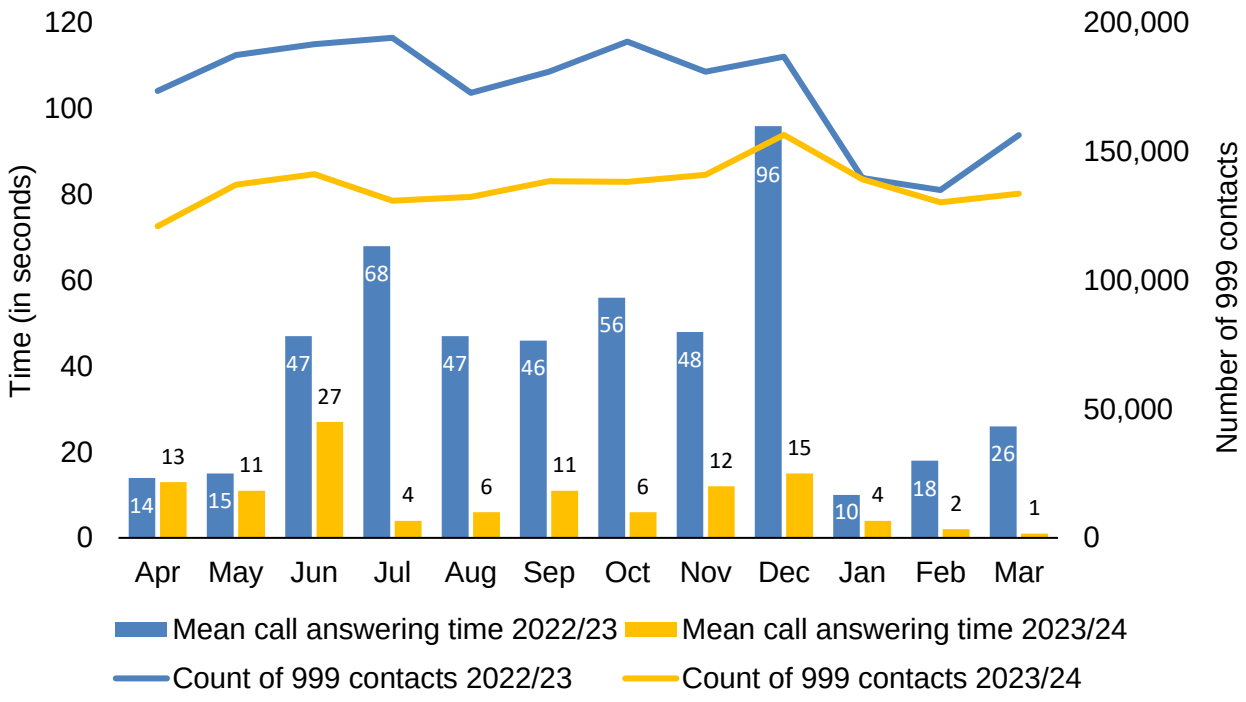


Figure 8: Mean call answering times (seconds) per month for cardiac arrest patients.

n=4,305 (excluding calls transferred directly from another service and those with missing time data)

- This year we answered our 999 calls more quickly with a mean answering time of **9** seconds - a **78.6%** decrease from last year (42 seconds in 2022/23).
- In 2023/24, the longest call answering times were in **June** (27 seconds), falling sharply in **July** (4 seconds).

3.3 Response Times

The following section provides the internationally defined **clinical response interval** (https://www.resuscitationjournal.com/article/S0300-9572(24)00182-5/fulltext). These times ('999 call' to 'arrival at scene') will be different to those reported by the NHS England Ambulance Quality Indicators (AQIs) as they report a different interval.[3]

Clinical response intervals are presented in Table 2 alongside the corresponding figures from previous two years for comparison.

Year	n	Mean	Median
2021-22	4,366	14:22	09:00
2022-23	4,610	16:06	09:36
2023-24	**4,572**	**12:52**	**08:31**

Table 2: '999 call' to 'arrival at scene' clinical response intervals (mm:ss)

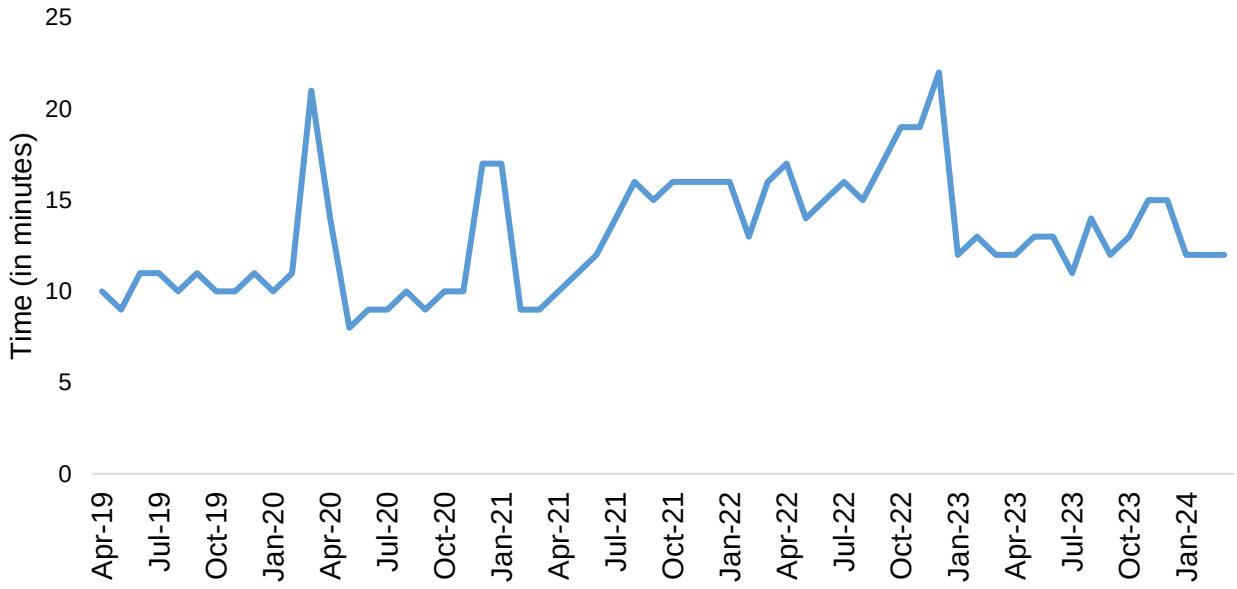


Figure 9: Historical monthly mean response intervals (mins)

[3] NHS England AQI response intervals are measured using Clock Start to Clock Stop as per the national AmbSYS specification which can be found at: https://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators/.

- In 2023/24 there was a **large reduction** in the mean call to scene time, down from 16:06 in 2022/23 to **12:52** this year. The current response times remain higher compared to those reported prior to the pandemic in 2019/20.

- Average response times varied on a monthly basis. The longest average time was observed in **December** 2023 (14:49) and the shortest in **July** 2023 (11:24).

3.4 Key Clinical Intervention Intervals

Year	Interval	n	Mean	Median
2022-23	999 call^ – LAS CPR*	2,615	17:13	11:55
	999 call^ – LAS defibrillation*~	596	15:34	12:04
2023-24	**999 call^ – LAS CPR***	**2,560**	**14:14**	**10:56**
	999 call^ – LAS defibrillation*~	**590**	**12:56**	**10:55**

^ *Time the 999 call was connected to the ambulance service*

* *Excludes LAS witnessed arrests and incidents where times were not documented*

~ *Based on an initial rhythm of ventricular fibrillation (VF)/ventricular tachycardia (VT)*

Table 3: Key time intervals from 999 call (mm:ss)

- **Substantial decreases** were seen in both the mean time from 999 call to LAS CPR (down from 17:13 in 2022/23 to **14:14** this year) and the mean time from 999 call to LAS defibrillation (down from 15:34 in 2022/23 to **12:56** this year). This was largely due to faster response times this year.

3.5 Bystander Interventions¥

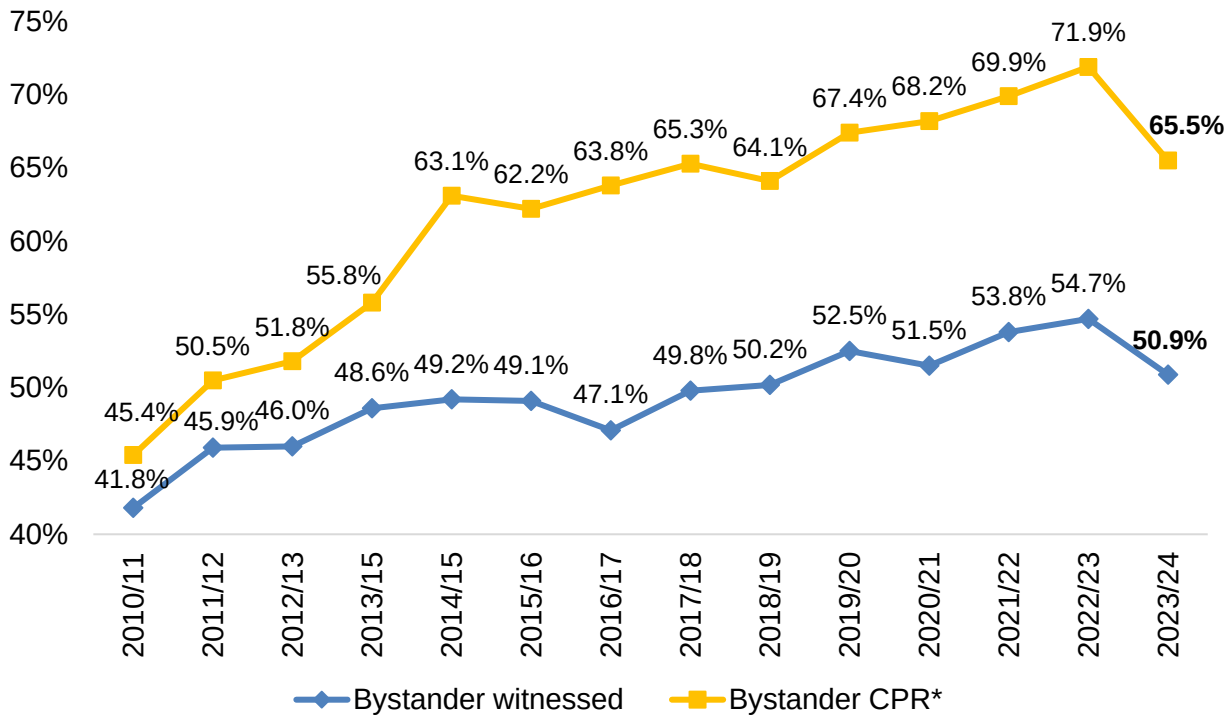


Figure 10: Bystander witnessed arrests and bystander CPR by year

¥ Bystander is defined as any person who is not part of the organised emergency medical response

** Excludes LAS witnessed arrests*

- Fewer patients (n=2,325) had their cardiac arrest witnessed this year than in previous years (**50.9%,** compared to 54.7% in 2022/23 and 53.8% in 2021/22).
- **65.5%** of patients (n=2,565) were reported as having bystander CPR provided before LAS clinicians arrived on-scene. This is a **6.4% decrease** from last year and the **lowest rate reported in the last five years**.
- Outcomes associated with Bystander-CPR are reported in Appendix 2.

3.6 Clinical Presentation

3.6.1 Aetiology

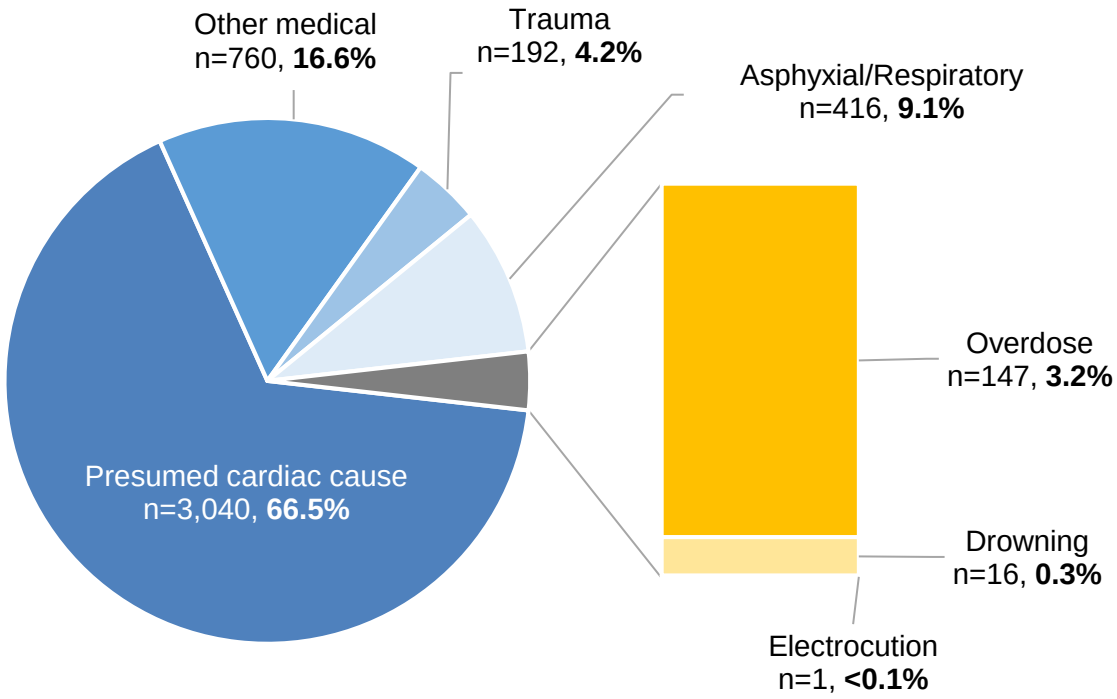


Figure 11: Breakdown of aetiology of cardiac arrests

- In most cases the aetiology was presumed cardiac which includes cases with no obvious cause (n=3,040, **66.5%**). This has continued to decline since 2020/21 (75.5%).

3.6.2 Initial arrest rhythm

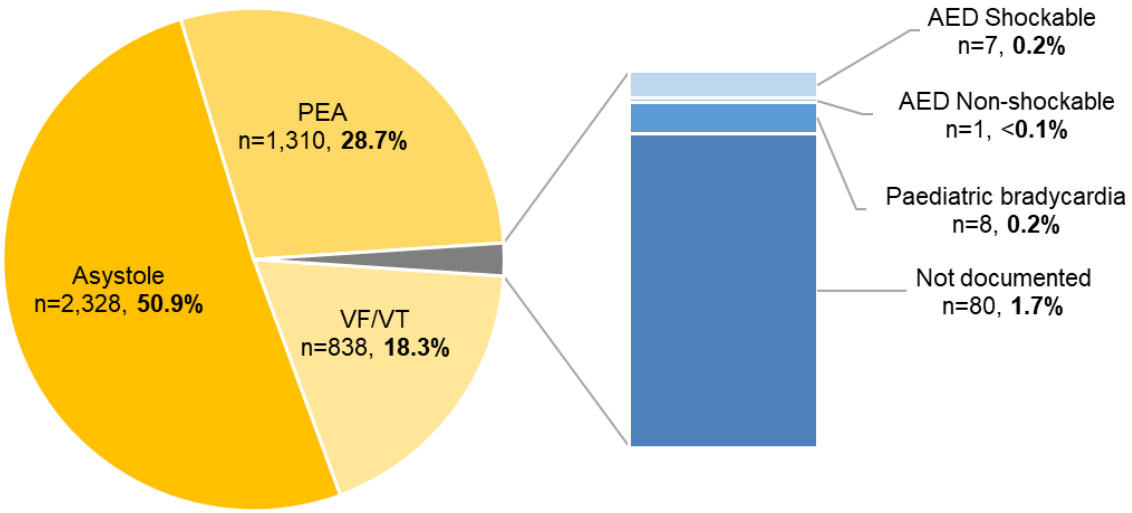


Figure 12: Breakdown of initial recorded cardiac arrest rhythm

- Half of all patients (n=2,328) presented in asystole. Whilst this was a small **decrease** when compared to last year (**50.9%** vs 52.0%), it remains slightly above the figures reported over the three years previously.

- A slight increase was seen in the proportion of patients presenting in a shockable rhythm (n=845, **18.5%**) compared to last year (17.7%); however this figure has consistently fluctuated across the previous years.

3.7 Conveyance

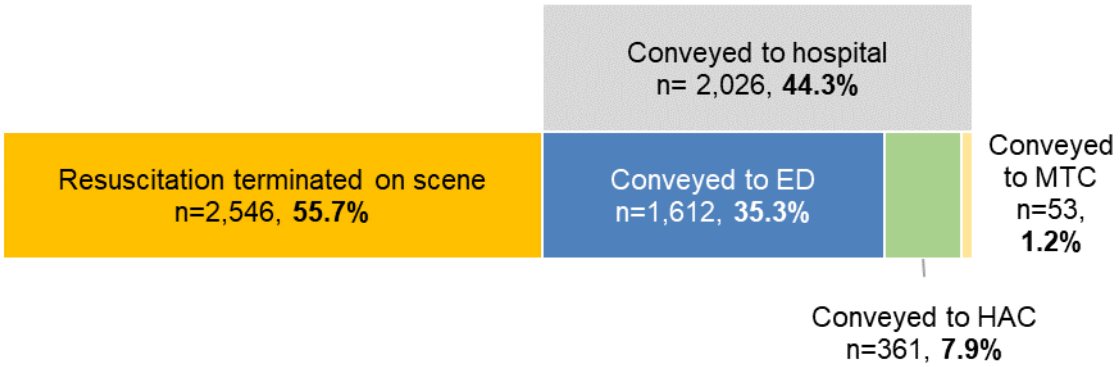


Figure 13: Breakdown of conveyance by destination

Percentages do not equal 100% due to rounding

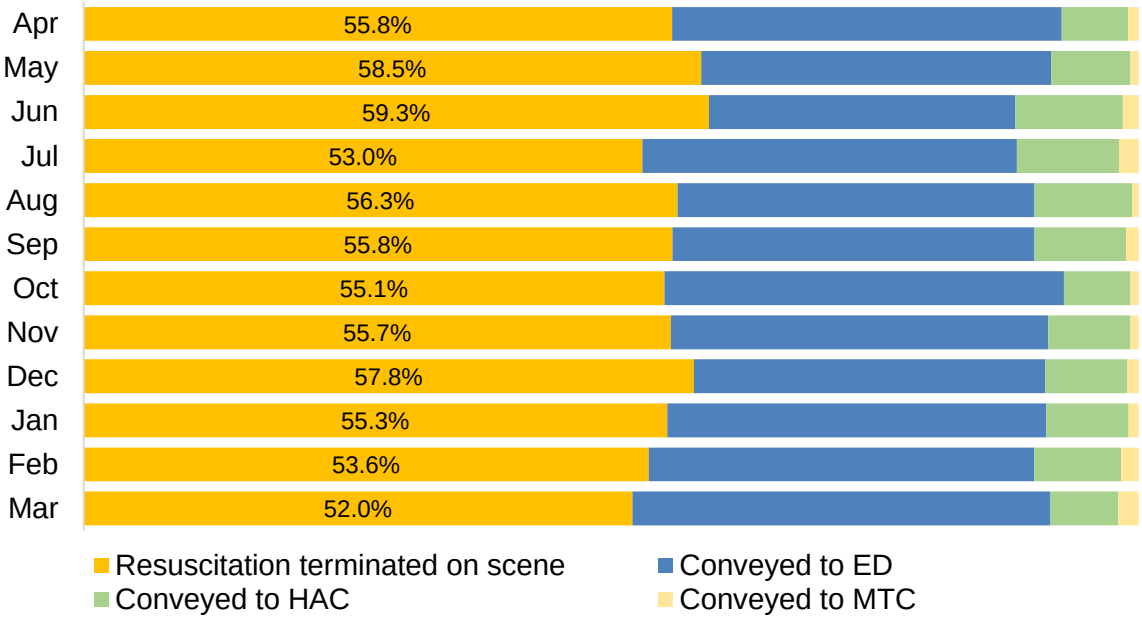


Figure 14: Breakdown of conveyance destination by month

- The percentage of patients transported to hospital has continued to **increase** – from 41.0% in 2021/22 to 42.7% in 2022/23 and **44.3%** (n=2,026) this year.
- The number of patients with a resuscitation attempt stopped on-scene varied from month to month, ranging from 52.0% (n=233) in March 2024 to 59.3% (n=198) in June 2023.
- The proportion of patients conveyed to specialist facilities remains consistent with last year's figures: 7.9% (n=361) to a Heart Attack Centre (HAC) and 1.2% (n=53) to a Major Trauma Centre (MTC).

4. Patient Outcomes

This section provides outcome information for two groups of patients according to international reporting guidelines:

1. **Overall group**: all patients for whom resuscitation was attempted by the LAS.

2. **Utstein comparator group**: a sub-group of patients for whom resuscitation was attempted following a cardiac arrest of a presumed cardiac cause, which was bystander witnessed, and presented in a shockable rhythm[4].

4.1 Return of spontaneous circulation (ROSC)

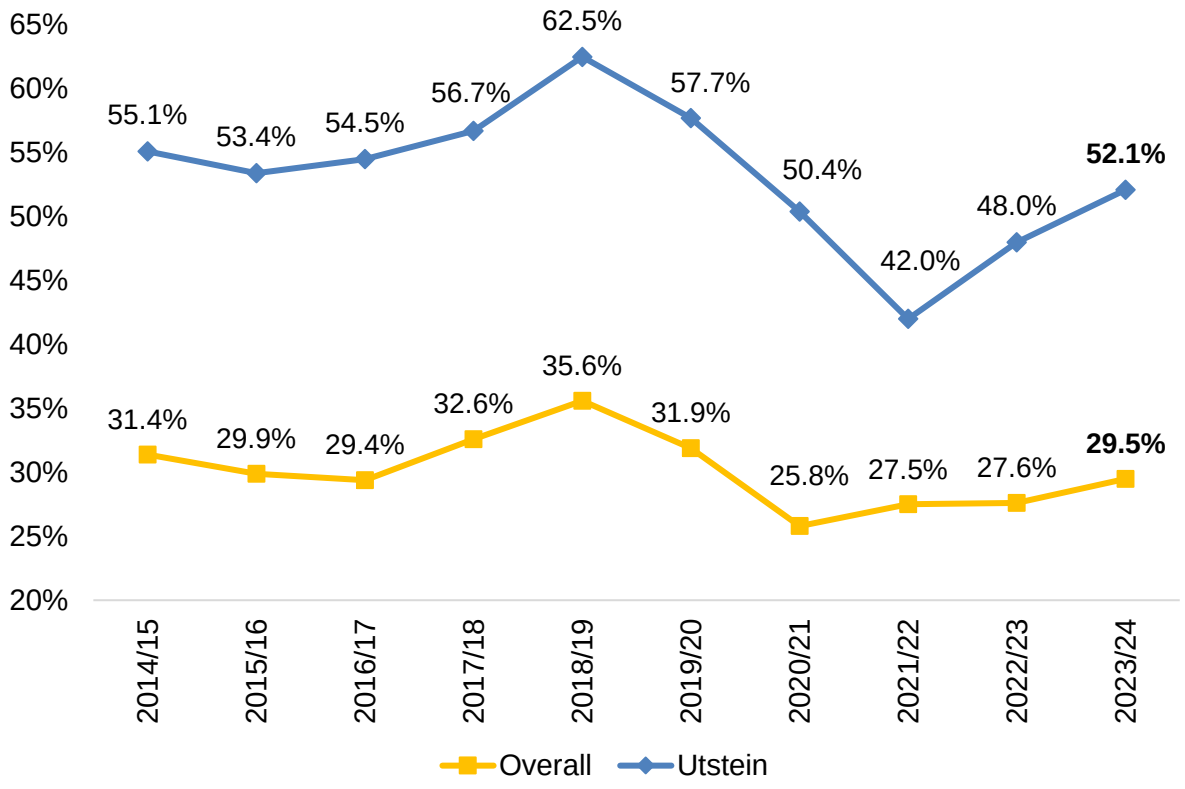


Figure 15: ROSC sustained to hospital per year

[4] https://www.resuscitationjournal.com/article/S0300-9572(24)00182-5/fulltext

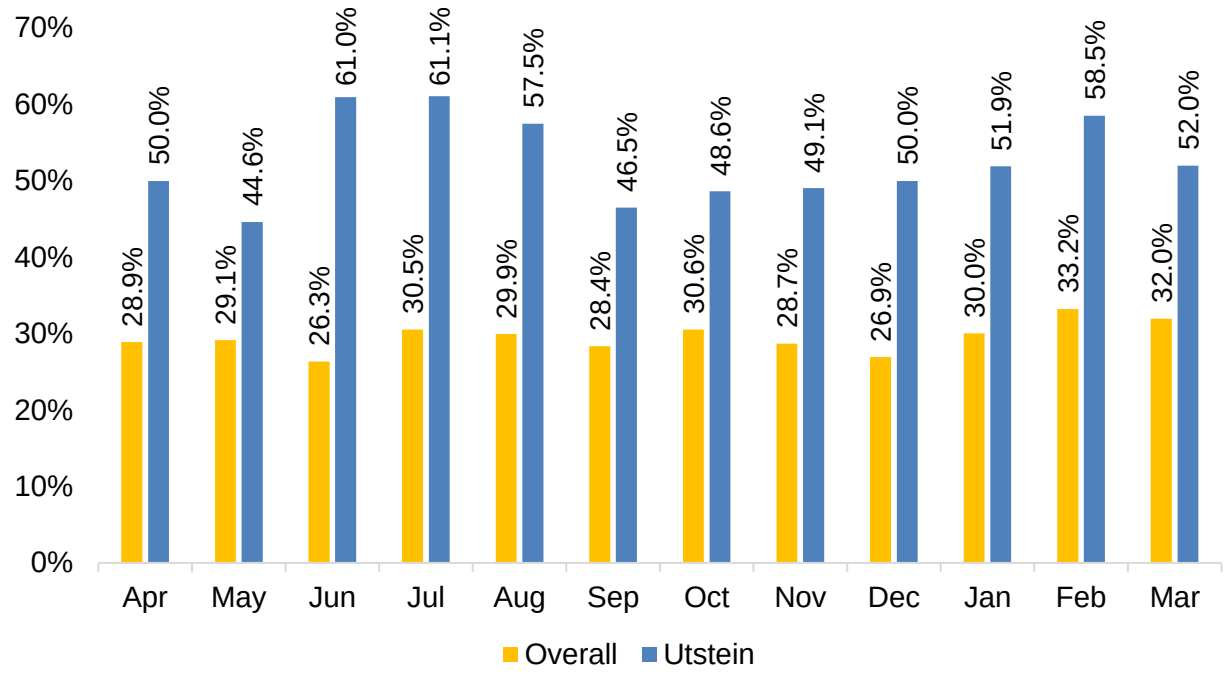


Figure 16: Monthly ROSC sustained to hospital

- There has been an **increase** in the overall proportion of patients for whom ROSC was achieved and sustained until arrival at hospital (**29.5%** in 2023/24 vs 27.6% in 2022/23).
- In the Utstein comparator group, the proportion of patients with ROSC sustained to hospital arrival continued to **increase**, from 42.0% in 2021/22 and 48.0% in 2022/23, to **52.1%** in 2023/24.
- The proportion of patients with ROSC sustained to hospital arrival varied throughout the year, with the highest rate in the overall group observed in February 2024 (n=121, 33.2%) and in Utstein comparator groups in July 2023 (n=22, 61.1%).

4.2 Survival

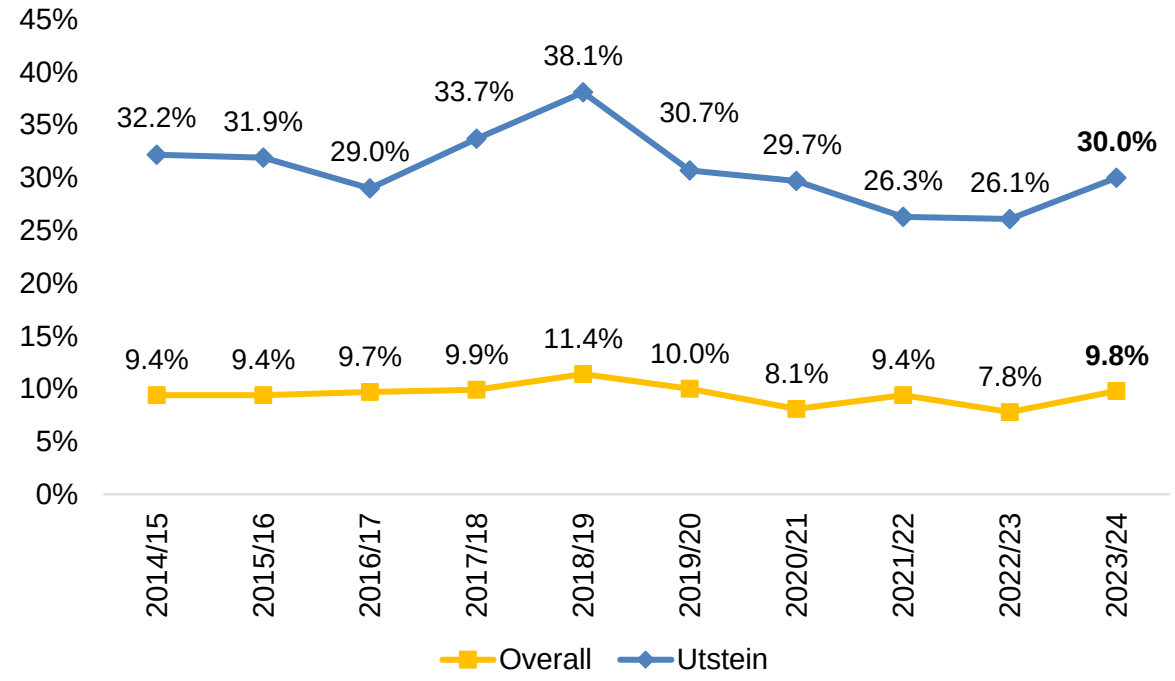


Figure 17: Yearly breakdown of survival to 30 days

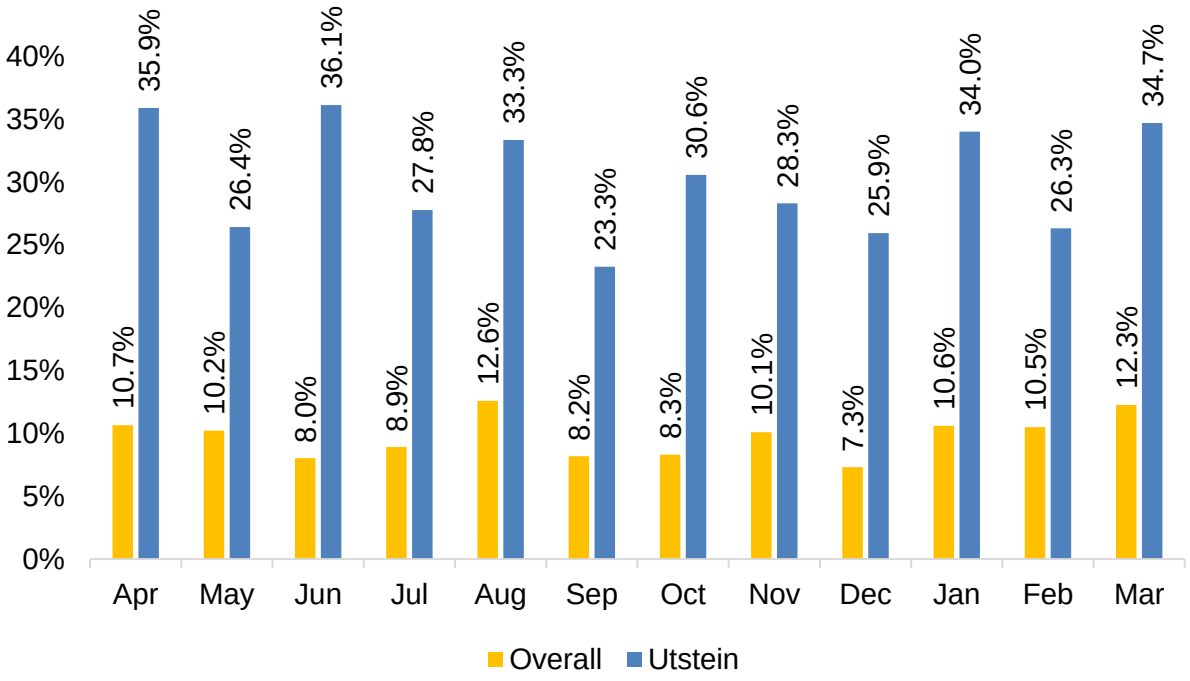


Figure 18: Breakdown of survival to 30 days by each month of 2023-24

- After a notable drop last year (in overall survival), there was a **2.0% increase** in the proportion of patients who were still **alive 30 days** after their cardiac arrest (**9.8%** in 2023/24 vs 7.8% in 2022/23).
- The proportion of survivors in the Utstein comparator group also **increased** by **3.9%** compared to the previous year.
- The highest survival rate in the Utstein comparator group was seen in **June** 2023 (36.1%), with the lowest observed in **September** 2023 (23.3%).

Group	30 Day Survival	
	LAS	National Average
Overall group	9.8%	9.3%
Utstein comparator group	30.0%	29.0%

Table 4: LAS survival compared with the national average for England

- The LAS survival figures remain **above the national average** this year.

5. Conclusions

This year we have seen an increase in survival from out-of-hospital cardiac arrest, with the figures being more similar to pre-pandemic levels. Our data suggests this is largely as due to an improved response provided by LAS in a number of key areas.

Over the last year we have seen a dramatic reduction in call answering times (from 42 seconds down to 9 seconds), faster delivery of dispatcher-assisted CPR instructions (a 12 second decrease), a reduction of over three minutes in the time taken to arrive on-scene, and the faster provision of CPR and defibrillation by our clinicians.

Our more timely delivery of care is likely to have contributed to our findings that this year a higher number of patients presented with a shockable rhythm, achieved a ROSC that was sustained to hospital, and survived to 30 days post-cardiac arrest.

The impact of our faster responses becomes even more apparent in the context of bystander CPR rates being at their lowest in 5 years and fewer patients receiving defibrillation prior to LAS arrival. The LAS's Community First Responder team have recently undertaken a number of initiatives to increase the public's confidence and skills in undertaking bystander CPR; we expect to see the impact of this in future annual reports.

Although the GoodSam network has continued to grow, with nearly a third of cardiac arrests now generating alerts, in almost half of all instances where a GoodSam alert was accepted by a responder, the responder did not ultimately arrive at the scene. It is recommended that the LAS focuses improvement work in this area to attempt to identify why such a large proportion of accepted alerts are not translating into a GoodSam responder providing assistance to patients as well as increasing the percentage of Good Sam alerts to cardiac arrests.

The LAS remains committed to improving the care we provide to patients in out-of-hospital cardiac arrest. As part of this, we have continued our strong programme of research, successfully recruiting 1,463 patients into cardiac arrest clinical trials during 2023/24. These trials include PARAMEDIC-3 (which aims to determine the most effective route for adrenaline administration in a pre-hospital setting and is expected to contribute to the national resuscitation guidelines), and RAPID-

MIRACLE which is evaluating the potential application of the MIRACLE$_2$ neuro-prognostication tool for patients in ROSC.

In addition, we have continued to provide data to the Out-of-Hospital Cardiac Arrest Outcomes (OHCAO) project to support national research programmes. We also continue to provide data to the Ambulance Quality Indicators (AQI) programme for national benchmarking.

In recognition of the hard work undertaken by our clinicians, call handlers and dispatchers, CARU sent out 3,154 letters to staff involved in the care of cardiac arrest patient who survived, thanking them for their part they played in the patient's survival. The number of recipients of these letters has almost doubled since last year.

Data from the Cardiac Arrest Registry also fed into an LAS project which streamlined the number of determinants eligible for public access defibrillation dispatch and aims to reduce the likelihood of inappropriate deployment and improve defibrillator availability across the capital.

Finally, CARU have been working on a new interactive cardiac arrest monthly report which will enable clinicians and their managers to access information relating to the care provided to the cardiac arrest patients they personally attend. We expect this to prompt further improvements to patient care by highlighting any areas for improvement as well as recognising good practice and facilitating clinical feedback.

Appendix 1: Outcomes for patients who had Pre-LAS Defibrillation

A pre-LAS defibrillator was deployed to 323 patients before arrival of LAS resources (section 2.3). Of these, 40 were successfully resuscitated before LAS clinicians arrived on-scene and further resuscitative efforts were not required. The remaining 283 patients (87.6%) had resuscitation continued by LAS clinicians and their outcomes are reported here.

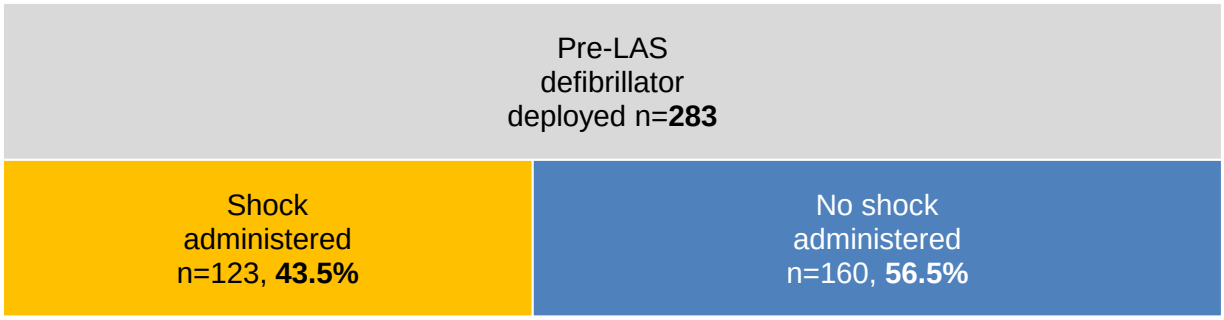


Figure 19: Pre-LAS defibrillator use where resuscitation was attempted by LAS

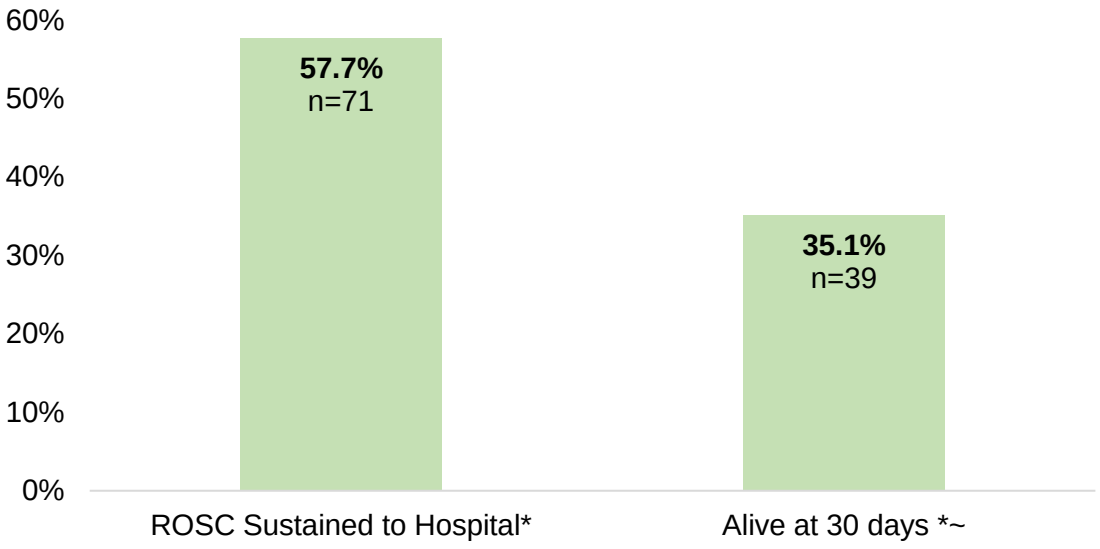


Figure 20: Outcomes for patients who received a pre-LAS defibrillator shock and had resuscitation continued by LAS

** Excludes cases where no shock was delivered*

~ Excludes 12 patients where outcome data were unavailable

- Following three years of growing pre-LAS defibrillator deployment, this has now dropped to 323 (from 353 in 2022/23 and 326 in 2021/22).

- Where LAS clinicians continued resuscitation, **43.5%** (n=123) of patients had a shock delivered before LAS arrival on-scene. This continues to decline since 2021/2022 when 47.9% of patients received pre-LAS defibrillation

- The proportion of patients, who received a pre-LAS defibrillation and survived their cardiac arrest to at least 30 days, **more than doubled** from 16.7% in 2022/23 to **35.1%** (n=39) this year. This is the highest figure reported since the '30 day survival' measure was introduced in 2020/2021.

Appendix 2: Outcomes for patients who had Bystander CPR (and had resuscitation attempted by LAS)

Bystander CPR is reported as per Utstein definitions and includes CPR performed by a person who is not part of the organised emergency medical response.

Where the arrest was not witnessed by LAS clinicians, **65.5%** of patients (n=2,565) were reported as receiving bystander CPR prior to the arrival of LAS.

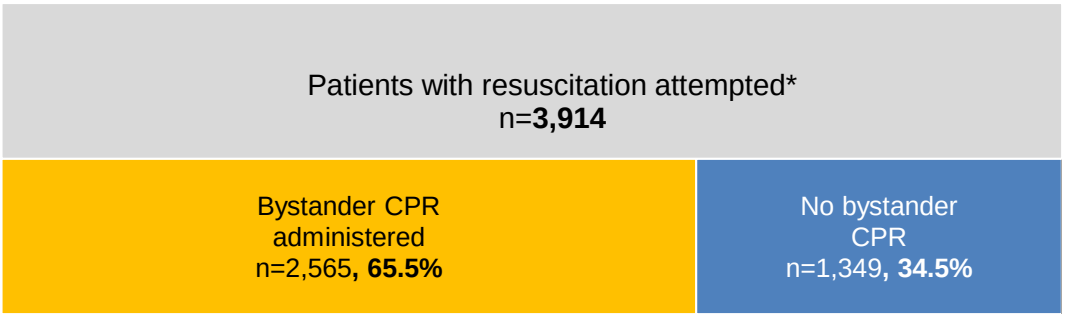


Figure 21: Bystander CPR delivery where resuscitation was attempted by LAS

** Excludes LAS clinician witnessed cardiac arrests*

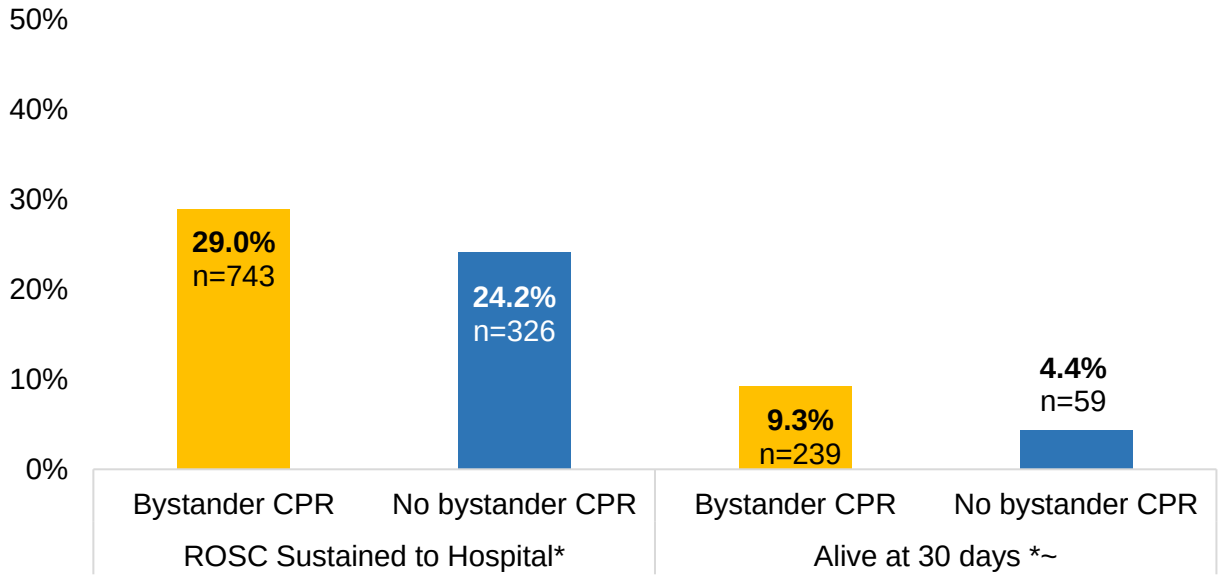


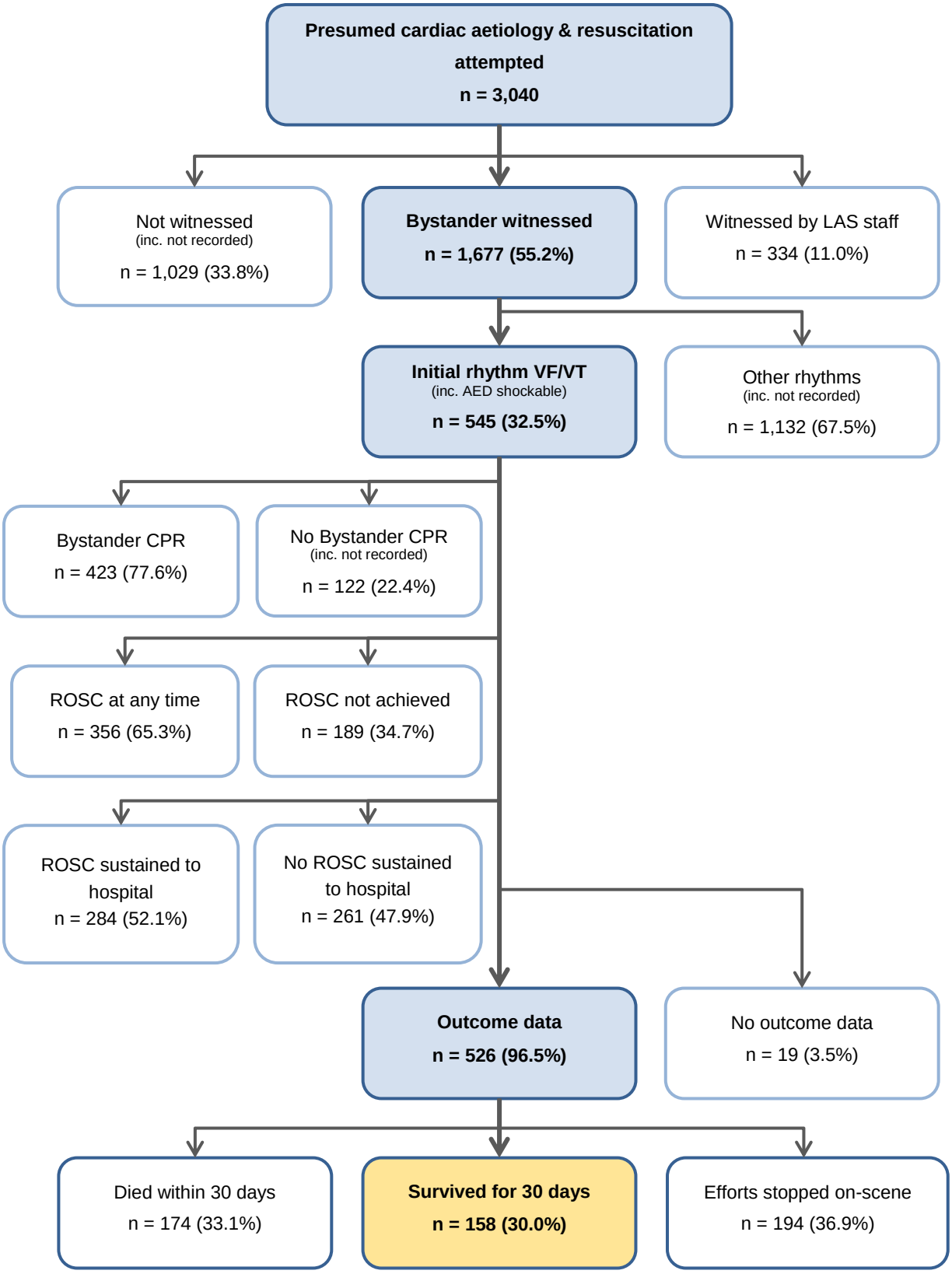
Figure 22: Outcomes for patients who received bystander CPR and had resuscitation continued by LAS

** Excludes LAS clinician witnessed cardiac arrests*
~ Excludes 89 patients where outcome data were unavailable

- **29.0%** of patients who received bystander CPR had ROSC sustained to hospital, compared to 24.2% who were not reported as receiving CPR prior to the arrival of LAS clinicians.

- Where bystander CPR was provided, overall survival to 30 days was **9.3%**, compared to 4.4% among patients without bystander CPR.

Appendix 3: Utstein Survival Template



Appendix 4: Cardiac Arrest Care Over the Last 5 years

		2019/20	2020/21	2021/22	2022/23	2023/24
Patients for whom resuscitation was attempted by LAS clinicians		4,355	4,904	4,366	4,613	4,572
999 Call to Dispatcher Assisted CPR times (mm:ss)	Mean	05:01	04:25	04:43	07:31	06:36
	Median	04:07	03:47	04:00	04:41	04:29
Response times (mm:ss)	Mean	11:32	11:53	14:22	16:06	12:52
	Median	07:50	07:59	09:00	09:36	08:31
999 Call to LAS CPR times (mm:ss)	Mean	17:03	14:17	15:59	17:13	14:14
	Median	10:43	10:54	11:42	11:55	10:56
999 Call to LAS Defibrillation	Mean	26:10	12:56	14:11	15:34	12:56
	Median	16:12	11:09	12:00	12:04	10:55
Bystander Witnessed		52.5%	51.5%	53.8%	54.7%	50.9%
Bystander CPR		67.4%	68.2%	69.9%	71.9%	65.5%
Aetiology	Presumed Cardiac	73.6%	75.5%	70.1%	69.6%	65.5%
Initial Rhythm	Asystole	46.8%	49.3%	48.2%	52.0%	50.9%
	PEA	31.0%	30.6%	29.0%	27.7%	28.7%
	VF/VT	21.4%	17.6%	19.4%	17.7%	18.3%
	Other	0.8%	2.5%	3.4%	2.6%	2.1%

Cont….

		2019/20	2020/21	2021/22	2022/23	2023/24
ROSC sustained to Hospital	Overall	31.9%	25.8%	27.5%	27.6%	29.5%
	Utstein	57.7%	50.4%	42.0%	48.0%	52.1%
30 Day Survival	Overall	10.0%	7.9%	9.4%	7.8%	9.8%
	Utstein	30.7%	29.2%	26.3%	26.1%	30.0%