



Cardiac Arrest Annual Report: 2010/11

July 2011

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1. Introduction

From 1st April 2010 to 31st March 2011, the London Ambulance Service NHS Trust (LAS) attended 9,948 patients who experienced an out-of-hospital cardiac arrest.

Clinical, operational and demographic information relating to each patient was collected and analysed by the Clinical Audit and Research Unit. This information was sourced from completed Patient Report Forms (PRFs), Emergency Operations Centre (EOC) records, Mobile Data Terminals (MDTs) and defibrillator data files. All patients who were conveyed to hospital following ongoing resuscitation attempts were traced and survival outcomes obtained from national databases and hospital sources where possible.

There have been a number of changes in policy and protocol which have directly influenced the treatment received by cardiac arrest patients during 2010/11. Firstly, in December 2010, the European Resuscitation Council updated the existing resuscitation guidelines, which helped inform the LAS's treatment procedures. Specifically, the LAS has encouraged the use of defibrillators in manual mode, removed atropine from the cardiac arrest protocol and reiterated the need to enhance post resuscitation care of patients on scene to ensure that the patient is stable prior to conveyance to hospital. Secondly, from September 2010, a new pathway was established whereby a specific group of cardiac arrest patients were conveyed directly to a Heart Attack Centre (cardiac catheter laboratory). Finally, in response to the recommendations made by the Joint Royal Colleges Ambulance Liaison Committees Airway Management Group, the LAS issued guidance regarding the direction of airway management in June 2010. This outlines training requirements and skill maintenance necessary to perform intubations at an adequate skill level and challenges surrounding this. It states that "the focus will be on the use of [supraglottic airway devices]" but "[endotracheal] intubation can still be carried out although serious consideration should be given to the use of a [supraglottic airway device] as the first line management when providing an advanced airway."

This report presents the out-of-hospital cardiac arrest survival rates for patients in London. The LAS calculates two types of cardiac arrest survival figure: an overall survival rate and an Utstein^{1,2} survival rate. The overall survival rate is based on those patients who had resuscitation attempted following an out-of-hospital cardiac arrest regardless of all factors. The Utstein survival calculation is conducted on a smaller sub-group of patients who have an arrest of presumed cardiac cause. This is an internationally validated method for calculating out-of-hospital cardiac arrest survival rates that allows for comparisons to be made between Emergency Medical Services. This calculation is the number of patients discharged alive as a proportion of the number of patients who had resuscitation attempted following a cardiac arrest of a presumed cardiac cause, where the arrest

was bystander witnessed and the initial arrest rhythm was shockable (Ventricular Fibrillation (VF) or pulseless Ventricular Tachycardia (VT)). Throughout this report the term Utstein refers to the above comparator group of patients only.

This report provides detailed information relating specifically to cardiac arrest patients under the age of 18 years is presented in Appendix 3.

2. Cause of Arrest

During 2010/11, the LAS attended a total of 9,948 out-of-hospital cardiac arrest patients. Of these, it was deemed that 5,693 (57.2%) patients were not suitable for resuscitation upon arrival of ambulance crews. Resuscitation was commenced for 4,255 (42.8%) patients in total: 3,336 arrests were due to a presumed cardiac cause, 293 were the result of a traumatic event, and a further 626 arrests were due to other causes (e.g. respiratory disease, drug overdose).

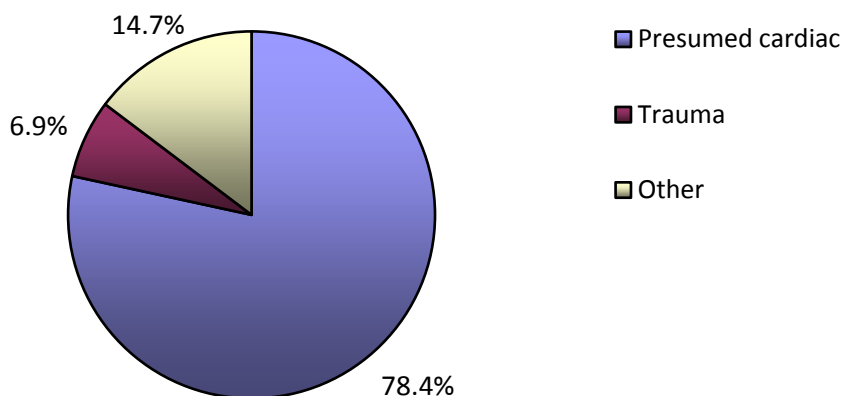


Figure 1 – Cause of arrest

3. Profile of Arrest

3.1. Resuscitation Not Attempted

Of the 5,693 cardiac arrests where a full resuscitation cycle was not undertaken, 98.6% (n=5,614) of patients were deceased upon the arrival of ambulance crews, while a further 79 patients had a Do Not Attempt Resuscitation (DNAR) order in place. The average age of patients was 70 years, the majority were male (59.9%; n=3,410) and arrests most frequently occurred in a private location (94.3%; n=5,367).

3.2. Resuscitation Attempted

Table 1 shows the profile of cardiac arrest patients, where resuscitation was commenced (regardless of the cause of arrest).

Resuscitation Attempted	
Patient Demographics	
Number of cases:	4,255
Average age:	65 (0-102) years
Gender:	Male (64%; n=2,741) Female (36%; n=1,513); Not documented (0%; n=1)
Average age by gender:	Male (63 years) Female (69 years)
Ethnicity ⁺ :	White (61.9%) Mixed (0.4%) Asian/ British Asian (6.7%) Black/Black British (6.3%) Other Ethnic Group (3.1%) Unable to obtain (17.5%) Not documented (4.1%)
Event Information	
Most common day:	Saturday (15.4%; n=657)
Most common month:	December (10.6%; n=452)
Location:	Private (78%; n=3,320) Public (21.9%; n=931) Not documented (0.1%; n=4)
Witnessed [^] :	Bystander (41.8%; n=1,779) Not witnessed (36.9%; n=1,572) Crew witnessed (20.6%; n=877) Not documented (0.6%; n=27)
Bystander CPR:	36% (n=1,533)
Initial presenting rhythm:	Asystole (50.4%; n=2,146) VF/ pulseless VT (21.1%; n=899) PEA (26.9%; n=1,143) Not documented (1.6%; n=67)
ROSC:	32% (n=1,361)
ROSC sustained to hospital:	24.7% (n=1,051)

Table 1 – Profile of cardiac arrests in London for all patients where resuscitation was attempted

⁺ Due to the nature and condition of cardiac arrests, patients are often unable to provide ethnicity information. Crews therefore document on the PRF that they are unable to obtain this information.

[^] Due to rounding, percentages will not equal 100%

4. Presumed Cardiac Aetiology

The following section focuses only on those cardiac arrests of a presumed cardiac cause (n=3,336) irrespective of all factors (e.g. witnessed, bystander CPR, initial rhythm).

4.1. Patient Demographics

The majority of cardiac arrest patients were male (64% vs. 36% female). Ages ranged from 0 – 102 years, with an average of 68. As seen previously, females were older than males by an average of six years (72 vs. 66 years respectively). The distribution of age groups is shown in Figure 2 below.

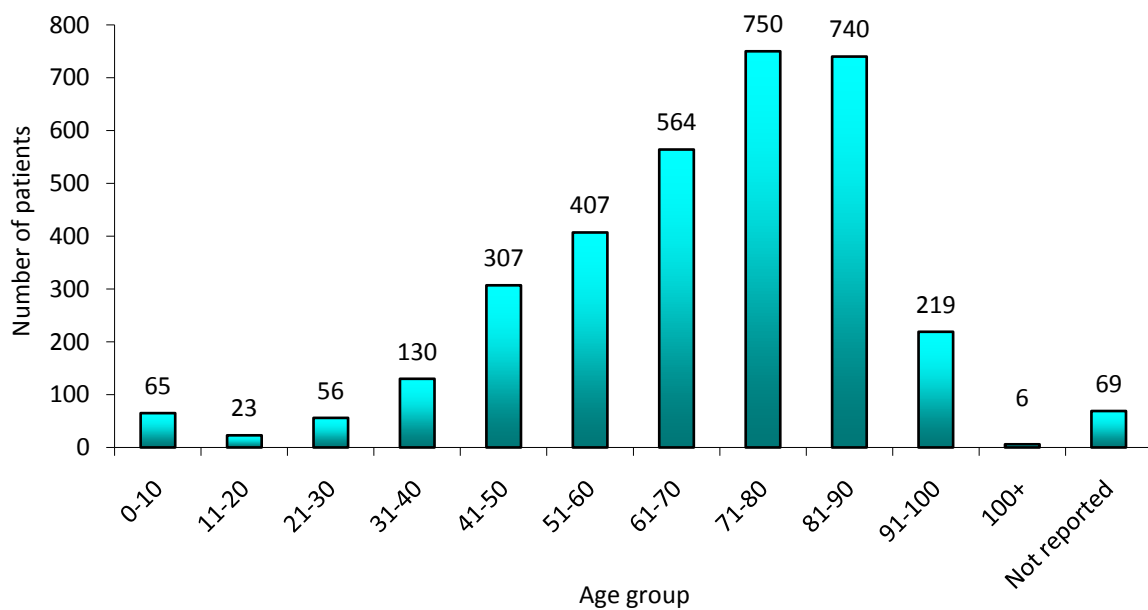


Figure 2 – Age groups of patients

4.2. Day and Month of Cardiac Arrest

Cardiac arrests of presumed cardiac cause most frequently occurred on a Monday (15.5%; n=517) and least frequently on a Friday (13.1%; n=438). The greatest number of arrests occurred during the month of December (10.8%; n=361), with the least number of cardiac arrests in July (n=230; 6.9%).

4.3. Location

A greater number of cardiac arrests of presumed cardiac cause occurred in a private, residential location (79%; n=2,637). Of which, 2,256 were in the home and 381 in a care home facility. 20.8% (n=695) of arrests occurred in a public place. In just 0.1% (n=4) of cases, there was no indication as to the location of the arrest.

Location	n	% [^]
Private		
Home	2,256	67.7
Care Home	381	11.4
Public		
Work	71	2.1
Street	310	9.3
GP Surgery	14	0.4
Other public	300	9.0

Table 2 – Location of cardiac arrests

Furthermore, of the 300 arrests that occurred within the other public location category, the ten most common locations have been broken down by frequency in Table 3 below.

Other public	n	%
Underground/ Rail/ Bus	55	18.3
Shop	44	14.7
Hospital/ Walk in centre	38	12.7
Leisure centre/ Sports facility	33	11.0
Airport	26	8.7
Hotel/ Hostel	14	4.7
Public House/ Club	14	4.7
Place of worship	11	3.7
Parkland/ Woodland	10	3.3
Restaurant	8	2.7

Table 3 – Breakdown of top ten other public locations

[^] Due to rounding, percentages will not equal 100%

4.4. Response Times

Following the triage of a 999 call, a response category is allocated in line with Department of Health (DH) definitions. Internally, the LAS further allocate colour coded response categories (red, amber or green) with levels of 1, 2 and 3 to describe the priority within the category. 60.4% (n=2014) of cardiac arrests were allocated a Red 1 category, the highest priority, at the point of the 999 call.

Ambulance response times for all 3,336 patients are displayed in Table 4. Response times achieved in 2009/10 have also been included for the purpose of comparison. The average 999 call to arrival on scene interval remains consistent with that reported in 2008/09 and 2009/10 at seven minutes. The average on scene time has increased by four minutes to 49 minutes and the average 999 call to arrival at hospital interval has increased by eight minutes to 60 minutes. In addition, the average overall job cycle time has increased by 12 minutes to 125 minutes.

Time Interval	2010/11 Average Time (mins.)	2009/10 Average Time (mins.)
999 (Call Connect)* - arrival on scene	7	7
On scene time	49	45
999 (Call Connect)* - arrival at hospital	60	52
Job cycle (Call Connect* - green ∞)	125	113

* Call Connect refers to the time that the call was connected to the ambulance service.

∞ Green is the time at which the crew have completed the job and are available for the next call.

Table 4 – Response times for those cardiac arrests of a presumed cardiac cause

This year we have also looked at response times for the group of patients whose arrest was due to a presumed cardiac cause, where the arrest was bystander witnessed and where the initial rhythm was VF or pulseless VT (i.e. the Utstein comparator group). The response times for this group are displayed in Table 5.

Time Interval	2010/11 Average Time (mins.)
999 (Call Connect)* - arrival on scene	6
999 (Call Connect)* - 1 st LAS defibrillation	11
Arrival at scene - 1 st LAS defibrillation	4
999 (Call Connect)* - arrival at hospital	57
Job cycle (Call Connect* - green ∞)	124

* Call Connect refers to the time that the call was connected to the ambulance service.

∞ Green time is the time at which the crew have completed the job and are available for the next call.

Table 5 – Response times for the Utstein comparator group

4.5. Witnessed Arrest

In line with previous years, almost half of all cardiac arrests (44.1%; n=1,471) of a presumed cardiac cause were bystander witnessed (either seen or heard) and a further 19.2% (n=640) were witnessed by an LAS crew. In 36.2% (n=1,209) of patients the cardiac arrest was not witnessed and in 0.5% (n=16) of cases there was no indication as to whether the cardiac arrest was witnessed or not. Cardiac arrests were more frequently witnessed in a private location (71.4%; n=1,051). Appendix 1 provides further information on the impact of witnessed arrests on ROSC and survival figures.

4.6. Bystander CPR

For just over one third of patients (36.7%; n=1,223) bystander CPR was undertaken prior to the arrival of an LAS crew. Bystander CPR was more frequently commenced when the cardiac arrest was witnessed rather than un-witnessed (61% vs. 39%). Additionally, bystander CPR was also more common when the arrest occurred in a private location compared to those arrests that occurred in public (70% vs. 30%). Of interest, the work place was the most likely location for a bystander to perform CPR (62%). These figures are consistent with those seen in previous years. Appendix 1 provides further information on the relationship between bystander CPR, ROSC and survival rates.

4.7. Initial Presenting Rhythm

As detailed in previous reports, almost half of all cardiac arrest patients presented to LAS ambulance crews with an asystolic heart rhythm (47.6%; n=1,589). Additionally, 25.5% (n=851) of patients presented with an initial rhythm of VF or pulseless VT. Pulseless Electrical Activity (PEA) accounted for a further 25.9% (n=863). In 1% (n=33) of cases PRFs did not give any indication as to the patient's initial arrest rhythm. Appendix 1 provides further information on each initial presenting rhythm and its impact on both ROSC and survival figures.

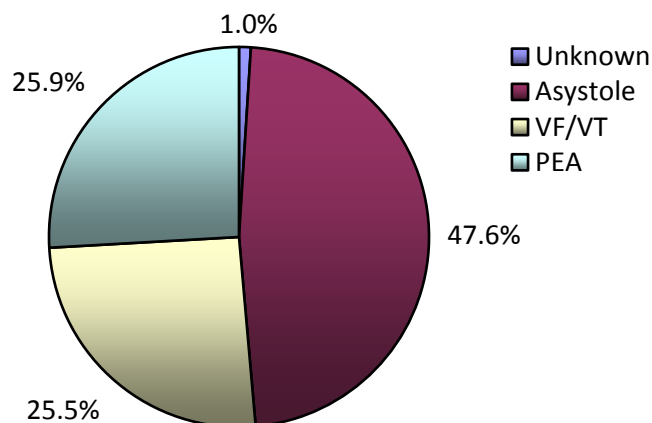


Figure 3 – Initial presenting rhythm

4.8. Return of Spontaneous Circulation (ROSC)

In just over one third of patients (33.5%; n=1,116) ROSC was achieved at some point whilst in the care of LAS crews. Just under three quarters of these patients collapsed in a private location (74.6%; n=832) and 74.3% (n=829) had an arrest that was witnessed either by a bystander or an LAS crew. In addition, 38.8% (n=433) of patients in whom ROSC was achieved (at any point) received bystander CPR; a 4% increase on last year. Where ROSC was achieved, the majority of patients presented with an initial arrest rhythm of VF/ pulseless VT (44.5%, n=497).

Where ROSC was achieved (n=1,116), it was sustained to arrival at hospital in 865 cases (77.5%). Therefore, of the total population of 3,336 cardiac arrest patients, 25.9% (n=865) had a return of spontaneous circulation present on arrival at hospital; this figure represents an increase of 2% from that reported in 2009/10.

The graph below demonstrates the year on year increases in both ROSC achieved at some point whilst in LAS care and ROSC sustained to hospital.

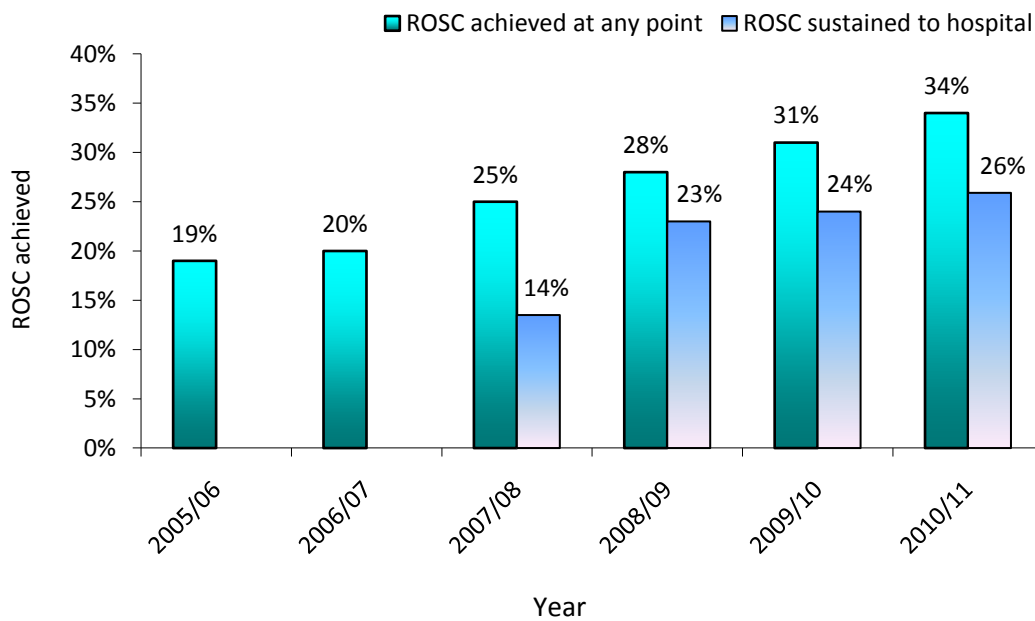


Figure 4 – Percentage of patients with ROSC by year

4.9. Airway Management

Airway management includes either endotracheal tube intubation or supraglottic airway device (SGA) placement (such as Laryngeal Mask Airway™ or I-gel™). Trained Paramedics are able to perform both interventions, whereas recently qualified Paramedics and Level 4 Emergency Medical Technicians (EMT) are able to place SGA's only. During 2010/11, there were 2,241 cases where resuscitation was attempted and a Paramedic or Level 4 EMT was present. In 83% of cases at least one successful airway management intervention was undertaken. For the purpose of comparison, numbers of intubations and SGA's placed in 2009/10 are included in brackets in Table 6 below.

Airway Management	
Number of successful intubations*	1,826 (1,935)
Number of SGA's placed*	1,149 (674)
Percentage of patients who were intubated, had an SGA placed, or both	83%

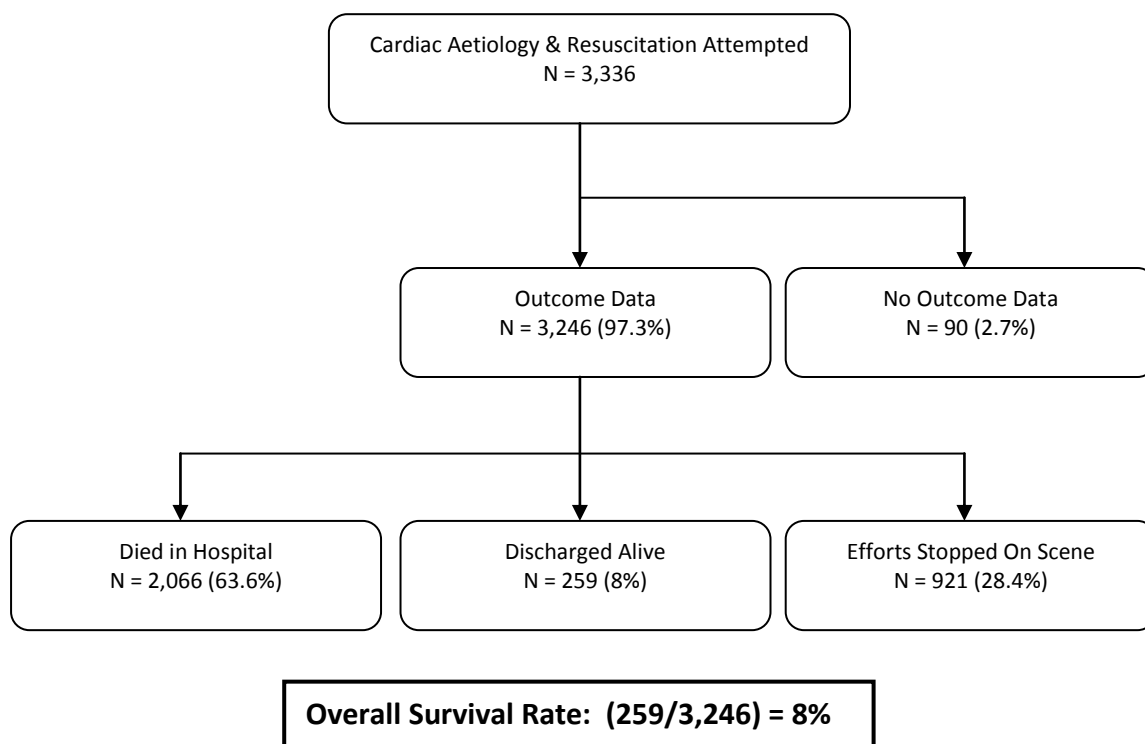
* In some cases a patient may have been intubated and had an SGA placed prior or subsequent to intubation; these cases have been included and reported in both intubation and SGA data.

Table 6 – Airway management

4.10. Survival Calculations

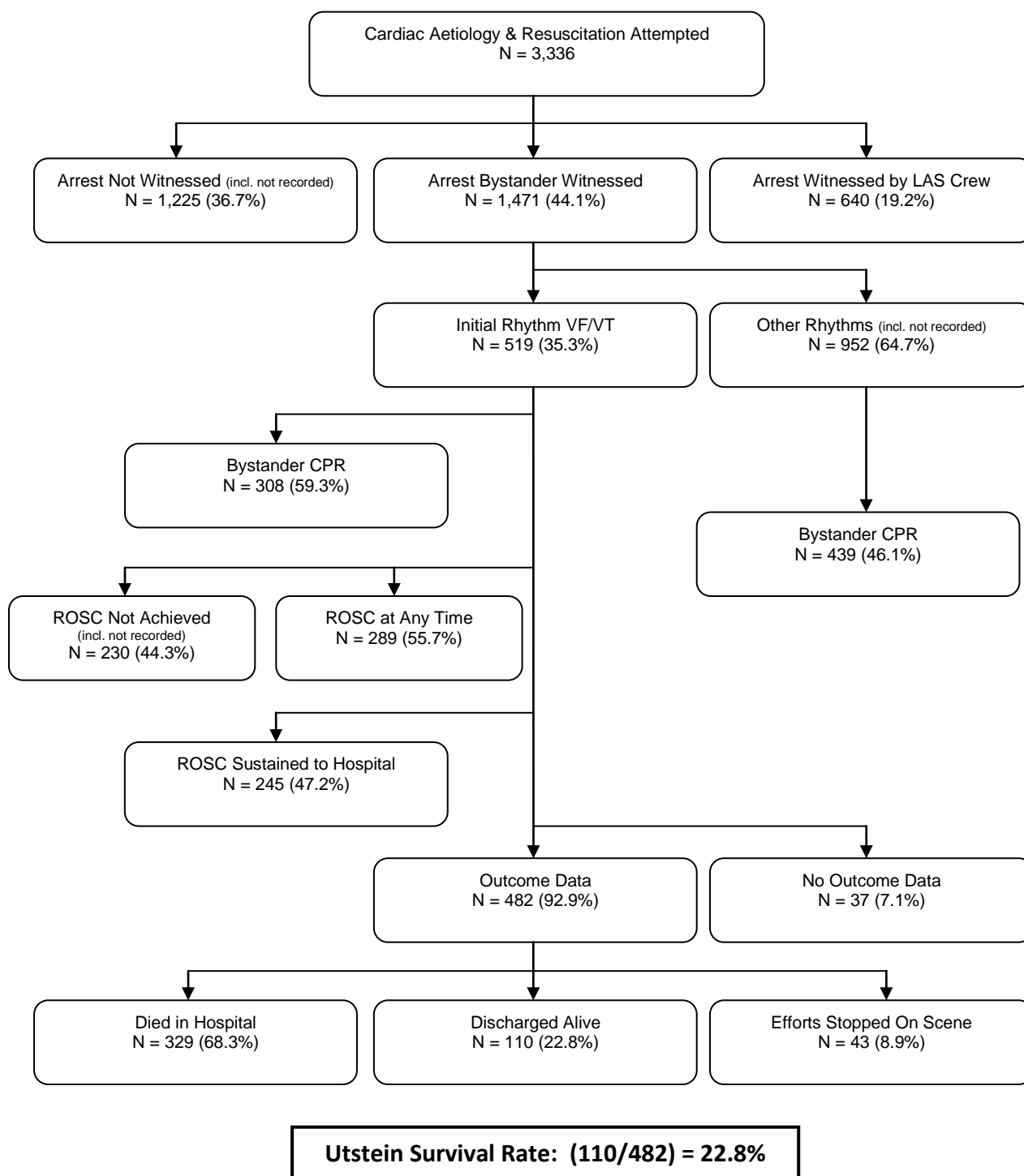
4.10.1. Overall Survival Rate

The overall survival rate is based on those patients who had resuscitation attempted by the LAS following an out-of-hospital cardiac arrest of a presumed cardiac cause irrespective of all factors. The overall survival rate for 2010/11 is 8%.



4.10.2. Utstein Survival Rate

The Utstein calculation is the number of patients discharged alive divided by the number of patients who had resuscitation attempted following a cardiac arrest of a presumed cardiac aetiology, where the arrest was bystander witnessed and the initial arrest rhythm was VF or pulseless VT. Patients for whom outcomes could not be traced (n=37) were excluded from the survival figure. Therefore, the valid denominator for the 2010/11 Utstein survival calculation is 482. The LAS Utstein survival rate for 2010/11 is 22.8%.



Excluding 2007/08, Utstein survival rates have increased year on year as demonstrated in Figure 5 below.

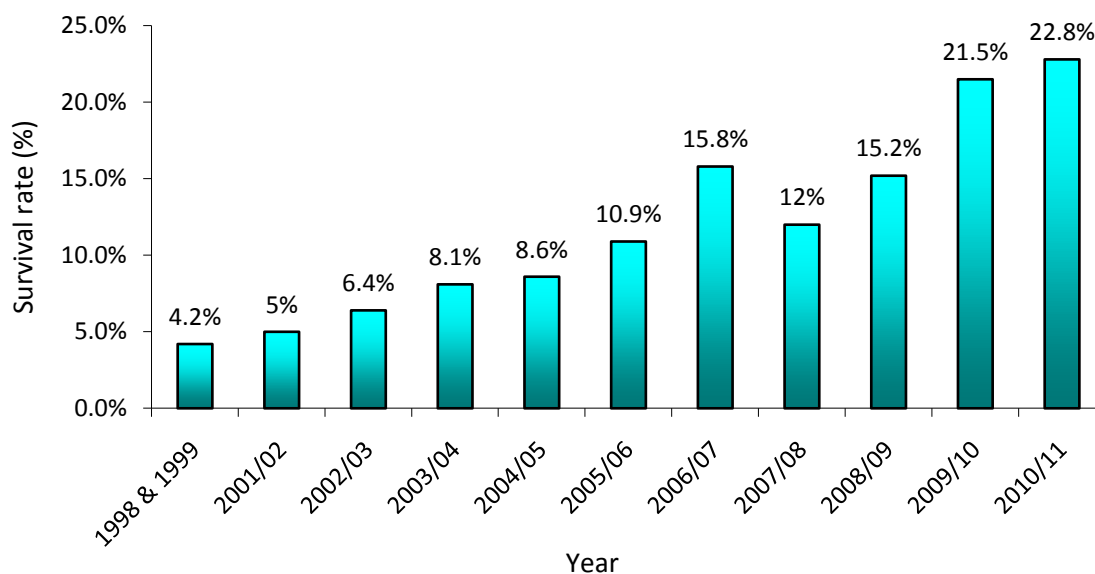


Figure 5 – Utstein survival rate by year

4.10.3. Survival from LAS Crew Witnessed Cardiac Arrests Only

Survival is higher in cardiac arrests that were witnessed by ambulance crews as these patients would be expected to receive immediate interventions. Arrests witnessed by LAS crews accounted for 19.2% (n=640) of all out-of-hospital cardiac arrests of presumed cardiac cause during 2010/11; the table below details the outcomes for this group of patients. As 23 patients could not be traced to hospital, the valid denominator for overall survival is 617 and 144 for the Utstein comparator group (presumed cardiac cause, crew witnessed and initial rhythm of VF/pulseless VT).

Outcome	n	%
Died on scene	60	9.7
Died in hospital	461	74.7
Overall survival rate	96/617	15.6
Utstein survival rate	80/144	55.6

Table 7 – Overall and Utstein survival from crew witnessed arrests

5. Trauma

During 2010/11, there were 293 patients whose cardiac arrest was the result of a traumatic event. Road traffic accidents and other traumatic incidents (e.g. fall from height, assault) were the most frequent cause of the traumatic event (see Table 8 below).

Trauma		
Cause	n	%
Road traffic accident	81	28%
Hanging	61	21%
Stabbing	33	11%
Drowning/Submersion	17	6%
Shooting	12	4%
Electrocution	7	2%
Other	82	28%

Table 8 – Cause of traumatic event

Of the 293 patients, over two thirds of these patients were male (78.2% vs. 21.8%) and the average age of patients was 40, with the greatest number of arrests occurring in the 21 - 30 year old age group. The majority of cardiac arrests of a traumatic cause occurred on the street (45%; n=132), closely followed by a private home location (35%; n=102). London's Air Ambulance (HEMS) were present on scene in 51% of cases (n=149). An initial presenting shockable heart rhythm (VF or pulseless VT) was only present in 4.4% (n=13) of cases.

For patients where trauma was the cause of the cardiac arrest, outcomes could not be traced in 15 cases and therefore the valid denominator is 278. The overall survival rate for this group of patients is 2.9% (n=8).

6. Other (non-cardiac) Cause

626 patients had a cardiac arrest that, due to its cause, was classified as other. This category includes causes such as drug overdose, respiratory disease and other non-cardiac related causes. Within this group, 92% (n=578) of arrests occurred within a private location, nearly two thirds (59.9%; n=375) of patients presented with an asystolic heart rhythm and 30% (n=190) of patients received bystander CPR prior to the arrival of the LAS.

7. Direct Conveyance to Heart Attack Centre

In September 2010, a new pathway was implemented for cardiac arrest patients, who had been stabilised on scene by crews, to be conveyed to one of eight Heart Attack Centres in London. The eligibility criteria for this pathway is: patients aged 18 years or over, ROSC achieved after an initial rhythm of VF or pulseless VT, evidence of ST-elevation on a 12 lead ECG and where the cause of arrest was believed to be cardiac in origin.

Figure 6 below shows the number of patients taken to a Heart Attack Centre and those that survived to hospital discharge.

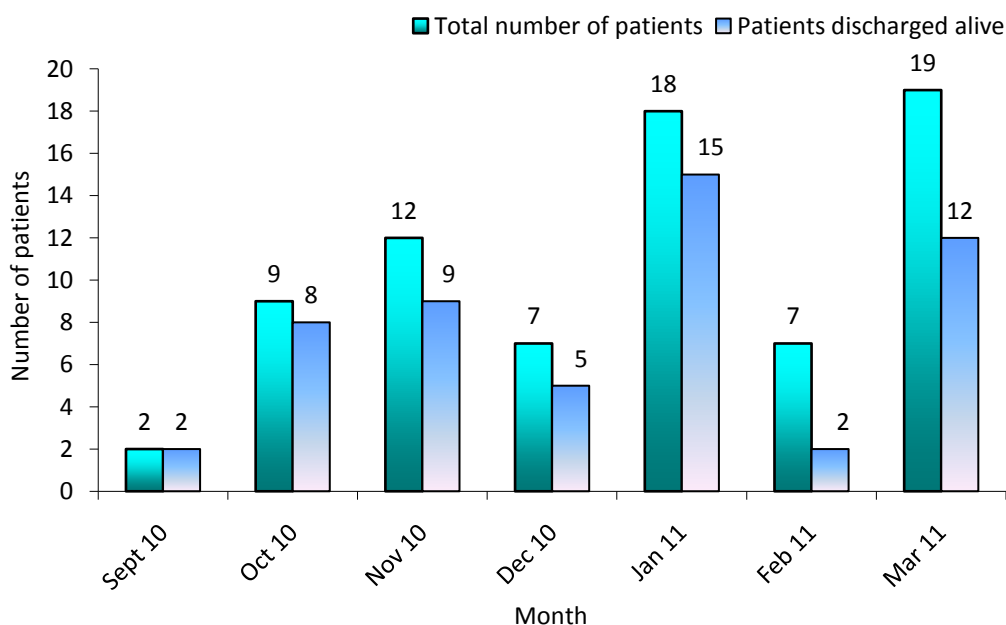


Figure 6 – Number and survival to discharge for patients conveyed directly to Heart Attack Centres

8. Survival from Defibrillators in Public Places

During 2010/11, defibrillators situated in public places were deployed a total of 25 times. Detailed information for this group of patients can be viewed in Appendix 2. Outcomes were obtained for all 25 patients; of these eight patients survived to hospital discharge resulting in an overall survival rate of 32% (n=8/25), a decrease of 1% on 2009/10. Due to the small numbers within this group, an Utstein survival calculation is not appropriate.

9. Discussion

For the third consecutive year, the LAS has seen an increase in the Utstein survival rate with the 2010/11 figure of 22.8% being the highest rate achieved by the LAS to date. The increase of 1.3% from 21.5% in 2009/10 continues the positive trend that is emerging. The overall survival rate of 8% has remained consistent with that reported last year for those arrests that occurred due to a presumed cardiac cause. In addition, a considerable increase of 9.3% has been seen in the Utstein survival rate of those cardiac arrests that were witnessed by LAS crews, where the survival rate has increased from 46.3% in 2009/10 to 55.6% in 2010/11.

Many factors outlined in this report have remained in line with those figures reported in 2009/10. Patient demographics, proportions of witnessed arrests, rates of bystander CPR, arrest location and initial presenting rhythms have all remained fairly consistent. Changes can however be seen in response times; while call to arrival at scene is identical to that reported in 2009/10 (7 minutes), call to first LAS defibrillation (for patients in the Utstein comparator group) has increased by one minute to 11 minutes. Similarly, both call to arrival at hospital and overall job cycle have seen noticeable increases (of 8 minutes and 12 minutes respectively). These are in part due to improvements made in the management of cardiac arrest patients through efforts to achieve ROSC and stabilise patients before conveyance to hospital. When comparing figures to those of 2009/10, rates of conveyance for those patients in whom ROSC was never achieved at any point has decreased by 10% (49% vs. 39% respectively) and the number of patients who were recognised as life extinct on scene by LAS crews has increased by approximately 10%. This clearly demonstrates that increasingly patients are being conveyed to hospital where appropriate and that resuscitation is being ceased where it is unsuccessful, which may in turn be reflected in the increase in response times for this reporting period.

During 2010, cardiac care initiatives and changes in protocol were introduced that may have had a direct impact on the increase seen in the Utstein survival rate. In September 2010, the decision was made to convey patients with ROSC following an arrest of a presumed cardiac cause, where the initial presenting rhythm was VF or pulseless VT and ST-elevation was clearly showing on a 12 lead ECG, directly to a Heart Attack Centre. This has enabled those patients who suffered a cardiac arrest due to a blocked coronary artery (i.e. a potentially reversible cause) to gain immediate access to primary angioplasty where appropriate. This change is reflected in the increased number of patients conveyed directly to a Heart Attack Centre and may go some way to accounting for the increase in survival. It may also have impacted on the 999 call to arrival at hospital response time as conveying a patient to the nearest Heart Attack Centre may involve a longer journey time than conveying to the nearest hospital Accident & Emergency department.

Furthermore, in December 2010, in line with the release of the European Resuscitation Council's changes to existing resuscitation guidelines the LAS released a cardiac care circular providing an update on basic and advanced life support guidelines. Among the changes contained within this document were: using a defibrillator in manual mode allowing for a reduced break in chest compressions and the withdrawal of atropine in all cardiac arrests. Again, these changes in combination with other factors may also have contributed to the increase in survival.

An important next step in improving survival from an out-of-hospital cardiac arrest relies on an increase being made to the number of defibrillator data files which are downloaded and saved either from FR2 data cards or using the Lifepak 1000. For 2010/11, the download rate ranges from 7% to 17%, which is substantially lower than the 100% target. Download analysis should be performed whenever possible from electronic cards or the Lifepak 1000 and these files should be analysed and findings fed back to crews, to allow for further improvements in care to be made. In addition, the LAS should continue to pursue options for pre-hospital therapeutic hypothermia in light of recent of National Institute of Health and Clinical Excellence guidelines³ recommending commencement of induced hypothermia as soon as possible after the cardiac arrest has occurred.

There are two further trends which have continued during this reporting period, the first of which is the support given by London hospitals in providing the LAS with timely and detailed patient outcome information. This has allowed the LAS to obtain 97.3% of all patient outcomes, with the remaining 2.7% largely made up of those patients for whom little or no personal information could be obtained. Secondly, the quality of PRF documentation completed by LAS crews has also continued to improve. In many areas the percentage of missing information is as little as 1% or less. This is a substantial achievement and has enabled the most robust dataset to date to be compiled.

To conclude, the increases seen in survival to hospital discharge and rates of ROSC illustrate the continual improvements that are being made by the LAS to strengthen the cardiac care that patients receive. In addition, further initiatives such as pre-hospital therapeutic hypothermia in combination with improved PRF documentation and an increased number of defibrillator data downloads are expected to aid this improvement further.

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3. National Institute for Health and Clinical Excellence. Therapeutic hypothermia following cardiac arrest. National Institute for Health and Clinical Excellence, 2011.

Appendix 1: Bystander CPR, ROSC, ROSC sustained to hospital and overall survival by patient group 2010/11

Resus Attempted

Patient group	Bystander CPR	ROSC	ROSC sustained to hospital	Overall survival
Location				
Home	29.9%	31.0%	23.8%	6.2%
Care Home	45.6%	30.8%	23%	1.1%
Work	60.2%	41%	30.1%	19.2%
Street	41.4%	30.2%	23.6%	11.7%
GP Surgery	55.6%	50%	33.3%	12.5%
Other	58.2%	41%	33.8%	17.3%
Initial presenting rhythm				
Asystole	39.0%	21.8%	15.7%	1.4%
PEA	24.8%	29.7%	22.2%	3.1%
VF/VT	43.9%	57.2%	47.1%	25.9%
Witnessed				
Bystander	49.7%	38.1%	29.6%	8.9%
Crew	-	35.9%	28.7%	14.1%
Not witnessed	40.5%	22.8%	16.7%	2.2%
Bystander CPR				
No	-	29.1%	21.5%	4.1%
Yes	-	33.2%	26.3%	7.5%

Presumed Cardiac Only

Patient group	Bystander CPR	ROSC	ROSC sustained to hospital	Overall survival
Location				
Home	29.9%	31.7%	24.4%	6.1%
Care Home	47.2%	30.7%	22.6%	0.8%
Work	62%	43.7%	32.4%	21.2%
Street	43.5%	35.5%	28.7%	15.5%
GP Surgery	57.1%	50%	42.9%	16.7%
Other	59.7%	45%	37%	20.8%
Initial presenting rhythm				
Asystole	39.3%	21.5%	15.3%	1.3%
PEA	24.2%	30.1%	22.5%	2.2%
VF/VT	44.5%	58.4%	48.3%	26.5%
Witnessed				
Bystander	50.8%	39.1%	30.5%	9.6%
Crew	-	39.7%	32.2%	15.6%
Not witnessed	38.9%	23.2%	17%	2.3%
Bystander CPR				
No	-	29.1%	21.4%	4%
Yes	-	35.4%	28.2%	8.7%

Appendix 2: Defibrillators in public places

The table below provides details on all 25 cases in which a Public Access Defibrillator was deployed.

Public Access Defibrillation	
Patient Demographics	
Number of cases:	25
Average age:	67 (40 - 89 years)
Gender:	Male (96%); Female (4%)
Event Information	
Incident location:	Airport 28% (n=7) Public Transport 36% (n=9) Leisure centre 4% (n=1) Shopping centre 8% (n=2) Other location 20% (n=5) Workplace 4% (n=1)
Bystander witnessed:	(92%; n=23)
Bystander CPR:	80% (n=20)
Initial rhythm (as recorded by public defibrillator):	VF/VT (84%; n=21) Non-shockable (16%; n=4)
Average number (and range) of PAD shocks*:	2 (1-7) shocks
ROSC:	40% (n=10)
Overall survival:	32% (8/25)

* Where initial rhythm was VF/pulseless VT

Appendix 3: Key findings for patients under 18 years

In 2010/11, a total of 179 patients under the age of 18 had a cardiac arrest. Resuscitation was attempted for 153 (85.5%) patients, of these 85 (55.6%) were presumed to be due to a cardiac cause, 17 (11.1%) were thought to be due to trauma and 51 (33.3%) were due to another non cardiac cause.

	Presumed cardiac	Trauma	Other (non-cardiac)
Cardiac arrests: n	85	17	51
Gender: n (%)			
Male	48 (56.5)	12 (70.6)	28 (54.9)
Female	37 (43.5)	5 (29.4)	22 (43.1)
Not known	-	-	1 (2)
Ethnicity[^]: n (%)			
White	28 (32.9)	7 (41.2)	20 (39.2)
Mixed	1 (1.2)	-	1 (2)
Asian/ British Asian	9 (10.6)	-	3 (5.9)
Black/ Black British	13 (15.3)	3 (17.6)	12 (23.5)
Other Ethnic Group	7 (8.2)	1 (5.9)	3 (5.9)
Unable to obtain	24 (28.2)	6 (35.3)	10 (19.6)
Not documented	3 (3.5)	-	2 (3.9)
Presenting cardiac rhythm: n (%)			
VF/VT	9 (10.6)	-	3 (5.9)
PEA	8 (9.4)	9 (52.9)	6 (11.8)
Asystole	59 (69.4)	7 (41.2)	35 (68.6)
Not known	9 (10.6)	1 (5.9)	7 (13.7)
Arrest witnessed: n (%)			
Bystander	24 (28.2)	5 (29.4)	16 (31.4)
EMS personnel	5 (5.9)	1 (5.9)	7 (13.7)
Not witnessed	56 (65.9)	11 (64.7)	27 (52.9)
Not known	-	-	1 (2)
Bystander CPR: n (%)			
Yes	37 (43.5)	12 (70.6)	18 (35.3)
No	48 (56.5)	5 (29.4)	33 (64.7)
Arrest location: n (%)			
Public	12 (14.1)	9 (52.9)	2 (3.9)
Private	73 (85.9)	8 (47.1)	49 (96.1)
Other public location: n (%)			
Airport	2 (2.4)	-	-
Hotel/ Hostel	-	-	1 (2)
Leisure centre	1 (1.2)	1 (5.9)	-
Parkland/ Woodland	2 (2.4)	-	-
River	-	1 (5.9)	-
School	4 (4.7)	-	-
Shop	-	1 (5.9)	-
ROSC[^]: n (%)			
Yes	13 (15.3)	2 (11.8)	8 (15.7)
No	70 (82.4)	15 (88.2)	43 (84.3)
Not known	2 (2.4)	-	-
ROSC sustained to hospital: n (%)			
Yes	12 (14.1)	1 (5.9)	8 (15.7)
No	71 (83.5)	16 (94.1)	43 (84.3)
Not known	2 (2.4)	-	-
Overall Survival: % (n)	5 (4/80)	5.9 (1/17)	10.9 (5/46)

[^] Due to rounding percentages will not equal 100%