London Ambulance Service NHS Trust

Cardiac Arrest Annual Report: 2012/13

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Key findings - 2012/13

- Survival to hospital discharge rates have decreased compared to last year for some groups of our cardiac arrest patients, but nonetheless remain higher than all years preceding 2011/12.
  - For all cardiac arrest patients where resuscitation was attempted, survival to discharge decreased by less than 1% to 8.8% this year (from 9.7% in 2011/12).
  - Survival to discharge for patients whose arrest was of a presumed cardiac origin decreased by 1.6% from 10.9% in 2011/12 to 8.9% this year.
  - The Utstein survival rate decreased by 3.3% to 28.4% (from a high of 31.7%).
- For patients whose arrest was associated with a trauma or another non-cardiac cause, survival to hospital discharge rates increased to their highest to date (5.2% and 6.5% respectively).
- Return of Spontaneous Circulation (ROSC) rates have improved, with ROSC being sustained to arrival at hospital for an additional 2% of patients compared to last year. This demonstrates that we are getting more patients to hospital with a pulse than before, yet fewer are surviving to leave hospital.
- Bystander CPR figures have increased to the highest level yet, with more than half of patients receiving CPR before LAS personnel arrive on scene.
- The percentage of cardiac arrest patients presenting with an initial shockable rhythm has decreased slightly this year (by 3.4%).
- 277 cardiac arrest patients were conveyed to Heart Attack Centres (HACs) under a specialist pathway for STEMI patients. The survival to discharge rate for these patients has also decreased by over 15% from the previous year to 47.9%. It is likely that this is a result of the inclusion of all initial arrest rhythms as part of the pathway criteria, rather than just those with a shockable rhythm (who have the best chance of a favourable outcome). Consideration needs to be given by the LAS and the pan-London HAC group of the impact of the pathway for patients with Asystole and PEA initial arrest rhythms that are conveyed to a HAC.

1. Introduction

Survival from out-of-hospital cardiac arrest is complex, and dependant on numerous factors, including the aetiology of the arrest; any underlying co-morbidities that the patient may have; the provision of cardiopulmonary resuscitation (CPR); access to defibrillation equipment and critical interventions, as well as the impact of post resuscitative treatment. The role of the Emergency Medical Service is vital in ensuring that patients receive resuscitative efforts immediately. Between 1st April 2012 and 31st March 2013, the London Ambulance Service NHS Trust (LAS) attended a total of 10,111 patients who had suffered an out-of-hospital cardiac arrest. This report details the profile of these patients, our response to them, the resuscitation efforts provided, and their survival outcomes.

Data for this report has been sourced from the LAS cardiac arrest registry which enables us to monitor the care provided to out-of-hospital cardiac arrest patients, with the overall aim of improving patient outcomes in London. Data are collected from a number of sources including: Patient Report Forms (PRFs) - the clinical records completed by ambulance clinicians, vehicle based Mobile Data Terminals (MDTs), defibrillator downloads and 999 call logs. The survival status of patients conveyed to hospital is obtained from national patient records and direct contact with the receiving hospitals.

A breakdown of figures by aetiology can be found in Appendix 1. Appendix 2 presents figures specifically for cases where defibrillators were utilised in public places. Appendices 3 and 4 provide a further breakdown for patients with a traumatic or ‘other’ non-cardiac cause for their arrest. Finally, Appendix 5 focuses on cardiac arrest patients under the age of 35.

2. Overview of Cardiac Arrests

2.1. Resuscitation Not Attempted/Required

Of the 10,111 patients in cardiac arrest that the LAS attended during 2012/13, a resuscitation attempt was not undertaken for 55.8% (n=5,645) of cases. 96.2% (n=5,428) of patients were declared dead upon the arrival of the ambulance clinicians, and for the remaining 3.8% (n=217) a Do Not Attempt CPR order (DNA-CPR), or an appropriate equivalent, was in place.

2.2. Resuscitation Attempted

Resuscitation was attempted for 44.2% (n=4,466) of cardiac arrest patients. The majority (86.1%; n=3,848) of patients were suspected of having a cardiac origin to their arrest. Traumatic cardiac arrests accounted for a further 5.3% (n=236) of cases, whilst 8.6% (n=382) of patients suffered an arrest that was due to an 'other' non-cardiac cause (e.g. overdose, respiratory obstruction, terminal illness). Please see Appendix 1 for comparison of characteristics by aetiology.

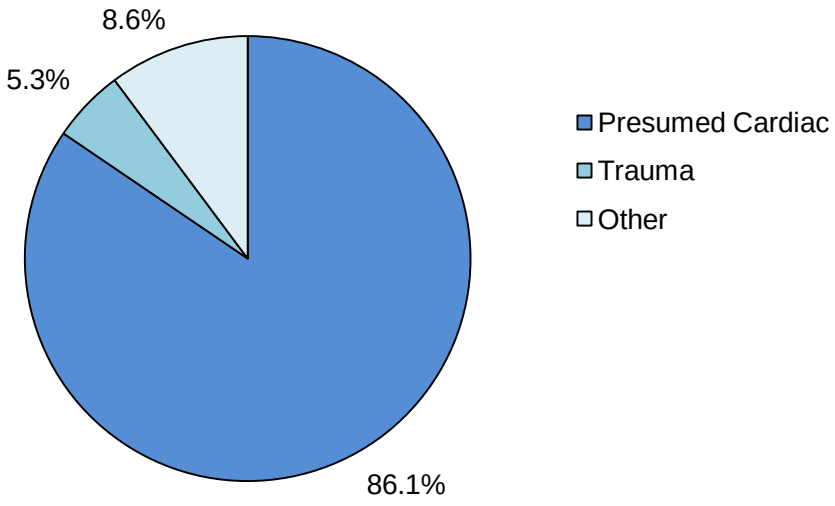

Figure 1 – Cause of cardiac arrest in patients where resuscitation was attempted

Table 1 – Characteristics of all cases where resuscitation was attempted (irrespective of cause of arrest)

Overall Resuscitation Attempted (n=4,466)	
Patient Demographics	
Average age:	67 (range=0-106 years)
Gender:	Male (63%; n=2,802); Female (37%; n=1,661); Not Documented (0%; n=3)
Average age by gender:	Male (65 years); Female (70 years)
Race^:	White (65.5%; n=2,923); Mixed (0.4%; n=18); Asian (8.0%; n=359); Black (6.7%; n=299); Other Race (3.5%; n=155); Unable to Obtain (14.0%; n=627); Not Documented (1.9%; n=85)
Event Information	
Most common time of day:	08.00 - 11.59 (23.0%; n=1,029)
Most common day:	Monday (15.0%; n=671)
Most common month:	December (10.5%; n=467)
Response categories∞#:	Red 1 (60.5%; n=2,702); Red 2 (32.8%; n=1,464); C1 (1.3%; n=57); C2 (3.7%; n=164); C3 (1.1%; n=49); C4 (0.7%; n=30)
Response times (median):	999 call* - arrival on scene = 7 minutes 999 call* - arrival at hospital = 67 minutes Job Cycle⌖ = 133 minutes
Location:	Private (77.7%; n=3,469); Public (22.3%; n=997)
Witnessed:	Bystander (46.0%; n=2,054); LAS Crew (18.7%; n=837); Unwitnessed (35.1%; n=1,567); Not Documented (0.2%; n=8)
Bystander CPR:	51.8% (1,879/3,629)~
Initial Rhythm:	Asystole (51.8%; n=2,313); Pulseless Electrical Activity (25.9%; n=1,158); Ventricular Fibrillation or pulseless Ventricular Tachycardia (20.6%; n=921); Not Documented (1.7%; n=74)
Outcome Information	
Recognition of Life Extinct on scene	37.0% (n=1,654)
ROSC sustained to hospital:	31.3% (n=1,396)
Survival to discharge+:	8.8% (n=390/4,407)

^ Due to the critical condition of cardiac arrest patients, definitive race information is not always possible to obtain and therefore this data should be viewed with caution.

∞ Red response categories are given to calls that appear to be immediately life threatening. Red 1 is used for calls where the patient is not breathing and are classed as the most time critical, whilst Red 2 is used for calls where the complaint given is serious but less immediately time critical. All other calls are given a Category C response based on the information provided by the caller regarding the patient's condition.

Due to rounding the percentages do not always equal 100%.

* In line with national definitions, 999 call is the time at which the call is connected to the ambulance service for Red 1 calls. For Red 2 and Category C calls, 999 call is defined as the time at which the chief complaint is established or one minute elapses, whichever comes first.

⌖ The Job Cycle time is the length of time between the 999 call and the crew indicating they are available for another patient.

~ The denominator for bystander CPR excludes arrests witnessed by LAS crews.

+ Denominator excludes patients with unknown survival outcomes (n=58).

3. Presumed Cardiac Patients

Patients with a presumed cardiac origin to their arrest constitute the largest group of cardiac arrests where resuscitation was attempted (86.1%; n=3,848). Unlike traumatic cardiac arrest patients and those with 'other' causes, arrests of presumed cardiac cause are more uniform as the arrest is usually triggered by a myocardial infarction (heart attack), heart failure, cardiomyopathy (cardiac muscle disease) or some form of valvular or electrical disorder within the heart. Please see Appendix 1 for overall information on presumed cardiac patients.

3.1. Patient Demographics

The majority of patients in the presumed cardiac group were male (62.1%), with an average age of 66 years compared to females who had an average age of 71.

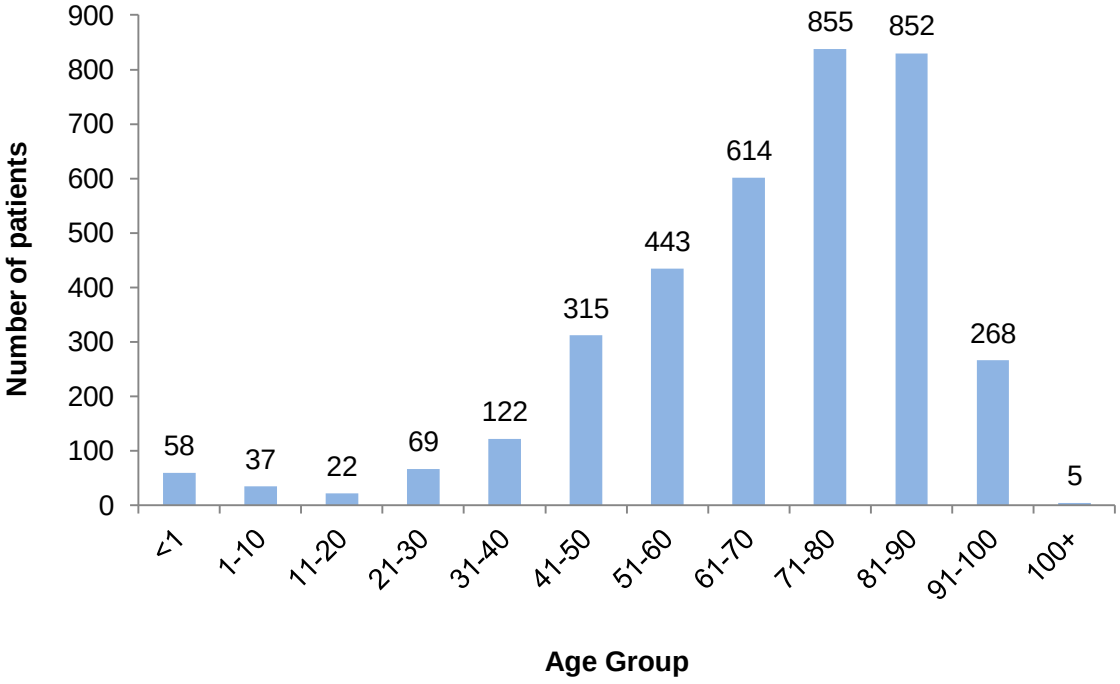

Figure 2 – Age group distribution of presumed cardiac cause patients

3.2. Location Information

Table 2 overleaf shows that cardiac arrests of presumed cardiac cause were more likely to occur in a private setting (79.2%; n=3,848), especially within the home (n=2,619). The street was the most common of the public locations (9.5%; n=365).

Table 2 – Location of cardiac arrests of presumed cardiac cause

Location	n	%
Private (n=3,048)		
Home	2,619	68.1%
Care Home	429	11.1%
Public (n=800)		
Street	365	9.5%
Healthcare Facility (e.g. GP surgery, walk-in centre)	66	1.7%
Work	64	1.7%
Public Transport	63	1.6%
Social Venue (e.g. pub/bar/club, restaurant/café, cinema/theatre)	45	1.2%
Leisure Centre/ Sports Club	44	1.1%
Shop	42	1.1%
Hotel/ Hostel	25	0.6%
Airport	23	0.6%
Place of worship	15	0.4%
School	10	0.3%
Other (e.g. park/woods, prison)	38	1.0%

3.3. Bystander Information

Nearly half (47.7%; n=1,835) of cardiac arrests of a presumed cardiac origin were witnessed (either seen or heard) by a bystander. Bystanders provided CPR prior to the arrival of the LAS in over half (51.8%; n=1,634/3,153[i]) of these cases. Of note, bystander witnessed rates have remained consistent over recent years, but rates of bystander CPR have increased by over 10% during the past five years (see Figure 3).

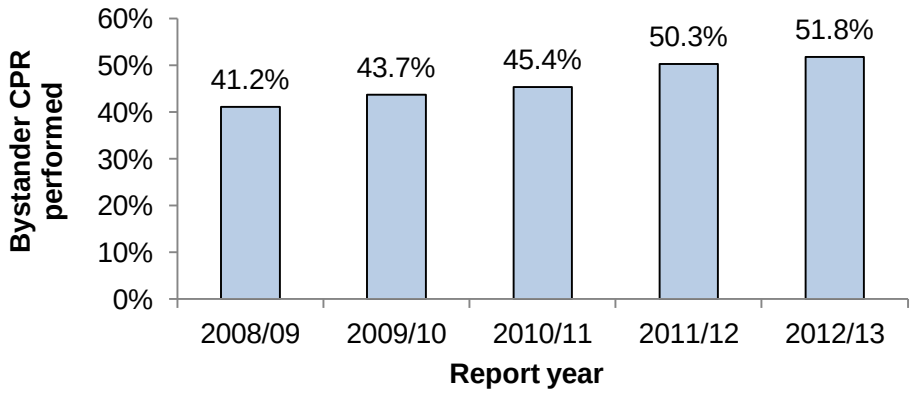

Figure 3 – Rates of bystander CPR for presumed cardiac patients

[i] This year, the denominator for bystander CPR excludes arrests witnessed by LAS crews. To enable comparisons bystander CPR rates have been re-calculated for the previous four years,

3.4. Initial Rhythm

Three quarters (75.6%; n=2,911) of patients had an initial arrest rhythm of Asystole or Pulseless Electrical Activity (PEA), with 23.1% (n=888) having a shockable rhythm of Ventricular Fibrillation or pulseless Ventricular Tachycardia (VF/VT). This has declined from previous years where VF/VT constituted at least 25% of presenting initial rhythms.

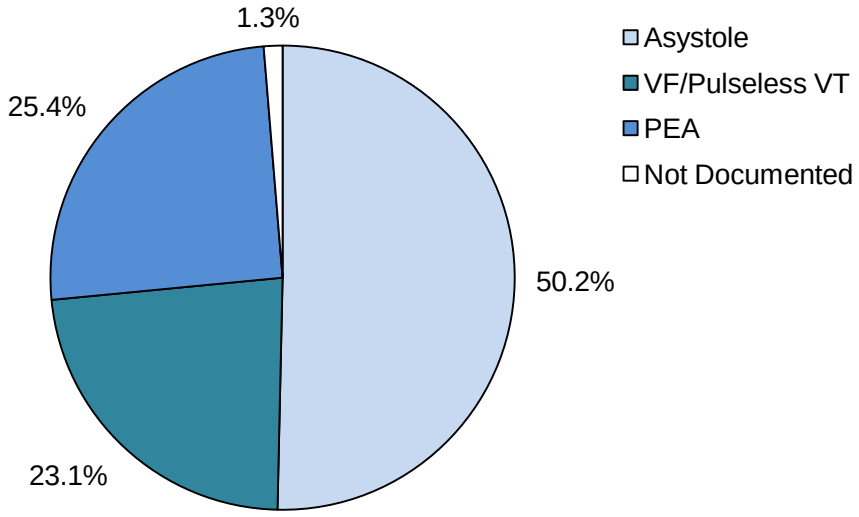

Figure 4 – Initial presenting rhythm of presumed cardiac patients*

* Due to rounding the percentages do not equal 100%.

3.5. LAS CPR and Defibrillation Times

CPR was commenced within 8 minutes from the 999 call and defibrillator shocks initiated for VF/VT patients after an average of 3 minutes of CPR.

Table 3 – Response times for presumed cardiac patients

Time Interval	Median Time (mins)
999 call - LAS CPR commenced~	8
999 call - LAS Defibrillation~ ^	11

~ Excludes cardiac arrests that were witnessed by ambulance crews.
^ Only cases where the initial rhythm presented was shockable (VF/pulseless VT).

3.6. Return of Spontaneous Circulation (ROSC)

ROSC sustained to hospital has increased to 32.2% (n=1,240) this year from 30.1% in 2011/12.

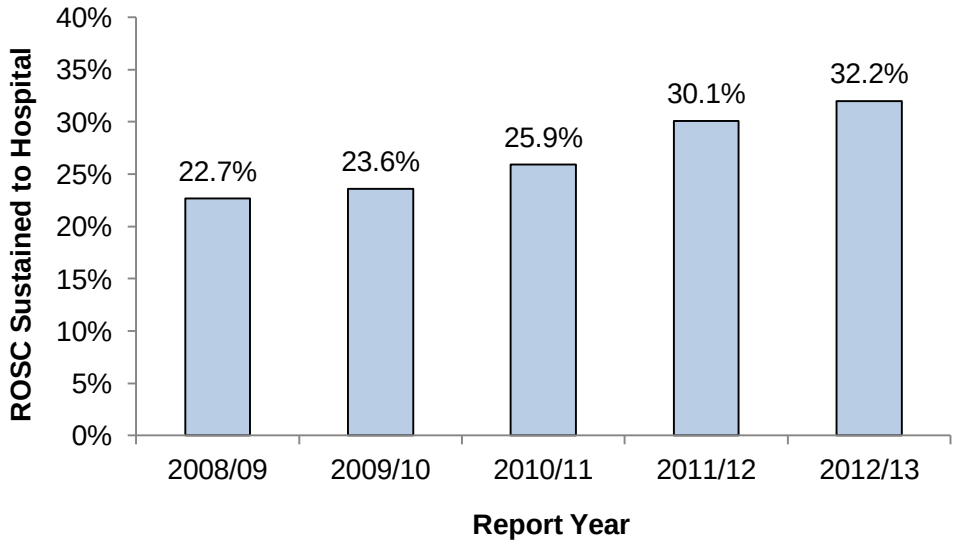

Figure 5 – ROSC sustained to hospital for presumed cardiac patients

3.7. Survival to Discharge from Hospital

Figure 6 below shows that survival from a cardiac arrest of presumed cardiac origin was 9.3% (n=355/3,803) in 2012/13. This is a decrease of 1.6% from 10.9% reported last year.

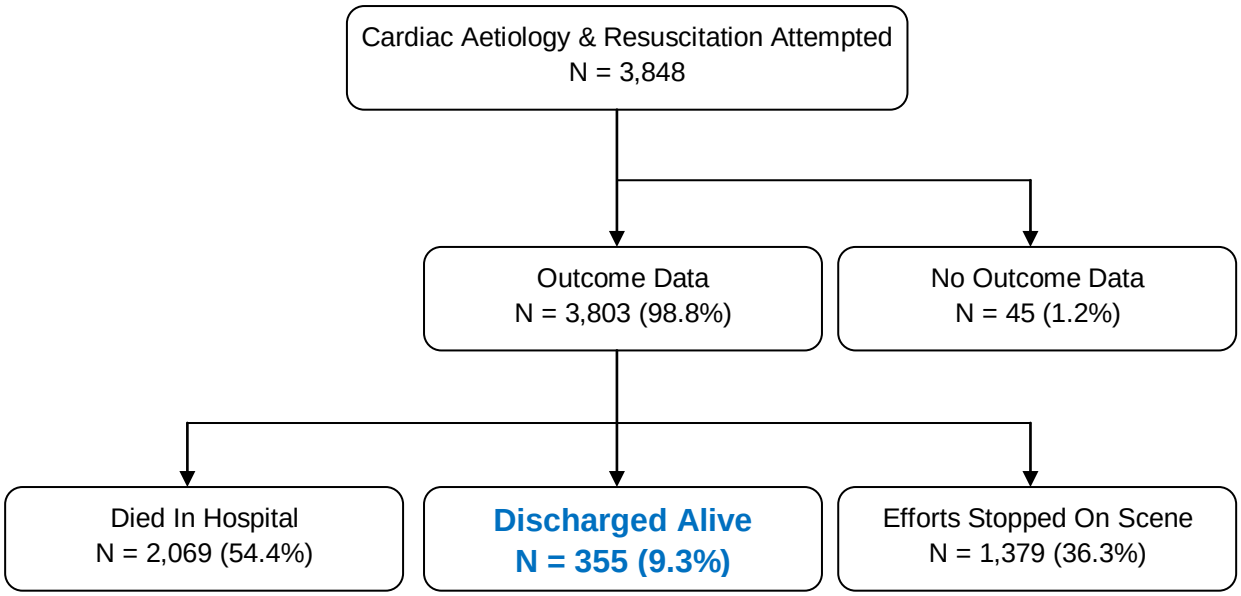

Figure 6 – Survival from cardiac arrests of presumed cardiac origin

Patients who have their arrest witnessed and have a shockable rhythm of VF or pulseless VT have the best chance of survival from a cardiac arrest of cardiac origin[2]. The Utstein calculation is an internationally validated method that enables the survival of this specific subset of patients to be analysed and allows for accurate comparisons between Emergency Medical Services. Figure 7 below shows that survival to discharge within the Utstein group in 2012/13 was 28.4%. Again, this is a decrease from the previous year of 3.3% from 31.7%.

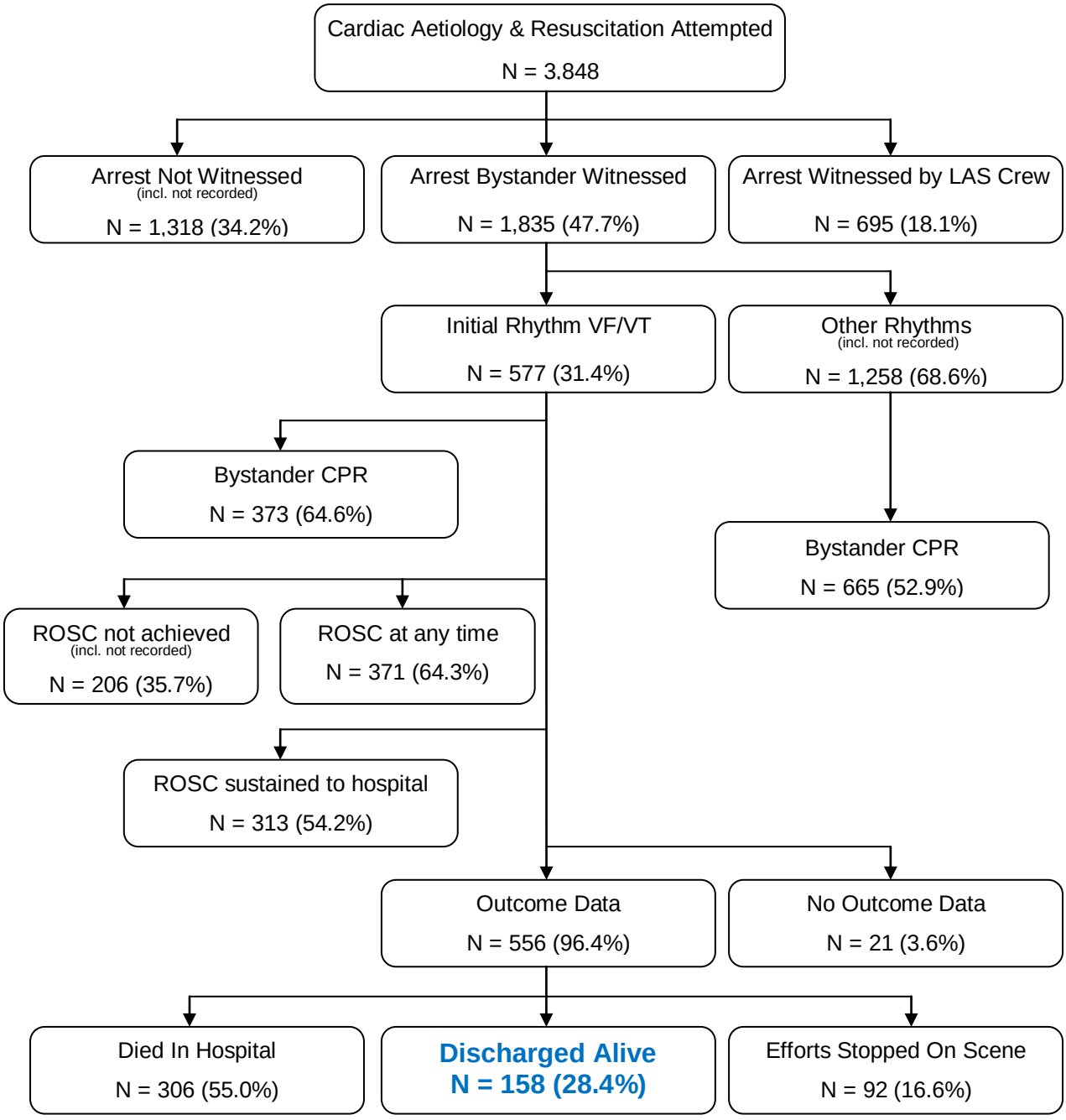

Figure 7 – Utstein survival from cardiac arrests of presumed cardiac origin

All factors contributing to the Utstein calculation have remained consistent with previous years except ROSC sustained to hospital which has increased by 2.4% to 54.2% (n=313) in 2012/13 from 51.8% in 2011/12.

Although survival rates have decreased this year for both presumed cardiac and Utstein patient groups, they still represent an increase on all years preceding 2011/12.

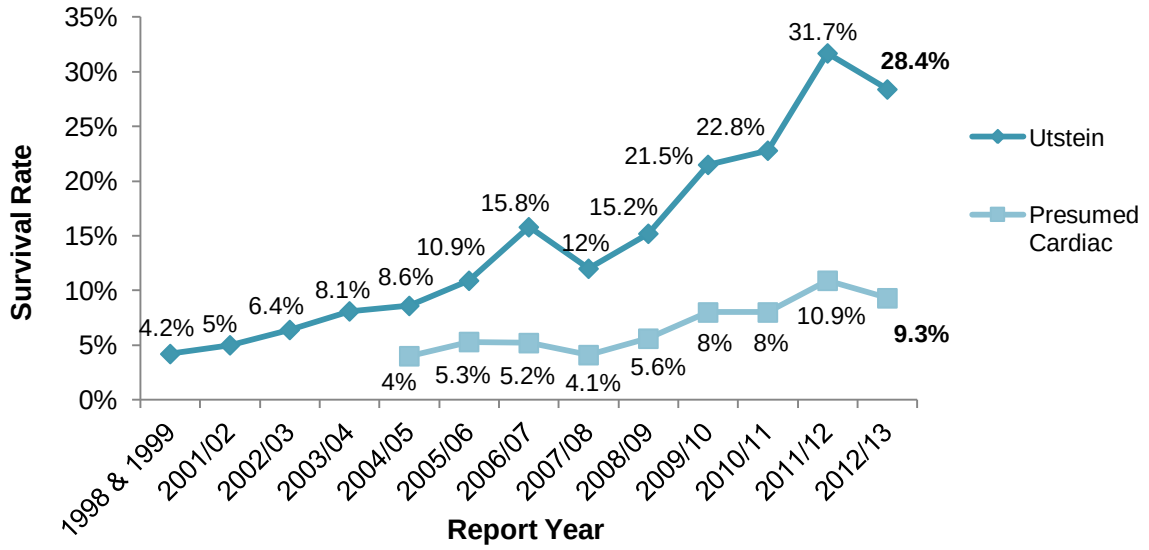

Figure 8 – Presumed cardiac and Utstein survival by year

3.8. Patients conveyed to Heart Attack Centres (HACs)

277 cardiac arrest patients were conveyed directly to one of eight HACs in London as they had regained a stable ROSC and a 12 lead electrocardiogram (ECG) showed ST-elevation Myocardial Infarction (STEMI). The HACs are able to perform angiography and if required primary Percutaneous Coronary Intervention (pPCI) to remove any blockage(s) in the coronary arteries and subsequently insert a stent to hold the artery open to enable blood flow to the heart. Initially this pathway was launched only for patients with a shockable rhythm but this was extended in May 2011 to include all presenting arrest rhythms.

The majority of patients in this group initially presented with shockable arrest rhythms on arrival of ambulance clinicians (72.2%; n=200), with Asystole and PEA recorded in 14.8% (n=41) and 11.9% (n=33) of patients respectively. 1.1% (n=3) of patients had no documented initial rhythm.

ROSC was sustained to hospital for 89.2% of patients (n=247). Overall, where outcome information was available (n=261), the survival to discharge rate was 47.9% (n=125) representing a substantial decrease of more than 15% from the previous year. However, when considering the patients' initial arrest rhythm, survival was much higher in patients with a shockable rhythm (63.6%; n=117/184) than those in Asystole (7.3%; n=3/41) or PEA (12.1% n=4/33). An additional patient with no documented rhythm also survived to discharge.

4. Trauma Patients

Patients suffering a cardiac arrest as a result of trauma accounted for just 5.3% (n=236) of patients where resuscitation was attempted. In general, the cause and extent of injuries sustained by these patients is quite diverse and, as such, outcomes can vary significantly. Please see Appendix 1 for overall statistics for traumatic cardiac arrest patients and Appendix 3 for a detailed breakdown of the type of trauma sustained.

4.1. Demographics and Event Information

Over three quarters of traumatic cardiac arrest patients were male (75.4%; n=178). The average age of patients was 44 years (younger than the presumed cardiac group of patients by an average of 24 years).

Traumatic cardiac arrests were most commonly caused by Road Traffic Collisions (RTC), which accounted for 24.6% of cases (n=58). This was closely followed by cardiac arrests caused by asphyxiation from hanging (24.2%; n=57), fall from height (12.7%; n=30), stabbing (12.7%; n=30), and drowning or submersion (8.9%; n=21). London's Air Ambulance (HEMS) was present on scene alongside LAS crews in 60.6% (n=143) of cases.

Considering unwitnessed arrests were typical of this group of patients (62.3%; n=147), bystander CPR was attempted in over half of cases (55.9%; n=113/202[ii]). The majority of traumatic arrests presented with an initial rhythm of Asystole (61.0%; n=144), whilst the proportion of patients with a shockable rhythm was relatively small (7.6%; n=18).

4.2. ROSC and Survival to Discharge from Hospital

Within the traumatic cardiac arrest group, ROSC was sustained to hospital for 19.1% (n=45/236) of patients. Where survival information was available (n=230), survival to discharge was 5.1% (n=12); an increase of 1.7% from 3.4% in 2011/12. The majority of survivors were from patients who had an initial rhythm of PEA (41.7%; n=5/12), despite asystole being more common in traumatic cardiac arrests (see Appendix 3).

[ii] The denominator for bystander CPR excludes arrests witnessed by LAS crews.

5. ‘Other’ Patients

During 2012/13, 382 patients had a cardiac arrest where the cause was neither cardiac nor trauma related and were therefore considered as a result of ‘other’ causes. Please see Appendix 1 for overall statistics for these patients and Appendix 4 for a detailed breakdown by the various causes of arrest that fall into this category.

5.1. Demographics and Event Information

41.1% (n=157) of patients had a respiratory cause to their arrest, which includes patients who have an obstructed airway or who suffer a respiratory arrest that leads to a cardiac arrest. Over a third of arrests (36.6%; n=140) were due to terminal illness and 16.2% (n=62) occurred following an overdose. The remaining patients’ arrests were a result of suicide (non-overdose and non-trauma related), neonatal resuscitation at birth and stroke (6.0%, n=23).

Witnessed arrests either by a bystander or crew (42.9% and 28.3% respectively) were higher in the ‘other’ group of patients than cardiac or traumatic origins. However, bystander CPR was lower in this group of patients (49.2%; n=158/321[iii]). The majority of patients had an asystolic initial arrest rhythm (61.5%; n=235) or had PEA (29.3%; n=112). Shockable initial arrest rhythms were present in only a small number of patients (3.9%; n=15).

5.2. ROSC and Survival to Discharge from Hospital

Within the ‘other’ group, the ROSC sustained to hospital rate was 29.1% (n=111). The survival to discharge rate for these patients has risen by 1.0% from 5.1% in 2011/12 to 6.1% (n=23/374) this year.

[iii] The denominator for bystander CPR excludes arrests witnessed by LAS crews.

6. Summary figures

A summary of ROSC sustained to hospital and survival rates by patient sub-group are displayed in Table 4 below.

Table 4 – Summary of survival rates

Type	ROSC Sustained to Hospital	Survival Rates*
All Resuscitation Attempted	31.3% (1,396/4,466)	8.8% (n=390/4,407)
Presumed Cardiac	32.2% (1,240/3,848)	9.3% (355/3,803)
Utstein (Presumed cardiac, bystander witnessed & VF/VT)	54.2% (313/577)	28.4% (158/556)
Direct to HAC (Presumed cardiac, ≥18 y/o, ROSC & STEMI)	89.2% (247/277)	47.9% (125/261)
Trauma	19.1% (45/236)	5.1% (12/230)
Other	29.1% (111/382)	6.1% (23/374)

* Denominator excludes cases where patient outcome was unknown

7. Discussion

During 2012/13 the LAS continued to provide a high quality service to our cardiac arrest patients as evidenced by our response times, resuscitative efforts, and survival rates that, although slightly lower than last year, are still amongst the highest in the world.

The majority of factors detailed in this report have remained fairly consistent with previous years, including basic demographics, location of arrests, rates of witnessed arrests and response times. More patients than ever before are receiving CPR by members of the public prior to the arrival of the LAS, with over half of patients receiving bystander CPR. We have seen an increase in the rate of ROSC sustained to hospital across all patient groups, which indicates better pre-hospital management and stabilisation of patients by LAS staff.

It is therefore difficult to determine the exact reasons behind the decreases in survival rates. There has been a decline in cardiac arrest patients presenting in a shockable initial rhythm of VF or pulseless VT (by 1.6% in all resuscitation attempted patients and 3.4% in the presumed cardiac group), which may be a result of changing patient co-morbidities that could have contributed to a decreased likelihood of survival. In addition, a greater number of cardiac arrests were attended this year (454 patients more than 2011/12), which may be reflective of the increasing volume of life threatening calls that ambulance services have experienced in the last year. However, the decreases in survival to discharge rates have been relatively small for the three main patient sub-groups, with less than a 1% decline for all resuscitation attempted patients, less than 2% for the presumed cardiac group and 3% for the Utstein subset. Given the increases in survival rates last year were surprisingly large (with the Utstein survival rate increasing by 8.9% from 22.8 in 2010/11 to 31.7%), and that the rates this year have exceeded all years preceding 2011/12, it is reasonable to conclude that the survival rates we have reported remain in line with an upward trend of recent years.

Survival rates continue to be highest amongst cardiac arrest patients that regain ROSC, present with a STEMI, and are transported directly to a HAC. The survival to discharge rate for these patients was 47.9%; considerably lower than seen in 2011/12 - by over 15%. The reason for this decrease is most likely the extension of the pathway criteria to include all initial arrest rhythms in May 2011. Only a small number of patients with Asystole or PEA (n=28) were conveyed to HACs in 2011/12, whilst in 2012/13, this figure was higher (n=74). When examining survival by initial arrest rhythm it is evident that survival is lower in this non-shockable group. Shockable rhythms have a high survival rate (63.6%), whereas patients with an initial rhythm of Asystole or PEA have significantly lower survival rates (7.3% and 12.1% respectively). It is expected that survival from cardiac arrests with presenting rhythms of Asystole or PEA is lower than shockable rhythms. As such, the HAC pathway for all initial arrest rhythms may still be of benefit but this needs further consideration in light of the disparity between rates of survival.

Trauma and 'other' cause cardiac arrests have seen improvements in survival this year, and are the highest achieved for these patient groups to date. Although these increases in survival rates are small (less than 2%), they are notable for these groups as resuscitation attempts are often extremely challenging and the chance of survival is generally poor. ROSC sustained to hospital rates are also the highest reported for both traumatic arrests and 'other' causes, with the rate for the 'other' cause group comparable to the presumed cardiac group (31.1% and 32.2% respectively).

Data for ROSC sustained to hospital and termination of resuscitation efforts on-scene suggests that we are still conveying nearly a third of patients to hospital with ongoing CPR. It is accepted that this is appropriate for patients with reversible causes (e.g. drug overdose) and complex factors (e.g. pregnancy). However, for patients where reversible causes and complex factors are not present, it is crucial to the success of the resuscitation that the patient is managed on-scene until ROSC is stabilised before making the journey to hospital. A further area of interest that emerges is the number of patients in the end stage of a terminal illness who are resuscitated by crews and taken to hospital (see Appendix 4) as the survival rate of this group of patients is extremely low (1.4%). The LAS have worked hard over recent years to ensure that staff feel able to appropriately terminate resuscitation efforts on scene rather than conveying a non-viable patient to hospital. These are often difficult resuscitations and staff do not always have the appropriate information regarding the patient's condition available to them. It is hoped that Co-ordinate my Care - a national centralised database holding details of patients in palliative care - will enable staff to have greater access to the information required to treat patients appropriately and with dignity at the end stages of a terminal illness.

Education of people in the community has been a key contributor to improvements in cardiac arrest survival rates over recent years. During 2012/13 a total of 17,019 members of the public attended resuscitation training courses. This, along with the continued protocol of giving compression-only CPR instructions over the phone by our Emergency Medical Dispatchers, has helped improve our bystander CPR figures to their highest yet. Additionally, 240 new Public Access Defibrillators (PADs) were fitted in locations throughout London, with another 1,226 people trained in their effective use. Rates of survival when a PAD is used have been consistently high over the years. In 2012/13, a PAD was used successfully in 16 patients to deliver a defibrillator shock and the survival rate for this group was 41.7%.

LAS staff have received cardiac care bulletins throughout the year advising them of changes to protocols, local training and messages reinforcing aspects of cardiac care. The LAS have a package of core skills refresher courses for clinical staff, where both basic and advanced life support principles are reinforced. Staff have also received feedback for every survivor of a cardiac arrest that has survived to leave hospital and, to this end, 1,724 letters have been sent over the last year congratulating frontline staff on their successful resuscitation efforts.

In 2012/13 we have implemented initiatives to improve cardiac care. A cardiac arrest checklist has been introduced as a tool to remind staff of the patient management required both during and after resuscitation efforts. Initial pilots have begun in the use of mechanical CPR which will be explored further in the coming year, as well as trialling the deployment of a clinical supervisor to support staff during critical incidents.

During 2013/14 we hope to begin a phased implementation of the use of therapeutic hypothermia for cardiac arrest patients that have regained ROSC, irrespective of initial arrest rhythm. In patients with shockable rhythms, this has been an accepted method for over 10 years to prevent further damage to brain tissue [3]. Recent research has further suggested the effectiveness of therapeutic hypothermia in patients exhibiting non-shockable rhythms [4]. Initially staff from three LAS Complexes when conveying post-cardiac arrest patients to a specific hospital will use intravenous cold saline solution to cool the patient. We hope that a localised implementation working closely with hospitals will allow the LAS to gain a better understanding of the impact of the treatment on patient outcomes when commenced in a pre-hospital setting and continued at hospital.

The quality of data this year has been extremely high. We have had the best levels of PRF completeness from LAS staff to date, with very little missing information (see Table 1). Due to the continued assistance from all of the hospitals that we collect outcomes from in and around London, we have received nearly 99% of patient outcomes.

Of ongoing concern is the continued decline of data downloaded from defibrillators, which has dropped to less than 2%. The LAS is yet to agree an appropriate method of transmitting data from Lifepak 15 defibrillators either using a cable or wireless technique, meaning the only information that can be downloaded is from equipment that is used less frequently such as the Lifepak 1000 and FR2. In addition, the ability to download data directly from Lifepak 1000's and FR2 data cards is dependent on Team Leader availability at station, which is often limited especially in periods of high operational demand. Whilst defibrillator information remains largely unavailable, we are unable to provide information requested by hospitals to assist ongoing patient care or by coroners during an inquest. Also, without complete defibrillator data we cannot fully assess the quality of our resuscitative practices and enhance staff education and training as needed.

It is disappointing to report a decrease in survival rates after many years of improvements. However, the decreases are relatively small. We have continued to provide a rapid response and intervention to out-of-hospital cardiac arrests and our improving ROSC to hospital figures are indicative of the high quality care our staff provide to patients on-scene. It is hoped that by highlighting areas that could be strengthened and continuing the roll-out of cardiac initiatives we will see further improvements for our patients in future years.

8. References

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9. Acknowledgements

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Appendix 1: Details by aetiology (2012/13)

	Presumed Cardiac	Trauma	Other Causes
Number of patients:	**n=3,848**	**n=236**	**n=382**
Gender:			
Male	62.1% (n=2,388)	75.4% (n=178)	61.8% (n=236)
Female	37.9% (n=1,460)	24.6% (n=58)	37.4% (n=143)
Not Documented	-	-	0.8% (n=3)
Age:			
Average age	68	44	60
Most Common Time:			
Time	08:00-11:59 (23.5%; n=904)	20:00-23:59 (19.9%; n=47)	16:00-19:59 (22.0%; n=84)
Arrest location:			
Private	79.2% (n=3,048)	35.2% (n=83)	88.5% (n=338)
Public	20.8% (n=800)	64.8% (n=153)	11.5% (n=44)
Witnessed:			
Bystander	47.7% (n=1,835)	23.3% (n=55)	42.9% (n=164)
Crew	18.0% (n=695)	14.4% (n=34)	28.3% (n=108)
Unwitnessed	34.1% (n=1,312)	61.9% (n=146)	28.5% (n=109)
Not Documented	0.2% (n=6)	0.4% (n=1)	0.3% (n=1)
Bystander CPR^:			
Yes	51.8% (n=1,634)	55.9% (n=113)	48.2% (n=132)
No	48.2% (n=1,518)	43.6% (n=88)	51.8% (n=142)
Not Documented	0.0% (n=1)	0.5% (n=1)	-
Rhythm:			
Asystole	50.2% (n=1,934)	61.0% (n=144)	61.5% (n=235)
PEA	25.4% (n=977)	29.3% (n=69)	29.4% (n=112)
VF/ Pulseless VT	23.1% (n=888)	7.6% (n=18)	3.9% (n=15)
Not Documented	1.3% (n=49)	2.1% (n=5)	5.2% (n=20)
ROSC sustained to hospital:			
Yes	32.2% (n=1,240)	19.1% (n=45)	29.0% (n=111)
No	67.7% (n=2,604)	79.2% (n=187)	70.7% (n=270)
Not Documented	0.1% (n=4)	1.7% (n=4)	0.3% (n=1)

^ The denominators for bystander CPR exclude arrests witnessed by LAS crews.

Appendix 2: Defibrillators in public places (2012/13)

The table below provides details of the 16 patients on whom a Public Access Defibrillator (PAD) was utilised. An additional 6 cases in which the defibrillator pads were applied to a patient but no shock given, either due to the presence of a non-shockable rhythm or the arrival of ambulance personnel on scene, are not included in these figures.

Public Access Defibrillation	
Patient Demographics	
Number of patients:	16
Average age:	68
Age range:	52-84
Gender:	Male (75%); Female (25%)
Event Information	
Bystander witnessed:	87.5% (14/16)
Bystander CPR:	100% (16/16)
Average number of PAD shocks:	2
Range of PAD shocks:	1-4
ROSC sustained to hospital:	50.0% (8/16)
Survival to discharge*:	41.7% (5/12)

* Four patients excluded from the denominator as outcome could not be obtained.

Appendix 3: Traumatic cardiac arrest patients (2012/13)

Trauma	Number of Patients	Initial Rhythm				ROSC Sustained to Hospital %	Survival to discharge * %
		Asystole	VF/ VT	PEA	Not Documented		
RTC	58	37.9% (22/58)	12.1% (7/58)	48.3% (28/58)	1.7% (1/58)	10.3% (6/58)	5.5% (3/55)
Hanging	57	87.7% (50/57)	-	10.5% (6/57)	1.8% (1/57)	28.1% (16/57)	1.8% (1/57)
Fall from height	30	66.7% (20/30)	10.0% (3/30)	23.3% (7/30)	-	3.3% (1/30)	0% (0/30)
Stabbing	30	50.0% (15/30)	10.0% (3/30)	40.0% (12/30)	-	13.3% (4/30)	3.3% (1/30)
Drowning / Submersion	21	71.4% (15/21)	9.5% (2/21)	14.3% (3/21)	4.8% (1/21)	33.3% (7/21)	25.0% (5/20)
Fall down stairs	11	54.5% (6/11)	-	45.5% (5/11)	-	45.5% (5/11)	0% (0/10)
Assault	9	77.8% (7/9)	11.1% (1/9)	-	11.1% (1/9)	33.3% (3/9)	0% (0/8)
Burns / Smoke inhalation	5	80% (4/5)	-	-	20% (1/5)	0% (0/5)	20.0% (1/5)
Person hit by train	4	25% (1/4)	-	75.0% (3/4)	-	0% (0/4)	0% (0/4)
Laceration / Bleeding	3	33.3% (1/3)	-	66.7% (2/3)	-	66.7% (2/3)	33.3% (1/3)
Shooting	2	50% (1/2)	-	50.0% (1/2)	-	0% (0/2)	0% (0/2)
Electrocution	2	-	100% (2/2)	-	-	50.0% (1/2)	0% (0/2)
Falling object	2	50.0% (1/2)	-	50.0% (1/2)	-	0% (0/2)	0% (0/2)
Other ^	2	50.0% (1/2)	-	50.0% (1/2)	-	0% (0/2)	0% (0/2)

* Survival figures are based on available outcomes; instances where the outcome is unknown are removed from the denominator.

^ The 'other' category includes one case of head trauma of an unknown cause, and another of an industrial incident involving a patient being crushed.

Appendix 4: Cardiac arrest patients with 'other' causes (2012/13)

Cause	Number of Patients	Initial Rhythm				ROSC Sustained to Hospital %	Survival to discharge * %
		Asystole	VF/ VT	PEA	Not Documented		
Respiratory	157	56.1% (88/157)	2.5% (4/157)	39.5% (62/157)	1.9% (3/157)	39.5% (62/157)	7.1% (11/156)
Terminal Illness	140	66.4% (93/140)	3.6% (5/140)	29.3% (41/140)	0.7% (1/140)	17.1% (24/140)	1.4% (2/140)
Overdose	62	75.8% (47/62)	9.7% (6/62)	12.9% (8/62)	1.6% (1/62)	30.6% (19/62)	8.8% (5/57)
Neonatal	17	5.9% (1/17)	-	5.9% (1/17)	88.2% (15/17)	23.5% (4/17)	33.3% (5/15)
Suicide ^	5	100.0% (5/5)	-	-	-	40.0% (2/5)	20.0% (1/5)
CVA / Stroke	1	100.0% (1/1)	-	-	-	0.0% (0/1)	0.0% (0/1)

* Survival figures are based on available outcomes; instances where the outcome is unknown are removed from the denominator.

^ The 'suicide' aetiology is only used for cases which cannot be placed in an existing category, i.e trauma or overdose.

Appendix 5: Cardiac arrest patients under 35 years old (2012/13)*

* All resuscitation attempted patients

	Under 1	1-8	9-18	19-35
Number of patients:	n=76	n=44	n=33	n=196
Gender:				
Male	60.5% (n=46)	47.7% (n=21)	69.7% (n=23)	69.4% (n=136)
Female	35.5% (n=27)	52.3% (n=23)	30.3% (n=10)	30.6% (n=60)
Not Documented	4.0% (n=3)	-	-	-
Potential Cause:				
Presumed Cardiac	76.3% (n=58)	72.8% (n=32)	60.6% (n=20)	61.2% (n=120)
Trauma	1.3% (n=1)	13.6% (n=6)	21.2% (n=7)	22.0% (n=43)
Other	22.4% (n=17)	13.6% (n=6)	18.2% (n=6)	16.8% (n=33)
Race^:				
White	35.5% (n=27)	27.3% (n=12)	30.3% (n=10)	52.6% (n=103)
Mixed	-	4.6% (n=2)	-	1.0% (n=2)
Asian	6.6% (n=5)	13.6% (n=6)	15.2% (n=5)	6.6% (n=13)
Black	21.0% (n=16)	15.9% (n=7)	24.2% (n=8)	9.7% (n=19)
Other Ethnic Group	5.3% (n=4)	13.6% (n=6)	9.1% (n=3)	4.1% (n=8)
Unable to Obtain	25.0% (n=19)	25.0% (n=11)	18.2% (n=6)	21.9% (n=43)
Not Documented	6.6% (n=5)	-	3.0% (n=1)	4.1% (n=8)
Arrest location:				
Private	90.8% (n=69)	79.5% (n=35)	66.7% (n=22)	59.2% (n=116)
Public	9.2% (n=7)	20.5% (n=9)	33.3% (n=11)	40.8% (n=80)
Witnessed:				
Bystander	22.4% (n=17)	34.1% (n=15)	51.5% (n=17)	32.7% (n=64)
Crew	18.4% (n=14)	2.3% (n=1)	9.1% (n=3)	14.8% (n=29)
Unwitnessed	59.2% (n=45)	63.6% (n=28)	39.4% (n=13)	52.0% (n=102)
Not Documented	-	-	-	0.5% (n=1)
Bystander CPR:				
Yes	58.1% (n=36/62)	55.8% (n=24/43)	53.3% (n=16/30)	62.9% (n=105/167)
No	41.9% (n=26/62)	44.2% (n=19/43)	46.7% (n=14/30)	36.5% (n=61/167)
Not Documented	-	-	-	0.6% (n=1/167)
Rhythm:				
Asystole	64.5% (n=49)	84.1% (n=37)	63.6% (n=21)	62.2% (n=122)
PEA	9.2% (n=7)	13.6% (n=6)	18.2% (n=6)	18.4% (n=36)
VF/ Pulseless VT	-	-	12.1% (n=4)	18.4% (n=36)
Not Documented	26.3% (n=20)	2.3% (n=1)	6.1% (n=2)	1.0% (n=2)
ROSC sustained to hospital:				
Yes	14.5% (n=11)	9.1% (n=4)	33.3% (n=11)	27.6% (n=54)
No	85.5% (n=65)	90.9% (n=40)	66.7% (n=22)	70.4% (n=138)
Not Documented	-	-	-	2.0% (n=4)
Survived to discharge~:				
Yes	11.0% (n=8/73)	7.0% (n=3/43)	15.2% (n=5/33)	15.5% (n=30/193)
No	89.0% (n=65/73)	93.0% (n=40/43)	84.8% (n=28/33)	84.5% (n=163/193)

^ Due to the critical condition of cardiac arrest patients, definitive race information is not always possible to obtain and therefore this data should be viewed with caution.

~ Survival figures are based on available outcomes; instances where the outcome is unknown are removed from the denominator.