



SA Ambulance Service

Cardiac Arrest Registry Summary Report

2016-2017



Foreword

As a precursor to a more comprehensive cardiac arrest report, this report is intended to provide a basic summary of the information SAAS has collated regarding the out of hospital cardiac arrest (OHCA) events attended by SA Ambulance Service (SAAS) during the period 1 July 2016 to 30 June 2017. Whilst there is a “historical” element to this data set, it represents our first summary and will provide the benchmark for future reports.

It is hoped that the information in this summary will assist in directing energy and resources to those areas that will have the most positive impact on the chances of surviving an OHCA in South Australia. Many staff (too many to name here) have contributed in a variety of ways to the development of the SAAS Cardiac Arrest Registry (SAAS-CAR). It is due to their hard work and commitment, navigating the treacherous path of developing a data base that has integrity and is useable, that we can publish this summary report. The absence of an electronic patient clinical report (PCR) has hampered these efforts beyond description however their perseverance has produced an exceptional result and I thank them. We have developed a standalone modified Utstein template based on Perkins G, Jacobs I. et al., (2015) for 2016-17 data that is included as part of this summary report.

I look forward to this report paving the way to truly measuring and improving our performance in the treatment of cardiac arrest patients in the South Australian community.

Keith Driscoll

Executive Director

Clinical Performance & Patient Safety

Introduction

Out-of-hospital cardiac arrest (OHCA) is a significant public health issue in Australia with a recorded 2038 occurring in South Australia (SA) alone in the 2016 – 2017 financial year period. To put that figure into perspective, our Paramedics attend almost 6 South Australians per day, who have suffered an OHCA event. Improving survival from OHCA is at the forefront of SA Ambulance Service's (SAAS) agenda providing emergency and non-emergency services over the entire state of SA equating to some 984,377 km².

Measuring OHCA performance worldwide has gained considerable attention, however this is nothing new. Initially developed in 1991, the Utstein guidelines are a uniform method of reporting outcomes from OHCA registries (Perkins G, Jacobs I. et al., 2015). However, not all out of hospital providers, such as ambulance services, have established OHCA registries. This was emphasised by the Global Resuscitation Alliance (GRA), an initiative arising from Seattle and King County in the United States of America where they reportedly have one of the best survival rates in the world (2017). One improvement strategy is to develop a cardiac arrest registry and SAAS has done just that and the SA Ambulance Service Cardiac Arrest Registry (SAAS-CAR) was recently included as one of 27 international case reports in the GRA's 'Acting on the call' updated report (Eisenberg, M, Lippert, FK, et al., 2018).

Developing the SA Ambulance Service Cardiac Arrest Registry (SAAS-CAR)

The SAAS-CAR contains information on all OHCA events attended by SAAS throughout the state of SA. OHCA data is captured from patient clinical records (paper based) and merged with ambulance dispatch operational databases, (South Australian Computer Aided Dispatch).

Dating back to July 2009, the registry contains all recorded OHCA events (including those where resuscitation was and was not initiated) totalling 14,682 cases as at the 1 July 2017. SAAS provides reports containing survived event data (return of spontaneous circulation (ROSC)) to the Council of Ambulance Authorities Inc., (CAA) and SA Health as part of a suite of Key Performance Indicators.

The SAAS-CAR also captures survival data (survival to hospital discharge) utilising SA Health's Enterprise Patient Administration System (EPAS) and Open Architecture Clinical Information System (OACIS). The SAAS-CAR underwent a significant overhaul in 2016 to ensure alignment with the Australian and New Zealand Resuscitation Consortium (Aus-ROC) Epistry (Aus-ROC 2013) and plans to obtain linkage to the Registry of Births, Deaths and Marriages in SA and to report on the Quality of Life of our survivors.

SA Department for Health and Wellbeing Human Research Ethics Committee approved the SAAS-CAR for epidemiological research and provision of de-identified data to the Aus-ROC Epistry (HREC-14-SAH-120).

Acknowledgements: SA Ambulance Service, SA Health Prevention and Population Health branch, South Australian Department for Health and Wellbeing, Dr Leah Couzner (Flinders University) and Mr Paul Hakendorf (Southern Adelaide Health Local Network (SAHLN)).

Methodology

This summary report is designed as a standalone industry style report, benchmarking survival from OHCA in meaningful terms, whilst providing essential incidence rates, cause of cardiac arrest and especially the Utstein recommended Patient Outcomes Reporting Population (Perkins, Jacobs et al. 2015). In particular, SAAS report on two specific outcomes: **all treated cardiac arrests** and **The Utstein Comparator Group** (all ages and causes of OHCA that were witnessed by a bystander and the first arrest rhythm seen by SAAS was "shockable" *Ventricular Fibrillation (VF) / pulseless Ventricular Tachycardia (pVT)*). The latter, the Utstein Comparator Group, is benchmarked here against 5 selected ambulance services producing annual reports in the same time period.

Statistical analysis

Data preparation and analysis were done using IBM SPSS Version 24 software. Microsoft Excel 2010 was used to collate tables and build graphs to visualise the data. The chi-square test was done between categorical variables to check for statistical associations. The χ^2 statistic, p-values and 95% CI (confidence interval) were also presented.

Crude incidence rates and age-standardised incidence rates in this report were calculated using the Australian Bureau of Statistics (ABS) South Australian population for 2016 and were expressed as per 100,000 population. Age-standardised incidence rates were standardised to the 2001 Australia Standard population.

There were missing data across a range of variables, especially those where resuscitation was not performed (Refer table 1).

Table 1: Number and proportion of missing data - SA Ambulance Service –Cardiac Arrest Registry, 2016 - 2017

SAAS-CAR data item	Resuscitation Attempted			
	YES		NO	
	number	percent	number	percent
Patient age	4	0.5	51	4.3
Patient sex	0	0.0	0	0.0
Arrest location	0	0.0	2	0.2
Witnessed status	3	0.3	64	5.4
Bystander CPR	5	0.6	1	0.1
First monitored arrest rhythm	8	0.9	11	0.9
Response time	0	0.0	0	0.0
Scene Outcome	0	0.0	0	0.0
Survived event	0	0.0	0	0.0
Hospital discharge status	4	1.3	0	0.0

Survived event = ROSC on arrival at hospital

South Australian population profileⁱ

- > At 31 December 2016, South Australia had an estimated resident population of 1,716,966 million people (49.3% male and 50.7% female). Aboriginal people made up 2% of the SA population, an increase of five per cent since 2011 to a total of 34,184 people.
- > The median age of people in SA was 40 years, which is the second highest median age in Australia, behind Tasmania.
- > Children aged 0 - 14 years made up 17.5% of the population and people aged 65 years and over made up 18.3% of the population.

ⁱAustralian Bureau of Statistics, 2016 Census

Out of hospital cardiac arrest



SAAS recorded **289,225 INCIDENTS** for 2017



SAAS provided **EMERGENCY & NON-EMERGENCY** services throughout South Australia covering **984,377km²**



POPULATION of SA 2017 **1,716,966** people



Our metropolitan median **RESPONSE TIME** was **7.9** mins & rural **8.6** mins



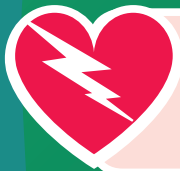
SAAS attended **2038 OHCAs** & **PERFORMED RESUSCITATION** on **863** patients



The **MEDIAN AGE** of attended patients was **68** years, **65%** Male **35%** Female



63% of treated patients had **RECEIVED BYSTANDER CPR**



18 patients had a "**SHOCK DELIVERED**" before SAAS arrival and **72%** of those **SURVIVED**



Where were the Patients resuscitated by SAAS?

75% of patients resuscitated by SAAS were at HOME	18% were in a PUBLIC PLACE	6% RESIDENTIAL CARE	1% in a health or MEDICAL FACILITY
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The Utstein Patient Outcomes Reporting Population
Of the **863** patients resuscitated by SAAS, **10.5%** were discharged from hospital. Of those **863** patients whose cardiac arrest was witnessed by a bystander and in a "shockable" rhythm, **33.3%** were discharged from hospital.

Incidence

Age and sex distribution – total out of hospital cardiac arrest events

SAAS attended a total of 2038 OHCA patients with a median age of 68 years (with interquartile range of 54 to 81 years). There was a different distribution by age and sex for OHCA (p-value <0.0001). There were 55 cases missing for age and therefore excluded.

- > Of the total SAAS attended OHCA patients, 65% were male and 35% were female.
- > Males aged 61 to 70 years comprised the highest proportion (22%) of SAAS attended OHCA for males.
- > Females aged 81 to 90 years comprised the highest proportion (24%) of SAAS attended OHCA for females.

Age and sex distribution – attempted resuscitation events

Out of a total of 2038 OHCA patients, SAAS attempted resuscitation on 863 people with a median age of 66 years (interquartile range (IQR) of 51 to 78 years). Four cases were missing for age and therefore excluded.

- > Of the total SAAS attended OHCA events for which attempted resuscitation was performed, 66% were male and 34% were female.
- > For males, those aged 61 to 70 years were the highest proportion (22%) of OHCA events for which attempted resuscitation was performed.
- > For females, those aged 81 to 90 years were the highest proportion (19%) of OHCA events for which attempted resuscitation was performed.
- > There was a significant association between age groups and resuscitation attempts for males and females (p-value<0.0001).

Crude incidence rates for OHCA

The crude incidence rate ranged from 106.7 per 100,000 population (95% CI= 95.9 to 117.4) in the Southern Adelaide Local Health Network (SAHLN) area of residence to 128.0 per 100,000 population (95% CI=117.5 to 138.5) for people who resided in the Central Adelaide Local Health Network (CAHLN) geographic area. Fifty-five cases were missing for age and therefore excluded. Two cases attended by SAAS were interstate and therefore excluded.

- > Males had the highest crude incidence rate of OHCA events for all Local Health Network (LHN) areas for all OHCA attended events.

Age-standardised incidence rates for OHCA events

Age-standardised incidence rates of OHCA per 100,000 were standardised to the 2001 Australian Standard population. Two interstate events were attended by SAAS and fifty-five cases were of unknown age and therefore excluded.

- > The Northern Adelaide Local Health Network (NAHLN) had the highest age standardised incidence rate of OHCA and males had the highest age standardised incidence rate for all LHN areas for all OHCA attended events.



Key Findings

In 2016-2017:

- > SAAS recorded a total of 289,225 incidents, of those 138,420 (48%) were considered emergency responses, "requiring lights and sirens".
- > Median response times (excluding those witnessed by SAAS) were 8.1 minutes (IQR 6.0 – 11.4) for all of SA attended OHCA, 7.9 minutes (IQR 6.1 – 10.2) within Metropolitan Adelaide and 8.6 minutes (IQR 5.8 – 15.4) in country or rural areas.
- > Of the emergency responses, a total of 2038 (1.5%) were for OHCA. That's almost 6 people per day being attended by SAAS for OHCA.
- > Of the total SAAS attended OHCA, 65% were male and 35% were female.
- > Of the 2038 OHCA attended, 2015 (99%) were adults (age ≥ 16), 23 (1%) were paediatrics (age ≤ 15)).
- > Of the total SAAS attended OHCA, SAAS performed cardiopulmonary resuscitation on 863 people (42%).
- > SAAS was more than twice as likely to perform resuscitation on a paediatric, compared to an adult (87% Vs 42%), however paediatrics were less than half as likely to survive (5% Vs 11%).
- > Of the total SAAS attended OHCA, resuscitation was not performed, or ceased shortly thereafter, on 1175 (58%) people. The most likely reason not to perform resuscitation was the person being obviously deceased (n=1116 (95%). In 22 people (1.9%), resuscitation was ceased after locating an advanced care directive (ACD) and in 37 people (3.1%) resuscitation was not initiated when the OHCA was witnessed by SAAS paramedics (likely due ACD located, family expressed wishes or medical futility).
- > Of those people where SAAS performed resuscitation (n= 863), 75% were at home, 18% in a public place, 6% in residential care and less than 1% were in a health or medical facility. Of those resuscitated (n=863), 45% were bystander witnessed and 63% received resuscitation from a bystander.
- > Of the 863 adults aged 16 years and older where SAAS performed resuscitation, the most likely cause of the arrest was listed by paramedics as medical (which includes presumed cardiac cause) (79%). Other causes included respiratory (6%), asphyxia or hanging (6%), overdose poisoning (4%), trauma (4%) and drowning (1%).
- > Of the 20 children aged 15 years and younger where SAAS performed resuscitation, the most likely cause of the arrest was listed by paramedics as medical (which includes presumed cardiac cause) (45%). Other causes included asphyxia or hanging (35%), trauma (15%) and drowning (5%). There were no causes listed as overdose, poisoning or respiratory.
- > A public accessed automatic external defibrillator (AED) was applied to 21 people prior to SAAS arrival, 18 of those had a "shock delivered" with 13 (72%) surviving to hospital discharge, which is an exceptional outcome for our patients.

In 2016-17, SAAS recorded a survival to hospital discharge rate in the **all SAAS treated arrest** group (all ages and causes OHCA, (includes SAAS witnessed) of 10.5%.

In 2016-17, SAAS recorded a survival to hospital discharge rate in the **Utstein Comparator Group** (all ages and causes OHCA - bystander witnessed (excludes SAAS witnessed) - shockable rhythm (VF / pVT)) of 33.3%:

- > Higher than London Ambulance Service and St John Ambulance New Zealand (30%)
- > Lower than St John Ambulance Western Australia (35%) and Ambulance Victoria (37%)
- > The highest survival to hospital discharge was King County (Seattle) at 56%

SA Ambulance Service (SAAS) out of hospital cardiac arrest (OHCA) summary 2016-17 based on the modified Utstein template¹

Population & Area served by SAAS²		SAAS ³ is the principal provider of ambulance services in South Australia comprising of out-of-hospital emergency, non-emergency medical care and MedSTAR Medical Retrieval, emergency and major events management, rescue services in collaboration with other emergency services e.g. water rescue, cliff rescue & confined space rescue.				
1,716,966 persons						
984,377 km ²						
All OHCA's attended		Response Time all OHCA's Excl. SAAS witnessed: n=1877 Median (IQR)		All OHCA's attended 8.1 mins (6.0 – 11.4)		
n=2038				Metropolitan 7.9 mins (6.1 - 10.2)		
				Country / Rural 8.6 mins (5.8 – 15.4)		
Resuscitation Attempted		Resuscitation Not Attempted*				
n=863 (42.3%)		All Cases n=1175		Non Initiation n=37 (3.1%)		
VF n=214		Obviously Deceased n=1116 (95%)		Premature Cessation n=22 (1.9%)		
pVT n=22						
PEA n=215						
ASYS n=395						
Unknown Shockable n=3						
Unknown Non-Shockable n=6						
Unknown n=8						
Total Shockable n=239 (27.7%)						
Total Non-Shockable n=616 (71.4%)						
Core Patient Elements: Resuscitation Attempted						
Location		Home n= 651 (75.4%)		Public n= 152 (17.6%)		
		Residential Care n= 52 (6.0%)		Health Medical n= 8 (0.9%)		
		Unknown n= 0				
Patient		Age: Years		Adult - Paediatric		
		Median (IQR) Unknown		≥ 16 years ≤ 15 years		
		66 (51 - 78) n= 4 (0.5%)		n= 843 (97.7%) n= 20 (2.3%)		
				Male n= 574 (66.5%)		
				Female n= 289 (33.5%)		
				Unknown n= 0		
Witnessed		Bystander n= 390 (45.2%)		SAAS n= 119 (13.8%)		
		Unwitnessed n= 351 (40.7%)		Unknown n= 3 (0.3%)		
Bystander Response		Bystander CPR (bCPR)			Bystander AED **	
		No bCPR n= 314 (36.4%)		bCPR n= 544 (63.0%)		
		Unknown n= 5 (0.6%)		Pads Applied n= 21		
				Shock delivered n= 18		
Aetiology		Medical / Presumed Cardiac n= 675 (78.2%)		Trauma n= 37 (4.3%)		
		Overdose / Poisoning n= 37 (4.3%)		Drowning n= 5 (0.6%)		
		Electrocution n= 0		Asphyxia: Incl. Hanging n= 58 (6.7%)		
				Respiratory n= 51 (5.9%)		
				Unknown n= 0		

Patient Outcomes Reporting Population		Any ROSC		Survived Event		Survived to Discharge	
		Yes Unknown		Yes Unknown		Yes Unknown	
SAAS Witnessed Included		All SAAS Treated Arrests n= 863		n= 327 (37.9%) n= 0		n= 228 (26.4%) n= 0	
SAAS Witnessed Excluded		Shockable bystander witnessed: The Utstein Comparator Group n= 150		n= 98 (65.3%) n= 0		n= 83 (55.3%) n= 0	
		Shockable bystander CPR n= 161		100 (62.1%) n= 0		n= 80 (49.7%) n= 0	
		Non-shockable witnessed n=236		n= 76 (32.2%) n= 0		n= 45 (19.1%) n= 0	
						n= 46 (28.6%) n= 1 (0.6%)	
						n= 6 (2.5%) n= 1 (0.4%)	

Benchmarking the Utstein Comparator Group¹		Survived Event		Survived to discharge	
Shockable bystander witnessed. Excludes Emergency Medical Service witnessed		SA Ambulance Service ³		55%	
		King Country (Seattle) ⁴		n/a	
		Ambulance Victoria ⁵		58%	
		London Ambulance Service NHS ⁶		55%	
		St John New Zealand ⁷		50%	
		St John Western Australia ⁸		43%	
				35%	

Legend: *Resuscitation Not Attempted: Non Initiation (OHCA witnessed by SAAS however resuscitation not commenced in respecting Advance Care Directive (ACD) &/or family's' expressed wishes), Premature Resuscitation: Resuscitation attempts interrupted early (< 5 mins without invasive treatments) due to evidence of ACD &/or family's' expressed wishes, Obviously Dead: ACD &/or family's' expressed wishes, Obvious signs of death (Rigormortis, Morbid lividity) or Injuries incompatible with life (Decapitation, Transection, Decomposition, Overwhelming incineration/trauma). **AED (Automated External Defibrillator) does not include AED onsite when not confirmed OHCA, may have missed cases as AED register under development and does not include OHCA's with Return of Spontaneous Circulation (ROSC) prior to SAAS arrival (reported separately). Rhythm first seen by SAAS: ASYS (Asystole), Pulseless Electrical Activity (PEA), pulseless Ventricular Tachycardia (pVT), Ventricular Fibrillation (VF); Non-Shockable rhythm: ASYS or PEA; Shockable rhythm: pVT or VF; Survived Event: ROSC on arrival at receiving hospital; Survived to discharge: Alive at hospital discharge.

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Abbreviations and Acronyms

AED	Automated External Defibrillator
ASIR	Age Standardised Incidence Rate
Aus-ROC	Australian Resuscitation Outcomes Consortium
CI	Confidence Interval
GRA	Global Resuscitation Alliance
IQR	Interquartile range
OHCA	Out of Hospital Cardiac Arrest
ROSC	Return of Spontaneous Resuscitation
SA	South Australia
SAAS	SA Ambulance Service
SAAS-CAR	SA Ambulance Service Cardiac Arrest Registry

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