



St John

Out-of-Hospital Cardiac Arrest

Report

2020





Acknowledgement

St John WA acknowledges the Aboriginal people of the many traditional lands and languages groups across Western Australia as the traditional custodians of this land. We pay our respects to their ancestors and Elders, past, present and emerging.

St John WA is committed to honouring the unique cultural and spiritual relationships to the land, sea and waterways and the rich continuing contribution Aboriginal and Torres Strait Islander peoples make to our society.



Introduction

We present our out-of-hospital cardiac arrest (OHCA) report for the calendar year 2020 that is made possible by the close collaboration and partnership with the team at Pre-hospital, Resuscitation and Emergency Care Research Unit (PRECRU) based at Curtin University, Perth. The Western Australia (WA) cardiac arrest database is managed and maintained at PRECRU and continues to inform and influence practice.

As with many other healthcare and ambulance systems, 2020 proved to be a year of coping with new challenges and learning to adapt to revised methods of delivering ambulance care. At the time of writing, Western Australia has largely escaped widespread exposure to Covid-19. Intermittent periods of restriction, lockdown and community uncertainty were nonetheless a reality, and this had some impact on service delivery at times. Despite these circumstances, we observed that the effect on patient survival and other important variables such as Bystander CPR rates and AED use remained fairly robust in comparison to other jurisdictions that reported a contrasting picture (1).

Previously, we have reported on survival to hospital discharge, however in 2020 we are reporting on the number of people who survived to 30 days which is argued to be a reliable system or jurisdictional comparator (2). In 2020, of the 1086 cases where resuscitation was commenced, 128 people survived to 30 days.

We remain mindful of those who did not survive OHCA in WA and we pause to acknowledge and offer our respects to them, their families, and communities. We resolve to continue in our efforts in developing and making improvements to our systems and practice.



Acknowledgements

A/Prof Paul Bailey
(Medical Director)

Prof Judith Finn
(Director PRECRU)

Dr Stephen Ball
(Dep. Director PRECRU)

Dan Rose
(Clinical Services)

Michelle Fyfe APM
(CEO St John WA)

Rudi Brits
(Clinical Services)

Prof Ian Jacobs **(late)**

The PRECRU team

The Clinical Services team

The State Operations team

All our valuable volunteers
and career staff alike



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Abbreviations

AED	Automated External Defibrillator	PEA	Pulseless Electrical Activity
AHPRA	Australian Health Practitioner Regulation Agency	PCI	Percutaneous Coronary Intervention
AM	Area Manager	PRECRU	Pre-hospital, Resuscitation and Emergency Care Research Unit (Curtin Uni)
ALS	Advanced Life Support	ROSC	Return of Spontaneous Circulation
BLS	Basic Life Support	SIDS	Sudden Infant Death Syndrome
CAD	Computer Aided Dispatch	SJWA	St John Western Australia
CPR	Cardio-Pulmonary Resuscitation	SJNZ	St John New Zealand
ED	Emergency Department	STHD	Survival to Hospital Discharge
EMS	Emergency Medical Services	VACAR	Victorian Ambulance Cardiac Arrest Registry
EMT	Emergency Medical Technician	VF	Ventricular Fibrillation (shockable rhythm)
ePCR	Electronic Patient Care Record	VT	Ventricular Tachycardia (shockable rhythm when pulseless)
HREC	Human Research Ethics Committee	WA	Western Australia
ILCOR	International Liaison Committee on Resuscitation		
MPDS	Medical Priority Dispatch System		
OHCA	Out of Hospital Cardiac Arrest		

Definitions

Adults

Patients aged 16 years or greater, or where the age is missing/unknown (in the absence of the patient being described as a child).

Asystole

Absence of any cardiac activity.

Defibrillation

Providing an electrical shock to a patient in a shockable heart rhythm.

EMS attempted resuscitation

Cases where paramedics or volunteer officers attempted to revive a patient in cardiac arrest using CPR and/or defibrillation, as well as any patients who received an AED shock by bystanders.

EMS attended

Cardiac arrest events attended by EMS regardless of whether treatment was provided.

EMS response time

The time from the start of the emergency call to arrival of EMS crew on scene.

EMS treated

Cases involving an EMS attempted resuscitation.

Event survival

Patients that have a palpable pulse on arrival at hospital as documented on the ePCR.

Metropolitan/Metro

Denotes the Perth metropolitan area (based on the Australian Bureau of Statistics classification for Greater Capital City Statistical Areas, 2016).

Out of Hospital Cardiac Arrest

Where the patient has no signs of circulation. Specifically, when there is an absence of a detectable carotid pulse, the patient is unconscious/unresponsive, and has agonal/absent breathing; with the event occurring outside of hospital.

Paediatrics/Children

Patients aged less than 16 years.

Paramedic

Registered as a paramedic providing ALS (registered with Australian Health Practitioner Regulation Agency, AHPRA)

Presumed cardiac

Cases where the cause of arrest is not due to a known precipitator (e.g., trauma, overdose/poisoning, asphyxial), as determined from the ePCR.

Regional/Rural WA

Denotes areas outside the Perth metropolitan area.

Return of Spontaneous Circulation

Return of spontaneous circulation (i.e., detectable pulse).

State Operations Centre

St John WA call centre for emergency ambulance (Triple Zero, '000') and non-urgent calls.

Survival to 30 days

Patient survival for 30 days or more after an out-of-hospital cardiac arrest.

Shockable Rhythm

Cardiac electrical rhythms which are appropriate to receive defibrillation by EMS, or a bystander with a public AED. These rhythms include ventricular fibrillation and pulseless ventricular tachycardia.

Transport Officer

St John WA transport officer, with basic life support training.

Utstein comparator patient group

Patients who are witnessed to arrest by a bystander, present in a shockable rhythm, and receive EMS attempted resuscitation.

Volunteer Ambulance Officer

Unpaid volunteer with relevant training and skill, providing ambulance services to their community.



About our service and response *to cardiac arrest*

St John WA (SJWA) provides ambulance services across a vast land mass approximately 2.5 million km² in area. Western Australia (WA) has a population of approximately 2.66 million, the majority of whom reside within the Perth metropolitan and South-West areas of the state (3).

More than 6000 volunteers serve their communities through SJWA, particularly in frontline clinical care in smaller and more remote areas to a Basic Life Support (BLS) level. In some larger towns, volunteers often work alongside paramedic colleagues. The Perth metropolitan area and many bigger regional centres are typically served by paramedic ambulance crews.

All incoming '000' emergency calls to SJWA are handled and triaged through Medical Priority Dispatch System software (MPDS) by specialist call takers. More than 1100 calls for assistance are received by the State Communications Centre per day. Until November 2020, all calls that reported unconscious persons who were not breathing normally, were coded as cardiac arrest, generating a multiple asset response. However, in late November 2020, additional MPDS pathways were activated to allow the call-taker to select appropriate options when the caller reports that someone has clearly passed away or that CPR is inappropriate. In such cases, a single asset response is tasked.

Multiple asset responses typically comprise two ambulances, each with two officers. Wherever possible a Clinical Support Paramedic (CSP) will be tasked in metropolitan areas to provide overview, leadership and additional decision-making authority. An operational area manager (AM) may be deployed as an alternative. These responders also carry mechanical CPR devices to be used if transport to hospital is warranted. In rural areas, a Community Paramedic (CP) may be deployed where practical to provide paramedic support to volunteer officer crews. Mechanical CPR devices are not available outside of the Perth metropolitan area.

When it is established that a cardiac arrest is in a public location, an alert is automatically generated for registered users of the SJWA First Responder app (4) within 500 meters who might be able to attend. The intent is for responders to provide or continue CPR and where available, facilitate community AED use whilst the ambulance response is en route.

Benchmarking Summary *Report*

In previous annual reports, we have provided benchmarking comparisons between Western Australia and other jurisdictions on OHCA survival statistics.

The data period for those other jurisdictions was typically 6-12 months earlier than in Western Australia, due to the availability of data at the time of publishing the WA annual reports. However, due to the potential impacts of COVID-19 on OHCA survival (and for those impacts to differ between jurisdictions),

there is a greater significance on data periods of all jurisdictions being aligned, and on understanding contextual differences between jurisdictions in COVID-19. For these reasons, we decided to suspend benchmarking comparisons for the 2020 report.



3 people

PER DAY WERE TREATED FOR OUT-OF-HOSPITAL CARDIAC ARREST IN WESTERN AUSTRALIA



71% OCCUR IN A PRIVATE RESIDENCE

20% OCCUR IN A PUBLIC LOCATION

9% OCCUR IN OTHER LOCATIONS (E.G. AGED CARE FACILITIES AND MEDICAL CENTRES)



80%

OF PATIENTS RECEIVED BYSTANDER CPR



6%

RECEIVED DEFIBRILLATION BY A COMMUNITY BASED DEFIB PRIOR TO AMBULANCE ARRIVAL



9.3 minutes

MEDIAN TIME IT TOOK ST JOHN TO REACH A PATIENT IN THE METRO AREA



13.6 minutes

MEDIAN TIME IN RURAL AND REGIONAL LOCATIONS



21% OF PATIENTS SURVIVED THE EVENT (HAD A PULSE ON ARRIVAL AT HOSPITAL)

12% OF PATIENTS SURVIVED TO HOSPITAL DISCHARGE

Utstein survival 35.7%*

*REFERS TO SURVIVAL AMONG OHCA PATIENTS WHO EXPERIENCED A BYSTANDER-WITNESSED, SHOCKABLE CARDIAC ARREST.



AMBULANCE
PARAMEDIC

ACCENT

ST. JOHN'S

The Registry

In 1996, the SJWA out-of-hospital cardiac arrest database was established. It is maintained by the team at PRECRU, at Curtin University in Perth, WA, and includes all ambulance-attended OHCA cases in Western Australia. The data are compiled from:

1. Computer aided dispatch data;
2. Pre-hospital clinical care and management data through ambulance patient records (electronic records became available from mid-2011); and
3. Date of death, as well as hospital outcome data.

In 2014, a more comprehensive ability to capture state-wide data commenced, with research nurses manually reviewing hospital medical records to determine survival to hospital discharge. In addition, survival to 30 days is confirmed by checking the WA State Registry of Births, Deaths and Marriages (5).

The database contains over 40,000 OHCA records (as of 31 December 2020). De-identified data is shared with the Australasian Resuscitation Outcomes Consortium (Aus-ROC) OHCA Epistry (Epidemiological Registry), which enables unique insights to be gained regarding OHCA patients across Australia and New Zealand, including regional comparisons (6).

Definition of OHCA

The database defines an OHCA patient as someone with no signs of circulation – specifically the absence of a carotid pulse, in combination with unconsciousness, and agonal or absent breathing; with the event occurring outside of hospital.

Eligibility

Inclusion and exclusion criteria for the SJWA OHCA database are described in Tables 1 & 2 below:

Table 1	SJWA OHCA database inclusion criteria (all of the following):
1	All patients, of any age who suffer a cardiac arrest in an out-of-hospital setting. This includes residential aged care facilities.
2	Occurred in the State of Western Australia and were attended by SJWA. a. All unconscious patients who are pulseless and not breathing (or have “agonal”, gasping breaths) on arrival of SJWA; OR b. All patients who become unconscious, pulseless and stop breathing (or have initial “agonal”, gasping breaths) in the presence of SJWA (i.e., EMS-witnessed arrests) OR c. Patients who have a pulse on arrival of SJWA having been successfully defibrillated by a bystander prior to the arrival of SJWA.
3	

Table 2	SJWA OHCA database exclusion criteria (any of the following):
1	Any patient who suffers a cardiac arrest in a hospital facility where SJWA may be in attendance but are not the primary care providers.
2	Any patient who suffers a cardiac arrest during an inter-hospital transfer where SJWA may be providing transport but are not the primary care providers.
3	Any patient where the bystander or lay person suspected a cardiac arrest, but the patient is not in cardiac arrest on arrival of SJWA, and no defibrillation has occurred.
4	Patients with brief episodes of pulselessness who DO NOT receive CPR or defibrillation from SJWA.

Data capture

The data fields in the SJWA OHCA database are based on the internationally agreed definitions that are outlined in the Utstein template from the International Liaison Committee on Resuscitation (ILCOR) (7).

Several data sources are used to capture OHCA cases in WA:

1. Computer aided dispatch (CAD) system database

CAD is an organisational database with comprehensive geographical and operational information collected by the SJWA State Operations Centre. Specifically, the database includes date and incident location. The system timestamps key points such as the receipt time of the 000-emergency call, the dispatch time of the first ambulance as well as the time of arrival at scene of the first ambulance. This data enables response time data to be accurately calculated.

2. Electronic patient care record (ePCR)

The ePCR records multiple data fields, including patient demographics, clinical assessment and management. Importantly, this includes identification of the cardiac arrest heart rhythms, defibrillation delivery (including bystander use of automated external defibrillator: AED), as well as the administration of any cardiac arrest medicines. The ePCR was introduced in SJWA in 2011, with paper-based records used previously.

A sensitive but not specific electronic search strategy is conducted to identify potential cases from the CAD database to ensure the capture of all OHCA cases in WA that are attended by SJWA. A research nurse carefully scrutinises the results manually, and only those cases meeting the criteria for OHCA (Tables 1 and 2) are included in the SJWA OHCA database.

Presenting arrest rhythms and probable causes of OHCA are determined by manual review of the ePCR records.

Survival outcomes of 'return of spontaneous circulation' (ROSC) and 'ROSC on arrival at hospital' (i.e., event survival) are also obtained from the ePCR records.

3. Survival follow up

From this 2020 annual report onwards, we are reporting 30-day survival as the primary survival outcome, whereas we previously reported survival to hospital discharge (STHD). Despite these two measures being almost 100% equivalent in Western Australia (within less than 1 in every

200 cases being discordant between the two measures among initial survivors to hospital), we have decided to report on 30-day survival for increased comparability with other jurisdictions as it has been argued that the "comparability of survival-to-hospital-discharge is more limited by cultural differences and health system differences" (2).

Data quality and history clarification

All data in the SJWA OHCA database are subject to ongoing quality improvement, with changes being incorporated and backdated in the database as needed.

As with the 2018 and 2019 SJWA OHCA annual reports, 'resuscitation attempt' is defined as any EMS resuscitation attempt (CPR and/or defibrillation shock delivered) OR a bystander AED shock delivered. This is consistent with the SJNZ OHCA annual reporting.

For many variables in this report, data are reported across a five-year period, 2016-2020. This is done using the current version of both the data and coding definitions. For example, resuscitation attempt is reported retrospectively with the same definition – in referring to cases with EMS resuscitation attempt (CPR and/or defibrillation) OR bystander AED shock being delivered. Notably, there are some changes in survival statistics between this report and previous years, due to our change to reporting 30-day survival compared to survival-to-hospital discharge, and the fact that there are occasional cases that are discordant between the two metrics.

Ethics approval

SJWA has given approval for the SJWA OHCA database to be managed at PRECRU (Curtin University) – under strict data access and security protocols. The Human Research Ethics Committee (HREC) at Curtin University has given approval for the SJWA OHCA database to be used for specific research purposes.

PRECRU has standing ethics approval, granted by individual hospital HREC's, to access relevant hospital medical records for the purposes of determining OHCA patient outcomes. The Registrar of Births, Deaths and Marriages in WA has approved PRECRU researchers to access the WA Death Registry for HREC-approved studies.

All data relating to the SJWA OHCA database are securely stored by PRECRU at Curtin University as per the PRECRU Data Access and Security Policy.

Missing data

The utility of the SJWA OHCA database relies on completeness of data capture. Missing data are relatively rare for all core variables (see Table 3).

Number of records with missing data for select SJWA OHCA database variables in 2020 (from total of n=2698 cases)

Table 3: Number of records with missing data for select SJWA OHCA database variables in 2020 (from total of n=2698 cases)

Missing data	Number of cases
Sex	0
Age	5
Aetiology	0
Witness status	0
Location type	0
Response time	3
Initial Arrest Rhythm	24
Bystander CPR	5
Bystander shock given	1
30-day survival	0





Incidence and demographics

SJWA attended to 2698 OHCA cases in the calendar year 2020 (01 January – 31 December), a slight decrease on 2019 (n=2722). The majority of cases (n=2660) were classified as adults (16 years and above) compared to those aged under 16 years of age (n=38).

Of all OHCA cases, 69.2% were recorded by paramedics as male and 30.8% as female.

The crude incidence for adults was 125.8 per 100,000 population, compared to children at 6.9 per 100,000. These are both slightly lower than the rates observed in 2019 (128.9/100,000 for adults; 7.6/100,000 for children).

Table 4: Overview of OHCA cases attended by St John WA

	No of Cases	% of all cases	% resus attempted	Incidence Rate*
Adults	2660	98.6	40.3% (n=1086)	125.8
Children	38	1.4		6.9
TOTAL	2698	100%	--	--

* Per 100,000 population

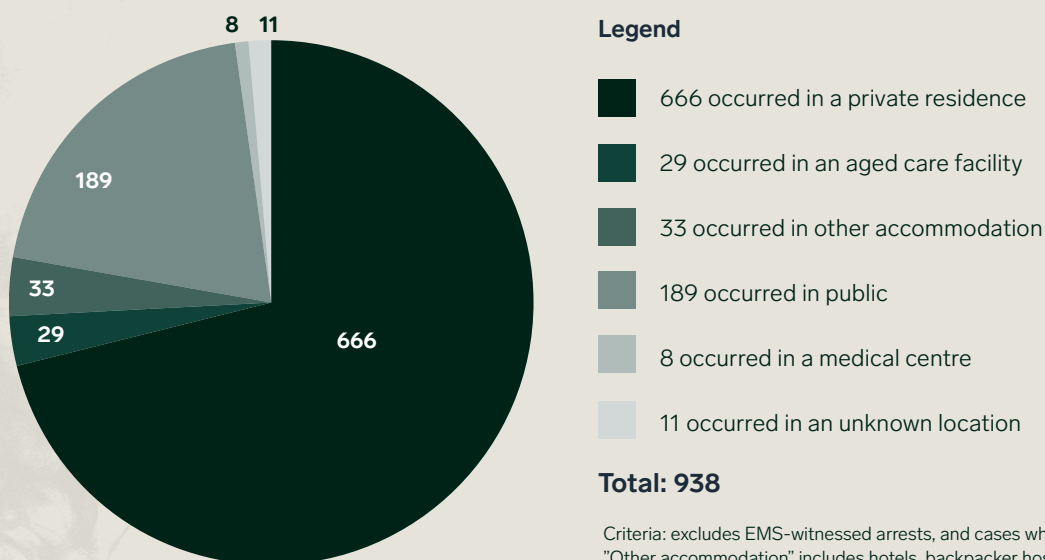
Location of Cardiac Arrest

Similar to previous years, the majority of patients (71%) suffered a cardiac arrest at a private residential address which is similarly observed in other systems.

If the cardiac arrest occurs in a public place, the likelihood of being 'seen or heard' to collapse is greater and is associated with improved outcomes as the chain of survival is activated sooner. In 2020, fewer patients (20%) were recorded to have suffered a cardiac arrest in a public place compared to 2019 (24%); likely to reflect the impact of the COVID-19 pandemic (1).

These figures exclude cases where the cardiac arrest occurred whilst the patient was already in the care of SJWA ambulance officers (i.e., EMS-witnessed arrest).

Figure 1: Location of arrest



Criteria: excludes EMS-witnessed arrests, and cases where resus not attempted. "Other accommodation" includes hotels, backpacker hostels and caravan parks.



Resuscitation Attempted

In July 2019, revised clinical practice guidelines (CPG's) were introduced at SJWA, expanding on situations where in-field resuscitation attempts could be withheld or ceased. Despite an anticipating a declining trend in the number of resuscitation attempts as a result of this guidance, of the 2698 OHCA cases in 2020, 40.3% had a resuscitation attempt by SJWA (n=1086). This is on par with that reported in 2019, where of the 2722 cases, attempts occurred in 40.3% (n=1096).

Presenting rhythms

Of the 1057 adult OHCA cases receiving a resuscitation attempt, 282 (26.7%) presented in a shockable rhythm (VF or VT).

A combined total of 775 cases presented in non-shockable rhythms, the most common of which was asystole, recorded in 542 cases (51.3%). Pulseless electrical activity (PEA) featured in 163 cases (15.4%). Of note, 53 cases (5%) had an unspecified non-shockable rhythm, associated with some volunteer non-metro locations that still use screenless automated AEDs, and no shock was advised. The remaining 17 cases had unknown presenting rhythms.

Figure 2: Frequency of adult initial arrest rhythms 2020

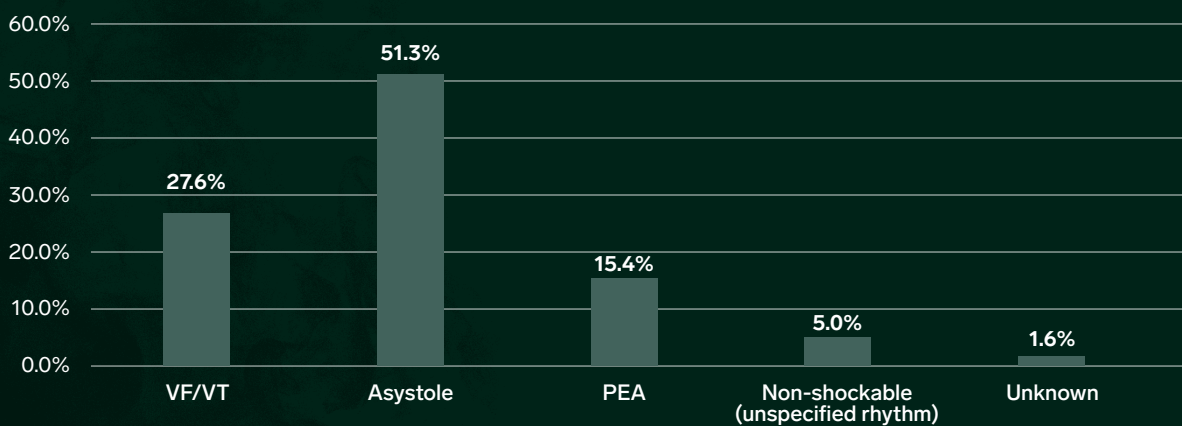


Table 5: Initial arrest rhythm summary 2016-2020

Rhythm	2016	2017	2018	2019	2020
Shockable	252	268	327	282	282
Non-Shockable	921	870	753	773	758
Unknown	1	0	36	9	17
TOTAL	1174	1138	1116	1064	1057

Precipitating Causes – Children (<16 yrs)

Among children, a presumed cardiac aetiology was recorded in 10 cases in 2020, up by one from 2019. Single increases were observed for both Respiratory causes and sadly, drowning events. Fewer traumatic, hanging or sudden infant death syndrome (SIDS) cases were recorded as demonstrated in Table 6.

Table 6: Aetiology - Children

Cause of arrest	2016	2017	2018	2019	2020	TOTAL
Presumed cardiac	8	9	8	9	10	60
Respiratory	2	3	4	2	3	16
Drowning	3	4	6	2	3	25
Trauma	4	5	3	6	5	29
Hanging		5	2	3	1	14
SIDS	16	12	7	9	6	57
Electrocution			1			2
Malignancy/Palliative			1	1		
Other		5		1		6
TOTAL	33	43	31	32	29	210

Precipitating Causes – Adults (16 + yrs)

Of adult OHCA cases in 2020 where resuscitation was attempted, 76.6% had a presumed cardiac cause (n=810), with the next most common causes being hanging (6.4%, n=68), trauma (6.3%, n=67) and drug overdose (5.4%, n=57). There was a concerning increase in drownings, comprising 2.0% (n=21) of adult OHCA cases with a resuscitation attempt in 2020, compared to an average of 1.1% over the previous 4 years. See Table 7.

Table 7: Aetiology - Adults

Cause of arrest	2016	2017	2018	2019	2020	TOTAL
Presumed cardiac	912	884	889	810	810	5297
Respiratory	21	21	30	33	23	142
Drowning	11	12	8	16	21	76
Trauma	98	87	57	73	67	451
Hanging	72	74	67	68	68	429
Drug overdose	45	46	50	52	57	289
Electrocution				2	2	7
Malignancy/Palliative	14	11	15	10	9	76
Other	1	3				5
TOTAL	1174	1138	1116	1064	1057	6772



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AMBULANCE

Pre-ambulance community response (Bystander CPR and AED activity)

The percentage of OHCA patients receiving bystander CPR prior to the arrival of SJWA remains high at 79.6% for all cases where resuscitation attempts were made.

Table 8: Bystander CPR (all of WA)

	2016	2017	2018	2019	2020
CPR provided	718	748	800	742	745
No evidence of bystander CPR	347	294	201	196	191
TOTAL	1065	1042	1001	938	936
% where CPR provided	67.4	71.8	79.9	79.1	79.6

Criteria: Excludes EMS-witnessed arrests, and cases where resus was not attempted.

Community AEDs are unequivocally associated with improved chances of survival (8). AEDs were employed on more OHCA patients in 2020 (n=134) than previously in the last 5 years, although the number of cases where a defibrillation shock was delivered fell slightly to 55 in 2020. Of the 55 patients who received a defibrillation shock, 35 (45.5%) had a pulse on arrival at ED and 22 survived to 30 days (40%) as shown in Table 9 and 10.

Table 9: Bystander use of AED and number of survivors (all of WA)

	2016	2017	2018	2019	2020
AED pads applied by bystander	40	86	111	131	134
AED shock delivered by bystander	25	41	60	59	55
ROSC at ED after bystander AED shock	14	20	46	35	25
AED pads applied by bystander	40	86	111	131	22

Table 10: Percentage survival where bystander was first to shock patient

	2016	2017	2018	2019	2020
% ROSC at ED	56	48.8	76.7	59.3	45.5
% 30-day survival	52	41.5	66.7	50.8	40.0



SJWA Response *Times*

In cases where resuscitation was attempted, response times in 2020 were slightly longer than in 2019 (increase in the median time of 0.2 minutes).

The metropolitan median response time was 9.3 minutes in 2020, longer than the previous four years. In rural WA the median time of 13.6 minutes is similarly the longest observed over the previous four years. One contributing factor to delays may be the application of PPE prior to arrival (1).

Table 11: Metro response times (in minutes)

	2016	2017	2018	2019	2020
Median	9.1	8.8	8.6	9.1	9.3
10th centile	5.3	5.6	5.1	5.5	5.4
25th centile	7.1	7.0	6.4	6.9	7.1
75th centile	11.7	11.3	10.9	11.8	11.6
90th centile	15.1	14.4	14.4	14.6	14.9

Criteria: Excludes cases where resus was not attempted

Community AEDs are unequivocally associated with improved chances of survival (7). AEDs were employed on more OHCA patients in 2020 (n=134) than previously in the last 5 years, although the number of cases where a defibrillation shock was delivered fell slightly to 55 in 2020. Of the 55 patients who received a defibrillation shock, 35 (45.5%) had a pulse on arrival at ED and 22 survived to 30 days (40%) as shown in Table 9 and 10.

Table 12: Rural/remote response times (in minutes)

	2016	2017	2018	2019	2020
Median	12.4	13.3	12.1	13.3	13.6
10th centile	6.4	6.5	6.8	5.8	6.5
25th centile	9.0	9.0	8.9	9.1	8.4
75th centile	19.8	20.2	18.8	21.9	19.6
90th centile	33.0	32.3	29.0	32.3	28.7

Criteria: Excludes cases where resus was not attempted

Outcomes

The total number of patients who survived OHCA at 30 days in 2020 was 128 (124 adults and 4 children). This represents 11.8% of the 1086 OHCA patients who had resuscitation attempted. Arriving at ED with a pulse (ROSC at ED) is a prognostically favourable indicator and arguably a barometer of prehospital performance. As highlighted in Table 13, of the 1086 resuscitation attempted cases, 224 patients had ROSC at ED (20.6%).

Thirty-day survival in 2020 was the third highest in the last five years, despite Covid-19, a new novel virus, becoming an evolving pandemic, impacting not only the ambulance service, but the wider health system as a whole. In collaboration with the Prehospital, Resuscitation and Emergency Care Research Unit (PRECRU) at Curtin University, St John WA recently published an analysis demonstrating no apparent effect of the initial wave of the Covid-19 pandemic in Western Australia (March-May 2020) on OHCA incidence and survival, compared to the same date range in 2017-2019 (6).

Despite a small increase in median EMS response time between 2017-2019 and 2020 (from 8.8 to 9.7 minutes), there was no significant change in key aspects of bystander assistance (proportion of patients receiving CPR, and delivery of an AED shock), and no change in 30-day survival. Overall, these results suggest a level of robustness of the chain of survival for OHCA patients to periods of heightened Covid restrictions and awareness.

Table 13: % Survival (of resuscitation attempted cases)

	2016	2017	2018	2019	2020
% ROSC at ED	18.9	21.4	23.7	21.4	20.6
% 30-day survival	9.6	9.8	14.6	12.5	11.8





JOHN AMBULANCE
SINGH

ADVANCED EMERGENCY
MEDICAL DISPATCHER



ST JOHN AMBULANCE
ISAAC SWOMA

BROCK'S LAW
The presence of an AED
does not ensure its use -
the EMO does.



Adult outcomes according to initial presenting rhythm

Those OHCA patients who presented in shockable rhythms were most likely to have a favourable outcome and comprised the majority of cases with ROSC at ED recorded in 2020. Of the adult patients who survived to 30-days, 77.4% were initially in VF/VT (n=96).

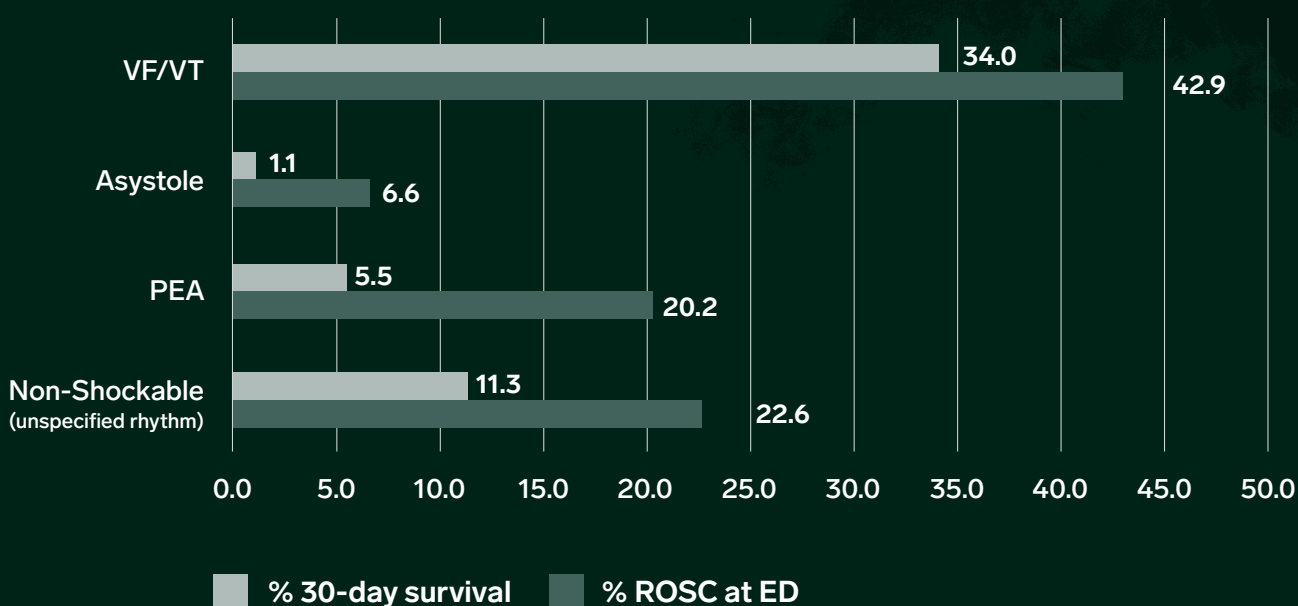
Asystole as a presenting rhythm is associated with poorer outcomes, however 36 patients in this cohort were recorded as ROSC at ED, with six survivors to 30 days. Other non-shockable rhythms had 30-day survival that was, similar to asystole, much lower than survival for shockable (VF/VT) patients. See Table 14 and Figure 3.

Table 14: Number of survivors by Initial Arrest Rhythm, for adults

	ROSC at ED	30-DAY SURVIVAL	TOTAL
VF/VT	121	96	282
Asystole	36	6	542
PEA	33	9	163
Non-shockable (unspecified rhythm)	12	6	53
Unknown	15	7	17
TOTAL	217	124	1057

Criteria: Restricted to adults (≥ 16 yrs); Excludes cases where resus was not attempted

Figure 3: Survival by Initial Arrest Rhythm for adults





Utstein Comparator Group

The Utstein comparator group is defined as all-cause cardiac arrest in the community where the patient is witnessed to collapse by bystanders and presents with an initial shockable rhythm. It reflects outcomes for a cohort who are regarded as most likely to have prognostically favourable survival outcomes. Importantly, the Utstein comparator group, in having a defined set of patient characteristics, facilitates more meaningful benchmarking against other systems.

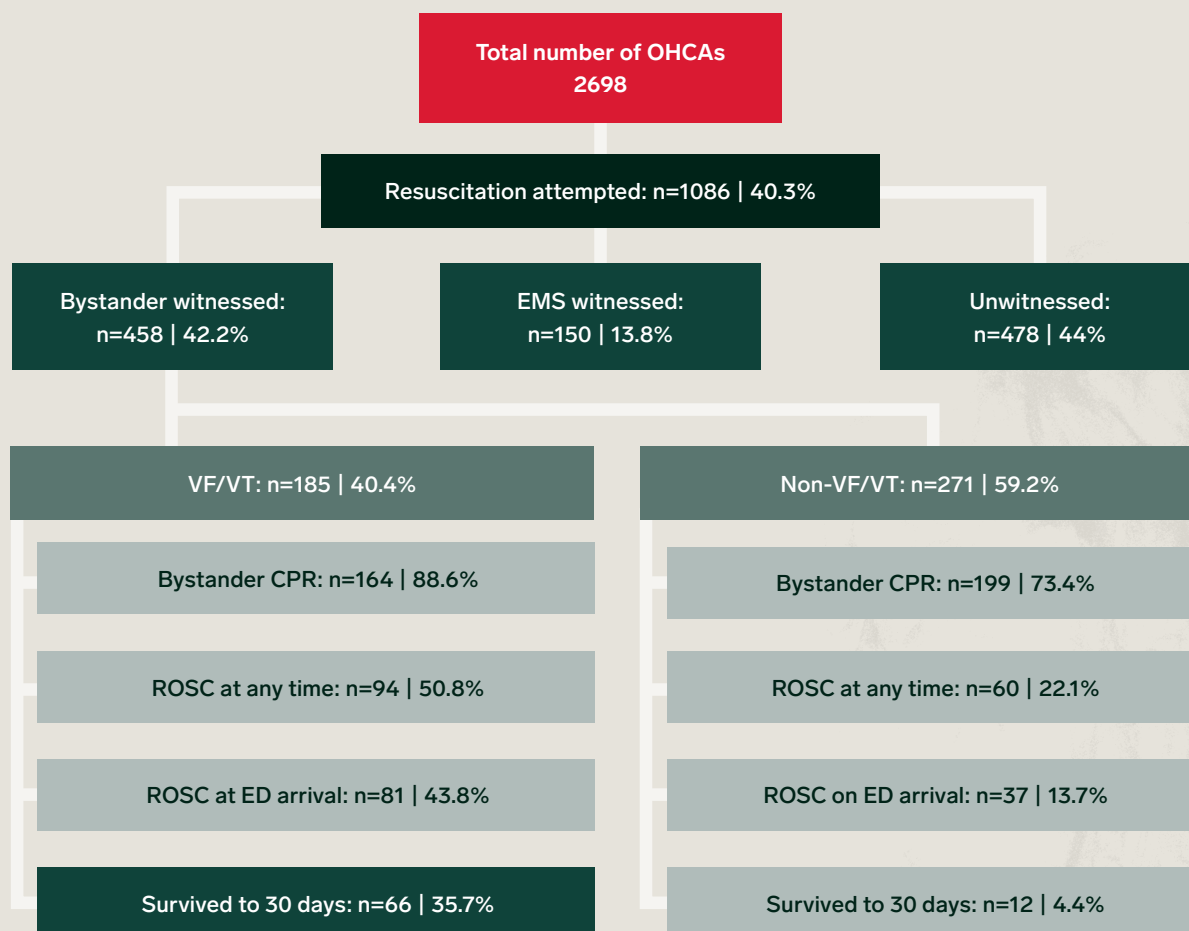
Table 15: Utstein survival by year

Year	2016	2017	2018	2019	2020
Utstein Survival (%)	34.5	28.1	38.2	34.5	35.7

Resuscitation was commenced in 1086 patients, 458 (42.2%) of whom were witnessed (or heard) to collapse. A shockable rhythm (VF/VT) was recorded in 185 (40.4%) of those cases. A reassuringly large proportion of those cases received bystander CPR (88.6%). As shown in Figure 4, of the 185 patients in VF/VT, 81 (43.8%) were recorded as ROSC at ED and 66 survived to 30 days (35.7%).

Similar to 2019, the Utstein comparator group represented less than a fifth of all patients where resuscitation was attempted (185/1086=17%). However, this group comprised 51.6% of survivors (66/128).

Figure 4: Utstein criteria





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Outcomes according to rurality

As of mid-2020, the Australian Bureau of Statistics recorded just over 2.66 million people living in WA, with 79.8% (2.13 million) in metropolitan Perth, and approximately 538,000 in regional WA. The majority of OHCA cases with attempted resuscitation occur in metropolitan Perth (820/1086 = 75.5%).

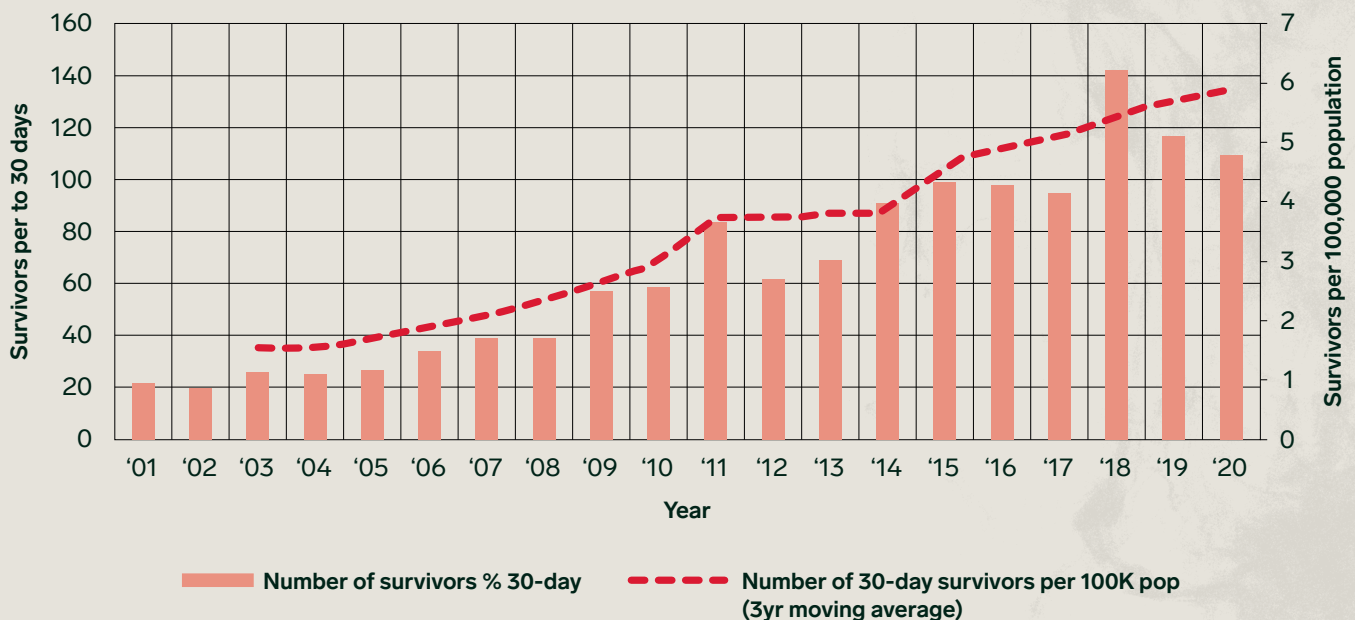
Figure 5: Comparative outcomes – Metropolitan Perth vs Regional WA



Survival per 100,000 population

From 2018 to 2020 in the Perth metropolitan area, there was an average of 5.88 OHCA survivors (30-day survival) per 100,000 population per year, with a consistent increase in the 3-year average over the last 20 years. This metric, of the number of survivors per 100,000 population provides a useful measure for comparing with other EMS's, due to its independence from any differences between EMS's (or over time) in the propensity for attempting versus withholding resuscitation.

Figure 6: Number of survivors, and Survival per 100K Population (Metro Perth)





Outcomes at Scene

Table 16: Outcomes at Scene

Scene outcomes	Cases	%
Transported from scene with ROSC	237	21.8
Transported from scene without ROSC	347	32.0
Resuscitation efforts ceased at scene	502	46.2
TOTAL	1086	100.0

Criteria: Excludes cases where resus was not attempted

Among patients in 2020 with an EMS resuscitation attempt, 32% were transported from the scene without ROSC (i.e., CPR in progress), down from 40% in 2019. There are two factors that likely contributed to this change. Firstly, additional criteria for termination-of-resuscitation, introduced in July 2019 likely meant an increase in the number of patients declared deceased on scene, and corresponding decrease in the number being transported from the scene without ROSC. In addition, since the introduction of high-performance CPR in late 2018, SJWA have continually encouraged ambulance officers to pursue (among patients not meeting termination-of-resuscitation criteria) more prolonged resuscitation efforts on scene to maintain quality of care and increase the chances of earlier ROSC. As a result of these initiatives, we expect that some patients who would have previously been transported from the scene without ROSC, are likely to achieve and be transported with ROSC, due to the sustained resuscitation efforts on scene.

Outcome by destination hospital

All of Western Australia's large tertiary teaching hospitals are located in Perth. Given that a large proportion of OHCA cases are have a presumed cardiac cause (see Tables 6 and 7), when patients are transported to a hospital that has an on-site 24-hour primary percutaneous coronary intervention (PCI) service, the odds of 30-day survival are much increased. In 2020, a total of 117 OHCA patients who had ROSC at the time of scene departure were transported directly to a PCI capable hospital, of which 64.1% survived to 30 days. This contrasts with 39.5% 30-day survival in the 38 OHCA patients who had ROSC at the time of scene departure and transported to a non-PCI capable hospital.

Table 17: Percentage 30-day survival according to whether the patient had direct transport to PCI hospital

	2019
% 30-day survival if PCI	64.1
% 30-day survival if not PCI	39.5

Criteria: Includes adult OHCA cases of presumed cardiac aetiology in metropolitan Perth, where EMS resuscitation was attempted, and the patient had ROSC at the time of being transported from the scene to hospital.

Conclusion

We reflect with much positivity on 2020. In the context of our commitment to resuscitation improvement, we remain confident that our initiatives continue to influence OHCA patient outcomes. We acknowledge and celebrate the successes we have observed with each of the 128 survivors, and the aspects of the system and care that contributed to these outcomes.

We reaffirm our resolve to continue optimising each step in the system and remain focussed on our objective. From first aid training, AED availability, to '000' calls, ambulance dispatch and optimal hands-on care, SJWA remains committed to excellence and will persist in our endeavours along with our partners.

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