

Out-of-Hospital Cardiac Arrest Report

2021





Acknowledgement

St John WA acknowledges the First Nations people of the many Traditional lands and language groups across Western Australia, as the Traditional Custodians of the Country. We pay our respects to their Ancestors and Elders, past and present.



Introduction

We present our out-of-hospital cardiac arrest (OHCA) report for the calendar year 2021 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, 2021 proved to be a year of coping with continuing challenges and learning to adapt to revised methods of delivering ambulance care. Intermittent periods of restriction, lockdown and community uncertainty were a reality, and this had some impact on service delivery at times. Despite these circumstances, patient survival and other important variables such as Bystander CPR rates and AED use remained fairly robust.

In 2021, of the 1115 cases where resuscitation was commenced, 230 (20.6%) had spontaneous circulation on arrival at the emergency department, and 117 (10.5%) 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.

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The PRECRU team

The Clinical Services team

The State Operations team

All our valuable volunteers and career staff alike.

Learn more about the team at [impact.stjohnwa.com.au](https://www.stjohnwa.com.au) and follow the links.



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Abbreviations

AED	Automated External Defibrillator	MPDS	Medical Priority Dispatch System
AHPRA	Australian Health Practitioner Regulation Agency	OHCA	Out of Hospital Cardiac Arrest
AusROC	Australasian Resuscitation Outcomes Consortium	PEA	Pulseless Electrical Activity
ALS	Advanced Life Support	PCI	Percutaneous Coronary Intervention
BLS	Basic Life Support	PRECRU	Pre-hospital, Resuscitation and Emergency Care Research Unit (Curtin University)
CAD	Computer Aided Dispatch	QAS	Queensland Ambulance Service
CP	Community Paramedic	ROSC	Return of Spontaneous Circulation
CPR	Cardio-Pulmonary Resuscitation	SIDS	Sudden Infant Death Syndrome
CSP	Clinical Support Paramedic	SJWA	St John Western Australia
ED	Emergency Department	SJNZ	St John New Zealand
EMS	Emergency Medical Service	STHD	Survival to Hospital Discharge
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		

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).

Ambulance Officer

Paid career staff working on-road while training to become a paramedic.

Asystole

Absence of any cardiac electrical activity.

Defibrillation

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

EMS attempted resuscitation/EMS treated

Cases where trained ambulance clinicians attempted to revive a patient in cardiac arrest using CPR and/or defibrillation, as well as any patients who received an AED shock from bystanders.

EMS attended

Cardiac arrest events attended by trained ambulance personnel regardless of whether treatment was provided.

EMS response time

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

Event survival

Patients who 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 with the Paramedicine Board of Australia, which is overseen by the 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 circulation to the body with a 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 St John ambulance clinicians, or from 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 a shockable rhythm, and receive EMS attempted resuscitation.

Volunteer

Unpaid volunteer with relevant training and skill, providing ambulance services to their community. These include Emergency Medical Technicians, Assistants and Responders.



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 2.75 million, the majority of whom reside within the Perth metropolitan and South-West areas of the state (1).

In 2021, a total of 690 career paramedics and ambulance officers in metropolitan Perth and 130 career paramedics and 2601 volunteer ambulance officers in country WA served their community through the provision of emergency ambulance responses. Career staff provide resuscitative care to the Advanced Life Support level and volunteer crews provide such care to the Basic Life Support level.

All incoming Triple Zero (000) emergency calls to SJWA are handled and triaged through the Medical Priority Dispatch System (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 someone has clearly passed away or 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 manager may be deployed as an alternative. These responders also carry mechanical CPR devices to be used if transport to hospital is undertaken. In rural areas, a Community Paramedic (CP) may be deployed where practical to provide paramedic support to volunteer Emergency Medical Technician (EMT) or Emergency Medical Assistant (EMA) crews. Mechanical CPR devices are not available outside 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 (2) within 500 metres 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 enroute.



Benchmarking Summary Report

Table 1: Key figures for all-cause events where EMS attempted resuscitation

Year	Total events	Bystander CPR % ¹	Bystander AED use % (pads applied) ¹	Median metro response time (mins)	Median rural response time (mins)	% ROSC at ED	% 30-day survival
2017	1181	71.8	7.2	8.8	13.3	21.4	9.8
2018	1147	79.9	9.3	8.6	12.1	23.7	14.6
2019	1112	79.0	11.8	9.1	13.3	21.1	12.3
2020	1086	79.6	12.2	9.3	13.6	20.6	11.6
2021	1115	81.5	13.6	9.9	12.8	20.6	10.5

¹ Percentages for bystander CPR and bystander AED use were calculated specifically for non-EMS witnessed arrests

Table 2: Benchmarking survival outcomes for all-cause events, where EMS attempted resuscitation¹

	Collection period	Total number of events	% ROSC at ED	% Survival ²
St John WA	1 Jan to 31 Dec 2021	1115	20.6	10.5
Ambulance Victoria	1 Jan to 31 Dec 2021	3016	31.7	12.6
Qld Ambulance Service	1 Jan to 31 Dec 2021	2427	28.0	11.7
Hato Hone St John NZ	1 Jan to 31 Dec 2021	2422	26.3	13.0

¹ Includes EMS-witnessed arrests. EMS resuscitation attempt refers to patients with EMS CPR and/or EMS defibrillation and/or delivery of AED shock by bystanders; except for QAS, whose data here relate exclusively to cases with EMS CPR and/or EMS defibrillation.

² 30-day survival, except for Ambulance Victoria who report survival to hospital discharge.

Table 3: Benchmarking survival outcomes – the Utstein comparator group¹

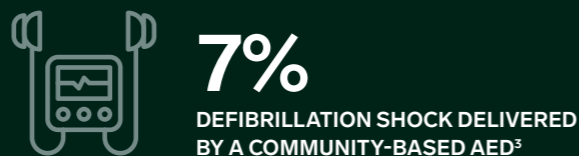
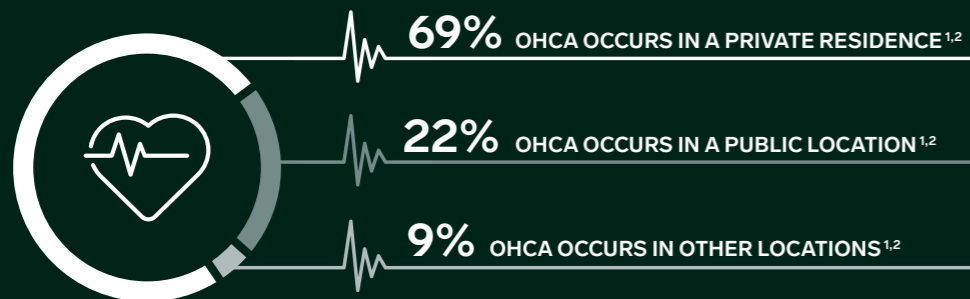
	Collection period	Total number of events	% ROSC at ED	% Survival ²
St John WA	1 Jan to 31 Dec 2021	177	48.0	33.9
Ambulance Victoria	1 Jan to 31 Dec 2021	452	61.6	35.1
Qld Ambulance Service	1 Jan to 31 Dec 2021	338	49.1	28.1
Hato Hone St John NZ	1 Jan to 31 Dec 2021	488	44.7	27.5

¹ Refers to patients with EMS resuscitation attempt, who had a bystander-witnessed arrest, with an initial shockable rhythm. EMS resuscitation attempt refers to patients with EMS CPR and/or EMS defibrillation and/or delivery of AED shock by bystanders; except for QAS, whose data here relate exclusively to cases with EMS CPR and/or EMS defibrillation.

² 30-day survival, except for Ambulance Victoria who report survival to hospital discharge.

3 people

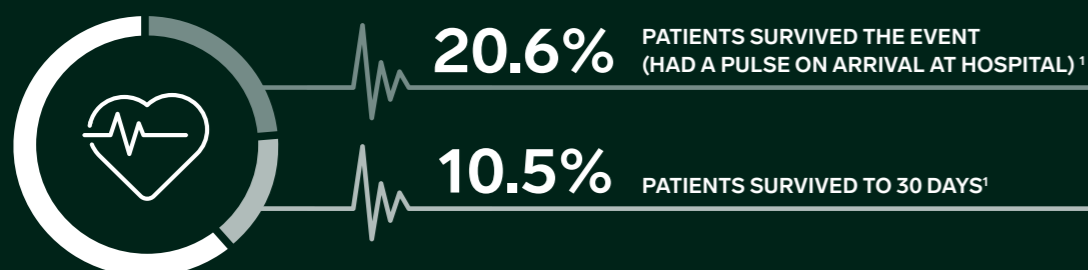
PEOPLE PER DAY TREATED FOR OHCA IN WESTERN AUSTRALIA¹



MEDIAN TIME IT TOOK ST JOHN TO REACH A PATIENT IN THE METROPOLITAN AREA¹



MEDIAN TIME IN RURAL AND REMOTE LOCATIONS¹



Utstein survival 33.9%⁴

¹ Cases where EMS attempted resuscitation
² Excludes EMS-witnessed arrests
³ Bystander-witnessed arrests where SJWA provides ongoing resuscitation
⁴ Refers to survival among patients who experience OHCA witnessed by a bystander, present in a shockable rhythm, and receive EMS attempted resuscitation.

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 is 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 (3).

The database contains over 43,000 OHCA records (as of 31 December 2021). De-identified data is shared with the Australasian Resuscitation Outcomes Consortium (AusROC) OHCA Epistry (Epidemiological Registry), which enables unique insights to be gained regarding OHCA patients across Australia and New Zealand.

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

Table 4: SJWA OHCA database inclusion criteria

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 5: SJWA OHCA database exclusion criteria

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) (4).

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 Triple Zero (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 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 attended by SJWA. A research nurse carefully scrutinises the results manually, and only those cases meeting the criteria for OHCA (Tables 4 and 5) 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

The 2020 OHCA report onwards reports the 30-day survival as the primary survival outcome, whereas we previously reported survival to hospital discharge (STHD). These two measures are almost 100 per cent equivalent in WA, with less than one in every 200 cases being discordant between the two measures among initial survivors to hospital.

Data quality and history clarification

As with the 2018-2020 SJWA OHCA reports, 'resuscitation attempt' is defined as EMS CPR and/or EMS defibrillation (to the exclusion of cases where resuscitation was discontinued due to the presence of a not-for-resuscitation order), and/or a bystander AED shock delivered.

For many variables in this report, data is reported across a five-year period, 2017-2021. 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 (whereas the 2017 report defined EMS resuscitation attempt exclusively as EMS CPR and/or defibrillation). 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 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 HRECs, 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 6).

Table 6: Missing data

Variable	Number of cases
Sex	1
Age	6
Aetiology	0
Witness status	0
Location type	0
Response time	2
Initial Arrest Rhythm	26
Bystander CPR	0
Bystander shock given	0
30-day survival	0

Number of records with missing data for select SJWA OHCA database variables in 2021 (from total of n=2873 cases).





Incidence and demographics

SJWA attended 2873 OHCA cases in the calendar year 2021 (1 January – 31 December), an increase on 2020 (n=2698). The majority of cases (n=2833) were classified as adults (16 years and above) compared to those aged under 16 years of age (n=40).

Of all OHCA cases, 68.2% were recorded by paramedics as male and 31.8% as female.

The crude incidence of OHCA increased from 2020 to 2021. In 2021 for adults, crude incidence was 129.6 per 100,000 population, compared to children at 7.1 per 100,000. By comparison, in 2020 OHCA incidence for adults was 125.8/100,000, and for children was 6.9/100,000.

Table 7: Overview of OHCA cases attended by St John WA

	No of Cases	% of all cases	Incidence Rate*	% resus attempted **
Adult	2833	98.6%	129	38.8%
Children	40	1.4	7.1	
TOTAL	2873	100%	--	--

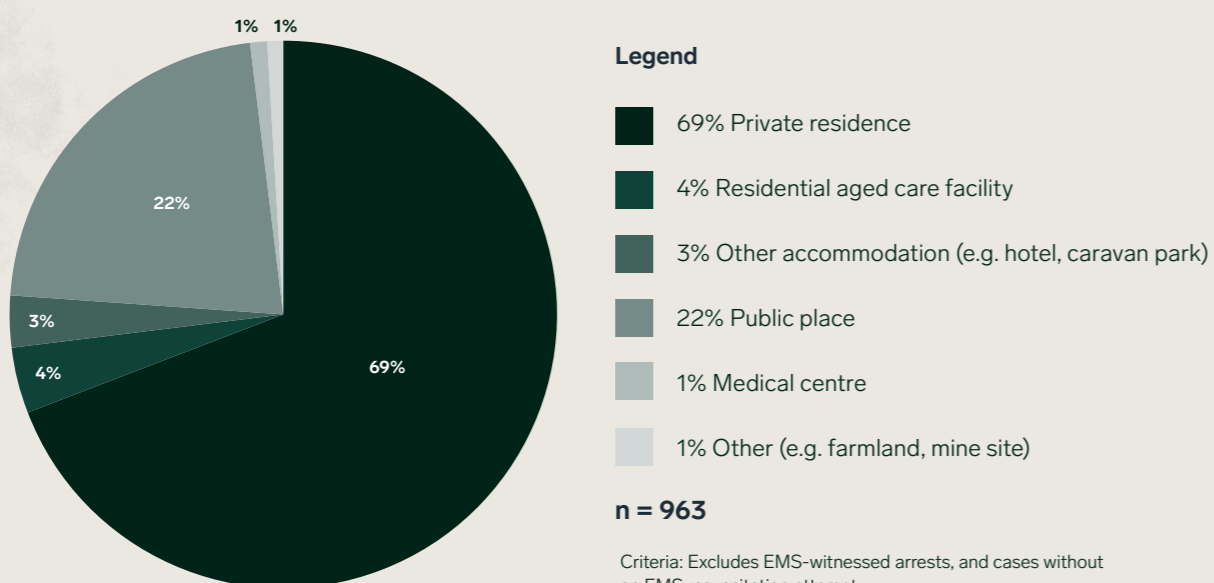
*per 100,000 population. **N=1115

Similar to previous years, the majority of patients (69%) 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 2021, 22% of patients suffered a cardiac arrest in a public place compared to 20% in 2020.

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

Figure 1: Location of arrest



Resuscitation attempted

In July 2019, revised clinical practice guidelines (CPGs) were introduced at SJWA, expanding on situations where in-field resuscitation attempts could be withheld or ceased. In 2021, SJWA attempted resuscitation on 38.8% (n=1115) of OHCA patients, compared to 40.9% (n=1112) in 2019.

Presenting rhythms

Of the 1088 adult OHCA cases receiving a resuscitation attempt, 258 (23.7%) presented in a shockable rhythm (VF or VT).

A combined total of 817 cases presented in non-shockable rhythms, the most common of which was asystole, recorded in 589 cases (54.1%). Pulseless electrical activity (PEA) featured in 168 cases (15.4%). Of note, 60 cases (5.5%) had an unspecified non-shockable rhythm, associated with some volunteer non-metro locations that use screenless automated AEDs, and no shock was advised. Of the remaining cases, 12 had unknown presenting rhythms, and 1 case was bradycardic.

Figure 2: Frequency of adult initial arrest rhythms 2021

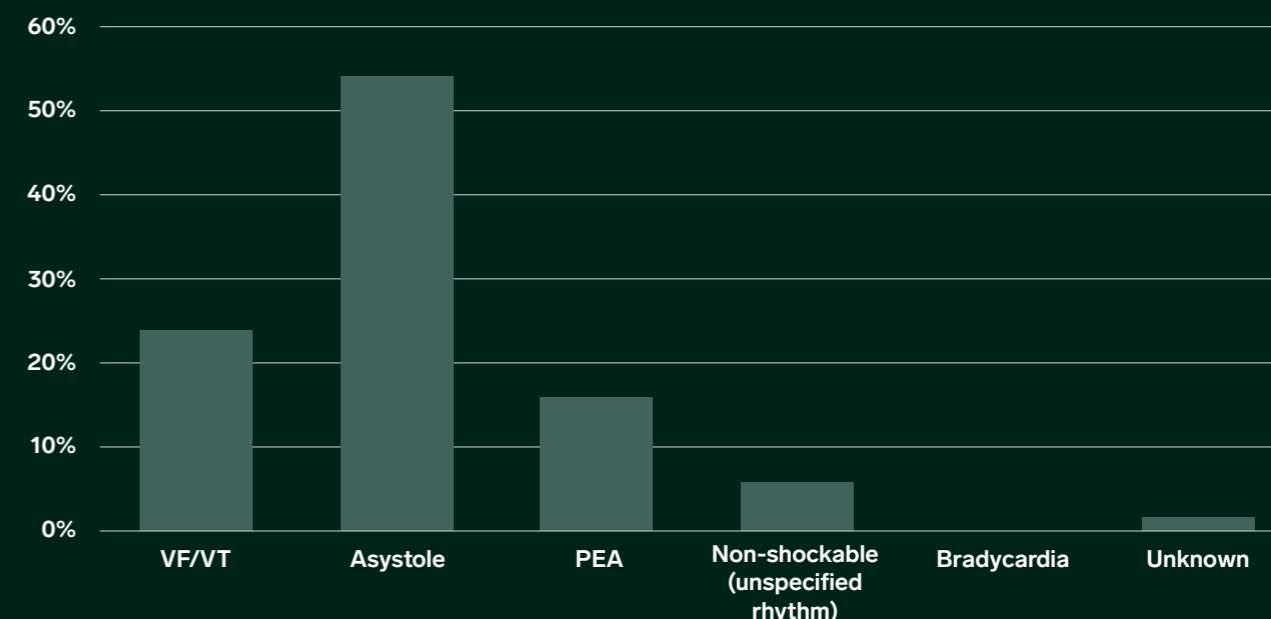


Table 8: Initial arrest rhythm summary 2017-2021

Rhythm	2017	2018	2019	2020	2021
Shockable	268	327	282	282	258
Non-shockable	870	753	788	758	817
Unknown	0	36	9	17	12
Bradycardic	0	0	0	0	1
TOTAL	1138	1116	1079	1057	1088



Precipitating Causes – Children (<16 yrs)

Among the 27 paediatric OHCA cases where SJWA attempted resuscitation in 2021, a presumed cardiac aetiology was recorded in 10 cases, with other causes including trauma (n=6), hanging (n=5) and SIDS, sudden infant death syndrome (n=4).

Table 9: Aetiology – Children

	2017	2018	2019	2020	2021	TOTAL
Presumed cardiac	9	8	9	10	10	46
Respiratory	3	4	2	3		12
Drowning	4	6	2	3	1	16
Trauma	5	3	6	5	6	25
Hanging	5	2	4	1	5	17
SIDS	12	7	9	6	4	38
Drug overdose					1	1
Electrocution		1				1
Malignancy/Palliative				1		1
Other	5		1			6
TOTAL	43	31	33	29	27	163

Criteria: Excludes cases where resus was not attempted

Precipitating Causes – Adults (16 + yrs)

Of adult OHCA cases in 2021 where SJWA attempted resuscitation, 78.1% had a presumed cardiac cause (n=850), with the next most common causes being hanging (6.8%, n=74), trauma (6.7%, n=73), drug overdose (4.0%, n=43) and drownings (1.6%, n=17).

Table 10: Aetiology - Adults

	2017	2018	2019	2020	2021	TOTAL
Presumed cardiac	884	889	822	810	850	4255
Respiratory	21	30	33	23	19	126
Drowning	12	8	16	21	17	74
Trauma	87	57	75	67	73	359
Hanging	74	67	69	68	74	352
Drug overdose	46	50	52	57	43	248
Electrocution			2	2	2	6
Malignancy/Palliative	11	15	10	9	10	55
Other	3					3
TOTAL	1138	1116	1079	1057	1088	5478

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

The percentage of OHCA patients receiving bystander CPR prior to the arrival of SJWA was 69.7% among bystander-witnessed arrests, and 27.4% among unwitnessed arrests.

Table 11: Bystander CPR witnessed/unwitnessed

% bystander CPR	2017	2018	2019	2020	2021
Among bystander-witnessed arrests	65.4	71.2	69.1	66.8	69.7
Among unwitnessed arrests	29.9	31.1	30.0	31.3	27.4

The percentage of OHCA patients receiving bystander CPR prior to the arrival of SJWA was 81.5% for all cases where resuscitation attempts were made.

Table 12: Bystander CPR among cases with an EMS resuscitation attempt

	2017	2018	2019	2020	2021
CPR provided	748	800	754	745	785
No evidence of bystander CPR	294	201	200	191	178
TOTAL	1042	1001	954	936	963
% where CPR provided	71.8%	79.9%	79.0%	79.6%	81.5%

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

Community AEDs are unequivocally associated with improved chances of survival (5). AEDs were used by bystanders (i.e., AED pads applied) on 157 OHCA patients in 2021, with a defibrillation shock being delivered in 56 cases. Of those 56 patients, 30 (53.6%) had a pulse on arrival at ED and 26 survived to 30 days (46.4%).

Table 13: Bystander use of AED and number of survivors (all of WA)

	2017	2018	2019	2020	2021
AED pads applied by bystander	86	111	131	134	157
AED shock delivered by bystander	41	60	59	55	56
ROSC at ED after bystander AED shock (n)	20	46	35	25	30
30-day survivors after bystander AED shock (n)	17	40	30	22	26
% ROSC at ED after bystander AED shock	48.8%	76.7%	59.3%	45.5%	53.6%
% 30-day survival after bystander AED shock	41.5%	66.7%	50.8%	40.0%	46.4%

Criteria: Excludes EMS-witnessed arrests



SJWA Response Times

In cases where resuscitation was attempted, median response times in 2021 in metropolitan Perth was 9.9 minutes, compared to 9.3 minutes in 2020. In rural WA, median response time in 2021 was 12.8 minutes, compared to 13.6 minutes in 2020.

Table 14: Metro response times (in minutes)

	2017	2018	2019	2020	2021
Median	8.8	8.6	9.1	9.3	9.9
10th centile	5.6	5.1	5.5	5.4	5.7
25th centile	7.0	6.4	6.9	7.1	7.3
75th centile	11.3	10.9	11.8	11.6	12.7
90th centile	14.4	14.4	14.6	14.9	17.2

Criteria: Excludes cases where resus was not attempted.

Table 15: Rural/remote response times (in minutes)

	2017	2018	2019	2020	2021
Median	13.3	12.1	13.3	13.6	12.8
10th centile	6.5	6.8	5.8	6.5	6.3
25th centile	9.0	8.9	9.1	8.4	8.6
75th centile	20.2	18.8	21.9	19.6	18.6
90th centile	32.3	29.0	32.3	28.7	29.7

Outcomes

The total number of patients who survived their OHCA at 30 days in 2021 was 117 (113 adults and 4 children). This represents 10.5% of the 1115 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 16, of the 1115 resuscitation attempted cases, 230 patients had ROSC at ED (20.6%).

Table 16: Percentage Survival (of resuscitation attempted cases)

	2017	2018	2019	2020	2021
% ROSC at ED	21.4	23.7	21.1	20.6	20.6
% 30 day survival	9.8	14.6	12.3	11.6	10.5

Adult outcomes according to initial presenting rhythm

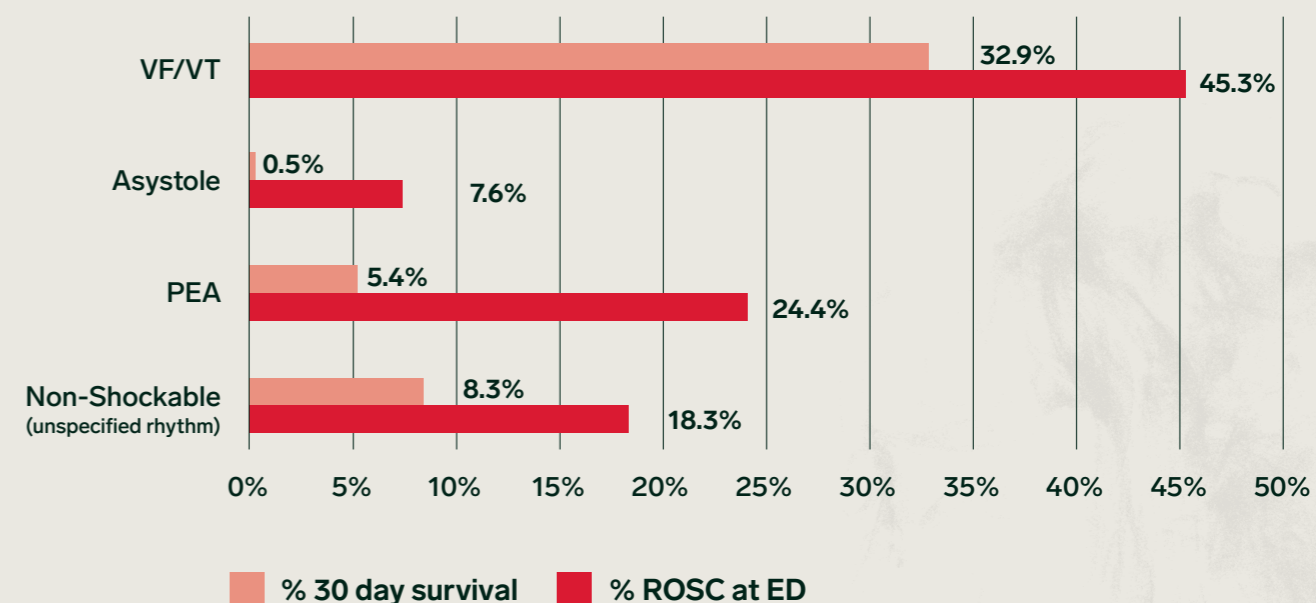
Those OHCA patients who presented in shockable rhythms were most likely to have a favourable outcome and comprised the majority of cases with ROSC at ED recorded in 2021. Of the adult patients who survived to 30-days, 75.2% were initially in VF/VT (n=85).

Asystole as a presenting rhythm is associated with poorer outcomes. A total of 45 patients in this cohort were recorded as ROSC at ED, with 3 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 17 and Figure 3.

Table 17: Number of survivors by initial arrest rhythm, for adults

	ROSC at ED	30-day survivors	TOTAL
VF/VT	117	85	258
Asystole	45	3	589
PEA	41	9	168
Non-shockable (unspecified)	11	5	60
Bradycardia	1	1	1
Unknown	10	10	12
TOTAL	225	113	1088

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, presents with an initial shockable rhythm, and receives an EMS resuscitation attempt. It reflects 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.

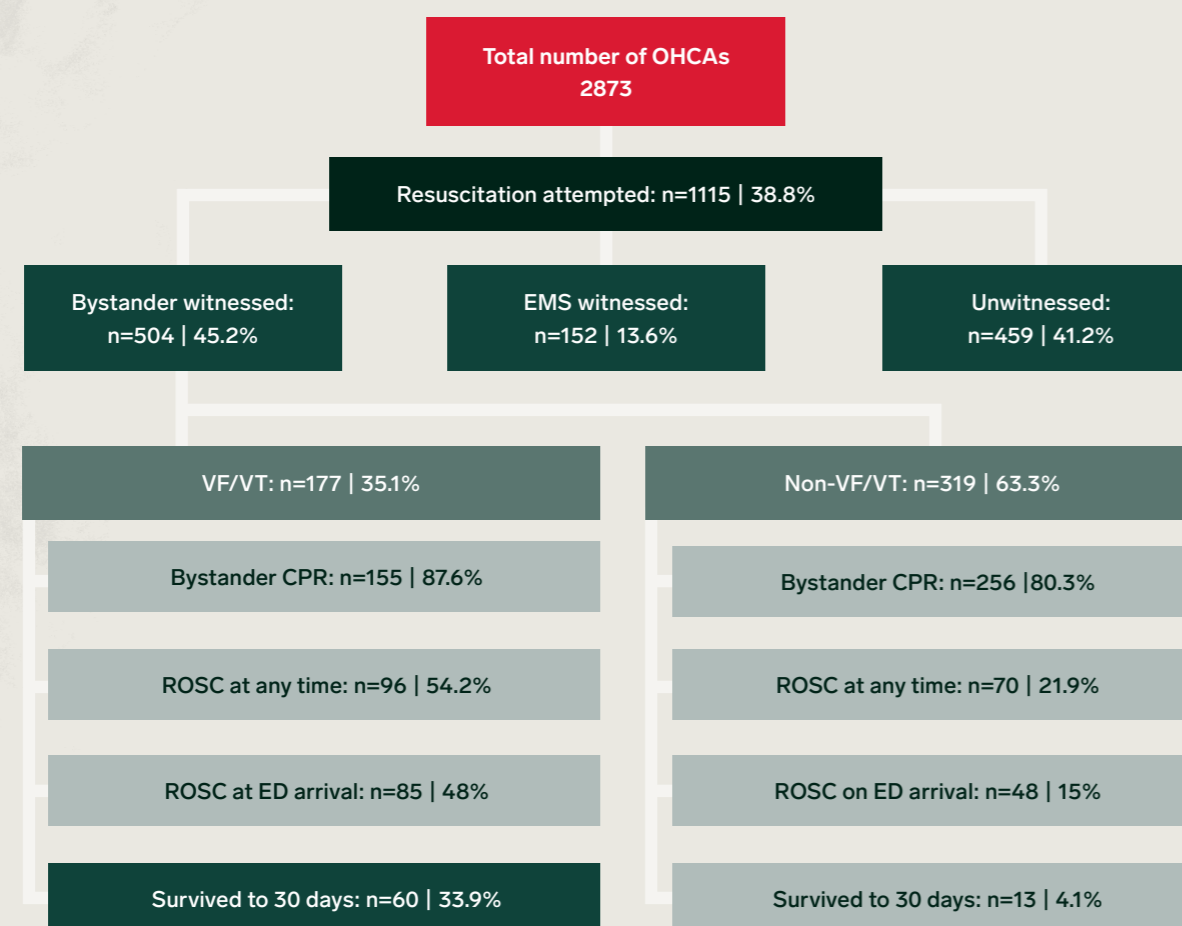
Table 18: Utstein survival by year

Year	2017	2018	2019	2020	2021
Utstein Survival (%)	28.1	38.2	34.5	35.7	33.9

Resuscitation was commenced in 1115 patients, 504 (45.2%) of whom were witnessed (or heard) to collapse. A shockable rhythm (VF/VT) was recorded in 177 (35.1%) of those cases. A large proportion of those cases received bystander CPR (87.6%). As shown in Figure 4, of the 177 patients in VF/VT, 85 (48.0%) were recorded as ROSC at ED and 60 survived to 30 days (33.9%).

While the Utstein comparator group represented only 15.9% (177/1115) of patients with an EMS resuscitation attempt, they comprised 51.3% of all 30-day survivors (60/117).

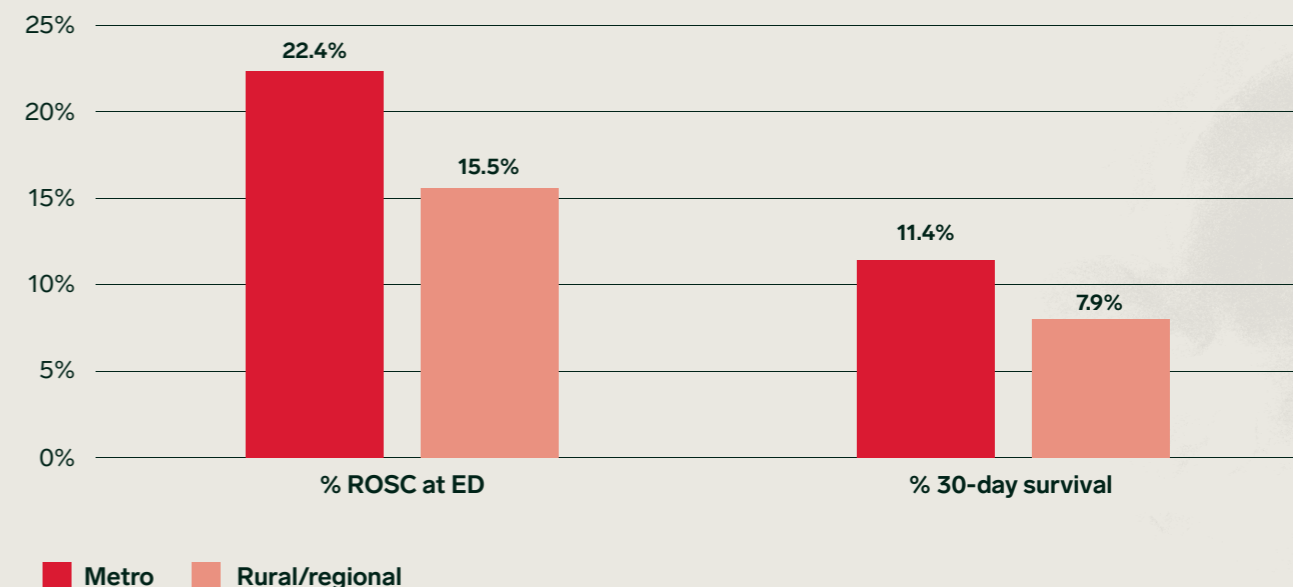
Figure 4: Utstein criteria



Outcomes according to rurality

As of mid-2021, the Australian Bureau of Statistics recorded just over 2.75 million people living in WA, with 79.7% (2.19 million) in metropolitan Perth, and approximately 557,000 in regional WA. The majority of OHCA cases with attempted resuscitation occur in metropolitan Perth (825/1115 = 74.0%).

Figure 5: Comparative outcomes – Metropolitan Perth vs Regional WA

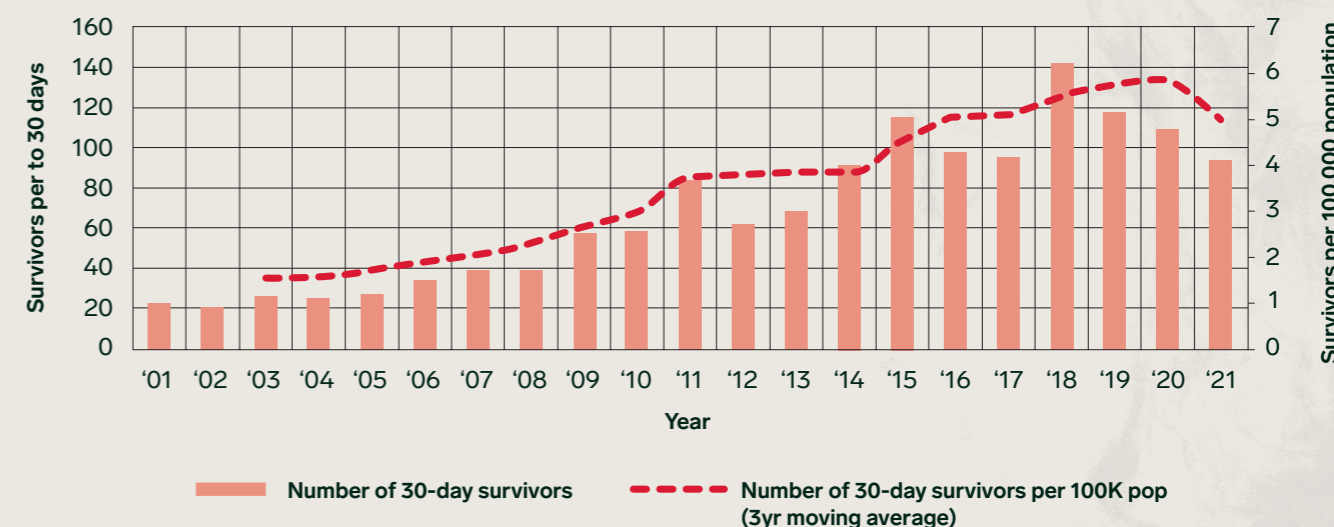


*Excludes cases where resuscitation was not attempted.

Survival per 100,000 population

From 2019 to 2021 in the Perth metropolitan area, there was an average of 5.01 OHCA survivors (30-day survival) per 100,000 population per year. This metric of the number of survivors per 100,000 population provides a useful measure for comparing with other EMSs, due to its independence from any differences between EMSs (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 19: Outcomes at scene

Scene outcomes	Cases	%
Transported from scene with ROSC	256	23.0
Transported from scene without ROSC	284	25.5
Resuscitation efforts ceased at scene	575	51.6
TOTAL	1115	100.0

Criteria: Excludes cases where resus was not attempted

Among patients in 2021 with an EMS resuscitation attempt, 25.5% were transported from the scene without ROSC (i.e., CPR was in progress during transport), 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 paramedics and volunteers 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 have a presumed cardiac cause (see Tables 9 and 10), 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 2021, a total of 124 OHCA patients in Perth who had ROSC at the time of scene departure were transported directly to a PCI capable hospital, of which 50.0% survived to 30 days. This contrasts with 36.4% 30-day survival in the 44 OHCA patients in Perth who had ROSC at the time of scene departure and were transported to a non-PCI capable hospital.

Table 20: Percentage 30-day survival according to whether the patient had direct transport to PCI hospital

	% of cases
% 30-day survival if PCI	50.0
% 30-day survival if not PCI	36.4

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 on the challenges that 2021 brought to the community and to frontline ambulance services. Despite the challenges faced and a 6% increase in the total number of OHCA responses, the proportion of patients who survived an OHCA (with ROSC at the emergency department) remained the same as 2020.

Whilst the metropolitan ambulance median response time increased, rural response times decreased between 2020 and 2021. In the context of our commitment to resuscitation improvement, we remain confident that our initiatives will have a positive impact on OHCA survivability. We acknowledge and celebrate the successes we have observed with each of the 117 patients who survived to at least 30 days, and the aspects of the system and care that contributed to these outcomes.

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