

**Out-of-Hospital  
Cardiac Arrest Report  
2018**

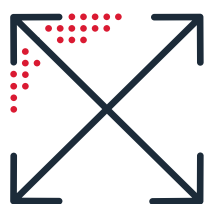


## Our approach to high performance CPR

St John introduced IMPACT (improved performance and CPR team) Resuscitation in 2018, our own version of high performance CPR.

High performance differs from previous approaches to CPR, with its focus on resuscitation in a pit crew style system, where paramedics rotate to reduce “hands-off chest time” and minimise interruptions to CPR.

Its introduction has coincided with other investments in system improvement, contributing to record survivor numbers. The guiding principles for IMPACT are:



### Create or move to a good working space

We consider high performance CPR to be a set of principles rather than a rigid stepwise approach to skill delivery. Our clinical teams are encouraged to consider adequate working space. This affords the team the best all round access to the patient in order to deliver better care.



### Standardised equipment placement

As often as possible, we aim to place our clinical equipment in a standardised layout. With the aid of a Human Performance and systems consultant the layout was designed so that the right kit is in the right place for the right skill. This standardisation allows Paramedics and EMT's to perform skills more seamlessly. This affords the team the best all round access to the patient in order to deliver better care.



### High quality focussed compressions with minimal interruption

Delivery of excellent quality compressions with minimal interruption is critical to effective care. IMPACT demands minimally interrupted compressions delivered with complete focus to optimise quality. Other team members are instructed not to distract the compressor. This affords the team the best all round access to the patient in order to deliver better care.



### Use feedback and CPR quality devices

The use of feedback technology is mandatory when available, and allows the focussed compressor to ensure each compression metric (rate, depth and recoil) is the best it can be. Such data also has a vital role in quality improvement programs that inform and develop our valuable volunteers and career clinicians. This affords the team the best all round access to the patient in order to deliver better care.



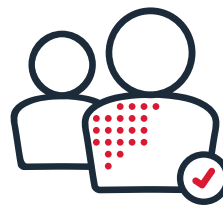
**Swap compressor every loop (loops = 2mins)**

Another principle of IMPACT is the mandatory swapping of compressor at the 2 minute mark to mitigate the risk of poor quality compressions delivered by a fatigued compressor, arguably a preventable harm.



**Calm, quiet and co-ordinated scene**

Providing care for OHCA is demanding and stressful for our clinical teams. We know that teams work more effectively when the environment is well co-ordinated. Advocating a calm, quiet environment promotes task focus for each clinician, reduces cognitive load and better planning. This affords the team the best all round access to the patient in order to deliver better care.



**Create an overview position, if possible**

IMPACT is very much intended to allow our clinical teams to provide care as effectively as possible. Leadership and holistic overview is a crucial part of the team. Remaining hands-off, the leader has the bandwidth to co-ordinate skills and anticipate next steps, allowing individual skill delivery at the patient side to be undistracted.



**Closed loop communication/ Functional language**

In a similar thread to standardised equipment placement, we have adopted a standardised phraseology with in a closed loop style of communication. Through a human factors consultant, we continue to draw lessons from the functional language of the aviation cockpit to optimise care and mitigate risks, especially at critical phases of the resuscitation such as defibrillation.



**(BVM Oxygen)/Controlled ventilation**

The final principle of IMPACT is adequate oxygenation and the avoidance of over-ventilation for all OHCA patients. There is an emphasis on minimal distraction and task focus similar to that expected of the compressor. The aim is to deliver the right volume, at the right rate, at low pressure. This promotes better CPR induced blood flow. This affords the team the best all round access to the patient in order to deliver better care.



Once again we would like to acknowledge the pioneering work of the late Prof Ian Jacobs, who would undoubtedly be very proud of the progress in out of hospital cardiac arrest outcomes documented in this report.

## Other acknowledgements

Paul Bailey, Dr Stephen Ball (PRECRU), Dennis Bertoldo, Deon Brink, Rudi Brits, Lauren Davids, Prof Judith Finn (PRECRU), Sheryl Gallant (PRECRU), Joanne Hill, Nicole McKenzie (PRECRU), Alani Morgan (PRECRU), Dan Rose, and Lyn Sillitto.

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## Abbreviations

**ALS** Advanced Life Support

**AED** Automated External Defibrillator

**AUS-ROC** Australian Resuscitation Outcomes Consortium ([ausroc.org.au](http://ausroc.org.au))

**CAD** Computer Aided Dispatch

**CFR** Community First Responder

**CPR** Cardiopulmonary Resuscitation

**ECG** Electrocardiogram

**ED** Emergency Department

**EMS** Emergency Medical Services

**EMT** Emergency Medical Technician

**HREC** Human Research Ethics Committee

**MPDS** Medical Priority Dispatch System

**OHCA** Out of Hospital Cardiac Arrest

**PCR** Patient Care Record

**PEA** Pulseless Electrical Activity

**PRECRU** Pre-hospital, Resuscitation and Emergency Care Research Unit, Curtin University

**ROSC** Return of Spontaneous Circulation

**SJWA** St John WA

**SOC** State Operations Centre

**VF** Ventricular Fibrillation

**pVT** Pulseless Ventricular Tachycardia

**WA** Western Australia

# Definitions

## **Adults**

Patients aged 16 years or greater, or where the age is missing/unknown.

## **Asystole**

Absence of any cardiac activity.

## **Defibrillation**

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

## **EMS attempted resuscitation**

Cases where paramedics or volunteer EMTs 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 PCR.

## **Metro**

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

## **Out of Hospital Cardiac Arrest**

Cardiac arrest that has occurred Out-of-Hospital where the patient has no signs of circulation. Specifically these are when there is an absence of a detectable carotid pulse, unconsciousness/unresponsiveness, and agonal/absent breathing; with the event occurring outside of hospital.

## **Paediatrics**

Patients aged less than 16 years.

## **Paramedic**

ALS Qualified Ambulance Officer.

## **Presumed cardiac**

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

## **Regional/Rural WA**

Denotes areas outside the Perth metropolitan area.

## **Return of Spontaneous Circulation**

Cases in which the resuscitation attempt results in a return of spontaneous circulation (i.e. detectable pulse) at any time.

## **State Operations Centre**

Triple Zero (000) and non-urgent call centre.

## **Survival to hospital discharge**

Patients who are discharged from hospital alive.

## **Shockable Rhythm**

Rhythms which are appropriate to receive defibrillation, including ventricular fibrillation and pulseless ventricular tachycardia, by EMS, or a bystander with a public AED.

## **Transport Officer**

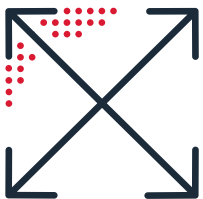
Basic life support transport officers.

## **Utstein comparator patient group**

Patients who are witnessed to arrest by a bystander, present in a shockable rhythm, and EMS attempted resuscitation (i.e. EMS delivered CPR and/or defibrillation, and/or an AED shock was delivered by bystanders).

## **Volunteer EMT**

Unpaid Emergency Medical Technician (formerly referred to as a Volunteer Ambulance Officer), providing emergency services to their community.



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## CCTV presents new learning opportunities

The St John WA approach to OHCA in recent years has been one that is committed to the relentless pursuit of excellence.

In 2018, a new point of focus has been the video analysis of OCHA. As CCTV has become more prevalent in public places and domains such as gyms, the availability of high definition, high quality video has opened up a learning tool for us to understand and appreciate what happens prior to ambulance arrival.

St John WA Resuscitation Improvement Coordinator Dan Rose (pictured below) has spent many hours reviewing vision for areas of improvement.

“Videos represent a valuable learning data source for understanding behaviour,” he said.

“When we have obtained vision we try to invite our ambulance crews to watch the vision together – we can take a lot away from this, especially when it is overlaid with the audio from the Triple Zero (000) call.”

While Dan has made observations that can be used in developing operational teams, he has also learned a great deal about bystander behaviour.

“It can be more interesting to see what the public do than our own people,” he said.

“For example, while we are very good at first aid training, CPR and defibrillator skills, one area we may have inadvertently overlooked is bystander recognition of cardiac arrest, particularly when it is sudden and unexpected.

“If we are able to better educate around this, then cardiac arrest can potentially be identified earlier, which means earlier Triple Zero (000) activation, bystander CPR and AED use”.

Dan said in other high performing areas of the world, similar analysis was undertaken so that the system of care involved in cardiac arrest response was enhanced. It’s about serving our communities and patients better, he said.





## Introduction

It is with great pleasure that we present the 2018 annual report into out-of-hospital cardiac arrest (OHCA) in Western Australia. Every year, approximately 1100 people are treated for OHCA in Western Australia, and historically 10 per cent of those patients survive to hospital discharge. We are pleased to report that in 2018, 172 patients (15 per cent of those treated for cardiac arrest) survived to hospital discharge, a 53 per cent improvement in total survivor numbers on the 2017 result.

This report is made possible by the collaboration between St John and the Pre-Hospital, Resuscitation and Emergency Care Research Unit (PRECRU) based at Curtin University. PRECRU are the custodians of the longest running OHCA database in Australia.

Having built on the lessons learned in 2016 and 2017 at the Resuscitation Academy in Seattle and the CPR University course in Phoenix, we have implemented a system of ambulance response to cardiac arrest that is based on aggregated marginal gains. Our improvement has come from a sharp focus on every phase of the patient in cardiac arrest – from community preparedness via first aid training and

the availability of community based defibrillators, to initiatives in our State Operations Centre on improving early recognition and dispatch-assisted CPR during emergency calls, and the care we deliver at the scene of a cardiac arrest via implementation of IMPACT – our high performance CPR process. We have been relentless in the pursuit of improvement.

We pause and pay our respects to the victims of OHCA that did not survive, and their families. We reaffirm our intention of pushing the limits of what is possible in the years ahead.

## The St John WA ambulance service

We provide emergency ambulance services to a population of approximately 2.6 million people, encompassing an area of some 2.5 million square kilometres. Emergency ambulance services are provided by approximately 800 paid paramedics and 5,000 volunteer emergency medical technicians (EMTs). Paramedics provide care in Perth and larger regional centres, with volunteer EMTs providing care in rural and regional locations across a large number of smaller regional locations. Our service encounters more than 360,000 patients per year in both ambulance and event health settings.

Paramedics have generally completed a four year tertiary degree through Curtin University, emerging with a bachelor's degree in paramedicine.

In Australia, emergency services are activated via the Triple Zero (000) call service. Ambulance calls in Western Australia are directed to the SJWA State Operations Centre (SOC) where they are answered by specially trained call-takers and prioritised according

to the nature of the emergency using a validated process called the Medical Priority Dispatch System (MPDS). There are two ambulance Triple Zero (000) operation centres in Western Australia – the main facility in Belmont, with a smaller facility in Wangara in Perth's northern suburbs. SJWA receives approximately 750 calls for emergency ambulance response per day.

### Responding to a cardiac arrest

When a Triple Zero (000) call that is consistent with cardiac arrest is detected by our call takers, the highest priority response is triggered, resulting in the dispatch of the nearest available ambulance resources regardless of other pre-existing taskings. While ambulances are en-route, the call taker provides over-the-phone instructions on how to perform CPR – a key step in maximising the patient's chances of survival, as well as providing information on the location of nearby automated external defibrillators (AEDs). At the same time, the St John First Responder smartphone app automatically alerts any nearby community first responders, who may choose to assist the patient and bystanders.

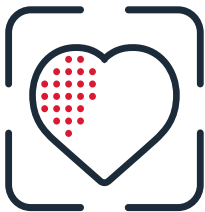
In the Perth metropolitan area, two ambulances (each consisting two crew members) respond to a cardiac arrest, in addition to either a Clinical Support Paramedic or an Area Manager. That is to say, a 5-person response is triggered. In larger regional centres, the response typically consists of two ambulances, while in smaller rural and regional locations, a single ambulance crew consisting of two EMTs responds.

SJWA crews practice under relevant Clinical Practice Guidelines which are based on the Australian Resuscitation Council (ARC) guidelines available at [resus.org.au/guidelines](https://resus.org.au/guidelines). Our protocols are developed by our Clinical Services team and ratified by our Medical Policy Committee which consists of independent medical experts drawn from the fields of emergency medicine, general practice, anaesthesia, intensive care, trauma surgery and retrieval medicine.



**Standardised equipment placement**

As often as possible, we aim to place our clinical equipment in a standardised layout. With the aid of a Human Performance and systems consultant the layout was designed so that the right kit is in the right place for the right skill. This standardisation allows Paramedics and EMT's to perform skills more seamlessly. This affords the team the best all round access to the patient in order to deliver better care.



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## About this report

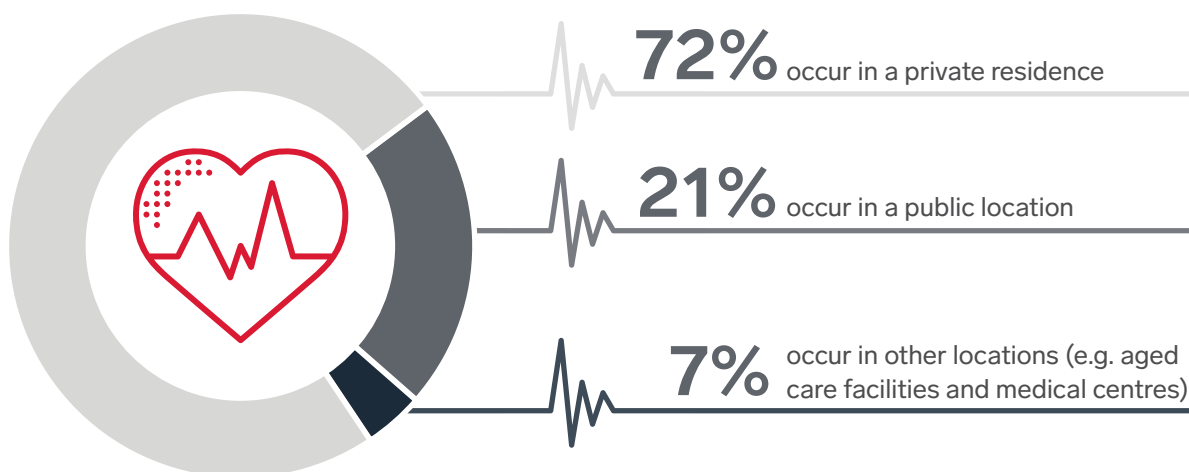
Out-of-hospital cardiac arrest remains a leading cause of death, both in Western Australia and around the world.

Survival from OHCA is highly variable, and dependent on many factors – and this survival represents a sentinel measure of the quality of EMS delivered healthcare and community response. Knowledge derived from our previous reports, published for 2016 and 2017 have driven system level improvements described in this, our 2018 report.

The data presented in this report represent cases identified through the SJWA OHCA registry, covering the period from 1 January 2018 to 31 December 2018 and represent all OHCA cases attended by SJWA in that time period.

Where possible, we have compared our own performance with that of St John New Zealand, Ambulance Victoria, London Ambulance Service and King County Emergency Medical Services in Washington, USA.

Two broad patient groups are examined in this report – all patients attended by ambulance crews, and a subset of those attended where resuscitation was attempted. Major endpoints include survival to hospital arrival (“survived event”) which is defined as the presence of a pulse at Emergency Department arrival, and survival to hospital discharge .

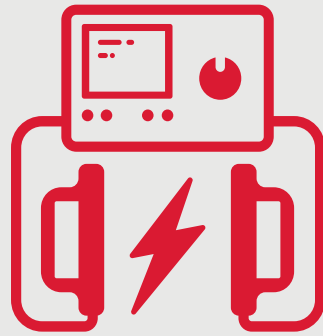


**Utstein survival 38.0%\***



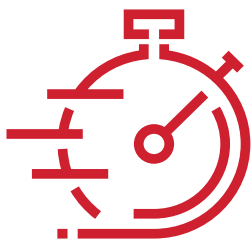
**80%**

of patients received  
bystander CPR



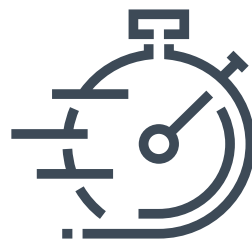
**5%**

received defibrillation by a  
community based defibrillator  
prior to ambulance arrival



**8.6**  
minutes

Median time in which a St John Ambulance  
reached a patient in the Perth metropolitan area



**12.1**  
minutes

Median time in which a St John Ambulance  
reached a patient in rural and regional locations



**24%** of patients survived the event  
(had a pulse on arrival at hospital)

**15%** of patients survived to hospital  
discharge

\*Refers to survival among OHCA patients who experienced a bystander-witnessed,  
shockable cardiac arrest



**Use feedback and CPR quality devices**

The use of feedback technology is mandatory when available, and allows the focused compressor to ensure each compression metric (rate, depth and recoil) is the best it can be. Such data also has a vital role in quality improvement programs that inform and develop our valuable volunteers and career clinicians. This affords the team the best all round access to the patient.



# Benchmarking executive summary

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

	Total events	Bystander CPR %	% AED use (pads applied)	Metro response times (mins)	Rural response times (mins)	% ROSC at ED	% survival
2015	1,265	63.7	2.1	8.9	13.5	21.4	10.1
2016	1,207	67.4	3.3	9.0	12.3	18.9	9.4
2017	1,182	71.7	6.4	9.0	13.1	21.4	9.6
2018	1,144	79.6	8.5	8.6	12.1	23.8	15.1

Table 2: Benchmarking survival outcome for all cause events, where EMS attempted resuscitation

Ambulance service	Collection period	Total number events	% ROSC at ED	% survival
Ambulance Victoria	1 July 2017 to 30 June 2018	3,050	25	10
London Ambulance Service	1 April 2017 to 31 March 2018	4,389	33	9
King Country EMS	1 January 2018 to 31 December 2018	1,298	N/A	22
St John WA	1 January 2018 to 31 December 2018	1,144	24	15

Table 3: Benchmarking survival outcomes - the Utstein Comparator group

Ambulance service	Collection period	Total number events	% ROSC at ED	% survival
St John New Zealand	1 July 2017 to 30 June 2018	529	52	32
Ambulance Victoria	1 July 2017 to 30 June 2018	468	57	37
London Ambulance Service	1 April 2017 to 31 March 2018	592	57	32
King County EMS	January - December 2018	209	N/A	56
St John WA	1 January 2018 to 31 December 2018	216	46	38



When AEDs have been used in the community, every effort is made to retrieve the heart rhythm data as soon as possible by the Clinical Services team. Dan Rose, Resuscitation Improvement Coordinator, said that while many ambulance services worldwide try to collect this data as a matter of routine, St John was going one step further by ensuring it is entered into the medical records by the hospital caring for the patient. He said doctors were increasingly pre-empting this and asking St John for the information as it can influence treatment decisions.

“We are also able to gain some valuable insight into what life threatening heart rhythms typically present, as well as how confidently AEDs are used by bystanders and the quality of CPR in some cases,” he said.

# The St John WA PRECRU OHCA registry

Our registry was established in January 1996 by the late Professor Ian Jacobs and was the first OHCA registry in Australia and New Zealand. The registry is maintained by PRECRU at Curtin University.

Since inception, this database has included:

1. Computer aided dispatch data;
2. Pre-hospital clinical management data derived from patient care records (electronic from mid-2011 onwards); and
3. Hospital outcome data derived from hospital medical records for OHCA cases of all ages occurring in Perth where SJWA paramedics attended.

Comprehensive state wide data capture commenced in 2014.

Patient survival outcomes are ascertained by checking against death records from the WA State Registry of Births, Deaths and Marriages.

Survival to hospital discharge and neurological outcomes are determined via manual review of hospital medical records by a research nurse.

The database now contains over 34,800 OHCA cases (as of 31 December, 2018). We share this data to the Australian Resuscitation Outcomes Consortium (Aus-ROC) Australian and New Zealand OHCA Epistry, which enables unique insights to be gained regarding these patients across Australia and New Zealand, including regional comparisons.

## Definition of OHCA

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

## Eligibility

The case inclusion and exclusion criteria for the SJWA OHCA database are described in Tables 4 and 5.

Table 4	SJWA OHCA database inclusion criteria
1	All patients (of any age) who suffer a cardiac arrest in an out-of-hospital setting (including residential care facilities).
2	Occurred in the state of Western Australia and was attended by SJWA.

Table 4	SJWA OHCA database inclusion criteria
3	a. All patients who are unconscious and pulseless with either agonal or no breathing on arrival of SJWA
	OR
	b. All patients who become unconscious and pulseless with either agonal or no breathing in the presence of SJWA (so called EMS witnessed/paramedic-witnessed arrests)
	OR
	c. Patients who have a pulse on arrival of SJWA following successful defibrillation provided by a bystander prior to arrival of SJWA

Table 5	SJWA OHCA database exclusion criteria
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	Bystander/lay person suspected a cardiac arrest where 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 by SJWA.

## Data capture

Data fields in the SJWA OHCA database are based on internationally agreed definitions that are outlined in the Utstein template from the International Liaison Committee on Resuscitation (ILCOR). Two data sources are used to capture OHCA cases in WA:

### Computer aided dispatch (CAD) system database

The CAD system database is an organisational database with comprehensive geographical and operational information collected by the SJWA State Operations Centre. Specifically, the database includes date, incidence location, and the timestamps

of key events – i.e. when the emergency call is received, the first ambulance is dispatched, and the first ambulance arrives at the scene, enabling the calculation of valuable data on response times.

### Electronic patient care record (e-PCR). SJWA complete an electronic patient care record for all patients attended.

The e-PCR includes data on patient demographics, clinical assessment and management, such as identification of cardiac arrest rhythms, defibrillation (including bystander use of automated external defibrillator: AED), and administration of cardiac arrest drugs. The e-PCR was introduced in 2011. Prior to this, patient care records were paper-based. In order to ensure the capture of all OHCA cases in WA attended by SJWA, a sensitive but not specific electronic search strategy is conducted to identify potential OHCA cases from the CAD database for review. After manual scrutiny of individual cases by a research nurse, only those cases meeting the criteria for cardiac arrest (Tables 1 and 2) are included in the SJWA OHCA database. The initial arrest rhythm and causes of OHCA are also determined by manual review of the SJWA e-PCR. Survival outcomes of return of spontaneous circulation (ROSC), and ROSC on arrival at hospital (i.e. patient survived event) are obtained from the e-PCR. Survival to hospital discharge and longer term survival are determined by manual review of hospital records and/or WA State Death Registry – as described previously.

### Data quality

The data in the SJWA OHCA database are subject to ongoing quality improvement, with changes incorporated and back-dated in the database as needed. In 2017, two variables were recoded, namely 'resuscitation attempted by SJWA' and 'bystander-witnessed arrest', to more closely align with the Utstein definitions. (3) 'Bystander witnessed' now includes OHCA cases that were 'seen or heard'. Therefore, numbers reported in this report for 2016 may differ slightly from the 2016 SJWA OHCA annual report.

### Changes in relation to previous annual reports

In our previous, 2017 annual report, our definition of 'resuscitation attempt' followed the Utstein guidelines, relating exclusively to instances where the EMS (i.e. SJWA paramedics or EMTs) performed CPR and/or defibrillation. In this 2018 annual

report, we have adopted an expanded definition of resuscitation attempt, which, in addition to cases where EMS performed CPR and/or defibrillation, also includes patients who received an AED shock by bystanders. This same definition is also used in St John New Zealand's OHCA annual reporting. We see these cases as an integral component of system performance, which should be included as a core component of reporting. To facilitate comparisons with previous years, any statistics for 2017 and earlier that are reported in this report also use this expanded definition of resuscitation attempt.

### Ethics approval

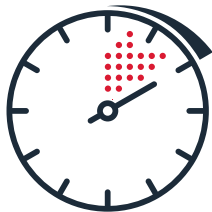
SJWA has given approval for the SJWA OHCA database to be managed at PRECRU (Curtin University) – under strict data access and security protocols. The Human Research Ethics Committee (HREC) at Curtin University has given approval for the SJWA OHCA database to be used for specific research purposes. Ethics approval to access hospital medical records to determine OHCA patient outcomes has been granted by the individual hospital HRECs. The WA Registrar of Births, Deaths and Marriages has approved access to the WA Death Registry by PRECRU researchers for HREC-approved studies. All paper and electronic 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 is relatively rare for all core variables (see Table 6 below).

**Table 6: Missing data (from n=2580 cases)**

Missing data	Number of cases
Sex	1
Age	9
Aetiology	0
Witness status	0
Location type	0
Response time	0
Initial arrest rhythm	12
Bystander CPR	0
Bystander shock given	0
Survived to hospital arrival	0
Survived to hospital discharge	1



**Swap compressor every loop (loops = 2mins)**

Another principle of IMPACT, a mandatory swapping of compressor at the 2 minute mark occurs to mitigate the risk of poor quality compressions delivered by a fatigued compressor, arguably a preventable harm.

## Incidence and demographics

In the period 1 January to 31 December 2018, SJWA attended 2,580 cases, of which 2,545 (99 per cent) were adults and 35 (1 per cent) were children. The crude incidence of OHCA in WA for adults was 123.6 per 100,000 population, similar to that reported elsewhere and 6.5 per 100,000 for children.

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

	Number of cases	Percentage of all cases	Resuscitation attempted (%)	Incidence rate	Gender
Adults	2545	99	44	123.6 per 100,000 person-years	Male 68% Female 32%
Children	35	1	-	6.5 per 100,000 person-years	-
<b>Total</b>	<b>2580</b>	<b>100</b>	<b>-</b>	<b>-</b>	<b>N/A</b>

### Resuscitation attempted

Of the 2,580 cardiac arrest cases attended, resuscitation was attempted in 1,144 patients – 44 per cent, a further reduction when compared to previous years. The increase in total survivor numbers in 2018 over previous years (see Outcomes – page 28), indicates that we have been able to achieve improved patient outcomes while at the same time becoming more adept at identifying patients that are suitable for resuscitation.

### Precipitating causes for children (age<16)

In 2018, the number of paediatric OHCA cases where EMS attempted resuscitation (n=31 cases), was the lowest in the last 4 years, predominantly due to a reduction in the number of SIDS (Sudden Infant Death Syndrome) cases.

**Table 8: Aetiology - Children**

Aetiology - children					
Cause of arrest	2015	2016	2017	2018	Total
Presumed cardiac	16	7	7	8	38
Respiratory	2	2	3	4	11
Malignancy					
Trauma	6	4	5	3	18
Hanging	3		5	2	10
Drowning	7	3	4	6	20
Drug overdose					
Electrocution	1			1	2
SIDS	7	17	15	7	46
Other			6		6
<b>Total</b>	<b>42</b>	<b>33</b>	<b>45</b>	<b>31</b>	<b>151</b>

Criterion: Excludes cases where EMS did not attempt resuscitation.

## Precipitating causes for adults (age≥16)

Likely precipitating causes are recorded in the electronic patient care record with a presumption of cardiac cause unless it is known or likely that the cardiac arrest was precipitated by another cause. The majority of adult cardiac arrests are of presumed cardiac origin, with trauma, malignancy and drug overdose representing the majority of the remainder.

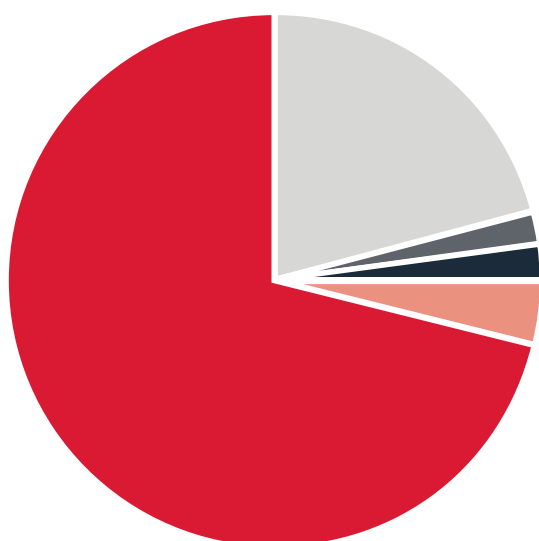
**Table 9: Aetiology - adults**

Aetiology - adults					
Cause of arrest	2015	2016	2017	2018	Total
Presumed cardiac	992	912	884	886	3674
Respiratory	14	21	21	31	87
Malignancy	17	14	11	15	57
Trauma	69	98	85	56	308
Hanging	80	72	76	68	296
Drowning	8	11	12	8	39
Drug overdose	39	45	46	49	179
Electrocution	3				3
Other	1	1	2		4
<b>Total</b>	<b>1223</b>	<b>1174</b>	<b>1137</b>	<b>1113</b>	<b>4647</b>

Criterion: Excludes cases where EMS did not attempt resuscitation.

## Arrest location

In keeping with previous reports, the family home continues to be the most common place for an OHCA to occur with the second most common place a public area, including the workplace.



**Figure 1: Cardiac arrest locations**

- 716 occurred in a private residence
- 208 occurred in public
- 41 occurred in an aged care facility
- 17 occurred in other accommodation\*
- 15 occurred in a medical centre

\* for example, hotels, backpacker hostels, and caravan parks

Criteria: Excludes EMS-witnessed arrests, and cases where EMS did not attempt resuscitation



### Calm, quiet and co-ordinated scene

Providing care for OHCA is demanding and stressful for our clinical teams. We know that teams work more effectively when the environment is well co-ordinated. Advocating a calm, quiet environment promotes task focus for each clinician, reduces cognitive load and better planning. This affords the team the best all round access to the patient in order to deliver optimal care.



## SJWA response times

Modest improvements in response times (from call pickup in State Operations Centre to ambulance arrival) were noted in both Perth, 8.6 minutes, and rural and regional locations, 12.1 minutes in 2018.

### Response time summary statistics

**Table 10: Metro response time in minutes**

	2015	2016	2017	2018
Median	8.9	9.0	9.0	8.6
10th centile	5.3	5.3	5.6	5.1
25th centile	6.8	7.1	7.1	6.5
75th centile	11.2	11.7	11.4	10.9
90th centile	14.1	15.1	14.7	14.5

Criteria: Excludes cases where resuscitation was not attempted.

**Table 11: Rural/regional response time in minutes**

	2015	2016	2017	2018
Median	13.5	12.3	13.1	12.1
10th centile	6.9	6.4	6.4	6.8
25th centile	9.0	9.0	8.9	8.9
75th centile	19.6	19.5	20.1	18.7
90th centile	32.0	33.0	33.4	28.9

Criteria: Excludes cases where resuscitation was not attempted.

## Community response pre-ambulance arrival

SJWA supports community and bystander CPR in a number of ways: through our first aid training courses, through grants supporting the broader distribution of community based AEDs, and via our First Responder smartphone app. Our call takers are trained to provide instructions on the provision of chest compressions and defibrillation to OHCA bystanders.

**Table 12: Provision of bystander CPR**

	2015	2016	2017	2018	Total
CPR provided	706	718	748	793	2965
No evidence of bystander CPR	403	347	295	204	1249
<b>Total</b>	<b>1109</b>	<b>1065</b>	<b>1043</b>	<b>997</b>	<b>4214</b>
<b>% where CPR provided</b>	<b>63.7</b>	<b>67.4</b>	<b>71.7</b>	<b>79.5</b>	

Criteria:

Excludes EMS-witnessed arrests, and cases where EMS resuscitation was not attempted

Widespread distribution and utilisation of community based AEDs represent a significant source of additional survivors to the Western Australian community. We have seen a steady increase in the total number of AEDs located on our First Responder app; an increase in the number of patients who have AED pads applied by bystanders; an increase in the number of OHCA patients shocked by bystanders, and finally an increase in the number of survivors to hospital discharge who were shocked by a community-based AED prior to ambulance arrival.

**Table 13: Bystander use of AED and number of survivors - all of WA**

Values	2015	2016	2017	2018	Total
AED pads applied by bystander	27	40	86	111	264
AED shock delivered by bystander	26	25	41	60	152
ROSC at ED after bystander AED shock	17	14	20	46	97
Number of survivors to hospital discharge after bystander AED shock	13	14	17	40	84



**Create an overview position, if possible**

IMPACT is very much intended to allow our clinical teams to provide care as effectively as possible. Leadership and holistic overview is a crucial part of the team. Remaining hands-off, the leader has the bandwidth to co-ordinate skills and anticipate next steps, allowing individual skill delivery at the patient side to be undistracted. This affords the team the best all round access to the patient in order to deliver better care.



### Closed loop communication/Functional language

In a similar thread to standardised equipment placement, we have adopted a standardised phraseology with in a closed loop style of communication. Through a human factors consultant, we continue to draw lessons from the functional language of the aviation cockpit to optimise care and mitigate risks, especially at critical phases of the resuscitation such as defibrillation.

# Outcomes

## Adult outcome from all cause cardiac arrests

In 2018, 24 per cent of OHCA cases with resuscitation attempted had a pulse at ED arrival. This represents a small improvement over the period 2015-2017 (19-21 per cent). However, survival to hospital discharge among resuscitation-attempted cases was much higher in 2018 (15 per cent) than in the period 2015-2017 (9-10 per cent), a substantial improvement on previous years, suggesting that patients with ROSC at ED might be a more heterogeneous group than previously thought.

In 2018, Western Australia had 172 OHCA survivors to hospital discharge – a substantial increase on the 2017 result – 113 (not attributable to population growth) and also higher than our previous best year – 2015, 128. We compare survival outcomes over the last four years in the table below.

**Table 14: Trends in survival outcomes 2015-2018**

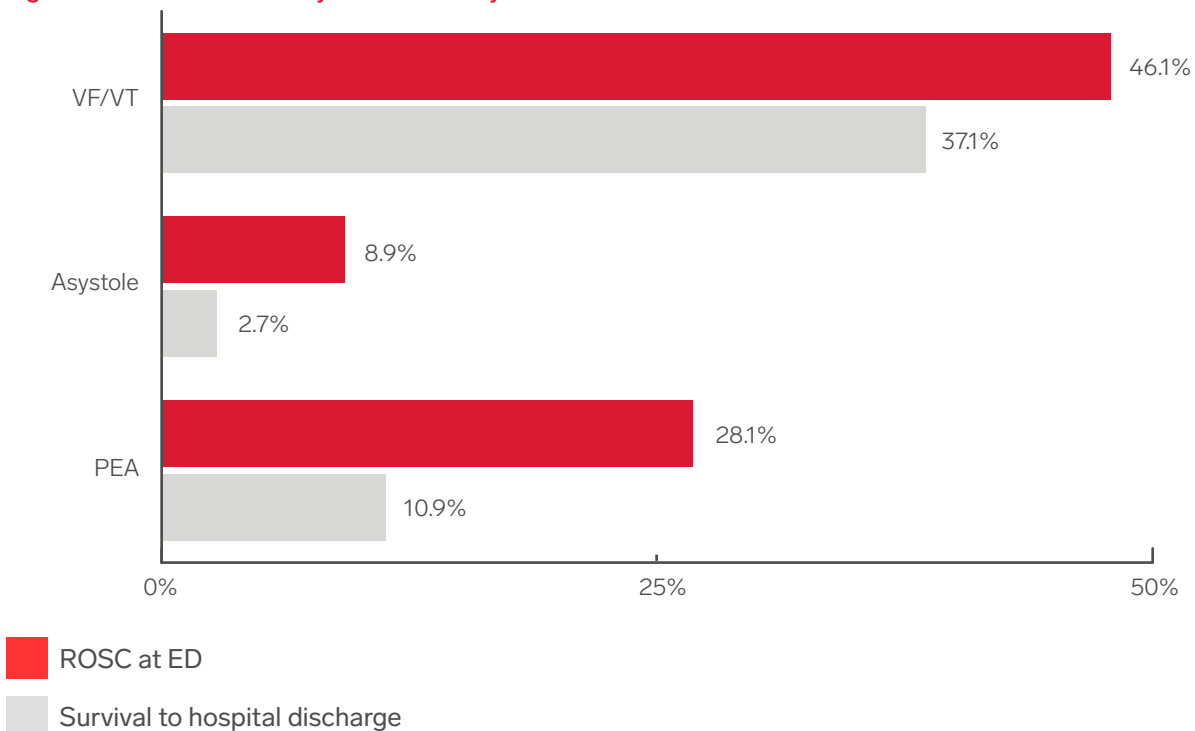
	2015	2016	2017	2018
%ROSC at ED	21.4	18.9	21.4	23.8
% Survival to hospital discharge	10.1	9.4	9.6	15.0

## Adult outcomes according to presenting rhythm

OHCA patients presenting in a shockable rhythm – either ventricular fibrillation or ventricular tachycardia – have the highest chance of survival to hospital discharge when compared to patients in non-shockable rhythms.

Western Australia has traditionally had a low rate of shockable rhythms in the OHCA cohort, comprising 21-23 per cent of cases in 2015-2017 where resuscitation was attempted. However, in 2018 the VF/VT rate was 29 per cent. The reasons for this are unclear – one possibility is that it reflects shorter time to defibrillation, facilitated by increased investment in, and utilisation of community-based AEDs.

**Figure 2: Survival statistics by initial arrest rhythm**



Criteria: Restricted to adults (≥ 16 yrs); excludes cases where EMS did not attempt resuscitation

**Table 15: Survival statistics by initial arrest rhythm**

Rhythm	2015	2016	2017	2018	Total
VF/VT	255	250	258	321	1084
Asystole	705	664	615	563	2547
PEA	263	259	264	201	987
Non-shockable (unspecified rhythm)				19	19
Unknown		1		9	10
<b>Total</b>	<b>1223</b>	<b>1174</b>	<b>1137</b>	<b>1113</b>	<b>4647</b>

Criteria: Restricted to adults (≥ 16 yrs); excludes cases where EMS did not attempt resuscitation

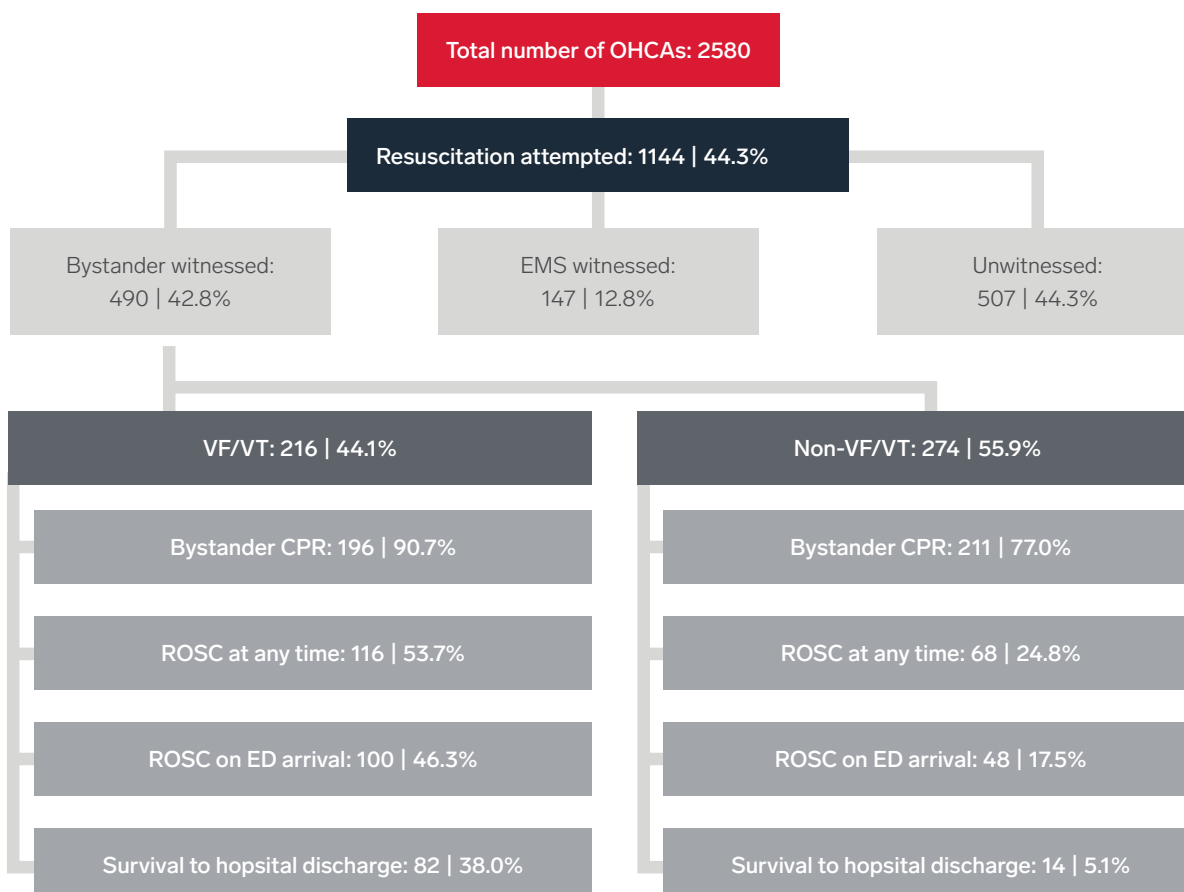
We also noted an unusually high number of survivors from the presenting rhythm asystole – 15 in 2018 compared to an average of 4 per year in the period 2015-2017.

### Utstein Comparator Group

The Utstein Comparator Group looks at outcomes for all cause OHCA patients where there is a bystander-witnessed, shockable cardiac arrest.

The Utstein Comparator Group represents the patients most likely to survive OHCA. During 2018, 216 patients met the Utstein criteria and 82 survived, for a survival rate of 38 per cent.

**Figure 3: Utstein criteria**





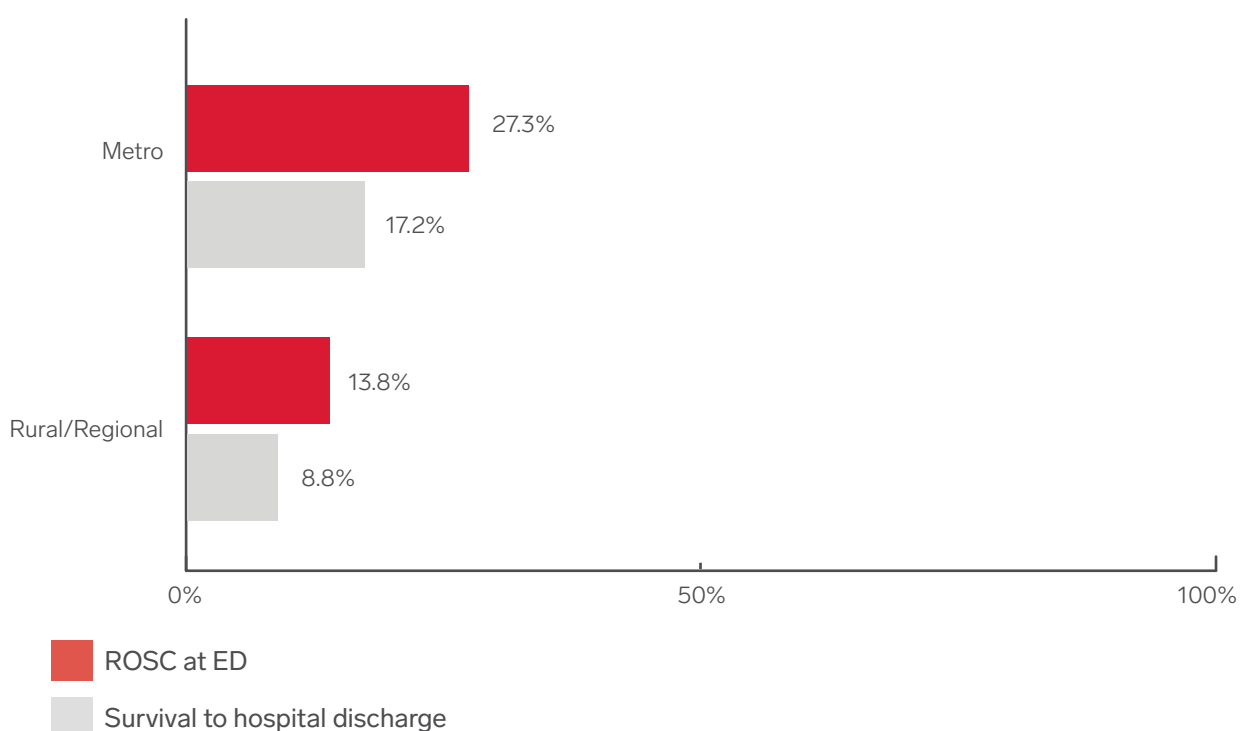
**(BVM Oxygen)/Controlled ventilation**

The final principle of IMPACT is adequate oxygenation and the avoidance of over-ventilation for all OHCA patients. There is an emphasis on minimal distraction and task focus similar to that expected of the compressor. The aim is to deliver the right volume, at the right rate, at low pressure. This promotes better CPR induced blood flow. This affords the team the best all round access to the patient.

## Outcomes according to rurality

Western Australia is a very large state (2.5 million square kilometres); in spite of this, almost 80 per cent of the population lives in Perth, the capital city. In Figure 4 we compare OHCA outcomes in the Perth metropolitan area compared to the rest of Western Australia. In 2018, the likelihood of survival from an arrest in the Perth metropolitan area was almost double that seen in rural and regional areas.

Figure 4: Outcomes in the Perth Metropolitan area v the rest of WA



Criteria: Excludes cases where EMS did not attempt resuscitation

## Conclusion

The data presented in our 2018 OHCA report demonstrates pleasing improvements in the rate of OHCA survival in Western Australia. This improvement has been generated across the community with every phase of the OHCA response playing a vital role.

We are pleased to report that our performance sits well in comparison with other Australian and New Zealand jurisdictions. Perhaps the 2018 result has opened a window on what might be possible in our vast state, and it is most encouraging. While it is satisfying, much work remains to be done to sustain and further improve the rates of OHCA survival in our community.

**St John**



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