



ST JOHN WA  
**CARDIAC ARREST REPORT** 2016



Compiling this report would not have been possible without the pioneering work of our colleague and friend the late Professor Ian Jacobs, who was at the national and international forefront of cardiac arrest research.

Prof Jacobs established the West Australian out-of-hospital cardiac arrest database in 1996 and it was his vision that has enabled this report to be published.

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# ABBREVIATIONS

<b>ALS</b>	Advanced Life Support
<b>AED</b>	Automated External Defibrillator
<b>AM</b>	Area Manager
<b>AO</b>	Ambulance Officer
<b>AUS-ROC</b>	Australasian Resuscitation Outcomes Consortium
<b>CAD</b>	Computer Aided Dispatch
<b>CFR</b>	Community First Responder
<b>CPR</b>	Cardiopulmonary Resuscitation
<b>CSP</b>	Clinical Support Paramedic
<b>DoH</b>	Department of Health
<b>ECG</b>	Electrocardiogram
<b>EMS</b>	Emergency Medical Services
<b>MMO</b>	Manager Metropolitan Operations
<b>MPDS</b>	Medical Priority Dispatch System
<b>OHCA</b>	Out-of-Hospital Cardiac Arrest
<b>PCR</b>	Patient Care Record
<b>PEA</b>	Pulseless Electrical Activity
<b>PRECRU</b>	Pre-hospital, Resuscitation and Emergency Care Research Unit, Curtin University
<b>ROSC</b>	Return of Spontaneous Circulation
<b>SJA WA</b>	St John Ambulance WA
<b>SOC</b>	State Operations Centre
<b>SRU</b>	Single Responder Unit
<b>VACAR</b>	Victorian Ambulance Cardiac Arrest Registry
<b>VF</b>	Ventricular Fibrillation
<b>VT</b>	Pulseless Ventricular Tachycardia
<b>WA</b>	Western Australia

# DEFINITIONS

<b>Adults</b>	Patients aged greater than 15 years of age, or where the age is missing/unknown
<b>Ambulance officer</b>	Crew member studying towards a degree in paramedicine
<b>Asystole</b>	Absence of any cardiac activity
<b>Dead on arrival</b>	Cases for which paramedics determine a patient to be deceased on arrival
<b>Defibrillation</b>	Providing an electrical shock to a patient in a shockable rhythm
<b>Died at scene</b>	Patients who receive an EMS attempted resuscitation but do not survive to transport
<b>Emergency medical services</b>	Denotes St John Ambulance WA paramedics, Volunteer Ambulance Officers or first responders, including community emergency response
<b>EMS attempted resuscitation</b>	Cases where either paramedics or first responders attempted to revive a patient in cardiac arrest using CPR and/or defibrillation, irrespective of duration
<b>EMS attended</b>	Cardiac arrest events attended by paramedics regardless of whether treatment was provided
<b>EMS response time</b>	The time from emergency call to arrival of EMS crew on scene
<b>EMS treated</b>	Cases involving an EMS attempted resuscitation
<b>Event survival</b>	Patients that have a palpable pulse on arrival at hospital as documented on the PCR
<b>Metro</b>	Denotes the Perth Metropolitan area
<b>Paediatrics</b>	Patients aged less than 16 years
<b>Paramedic</b>	ALS Qualified Ambulance Officer
<b>PCI-capable hospital</b>	Denotes a hospital with access to 24/7 Percutaneous Coronary Intervention (PCI) capabilities
<b>Presumed cardiac aetiology</b>	Cases where the cause of arrest is not due to a known precipitator (e.g. trauma, overdose poisoning, etc.), as acquired from the PCR
<b>Regional WA</b>	Denotes areas outside the Perth Metro area
<b>Return of Spontaneous Circulation</b>	Cases in which the resuscitation attempt results in a return of spontaneous circulation (i.e. detectable pulse) at any time
<b>State Operations Centre</b>	Triple zero (000) and non-urgent call centre
<b>Survival to hospital discharge (or discharged alive)</b>	Patients who are discharged from hospital alive
<b>Shockable Rhythm</b>	Rhythms which are appropriate to receive defibrillation, including ventricular fibrillation and pulseless ventricular tachycardia, by EMS or a bystander with a public automated external defibrillator
<b>Transport Officer</b>	Basic life support transport officers
<b>Transported with CPR</b>	Patients who, at the time of scene departure, are administered ongoing CPR.
<b>Transported with ROSC</b>	Patients who, at the time of scene departure, have a ROSC (i.e. detectable pulse)
<b>Utstein patient group</b>	Patients who are witnessed to arrest by a bystander, present in a shockable rhythm and an attempt at resuscitation was made by EMS
<b>Volunteer Ambulance Officer</b>	Unpaid Ambulance Officer providing emergency services to their community



'It just goes to show that anybody can do first aid'



# THE POWER OF ONE

**One person can be the difference between life and death in the event of a sudden cardiac arrest. For father of two Bill Tucker that one person was Abigail Adamson who selflessly came to his aid when he suffered a cardiac arrest while shopping in the Perth CBD in July 2016.**

Kathmandu assistant manager Abigail responded to screams for help from bystanders and rushed outside the shop and saw Bill lying on the ground, unresponsive, grey and with no pulse.

Despite this daunting scenario, Abigail took immediate charge of the scene, directing someone to call triple zero (000) before starting CPR. Fate had intervened as she had only completed her CPR training with St John a few weeks earlier.

The ambulance crew arrived on scene shortly after and as Abigail's CPR was so effective, they asked her to keep going while they did various clinical interventions including providing shocks from a defibrillator, which led to Mr Tucker's revival.

Mr Tucker was rushed to Royal Perth Hospital where he spent five weeks recuperating. He has since made a full recovery with nil ongoing physical deficits.

Abigail said: "It was a bit of a scary experience, but it just goes to show that anybody can do first aid."

"If it hadn't have been for the training, I wouldn't have had a clue," she said. "I still would have attempted to help in some way but I actually knew what I was doing."

Unsurprisingly, Bill is thankful that Abigail had the skills and confidence to step up and save his life.

"I owe my life to her really ... I was dead for 45 minutes and the only thing keeping me going was the CPR by Abigail and then the paramedics."

The first minutes after a sudden cardiac arrest are pivotal in the survival of the patient.

St John Ambulance clinical support paramedic Duncan Patterson said early intervention saved Mr Tucker.



# INTRODUCTION

## from CEO | Clinical Director | PRECRU Director Tony Ahern | Paul Bailey | Judith Finn

It is with great pleasure that St John Ambulance Western Australia (SJA WA) presents this, our first annual report on the management of out-of-hospital cardiac arrest. Thanks to the pioneering out-of-hospital cardiac arrest registry maintained by PRECRU, we have been able to compare changes in our performance over time as well as compare ourselves to systems around the country and indeed around the world.

Western Australia is a big state, and we take the responsibility of providing ambulance services with the utmost seriousness. In the Perth metropolitan area, approximately five individuals are treated for an out-of-hospital cardiac arrest each day. Over time, it has become increasingly apparent that the key components to patient survival involve far more than just a rapid ambulance response. Early recognition of cardiac arrest by members of the public, who then activate the ambulance service via Triple 000, perform high quality CPR and have access to an automated external defibrillator play a key role.

Triple zero (000) call takers, working in our State Operations Centre (SOC), are specifically trained in the recognition of cardiac arrest and are able to provide instructions on the performance of CPR at the scene, and of course our paramedic and ambulance officers respond with specific training and equipment for the management of the patient in cardiac arrest.

St John Ambulance provides our community with the ability to respond to these unexpected events through first aid and basic life support courses; instruction in the use of and supply of automatic external defibrillators; activation of first responders via our St John

First Responder App; and the provision of a comprehensive ambulance service throughout the state.

In February 2017, Associate Professor Paul Bailey and General Manager Clinical Services Deon Brink attended the Seattle Resuscitation Academy to learn from the best in the world in what it takes to be the best in the world. They showed us that there was no magic bullet, no miracle cure – but a collection of marginal improvements across each of the steps in the processes that will yield a significant improvement in our out-of-hospital cardiac arrest management over time. We are firmly committed in implementing, as far as practical, these changes.

This report allows us to pause and reflect on our current performance; to celebrate our successes; and quietly contemplate areas for improvement in the care provided to the public of Western Australia. Cardiac arrest is a tragic event for many families – and to those affected we offer our utmost sympathy and a firm resolve to continue to improve patient outcomes in future years.

# DESCRIPTION OF OUR SERVICE

**St John Ambulance Western Australia provides emergency ambulance services in Western Australia – a land area of some 2.5 million square kilometres – serving a population of approximately 2.6 million people. Ambulance services are provided by dedicated and skilled volunteers and community paramedics in rural and some regional locations, with career paramedics engaged in the Perth metropolitan area and larger regional centres. Care is provided to more than 300,000 patients per year in both ambulance and event health settings.**

St John ambulance officers and paramedics, paid and volunteer, are supported through ongoing clinical education. Our graduate paramedics complete a four-year training program, including a tertiary degree with Curtin University, graduating with a bachelor degree in paramedicine.

In Australia, emergency services are activated via the triple zero (000) call service. Ambulance calls are directed to the St John State Operations Centre (SOC) where they are answered by specially trained call takers and prioritised according to the time-critical nature of

In the Perth metropolitan area, the ambulance response to an out-of-hospital cardiac arrest includes two dual paramedic/ambulance crews and either an area manager or clinical support paramedic – which equals a total of five paramedics responding. In larger regional areas, the response most commonly consists of two ambulances.

In smaller rural locations, a cardiac arrest call-out will most commonly result in a single ambulance responding with a crew made up of two volunteer ambulance officers.

**In the Perth metropolitan area, the ambulance response to an out-of-hospital cardiac arrest includes two dual paramedic/ambulance crews and either an Area Manager or Clinical Support Paramedic – which equals a total of five paramedics responding.**

the emergency – using a well validated process called the Medical Priority Dispatch System (MPDS). There are two triple zero call centres in Western Australia – with the main facility at Belmont, near the Perth CBD, and a secondary centre at Wangara in Perth's northern suburbs. St John receives approximately 850 calls per day for emergency ambulance response.

When a call consistent with cardiac arrest comes in, MPDS allocates the highest priority response. During the call, questions are asked regarding the availability of a defibrillator locally and any bystanders/family are instructed to commence CPR while an ambulance is dispatched.

St John Clinical Practice Guidelines of relevance to out-of-hospital cardiac arrest include those relating to basic life support, defibrillation, advanced life support, airway support and recognition of life extinct. The latter covers situations where resuscitation is clearly not appropriate.

St John cardiac arrest protocols are based on the Australian Resuscitation Council (ARC) Guidelines [resus.org.au/guidelines/](https://www.resus.org.au/guidelines/)

All protocols are developed by St John's Clinical Governance team and ratified by our Medical Policy Committee.



## ABOUT THIS REPORT

**Sudden out-of-hospital cardiac arrest (OHCA) is a leading cause of death in Western Australia. As others have noted, benchmarking of performance measures associated with OHCA is a recognised way of comparing the performance of ambulance services worldwide, although concerns are often raised with regards to the accuracy of data (and the standardisation of definitions). In fact, the American Heart Association states that the management of OHCA by EMS agencies is the sentinel measure of the quality of EMS care.**

The cases and data in this, our first OHCA annual report, represent cases identified through the SJA WA OHCA registry covering the time period from January to December 31, 2016 and represent all OHCA cases attended to by St John in that time period. Further information on this process is available in the description of registry.

Analysis in this report refers to two broad patient groups, the first being OHCA attended (all patients); the second being resuscitation attempted (a subset of the first group where paramedics have commenced resuscitation). Major endpoints include 'survived event' which is defined as the presence of a pulse (otherwise

referred to as a 'return of spontaneous circulation' or ROSC) at Emergency Department (ED) arrival and 'survival to hospital discharge' which is self-explanatory.

Analysis of data was performed by PRECRU researchers in March 2016.

For the sake of clarity, outcomes of OHCA of relevance to international comparison are median response time, return of spontaneous circulation at ED arrival and discharged from hospital alive. There has also been increasing recognition of the importance not just of survival – but also of good neurological/ functional outcomes.



# DESCRIPTION OF REGISTRY

**The St John Ambulance Western Australia out-of-hospital cardiac arrest database (SJA WA OHCA database) was established in January 1996 by the late Professor Ian Jacobs. The SJA WA OHCA database is currently located within PRECRU at Curtin University.**

Since 1996, this database has primarily included:

1. computer-aided dispatch data,
2. prehospital clinical management data from patient care records (electronic records available from mid-2011), and,
3. hospital outcome data from hospital medical records, for OHCA cases of all ages occurring in Perth where SJA WA paramedics attended.

The comprehensive capture of regional WA data commenced in 2014.

Survival to hospital discharge and neurological outcomes (Cerebral Performance Category and Overall Performance Category) <sup>(1)</sup> are ascertained for patients admitted to a hospital in Perth, through manual review of hospital medical records. These outcomes cannot currently be determined for rural WA patients who are not transferred to a Perth hospital.

Patient survival outcomes after hospital discharge (e.g. 30 day and 12 month survival) are ascertained for metropolitan Perth and regional WA cases by checking against death records from the WA State Registry of Births, Deaths and Marriages.

Over the last 20 years, data for OHCA cases (children and adults) have been captured for more than 29,500 patients in WA.

## DEFINITION OF OUT-OF-HOSPITAL CARDIAC ARREST (OHCA)

The SJA WA OHCA database defines an OHCA case as a patient with no signs of circulation. Specifically there is an absence of a detectable carotid pulse, unconsciousness/unresponsiveness, and agonal/absent breathing; with the event occurring outside of hospital.

## ELIGIBILITY

The case inclusion and exclusion criteria for the SJA WA OHCA database are described in Tables i and ii.

Table i:	SJA WA 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 (including residential care facilities).
2	Occurred in the State of Western Australia and was attended by St John paramedics
3	<p>a. All patients who are unconscious and pulseless with either agonal or no breathing on arrival of St John paramedics.</p> <p>OR</p> <p>b. All patients who become unconscious and pulseless with either agonal or no breathing in the presence of St John paramedics (paramedic-witnessed arrest).</p> <p>OR</p> <p>c. Patients who have a pulse on arrival of SJA WA paramedics following successful defibrillation provided by a bystander prior to arrival of St John paramedics.</p>

Table ii:	SJA WA OHCA database exclusion criteria (all of the following):
1	Any patient who suffers a cardiac arrest in a hospital facility where SJA WA paramedics 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 SJA WA 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 St John paramedics, and no defibrillation has occurred.

## DATA CAPTURE

The data fields in the SJA WA OHCA database are based on the internationally agreed definitions that are outlined in the Utstein template from the International Liaison Committee on Resuscitation (ILCOR)<sup>(2)</sup>. Two data sources are used to capture OHCA cases in WA:

### 1. COMPUTER AIDED DISPATCH (CAD) SYSTEM DATABASE

The CAD system database is an organisational database with comprehensive geographical and operational information collected by the St John State Operations Centre. Specifically, the database includes date, incidence location, and timestamps of key steps in the call-taking process, i.e. the time an emergency call was received, ambulance response time, first ambulance dispatched time, and first ambulance arrival at scene.

### 2. ELECTRONIC PATIENT CARE RECORD (ePCR)

St John paramedics complete an electronic patient care record for all patients attended. The ePCR includes data on patient demographics, clinical assessment and paramedic management, such as identification of cardiac arrest rhythms, defibrillation (including bystander use of automated external defibrillator), and administration of cardiac arrest drugs. The ePCR 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 St John paramedics, a sensitive but not specific, search strategy is conducted to identify potential OHCA cases from the CAD database for review.

After manual scrutiny of individual cases by the database manager, only those cases meeting the criteria for cardiac arrest (Tables i and ii) are included in the SJA WA OHCA database.

The initial arrest rhythm and causes of OHCA are also determined by manual review of the ePCR.



Survival outcomes of return of spontaneous circulation (ROSC) and ROSC on arrival at hospital (i.e. patient survived event) are obtained from the ePCR. Survival to hospital discharge and longer-term survival are determined by manual review from hospital records (Perth-only) and/or WA State Death Registry – as described above.

## DATA QUALITY

The SJA WA OHCA database undergoes rigorous data quality control to ensure the accuracy of the data entered and coded.

The data in the SJA WA OHCA registry are subject to ongoing quality improvement, with changes being incorporated and backdated in the database as needed.

## ETHICS APPROVAL

St John WA has given approval for the SJA WA OHCA registry to be managed at PRECRU under strict data access and security protocols.

The Human Research Ethics Committee (HREC) at Curtin University has given approval for the SJA WA OHCA registry 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 in the Perth metropolitan area. All paper and electronic data relating to the SJA WA 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 SJA WA OHCA database relies on completeness of data capture. Missing data is relatively rare for all variables (see Table iii).

**Table iii:  
Number and proportion of missing data for select SJA WA OHCA database variables in 2016 (n=2,451)**

Variables	n	%
Patient age	11	0.4
Patient sex	Nil	0.0
Arrest location	Nil	0.0
Witnessed status	11	0.4
Bystander CPR	7	0.3
Initial arrest rhythm	13	0.5
Paramedics response time	Nil	0.0
Defibrillation time	7	0.3
Outcome at scene	9	0.4
Patient survived event (ROSC on arrival at hospital)	10	0.4
Hospital discharge status	8*	0.3

\*Note: Includes seven cases with hospital discharge data still pending

## REFERENCE

1. *Brain Resuscitation Clinical Trial I Study Group. A randomized clinical study of cardiopulmonary-cerebral resuscitation: design, methods, and patient characteristics. Am J Emerg Med. 1986;4(1):72-86.*
2. *Perkins GD, Jacobs IG, Nadkarni VM, Berg RA, Bhanji F, Biarent D, et al. Cardiac Arrest and Cardiopulmonary Resuscitation Outcome Reports: Update of the Utstein Resuscitation Registry Templates for Out-of-Hospital Cardiac Arrest: A Statement for Healthcare Professionals From a Task Force of the International Liaison Committee on Resuscitation (American Heart Association, European Resuscitation Council, Australian and New Zealand Council on Resuscitation, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Southern Africa, Resuscitation Council of Asia); and the American Heart Association Emergency Cardiovascular Care Committee and the Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation. Resuscitation. 2015;96:328-40.*

# INCIDENCE AND DEMOGRAPHICS

St John provides emergency ambulance services in Western Australia covering a land mass of approximately 2.5 million square kilometres and a population of approximately 2.6 million people, of whom 20 per cent are children aged 15 or younger. Just over 2 million people live in the Perth metropolitan region with approximately 550,000 people living in regional Western Australia.

For the purposes of this report, the Perth metropolitan area is the Greater Capital City Statistical Area (GCCSA) as defined by the Australian Bureau of Statistics in 2016.

In the period January 1, to December 31, 2016 St John attended 2,451 OHCA cases, of which 2,407 (98 per cent) were adults and 44 (two per cent) were children. The crude incidence of OHCA was 115.6 per 100,000 population, which is similar to that reported by St John New Zealand (128.9), Victoria Ambulance (118.6) and the London Ambulance Service (118.0) in 2014.

Rates in children at 8.2 cases per 100,000 population were again similar to that found elsewhere – Ambulance Victoria reported 7.4 per 100,000 population in 2014/15.

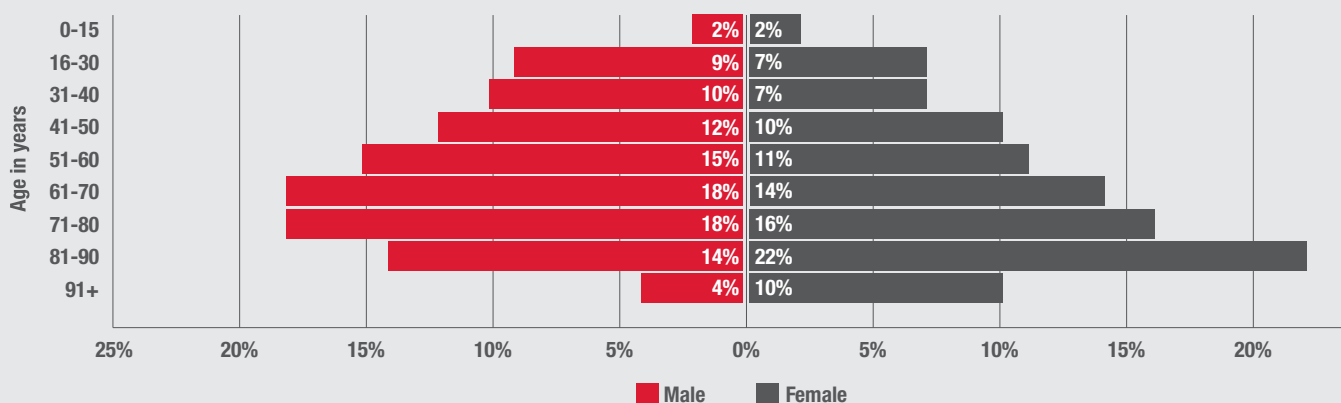
Of the 2,451 OHCA cases identified in 2016, resuscitation was commenced by St John crews in 1,208 cases (49 per cent). In around half of all OHCA cases attended, the person had been 'deceased' for too long or is deemed to have injuries inconsistent with life, or has an 'advanced care directive' in place – and therefore paramedics did not commence resuscitation.

As is usually found in other OHCA reports, there was a predominance of males over females at 67 per cent male, 33 per cent female. Male victims of OHCA had a median age of 63 years compared to females at 69 years of age.

**FIGURE 21**

## Age distribution of OHCA cases of all ages by sex in WA in 2016

Note: an alternative age distribution is provided in Figure 1. (VACAR: Page 23, Figure 6)

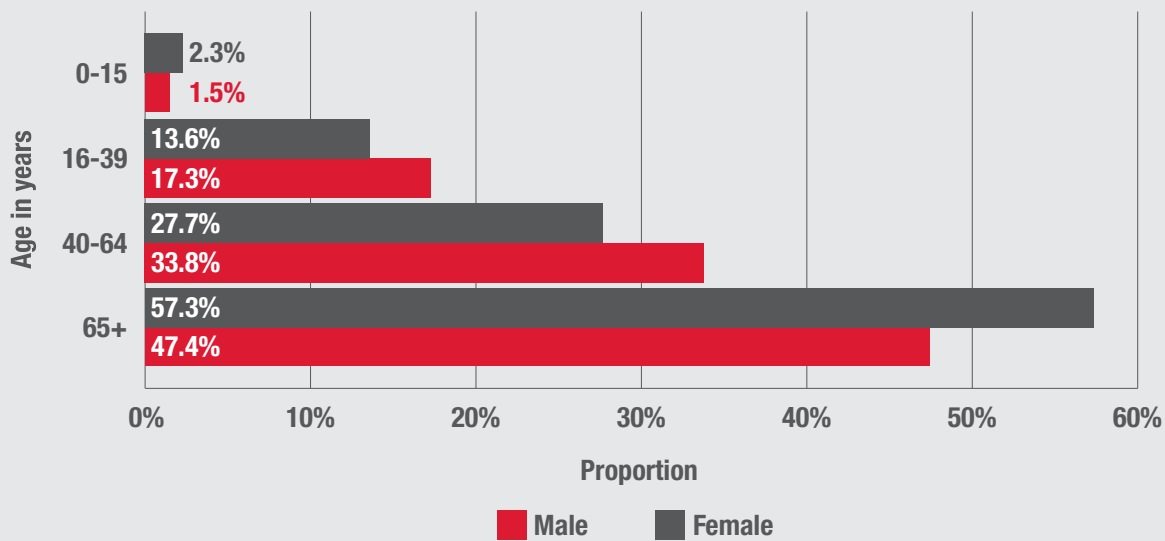


Again, as is often noted elsewhere, resuscitation was more commonly attempted in children than adults – a total of 33 / 44 patients (75 per cent).

**FIGURE 1**

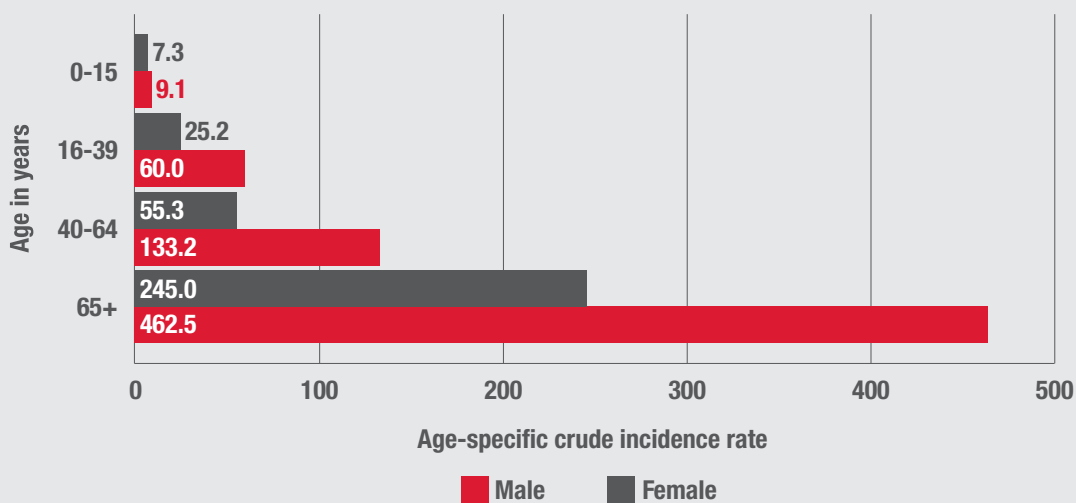
**Age distribution of OHCA cases of all ages by sex in WA in 2016**

Note: an alternative age-distribution by sex is provided in Figure 21 (which is more consistent with the VACAR report 'demographic profile' - Page 23, Figure 6 of VACAR annual report) (St John NZ: Page 15, Figure 1)



**FIGURE 2**

Age-specific incidence rate of OHCA cases in WA in 2016 (includes OHCA cases of all ages, irrespective of whether resuscitation was commenced by SJA WA paramedics) (St John NZ: Page 15, Figure 2\*) \*St John NZ refers to the equivalent figure as 'age-standardised' incidence.



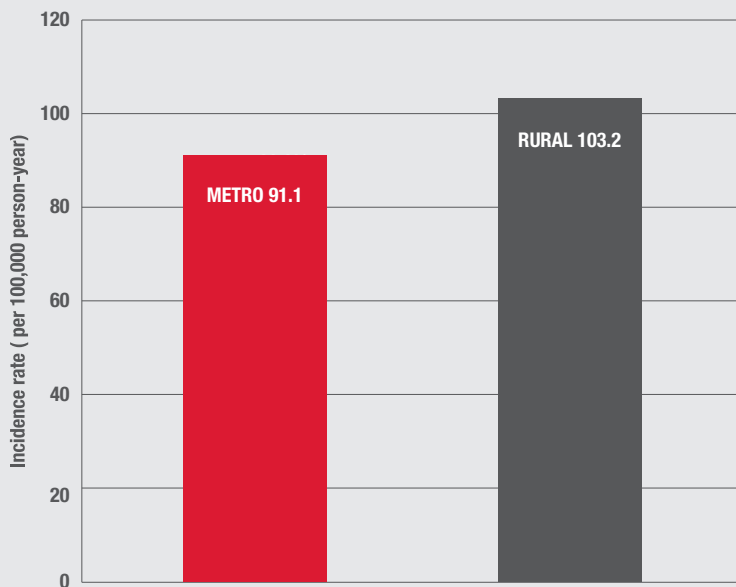


## INCIDENCES ACROSS RURAL AND REGIONAL AREAS IN WESTERN AUSTRALIA

Differences in OHCA incidence were identified between both metropolitan (91.1 cases per 100,000 person years) and rural/regional areas (103.2 cases per 100,000 person years), (Figure 3) as well as striking differences between WA Health Regions (Figure 3.1) which are not easily explained. A heat map is shown representing population linked incidence rates across the state.

**FIGURE 3**

Crude incidence rates of OHCA cases of all ages by region in WA in 2016 (irrespective of whether resuscitation was commenced both resuscitation by SJA WA paramedics) (St John NZ: Page 17, Figure 5)

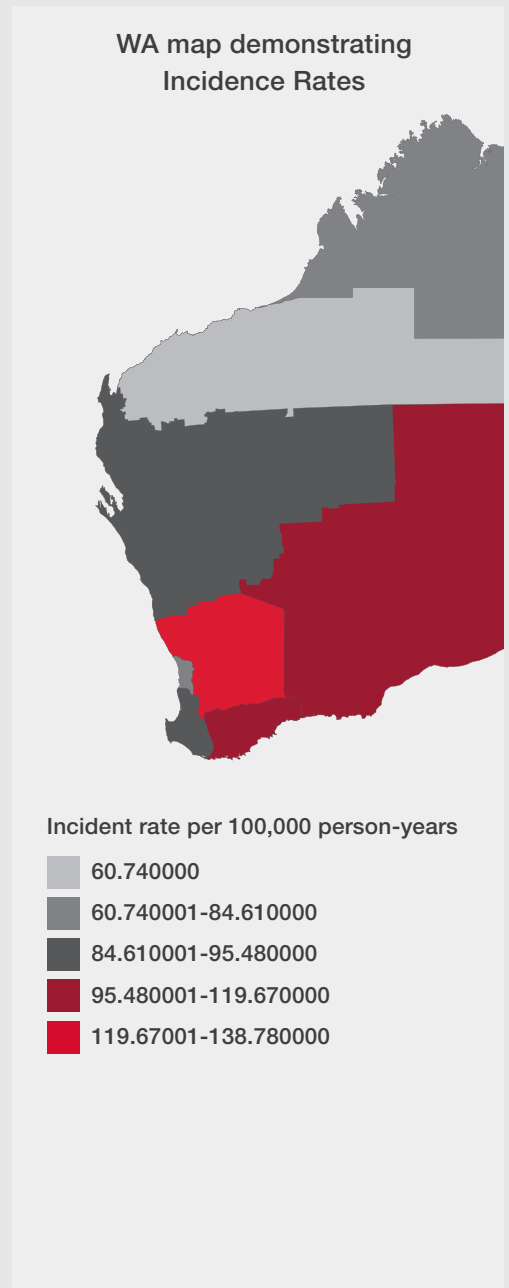
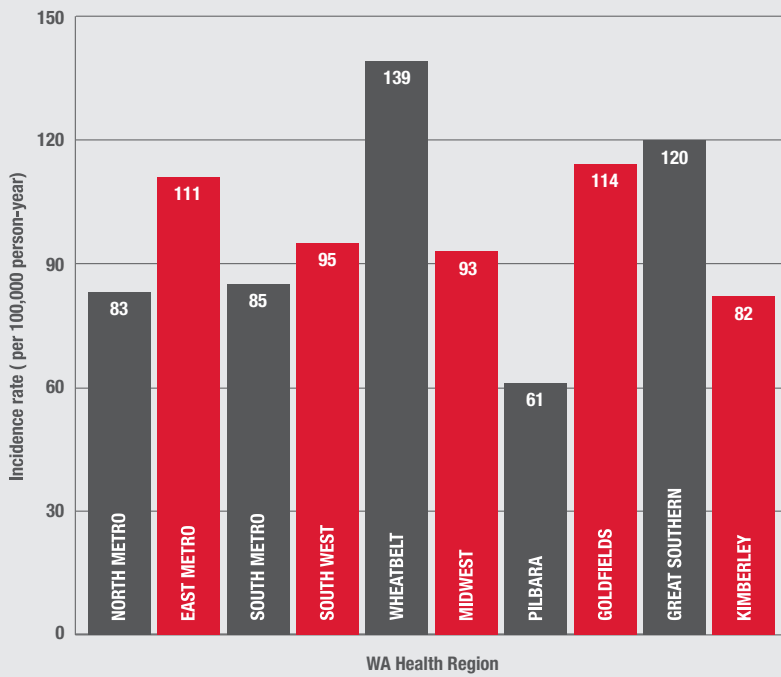


Location	Incidence	Population	Incidence rate*
Metro	1,882	2,065,867	91.1
Rural	569	551,305	103.2
<b>Total</b>	<b>2,451</b>	<b>2,617,172</b>	<b>93.7</b>

\*:per 100,000 person-year

**FIGURE 3.1**

Crude incidence rates of OHCA cases of all ages by WA Health Region in 2016 (including both resuscitation commenced and not commenced by SJA WA paramedics) (VACAR: Page 22, Figure 5)



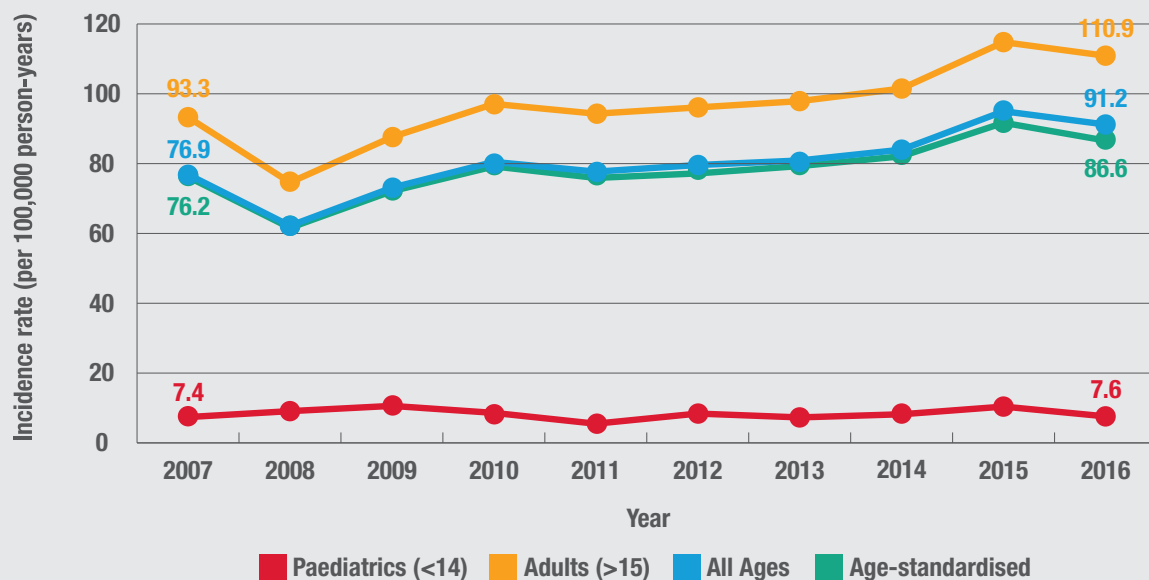
Health region	Incidence	Population	Incidence rate*
North Metro	604	732,283	83
East Metro	756	688,560	111
South Metro	539	643,635	85
South West	168	177,777	95
Wheatbelt	108	78,632	139
Midwest	63	68,583	93
Pilbara	40	66,543	61
Goldfields	69	61,165	114
Great Southern	72	60,790	120
Kimberley	32	39,204	82

\*:per 100,000 person-year

**FIGURE 19.2**

Trend in crude incidence rate of OHCA cases (all ages, adult, and paediatric), and age-standardised incidence rate (all ages), in the Perth metropolitan area between 2007 and 2016

(VACAR: Page 21, Figure 3)



**Note**

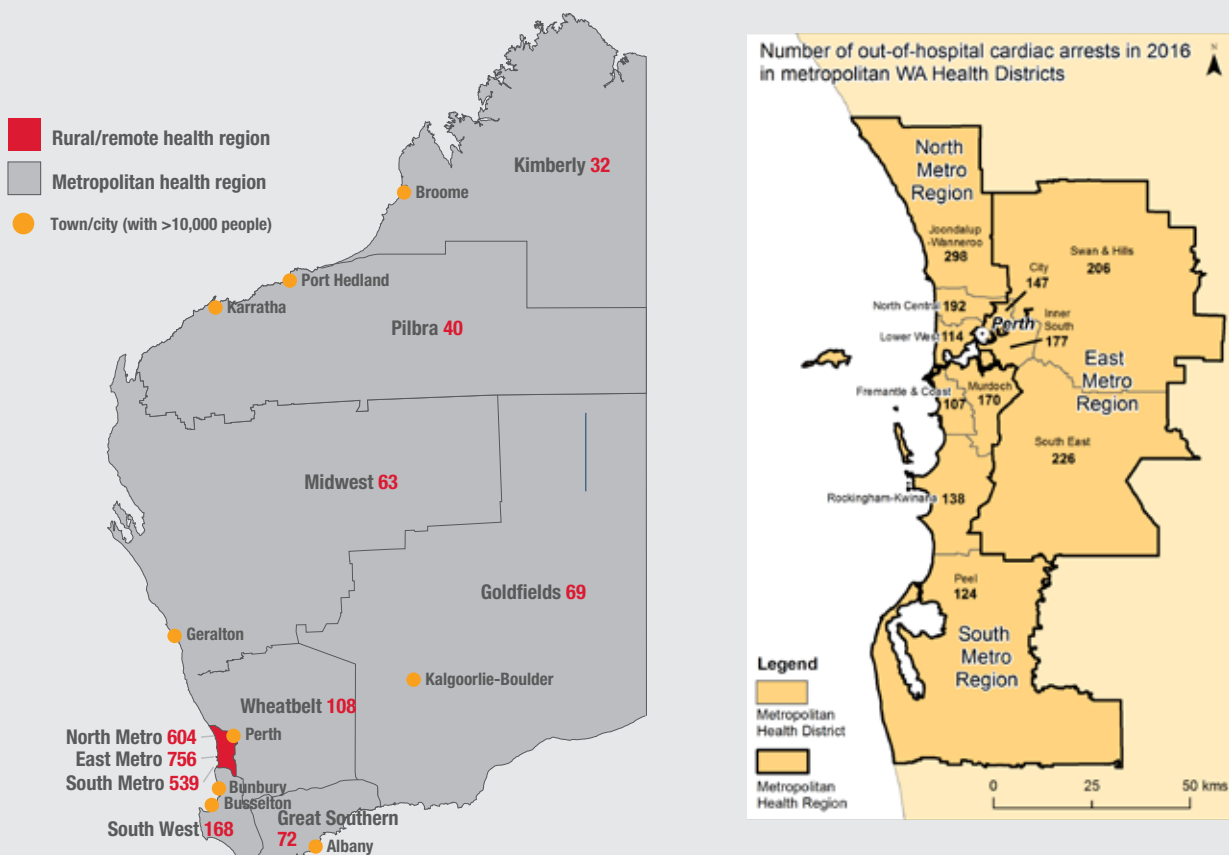
1. Population of five-year band (e.g. 0-4 years) was used because population of each year in the Perth metropolitan area was not available for 2013 to 2016.
2. Paediatrics were defined as those aged 14 or younger in this analysis because population of those aged 15 or younger was not available.
3. Populations in the Perth metropolitan area in 2016 were estimated by using those in 2014 and 2015.
4. Rural cases were not included because PCR/ePCR was incomplete before 2014.

Year	Paediatrics	Adult	All ages	Age-standardise incidence rate
2007	7.4	93.3	76.9	76.2
2008	9.1	74.6	62.2	61.6
2009	10.6	87.6	73.1	72.1
2010	8.6	97.1	80.5	79.2
2011	5.5	94.3	77.7	75.9
2012	8.4	96.1	79.6	77.2
2013	7.3	97.9	80.9	79.3
2014	8.2	101.5	84.0	82.1
2015	10.4	114.8	95.0	91.7
2016	7.6	110.9	91.2	86.6



Total numbers of OHCA occurring in 2016 across Western Australia and the Perth metropolitan area are shown in figure 3.2.

**FIGURE 3.2**  
Number of OHCA cases of all ages by WA Health Region in 2016



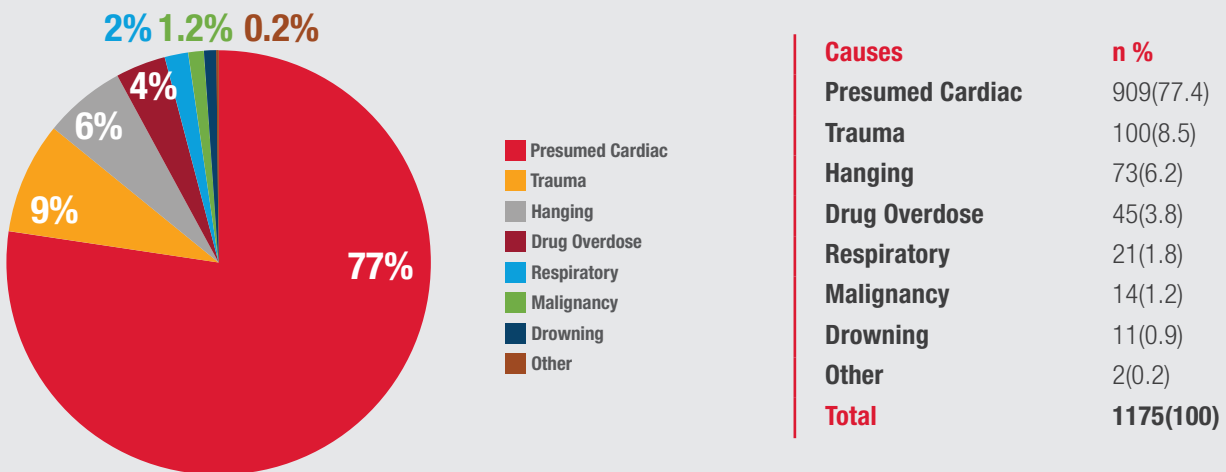




## PRECIPITATING EVENTS FOR ADULTS

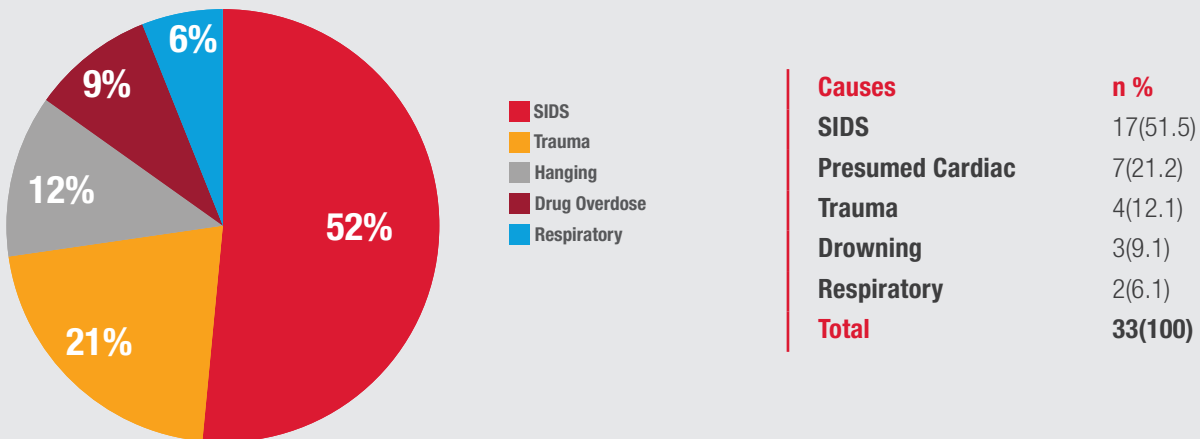
Events precipitating OHCA are recorded by paramedics in the electronic patient care record. Unless a clear alternate cause is present, OHCA in adults is presumed to be cardiac in nature. As can be seen in Figure 4, the majority of OHCA occurring in adults in Western Australia are presumed to be of cardiac origin, with trauma, hanging and drug overdose making up the majority of the remainder causes.

**FIGURE 4**  
Causes of adult OHCA cases (age≥16) where resuscitation was commenced by SJA WA paramedics, in WA in 2016



The aetiology of OHCA in children is different to that of adults, with sudden infant death syndrome accounting for approximately half the cases and presumed cardiac causes, trauma, drowning and respiratory causes accounting for the remainder.

**FIGURE 5**  
Causes of paediatric OHCA cases (age≤15) where resuscitation was commenced by SJA WA paramedics, in WA in 2016 (St John NZ: Page 17, Figure 8)



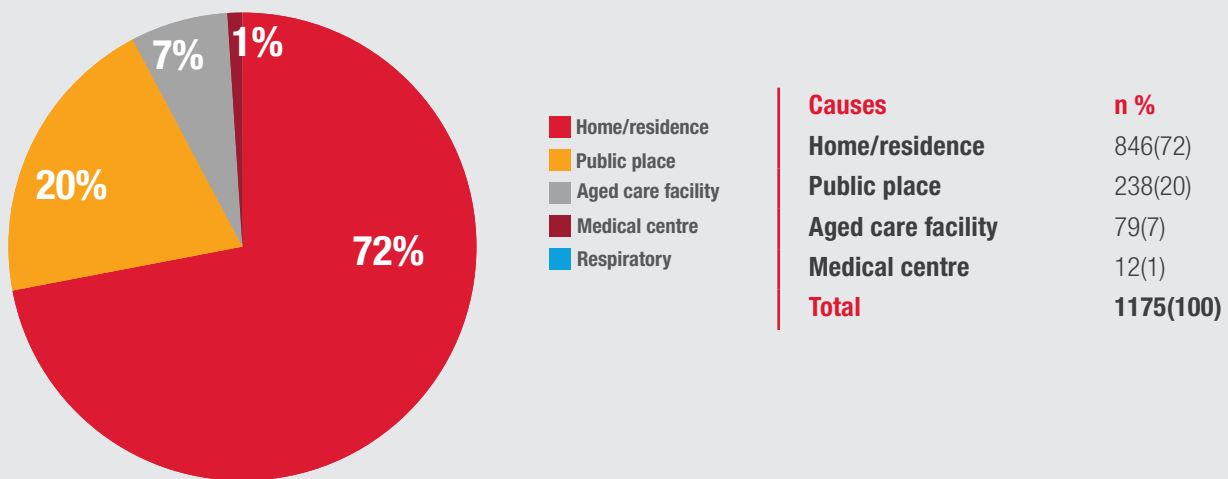
# ARREST LOCATIONS

OHCA arrest location plays a critical role in the eventual outcome for the patient.

Events occurring in public places such as the workplace, shops, and sporting/recreational facilities have a better outcome than those occurring in a residential setting.

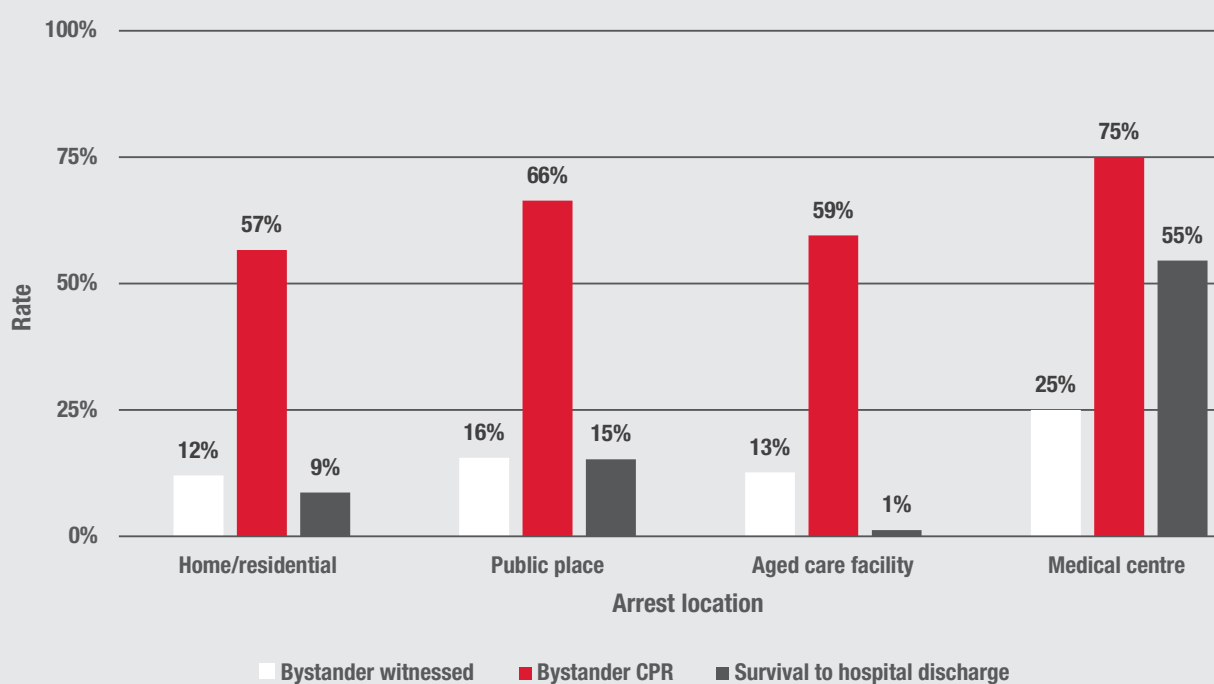
This is because public OHCA events are more likely to be witnessed, more likely to have a prompt triple zero (000) call, more likely to have bystander CPR and more likely to have an AED deployed. However, the most common arrest location for adult OHCA is the family home.

**FIGURE 6**  
Arrest locations of adult OHCA cases (age ≥ 16) where resuscitation was commenced by SJA WA paramedics, in WA in 2016 (St John NZ: Page 17, Figure 9 and VACAR: Page 27, Figure 11)



**FIGURE 23**

Proportion of adult OHCA cases (age≥16) which were witnessed by a bystander, received bystander CPR, and survived to hospital discharge among adult OHCA cases (age≥16) where resuscitation was commenced by SJA WA paramedics, in WA in 2016 (VACAR: Page 27, Figure 12)



	Home/residence	Public place	Aged care facility	Medical centre
<b>Bystander witnessed</b>	102(12%)	37(16%)	10(13%)	3(25%)
<b>Bystander CPR*</b>	478(57%)	158(66%)	47(59%)	9(75%)
<b>Survival to hospital discharge**</b>	73(9%)	36(15%)	1(1%)	6(55%)
<b>Total</b>	<b>846</b>	<b>238</b>	<b>9</b>	<b>12</b>

\*: Two cases were excluded because a status of bystander CPR was unknown.

\*\* : Six cases were excluded because survival status at hospital discharge was unknown.



# CHAIN OF SURVIVAL

The concept of the chain of survival was proposed in 1991. It is a sequence of events that is necessary to improve the patient's chances of surviving cardiac arrest. It has been modified numerous times over the years to reflect contemporary learnings and knowledge. The steps in the chain of survival can be found here: <http://bit.ly/2vNx4Ee>

## 1. EARLY RECOGNITION AND CALLING FOR HELP

Recognising the collapsed victim as being in cardiac arrest and early calling for help is essential to minimise the time in which the brain is without oxygen.

## 2. EARLY BYSTANDER CPR

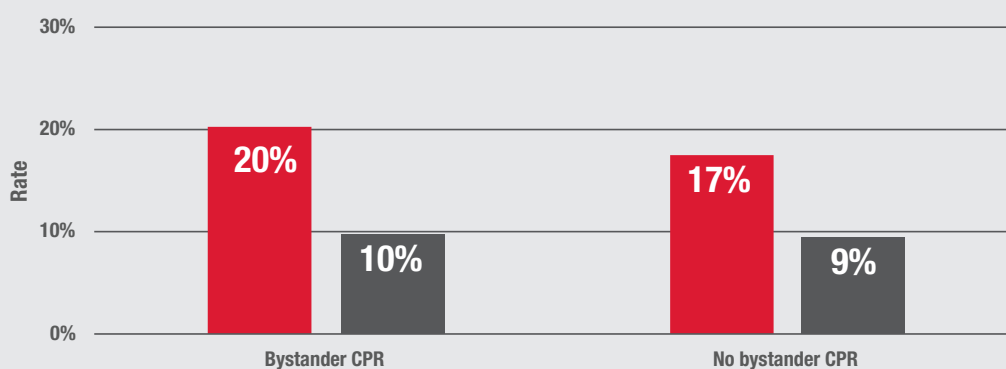
Brain tissue starts to die within 3 to 5 minutes after circulation stops due to the lack of oxygen. Even in the best systems in the world, it takes on average 4 to 12 minutes for the ambulance service to arrive at the victim's side. Simply by providing early chest compressions, bystander CPR provides the blood flow needed to buy the time needed for the ambulance to arrive and provide care.

Bystander CPR rates in Western Australia have significantly increased over the last 10 years, from 20 per cent of all events in 2007 to 35 per cent of all events in 2016, contributing to an increase in OHCA survival.

These improvements can, in part, be attributed to greater numbers of the general public who are trained in first aid as well as an improvement in OHCA recognition and the delivery of telephone CPR instructions from the SOC.

**FIGURE 25**

**Unadjusted survival outcomes after bystander CPR and resuscitation commenced by SJA WA paramedics in OHCA cases of all ages in WA in 2016. (VACAR: Page 30, Figure 15)**



**ROSC at arrival at hospital**

**Bystander CPR**

146(20%)

**No Bystander CPR**

85(17%)

**Survival to hospital discharge**

69(10%)\*\*

46(9%)\*\*\*

**Total\***

**721**

**486**

\*: One case was excluded from this analysis because of missing information

\*\* : Five cases were excluded from denominator because their survival status at hospital discharge is unknown.

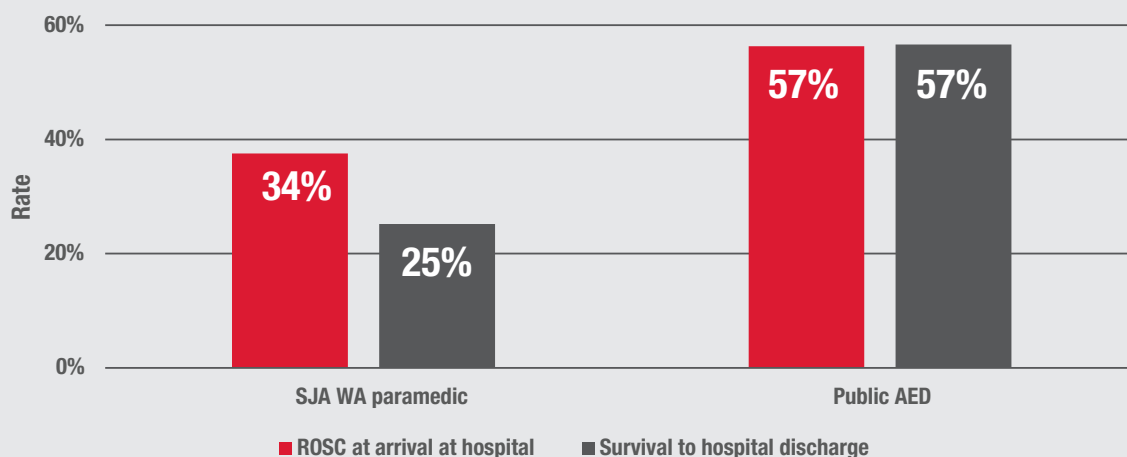
\*\*\*: One case was excluded from denominator because the survival status at hospital discharge is unknown.

### 3. EARLY DEFIBRILLATION

As chest compressions buy the time needed to provide care, defibrillation is the definitive treatment for victims in ventricular fibrillation, the most survivable of all cardiac arrest rhythms. It is not always necessary to wait for the arrival of an ambulance – the availability of Automated External Defibrillators (AEDs) in public places is increasing every day. The earlier you can provide a shock to victims in these rhythms, the better the chances of survival.

While time to first defibrillation is not currently tracked in the SJA WA OHCA database, clear outcome differences are based on who shocked the patient first – a public AED or an ambulance-based defibrillator. These differences are very likely related to time to defibrillation. Patients shocked by a public AED survive at twice the rate of those shocked just a few minutes later by a St John clinical crew. The discharge alive rate of 57 per cent provides powerful evidence as to the value of public AEDs and their associated impact on survival outcomes.

**FIGURE 26**  
**Unadjusted survival outcomes according to who shocked the first in OHCA cases of all ages where resuscitation was commenced with a shockable rhythm in WA in 2016** (VACAR: Page 31, Figure 16)



	SJA WA paramedics	Public AED
ROSC at arrival at hospital	108(34%)	13(57%)
Survival to hospital discharge	78(25%)	13(57%)
<b>Total</b>	<b>315</b>	<b>23</b>

#### 4. EARLY ADVANCED LIFE SUPPORT AND STANDARDISED POST RESUSCITATION CARE

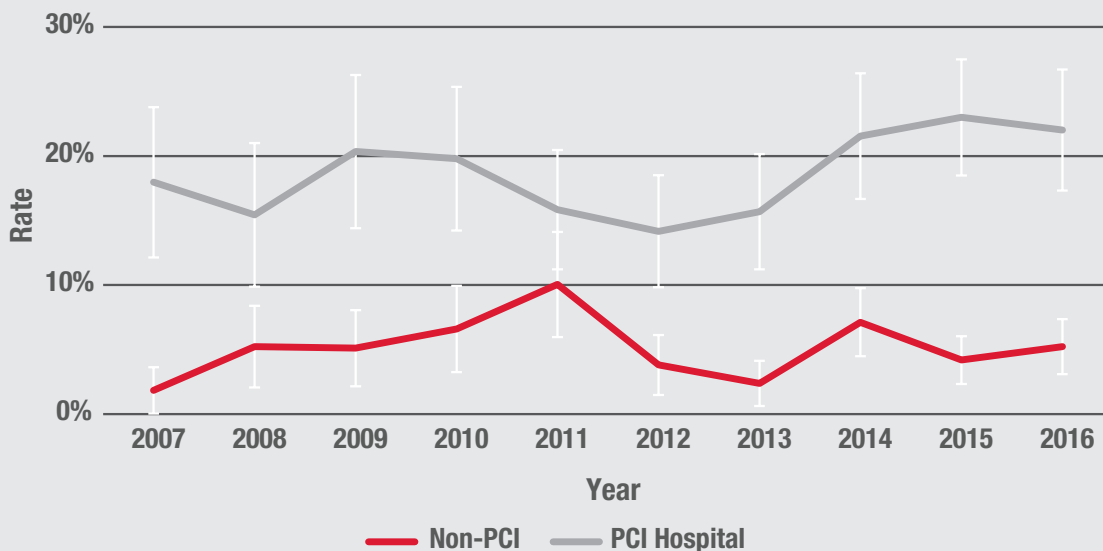
Once the ambulance arrives, they will be providing both basic and advanced life support measures including medications and airway control. Basic life support is still the key component of this. Standardised post-resuscitation care has recently been shown to be a key component in increasing survival rates.

##### Transfer to a cardiac centre

Others have noted that transport of OHCA patients to a percutaneous coronary intervention (PCI) capable hospital is associated with improved survival. St John data confirms this association. In 2016, patients transported to a PCI-capable hospital survived at four times the rate of those taken to a non PCI-capable hospital. The reasons underlying this are likely to be complex, perhaps in part related to patient characteristics, and not solely linked to the availability of a cardiac catheterisation laboratory.

**FIGURE 27**

**Unadjusted survival to hospital discharge for adult presumed cardiac OHCA cases (age $\geq$ 16) where resuscitation was commenced by SJA WA paramedics, according to transport to a PCI-capable hospital. (VACAR: Page 34, Figure 17)**



**Note:** Error bars show the 95% confidence interval around the population

# SYSTEM RESPONSE

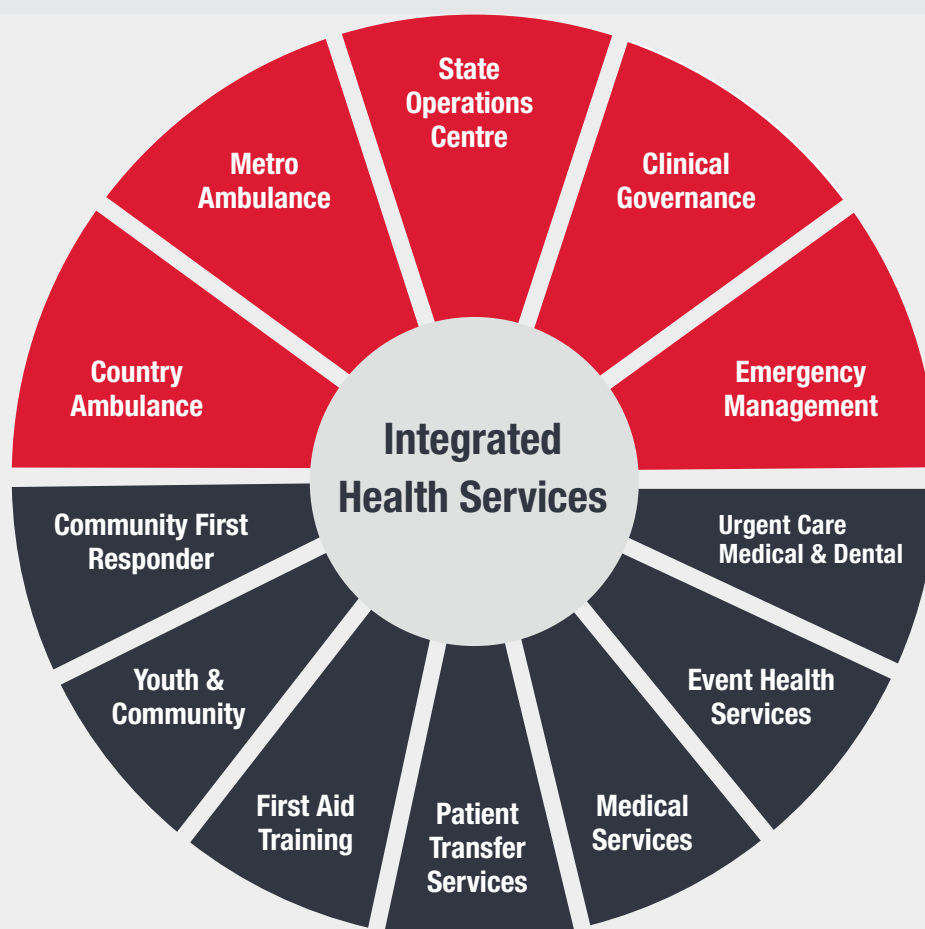
We continually get asked, “Why the focus on such a small, although significant, portion of your total call volume?”

The answer is within the Seattle King County motto:

*‘It takes a system to save a life’.*

Cardiac arrest cases test your whole system response, including what happens after the ambulance has delivered the victim to the hospital.

Generally speaking, if any part of the system fails, the victim does not survive.





## The system includes:



### a. Community:

- ▶ Number of people trained in first aid and CPR
- ▶ Number of public access defibrillators available
- ▶ Early recognition of cardiac arrest, calling for help and willingness to step in and perform CPR



### b. Ambulance service:

- ▶ Accurate and up-to-date Cardiac Arrest registry
- ▶ Early recognition of cardiac arrest and address acquisition during triple zero (000) call
- ▶ Early activation of first responders with AED locations known
- ▶ Telephone CPR initiated by the call taker
- ▶ Timely and evidenced based intervention with the right resources on scene
- ▶ Early transportation to the correct location



### c. Health service:

- ▶ Guideline directed care
- ▶ Extra corporeal membrane oxygenation in select cases
- ▶ Standardised post-resuscitation care
- ▶ Effective rehabilitation services

For every minute of cardiac arrest where CPR is not being performed the victim's chance of survival decreases by around 10 per cent.

By introducing simple interventions like early ambulance activation, chest compressions and AED deployment, we can alter this curve of death. At the Seattle Resuscitation Academy they have a saying;

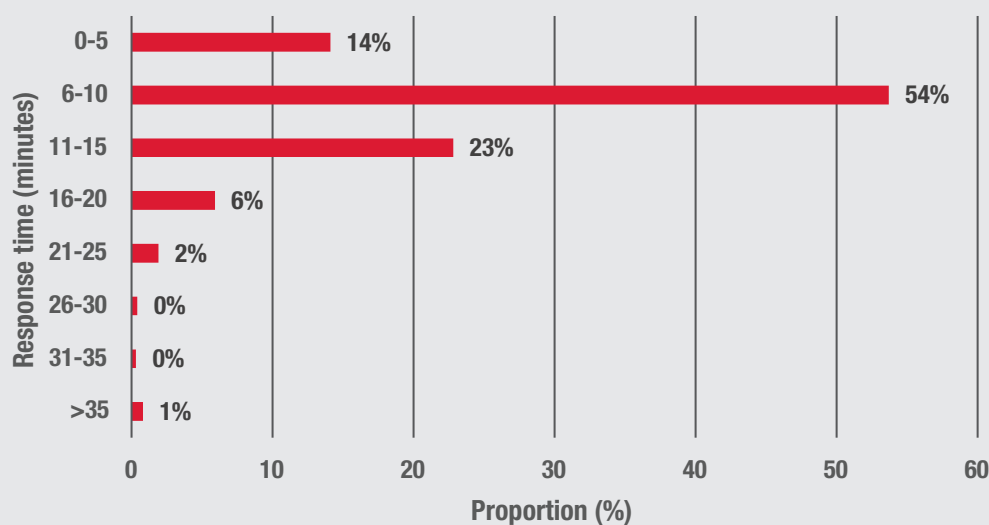
'Life is finite, death is infinite – and the difference between them is ten minutes.'

## ST JOHN RESPONSE TIMES

For cases where resuscitation was commenced, the median response time from call pickup in SOC to arrival of the ambulance on scene was nine minutes in the Perth metropolitan area and 12 minutes in rural and regional locations.

The median response times compare to St John New Zealand – eight minutes urban and 11 minutes rural; Wellington Free – eight minutes urban and 13 minutes rural; Ambulance Victoria – eight minutes urban and 10 minutes rural; London ambulance - eight minutes and King County EMS – six minutes urban and eight minutes rural.

**FIGURE 7**  
**Distribution of response time for OHCA cases of all ages where resuscitation was commenced by SJA WA paramedics, in the Perth metropolitan area in 2016** (St John NZ: Page 23, Figure 10)



Response time	n(%)	Cumulative percentage(%)
0-5	136 (14)	14
6-10	517 (54)	68
11-15	219 (23)	91
16-20	57 (6)	97
21-25	18 (2)	98
26-30	4 (0)	99
31-35	3 (0)	99
>35	8 (1)	100
<b>Total</b>	<b>962</b>	



MEDIAN RESPONSE

**9MIN**

PERTH METROPOLITAN



MEDIAN RESPONSE

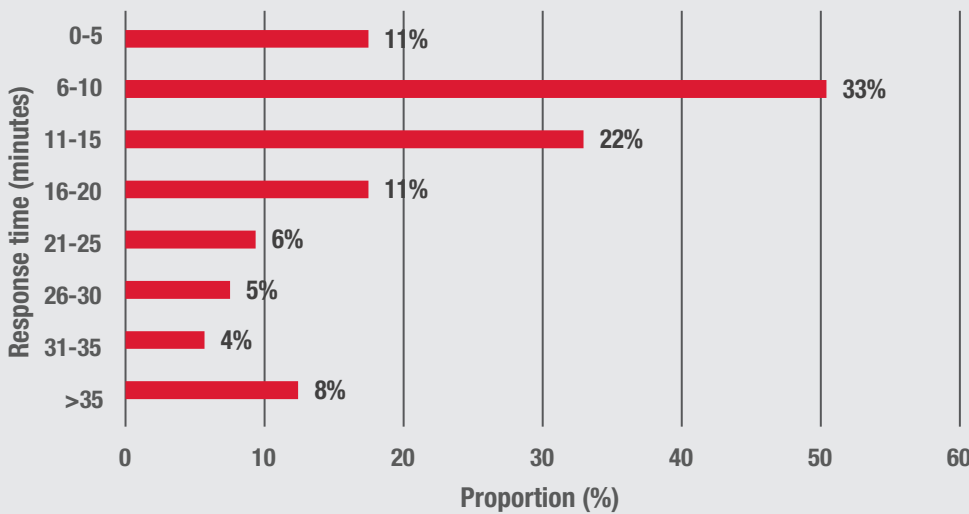
**12MIN**

COUNTRY



**FIGURE 8**

**Distribution of response time of OHCA cases of all ages where resuscitation was commenced by SJA WA paramedics, in the rural areas of WA in 2016** (St John NZ: Page 23, Figure 11)



Response time	n(%)	Cumulative percentage(%)
0-5	28 (11)	11
6-10	81 (33)	44
11-15	53 (22)	66
16-20	28 (11)	77
21-25	15 (6)	83
26-30	12 (5)	88
31-35	9 (4)	92
>35	20 (8)	100
<b>Total</b>	<b>246</b>	

# COMMUNITY RESPONSE PRE-AMBULANCE ARRIVAL

The slope of the patient survival curve post-arrest is steep. For every minute post-arrest without either CPR or defibrillation, survival falls 10 per cent. This carries the heavy implication that events preceding ambulance arrival are critical to the eventual patient outcome. Patients who receive early, high quality CPR and defibrillation with a locally available AED survive at approximately five times the rate of those who have neither.

St John WA supports community and bystander CPR via our first aid training courses, the presence of AEDs in the community, our Community First Responder program and the St John First Responder App.

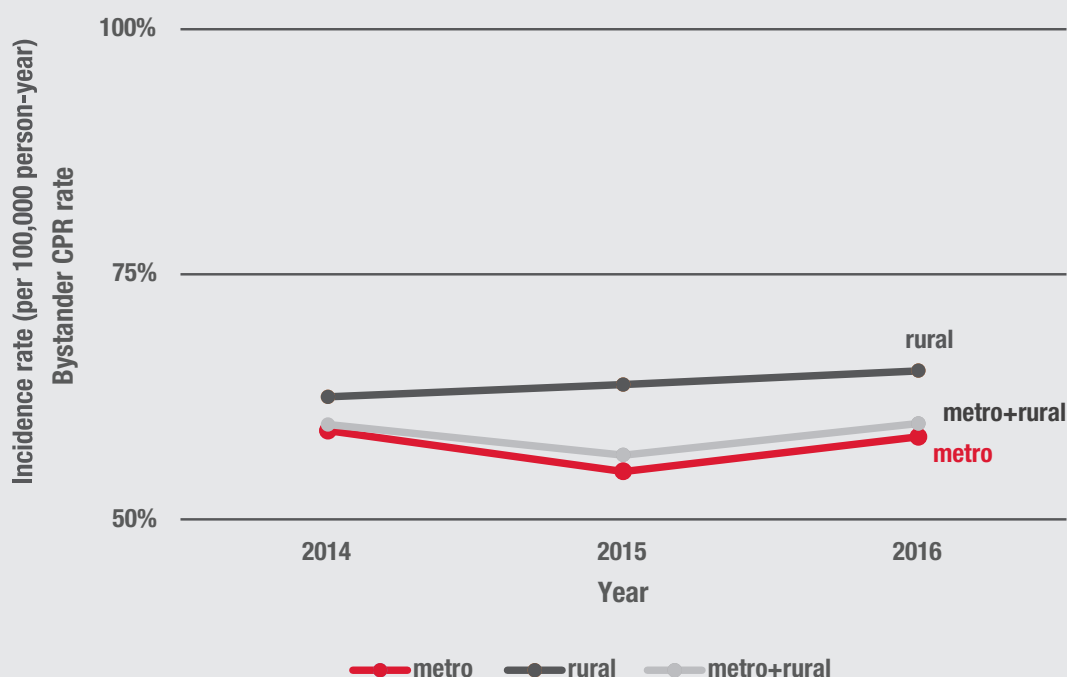
Understanding that bystander CPR plays such a vital role in patient outcomes, SOC call takers are trained to provide instruction on the provision of chest compressions and defibrillation to OHCA bystanders.

CPR rates amongst OHCA cases where resuscitation was commenced average 59

percent, with a significant gap between metropolitan (57 per cent) and regional communities (64 per cent) that is unexplained. Trends in these figures over the last few years are presented in Figure 9.

Time to defibrillation also plays a pivotal part in ensuring good patient outcomes. SOC call takers provide instructions on AED use when present. As has been demonstrated elsewhere, early defibrillation via an AED increases survival to hospital discharge to approximately 57 per cent in comparison to 10 per cent if an AED is not available prior to ambulance arrival.

**FIGURE 9**  
Trends of bystander CPR rates by region among OHCA cases of all ages where resuscitation was commenced by SJA WA paramedics, in WA between 2014 and 2016. (St John NZ: Page 25, Figure 12)





<b>Location</b>		<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>Total</b>
<b>Metro</b>	<b>Total</b>	857	1,033	962	<b>2,852</b>
	<b>Bystander CPR</b>	506	567	562	<b>1,635</b>
	<b>Rate</b>	59%	55%	58%	<b>57%</b>
<b>Country</b>	<b>Total</b>	192	240	244	<b>676</b>
	<b>Bystander CPR</b>	120	153	159	<b>432</b>
	<b>Rate</b>	63%	64%	65%	<b>64%</b>
<b>Metro + Country</b>	<b>Total</b>	1049	1,273	1,206	<b>3,528</b>
	<b>Bystander CPR</b>	626	720	721	<b>2,067</b>
	<b>Rate</b>	60%	57%	60%	<b>59%</b>

**Note:** Provision of bystander CPR was unknown in one case in 2015.

# OUTCOMES

## SCENE OUTCOME FOR OHCA IN ADULTS

ROSC at ED arrival is often counted as the key measure of success of an OHCA resuscitation. While rates do vary, over a 10 year period there has been a doubling in the rates of ROSC, and a four-fold increase in the absolute numbers of patients being transported with ROSC. This is due to a large increase in the number of resuscitations attempted over this period of time.

It is common practice around the world to continue resuscitation at the scene of an OHCA until either ROSC is achieved or resuscitation attempts are ceased. In many instances this is because CPR in the back of a moving vehicle is considered to be problematic.

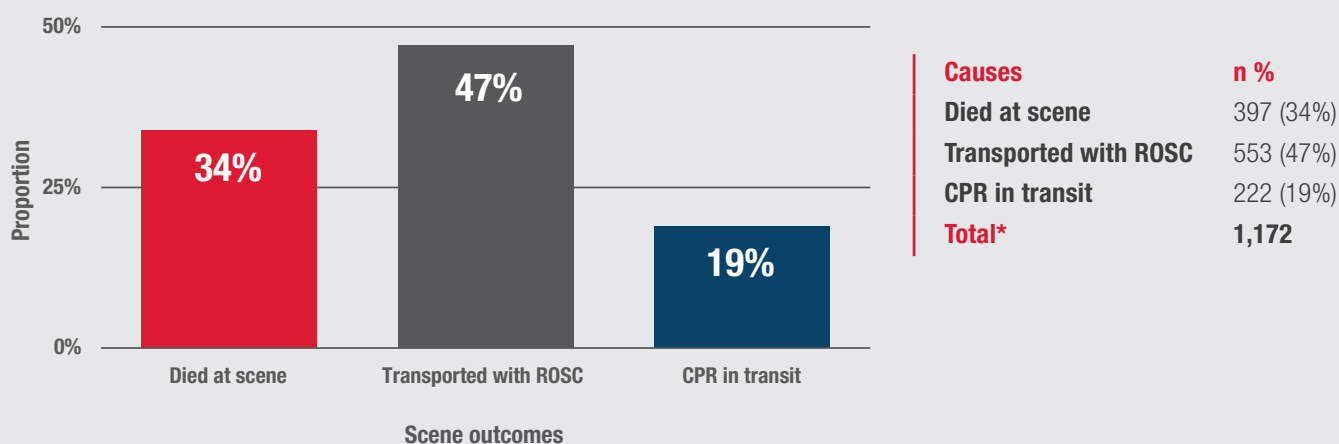
St John has taken a different approach to many other services around the world in regards to the transport of patients with CPR in progress, many of whom have the LUCAS device in situ, providing mechanical CPR. There is a small but significant number of patients who are transported with CPR in progress who survive to hospital discharge. In 2016, that number was eight.

This is reflected in scene outcomes for all cases of OHCA in adults where resuscitation was attempted.

The percentage of patients transported with CPR in progress was 19 per cent (222/1172); ROSC was achieved in 47 per cent (553/1172); and resuscitation was terminated at the scene in 34 per cent (397/1172) of cases. St John transports more patients with CPR in progress than most other services. In comparison, the scene outcome breakdown for St John New Zealand is three per cent transported with CPR in progress; 30 per cent transported with ROSC; and 67 per cent died at the scene.

**FIGURE 10**

Scene outcomes of all-causes OHCA cases in adults (age $\geq$ 16) where resuscitation was commenced by SJA WA paramedics, in WA in 2016 (St John NZ: Page 27, Figure 13)

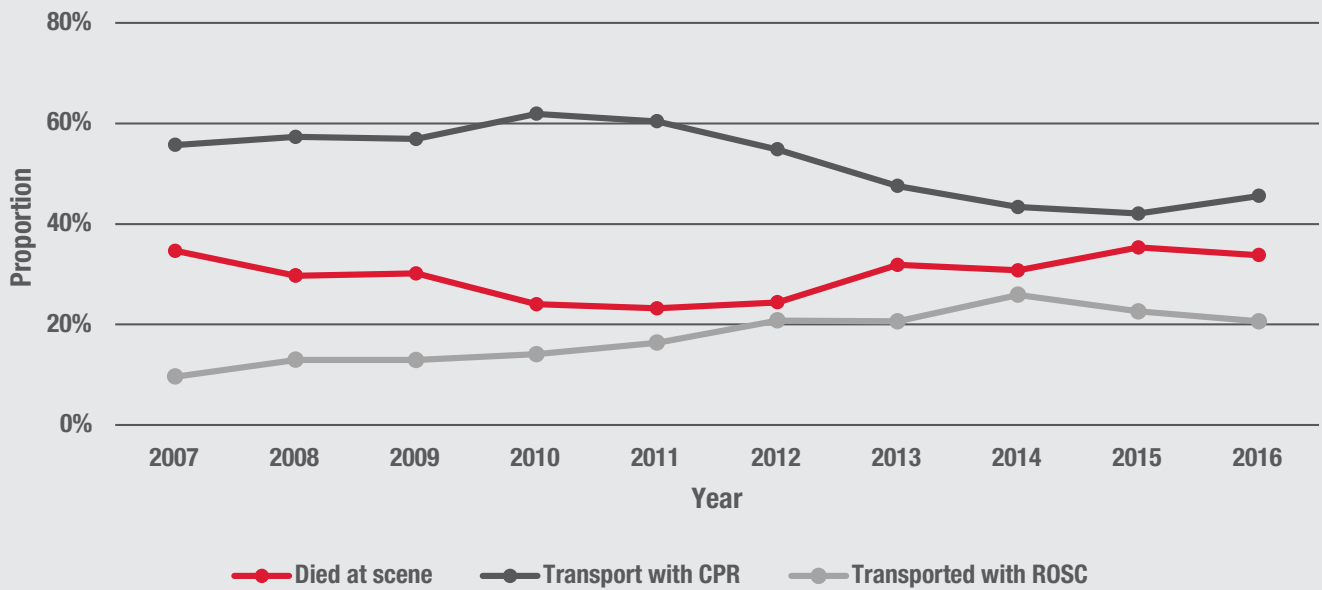




**FIGURE 28**

Scene outcomes for adult OHCA cases (age≥16) where resuscitation was commenced by SJA WA paramedics, in the Perth metropolitan area between 2007 and 2016

(VACAR: Page 37, Figure 18)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
<b>Died at scene</b>	158 (35%)	126 (30%)	142 (30%)	116 (24%)	153 (23%)	169 (24%)	238 (32%)	254 (31%)	350 (35%)	316 (34%)	2,022 (30%)
<b>Transport with CPR</b>	254 (55%)	243 (57%)	268 (57%)	299 (62%)	398 (61%)	380 (55%)	355 (47%)	358 (43%)	417 (42%)	426 (45%)	3,398 (51%)
<b>Transported with ROSC</b>	44 (10%)	55 (13%)	61 (13%)	68 (14%)	108 (16%)	144 (21%)	154 (21%)	214 (26%)	224 (23%)	193 (21%)	1,265 (19%)
<b>Total*</b>	<b>456</b> <b>(100%)</b>	<b>424</b> <b>(100%)</b>	<b>471</b> <b>(100%)</b>	<b>483</b> <b>(100%)</b>	<b>659</b> <b>(100%)</b>	<b>693</b> <b>(100%)</b>	<b>747</b> <b>(100%)</b>	<b>826</b> <b>(100%)</b>	<b>991</b> <b>(100%)</b>	<b>936</b> <b>(100%)</b>	<b>6,686</b> <b>(100%)</b>



## ADULT OUTCOMES FROM ALL CAUSE CARDIAC ARREST

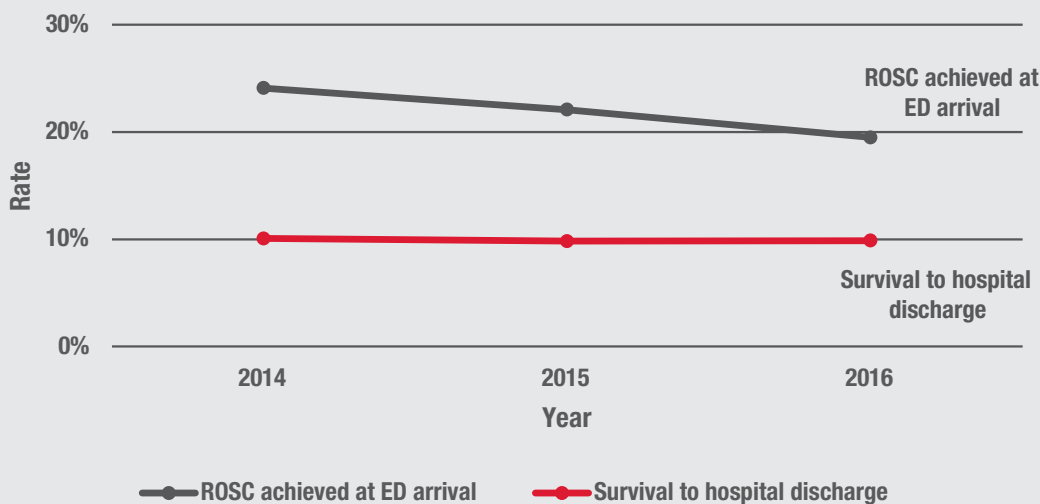
Survival from OHCA is regarded as an international benchmark of ambulance service effectiveness. 2016 demonstrated an event survival rate of 19 per cent (ROSC sustained to ED arrival), which was lower than in previous years. We are currently investigating the reasons for this – for example, whether the reduction can be explained because we are commencing resuscitation in more patients than previously.

The rate of survival to hospital discharge has remained steady at 10 per cent.

**FIGURE 11**

**Trends in survival outcomes for all-cause OHCA in adults (age≥16) where resuscitation was commenced by SJA WA paramedics, in WA between 2014 and 2016**

(St John NZ: Page 27, Figure 13) (St John NZ: Page 27, Figure 15&16) Rates of ROSC at ED and survival to hospital discharge can be seen in a table in Figure 11.



	2014	2015	2016	Total
<b>ROSC achieved at ED arrival</b>	244 (24%)	272 (22%)	229 (19%)	745 (22%)
<b>Survival to hospital discharge*</b>	102 (10%)	121 (10%)	116 (10%)	339 (10%)
<b>Total</b>	<b>1,013</b>	<b>1,232</b>	<b>1,175</b>	<b>3,420</b>

\*:10 cases were excluded from denominators because their survival statuses at hospital discharge were unknown.

## ADULT OUTCOMES ACCORDING TO PRESENTING RHYTHM

OHCA cases presenting in either ventricular fibrillation (VF) or ventricular tachycardia (VT) have the greatest potential for survival when compared to patients with a non-shockable rhythm such as pulseless electrical activity (PEA) or asystole.

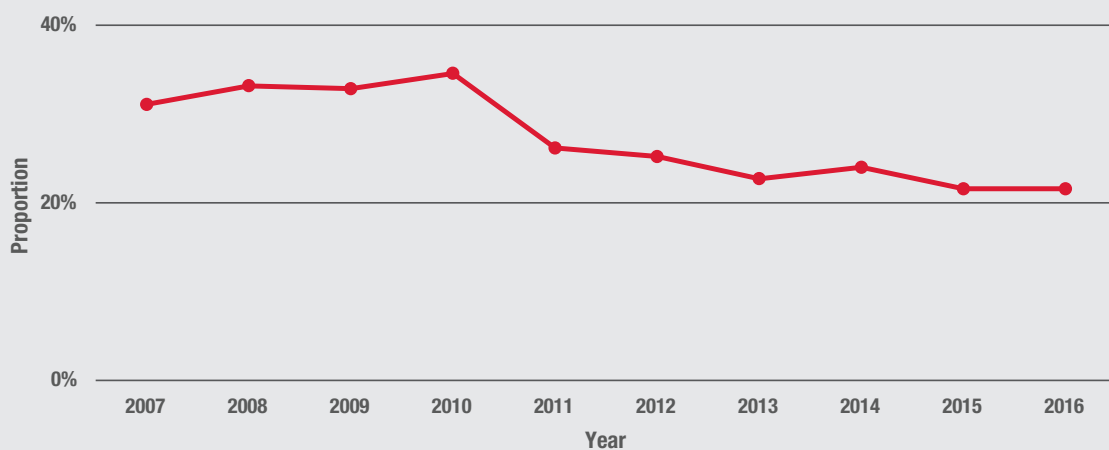
This is because the VF/VT can be treated with a defibrillator; whereas treatment for non-shockable rhythms requires identification and correction of the underlying cause.

Adult patients presenting with a shockable rhythm had an event survival rate of 45 per cent, compared to 10 per cent for asystole and 28 per cent for PEA. Survival to hospital discharge tells a different story, with the majority of patients in shockable rhythm who have ROSC at ED arrival surviving to hospital discharge. Survival to hospital discharge is less common in PEA and unusual in asystole.

Western Australia has an unexplained and unusually low percentage of patients presenting in a shockable rhythm, and this percentage is decreasing over time while absolute numbers of patients encountered in shockable rhythms has increased. The causes for this observation remain unclear.

**FIGURE 29**

Proportion of OHCA cases presenting a shockable rhythm among adult OHCA cases (age ≥16) where resuscitation was commenced by SJA WA paramedics, in the Perth metropolitan area between 2007 and 2016 (VACAR: Page39, Figure 21)

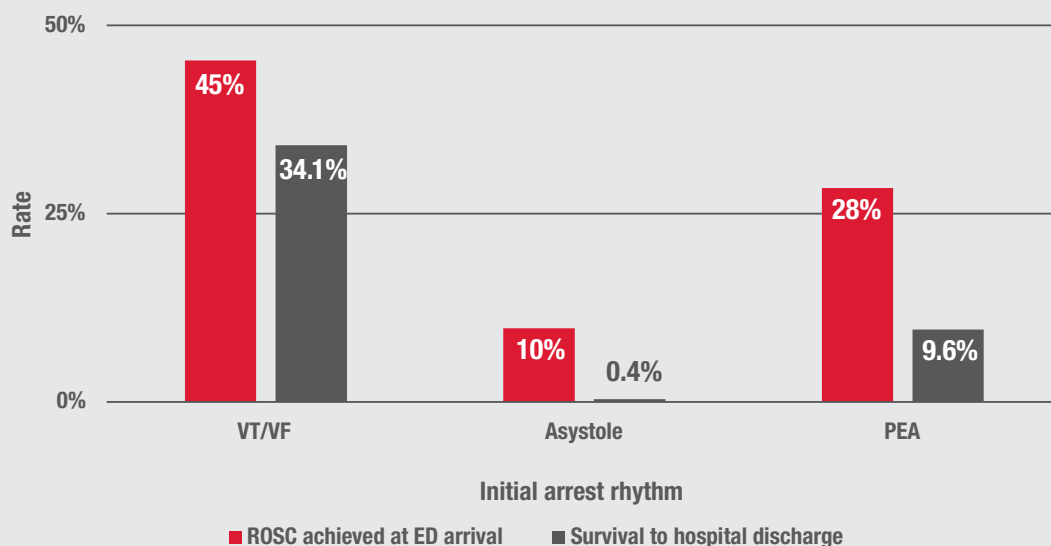


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
<b>Shockable rhythm</b>	142 (31%)	141 (33%)	156 (33%)	167 (35%)	173 (26%)	174 (25%)	169 (23%)	198 (24%)	215 (22%)	202 (22%)	1,737 (26%)
<b>Total*</b>	<b>457</b>	<b>425</b>	<b>475</b>	<b>483</b>	<b>661</b>	<b>690</b>	<b>744</b>	<b>825</b>	<b>996</b>	<b>936</b>	<b>6,692</b>

\*: Nine cases with missing initial rhythm were excluded.

**FIGURE 12**

Survival outcomes of adult OHCA cases (age≥16) by initial arrest rhythm where resuscitation was commenced by SJA WA paramedics, in WA between 2014 and 2016  
(St John NZ: Page 28 Figure 17)



2014	VT/VF	Asystole	PEA
ROSC achieved at ED arrival	113 (46%)	54 (10%)	73 (31%)
Survival to hospital discharge	75 (31%)	2 (0%)	22 (9%)
<b>Total*</b>	<b>244</b>	<b>523</b>	<b>237</b>

\*: Nine cases were excluded from this analysis because of missing initial arrest rhythm.

2015	VT/VF	Asystole	PEA
ROSC achieved at ED arrival	114 (45%)	75 (11%)	83 (31%)
Survival to hospital discharge*	86 (34%)	4 (1%)	31 (12%)
<b>Total**</b>	<b>256</b>	<b>708</b>	<b>266</b>

\*: Four cases were excluded from denominators because their survival statuses at hospital discharge were unknown.

\*\* : Two cases were excluded from this analysis because of missing initial arrest rhythm.

2016	VT/VF	Asystole	PEA
ROSC achieved at ED arrival	112 (45%)	56 (8%)	61 (23%)
Survival to hospital discharge*	93 (38%)	1 (0.2%)	19 (7.4%)
<b>Total**</b>	<b>248</b>	<b>663</b>	<b>261</b>

\*: Six cases were excluded from denominators because their survival statuses at hospital discharge were unknown.

\*\* : Three cases were excluded from this analysis because of missing initial arrest rhythm.

'Total (2014-2016)	VT/VF	Asystole	PEA
ROSC achieved at ED arrival	339 (45%)	185 (10%)	217 (28%)
Survival to hospital discharge*	254 (34.1%)	7 (0.4%)	73 (9.6%)
<b>Total**</b>	<b>748</b>	<b>1894</b>	<b>764</b>

\*: Ten cases were excluded from denominators because their survival statuses at hospital discharge were unknown.

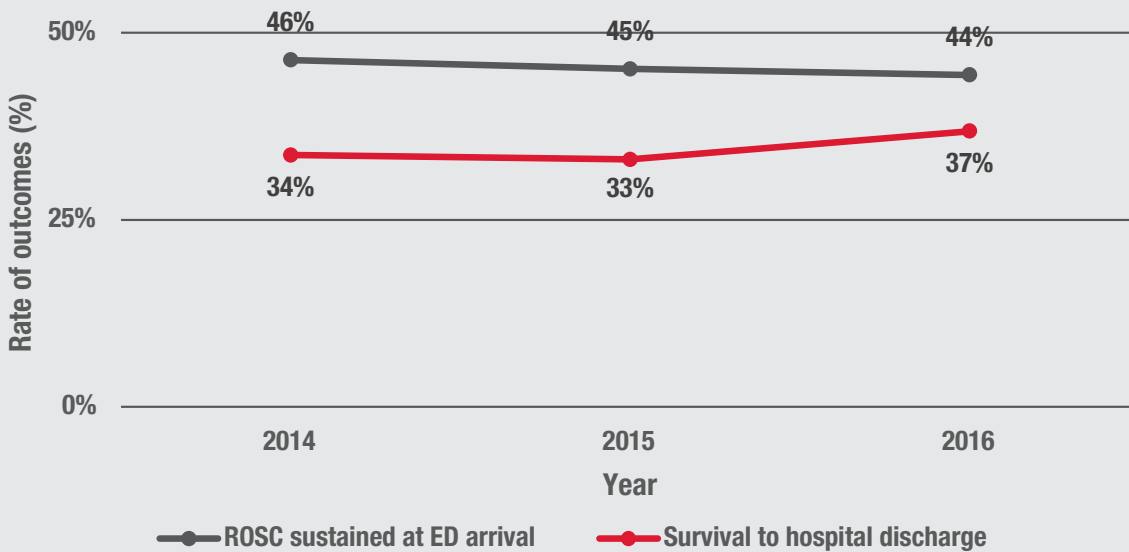
\*\* : Fourteen cases were excluded from this analysis because of missing initial arrest rhythm.

## UTSTEIN SURVIVAL

There is a group of patients whose OHCA is considered the most likely to survive. This group includes those who have an OHCA which is bystander witnessed, and have an initial shockable rhythm, and is of presumed cardiac cause, and where resuscitation is started by St John paramedics. The number of patients meeting this criteria in Western Australia in 2016 was 115 with 51 (44 per cent) achieving ROSC at ED arrival and 42 (37 per cent) surviving to hospital discharge.

Survival outcomes for this sub-group of OHCA patients are often compared internationally and are referred to as the 'Utstein comparator group'. The calculation of patient survival for this 'Utstein comparator group' is demonstrated in the figure below.

**FIGURE 13**  
Trends of outcomes in adult OHCA cases (age≥16) with bystander witness, initial shockable rhythm, presumed cardiac cause and resuscitation commenced by SJA WA paramedics, in WA between 2014 and 2016. (St John NZ: Page 29, Figure 18)

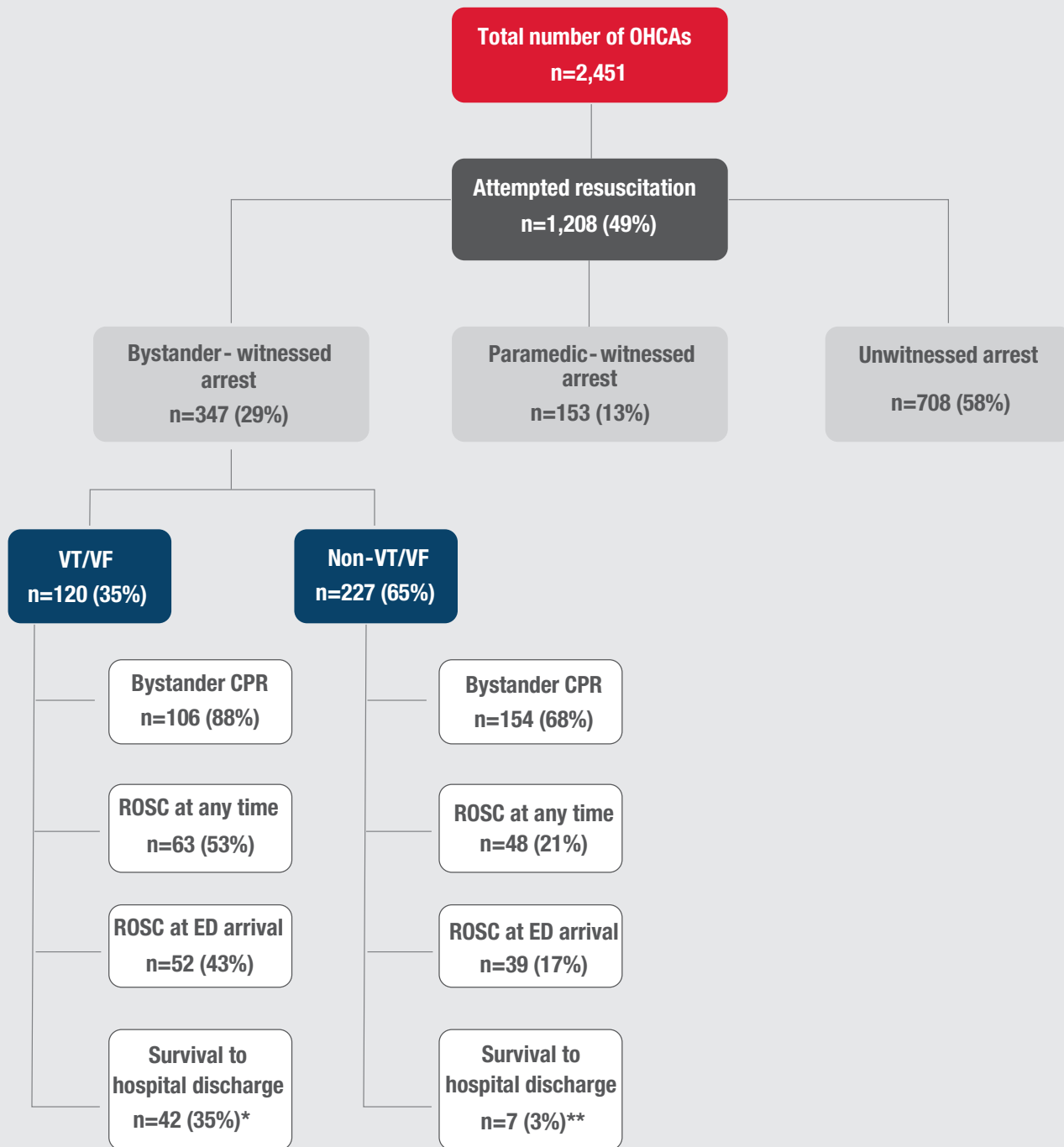


	2014	2015	2016	Total
ROSC achieved at ED arrival	51 (46%)	56 (45%)	51 (44%)	158 (45%)
Survival to hospital discharge	37 (34%)	41 (33%)	42 (37%)*	120 (34%)
<b>Total</b>	<b>110</b>	<b>124</b>	<b>115</b>	<b>349</b>

\*: One case was excluded from denominators because the survival status at hospital discharge was unknown.

**FIGURE 31**

Survival outcomes for the Utstein patient group of OHCA cases of all ages in WA in 2016  
 (VACAR: Page41, Figure 24)



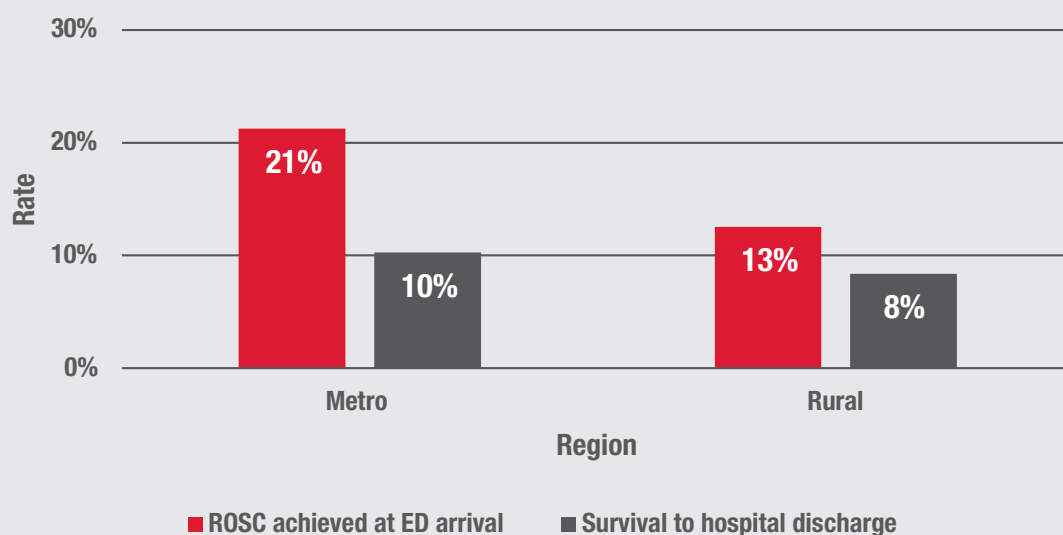
\*: One case was excluded because survival status at hospital discharge is unknown.

\*\* : Two cases were excluded because survival status at hospital discharge is unknown.

## OUTCOMES ACCORDING TO RURALITY

Given the population distribution of Western Australia, where the majority of the population (79 per cent in 2015) live in the Perth metropolitan area, comparatively few cardiac arrests occur in regional areas. A comparison of regional and Perth outcomes are demonstrated in Figure 14. While response times are generally longer in rural and regional locations, rates of bystander CPR are higher in country areas and there are comparatively more AEDs available.

**FIGURE 14**  
Survival outcomes of adult OHCA cases (age≥16) by region where resuscitation was commenced by SJA WA paramedics, in 2016 (St John NZ: Page 30, Figure 20)



	ROSC achieved at ED arrival	Survival to hospital discharge*	Total
<b>Metro</b>	199 (21%)	96 (10%)	<b>936</b>
<b>Rural</b>	30 (13%)	20 (8%)	<b>239</b>
<b>Total</b>	<b>229 (19%)</b>	<b>116 (10%)</b>	<b>1,175</b>

\*:Six cases (Four metro, Two rural) were excluded from denominators because their survival status at hospital discharge were unknown.

# CONCLUSION

The data presented in this report demonstrates that the response to OHCA in Western Australia provided by St John is of a high standard. The process of generating this report and reviewing our data formally has provided significant insight into the performance of our service, how we compare with others and the road ahead – where we might best focus on implementing change.

We are certainly pleased with our performance and the way it compares with others nationally and internationally, notwithstanding there is still work to be done to be on an even pegging with world's best practice.

It however, affirms our view that we provide the people of Western Australian with a first class ambulance service and that making first aid a part of everyone's life has a positive impact on the community.

Work in 2017 has focused so far on the State Operations Centre, improving the timeliness of response at the point of dispatch and the initiation of bystander CPR by the SOC call

taker – a process referred to as telephone CPR or TCPR. We have also appointed a dedicated Resuscitation Improvement Officer who will assist in this process.

Furthermore, exciting work is occurring in the area of community response to OHCA and the targeted distribution of public AEDs across Western Australia.

**We look forward to discussing our progress in the 2017 annual report.**

# PUBLICATIONS/RESEARCH HIGHLIGHTS

St John Ambulance Western Australia continues to support and actively participate in resuscitation research. The SJA WA OHCA database enables important observational studies to be undertaken, in order to provide a better understanding of the factors associated with survival outcomes after OHCA (1-5). In addition, together with a number of other ambulance services in Australia and New Zealand, St John WA also contributes data to the Australian Resuscitation Outcomes Consortium (Aus-ROC : [www.ausroc.org.au](http://www.ausroc.org.au) Australia and New Zealand out-of-hospital cardiac arrest (OHCA) registry (6, 7).

St John WA has also had a long-standing commitment to the conduct of high quality clinical trials aimed at establishing 'best practice' for the management of OHCA patients. For example, St John WA previously conducted the first ever randomised controlled trial (RCT) of the use of adrenaline in OHCA (8). More recently, St John WA participated (together with Ambulance Victoria and SA Ambulance Service) in the National Health and Medical Research Council (NHMRC) funded multi-centre RCT on the efficacy of therapeutic hypothermia in OHCA patients – known as the 'RINSE' trial (9). Currently, preparations are underway to begin the 'EXACT' study – a NHMRC-funded multicentre RCT of targeted oxygen management in OHCA patients.

[healthsciences.curtin.edu.au/health-sciences-research/research-centres-and-institutes/precru/our-research/projects/](http://healthsciences.curtin.edu.au/health-sciences-research/research-centres-and-institutes/precru/our-research/projects/)

All research studies undertaken by St John Ambulance Western Australia (or using St John data) are required to comply with the National Health and Medical Research Council – National Statement on Ethical Conduct in Human Research (2007) and have ethics approval from either a Western Australian university or a Western Australian hospital's (and in some cases both) Human Research Ethics Committee. In addition, all studies are reviewed, approved and monitored by the St John Ambulance (Western Australia) Research Advisory Group.

[healthsciences.curtin.edu.au/health-sciences-research/research-centres-and-institutes/precru/our-research/ethics/](http://healthsciences.curtin.edu.au/health-sciences-research/research-centres-and-institutes/precru/our-research/ethics/)



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# ACKNOWLEDGEMENTS

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