Victorian Ambulance Cardiac Arrest Registry

Ambulance Victoria

ANNUAL REPORT 2022/23

ACKNOWLEDGEMENT OF COUNTRY

Ambulance Victoria acknowledges the Traditional Owners of the lands in Victoria. We pay our respects to Aboriginal and Torres Strait Islander cultures and to Elders past and present and recognise Aboriginal self-determination is a human right.
At Ambulance Victoria, we recognise the diverse and unique cultures and histories of Aboriginal and Torres Strait Islander peoples and value the knowledge of countless generations of Custodians. We commit to working together to build a fair and just future. We will come together with Aboriginal and Torres Strait Islander communities to identify, understand, and develop opportunities to create and sustain a culturally aware organisation.

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A Message from the **VACAR Chair**

Ziad Nehme ASM

Out-of-hospital cardiac arrest (OHCA) is one of the leading causes of death worldwide and a significant public health issue in Australia.

Surviving an OHCA is dependant on the provision of timely pre-hospital interventions, known as the 'Chain of Survival'. Recognition and activation of Emergency Medical Services (EMS), early cardiopulmonary resuscitation (CPR) and defibrillation, and advanced resuscitation care are the hallmark components of the Chain of Survival which are monitored by EMS systems globally.

More recently, the Chain of Survival has included an additional link called 'Recovery and survivorship' which reflects the need for increased investment in initiatives to improve the long-term quality-of-life of OHCA survivors.

From roadside to recovery, the Victorian Ambulance Cardiac Arrest Registry (VACAR) has been monitoring and improving the journey of OHCA patients for over two decades. In that time we have achieved substantial improvements in the care of OHCA patients, through developments in pre-hospital care, better call-handling and dispatch, telecommunicator CPR, community engagement in CPR programs, the launch of the smartphone CPR crowd-sourcing app, GoodSAM®, and an enormous investment in resuscitation research.

In 2011, we also become one of the first registries in the world to routinely measure the quality-of-life of adult OHCA survivors, demonstrating our determination to monitor and improve the outcomes that matter most to our patients.

Our investment in OHCA systems-of-care continues in 2022/23. We launched the First Responder Shock Trial (FIRST) in collaboration with Hato Hone St John New Zealand and developed Ambulance Victoria's Cardiac Arrest Improvement Strategy 2023-2028.

The FIRST trial is an evolutionary clinical trial that aims to examine whether equipping GoodSAM responders with a personal, single use, ultraportable Automated External Defibrillator (AED) can help reduce the time to first defibrillation and increase survival from OHCA.

The trial is the first of its kind internationally and helps to address the social and geographical barriers that exist in the current placement of AEDs in the community.

In response to the devastating impacts of the COVID-19 pandemic, our Cardiac Arrest Improvement Strategy 2023-2028 represents our ongoing commitment to find new ways to strengthen the 'Chain of Survival' for OHCA.

The strategy is a culmination of international best practice, local input from subject matter experts, and over two-decades of evidence-based insights and learnings informed by the Centre for Research and Evaluation and the VACAR.

The strategy underpins an organisation-wide culture of excellence in OHCA care and delivers innovations in systems-of-care for cardiac arrest patients.

In the coming year, we've committed to delivering enhanced feedback to our paramedics on the outcome of OHCA patients, developing enhanced monitoring and analytics of resuscitation performance, launching a new clinical trial examining the benefit of post-resuscitation medications used to treat cardiogenic shock, and developing a research prospectus to actively seek investment in cardiac arrest research.

These programs of work are just some of the initiatives in our Cardiac Arrest Improvement Strategy that will help us achieve our vision of improving survival by 30% by 2028.

To that end, it is a pleasure to present to you the findings of the 2022/23 VACAR Annual Report.

Dr Ziad Nehme ASM

Director, Centre for Research & Evaluation

Chair, VACAR Steering Committee

Our Cardiac Arrest Improvement Strategy will help us achieve our vision of improving **survival by 30% by 2028.**

Executive Summary:
2022/23 Key Highlights

This year we treated more cardiac arrest patients than ever before

7,830
Out-of-hospital cardiac arrest patients across Victoria

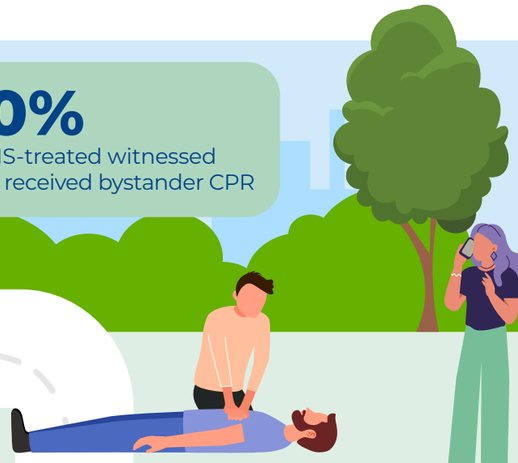
6.4%
increase from the previous year

65% were male

78%
of cardiac arrests occurred at home

More than ever before, the community are stepping in to help in cardiac arrest emergencies

80%
of EMS-treated witnessed cases received bystander CPR



139 cases
had a shock delivered from a public AED, the highest number on record

53%
survived when first shocked by public AED

26%
survived when first shocked by EMS

12%
survived when they received bystander CPR

5% survived with no bystander CPR

93%
of calls were correctly directed by bystanders to Triple Zero (000) ambulance

89%
of cardiac arrests were identified in the Triple Zero (000) call

The majority of cardiac arrest patients were attended within 10 minutes

Median response time
8.3 minutes

Half of all patients were defibrillated within
10.6 minutes

Cardiac arrest patients are returning home to their families

83%
of survivors were discharged from hospital directly home to their families

388
patients were discharged alive

36%
of patients discharged alive (Utstein cohort)

87%
of patients who survived to 1 year report favourable neurological recovery

Victorian Ambulance
Cardiac Arrest Registry

The Victorian Ambulance Cardiac Arrest Registry (VACAR) was established in 1999 and incorporates pre-hospital clinical and operational data, communications centre dispatch records, and hospital follow-up data for all OHCA events in Victoria where Ambulance Victoria were in attendance. The data is collated in the registry based on the internationally recognised Utstein template and definitions (Perkins 2015).

Hospital outcome data is supplemented by death records from the Victorian Registry of Births, Deaths and Marriages. Commencing January 2011, 12-month follow-up interviews have also been conducted with adult survivors. The VACAR maintains ethical approval from the Monash University Human Research Ethics Committee.

The VACAR is used to monitor key clinical indicators which measure the quality of ambulance care and allow for performance benchmarking. These clinical indicators include ambulance response times, event survival and survival to hospital discharge.

The registry is also used to measure the impact of ambulance programs such as the fire-fighter Emergency Medical Response Program, 'Call, Push, Shock' community CPR education program, Heart Safe Communities (in partnership with Heart Foundation Victoria) and public AED use.

In addition, VACAR has successfully established an internationally recognised research program, with the publication of scientific literature in key medical journals (see Research, page 40). The results of the research program are used to provide an evidence base for Ambulance Victoria treatment of cardiac arrest patients.

The VACAR proudly contributes data to the Australian Resuscitation Outcomes Consortium (Aus-ROC) Epistry (https://www.ausroc.org.au/), an epistry which was established with the aim of understanding regional, ambulance service and treatment factors associated with improved OHCA outcomes in Australia and New Zealand. In 2019, the VACAR also began contributing to the End Unexplained Cardiac Death (EndUCD) Registry which aims to collect data on all sudden cardiac arrests in patients aged 1-50 years.

Eligibility

The VACAR captures data on all OHCA patients where EMS are in attendance. For the purposes of this report, EMS is defined as Ambulance Victoria and participating first responder organisations, including Fire Services Victoria (in selected areas).

The VACAR defines the state of cardiac arrest as the cessation of cardiac mechanical activity as confirmed by the absence of signs of circulation, including the absence of a detectable carotid pulse, unresponsiveness and apnoea or agonal breathing. Patients eligible for inclusion in the VACAR are described at right.

VACAR inclusion and exclusion criteria

Inclusion criteria (all of the following)

1. Patients of all ages who suffer a documented cardiac arrest.
2. Occurs in the state of Victoria where Ambulance Victoria is the primary care giver. Cardiac arrests occurring in the neighbouring states of New South Wales and South Australia are considered for inclusion where Ambulance Victoria is clearly documented as the primary care giver.
3. Patients who are pulseless on arrival of EMS;

   OR

   Patients who become pulseless in the presence of EMS (EMS-witnessed arrests);

   OR

   Patients who have a pulse on arrival of EMS, where a successful attempt at defibrillation was undertaken by a bystander prior to arrival of EMS.

Exclusion criteria (any of the following)

1. Patients who suffer a cardiac arrest in a hospital facility, where Ambulance Victoria may be in attendance but are not the primary care giver.
2. Brief episodes of pulselessness which do not receive CPR or defibrillation by EMS.
3. Bystander-suspected cardiac arrest where the patient is not in cardiac arrest on arrival of EMS, no defibrillation was provided prior to arrival, and no other evidence verifying a cardiac arrest state is present.

How we Respond to **Cardiac Arrest in Victoria**

The state of Victoria has an estimated population of 6.8 million spread over approximately 227,000km^2. Over 5 million people live in the state's capital city of Melbourne. Ambulance Victoria is the state-wide EMS provider and comprises ambulance paramedics who have advanced life support skills (e.g. laryngeal mask airway, intravenous epinephrine) and Mobile Intensive Care Ambulance (MICA) paramedics who are authorised to perform endotracheal intubation, rapid sequence induction, needle thoracostomy and administer a wider range of medications.

Paramedics in Victoria have a three-year bachelor degree in Paramedicine. MICA paramedics are experienced paramedics who undergo a university-level post-graduate diploma in Intensive Care Paramedic Practice. Since December 2018, all paramedics are required to be registered with the Paramedicine Board of Australia via the Australian Health Practitioner Regulation Agency in order to practice.

Australia operates a single national telephone number for community access to emergency services (Triple Zero '000'). Telephone triage is performed using the Medical Priority Dispatch System. Unless circumstances suggest ventilations (as is the case for patients under the age of 18 years old), suspected cardiac arrest events identified in-call receive telephone CPR, recommending chest compressions until professional help can take over.

Advanced Life Support and MICA paramedics are dispatched concurrently to suspected cardiac arrest events in the community. A first responder program for early defibrillation by firefighters operates for patients in greater Melbourne and a number of large regional towns. In addition, Ambulance Victoria co-responds with 101 volunteer community teams in smaller, predominately rural communities across the state.

Approved community volunteer responders, called GoodSAM responders, are also dispatched to suspected cardiac arrest events. GoodSAM (Smartphone Activated Medic) is a free global smartphone application that is used to facilitate a rapid response to cardiac arrests across the globe by connecting nearby persons to patients experiencing a cardiac arrest in those critical minutes before emergency services arrive. GoodSAM is activated at the same time as ambulance dispatch by Triple Zero Victoria (000Vic) and alerts nearby registered users of the app of an event, as well as the location of the nearest AED.

Since the launch of the GoodSAM app on January 28th 2018, more than **16,600 volunteers** have registered to the GoodSAM app. In addition, more than **13,000 individuals and businesses have registered** their AEDs in Ambulance Victoria's AED registry, more than 6,500 of which are public AEDs.

Since 2018

16,661

volunteers have registered to the **GoodSAM app**

Ambulance Victoria cardiac arrest protocols follow the recommendations of the Australian and New Zealand Committee on Resuscitation. Paramedics are not obliged to commence resuscitation when the clinical presentation is inconsistent with life. They may discontinue resuscitation if advanced life support has been performed for 45 minutes without sustained return of spontaneous circulation (ROSC), unless there are exceptional circumstances as described in clinical practice guidelines.

In 2019, a resuscitation quality improvement initiative was rolled out across the state, training all paramedics and first responders in high-performance CPR. The initiative was supported by team-based resuscitation training, real-time feedback on CPR performance, structured resuscitation choreography and scene leadership, and post-event debriefing. Paramedics in Victoria are also required to complete an annual high-performance CPR competency test.

Ongoing monitoring of resuscitation quality occurs after every resuscitation attempt and paramedics attending a resuscitation are provided with a data-driven post-resuscitation debriefing report. These debriefing reports, called Team Performance Reports, consist of 19 metrics which align with international treatment recommendations and key actions within the Chain of Survival.

AV's Key Initiatives to Improve Cardiac Arrest Outcomes

1999

Victorian Ambulance Cardiac Arrest Registry (VACAR) established

2000

Metropolitan Ambulance Service and rural Victoria start training paramedics in Advanced Life Support (ALS)

Firefighters in metropolitan Melbourne are trained as emergency medical responders (EMRs), being dispatched at the same time as paramedics to life-threatening emergencies

2003

CPR awareness program launched in Victoria by Metropolitan and Rural Ambulance Services

2007

Simplification of telephone-assisted CPR instructions to 400 compressions before mouth-to-mouth

x400
compressions

2008

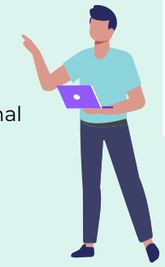
Expansion of the firefighter EMR program to outer metropolitan and regional areas of Victoria

2009

Ambulance Victoria commences an AED Registry which records the locations of AEDs across Victoria

2011

VACAR starts collecting patient-reported quality of life (QOL) and functional recovery data



2012

Expansion of MICA single responder units in metropolitan Melbourne and rural Victoria

2016

Clinical practice guidelines for resuscitation updated

2017

240+
career firefighters

across Victoria are trained through the EMR program

Commencement of the EXACT clinical trial (titration of oxygen after cardiac arrest)

2018

CPR awareness programs, including

Heart Safe Communities, train more than
1 million
people since 2004

Pilot of real-time and post event feedback on CPR quality for paramedics

Launch of the GoodSAM first responder app to paramedics and members of partner organisations

2019

VACAR 20-year anniversary and milestone 100,000th OHCA case recorded

Expansion of the GoodSAM first responder app to members of the public

2020

Introduction of Team Performance Report for cardiac arrest debriefing

Roll out of High Performance CPR for paramedics

2022

Artificial Intelligence developed to improve the detection of cardiac arrest in Triple Zero (000) calls (the AIDE study)

2023

2023-2028 Cardiac Arrest Improvement Strategy released

Commencement of FIRST and AUGMENT-VA clinical trials

A Story of **Survival**

Drama teacher returns to the stage after cardiac arrest

Standing up to help one of her students is the last thing 68-year-old drama teacher Lyndy Clarke remembers about 10 September 2023.

Lyndy was in the middle of directing a play at Caulfield Grammar when she went into cardiac arrest.

Her colleague saw her collapse and immediately started cardiopulmonary resuscitation (CPR).

Bystanders fetched an automated external defibrillator (AED) and used it to shock Lyndy three times before Ambulance Victoria (AV) paramedics arrived.

'It came completely out of the blue – I was fit and healthy and had no signs or symptoms of heart issues,' Lyndy said.

'The last thing I remember is getting up to give a direction and then I was waking up in the hospital 24 hours later.'

As fate would have it, Lyndy was the one who lobbied for the AED that saved her life, after she witnessed someone go into cardiac arrest at a school performance more than 10 years ago.

Lyndy said that incident opened her eyes to the importance of learning CPR and knowing how to use an AED – the two skills that saved her life.

'If the defibrillator had not been in the foyer outside the auditorium, I'd have died,' she said.

'People may assume they'll never need to help someone in cardiac arrest, but my advice is, learn these lifesaving skills and know where to find the nearest AED – you never know when you might need it.'

Every day, around 20 Victorians suffer a cardiac arrest but only one in 10 survive.

AV MICA Paramedic Brett Meyer said his team's clinical care on scene was aided by bystander intervention, which gave Lyndy the best chance of survival.

'Those moments between collapse and paramedics arriving are vital, and we're pleased that bystanders did everything they could to make sure Lyndy was in the best possible position to be revived by our team,' he said.

After a week in hospital and months of rehabilitation, Lyndy has returned to work and says she continues to feel healthier every day.

She is now a member of the **Shock Squad**, a group of cardiac arrest survivors brought together by Community First Responders Australia.

Lyndy Clarke with her colleague Pete Tserbis who started CPR on the day.

Every day, around 20 Victorians suffer a cardiac arrest but only one in 10 survive.

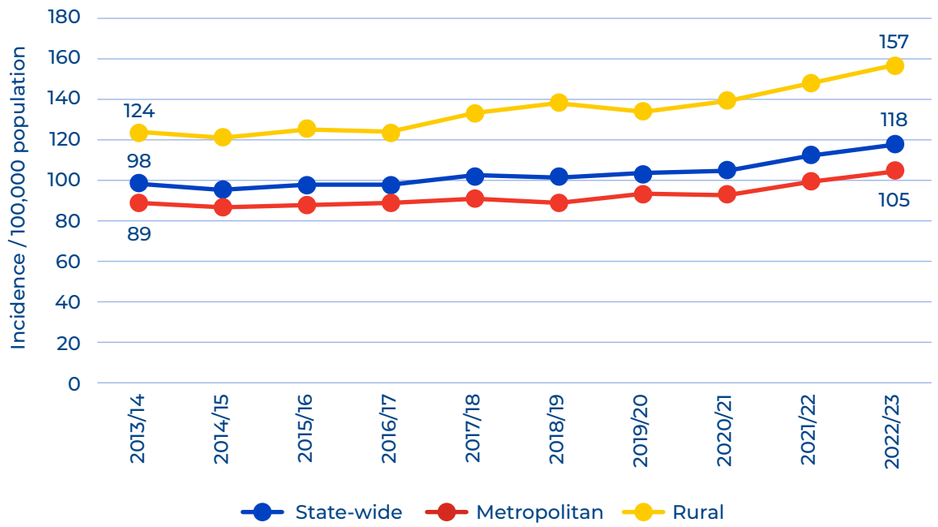
Lyndy aims to increase awareness about bystander intervention and has signed up to be a GoodSAM responder.

GoodSAM is a mobile app that connects patients in cardiac arrest with a nearby volunteer who is willing to start hands-only CPR while paramedics are on their way.

"If the defibrillator had not been in the foyer outside the auditorium, I'd have died."

Incidence

Out-of-hospital cardiac arrest incidence per 100,000 population



In 2022/23, Ambulance Victoria attended 7,830 OHCA events, a 6.4% increase on 2021/22.

The state-wide incidence of OHCA was **118 per 100,000 population**, which is an increase from 112 per 100,000 population in 2021/22, and 105 per 100,000 population in 2020/21.

OHCA incidence in metropolitan and rural areas also increased in 2022/23.

The age-adjusted incidence was 99 OHCA per 100,000 population, an increase from 96 per 100,000 population in 2021/22, and 91 per 100,000 population in 2020/21.

The increased incidence of OHCA observed in the past 2 years may be explained by mortality displacement. That is, it is possible that Victoria's COVID-19 lockdowns and restrictions in 2020/21 protected the elderly and/or frail, and that the risk of OHCA in these populations increased disproportionately after restrictions were lifted in 2022.

Ambulance Victoria attended

7,830

OHCA events

6.4% increase

118 per

100,000 population

Demographics

	Adult (≥ 16 years) population demographics^	**Paediatric** (< 16 years) population demographics^
	7,115 OHCAs	**90** OHCAs
	65% **were male** and the median age was 70 years	**56%** **were male** and the median age was 3 years
	30% were witnessed by a bystander	**32%** were witnessed by a bystander
	37% received a resuscitation attempt by EMS	**82%** received a resuscitation attempt by EMS

^Excludes EMS witnessed events.

Precipitating **Events**

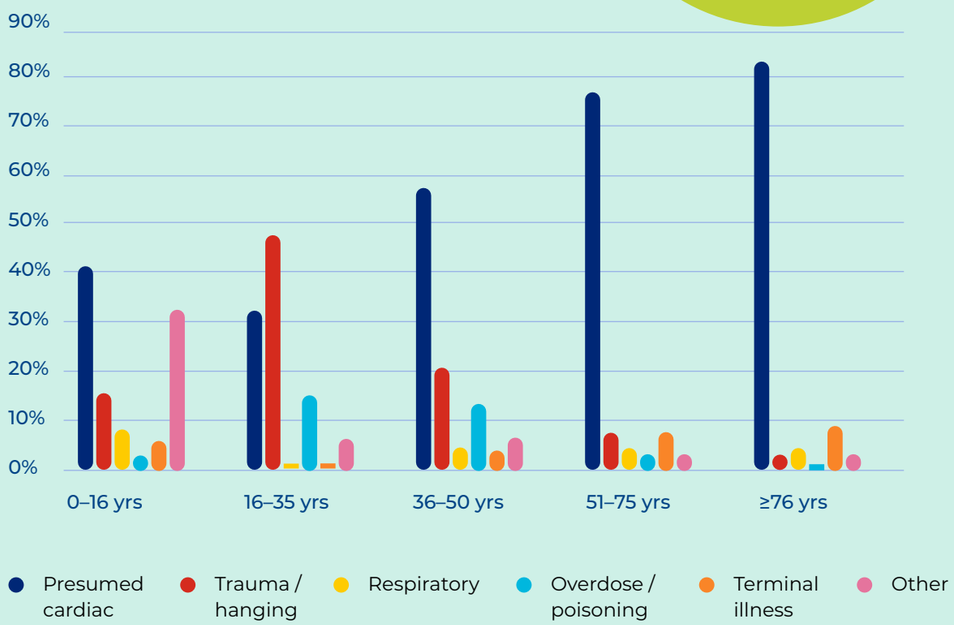
In 2022/23, 72% of OHCAs were due to a presumed cardiac aetiology. In accordance with the Utstein recommendations (Perkins 2015), OHCAs are presumed to be of cardiac origin unless a clear precipitator is specified on the patient care record.

In adult patients, the proportion of presumed cardiac events increased with increasing age. Among patients aged between 16 and 35 years, the most common cause of OHCA was trauma / hanging.

In paediatric patients, most events were of presumed cardiac origin. This was followed by 'Other' causes which most commonly included cases of sudden unexpected death in infancy (41%) and drowning (24%).

72%
of OHCAs were due to a presumed cardiac aetiology

Precipitating events by age group^



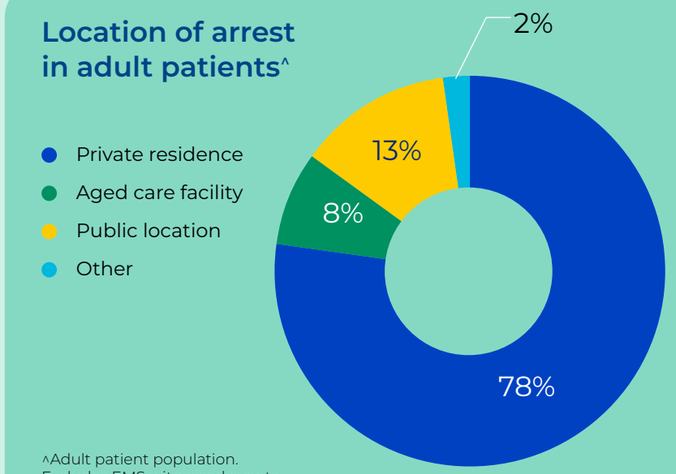
^Excludes EMS witnessed events.

Location **of Arrest**

In 2022/23, 78% of OHCAs occurred in the home, while 13% occurred in a public location.

Among patients who received a resuscitation attempt by EMS, 70% of OHCAs occurred in the home, and 21% occurred in a public location.

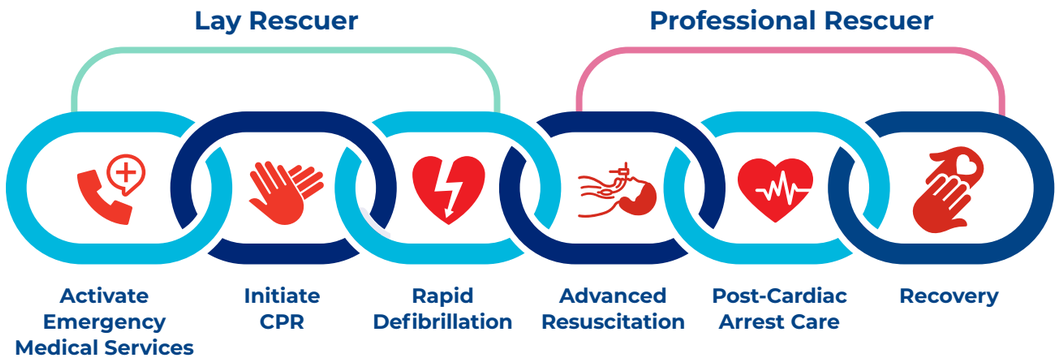
Location of arrest in adult patients^



^Adult patient population.
Excludes EMS witnessed events.

The **Chain of Survival**

The chain of survival is an internationally recognised series of steps that bystanders and EMS can take in order to maximise survival from OHCA.



The first three links, which can be administered by bystanders, have been associated with the largest gains in survival (Marijon 2023).

Interventions which aim to maximise bystander participation in resuscitation have the greatest impact on OHCA survival rates.

Link 1:
Activate EMS

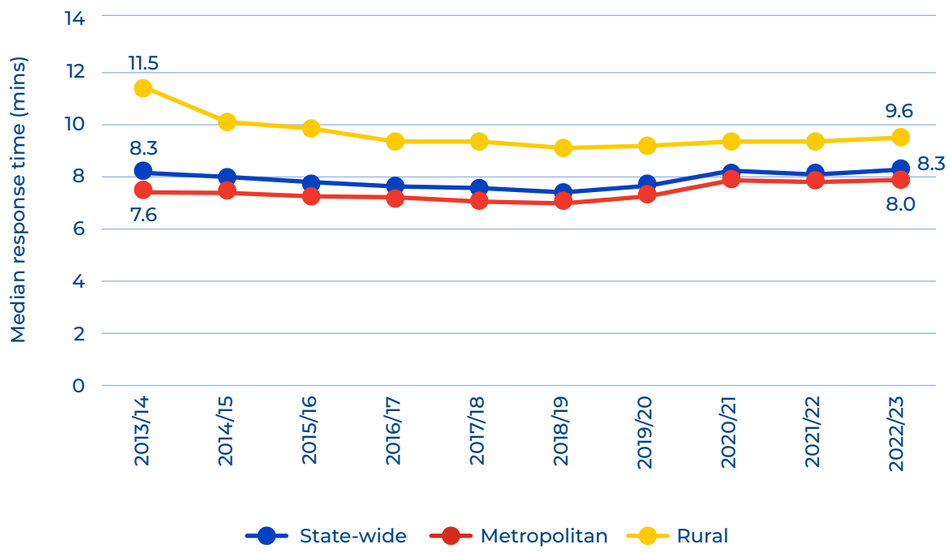
93%
of calls were initially directed to Triple Zero (000) ambulance*

89%
of OHCAs were identified during the Triple Zero (000) call*

8.3 mins
the median EMS response time^

65%
were attended by EMS within 10 minutes^

EMS response times over the past 10 years^



*Excludes EMS witnessed events.
^Includes patients receiving a resuscitation attempt by EMS. Excludes EMS witnessed events.

Link 2:
Initiate CPR

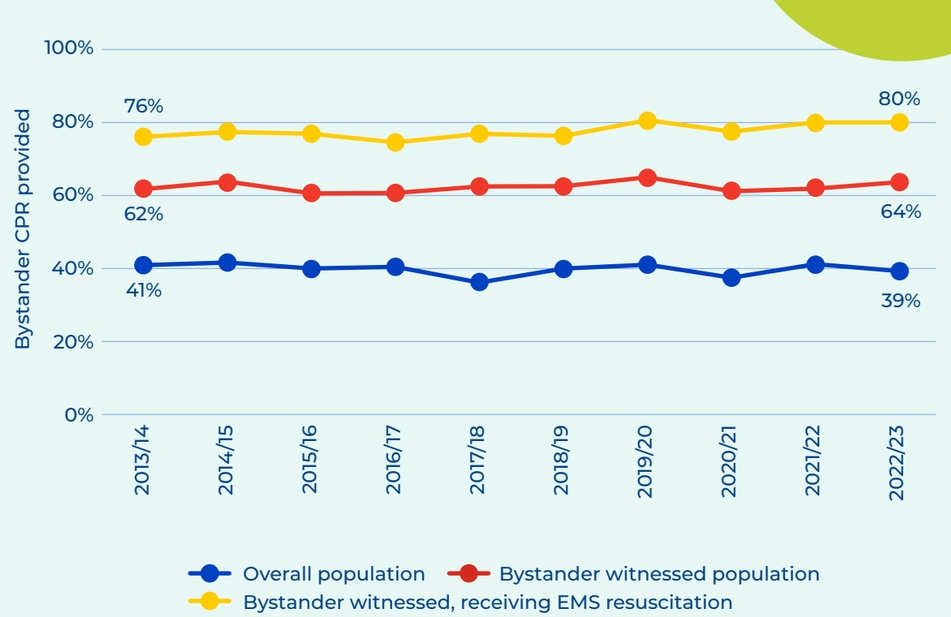
In 2022/23, 80% of bystander witnessed OHCA patients who received a resuscitation attempt by EMS were administered bystander CPR. This is the same as 2021/22.

Over the past decade, the rate of bystander CPR administration has plateaued. Although the implementation of the GoodSAM responder application in 2018 was associated with a small increase in bystander CPR administration, this was short-lived due to the COVID-19 pandemic.

The Ambulance Victoria Cardiac Arrest Improvement Strategy 2023-2028 aims to improve community-based participation in CPR and public access defibrillation by investing in community education programs (including education in schools) and Heart Safe Communities, as well as encouraging the use of digital media applications, such as GoodSAM, to enhance the community response to OHCA.

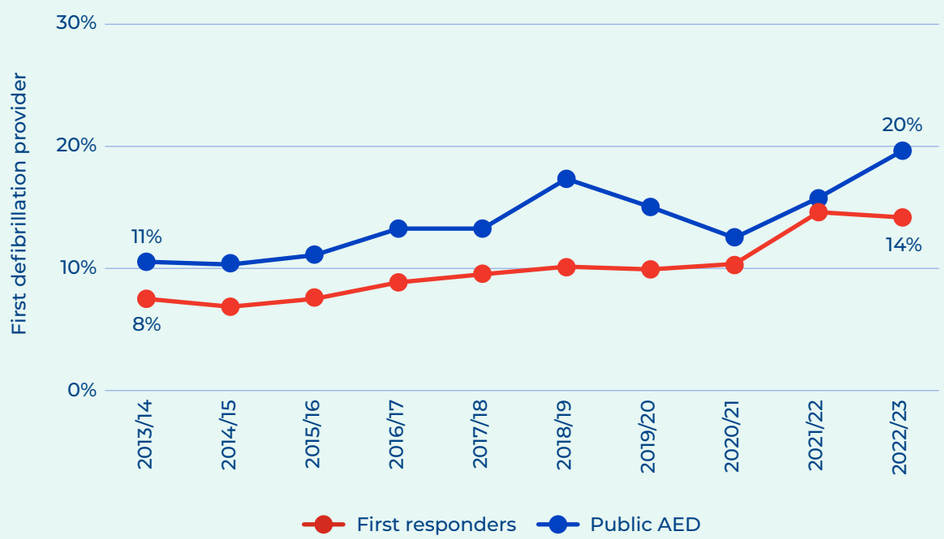
80%
of EMS-treated bystander witnessed OHCA

Bystander CPR rates over the past 10 years



Link 3:
Rapid Defibrillation

Initial defibrillation provider over the past 10 years^



In 2022/23, 20% of patients whose initial rhythm was shockable received their initial defibrillation from a bystander with a public AED.

Although reduced rates of bystander defibrillation were observed during the COVID-19 pandemic, this year we saw the highest rate of bystander defibrillation on record.

Median (90th percentile) time to first defibrillation in 2022/23^

^Includes initially shockable patients who received a resuscitation attempt from EMS. Excludes EMS witnessed events.

Link 4:
Advanced Resuscitation

Advanced resuscitation refers to the phase of OHCA management when paramedics step in and provide additional life-saving measures.

This includes the provision of high-quality CPR and defibrillation, amongst other clinical interventions designed to achieve return of spontaneous circulation (ROSC).

CPR is of high quality if it meets internationally-defined standards and follows a well-practiced choreography (the “pit-crew” approach) aimed at minimising interruptions to resuscitation.

Recommendations for optimal chest compressions include a target depth of **≥5cm** for adults and a rate of **100-120 compressions per minute**.

The main components of high-performance CPR (HP-CPR) are:

- high chest compression fraction
- targeted chest compression rate and depth
- allowing full chest recoil
- avoidance of over-ventilation

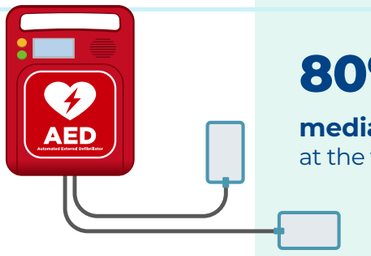
Recommendations for optimal chest compressions include a target depth of ≥5cm for adults and a rate of 100-120 compressions per minute. To maximise perfusion, guidelines for CPR and external cardiac compressions recommend minimising pauses in chest compressions. Lower chest compression fraction (i.e. longer pauses and lower proportion of time with CPR being performed) during resuscitation is associated with a decreased likelihood of ROSC and survival.

Resuscitation Quality Snapshot 2022/23

Early recognition

89%
of cases had placement of pads
within **2 minutes** of EMS arrival

94%
of cases had compressions underway
on pad placement



93%
of cases had the initial rhythm
correctly identified

High quality CPR

92%
median chest compression fraction

80%
median compressions
at the target depth

70%
median compressions
at the target rate

Early defibrillation

64%
of cases had the first defibrillation
within **2 minutes** of EMS arrival at patient

5.7 sec
median pre-shock pause

3.7 sec
median post-shock pause

Advanced care

84%
first pass intubation success

89%
of transported cases had a systolic blood pressure > 100mmHg on hospital arrival

68%
of VF/VT patients
who died on scene had an adequate duration **(45 minutes)** of resuscitation

45 min

Note: Includes all EMS attempted resuscitations for 2022-23. Excludes patients aged <12 years and traumatic cardiac arrests.

Link 5:
Post-Cardiac Arrest Care

In 2022/23, **93% of presumed cardiac aetiology OHCA patients were transported to a percutaneous coronary intervention (PCI)-capable facility**, in line with recent years.

PCI-capable hospitals have a process for receiving emergency patients via a pre-notification system and have full-time PCI capabilities.

Transport to a PCI-capable facility in 2022/23^

State-wide
93%

Metro
98%

Rural
78%

^Includes adult patients with a presumed cardiac aetiology who received a resuscitation attempt by EMS and transport to hospital. Excludes EMS witnessed events.

Link 6:
Recovery

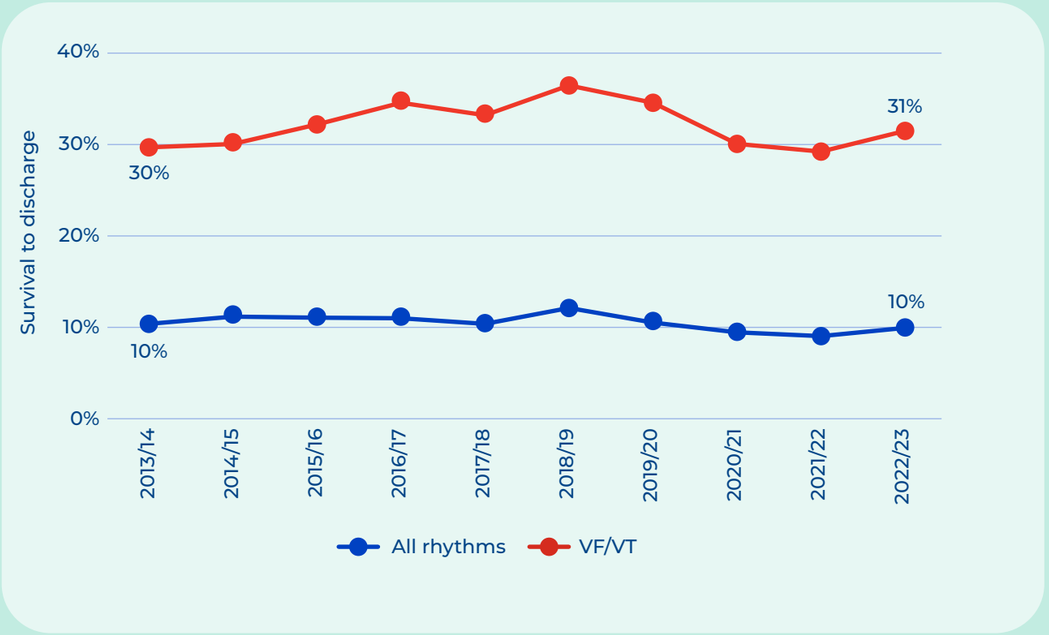
In 2022/23, **10% of all patients who received a resuscitation attempt by EMS survived to hospital discharge**, in line with previous years.

In patients who presented with a shockable cardiac rhythm including ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT), **31% of patients survived to hospital discharge**, an increase on the 29% observed in 2021/22. Survival to hospital (event survival) in these patients was 56% in 2022/23, an increase from 54% in 2021/22.

In the population of patients who were witnessed to arrest by EMS and arrested into VF/VT, 73% survived to hospital discharge, an increase from 70% in 2021/22.

Although increasing, survival rates have not yet returned to pre-COVID-19 levels. Ambulance Victoria's Cardiac Arrest Improvement Strategy 2023-2028 outlines four priority areas to improve OHCA survival by 30% in Victoria over the next 5 years (see page 38).

Survival to hospital discharge over the past 10 years^



^Includes adult patients receiving a resuscitation attempt by EMS. Excludes EMS witnessed events.

The importance of bystanders

In 2022/23, **12% of patients who received bystander CPR survived to hospital discharge**, compared with 5% of patients who did not receive bystander CPR.

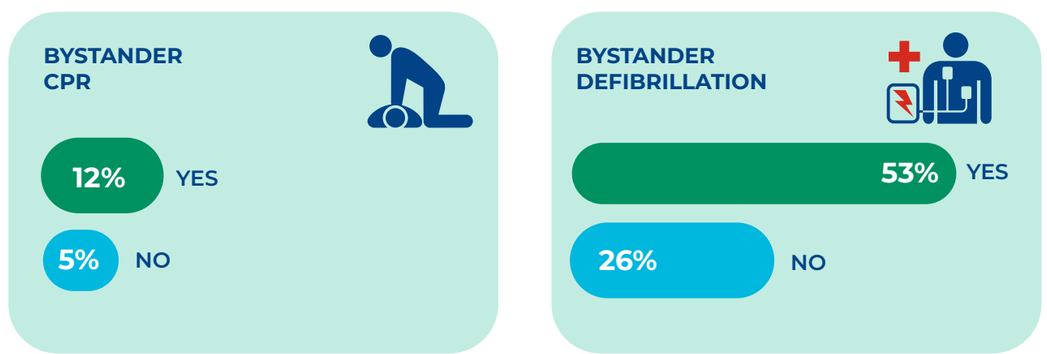
Further, over half **(53%) of the patients who received bystander defibrillation survived to hospital discharge**, compared with only 26% of patients who received their first defibrillation from EMS.

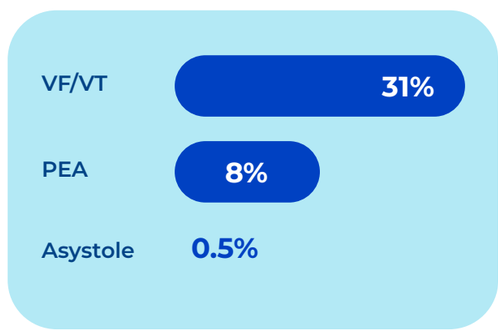
Patients who receive bystander CPR are also more likely to present to EMS in a shockable cardiac rhythm, and therefore have the greatest chance of survival.

These figures reiterate the importance of bystander interventions.

Survival to discharge^

Bystander interventions improve survival outcomes.





The chance of survival is highest when the initial cardiac rhythm is shockable.

^Figures include adult patients who received a resuscitation attempt by EMS. Excludes EMS witnessed events.

Patient outcomes

In 2022/23, **83% of adult patients who were discharged from hospital alive were discharged** back to their home or usual place of residence.

For adult patients arresting in 2021/22, **348 patients were alive 12 months after their arrest**. Among these patients, 233 responded to 12-month follow-up interviews this year.

At 12 months, **91% of responders were living at home without additional care.** In addition, 87% reported a good functional recovery or moderate disability according to the Glasgow Outcome Scale-Extended, a widely used global measure of functional outcome.

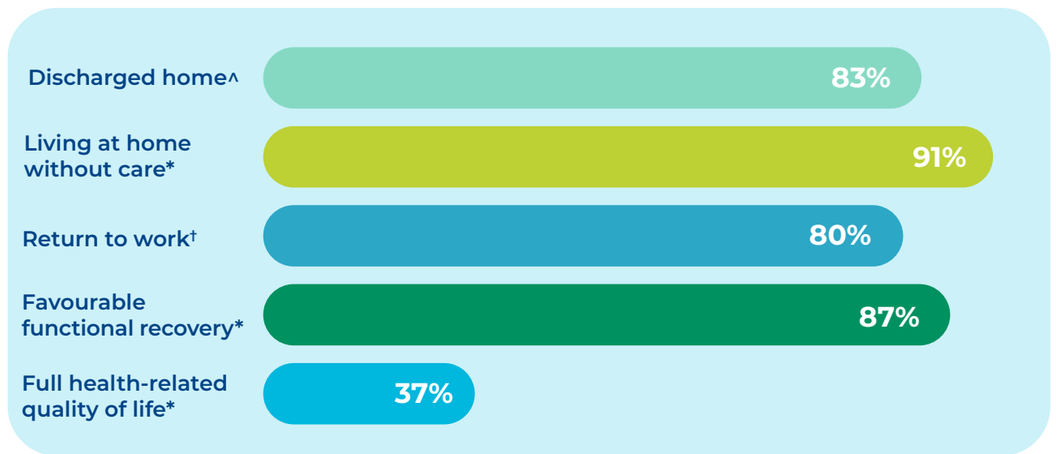
In total, 37% of patients reported full health-related quality of life (score = 1) at 12 months according to the ED-5D-5L, a widely used instrument which measures and describes health-related quality of life.. Among patients who were working prior to their arrest, 80% had returned to work.

83%

of adult patients

who were discharged from hospital alive were discharged back to their home

Patient recovery



^Presented as a proportion of adult survivors to hospital discharge in 2022/23.

*Presented as a proportion of 233 patients whose OHCA occurred in 2021/22 and responded to 12-month follow-up.

†Presented as a proportion of 134 patients whose OHCA occurred in 2021/22, responded to 12-month follow-up and were working prior to arrest.

Survival
Benchmarking

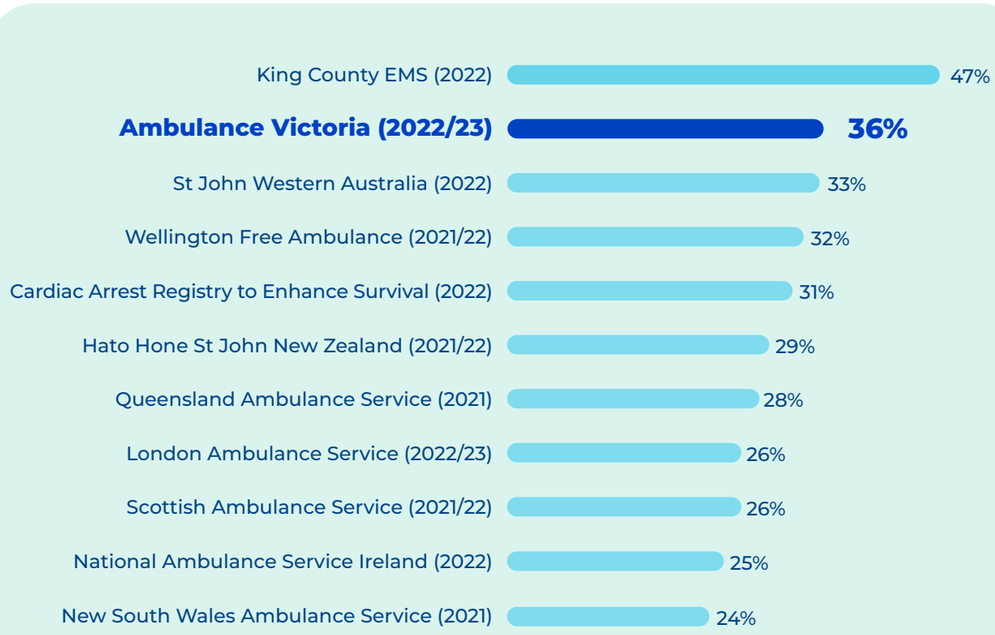
Utstein comparator group benchmarking

The Utstein template is a set of guidelines developed to promote uniform international reporting of OHCA data (Perkins 2015). The Utstein comparator group focusses on reporting survival within the cohort of patients who have a bystander witnessed OHCA, present in a shockable cardiac rhythm (VF/VT), and receive a resuscitation attempt by EMS.

The figure below displays survival rates reported nationally and internationally for the Utstein comparator group.

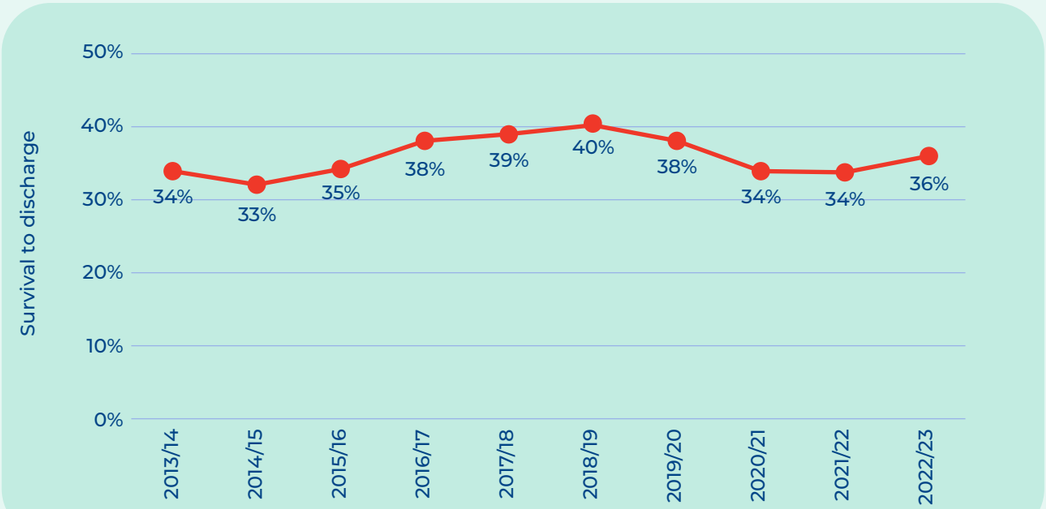
In 2022/23, **36.1% of patients within the Utstein comparator group in Victoria survived to hospital discharge**. This compares favourably to national and international services.

Utstein comparator group survival rates nationally and internationally

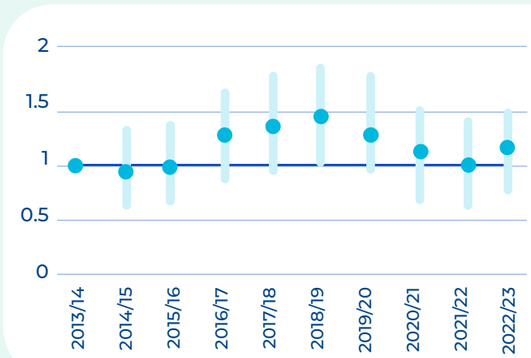


Note:
King County EMS and the Cardiac Arrest Registry to Enhance Survival report on non-traumatic OHCAs.
St John Western Australia, Queensland Ambulance Service, London Ambulance Service, Scottish Ambulance Service, Hato Hone St John New Zealand and Wellington Free Ambulance report 30-day survival.
Hato Hone St John and Wellington Free Ambulance report on adult patients (≥15 years) only.
National Ambulance Service Ireland report on adult patients (>17 years) only.

Utstein comparator group survival over the past 10 years in Victoria



Risk adjusted odds of survival^



Risk adjusted odds of survival to discharge in the Utstein comparator group

The risk-adjusted odds of survival to hospital discharge in 2022/23 were not significantly different from 10 years ago, although have improved since 2021/22. Relative to 2013/14, only 2018/19 was associated with a significant increase in survival.

The odds of survival have not returned to pre-COVID-19 levels. Refer to page 38 for Ambulance Victoria's Cardiac Arrest Improvement Strategy 2023-2028 which sets out strategies to improve OHCA survival in Victoria by 30%.

^ Risk-adjusted model was adjusted for patient age, male gender, public location and year of arrest.

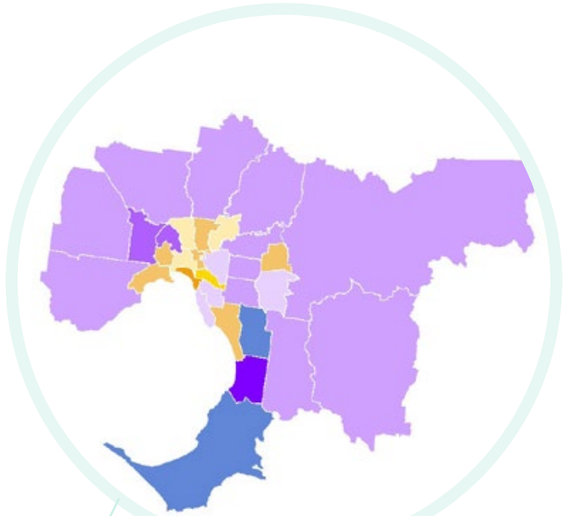
Priority **Locations**

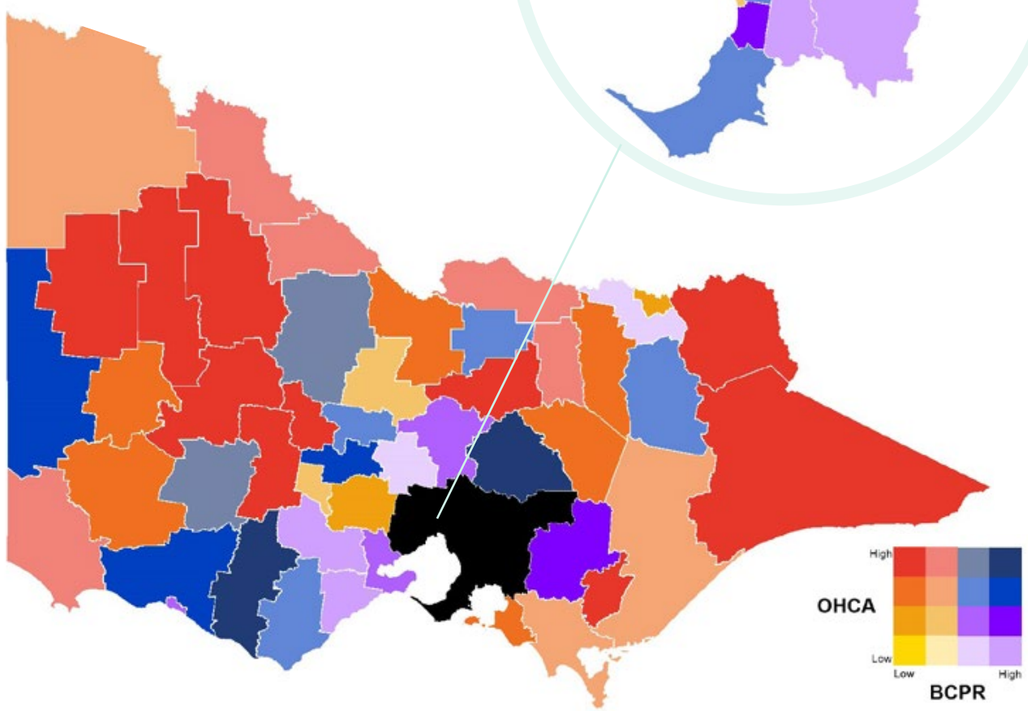
OHCA incidence relative to bystander CPR provision

The map depicts the incidence of OHCA relative to the proportion of patients who received bystander CPR within Local Government Areas of Victoria. Red areas are those with high incidence of OHCA, but low rates of bystander CPR provision. These represent high priority areas for CPR education and awareness.

CPR priority locations:

- Buloke
- Central Goldfields
- East Gippsland
- Hindmarsh
- Latrobe
- Northern Grampians
- Pyrenees
- Strathbogie
- Towong
- Yarriambiack



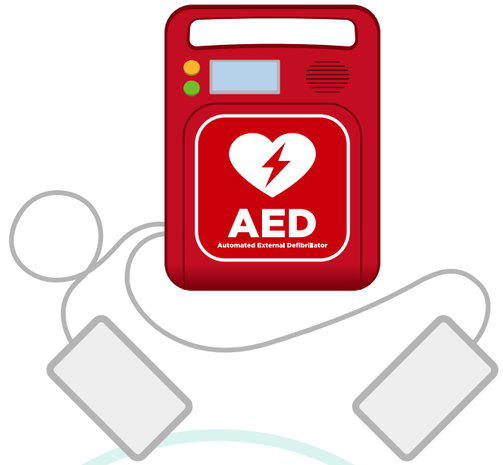


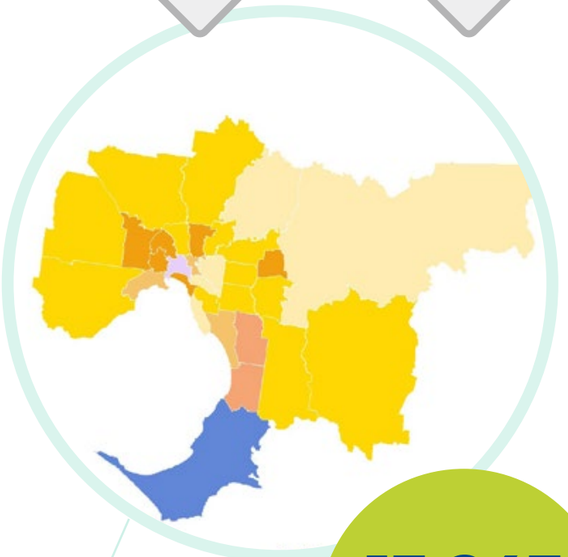
OHCA incidence relative to public AED availability

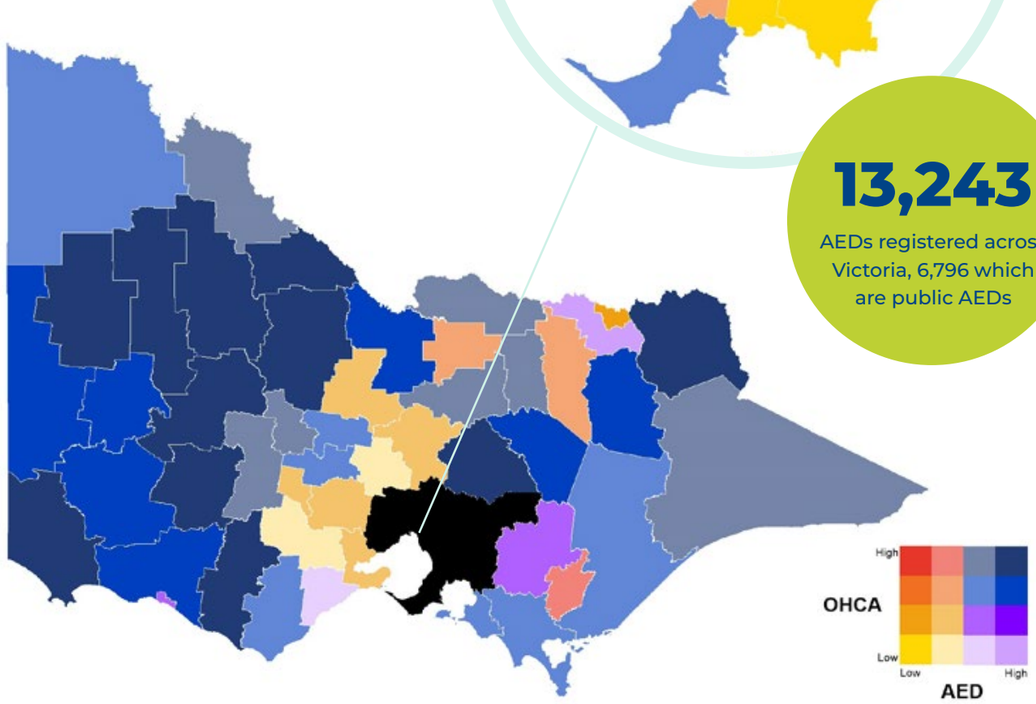
The map depicts the incidence of OHCA relative to the incidence of public AEDs within Local Government Areas of Victoria. Pink and peach coloured areas are those with high incidence of OHCA, but low incidence of public AEDs. These represent high priority areas in which public AED availability could be increased.

Public access defibrillation priority locations:

- Frankston
- Greater Dandenong
- Greater Shepparton
- Latrobe
- Wangaratta







13,243

AEDs registered across Victoria, 6,796 which are public AEDs

OHCA incidence relative to GoodSAM responder incidence

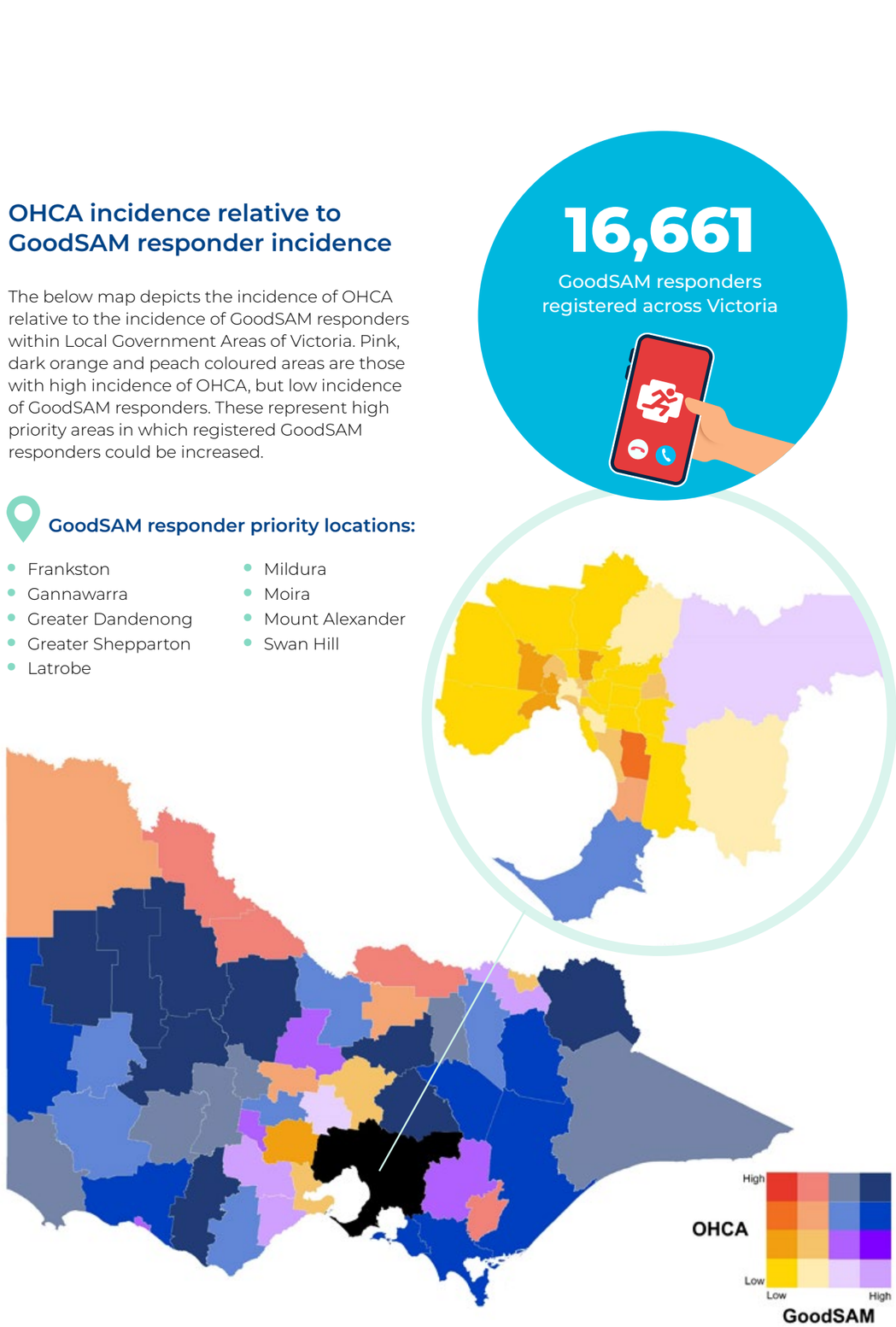
The below map depicts the incidence of OHCA relative to the incidence of GoodSAM responders within Local Government Areas of Victoria. Pink, dark orange and peach coloured areas are those with high incidence of OHCA, but low incidence of GoodSAM responders. These represent high priority areas in which registered GoodSAM responders could be increased.

GoodSAM responder priority locations:

- Frankston
- Gannawarra
- Greater Dandenong
- Greater Shepparton
- Latrobe
- Mildura
- Moira
- Mount Alexander
- Swan Hill

16,661

GoodSAM responders registered across Victoria

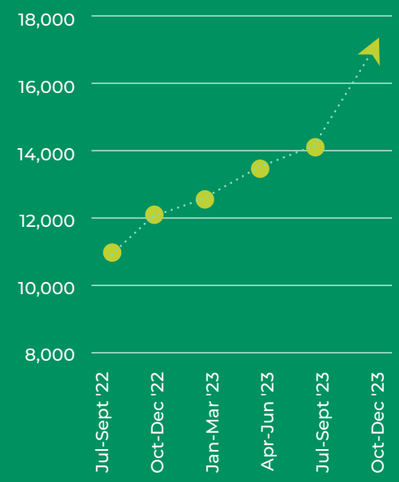


Become a **GoodSAM Responder**

For every minute that a cardiac arrest patient goes without CPR and/or defibrillation, their likelihood of survival decreases by 10%. Early intervention by bystanders can improve a patient's chances of survival.

GoodSAM is a free global smartphone app that is used to facilitate bystander response to cardiac arrest. A Triple Zero (000) call for suspected cardiac arrest triggers an alert to be sent to a nearby user of the app. The GoodSAM responder is notified of the patient's location, and the location of the nearest AED registered in Ambulance Victoria's AED registry.

Registered GoodSAM responders



646

patients attended by a GoodSAM responder in 2022/23

357

patients administered CPR by a GoodSAM responder in 2022/23

Become a GoodSAM responder

Register your AED in the AED registry

Cardiac Arrest
Improvement Strategy

In 2018/19, Ambulance Victoria reported its highest ever survival rate from OHCA. This improvement was not due to luck, but rather, the implementation of a targeted and comprehensive resuscitation quality improvement bundle. However, the COVID-19 pandemic had a devastating impact on the OHCA system of care across Australia and internationally. OHCA survival remains lower now than it was prior to the pandemic.

To improve survival from OHCA, Ambulance Victoria developed a Cardiac Arrest Improvement Strategy 2023-2028. The strategy will provide a focus for improving survival from OHCA between 2023 and 2028. Its ambitious goal is to improve survival to hospital discharge by 30% in bystander witnessed, initially shockable OHCA (the Utstein comparator group), or from 34% in 2021/22, to 44% in 2027/28.

Our Target

To improve survival to hospital discharge by

30%

in bystander witnessed initially shockable OHCA

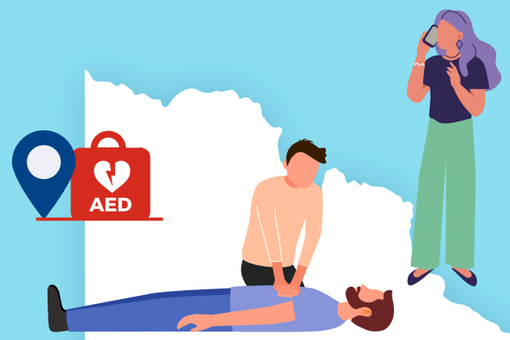
Cardiac Arrest Improvement Strategy 2023-2028

Strategic **Priority 1**

Community CPR and public access defibrillation

Enhance community-based participation in cardiopulmonary resuscitation and public access defibrillation.

- **Invest in community education programs and Heart Safe Communities**
- **Targeted delivery of CPR awareness education in schools (our Call, Push, Shock program)**
- **Identify inequities and barriers to the use of public access defibrillation**
- **Use digital media applications to enhance the community response**



Strategic **Priority 2**

Comprehensive system response

Optimise cardiac arrest recognition, call-handling and dispatch and provide a comprehensive system response.

- **Increase our first responder capacity in regional areas**
- **Provide focused reporting and monitoring of call handling performance**
- **Examine the potential for audio-visual connection for emergency calls**
- **Expert panel review and feedback of cardiac arrest recognition in the emergency call**

OUR VISION

To improve cardiac arrest survival rates in Victoria by **30%**

Strategic **Priority 3**

- **Enhance paramedic access to high-fidelity, team-based, training with feedback**
- **Establish a system-wide model for post-cardiac arrest debriefing**
- **Facilitate education with a focus on resuscitation training and end-of-life decision making**
- **Establish the evidence-base for existing resuscitation targets**

High-performance CPR

Establish world-leading performance in resuscitation and ensure all patients receive high-quality CPR.

Strategic **Priority 4**

Culture of excellence

Create an organisational-wide culture of excellence in resuscitation that embraces quality and performance.

- **Develop enhanced analytics of resuscitation care and outcomes across Ambulance Victoria**
- **Embed local champions in regions to promote high-performance CPR training**
- **Establish accountability for the monitoring and review of cardiac arrest**
- **Conduct world-leading clinical trials to advance the evidence-base**

2022/23
Research Publications

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Abbreviations

AED	Automated External Defibrillator
CPR	Cardiopulmonary Resuscitation
EMS	Emergency Medical Services
HP-CPR	High Performance Cardiopulmonary Resuscitation
MICA	Mobile Intensive Care Ambulance
OHCA	Out-of-Hospital Cardiac Arrest
PCI	Percutaneous Coronary Intervention
ROSC	Return of Spontaneous Circulation
VACAR	Victorian Ambulance Cardiac Arrest Registry
VF/VT	Ventricular Fibrillation / Ventricular Tachycardia

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AmbulanceVictoria

Caring

Safe

Effective

Connected

Acknowledgements

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