

# Out-of-Hospital Cardiac Arrest Registry

Rēhita Mate Manawa mō waho i te Hōhipera

Aotearoa New Zealand, National Report 2020/21



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## Clinical Audit and Research

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# Introduction

## Whakatakinga

**Every year in New Zealand over 2,000 people are treated for a cardiac arrest that occurs in the community. With only one in ten New Zealanders surviving to 30 days, death from cardiac arrest is our ‘silent toll’. It can happen to anyone of any age, including children.**

We remain focused on reducing this toll through the delivery of quality care, but we can't do it alone. We need all New Zealanders to help by knowing how to perform CPR and use a defibrillator (or AED). Survival is largely due to the quick actions of bystanders who initiate CPR and use an AED within the first few minutes of a cardiac arrest. Outcomes from out-of-hospital cardiac arrest (OHCA) are dramatically improved when a patient receives early CPR and defibrillation. The more people who know how to do CPR and have access to an AED in the community, the greater the chance of patient survival. For every minute without CPR or defibrillation, a patient's chance of survival falls by 10–15 percent. We believe that community initiatives such as free CPR awareness training, Restart A Heart Day, CPR in schools, and the GoodSAM smartphone application will improve survival from OHCA.

Alongside the community, the ambulance service has a strong influence on outcomes. Out-of-hospital cardiac arrest is the most time-critical and time-dependent condition to which the ambulance service responds. We benchmark ourselves internationally on our resuscitation performance as it tests all aspects of our system of care, from the community response to advanced life support. Benchmarking requires measurement and our Aotearoa New Zealand Cardiac Arrest Registry enables this. This continuous measurement determines whether making changes improves patient outcomes, and identifies further steps for improvement.

This report encompasses some of the COVID-19 pandemic period. However, in New Zealand we were fortunate that during this reporting period we had lockdowns of short duration and that were geographically isolated to select parts of New Zealand (<https://covid19.govt.nz/about-our-covid-19-response/history-of-the-covid-19-alert-system/>).

In addition, the rates of active COVID cases in the community during this period didn't exceed more than 200 per day ([www.stats.govt.nz/experimental/covid-19-data-portal](http://www.stats.govt.nz/experimental/covid-19-data-portal)).

However, there may be other factors related to COVID that negatively impacted healthcare systems, and these may have affected survival from OHCA during this time.

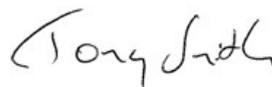
We are very pleased to present the 2020–2021 Aotearoa New Zealand, National Out-of-Hospital Cardiac Arrest Registry Annual Report.



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Head of Clinical Audit  
and Research  
St John



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Medical Director  
Wellington Free Ambulance



**Dr Tony Smith**  
Medical Director  
St John



# About this report

## Mō tēnei pūrongorongo

**Cardiac arrest remains a considerable public health issue, with ischaemic heart disease being the second most prevalent cause of death in New Zealand.**

Internationally, survival rates following out-of-hospital cardiac arrest (OHCA) are highly variable and can range from less than 6% to greater than 50%. Benchmarking survival from OHCA is a key measure of the clinical quality of an Emergency Ambulance Service (EAS) and is fundamental to making improvements in OHCA survival. Knowledge of New Zealand OHCA outcomes is a key driver to help identify and address areas for improvement in clinical care.

The data presented in this report is for all OHCA attended by the St John and Wellington Free Ambulance EAS in the period from 1 July 2020 to 30 June 2021.

The data presented in this report primarily relates to events that were either 'attended' or where there was a 'resuscitation attempted' by EAS personnel. 'Attended' refers to all OHCA where EAS personnel arrived at the scene regardless of whether or not a resuscitation attempt was made. 'Resuscitation attempted' refers only to those events where an attempt at resuscitation was made by EAS personnel.

Unless otherwise stated, all analyses exclude cardiac arrests witnessed by EAS personnel. In cases where it was not recorded whether the patient was an adult or a child, the patient was assumed to be an adult and was included in that category.

Unless otherwise stated, survival refers to survival to 30 days post cardiac arrest.

All population figures in this report are derived from either Statistics New Zealand population data or the Ministry of Health Primary Health Organisation (PHO) enrolment data<sup>1</sup>.

# Executive summary

## Tuhinga whakarāpopoto nui



**5 people a day**

(approx) were treated for an out-of-hospital cardiac arrest in New Zealand (more than 2,000 per year)

**30% female,  
70% male**



**75%**

of patients received bystander CPR



**5%**

received defibrillation by a Community Responder prior to ambulance arrival



The median time in which an EAS ambulance reached a patient was **8 minutes** in urban communities and **12 minutes** in rural and remote communities



**96%**

of events were co-responded to and attended by Fire and Emergency New Zealand



**25%**

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



**11%**

of patients survived

# Benchmarking executive summary

## Tuhinga whakarāpopoto Panekiretanga

### Key figures for all-cause events

Table 1: Key figures for all-cause events<sup>A</sup>

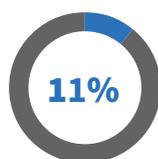
Year	Total number events	 % Bystander CPR	 % Community Responder AED use	 Urban median response time	 Rural & remote median response time	 % Attended by Fire & Emergency New Zealand	 % ROSC on handover	 % Survival
2018/19	2,010	76%	4%	8	13	92%	27%	14%
2019/20	2,212	75%	5%	8	12	95%	25%	13%
2020/21	2,184	75%	5%	8	12	96%	25%	11%

### Benchmarking (all-cause events)

The outcomes of OHCA for international benchmarking compare rates of return of spontaneous circulation (ROSC) sustained to hospital handover and survival. This group requires that the following criteria be met: includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events.

Table 2: Benchmarking survival outcomes for all-cause events<sup>A</sup>

Ambulance Service	Collection period	Total number events	% ROSC on handover	% Survival <sup>B</sup>
New Zealand	1 July 2020 to 30 June 2021	2,184	25%	11%
Ambulance Victoria <sup>2</sup>	1 July 2019 to 30 June 2020	2,564	27%	10%
Queensland Ambulance Service <sup>3</sup>	1 January 2020 to 31 December 2020	2,298	25%	10%
St John Western Australia <sup>4</sup>	1 July 2020 to 30 June 2021	924	18%	8%
King County EMS <sup>5</sup>	1 July 2020 to 30 June 2021	949	40%	15%



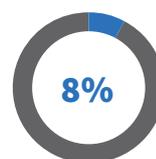
New Zealand



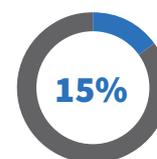
Ambulance Victoria



Queensland Ambulance Service



St John Western Australia



King County EMS

<sup>A</sup> All events, adult, resuscitation attempted: includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events.

<sup>B</sup> New Zealand, St John Western Australia, and Queensland report on survival to 30-days, all other services report survival to hospital discharge.



### Benchmarking (Utstein Comparator Group)<sup>A</sup>

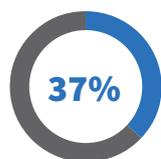
The outcomes of OHCA for international benchmarking compare rates of ROSC sustained to hospital handover and survival for a specifically selected subgroup of patients. This subgroup is referred to as the Utstein Comparator Group and requires that the following criteria be met: includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted, shockable presenting rhythm and bystander witnessed. Excludes children, EAS witnessed and no resuscitation attempt.

**Table 3: Benchmarking survival outcomes for adults (Utstein Comparator Group)<sup>A</sup>**

Ambulance Service	Collection period	Total number events	% ROSC on handover	% Survival <sup>B</sup>
<b>New Zealand</b>	1 July 2020 to 30 June 2021	600	49%	28%
<b>Ambulance Victoria<sup>2</sup></b>	1 July 2019 to 30 June 2020	-	-	37%
<b>Queensland Ambulance Service<sup>3</sup></b>	1 January 2020 to 31 December 2020	322	44%	26%
<b>St John Western Australia<sup>4</sup></b>	1 July 2020 to 30 June 2021	174	48	33%
<b>King County EMS<sup>5</sup></b>	1 July 2020 to 30 June 2021	161	70%	43%



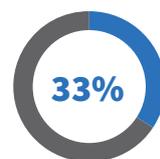
New Zealand



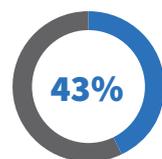
Ambulance Victoria



Queensland  
Ambulance Service



St John  
Western Australia



King County  
EMS

**A Utstein Comparator Group:** includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted, shockable presenting rhythm and bystander witnessed. Excludes children, EAS witnessed and no resuscitation attempt.

**B** New Zealand, St John Western Australia, and Queensland report on survival to 30-days, all other services report survival to hospital discharge.

# Improve survival in your community

## CPR awareness sessions

Knowing CPR means you could save the life of a friend, a colleague, a member of your whānau or someone on the street.

### 3 Steps for Life

The mission of 3 Steps for Life is to empower members of the community to step forward when help is needed, and increase out-of-hospital cardiac arrest survival rates. Delivered by volunteer Community Educators, this programme consists of public awareness sessions around basic CPR and AED training. It gives participants the skills and confidence to take action in responding to someone in cardiac arrest by:

- 1 Calling 111
- 2 Starting CPR
- 3 Using an AED

You can find out details about this course and how to attend by visiting [stjohn.org.nz/3stepsforlife](http://stjohn.org.nz/3stepsforlife) or email [3stepsforlife@stjohn.org.nz](mailto:3stepsforlife@stjohn.org.nz)

### Lloyd Morrison Foundation Heartbeat Programme

If you are in the Greater Wellington and Wairarapa area, Wellington Free Ambulance provides the Lloyd Morrison Foundation Heartbeat programme interactive training session free of charge. During the session you will learn everything you need to know about CPR and using an AED.

You can find out details about this course and how to attend by visiting [wfa.org.nz/heartbeat](http://wfa.org.nz/heartbeat) or email [heartbeat@wfa.org.nz](mailto:heartbeat@wfa.org.nz)

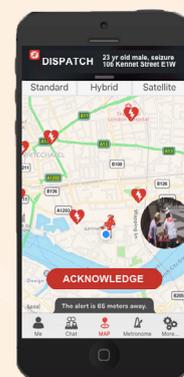




## Become a GoodSAM responder

If you are confident in CPR and in using an AED, you can be a GoodSAM responder. When there is a cardiac arrest, the GoodSAM app alerts trained people nearby that CPR is needed while an ambulance is on the way. Sign up to the GoodSAM app and improve someone's chance of surviving cardiac arrest.

Get all the info at [stjohn.org.nz/goodsam](http://stjohn.org.nz/goodsam)



## Volunteer as a CPR educator (3 Steps for Life instructor)

Make a difference in your community by volunteering with St John! We're looking for people to run 3 Steps for Life awareness sessions for your local community groups, such as sports clubs, retirement villages, marae communities and more. Full training will be provided!

To register your interest as a volunteer facilitator, please reach out to [3stepsforlife@stjohn.org.nz](mailto:3stepsforlife@stjohn.org.nz)

## Community help can double survival

When community defibrillation occurred prior to EAS arrival both event survival and 30-day survival were increased.

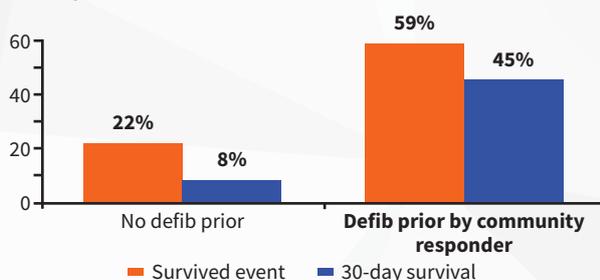


Figure 1: Influence of community defibrillation on outcomes (all events, adult, resuscitation attempted)<sup>A</sup>.

When a GoodSAM responder was present both event survival and 30-day survival were increased compared to events where there was no GoodSAM responder.

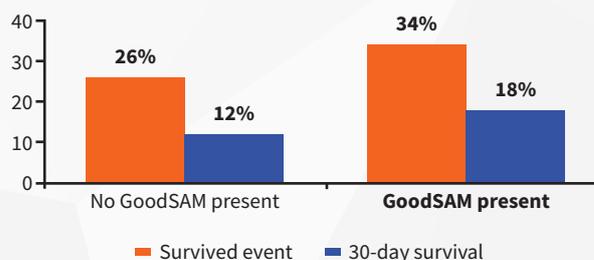


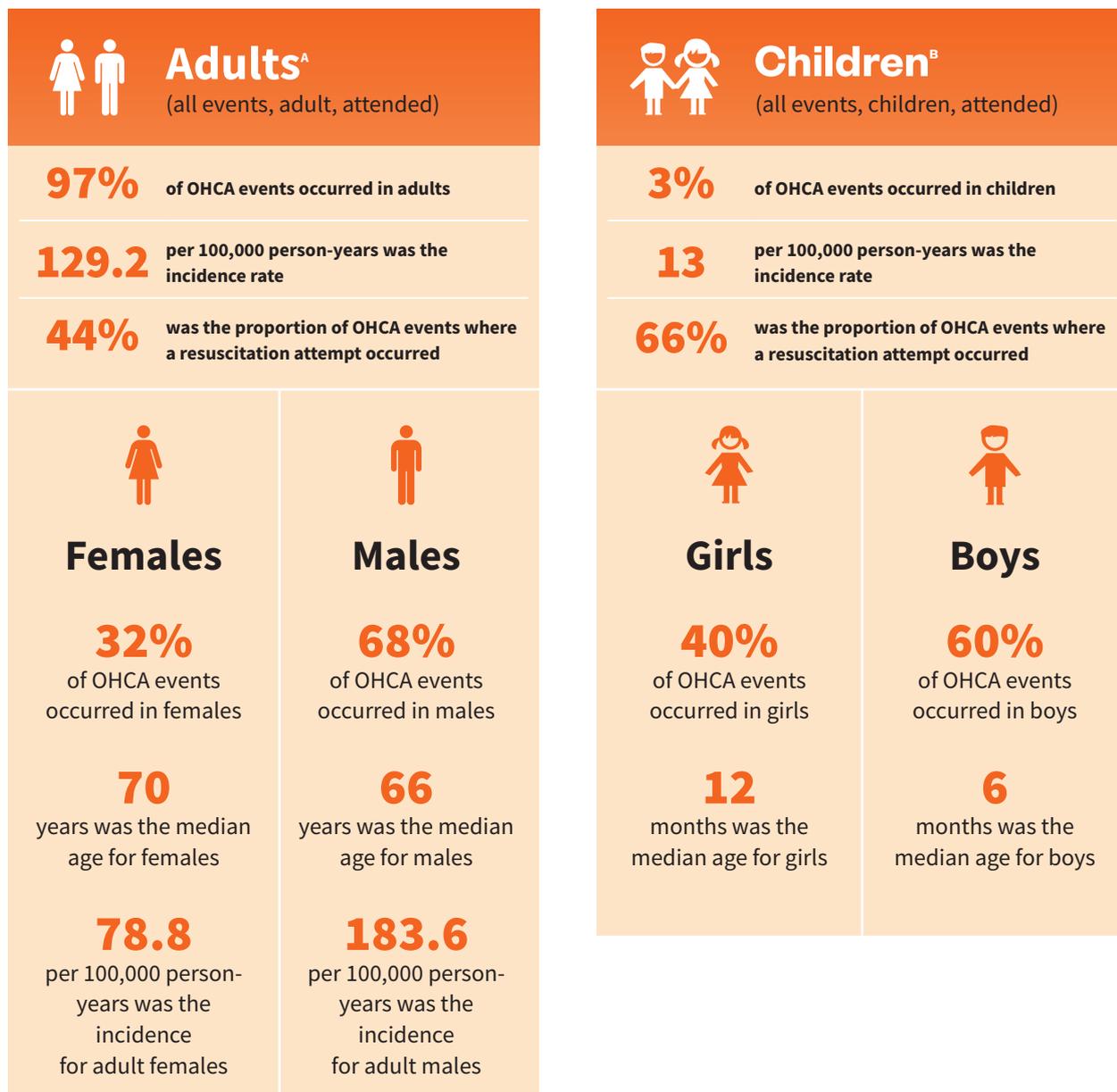
Figure 2: Influence of GoodSAM responder presence on outcomes (all events, adult, resuscitation attempted)<sup>A</sup>.

<sup>A</sup> **All events, adult, resuscitation attempted:** includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events.

# Incidence and demographics

## Taupori pāpātanga me Taupori āhuatanga

### Key figures for adults (≥ 15yrs) and children



### Overall age-adjusted incidence<sup>C</sup> 2020/21

**90.0** per 100,000 person-years

**A All events, adult, attended:** includes adults (≥ 15 years old), all-cause, resuscitation attempted and no resuscitation attempted. Excludes children, EAS personnel witnessed events.

**B All events, children, attended:** includes children (< 15 years old), all-cause, resuscitation attempted and no resuscitation attempted. Excludes adults, EAS personnel witnessed events. Includes events from 1 July 2018 through 30 June 2021.

**C** Age-adjusted incidence was calculated using the New Zealand PHO enrolment data for quarter 3, 2013 (July to September 2013)<sup>1</sup>.

### Age distribution of OHCA according to sex for adults

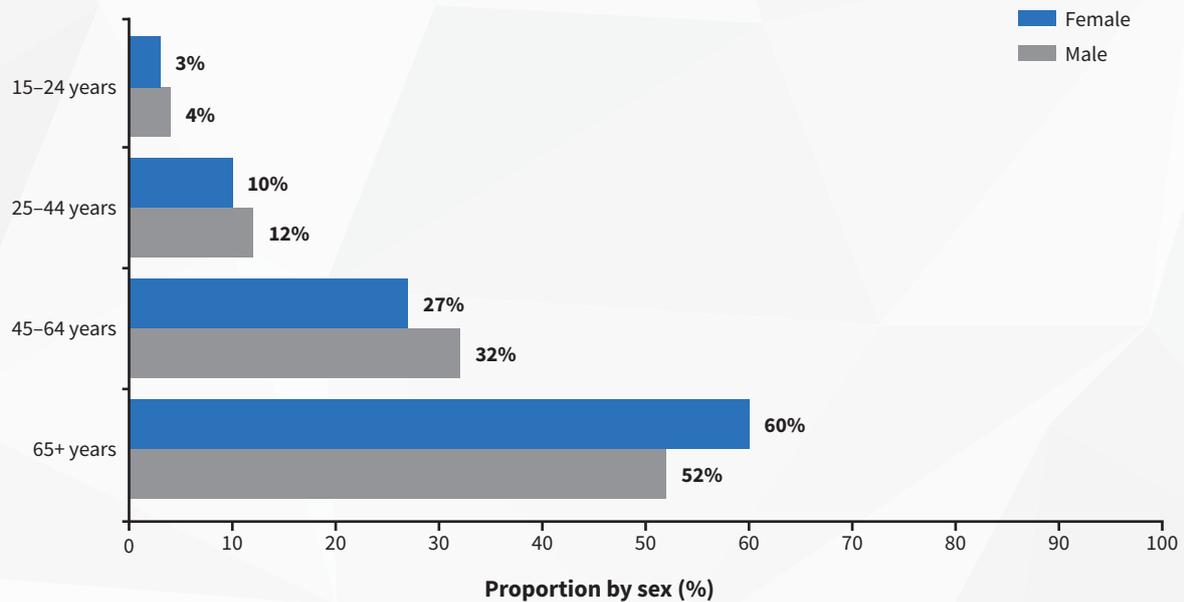


Figure 3: Age distribution of OHCA (all events, attended)<sup>A</sup>.

### Age-specific incidence of OHCA for adults

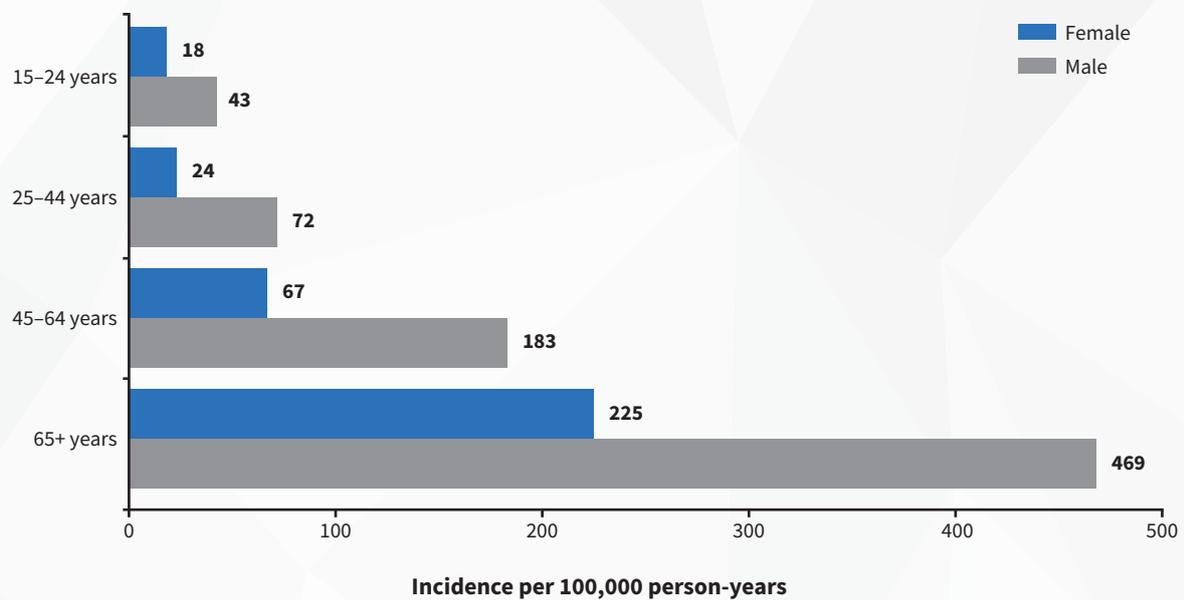


Figure 4: Age-specific rate of OHCA (all events, attended)<sup>A,B</sup>.

Men suffer OHCA at an earlier age than women, and women live longer than men. That is why men have a higher incidence of OHCA at every stage of adult life (Figure 4).

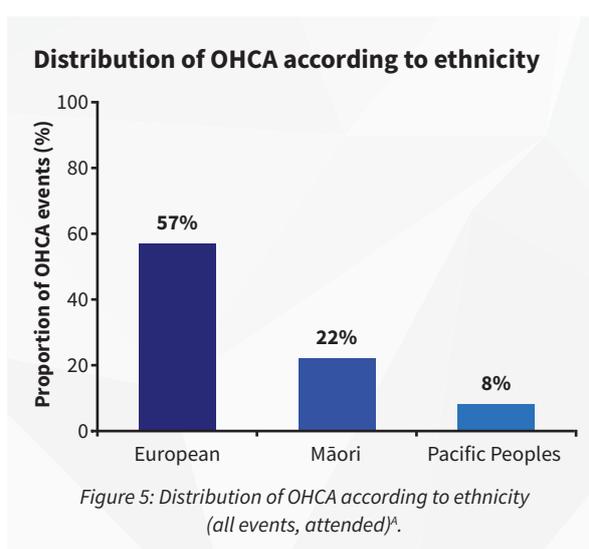
**A All events, attended:** includes adults, all-cause, resuscitation attempted and no resuscitation attempted. Excludes EAS personnel witnessed events and children.

**B** Age-specific incidence rates are based on Primary Health Organisation (PHO) Enrolment Demographics as at July 2021.

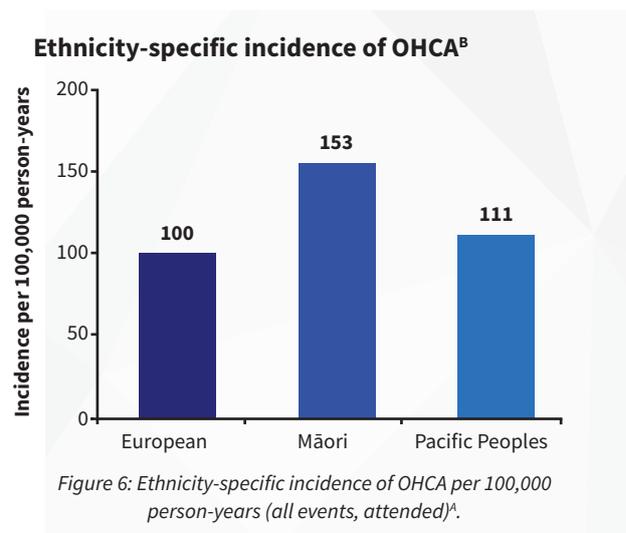


### Ethnicity

The majority of OHCA events attended by EAS were for patients of European ethnicity, which reflects the NZ population demographics (Figure 5). When ethnicity-specific rates were evaluated, Māori and Pacific Peoples had a disproportionately higher incidence of OHCA compared with Europeans. Ethnicity-specific rates were calculated based on the New Zealand Ministry of Health prioritised ethnicity categories<sup>6</sup>. Asian, Middle Eastern/Latin American/African, and Other Ethnicities combined made up approximately 7% of cardiac arrests attended. Data was unknown or missing for the remaining 7% of records.



	<b>European</b>
<b>100</b>	per 100,000 person-years
	<b>Māori</b>
<b>153</b>	per 100,000 person-years
	<b>Pacific Peoples</b>
<b>111</b>	per 100,000 person-years



**A All events, attended:** includes adults and children, all-cause, resuscitation attempted and no resuscitation attempted. Excludes EAS personnel witnessed events.  
**B** Ethnicity-specific incidence rates are based on Primary Health Organisation (PHO) Enrolment Demographics July 2021.

### Deprivation-specific rates<sup>A,B</sup>

The NZDep2013 is a measure of socioeconomic deprivation calculated using census data<sup>7</sup>. Some of the factors included in this measurement of deprivation are: no access to the internet, receiving a means tested benefit, household income below an income threshold, being 18–64 years old and unemployed, being 18–64 years old with no qualifications, not living in own home, a single parent family, household bedrooms less than occupancy threshold and no access to a car. The NZDep2013 quintiles range from Q1–5, where the 20% least deprived areas are scored as Q1, and the most deprived 20% are scored as Q5. The incidence of OHCA increases as deprivation increases (Figure 7).

### Incidence across urban and rural/remote areas<sup>C</sup>

A larger proportion of the New Zealand population is based within metropolitan centres and consequently a greater portion of OHCA events occurred within metropolitan localities (68%). The incidence rate for the urban population was 93 per 100,000 person-years and for the rural/remote population was 118 per 100,000 person-years.

### Precipitating events for adults

EAS personnel presume an OHCA to be of cardiac cause unless it is known or likely to have been caused by trauma, drowning, poisoning or any other non-cardiac cause. The most common aetiology of OHCA in adults where resuscitation was attempted was that of a presumed cardiac cause (Figure 8).

### Precipitating causes for children

The occurrence of OHCA in children is significantly less than in adults. The leading cause of OHCA in children was respiratory arrest followed by Sudden Unexpected Death in Infancy (SUDI) (Figure 9).

### OHCA location

The most common place for an OHCA to occur is in a person's home. The second most common place for an OHCA to occur is in a public area, which includes the workplace, the street, a shopping centre or similar (Figure 10).

Deprivation quintile-specific incidence of OHCA

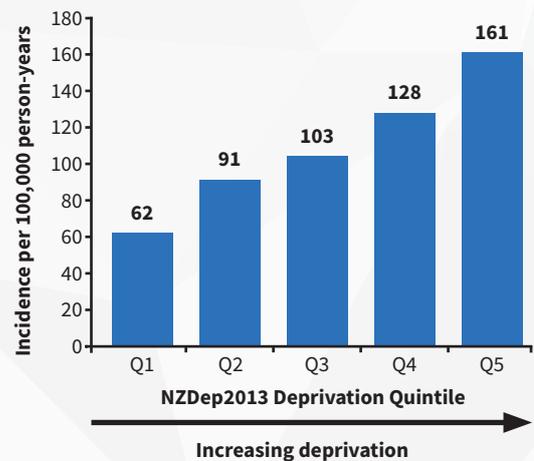


Figure 7: Deprivation quintile-specific rates (all events, attended)<sup>A</sup>.



**A All events, attended:** includes adults and children, all-cause, resuscitation attempted and no resuscitation attempted. Excludes EAS personnel witnessed events.

**B Deprivation calculation:** The NZDep2013 is a measure of socioeconomic deprivation assigned to a geographic area called a meshblock. The NZDep2013 quintile assigned to an event was derived from the incident location at the time of the event. Rates are based on Primary Health Organisation (PHO) Enrolment Demographics July 2021<sup>1</sup>.

**C Rural versus Urban (the location of the OHCA):** These terms are derived from Stats NZ Tatauranga Aotearoa definitions that were based on geography, land use, and population densities, as of 30 June 2021.

### Precipitating causes for adults

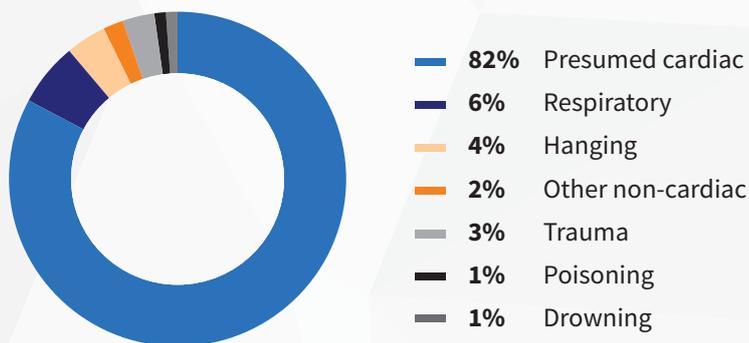


Figure 8: Precipitating causes for adults (all events, adult, resuscitation attempted)<sup>A</sup>.

### Precipitating causes for children

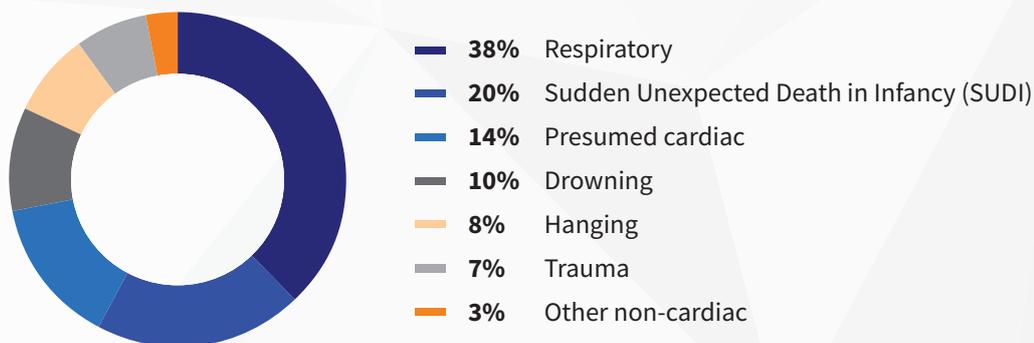


Figure 9: Precipitating causes for children (all events, child, resuscitation attempted)<sup>B</sup>.

### Location of OHCA

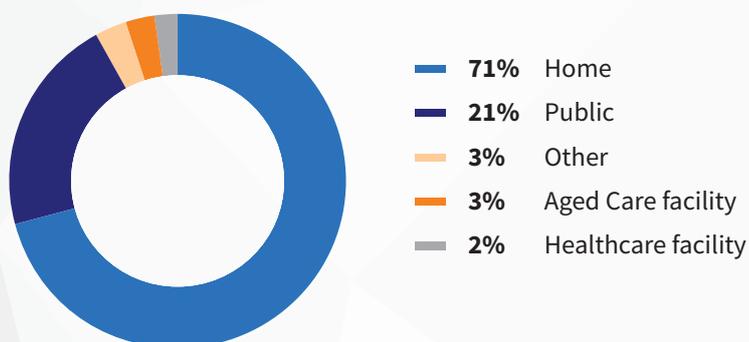


Figure 10: Location of OHCA for adults (all events, adult, resuscitation attempted)<sup>A</sup>.

**A All events, adult, resuscitation attempted:** includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events.

**B All events, child, resuscitation attempted:** includes children ( $< 15$  years old), all-cause, resuscitation attempted. Excludes adults and EAS personnel witnessed events. Includes data from 1 July 2018 to 30 June 2021 combined.



# Outcomes

## Whakataunga

### Adult outcome from all-cause cardiac arrest

The results from the OHCA Registry show an event survival rate (ROSC sustained to hospital handover) of 25%.

The rate of survival to 30 days in adults where resuscitation was attempted was 11%. In the 2020/2021 reporting period, there were 47 OHCA survivors per million population (Figure 11).

### Utstein Comparator Group

The international benchmarking of OHCA outcomes also compares survival rates for a specific group of patients. This subgroup is referred to as the Utstein Comparator Group and requires the following criteria to be met: includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted, shockable presenting rhythm, bystander witnessed and excluding EAS personnel witnessed events.

In the current reporting period, there were 600 cardiac arrests that met the Utstein criteria. This subgroup of patients represented approximately 30% of all events where resuscitation was attempted.

For this selected subgroup the rate of 30-day survival was 28%. This result is benchmarked against other services within the executive summary (Table 3).

### All OHCA survival per million population

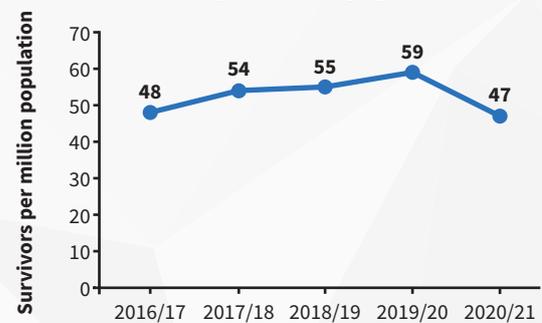


Figure 11: Survival per million outcome for all-cause OHCA (all events, adult, resuscitation)<sup>A</sup>

### Outcomes for all-cause OHCA in adults<sup>A</sup> 2020/21

**25%**  
ROSC

**11%**  
30-day survival

### Outcomes for OHCA in the Utstein Comparator Group<sup>B</sup> 2020/21

**49%**  
ROSC

**28%**  
30-day survival

**A All events, adult, resuscitation attempted:** includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events.

**B Utstein Comparator Group:** includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted, shockable presenting rhythm and bystander witnessed. Excludes children, EAS witnessed and no resuscitation attempt.

### Scene outcome for OHCA in adults

One of the contributing factors to patient survival is good quality chest compressions during CPR. Performing CPR during the transport of a patient following an OHCA may compromise the quality of the CPR being delivered. Therefore, in the majority of OHCA events, it is appropriate to continue resuscitation at the scene until either ROSC occurs or resuscitation is ceased. This is reflected in the scene outcomes observed in adult patients where resuscitation was attempted (Figure 12).

### Adult outcomes according to presenting rhythm

Patients who present with a shockable rhythm such as ventricular fibrillation (VF) or ventricular tachycardia (VT) have a greater chance of survival than patients who present with a non-shockable rhythm such as pulseless electrical activity (PEA) or asystole (Figure 13).

### EAS personnel witnessed outcomes

If a patient presents with a shockable rhythm and the arrest is witnessed by EAS personnel, the immediate intervention of defibrillation can lead to the best outcomes. Of the adult patients who had a shockable presenting rhythm where the arrest was witnessed by EAS personnel, the rate of event survival was 71% and survival to 30 days was 53% (not shown).

### Outcomes according to age

New Zealand has an aging population. It is important to review whether outcomes vary with age. Those who were 80 and over at the time of their cardiac arrest had the lowest percentage survival compared to those who were younger (Figure 14).

#### Scene outcome for all-cause OHCA in adults

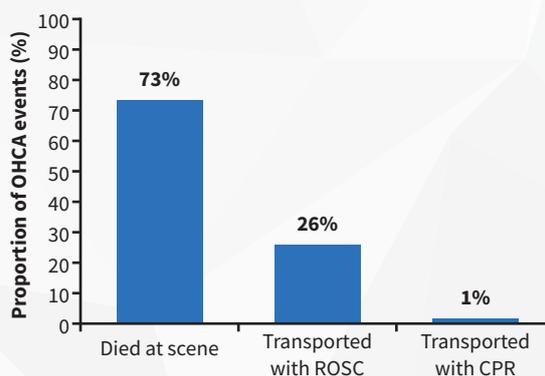


Figure 12: Scene outcome for all-cause OHCA (all events, adult, resuscitation attempted)<sup>A</sup>.

#### Outcomes of OHCA in adults according to presenting rhythm

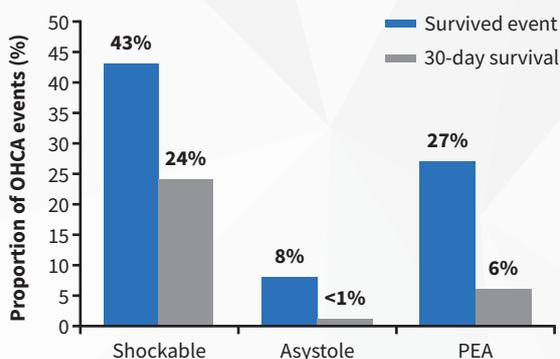


Figure 13: Outcomes for OHCA according to presenting rhythm (all events, adult, resuscitation attempted)<sup>A</sup>.

#### Outcomes of OHCA according to age

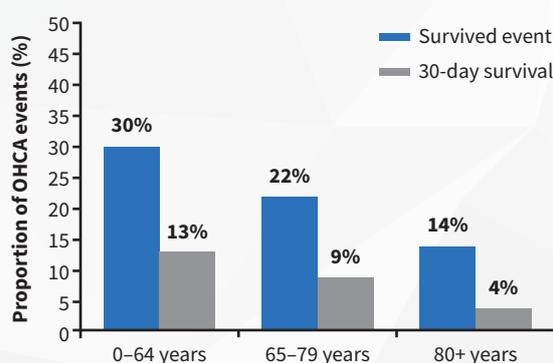
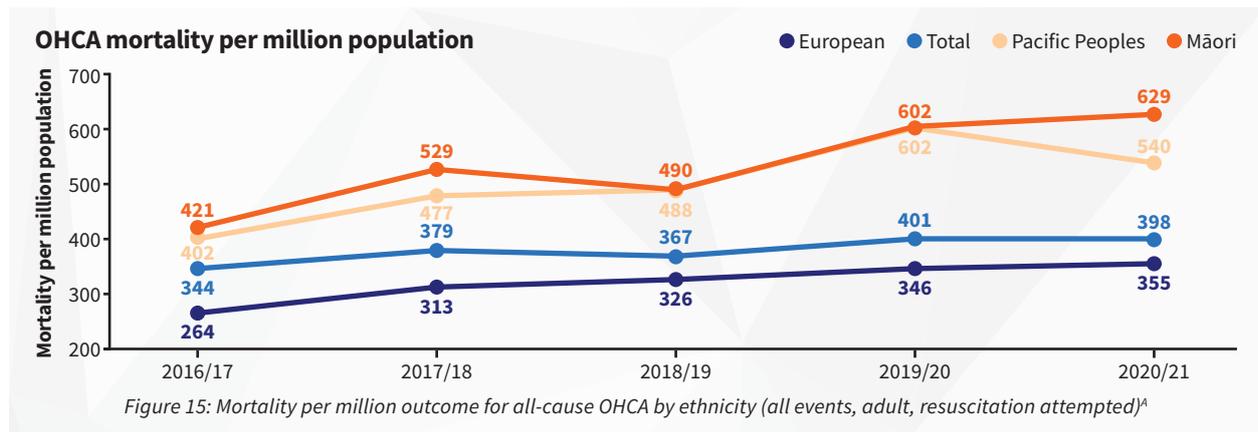


Figure 14: Influence of age on outcomes (all events, adults and children, resuscitation attempted)<sup>B</sup>.



### Adult outcomes according to ethnicity

Incidence of OHCA is higher in Māori and Pacific Peoples compared to European (Figure 6, page 11). Māori and Pacific Peoples had a lower 30-day survival than Europeans (Figure 16). It is likely that there are greater differences in outcomes according to ethnicity. OHCA mortality per million is higher in Māori and Pacific Peoples (Figure 15). However, the overall numbers of Māori and Pacific patients are small and thus may not be truly representative. Data shown is the period 1 July 2018 to 30 June 2021.

### Outcomes of OHCA in adults according to ethnicity

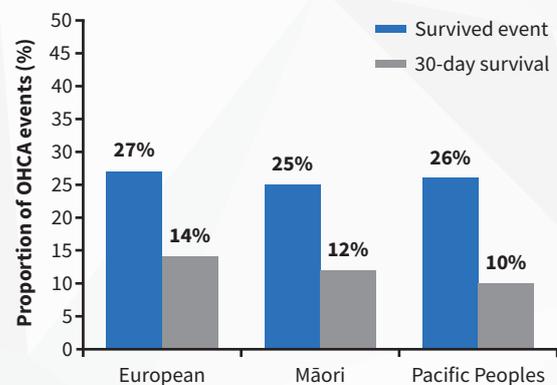


Figure 16: Influence of ethnicity on outcomes (all events, adult, resuscitation attempted)<sup>A</sup>.

### Adult outcomes according to deprivation

The incidence of OHCA increases with increasing socioeconomic deprivation. Compared to the least deprived quintile (Q1), those in the most deprived quintile (Q5) had lower event and 30-day survival (Figure 17).

### Outcomes of OHCA in adults according to deprivation quintile

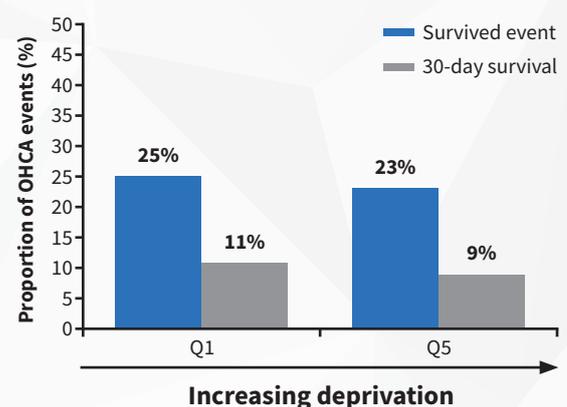
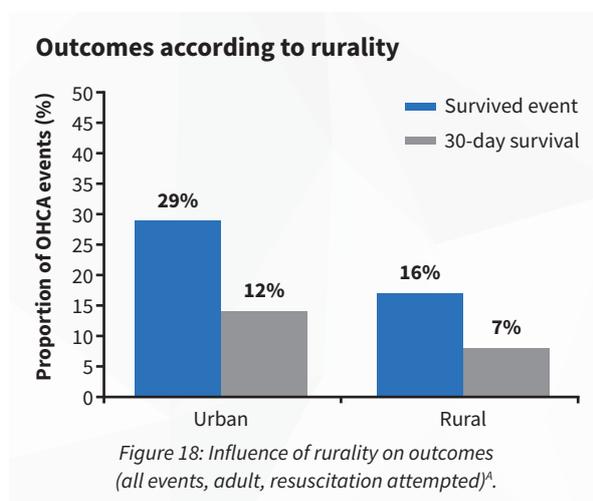


Figure 17: Influence of deprivation on outcomes (all events, adult, resuscitation attempted)<sup>A,B</sup>.

### Adult outcomes according to rurality

Incidents that occurred in rural locations also had lower event and 30-day survival than those that occurred in urban settings (Figure 18).



- A All events, adult, resuscitation attempted:** includes adults ( $\geq 15$  years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events.
- B Deprivation calculation:** The NZDep2013 provides a measure of social deprivation for every locality in New Zealand, based on census and other social data. Thus, the outcomes of every OHCA can be looked at in terms of social deprivation, according to the location where they occur. Social deprivation is categorised into five groupings known as quintiles<sup>7</sup>.

## The community response is fundamental to improving outcomes from OHCA

### Adult outcomes according to GoodSAM responder presence

GoodSAM (Good Smartphone Activated Medics) is a cell phone application that alerts community responders to nearby cardiac arrests ([www.goodsamapp.org](http://www.goodsamapp.org)). Anyone who is trained in CPR and how to use an AED is able to register as a GoodSAM responder ([youtu.be/EPwY3yGj8IY](https://youtu.be/EPwY3yGj8IY)).

In the 3 year period (1 July 2018 to 30 June 2021), a GoodSAM responder was present at 9% of all confirmed cardiac arrests. When a GoodSAM responder was present both event survival and 30-day survival were increased compared to events where there was no GoodSAM responder (Figure 2, page 8).

### Adult outcomes according to defibrillation by Fire and Emergency New Zealand

During this reporting period Fire and Emergency New Zealand personnel were present at 96% of adult OHCA events where resuscitation was attempted by EAS. When Fire and Emergency New Zealand or First Response Group defibrillation occurred prior to EAS arrival both event survival and 30-day survival were increased (Figure 19).

### Adult outcomes according to community defibrillation

When community defibrillation occurred prior to EAS arrival both event survival and 30-day survival were increased. Community members were fundamental in the early defibrillation of 116 adult patients in cardiac arrest, 45% of these survived to 30 days compared with only 8% that did not receive community defibrillation prior to EAS arrival (Figure 1, page 8).

#### Fire and Emergency New Zealand or First Response Group defibrillation prior to EAS arrival

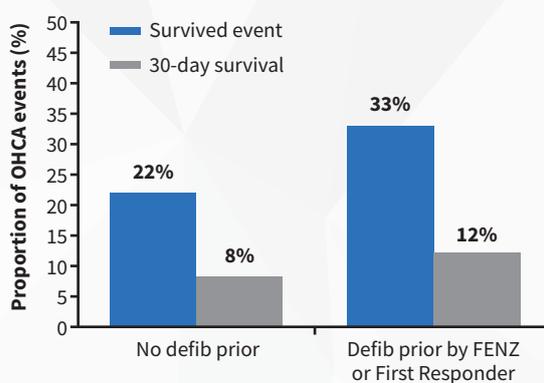


Figure 19: Influence of Fire and Emergency New Zealand or First Response Group defibrillation on outcomes (all events, adult, resuscitation attempted)<sup>A</sup>.

## Conclusion Mutunga

The data presented in this report represent the 2020/21 results from the Aotearoa New Zealand National OHCA registry. Year on year, these reports provide an update on how the EAS is performing in the crucial management of OHCA.



# Appendices

## The Aotearoa New Zealand National Out-of-Hospital Cardiac Arrest Registry

The Aotearoa New Zealand OHCA registry is overseen by Prof. Bridget Dicker on behalf of St John and Wellington Free Ambulance. Prof. Dicker is Head of Clinical Audit and Research at St John and an Adjunct Professor at Auckland University of Technology (AUT), Department of Paramedicine.

### Eligibility

The registry captures data on all OHCA events attended by EAS. A cardiac arrest is defined as a patient who is unconscious and pulseless with either agonal breathing or no breathing.

Inclusion and exclusion criteria are described in Table A1 and Table A2.

### Data capture

The data is collated in the registry using a reporting template based on international definitions outlined in the Utstein style of reporting and the variables developed by the Australasian Resuscitation Outcomes Consortium (Aus-ROC).

In the data collection process there are three separate points where data is acquired:

- Computer Aided Dispatch (CAD) and supporting systems
- On scene by the EAS personnel in attendance
- Mortality data from the New Zealand National Health Index (NHI) records.

### Computer aided dispatch

Patient and event details are collected by the Ambulance Communications Centre when a 111 call is received and an ambulance is dispatched, with data being entered into the CAD system. Data specifically related to cardiac arrest is obtained from the CAD system and transferred into the OHCA Registry.

### On scene collection

Ambulance officers on scene attending a patient in cardiac arrest are required to record specific data. This is recorded on an electronic Patient Report Form (ePRF) and submitted electronically to a secure server.

**Table A1: Inclusion criteria (all of the following).**

<b>1</b>	Patients of all ages who suffer a documented cardiac arrest
<b>2</b>	Occurs in New Zealand where the ambulance service or one of its participating co-responders is the primary treatment provider
<b>3</b>	<ul style="list-style-type: none"> <li>➤ Patients of all ages who on arrival of the EAS are unconscious and pulseless with either agonal breathing or no breathing <b>or</b></li> <li>➤ Patients of all ages who become unconscious and pulseless with either agonal breathing or no breathing in the presence of EAS personnel <b>or</b></li> <li>➤ Patients who have a pulse on arrival of EAS personnel following successful bystander defibrillation</li> </ul>

**Table A2: Exclusion criteria (any of the following).**

<b>1</b>	Patients who suffer a cardiac arrest in a hospital facility where the EAS may be in attendance but are not the primary treatment providers
<b>2</b>	Patients who suffer a cardiac arrest during an inter-hospital transfer where the EAS may be providing transport but are not the primary treatment providers
<b>3</b>	Bystander suspected cardiac arrest where the patient is not in cardiac arrest on arrival of the EAS personnel, and where defibrillation did not occur prior to ambulance arrival or no other evidence verifying a cardiac arrest state is present

## NHI patient outcome data

The patient's NHI is collected by EAS personnel on scene or at hospital handover. If the NHI was not available at the time of the event then the NHI is determined by cross-reference of the patient's date of birth and name to the NHI database.

If a patient dies the date of death is updated by the Ministry of Health identity data management team after matching NHI identity with the official death registrations on a monthly basis.

## Data quality

The registry is subject to quality improvement processes which involve continual auditing of existing data and updating of the registry entries as appropriate.

Registry reports are generated on a monthly and quarterly basis and these are analysed for variances in the numbers of cases and patient outcomes. These results are compared with international data from EAS that are similar to New Zealand.

## Missing data

These data include full electronic data capture of EMS records. Results may vary from those in 2018/19 as the 2018/19 period had a 6 month hiatus (Dec 2018 to July 2019) whereby St John EMS used paper data capture due to industrial action. This hiatus is likely to have affected the quality of data captured during that period.

## Ethical review

The OHCA Registry has been approved by the New Zealand Health and Disability Ethics Committee (Ethics reference: 19/NTB/187).

The registry is also subject to EAS internal research governance processes that include a locality review and locality authorisation as per the Standard Operating Procedures for Health and Disability Ethics Committees.

The OHCA Registry is held on a secure server which requires active directory permissions. At no stage is data that could identify individual patients or individual hospitals released from this registry.



## Abbreviations

<b>AED</b>	Automated external defibrillator	<b>PEA</b>	Pulseless electrical activity
<b>CAD</b>	Computer aided dispatch	<b>PHO</b>	Primary Health Organisation
<b>CPR</b>	Cardiopulmonary resuscitation	<b>ROSC</b>	Return of spontaneous circulation
<b>EAS</b>	Emergency ambulance service	<b>SUDI</b>	Sudden unexpected death in infancy
<b>EMS</b>	Emergency medical services	<b>VF</b>	Ventricular fibrillation
<b>GoodSAM</b>	Good Smartphone Activated Medics	<b>VT</b>	Ventricular tachycardia
<b>OHCA</b>	Out-of-hospital cardiac arrest		

## Glossary of terms

<b>Adjusted rates</b>	Rates are standardised to a control population.
<b>Adult</b>	Patients aged 15 years or older.
<b>Asystole</b>	The absence of any cardiac electrical activity.
<b>Children</b>	Patients aged less than 15 years.
<b>Community responder</b>	A member of the community who is not part of the EAS service who provides assistance at an OHCA event. For example, a member of the public, or an off duty ambulance officer or an off duty doctor or nurse.
<b>EAS attended</b>	This is the population of all patients following cardiac arrest where EAS personnel attended regardless of whether emergency treatment was provided.
<b>EAS personnel</b>	Emergency ambulance crews dispatched to a medical emergency.
<b>Presumed cardiac aetiology</b>	An OHCA is presumed to be of cardiac aetiology, unless it is known or likely to have been caused by trauma, drowning, poisoning or any other non-cardiac cause.
<b>Resuscitation attempted</b>	The performance of CPR by or under the direction of responding EAS personnel, or the delivery of a shock at any time (including before ambulance arrival).
<b>Return of spontaneous circulation</b>	The patient shows clear signs of life in the absence of chest compressions for more than 30 seconds. Signs of life include any of the following: normal breathing, palpable pulse, increasing end tidal CO <sub>2</sub> or active movement.
<b>Rural and remote service area</b>	Assigned according to SA2_2021 Urban Rural coding of incident location. <b>Rural includes:</b> Small urban area, Rural settlement, Rural other.

<b>Shockable rhythm</b>	Ventricular fibrillation, ventricular tachycardia or unknown shockable (AED).
<b>Specific rates</b>	Rates for specific segments/groups of the population (e.g. sex, age, ethnicity).
<b>Survival to 30-days</b>	The patient is alive at 30-days post-OHCA event.
<b>Survived event</b>	The patient has sustained ROSC to handover at hospital.
<b>Urban area</b>	Assigned according to SA2_2021 Urban Rural coding of incident location. <b>Urban includes:</b> Medium urban area, Major urban area, Large urban area.
<b>Witnessed event</b>	A witnessed cardiac arrest is one that is seen or heard by another person.

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