

Out-of-Hospital Cardiac Arrest Registry

Rēhita Mate Manawa mō waho i te Hōhipera

Aotearoa New Zealand, National Report 2019/20



St John



**WELLINGTON
FREE AMBULANCE**
kia ora te tangata

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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. Community rates of COVID-19 in New Zealand were low during this time and did not impact on OHCA rates or survival during the reporting period.

We are very pleased to present the 2019 – 2020 Aotearoa New Zealand, National Out-of-Hospital Cardiac Arrest Registry Annual Report.

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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 2019 to 30 June 2020.

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 data¹.

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)

31% female,
68% 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



95%

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)



13%








of patients survived

Benchmarking executive summary

Tuhinga whakarāpopoto Panekiretanga

Key figures for all-cause events

Table 1: Key figures for all-cause events^A

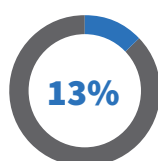
Year	Total number events	 % Bystander CPR	 % Community Responder AED use	 Urban median response time	 Rural & remote median response time	 % Attended by Fire & Emergency New Zealand	 % ROSC on handover	 % Survival
2018/19	2,010	76%	4%	8	13	92%	27%	14%
2019/20	2,212	75%	5%	8	12	95%	25%	13%

Benchmarking (all-cause events)

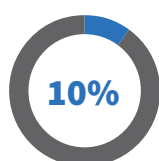
The outcomes of OHCA for international benchmarking compare rates of return of spontaneous circulation (ROSC) sustained to hospital handover and survival. This group requires that the following criteria be met: includes adults (≥ 15 years old), all-cause, resuscitation attempted. Excludes children, and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

Table 2: Benchmarking survival outcomes for all-cause events^A

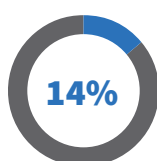
Ambulance Service	Collection period	Total number events	% ROSC on handover	% Survival ^B
New Zealand	1 July 2019 to 30 June 2020	2,212	25%	13%
Ambulance Victoria ²	1 July 2019 to 30 June 2020	-	28%	10%
Queensland Ambulance Service ³	1 January 2019 to 31 December 2019	2,210	31%	14%
St John Western Australia ⁴	1 July 2019 to 30 June 2020	902	19%	11%
King County EMS ⁵	1 July 2019 to 30 June 2020	895	43%	16%



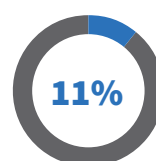
New Zealand



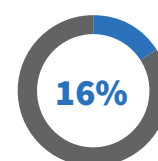
Ambulance Victoria



Queensland Ambulance Service



St John Western Australia



King County EMS

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

^B New Zealand and Queensland report on survival to 30-days, all other services report survival to hospital discharge.

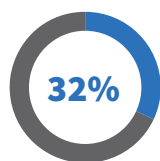


Benchmarking (Utstein Comparator Group)^A

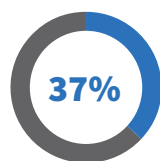
The outcomes of OHCA for international benchmarking compare rates of ROSC sustained to hospital handover and survival for a specifically selected subgroup of patients. This subgroup is referred to as the Utstein Comparator Group and requires that the following criteria be met: includes adults (≥ 15 years 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)^A

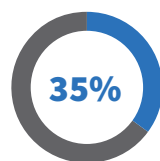
Ambulance Service	Collection period	Total number events	% ROSC on handover	% Survival ^B
New Zealand	1 July 2019 to 30 June 2020	637	49%	32%
Ambulance Victoria²	1 July 2019 to 30 June 2020	–	–	37%
Queensland Ambulance Service³	1 January 2019 to 31 December 2019	335	51%	35%
St John Western Australia⁴	1 July 2019 to 30 June 2020	197	44%	36%
King County EMS⁵	1 July 2019 to 30 June 2020	153	75%	48%



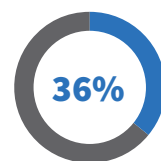
New Zealand



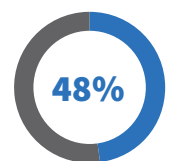
Ambulance Victoria



Queensland
Ambulance Service



St John
Western Australia



King County
EMS

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

B New Zealand and Queensland report on survival to 30-days, all other services report survival to hospital discharge.

This year was impacted by the COVID-19 pandemic, with the first COVID-19 cases being reported internationally in December 2019.

Timeline of key COVID-19 events

28 February 2020

First COVID-19 case reported in New Zealand.

14 March 2020

The Government announces anyone entering New Zealand must self-isolate for 14 days, except those arriving from the Pacific.

19 March 2020

All indoor gatherings of more than 100 people are to be cancelled.

Borders close to all but New Zealand citizens and permanent residents.

21 March 2020

The Government introduces the 4-tiered Alert Level system to help combat COVID-19. The Prime Minister announces that New Zealand is at Alert Level 2.

23 March 2020

At 1:30pm the Prime Minister announces New Zealand has moved to Alert Level 3, effective immediately. In 48 hours, New Zealand will move to Alert Level 4.

25 March 2020

At 11:59pm, New Zealand moves to Alert Level 4, and the entire nation goes into self-isolation. A State of National Emergency is declared at 12:21pm.

29 March 2020

New Zealand reports its first COVID-19-related death.

27 April 2020

New Zealand moves to Alert Level 3 at 11:59pm.

13 May 2020

New Zealand moves to Alert Level 2 at 11:59pm. The State of National Emergency expires at 12:21pm.



COVID-19 and OHCA

KOWHEORI-19 Me Rēhita Mate

Manawa mō waho i te Hōhipera

The New Zealand public health response to the COVID-19 pandemic to combat the spread of the virus was to develop a tiered Alert Level System, Level One being the least stringent and Level Four being a complete lockdown.

New Zealand was placed into Level Four lockdown from 23 March 2020, followed by Level Three from 27 April, then Level Two on 13 May. Under Alert Level Four individuals were restricted within household “bubbles”, only essential workers could leave their homes, travel was severely limited, all public venues closed, gatherings were cancelled, and all businesses were closed except for essential services such as supermarkets and hospitals. Primary healthcare consultations were conducted by video or telephone where possible. This was similar in Level Three except for food outlets, which could open for takeaways only, and those businesses that could not conduct work remotely were able to open for staff to return to work.

During the lockdown period (Alert Levels Four and Three, 23 March through to 13 May 2020) the ambulance services made several changes to usual practice to ensure the safety of staff and patients. In particular, resuscitation for cardiac arrest may expose personnel to aerosolisation of droplets, so a number of changes to resuscitation practice were deployed. The below list outlines the general principles that were applied by the Emergency Services during the New Zealand lockdown.

General principles for Emergency Services Personnel during lockdown

(Applied to all patients including those where there was no obvious respiratory history)

- All personnel were to:
 - Routinely pause more than two metres from the patient and undertake a risk assessment for viral illness and check higher index of suspicion criteria before approaching closer. Questions were asked before entering the premises to determine if there was any potential exposure to COVID-19 at the premises.
 - Wear a gown/coverall in addition to an N95 mask, safety glasses/face shield and gloves.
- Resuscitation was to commence unless the scenario clearly had a very poor prognosis (for example, unwitnessed cardiac arrest where the initial rhythm was asystole, or cardiac arrest was secondary to severe respiratory infection). Resuscitation was to commence if personnel were uncertain.
- Endotracheal intubation was to be avoided unless necessary; a Laryngeal Mask Airway (LMA) (with a filter in place) was the preferred airway device for ventilation.

- Following LMA placement, a towel or plastic sheet was to be draped over the face (entirely covering the face and LMA) to reduce the spread of droplets.
- Fire and Emergency Personnel were advised to perform chest compressions alone, with a towel or plastic sheet draped over the patient's face, and not to perform ventilation via a face mask.
- Rapid Sequence Intubation (RSI) (Advanced airway management involving neuromuscular blockade) was only to occur following discussion with the on-call doctor.
- No additional people such as family were to accompany patients in the ambulance to hospital.

Other changes during the lockdown

- Call Handlers introduced respiratory based questions to screen for respiratory illness.
- The GoodSAM responder alert system was turned off.
- Location: More people were at home, rather than in public areas or at work.
- No public first aid training occurred (90,992 in 2019 vs 74,045 in 2020, a decrease of 19%).
- There was no CPR in Schools training (148,126 in 2019 vs 135,696 in 2020, a decrease of 8%).
- There was no 3 Steps for Life training.
- Public were advised to perform compression only CPR with a towel draped over the person's face.

Impact of the lockdown on OHCA outcomes

To investigate the impact of the lockdown on OHCA outcomes we compared two time periods: *Lockdown* (23 March through to 13 May 2020); and *Pre-Lockdown* (the exact same period, 23 March through to 13 May, for the year 2018). The 2018 time period was chosen as the 2019 data may have been skewed due to industrial action with St John. Of note, these two time periods were only 7 weeks in duration, thus the data must be interpreted with caution due to the low number of cases presented.

All events attended

(Includes adults and children, all-cause, whether resuscitation was attempted or not. Includes EAS personnel witnessed events.)

When the two 7-week periods (Pre-Lockdown 2018 vs Lockdown 2020) were compared there was no significant difference in the average weekly number of OHCA events attended (103 vs 101, respectively) (**Table A3**). Interestingly, our additional investigation of OHCA events during the Level Four lockdown

period (5 weeks only) showed a slight decrease in weekly numbers (**Chan et al.**)⁶.

Looking at all events attended: There were no significant differences observed between Pre-Lockdown and Lockdown in the proportion of attempted resuscitations, the proportion of people in each age group, the sex of patients, the ethnicity of patients, the presumed cause of the OHCA, nor the event witnessed status (**Table A4**).

We have also recently described changes in overall ambulance demand in New Zealand during the COVID-19 Level Four lockdown period, showing an 11% reduction in demand (**Dicker et al, 2020**)⁷. However, attendance to any type of cardiac event (e.g. heart attack, OHCA, dysrhythmia, chest pain) remained relatively unchanged during lockdown.

Resuscitation attempted events

(Includes adults and children, all-cause, resuscitation attempted. Includes EAS personnel witnessed events)

There were no significant differences between Pre-Lockdown 2018 and Lockdown 2020 for sex, age, ethnicity, aetiology, witnessed status, shockable presenting rhythm, community defibrillation, bystander CPR, urban or rural location, response time, time to first shock by EAS, or the transport time to hospital, in OHCA where resuscitation was attempted (**Table A5**).

OHCA Location: There was a significant difference in the location of OHCA events. In the Pre-Lockdown period, 70% of OHCA events occurred in the home. During lockdown, this rose to 85%.

ROSC and Survival: There was a decrease in the proportion of patients with ROSC during Lockdown (26%) compared to the 7-weeks Pre-Lockdown (34%). However, there was no difference in the proportion of patients who survived to 30 days (16% for both periods).

These analyses have not been adjusted for confounding and they contain small numbers (335 resuscitations were attempted during the Lockdown period). Therefore, further statistical analysis is required.

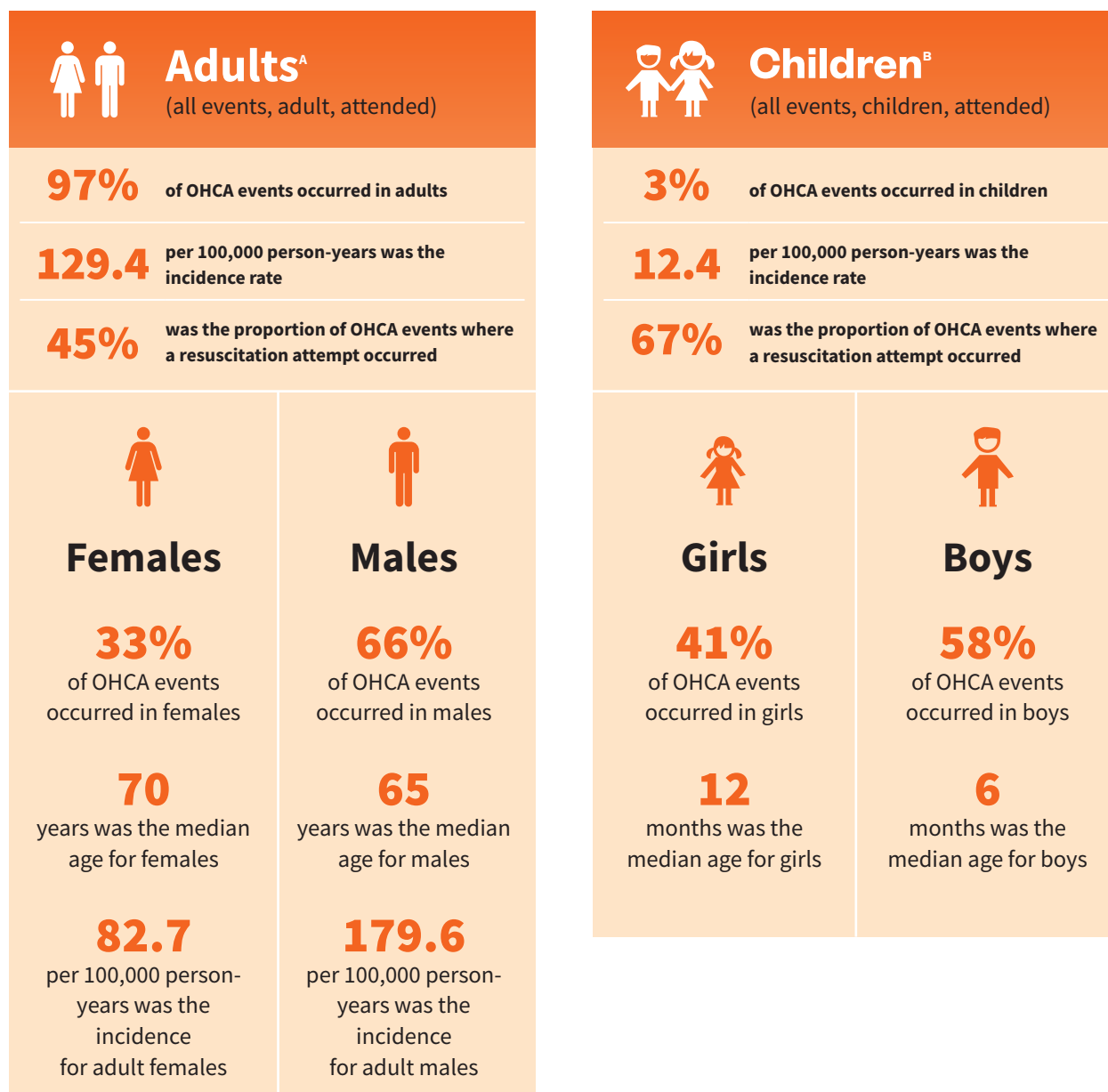
Summary

Overall, there is no evidence that the COVID-19 pandemic significantly affected OHCA rates and survival during the lockdown period in New Zealand.

Incidence and demographics

Taupori pāpātanga me Taupori āhuatanga

Key figures for adults (≥ 15yrs) and children



Overall age-adjusted incidence^C 2019/20

100.3 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 2020.

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

Age distribution of OHCA according to sex for adults

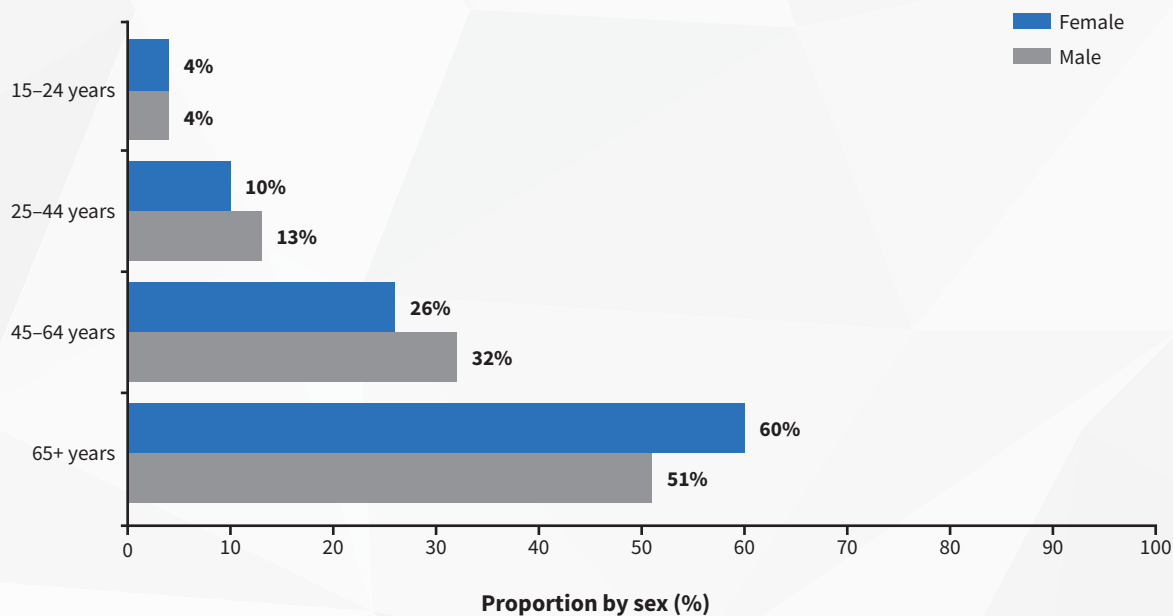


Figure 1: Age distribution of OHCA (all events, attended)^A.

Age-specific incidence of OHCA for adults

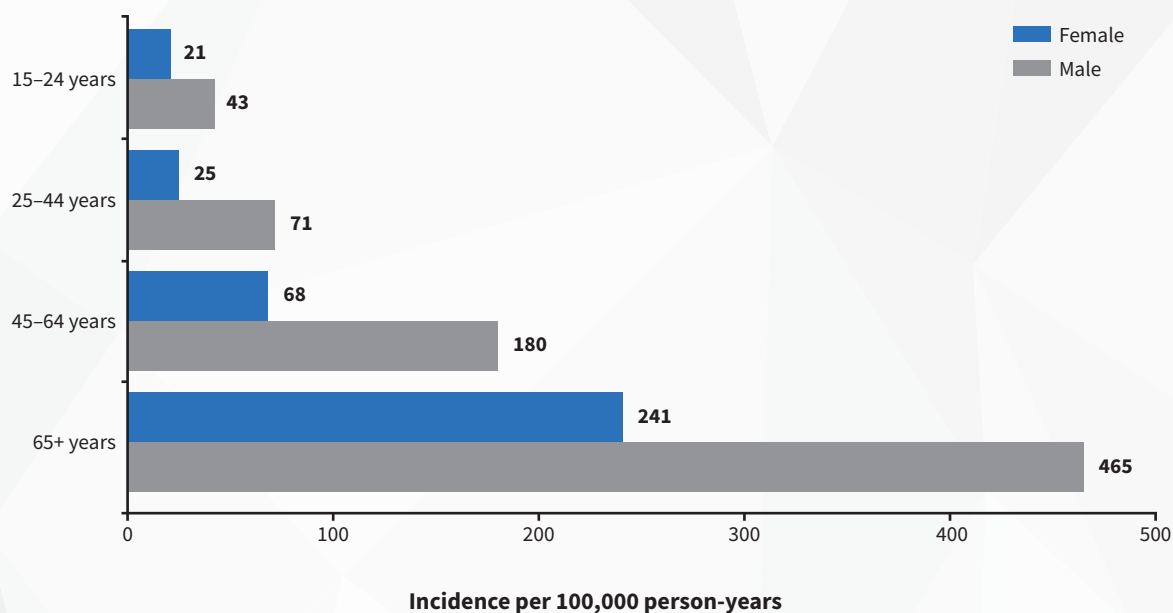


Figure 2: Age-specific rate of OHCA (all events, attended)^{A,B}.

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 2).

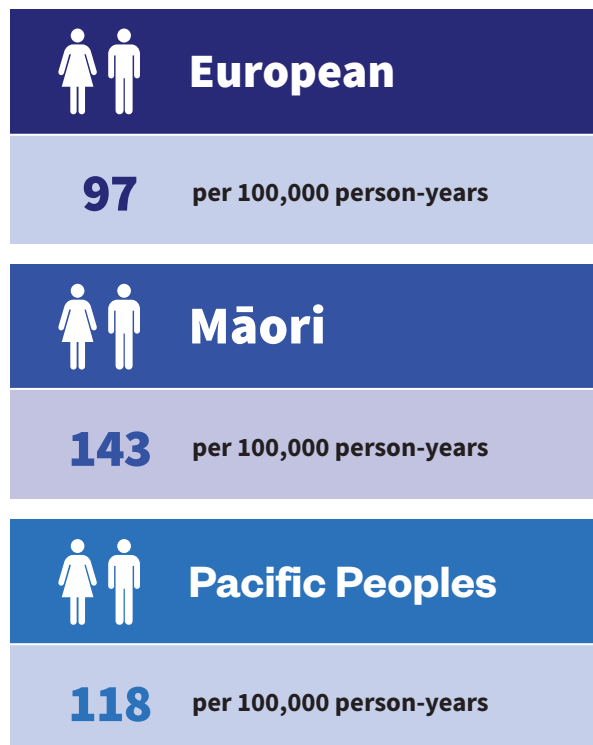
A All events, attended: includes adults, all-cause, resuscitation attempted and no resuscitation attempted. Excludes EAS personnel witnessed events and Children.

A Ethnicity-specific incidence rates are based on Primary Health Organisation (PHO) Enrolment Demographics 2020 Q1 (January to April 2020)¹.



Ethnicity

The majority of OHCA events attended by EAS were for patients of European ethnicity, which reflects the NZ population demographics (Figure 3). 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 categories⁸. Asian, Middle Eastern/Latin American/African, and Other Ethnicities combined made up approximately 5% of cardiac arrests attended. Data was unknown or missing for the remaining 10% of records.



Distribution of OHCA according to ethnicity

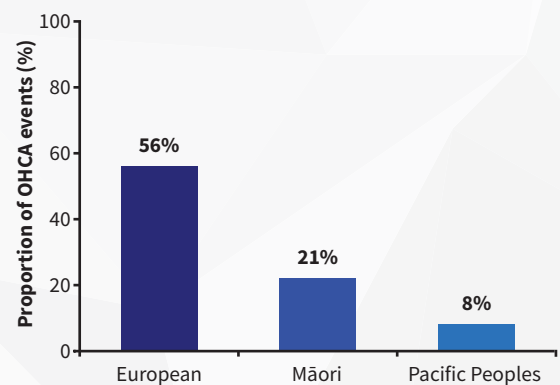


Figure 3: Distribution of OHCA according to ethnicity (all events, attended)^A.

Ethnicity-specific incidence of OHCA^B

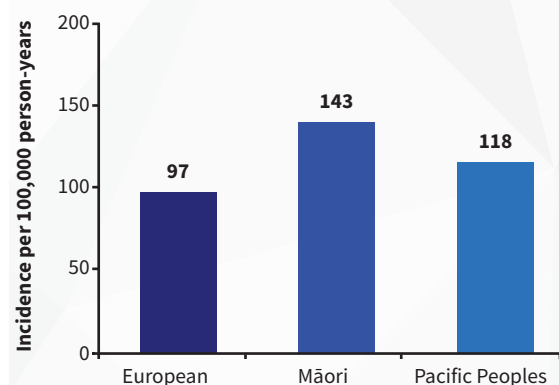


Figure 4: Ethnicity-specific incidence of OHCA per 100,000 person-years (all events, attended)^A.

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 2020 Q1 (January to April 2020)¹.

Deprivation-specific rates^{A,B}

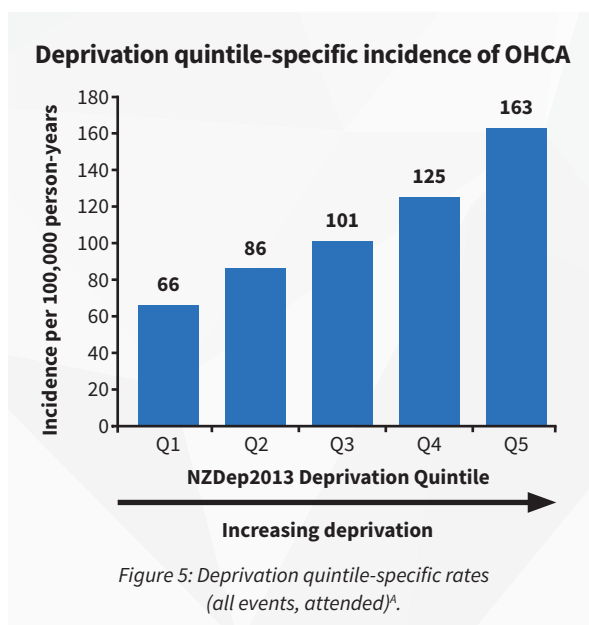
The NZDep2013 is a measure of socioeconomic deprivation calculated using census data⁹. Some of the factors included in this measurement of deprivation are: no access to the internet, receiving a means tested benefit, household income below an income threshold, being 18–64 years old and unemployed, being 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 5).

Incidence across urban and rural/remote areas^A

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 (72%). The incidence rate for the urban population was 110 per 100,000 person-years and for the rural/remote population was 143 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 6).



Precipitating causes for children

The occurrence of OHCA in children is significantly less than in adults. During the period of this report, the leading cause of OHCA in children was respiratory arrest followed by Sudden Unexpected Death in Infancy (SUDI) (Figure 7).

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 8).



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 2020 Q1 (January to April 2020)¹.

Precipitating causes for adults

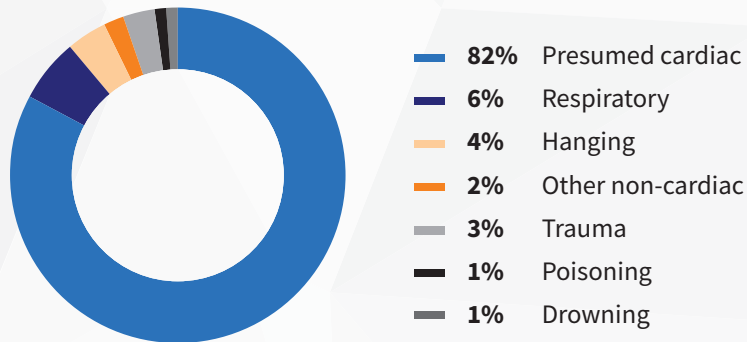


Figure 6: Precipitating causes for adults (all events, adult, resuscitation attempted)^A.

Precipitating causes for children

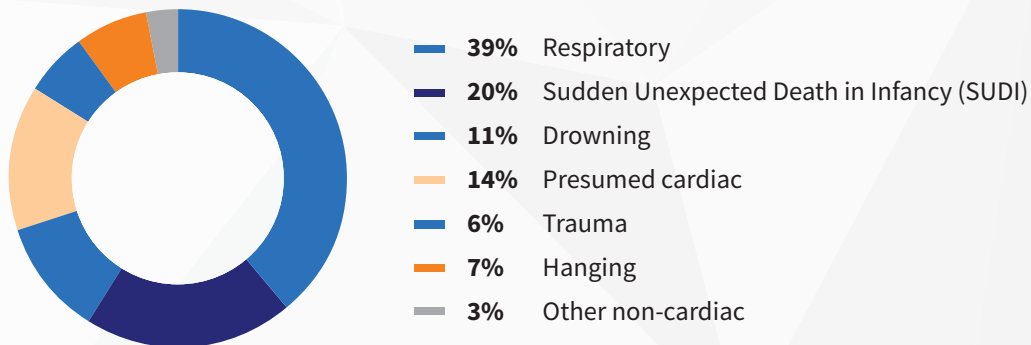


Figure 7: Precipitating causes for children (all events, child, resuscitation attempted)^B.

Location of OHCA

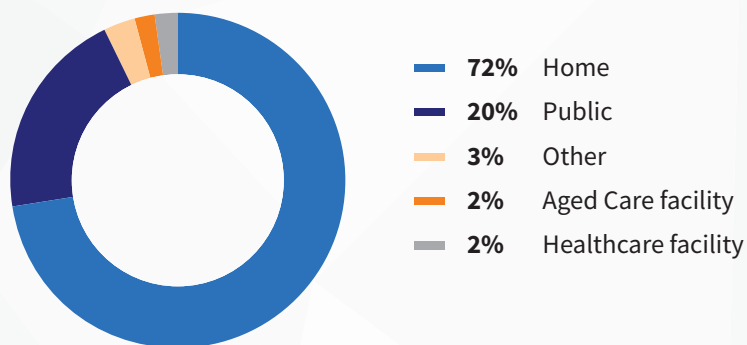


Figure 8: Location of OHCA for adults (all events, adult, resuscitation attempted)^A.

A All events, adult, resuscitation attempted: includes adults (≥ 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 years 2018/19 and 2019/20 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 13%.

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 (≥ 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 637 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 32%. This result is benchmarked against other services within the executive summary (Table 3).

Outcomes for all-cause OHCA in adults^A 2019/20

25%	13%
ROSC	30-day survival

Outcomes for OHCA in the Utstein Comparator Group^B 2019/20

49%	32%
ROSC	30-day survival

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

B Utstein Comparator Group: includes adults (≥ 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 9).

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 10).

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 72% and survival to 30 days was 54% (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 11).

Scene outcome for all-cause OHCA in adults

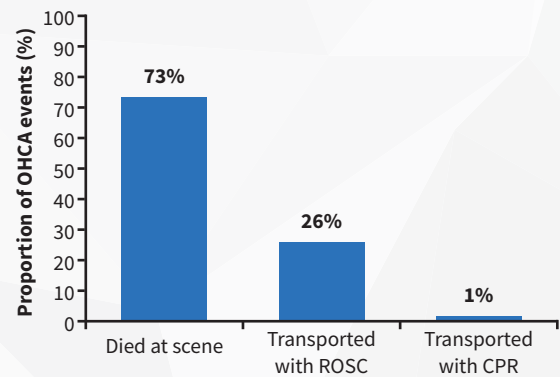


Figure 9: Scene outcome for all-cause OHCA (all events, adult, resuscitation attempted)^A.

Outcomes of OHCA in adults according to presenting rhythm

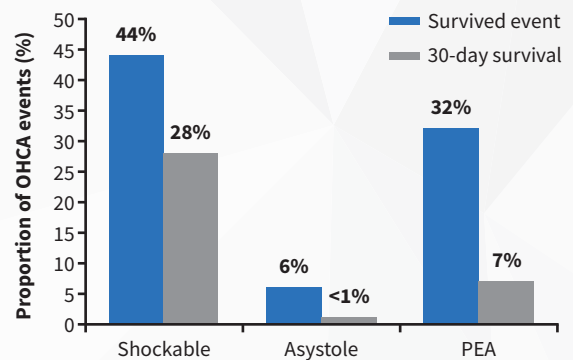


Figure 10: Outcomes for OHCA according to presenting rhythm (all events, adult, resuscitation attempted)^A.

Outcomes of OHCA according to age

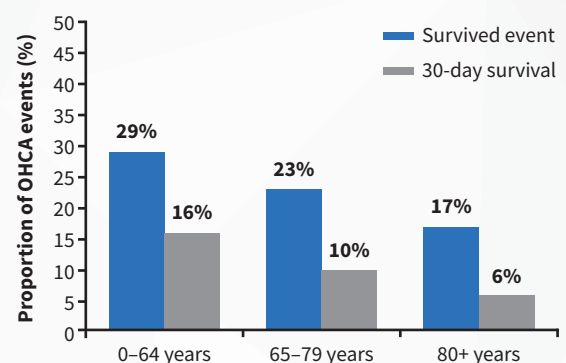


Figure 11: Influence of age on outcomes (all events, adults and children, resuscitation attempted)^B.

Adult outcomes according to ethnicity

Rates of OHCA are higher in Māori and Pacific Peoples compared to European. Māori and Pacific Peoples had a lower 30-day survival than Europeans (Figure 12). It is likely that there are greater differences in outcomes according to ethnicity. However, these are only for a single year therefore the overall numbers of Māori and Pacific patients are small and thus may not be truly representative.

Adult outcomes according to deprivation

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 13).

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 14).



Outcomes of OHCA in adults according to ethnicity

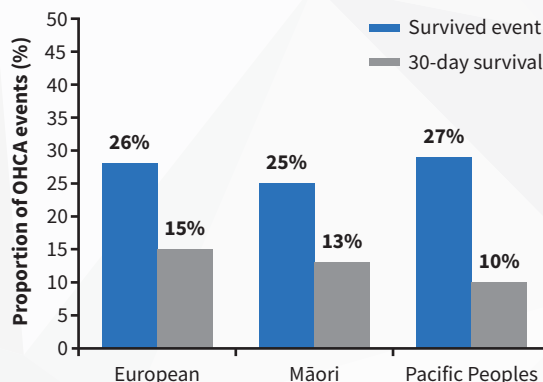


Figure 12: Influence of ethnicity on outcomes (all events, adult, resuscitation attempted)^A.

Outcomes of OHCA in adults according to deprivation quintile

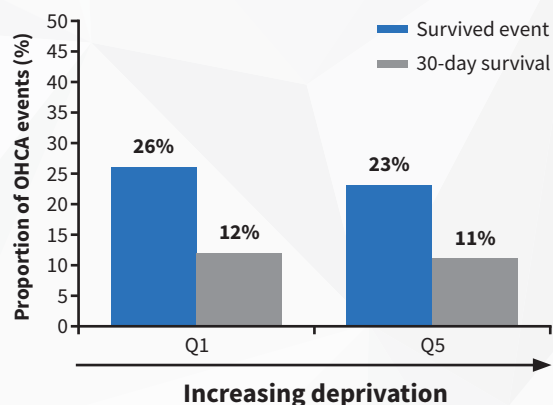


Figure 13: Influence of deprivation on outcomes (all events, adult, resuscitation attempted)^{A,B}.

Outcomes according to rurality

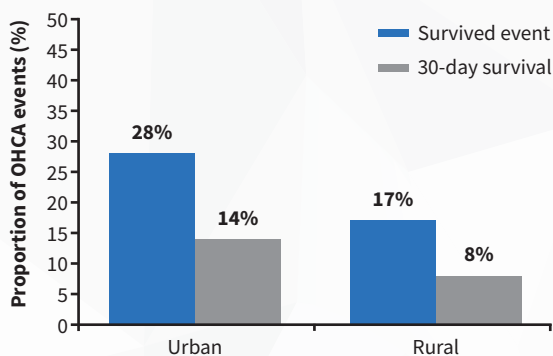


Figure 14: Influence of rurality on outcomes (all events, adult, resuscitation attempted)^A.

A All events, adult, resuscitation attempted: includes adults (≥ 15 years old), all-cause, resuscitation attempted. Excludes children, and 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 event⁷.

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). Anyone who is trained in CPR and how to use an AED is able to register as a GoodSAM responder (<https://youtu.be/EPwY3yGj8IY>).

In 9% of all confirmed cardiac arrests a GoodSAM responder was present. 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 15).

Adult outcomes according to defibrillation by Fire and Emergency New Zealand

During this reporting period Fire and Emergency New Zealand personnel were present at 95% 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 16).

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 112 adult patients in cardiac arrest, 40% of these survived to 30 days compared with only 10% that did not receive community defibrillation prior to EAS arrival (Figure 17).

Outcomes of OHCA in adults according to GoodSAM responder presence

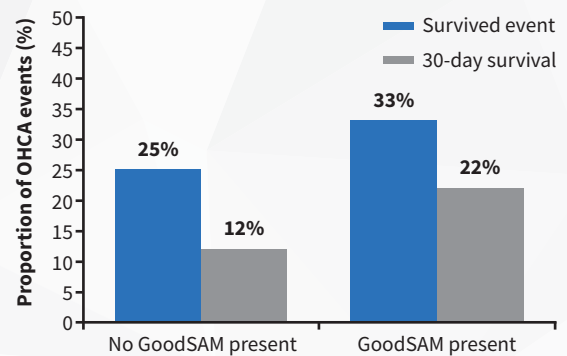


Figure 15: Influence of GoodSAM responder presence on outcomes (all events, adult, resuscitation attempted)^A.

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

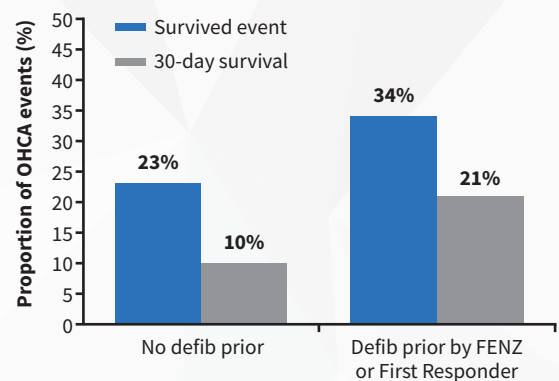


Figure 16: Influence of Fire and Emergency New Zealand or First Response Group defibrillation on outcomes (all events, adult, resuscitation attempted)^A.

Community defibrillation prior to EAS arrival

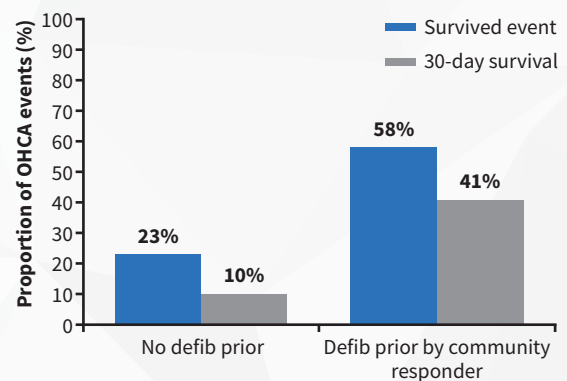


Figure 17: Influence of community defibrillation on outcomes (all events, adult, resuscitation attempted)^A.

Conclusion

Mutunga

The data presented in this report represent the 2019/20 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 Australian 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).

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

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

1	Patients who suffer a cardiac arrest in a hospital facility where the EAS may be in attendance but are not the primary treatment providers
2	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
3	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

The 2019/20 year included 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.

These data do not include any patients from the Whakaari / White Island eruption that occurred on December 9th 2019.

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.



COVID-19 and OHCA data tables

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

Table A3: Weekly OHCA event rate. Two tailed t-test

	Number of weeks	Average number of OHCA events	Standard Deviation	P-value
Pre-Lockdown	7	103.1	11.0	0.78
Lockdown	7	101.4	11.9	

Significant if <0.05

Table A4: Characteristics of all OHCA events attended during the 2018 Pre-Lockdown and 2020 COVID-19 Lockdown 7-week periods

		Pre-Lockdown (2018)	COVID-19 Lockdown (2020)	Significance (Chi-square)
Resuscitation Attempted	No	395 (53%)	403 (55%)	0.50
	Yes	352 (47%)	335 (45%)	
Age (years)	0 – 24	42 (6%)	35 (5%)	0.74
	25 – 64	305 (41%)	302 (41%)	
	65+	400 (54%)	401 (54%)	
Age category	Adult	729 (98%)	730 (99%)	0.05
	Child	18 (2%)	8 (1%)	
Ethnicity	European & Other	474 (73%)	464 (68%)	0.08
	Māori	125 (19%)	155 (23%)	
	Pacific Peoples	47 (7%)	65 (10%)	
Sex	Female	238 (32%)	260 (35%)	0.18
	Male	506 (68%)	477 (65%)	
Precipitating Cause	Non-Traumatic	657 (88%)	628 (89%)	0.69
	Traumatic	86 (12%)	77 (11%)	
Event Witnessed	Bystander	222 (30%)	223 (30%)	0.05
	EAS	75 (10%)	103 (14%)	
	No	450 (60%)	412 (56%)	

Significant if <0.05

All events resuscitation attempted: includes adults and children, all-cause, resuscitation attempted.
Includes EAS personnel witnessed events.

Table A5: Characteristics of OHCA events where resuscitation was attempted during the 2018 Pre-Lockdown and 2020 Lockdown 7-week periods.

		Pre-Lockdown (2018)	Lockdown (2020)	Significance (Chi-square)
Resuscitation Attempted	Yes	352 (100%)	335 (100%)	
Sex	Female	108 (31%)	106 (32%)	0.79
	Male	244 (69%)	229 (68%)	
Age (years)	0 – 24	21 (6%)	18 (5%)	0.82
	25 – 64	151 (43%)	138 (41%)	
	65+	180 (51%)	179 (53%)	
Age category	Adult	342 (97%)	331 (99%)	0.13
	Child	10 (3%)	4 (1%)	
Ethnicity	European & Other	221 (70%)	198 (62%)	0.14
	Māori	63 (20%)	82 (26%)	
	Pacific Peoples	34 (11%)	38 (12%)	
Precipitating Cause	Non-Traumatic	327 (93%)	312 (96%)	0.12
	Traumatic	25 (7%)	14 (4%)	
Event Witnessed	Bystander	166 (47%)	163 (49%)	0.16
	EAS	56 (16%)	68 (20%)	
	No	130 (37%)	104 (31%)	
Presenting Cardiac Rhythm	Non-shockable	219 (64%)	201 (61%)	0.43
	Shockable	123 (36%)	128 (39%)	
Community Defibrillation	Community Member	20 (6%)	8 (2%)	0.07
	FENZ	16 (5%)	20 (6%)	
	None	316 (90%)	307 (92%)	
CPR Performed Prior to Ambulance Arrival	No	126 (36%)	140 (42%)	0.11
	Yes	226 (64%)	195 (58%)	
Location of Event	Home	246 (70%)	284 (85%)	<0.001
	Public and Other	106 (30%)	51 (15%)	
Rurality of Event	Rural	92 (27%)	86 (26%)	0.89
	Urban	254 (73%)	243 (74%)	
ROSC On Handover	Yes	120 (34%)	88 (26%)	
	No	232 (66%)	247 (74%)	0.03
30 Day Survival	Survived	54 (16%)	53 (16%)	
	Died	292 (84%)	280 (84%)	0.91
Response time (minutes)	Median (IQR)	7 (5 – 10)	7 (6 – 11)	0.24
Time to first shock by EAS (minutes)	Median (IQR)	12 (9 – 21)	13 (9 – 23)	0.80
Transporting time (minutes)	Median (IQR)	18 (8 – 24)	15 (8 – 26)	0.24

Abbreviations

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

Glossary of terms

Adjusted rates	Rates are standardised to a control population.
Adult	Patients aged 15 years or older.
Asystole	The absence of any cardiac electrical activity.
Children	Patients aged less than 15 years.
Community responder	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.
EAS attended	This is the population of all patients following cardiac arrest where EAS personnel attended regardless of whether emergency treatment was provided.
EAS personnel	Where EAS personnel respond to a medical emergency in an operational capacity as part of an organised medical response team.
Presumed cardiac aetiology	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.
Resuscitation attempted	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).
Return of spontaneous circulation	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, normal end tidal CO ₂ or active movement.
Rural and remote service area	<p>Includes:</p> <p>Minor urban area: centred on smaller towns with a population between 1,000 and 9,999.</p> <p>and</p> <p>Rural centre: rural settlements or townships with population between 300 and 999.</p> <p>and</p> <p>Other: areas not classified as urban or rural centres with population under 300. (http://nzdotstat.stats.govt.nz/wbos/Index.aspx)</p>

Shockable rhythm	Ventricular fibrillation, ventricular tachycardia or unknown shockable (AED).
Specific rates	Rates for specific segments/groups of the population (e.g. sex, age, ethnicity).
Survival to 30-days	The patient is alive at 30-days post-OHCA event.
Survived event	The patient has sustained ROSC to handover at hospital.
Urban area	<p>Includes:</p> <p>Main urban area: centred on a city or major urban area with a minimum population of 30,000.</p> <p>and</p> <p>Secondary urban area: centred on large regional centres with a population between 10,000 and 29,999.</p> <p>(http://nzdotstat.stats.govt.nz/wbos/Index.aspx)</p>
Witnessed event	A witnessed cardiac arrest is one that is seen or heard by another person.

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