



St John
Here for Life

Out-of-Hospital Cardiac Arrest Registry

Annual Report 2017/18





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“In one split second, our lives changed forever.”

Those are the words of Janai and Blair Wakenell, who last November went through an ordeal no parent should ever have to go through. Their five-year-old son, Dylan, went into cardiac arrest.

Dylan was playing with his friend in the garden when he fell and didn't get up.

His friend ran to get help, and bystander CPR was performed before emergency services arrived.

“Everything just seemed to line up that day,” says Janai, Dylan's mother. That his friend knew to come and raise the alarm, that my friend could perform CPR before the ambulance arrived. The crews worked on him for so long before he was transported to hospital. All these factors really saved his life.”

Once at Starship Hospital, Dylan remained in cardiac arrest. The on-call paediatric cardiologist suggested Dylan be administered fentanyl as opposed to adrenaline, and finally a perfusing rhythm was achieved after an estimated 90 minutes. He was then diagnosed with catecholaminergic polymorphic ventricular tachycardia (CPVT).

“Most people with CPVT don't survive cardiac arrest,” Janai says.

“We learned Dylan suffered four cardiac arrests. So for him to survive is pretty amazing. We are so, so lucky and it's scary to think how else this could have turned out. He is definitely our miracle boy.”

For the ambulance officers involved, Dylan has proved a very special case.

“This is one job no ambulance officer ever wants to attend,” says Emma McConachy, one of the ambulance officers on the scene.

“In Dylan's case the chain of survival was excellent – starting with a very brave bystander who started CPR. This ensured that what was to follow was even possible.”

Clinical experts talk about the ‘chain of survival’ where it operates adeptly – from early recognition of the patient's symptoms, starting early CPR and defibrillation through to advanced life support provided by paramedics, before transportation to hospital where medical staff take over. When the ‘chain of survival’ operates efficiently, the patient has the best chance of survival.

“I think of Dylan often, especially on the hard days at work. I cannot express how much joy and pride it gives me to know we were part of a team that contributed to saving this young man's life,” says McConachy.

Janai says it was really special when the ambulance staff came to visit Dylan in hospital and at their home. “You could tell they were quite shaken up by this event, you see could see how much they cared about Dylan. That really meant something to us.”

Janai says it's important that awareness is raised about bystander CPR and also about CPVT, because if certain steps weren't taken in Dylan's case it would have been a different outcome.

“From the bottom of our hearts, we are so thankful to everyone who helped Dylan. If it wasn't for the help and support from everyone we don't think we would have been able to get through it. Dylan is our miracle boy, and we are just so grateful that everything lined up that day. He really got the best of the best.”





Introduction

Every year in New Zealand around 1,800 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 the "3 Steps for Life" programme (free CPR awareness training), Restart A Heart Day, ASB St John in Schools programme, and the GoodSAM smart phone application will improve survival from OHCA.

Alongside the community, St John 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 cardiac arrest registry enables this.

This continuous measurement determines whether making changes improves patient outcomes, and identifies further steps for improvement. The St John OHCA Registry was established in October 2013 and now contains over 20,000 OHCA records.

On behalf of St John, we are very pleased to present the 2017–2018 Out-of-Hospital Cardiac Arrest Registry Annual Report. ■

Bridget Dicker *Tony Smith*

Dr Bridget Dicker
Head of Clinical Audit
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St John

Dr Tony Smith
Medical Director
St John

The St John emergency ambulance service

St John is New Zealand's largest emergency ambulance service (EAS) covering around four million people or approximately 90% of the population.

The service operates across 97% of New Zealand's geographical area, while Wellington Free Ambulance covers the Wellington and Wairarapa regions.

The organisation calls on over 1,600 paid and over 3,000 volunteer ambulance officers to provide care to the more than 400,000 patients treated each year. Ambulance officers in New Zealand may be vocationally trained (National Diploma, NZQA Level 4–6), hold a three-year Bachelor of Health Science degree in Paramedicine or have postgraduate qualifications in advanced resuscitation. St John ambulance officers, both paid and volunteer, are supported through ongoing clinical education.

In an emergency New Zealanders dial 111 and are directed by telecommunications company 'Spark' to one of three emergency agencies. Every day around 1,300 of these calls are for an ambulance. St John owns and runs the 111 Clinical Control Centres in Auckland and Christchurch and helps run a third in Wellington, in a joint venture with Wellington Free Ambulance.

Responding to a cardiac arrest

When an emergency ambulance call comes in, St John call handlers use the Advanced Medical Priority Dispatch System (AMPDS) ProQA software to triage calls and determine the appropriate level of response. A colour coded response system is used, based on international best practice.

An immediately life threatening call, such as a cardiac arrest, is allocated a 'purple' response, taking precedence over all other calls and the closest responder is immediately dispatched. This may be an emergency ambulance or any other co-responder including the St John Patient Transfer Service, Fire and Emergency New Zealand, local first response groups or Primary Response in Medical Emergencies (PRIME) doctors and nurses. At the same time, nearby GoodSAM-registered Community Responders are also alerted. An intensive care paramedic qualified



in advanced life support is also sent to all suspected cardiac arrests, when available.

For a suspected cardiac arrest, the St John call handler instructs the caller to use an AED if available and guides them through the process of performing CPR.

Once ambulance officers reach the patient, they may continue the resuscitation attempt. Depending on the qualification of the responding personnel, they may also provide advanced life support such as advanced airway management, drug therapy, physiologic monitoring and post-cardiac arrest care.

A cardiac arrest is allocated a 'purple' response and the closest responder is immediately dispatched.

The cardiac arrest protocols used by ambulance officers have been developed by the National Ambulance Sector Clinical Working Group¹. In situations where resuscitation is not feasible, or clearly not in the best interest of the patient, St John ambulance officers may elect not to start a resuscitation attempt. When a resuscitation attempt is underway, it may later be stopped by ambulance officers following the written protocols within the St John Clinical Procedures and Guidelines¹. ■

About this report

Cardiac arrest remains a considerable public health issue, with ischaemic heart disease being the second most prevalent cause of death in New Zealand².

Internationally, survival rates following out-of-hospital cardiac arrest (OHCA) are highly variable and can range from less than 6% to greater than 50%³. 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 survival⁴. 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 EAS in the period from 1 July 2017 to 30 June 2018. The data for this report was extracted from the registry on 4 October 2018.

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)⁵⁻⁶.

Where possible comparisons are drawn with Ambulance Victoria, London Ambulance Service,

St John Ambulance Western Australia and King County Emergency Medical Services (EMS) in Washington USA⁷⁻¹⁰. These services were selected as the definitions and collection variables that are used in the St John OHCA Registry are similar to those used by these services.

The data presented in this report primarily relates to events that were either 'attended' or where there was a 'resuscitation attempted' by St John EAS personnel. 'Attended' refers to all OHCA where St John 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 St John 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) enrollment data¹¹⁻¹². ■



Executive summary



5 people a day

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

29% female,
71% male



74%

of patients received bystander CPR



The median time in which a St John ambulance reached a patient was **6 minutes** in urban communities and **9 minutes** in rural and remote communities



5.1%

received defibrillation by a Community Responder prior to ambulance arrival



84%

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



28%

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










13%
of patients survived

All events, adult, resuscitation attempted: includes adults (≥ 15 years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events. Annual comparisons for these figures are shown in Table 1.

Benchmarking executive summary

Key figures for all-cause events

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

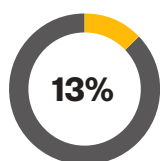
Year	Total number events	 % Bystander CPR	 % Community Responder AED use	 Urban median response time	 Rural & remote median response time	 % Attended by Fire & Emergency New Zealand	 % ROSC on handover	 % Survival
2013/14 (9mo)	1101	75%	3.9%	8	11	45%	27%	13%
2014/15	1690	74%	3.7%	8	10	82%	28%	12%
2015/16	1696	72%	4.5%	7	10	79%	25%	11%
2016/17	1792	72%	4.6%	5	8	82%	27%	12%
2017/18	1927	74%	5.1%	6	9	84%	28%	13%

Benchmarking (all-cause events)

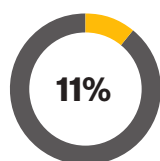
The outcomes of OHCA for international benchmarking compare rates of ROSC sustained to hospital handover and survival. This group requires that the following criteria be met: includes adults (≥ 15 years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events.

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

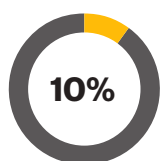
Ambulance Service	Collection period	Total number events	% ROSC on handover	% Survival
St John New Zealand	1 July 2017 to 30 June 2018	1,927	28%	13% ^B
Ambulance Victoria ^B	1 July 2016 to 30 June 2017	2,412	26%	11%
^C London Ambulance Service ⁷	From 1st April 2016 to 31st March 2017	4,448	29%	10%
^D St John Ambulance Western Australia ⁹	1 July 2017 to 30 June 2018	716	24%	11%
King County EMS ¹⁰	1 January 2017 to 31 December 2017	755	48%	20%



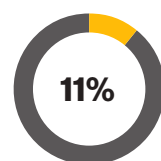
St John
New Zealand



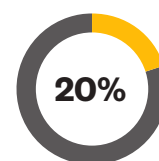
Ambulance Victoria



London
Ambulance Service



St John Ambulance
Western Australia



King County
EMS

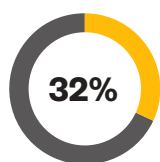
- A All events, adult, resuscitation attempted:** includes adults (≥ 15 years old), all-cause, resuscitation attempted. Excludes children, and EAS personnel witnessed events.
- B** St John New Zealand reports on survival to 30-days, all other services report survival to hospital discharge.
- C** London Ambulance Service includes only those with a presumed cardiac cause.
- D** Note: Perth metropolitan area only.

Benchmarking (Utstein Comparator Group)^A

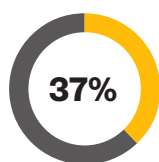
The outcomes of OHCA for international benchmarking compare rates of ROSC sustained to hospital handover and survival for a specifically selected subgroup of patients. This subgroup is referred to as the Utstein Comparator Group and requires that the following criteria be met: includes adults (≥ 15 years 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
St John New Zealand	1 July 2017 to 30 June 2018	529	52%	32% ^B
Ambulance Victoria ⁸	1 July 2016 to 30 June 2017	465	58%	37%
^C London Ambulance Service ⁷	From 1st April 2016 to 31st March 2017	606	55%	30%
^D St John Ambulance Western Australia ⁹	1 July 2017 to 30 June 2018	146	47%	35%
King County EMS ¹⁰	1 January 2017 to 31 December 2017	177	72%	50%



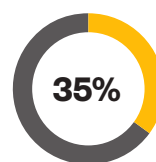
St John
New Zealand



Ambulance Victoria



London
Ambulance Service



St John Ambulance
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 St John New Zealand reports on survival to 30-days, all other services report survival to hospital discharge.

C London Ambulance Service includes only those with a presumed cardiac cause.

D Note: Perth metropolitan area only.



The St John Out-of-Hospital Cardiac Arrest Registry

The St John OHCA Registry was formally established in September 2013. Since the registry was established, data for cardiac arrests attended by St John has been successfully captured for more than 20,000 patients.

The St John OHCA Registry is overseen by Dr Bridget Dicker, St John Head of Clinical Audit and Research and Auckland University of Technology Senior Lecturer.

Eligibility

St John captures data on all OHCA events attended by the St John EAS. St John defines a cardiac arrest as a patient who is unconscious and pulseless with either agonal breathing or no breathing.

Inclusion and exclusion criteria are described in Table 4 and Table 5.

Data capture

This report reflects data recorded between 1 July 2017 and 30 June 2018. 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)⁵⁻⁶.

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 Clinical Control Centre when a 111 call is received and an ambulance is dispatched, with data being entered into the CAD system. Data specifically related to

Table 4: Inclusion criteria (all of the following).

1	Patients of all ages who suffer a documented cardiac arrest
2	Occurs in New Zealand where St John 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 St John 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 St John EAS personnel or ➤ Patients who have a pulse on arrival of St John EAS personnel following successful bystander defibrillation.

Table 5: Exclusion criteria (any of the following).

1	Patients who suffer a cardiac arrest in a hospital facility where St John 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 St John 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 St John EAS personnel, and where defibrillation did not occur prior to ambulance arrival or no other evidence verifying a cardiac arrest state is present
4	Patients who suffer a cardiac arrest where Wellington Free Ambulance is the primary treatment provider

cardiac arrest is obtained from the CAD system and transferred into the St John 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.

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.

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 St John. In this report, comparison is made between Ambulance Victoria, London Ambulance Service, St John Ambulance Western Australia and King County EMS where applicable⁷⁻¹⁰.

Missing data

Improvements made since the registry's inception have reduced the proportion of missing data. The overall fraction of missing pre-hospital data is now relatively low, which is reflective of an EAS culture that values continuous monitoring to improve patient outcomes.

Ethical review

The St John OHCA Registry has been approved by the New Zealand Health and Disability Ethics Committee (Ethics reference 13/STH/192) and the Auckland University of Technology Ethics Committee (Ethics reference 13/367).

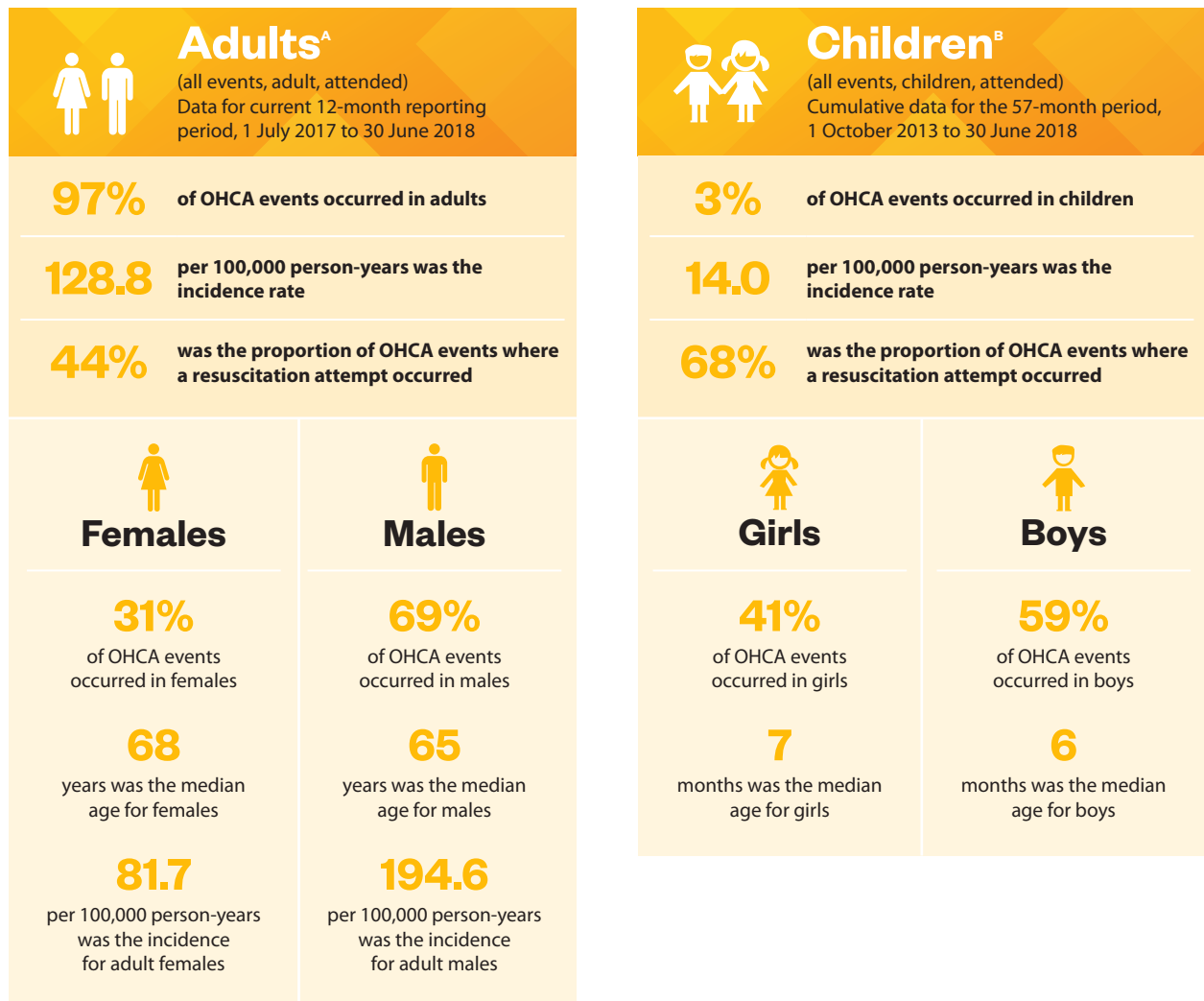
The registry is also subject to St John internal research governance processes that include a locality review and locality authorisation as per the Standard Operating Procedures for Health and Disability Ethics Committees.

The St John 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. ■



Incidence and demographics

Key figures for adults (≥ 15yrs) and children



The age adjusted rate of 103.2 per 100,000 person-years was higher than other services, with Ambulance Victoria reporting a rate of 88 per 100,000 person-years⁸. The higher rate of OHCA in New Zealand is congruent with 2015 OECD data that indicated the mortality from ischaemic heart disease was 129 per 100,000 population in New Zealand and 85 per 100,000 population in Australia¹³. The incidence rates for males were around twice that of females (Figure 3). Age-specific rates also indicated that males in all age groups had a higher incidence of OHCA compared with females (Figure 2).

The incidence rate for children was higher than comparable services, with Ambulance Victoria reporting a rate of 9 per 100,000 person-years during the 2016–2017 reporting period. This finding is in-line with 2014 OECD mortality data which reports 1.7 times higher infant mortality in New Zealand compared with Australia¹⁴. There was a higher proportion of cardiac arrest in boys compared to girls. Over the 57-month period, resuscitation was attempted in a proportionally higher percentage of events for children than for adults.

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.

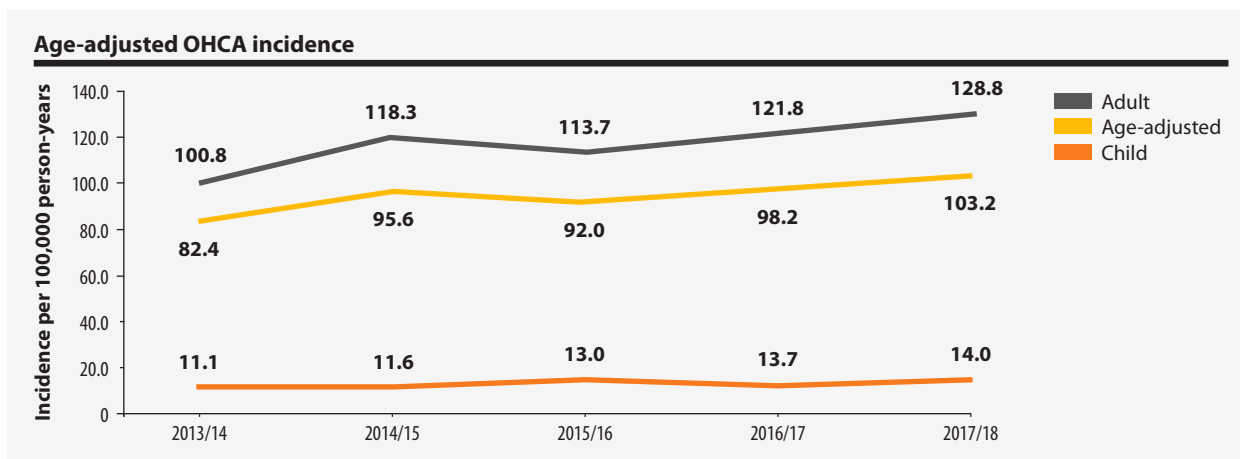


Figure 1: Incidence of all adult and child OHCA (all events, attended)^A. Age-adjusted incidence was calculated using the NZ 2013 population (Stats NZ)¹¹, excluding the Wellington and Wairarapa regions.

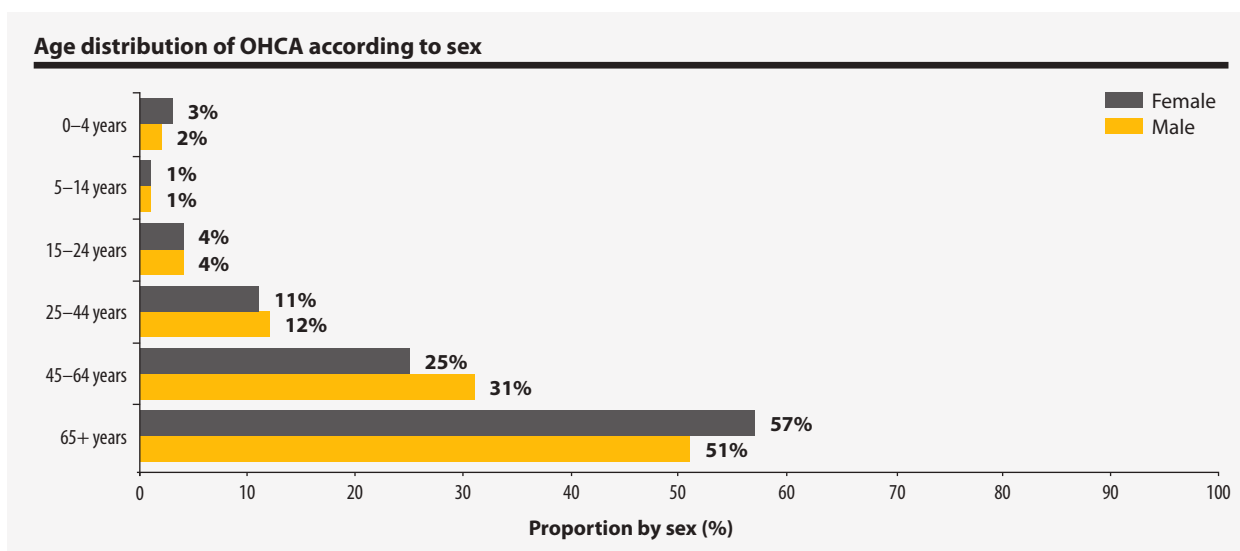


Figure 2: Age distribution of OHCA (all events, attended)^A.

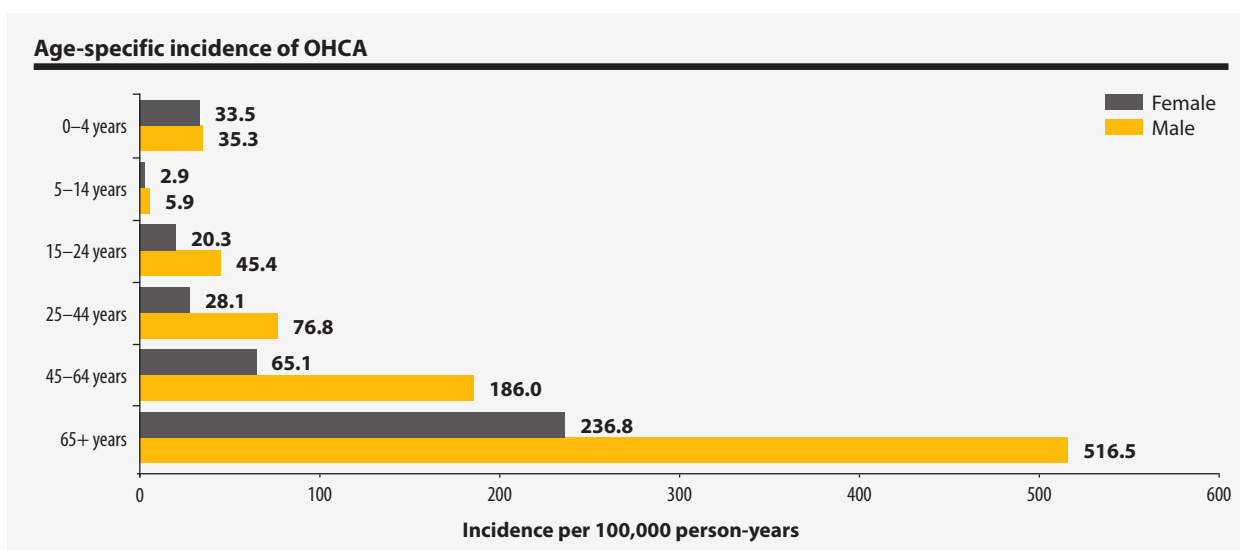


Figure 3: Age-specific rate of OHCA (all events, attended)^A.

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

Ethnicity

The majority of OHCA events attended by St John EAS were for patients of European ethnicity, which reflects the NZ population demographics (Figure 4).

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 categories¹². Asian, Middle Eastern/Latin American/African, and Other Ethnicities combined made up less than 5% of cardiac arrests attended.

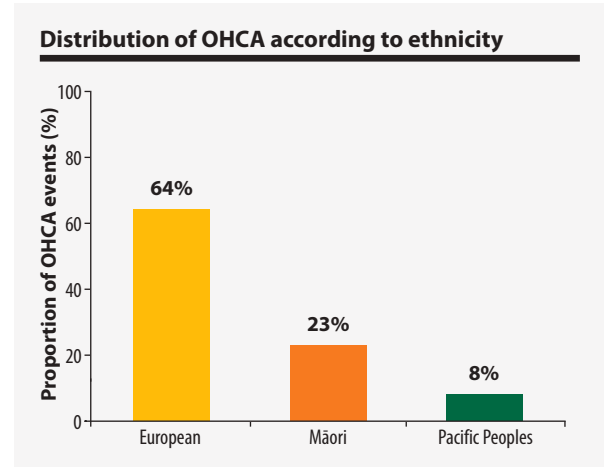
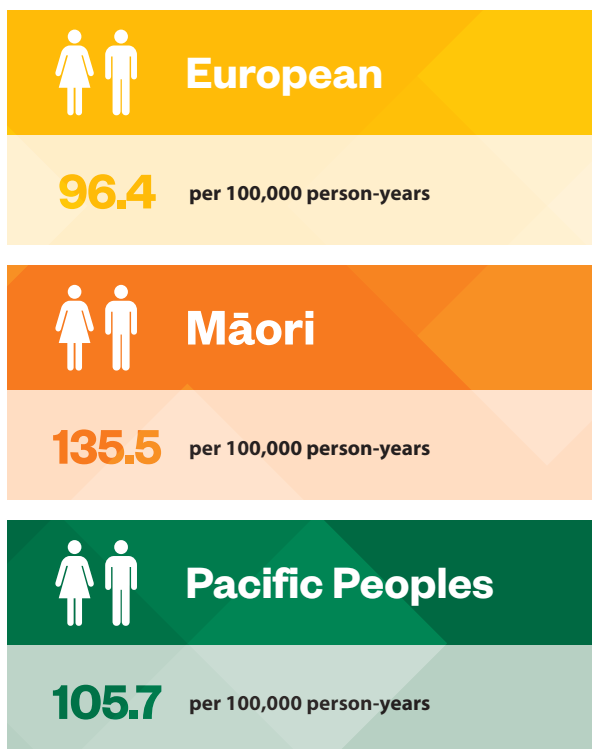


Figure 4: Distribution of OHCA according to ethnicity (all events, attended)^A.

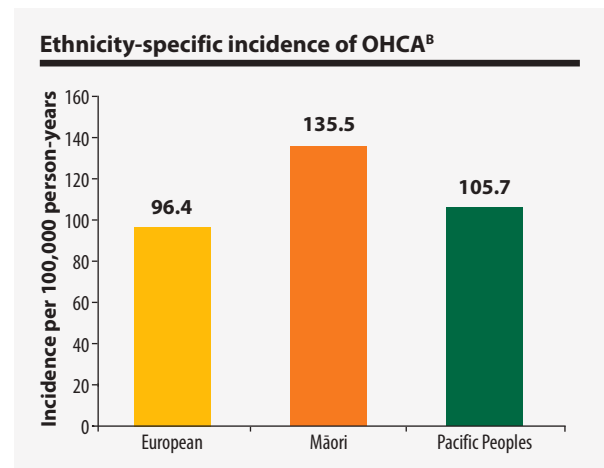


Figure 5: Ethnicity-specific incidence of OHCA per 100,000 person-years (all events, attended)^A.

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 2018Q3 (July to Sept 2018)

Deprivation-specific rates^B

The NZDep2013 is a measure of socioeconomic deprivation calculated using census data. 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.¹⁵

Incidence across urban and rural/remote areas

The population within the St John jurisdiction is classified as urban or rural and remote as per the Glossary of terms at the end of this report. A larger proportion of the New Zealand population is based within metropolitan centres and consequently a

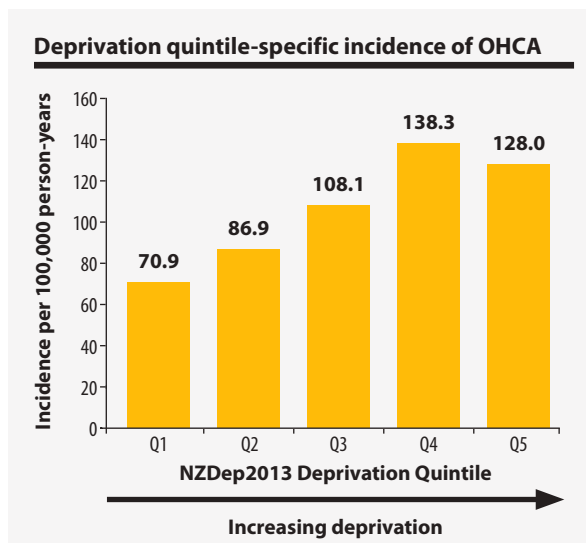


Figure 6: Deprivation quintile-specific rates (all events, attended)^A.

greater portion of OHCA events attended by St John occurred within metropolitan localities (70%). The incidence rate for the urban population was 95.0 per 100,000 person-years and for the rural/remote population was 103.7 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 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 home address of the patient at the time of the event.





Heat map of OHCA events within the St John jurisdiction

The heat map in Figure 7 represents where the majority of events occur and is focused on areas of population density^A. Red represents the highest concentration of OHCA on the heat map of OHCA events, followed by yellow and then green (Figure 7).

Precipitating events for adults

St John 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, which constituted 81% of events. Other common precipitating causes included respiratory arrest (6%), hanging (4%) and trauma (3%) (Figure 8).

Precipitating causes for children

The occurrence of OHCA in children is significantly less than in adults. Therefore cumulative data for a 57-month period from 1 October 2013 to 30 June 2018 was used for the analysis of precipitating causes. During this period, the leading cause of OHCA in children was Sudden Unexpected Death in Infancy (SUDI) followed by respiratory arrest (Figure 9). These findings are consistent with those of the New Zealand Mortality Review Data Group, which show that the incidence of SUDI in New Zealand is one of the highest among industrialised countries and the leading cause of death in children aged less than one year¹⁶.

OHCA location

The most common place for an OHCA to occur is in a person's home, with 71% of events where resuscitation was attempted occurring at home. The second most common place for an OHCA to occur is in a public area (21%), which includes the workplace, the street, a shopping centre or similar (Figure 10). ■

^A Heat map is not standardised to incidence per 100,000 person-years

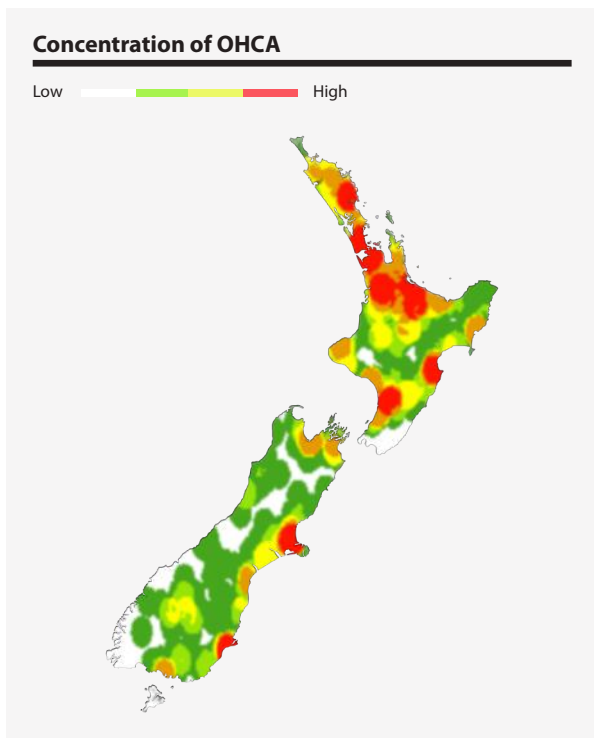


Figure 7: Concentration of OHCA events across New Zealand, excluding the Wellington Free Ambulance region.

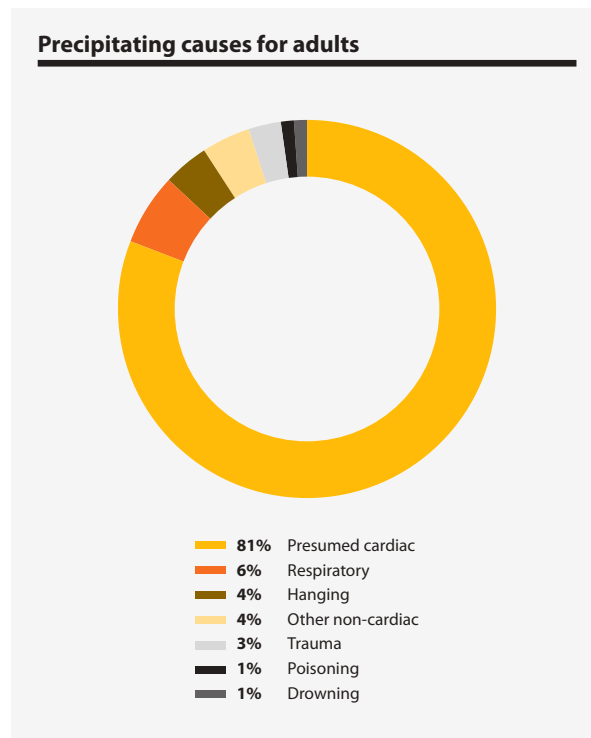


Figure 8: Precipitating causes for adults (all events, adult, resuscitation attempted)^A.

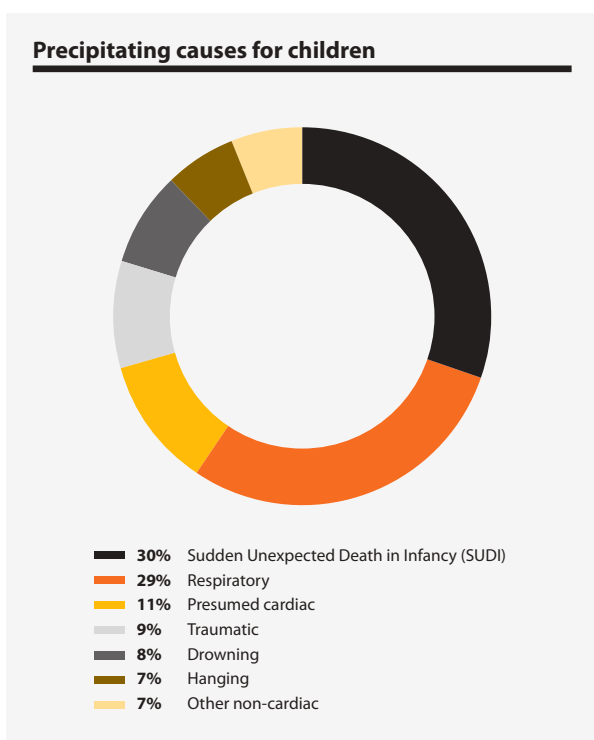


Figure 9: Precipitating causes for children (57-months, all events, child, resuscitation attempted)^B.

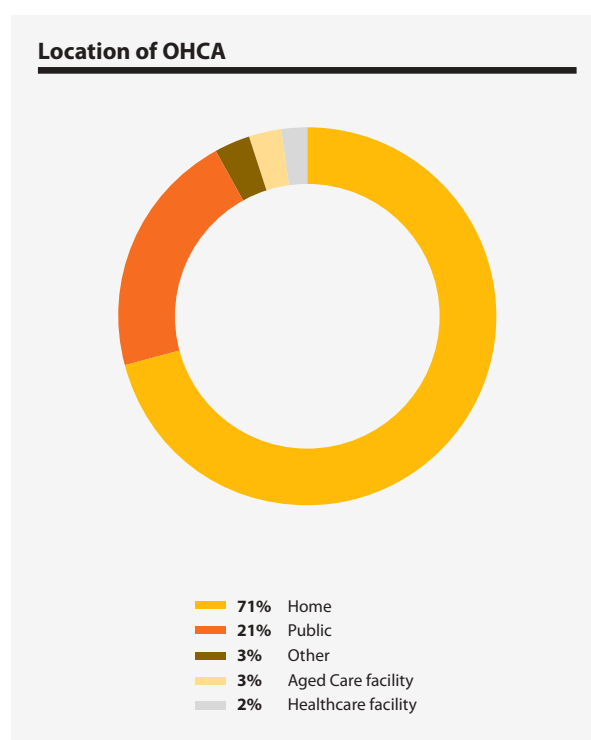


Figure 10: Location of OHCA for adults (all events, adult, resuscitation attempted)^A.

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.

The Global Resuscitation Alliance 10 Steps to improving outcomes

- | | | |
|---|-----------|--|
|  | 1 | Establish a cardiac arrest registry |
|  | 2 | Provide telephone-CPR instructions with ongoing training and quality improvement |
|  | 3 | Provide high-performance CPR with ongoing training and quality improvement |
|  | 4 | Use rapid dispatch |
|  | 5 | Measure resuscitation performance using the defibrillator recording |
|  | 6 | Begin an AED programme for first responders, including police officers, guards, and other security personnel |
|  | 7 | Use smart technologies to notify volunteer bystanders so they can respond to provide early CPR and defibrillation |
|  | 8 | Make CPR and AED training mandatory in schools and communities |
|  | 9 | Be accountable – publicise annual reports |
|  | 10 | Provide a culture of excellence |

The concept of the Resuscitation Alliance is that all members of the Global Resuscitation Alliance, of which St John NZ is one, will use and promote the 10 Steps for Improving Survival from Cardiac Arrest thus extending the best practices in cardiac arrest survival internationally.

Each of the 10 Steps consists of a number of elements outlined within the infographic and in detail within the foundation paper that can be downloaded here: <https://foundation915.files.wordpress.com/2016/07/a-call-to-establish-a-global-resuscitation-alliance-2016.pdf>¹⁷



1

Establish a cardiac arrest registry

The St John OHCA Registry was established in October 2013 and now contains over 20,000 records of OHCA. This continuous measuring and reporting

sets the stage for implementing change and making improvements over time.



2

Provide telephone-CPR instructions with ongoing training and quality improvement

The Clinical Control Centre personnel play a pivotal role in the rates of early bystander CPR. As soon as emergency Call Handlers suspect a patient is in cardiac arrest they provide instructions to the caller over the phone on how to perform CPR. This Call Handler directed CPR has been in place since 2002.

Call Handlers are also adept in directing callers to the location of AEDs. When AEDs are logged with AED Locations (<https://aedlocations.co.nz>), Call Handlers may access the AED Locations website and guide callers to the location of an AED. Alternatively, when AED details are provided directly to St John they are entered into our dispatch system. Then, when someone calls 111, Call Handlers can automatically visualise the AEDs within a 200m radius of the person calling. Also, if the caller states the patient is located at a different address, the Call Handler will be able to search the system and guide the caller to the AED.

Rates of bystander CPR

Of the OHCA where resuscitation was attempted, 74% of these had bystander CPR performed prior to ambulance arrival (witnessed and unwitnessed combined). This figure is similar to previous years (Figure 11).

Bystander CPR rates

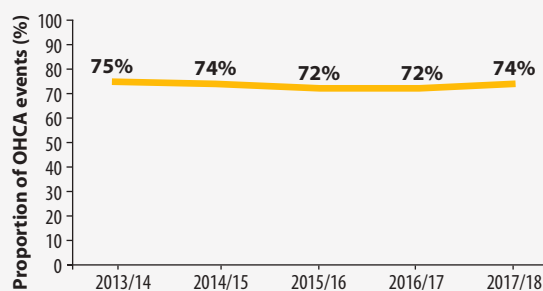


Figure 11: Bystander CPR rates (all events, adult, resuscitation attempted)^A.



3

Provide high-performance CPR with ongoing training and quality improvement

The St John Clinical Development team provide St John and co-responder personnel with CPR training through a programme of Continuing Clinical Education (CCE). During this reporting period specialised manikins were introduced to this programme that measured chest compression performance. Staff were expected to achieve a

score of 80%. Over the next 18 months, we intend to implement a New Zealand model of High Performance CPR jointly developed by St John, Wellington Free Ambulance, Fire and Emergency New Zealand, Auckland University of Technology and Whitireia Polytechnic.

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



4 Use rapid dispatch

With time to defibrillation being crucial, St John has protocols to ensure that patients in cardiac arrest are reached in the shortest possible time by responders trained in CPR and with access to a defibrillator. Clinical Control Centre staff give a cardiac arrest the highest priority and dispatch the closest resource immediately.

The time between when an emergency call is answered in the Clinical Control Centre to when an ambulance arrives is critical. This is one of the key performance indicators for St John EAS and the

target is to get trained personnel with a defibrillator to the patient as quickly as possible.

For OHCA where resuscitation was attempted by St John EAS, the median response time (from call pick up in the Clinical Control Centre to arrival of the first ambulance on scene) was six minutes in urban areas and nine minutes for rural and remote areas (Figure 12 and Figure 13).

Additionally, we currently have a dispatch focused audit initiative to ensure the closest vehicle with a defibrillator is always dispatched to a cardiac arrest.

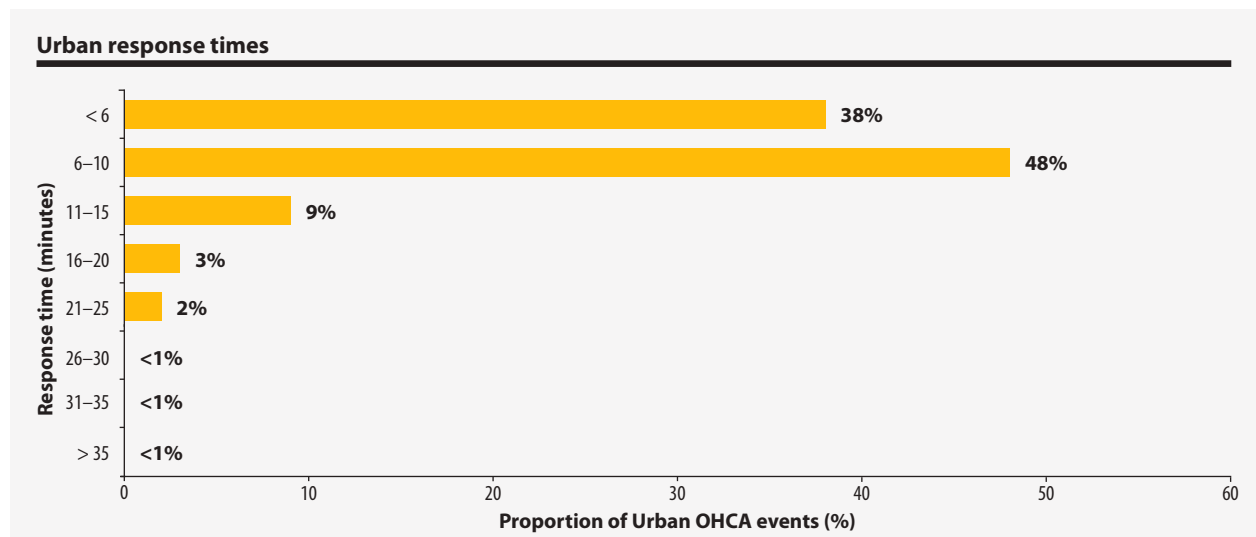


Figure 12: Urban response, time from answering the call to arrival of first ambulance (all events, adult, resuscitation attempted)^A.

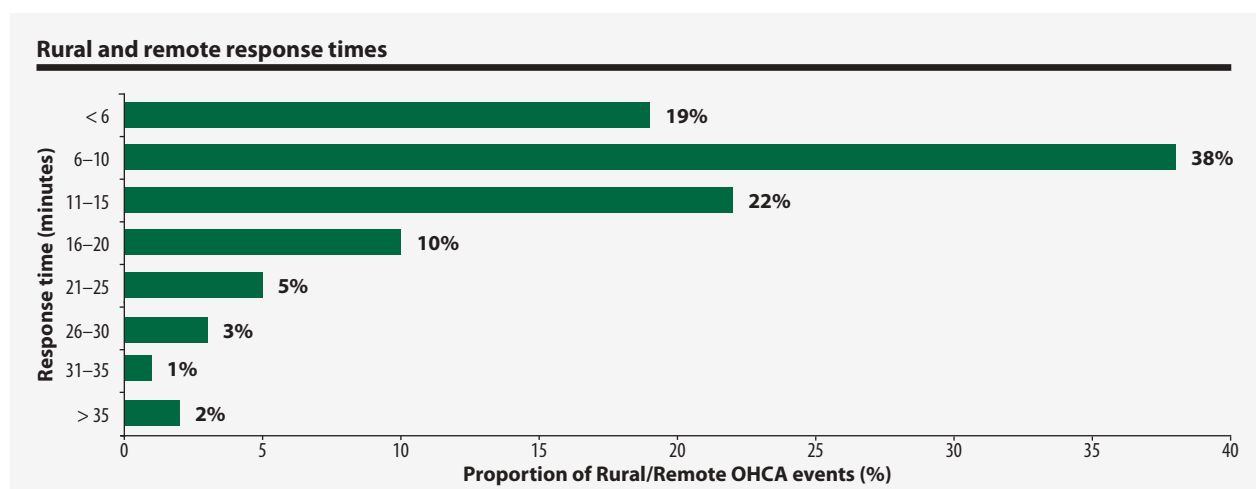


Figure 13: Rural and remote response, time from answering the call to arrival of first ambulance (all events, adult, resuscitation attempted)^A.

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



5

Measure resuscitation performance using the defibrillator recording

There is a range of defibrillators on the market now and many of these enable us to record information measuring the quality of CPR being performed at

the scene. In future we plan to explore the ability to download this information and provide constructive feedback on CPR quality to responding personnel.



6

Begin an AED programme for first responders, including police officers, guards, and other security personnel

When there is a suspected cardiac arrest the Clinical Control Centre immediately dispatches the closest resource, regardless of qualification. This may be an emergency ambulance or any other co-responder including the St John Patient Transfer Service, Fire and Emergency New Zealand, local first response groups or Primary Response in Medical Emergencies (PRIME) doctors and nurses. By dispatching the nearest resource, defibrillation and CPR can occur as quickly as possible, which may be before EAS arrival.

Fire and Emergency New Zealand

Since December 2013, Fire and Emergency New Zealand has been part of the team of professionals available to co-respond to an OHCA.

During this reporting period, Fire and Emergency New Zealand attended more than 80% of adult OHCA events where resuscitation was attempted by EAS.

Early CPR is one of the key links in the chain of survival. In 14% of adult OHCA events where resuscitation was attempted by EAS, Fire and Emergency New Zealand arrived on scene first to provide early CPR and use an AED.

During this reporting period Fire and Emergency New Zealand personnel were fundamental in the early defibrillation of 119 adult patients in cardiac arrest. Of these patients, 17% survived to 30-days post event.

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

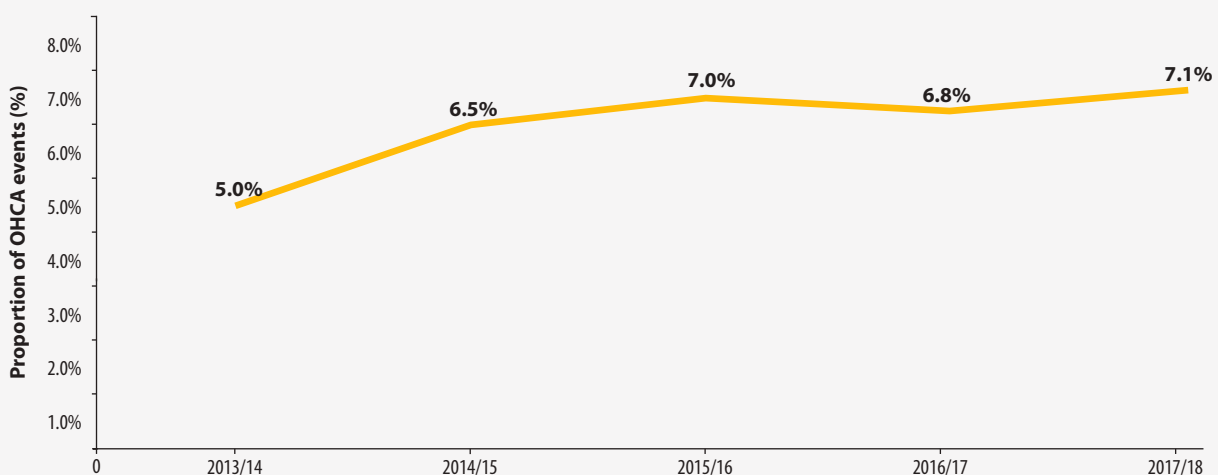


Figure 14: Proportion of events defibrillated prior to EAS arrival by Fire and Emergency New Zealand or First Response Groups (all events, adult, resuscitation attempted)^A.

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



Use smart technologies to notify volunteer bystanders so they can respond to provide early CPR and defibrillation

Public access defibrillators and community training have a large role to play in early defibrillation. If an emergency Call Handler suspects they are dealing with a cardiac arrest, one of the first questions they ask is if an AED is available. If so, they provide instructions on how to use it, as well as on how to perform CPR.

In this reporting period around 5% of the total OHCA events were defibrillated by a community member prior to EAS arrival.

Twenty-one percent of OHCA events occurred in a public location. Of these publicly occurring events, 11% were defibrillated by a member of the public prior to ambulance arrival.

In April 2018 the GoodSAM (Good Smartphone Activated Medics) application that alerts community responders to nearby cardiac arrests was launched in New Zealand (www.goodsamapp.org). Anyone who is trained in CPR and how to use an AED is able to register as a GoodSAM responder. Responders are verified through provision of a copy of a formal identification such as a drivers license, passport or St John ID. In the first three months since its introduction, over 2,500 community members had registered as GoodSAM responders.

Table 6: GoodSAM statistics for the 90-day period 1 April 2018 to 30 June 2018

Total number of people registered as GoodSAM responders in New Zealand	2,500
Total number of confirmed cardiac arrests with a GoodSAM responder at scene (adults, resuscitation attempted)	6% (n=26/439)
Number of alerts. Up to 3 alerts can be accepted for one incident.	Total = 2,456 Average per day = 27
Total number of alerts accepted	16% (n=403)

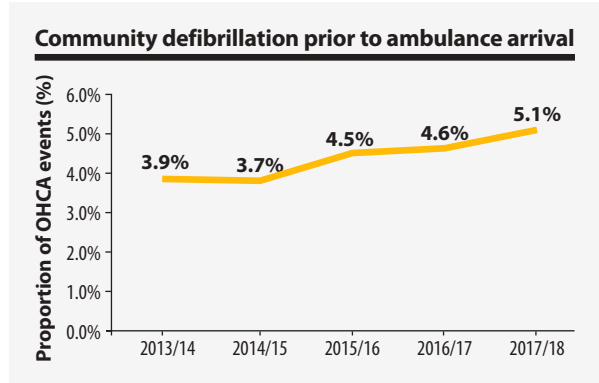


Figure 15: Proportion of events defibrillated prior to EAS arrival by Community Responders (all events, adult, resuscitation attempted)^A



Location of Community Responders who are using the GoodSAM App across New Zealand.

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



Make CPR and AED training mandatory in schools and communities

To improve the rates of bystander CPR and AED use, St John supports several community initiatives. These include the 3 Steps for Life community awareness programme, the ASB St John in Schools programme, and the National Marae OHCA Project.

3 Steps for Life

<https://www.stjohn.org.nz/What-we-do/Community-programmes/3-steps-for-life/>

3 Steps for Life is designed to give all New Zealanders the confidence and awareness to take action when somebody suffers a cardiac arrest by:

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

This initiative is an opportunity for our people to deliver free community awareness sessions with the potential to save up to 500 lives a year. All St John personnel who are qualified at First Responder (or above), along with certified St John tutors, can volunteer to run a one-hour CPR and AED 3 Steps for Life awareness session for community groups such as sports clubs, retirement villages and marae communities.

ASB St John in Schools

<https://www.stjohn.org.nz/What-we-do/Community-programmes/ASB-St-John-in-Schools-Programme/>

St John recognises that children also have a role to play in a community response to an OHCA. Between 1 July 2017 and 30 June 2018, the ASB St John in Schools programme trained 130,860 children in CPR and there are 6,104 St John Youth members engaged in learning first aid and CPR.

National Marae OHCA project

Māori are more at risk of cardiac arrest than non-Māori (See Figure 5). St John is working with marae around New Zealand to engage with Māori and provide support through improving access to AEDs and training in CPR.

Online resources

St John has developed several online videos and a smartphone application which are freely available to the public to help them learn CPR and how to use an AED:

- The St John CPR App: <https://www.stjohn.org.nz/First-Aid/CPR-App/>
- Learn how to do CPR and to use an AED, 3 Steps for Life: <https://www.stjohn.org.nz/What-we-do/Community-programmes/3-steps-for-life/>

Engagement with the Ministry of Education

St John supports the New Zealand Resuscitation Council, who are engaging with the Ministry of Education to discuss the possibility of adding to the compulsory education curriculum first aid training, including CPR and how to use an AED.

World Restart A Heart Day, October 16 (Annually)

In 2017 St John participated in its inaugural world Restart A Heart Day events, spending the day promoting the 3 Steps for Life (1. Call 111, 2. Start CPR, 3. Use an AED) at public events taking place throughout New Zealand. This year St John joined colleagues from Fire and Emergency NZ, NZ Police and the NZ Defence Force to bring the 3 Steps for Life to airports, schools and many other communities throughout New Zealand. A strong internet and social media campaign (restartaheart.co.nz, #restartaheart) along with a restart a heart day video (<http://www.stjohn.org.nz/restartaheartday>) ensured the campaign had wide reach to grow the numbers of community responders and trained members of the public.



9

Be accountable – publicise annual reports

All St John OHCA Registry Annual Reports are publicly available. The current report and all previous reports can be downloaded from the St John website here: <http://www.stjohn.org.nz/News--Info/Our-Performance/Cardiac-Arrest-Annual-Report/>



10

Provide a culture of excellence

To achieve change and a culture of excellence, St John relies on evidence gathered through research and audit. The St John Clinical Audit and Research Team frequently publishes in peer reviewed journals, presents at leadership meetings, analyses data in conjunction with Medical Directors and uses data to inform training.

Publications 2017/18

Gender and survival from out-of-hospital cardiac arrest: a New Zealand registry study.

Dicker B, Conaglen K, Howie G.
Emerg Med J. 2018 Jun;35(6):367-371. doi: 10.1136/emered-2017-207176. Epub 2018 Apr 16.

Incidence and outcomes of out-of-hospital cardiac arrest: A New Zealand perspective.

Dicker B, Davey P, Smith T, Beck B.
Emerg Med Australas. 2018 Oct;30(5):662-671. doi: 10.1111/1742-6723.12966. Epub 2018 Mar 23.

Regional variation in the characteristics, incidence and outcomes of out-of-hospital cardiac arrest in Australia and New Zealand: Results from the Aus-ROC Epistry.

Beck B, Bray J, Cameron P, Smith K, Walker T, Grantham H, Hein C, Thorowgood M, Smith A, Inoue M, Smith T, Dicker B, Swain A, Bosley E, Pemberton K, McKay M, Johnston-Leek M, Perkins GD, Nichol G, Finn J; Aus-ROC Steering Committee.
Resuscitation. 2018 May;126:49-57. doi: 10.1016/j.resuscitation.2018.02.029. Epub 2018 Mar 2.

The use of trained volunteers in the response to out-of-hospital cardiac arrest – the GoodSAM experience.

Smith CM, Wilson MH, Ghorbangholi A, Hartley-Sharpe C, Gwinnutt C, Dicker B, Perkins GD.
Resuscitation. 2017 Dec;121:123-126. doi: 10.1016/j.resuscitation.2017.10.020. Epub 2017 Oct 24.

Outcomes

Adult outcome from all-cause cardiac arrest

The results from the St John OHCA Registry show an event survival rate (ROSC sustained to hospital handover) of 28%. This is similar to previous reporting periods as shown in Figure 16.

The rate of survival in adults where resuscitation was attempted was 13%. This rate remains similar to previous years (Figure 16).

Utstein Comparator Group

The international benchmarking of OHCA outcomes compares outcomes for a specific group of patients. This subgroup is referred to as the Utstein Comparator Group and requires the following criteria to be met: all-cause, resuscitation attempted, shockable presenting rhythm, bystander witnessed and excluding EAS personnel witnessed events.

In the current reporting period, there were 529 cardiac arrests attended by St John 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 survival was 32% (Figure 17). This result is benchmarked against other services within the executive summary (Table 3).

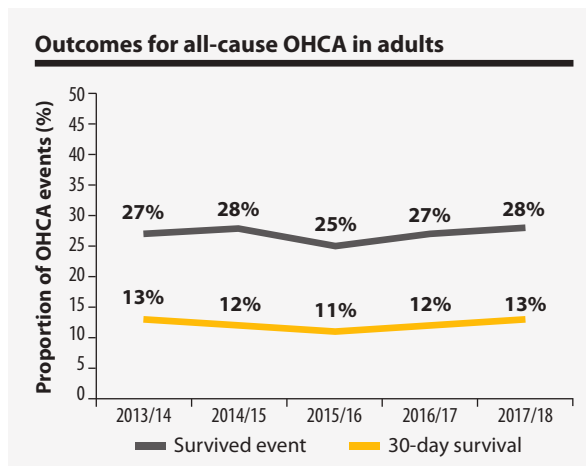


Figure 16: Outcomes for all-cause OHCA (all events, adult, resuscitation attempted)^A.

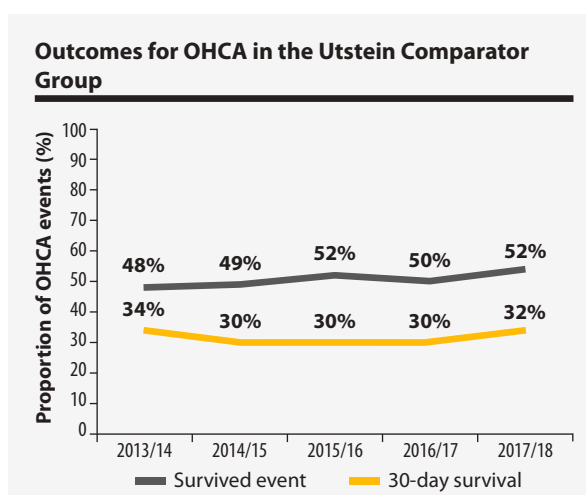


Figure 17: Outcomes of OHCA in the Utstein Comparator Group^B.

- 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 delivered⁴. Therefore, in the majority of OHCA events, it is appropriate to continue resuscitation at the scene until either return of spontaneous circulation (ROSC) occurs or resuscitation is ceased. This is reflected in the scene outcomes observed in adult patients where resuscitation was attempted (Figure 18). The overall percentage of patients transported with CPR in place was 2%, transported with ROSC was 28% and died at the scene was 70%.

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.

Adult patients who had resuscitation attempted and presented with a shockable rhythm, had an event survival rate of 46%. This compares with 34% for those in PEA and 9% for those in asystole. Similarly, adult patients presenting with a shockable rhythm had a higher rate of survival of 27%. This compares with 10% for those in PEA and 1% for those in asystole (Figure 19).

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 74% and survival to 30-days was 58% (not shown).

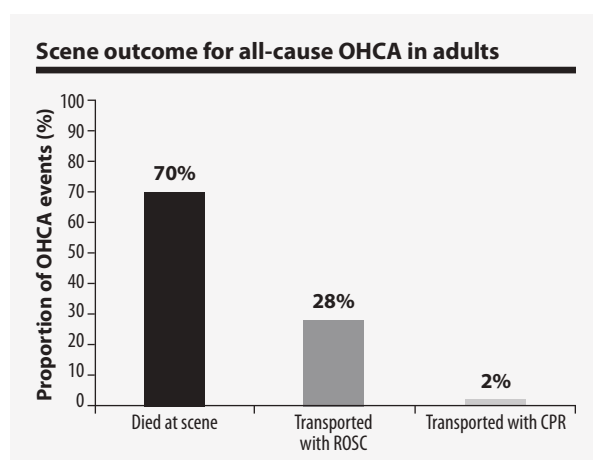


Figure 18: Scene outcome for all-cause OHCA (all events, adult, resuscitation attempted)^A.

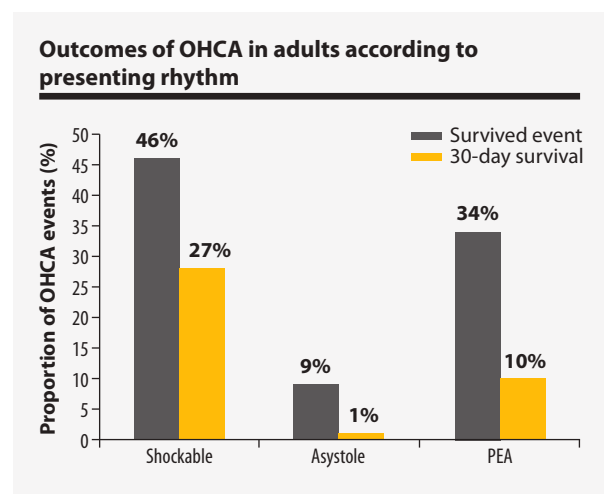


Figure 19: Outcomes for OHCA according to presenting rhythm (all events, adult, resuscitation attempted)^A.

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

Adult outcomes according to age

As the population ages it is important to review as to whether outcomes vary with age. Those who were middle-aged (25–64 years of age) at the time of their cardiac arrest had a higher percentage survival than those who were older or younger (Figure 20).

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 event survival and 30-day survival than European (Figure 21).

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 both lower event survival and 30-day survival (Figure 22).

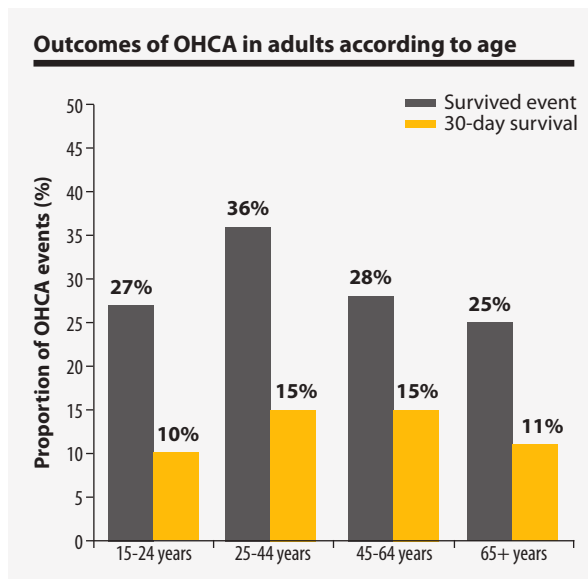


Figure 20: Influence of age on outcomes (all events, adult, resuscitation attempted)^A.

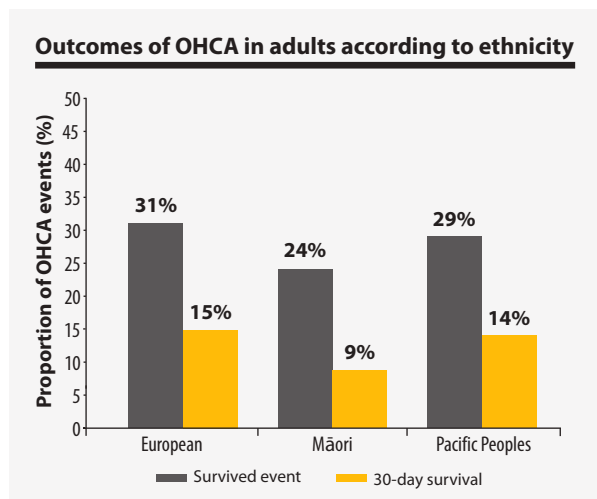


Figure 21: Influence of ethnicity on outcomes (all events, adult, resuscitation attempted)^A.

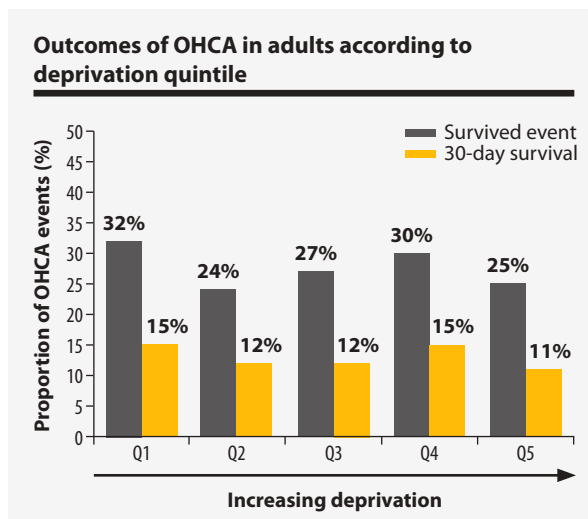


Figure 22: Influence of deprivation on outcomes (all events, adult, resuscitation attempted)^{A,B}.

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 home address of the patient at the time of the event.



Outcomes from all-cause OHCA occurring in children

OHCA occurring in children is significantly less likely than in adults. Due to the low incidence of cardiac arrest within the 12-month period, outcomes were analysed on cumulative data for a 57-month period (n=529, 1 October 2013 to 30 June 2018).

The precipitating causes of OHCA in children and the factors affecting survival differ markedly from

adults. In children the presenting rhythm is seldom shockable. Only 5% of children who had resuscitation attempted had a shockable rhythm. The most common precipitating event for OHCA in children is Sudden Unexpected Death in Infancy (SUDI) from which there was one survivor. Overall event survival for children where resuscitation was attempted by EAS personnel was 16% and survival to 30-days was 9% (not shown)^A.

Conclusion

The data presented in this report indicates that the service provided by St John in treating OHCA continues to be of a high quality and compares favourably with other similar emergency ambulance services internationally.

The data in this report will drive discussion on clinical improvements as part of ongoing service

planning and continual improvement within St John. As a result, new processes, technologies and research strategies may be implemented and the impact of these strategies will be measured. Measuring changes in outcomes year-on-year enables St John to improve the treatment of OHCA, ultimately leading to better patient survival rates. ■

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



Abbreviations

AED	Automated external defibrillator	ICP	Intensive care paramedic
CAD	Computer aided dispatch	OHCA	Out-of-hospital cardiac arrest
CPR	Cardiopulmonary resuscitation	PEA	Pulseless electrical activity
DHB	District Health Board	PRIME	Primary response in medical emergencies
EAS	Emergency ambulance service	ROSC	Return of spontaneous circulation
ECG	Electrocardiogram	SUDI	Sudden unexpected death in infancy
EMS	Emergency medical services	VF	Ventricular fibrillation
EMT	Emergency medical technician	VT	Ventricular tachycardia

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 St John EAS personnel attended regardless of whether emergency treatment was provided.
EAS personnel	Where St John 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 normal 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. (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.

The St John New Zealand Registry Group

St John steering committee

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Director of Clinical Operations

Dr Tony Smith

Medical Director

Dr Craig Ellis

Deputy Medical Director

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