Queensland Government

2021-22 Annual Report

Out of Hospital Cardiac Arrest & Prehospital ST-segment Elevation Myocardial Infarction

Queensland Ambulance Service

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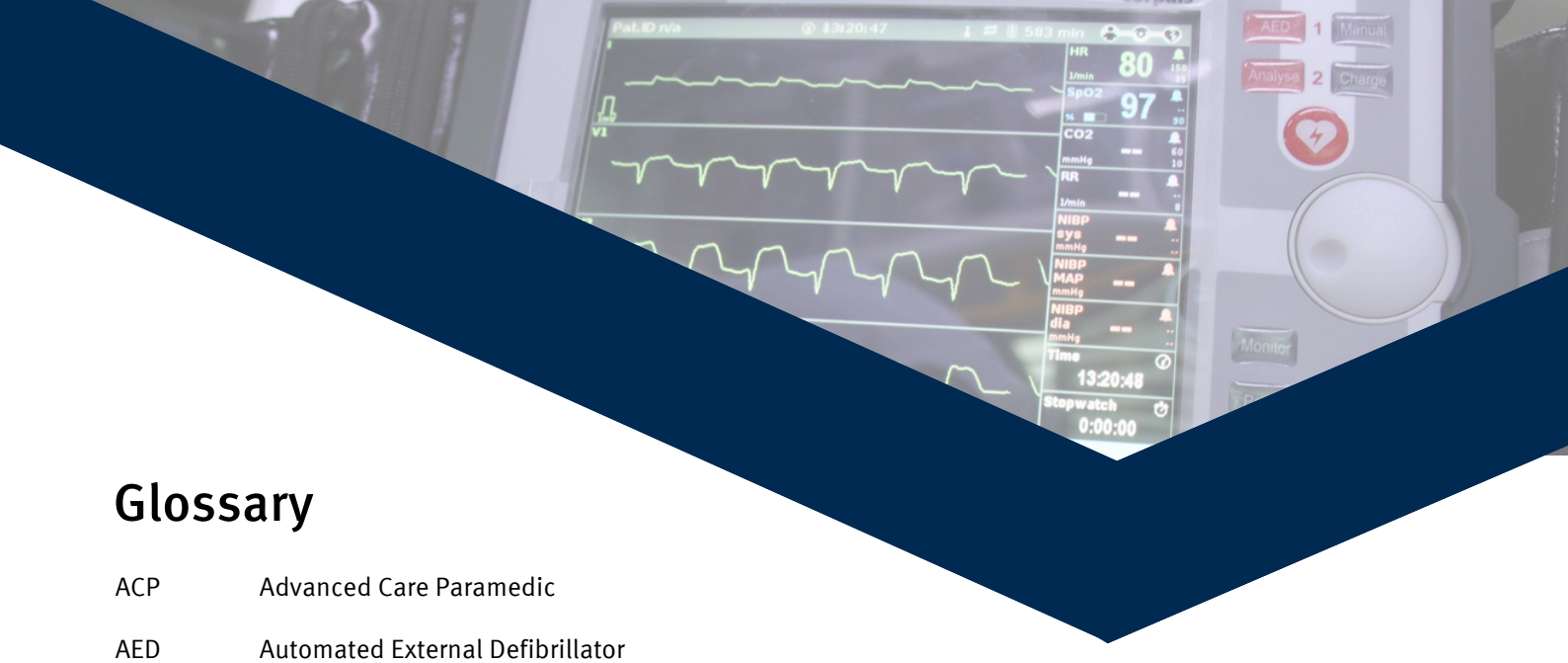

Glossary

ACP	Advanced Care Paramedic
AED	Automated External Defibrillator
CARES	Cardiac Arrest Registry to Enhance Survival
CCL	Cardiac Catheter Laboratory
CCP	Critical Care Paramedic
CPR	Cardiopulmonary Resuscitation
DCARF	Death and Cardiac Arrest Report Form
eARF	Electronic Ambulance Report Form
ECG	Electrocardiogram
EDC	Emergency Data Collection
EMD	Emergency Medical Dispatcher
FY	Financial Year
IQR	Interquartile Range
QHAPDC	Queensland Hospital Admitted Patient Data Collection
OHCA	Out-of-Hospital Cardiac Arrest
OHCAR	Out-of-Hospital Cardiac Arrest Register
PCI	Percutaneous Coronary Intervention
QAS	Queensland Ambulance Service
ROSC	Return of Spontaneous Circulation
SIDS	Sudden Infant Death Syndrome
STEMI	ST-segment Elevation Myocardial Infarction
USA	United States of America

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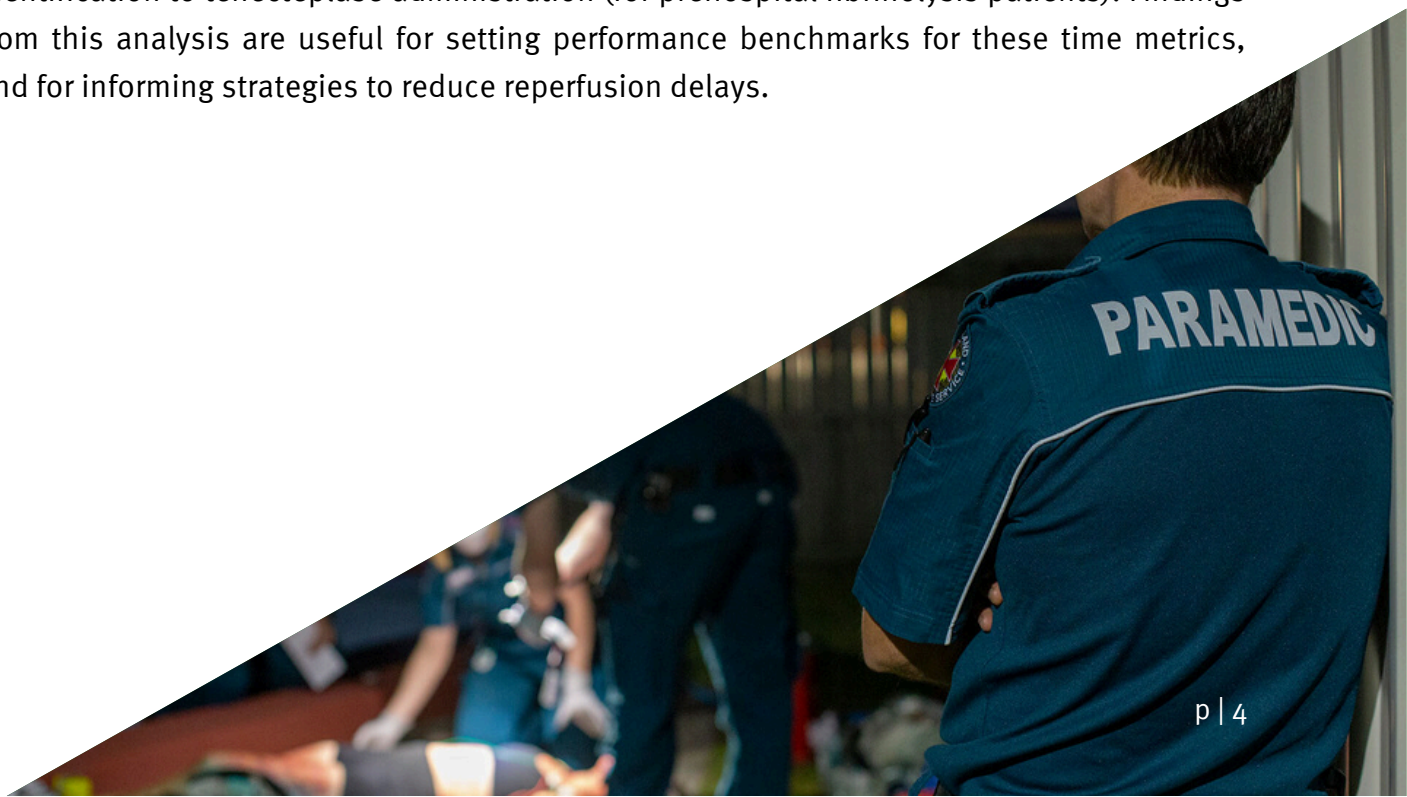
About this report

This report describes the characteristics, emergency ambulance response, management, and outcomes of two important groups of cardiac patients attended by Queensland Ambulance Service (QAS) paramedics in financial year (FY) 2021/22:

1. Out-of-hospital cardiac arrest (OHCA), and
2. Prehospital ST-segment elevation myocardial infarction (STEMI).

The QAS is committed to continual service development to further improve the care and outcomes for our patients. Central to the QAS' strategy to improve OHCA survival is the implementation of the Global Resuscitation Alliance "10 Steps to Improve Cardiac Arrest Survival".[1] This report describes the 10 steps, the QAS' existing and planned activities for each step, and opportunities for improvement.

The prognosis of STEMI is highly dependent on reperfusion times. For direct referral for primary percutaneous coronary intervention (direct PCI referral), there has recently been global recognition of the importance of prehospital notification in ensuring timely activation of the cardiac catheter laboratory (CCL). For STEMI patients undergoing prehospital fibrinolysis, minimising delays in tenecteplase administration is critical for ensuring timely reperfusion. This report evaluates the time intervals from prehospital STEMI identification to PCI referral phone call (for direct PCI referral patients) and from prehospital STEMI identification to tenecteplase administration (for prehospital fibrinolysis patients). Findings from this analysis are useful for setting performance benchmarks for these time metrics, and for informing strategies to reduce reperfusion delays.

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Out of Hospital Cardiac Arrest

Key OHCA facts at a glance

Adults (≥ 16 years)

6,217 Cardiac arrests attended

2,379 Resuscitation attempted

Children

135 Cardiac arrests attended

95 Resuscitation attempted

79%
of cardiac arrests occurred at **home**

65% of bystander-witnessed arrests **received bystander CPR**

9min
median response time
both metropolitan and rural

Utstein patient group

44% survived event

28% discharged alive

28% survived to 30 days

Demographics

In FY 2021/22, QAS paramedics attended a total of 6,352 patients. Of these, 2,474 (38.9%) received a resuscitation attempt by paramedics. Key statistics for adults and children are displayed in Figure 1.

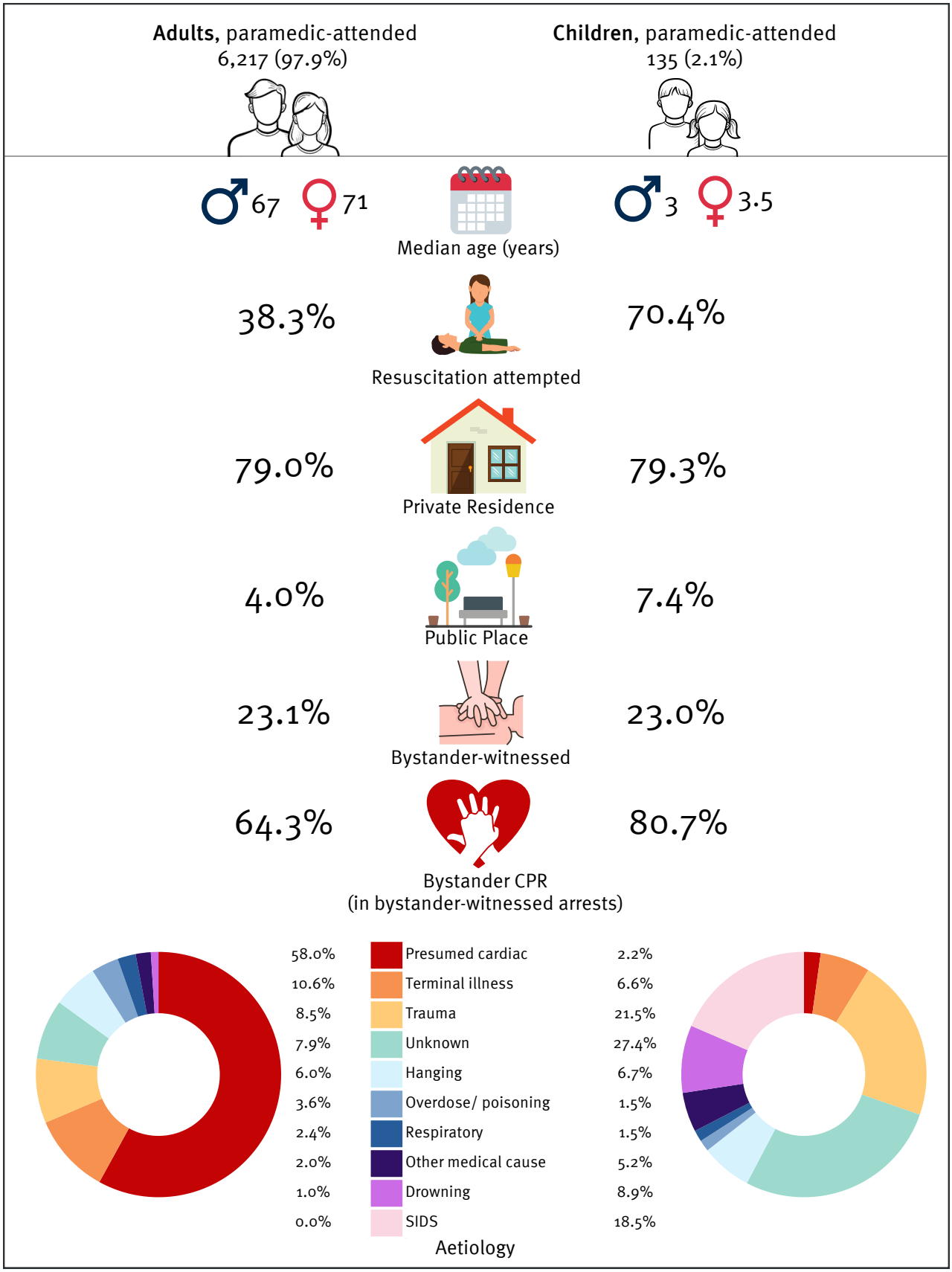


Figure 1. Key characteristics of OHCA patients, adults versus children.

Survival outcomes

Survival outcomes of various patient groups are presented in Figure 2. For all patients who received an attempted resuscitation by paramedics the rates of event survival (return of spontaneous circulation [ROSC] that is sustained to hospital arrival), survival to hospital discharge, and 30-day survival were 26.6%, 11.6%, and 11.4%, respectively. As expected, paramedic-witnessed arrests had the highest survival rates, with event survival, survival to discharge, and 30-day survival rates being 43.8%, 31.1%, and 29.5%, respectively (Figure 2).

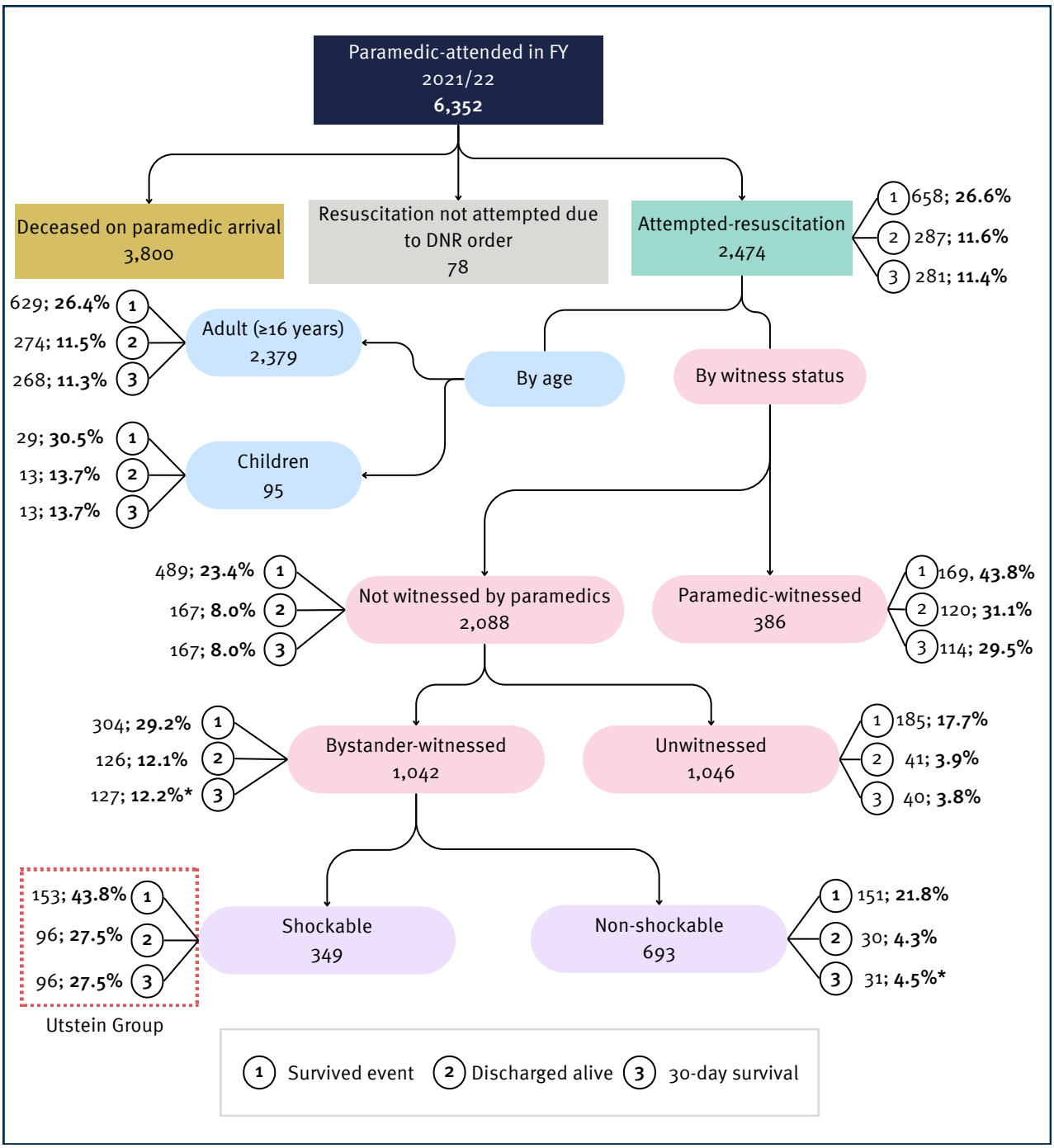


Figure 2. Survival rates of different patient groups. **30-day survival was higher than survival to hospital discharge due to one patient staying in the hospital for more than 30 days and deceased on discharge.*

In FY 2021/22, there were 349 paramedic-attended cardiac arrests that met the Utstein criteria (all-cause, attempted-resuscitation, initial shockable rhythm, bystander-witnessed). For this patient group, the rates of event survival, survival to discharge, and 30-day survival were 43.8%, 27.5%, and 27.5%, respectively (Figure 2). Table 1 benchmarks QAS survival figures against those of other ambulance services in Australia, New Zealand, and internationally for the Utstein patient group.

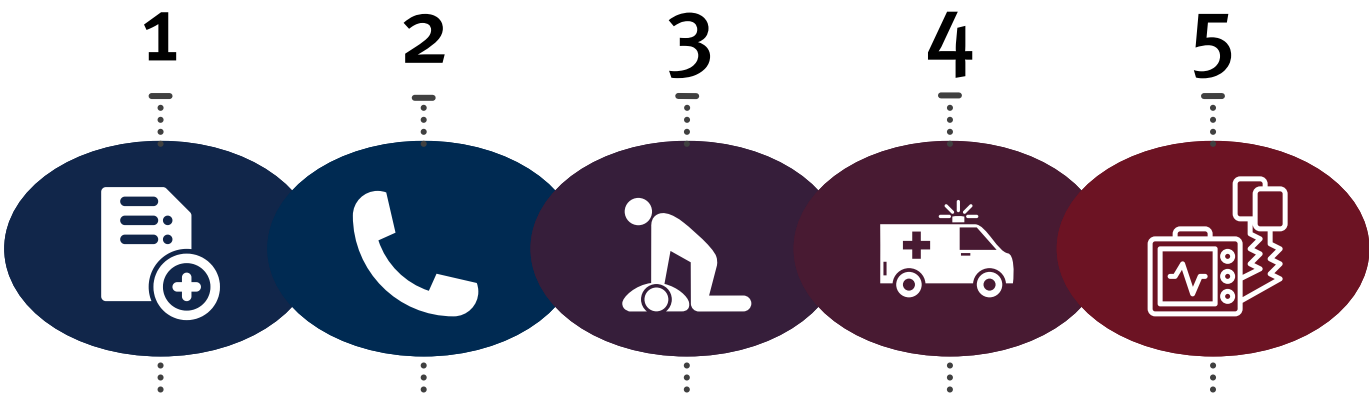
Table 1. Survival rates for the Utstein patient group from other ambulance services

Ambulance service	Time period	Definition of Utstein group	Survived event (%)	Discharged alive (%)	30-day survival (%)
Queensland Ambulance Service	1 July 2021 – 30 June 2022	All-age All-cause Attempted-resuscitation Bystander-witnessed Initial shockable rhythm	43.8	27.5	27.5
Hato Hone St John (New Zealand)[2]	1 July 2021 – 30 June 2022	≥ 15 year old All-cause Attempted-resuscitation Bystander-witnessed Initial shockable rhythm	43.0		29.0
Wellington Free Ambulance (New Zealand)[3]	1 July 2021 – 30 June 2022	≥ 15 year old All-cause Attempted-resuscitation Bystander-witnessed Initial shockable rhythm	50.0		32.0
Ambulance Victoria[4]	1 July 2021 – 30 June 2022	All-age All-cause Attempted-resuscitation Bystander-witnessed Initial shockable rhythm	60.0	34.0	
St John Western Australia[5]	Calendar 2021	All-age All-cause Attempted-resuscitation Bystander-witnessed Initial shockable rhythm	48.0		33.9
Seattle & King County (USA)[6]	Calendar 2021	All-age Non-traumatic Attempted-resuscitation Bystander-witnessed Initial shockable rhythm		46.0	
CARES (30 state-based registries in the USA)[7]	Calendar 2022	All-age Non-traumatic Attempted-resuscitation Bystander-witnessed Initial shockable rhythm	48.9	30.7	
Irish OHCAR[8]	Calendar 2021	› 17 year old Medical cause Attempted-resuscitation Bystander-witnessed Initial shockable rhythm	37.0	25.0	

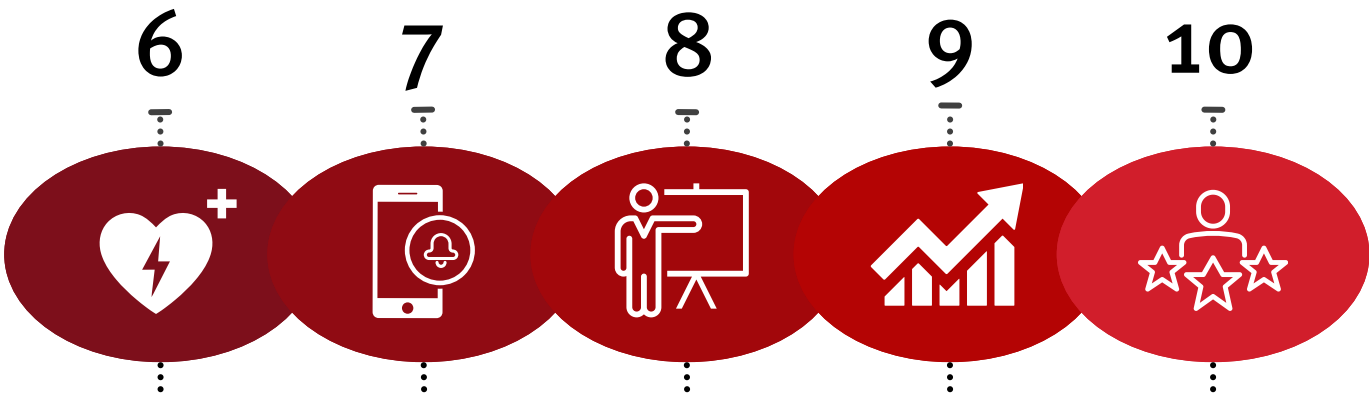
The Global Resuscitation Alliance

10 Steps to Improve Cardiac Arrest Survival

The Global Resuscitation Alliance is a consortium of renowned international organisations, emergency medical services, and resuscitation experts. The goal of this global network is to identify and promote best practices to improve OHCA survival, including the "10 Steps to Improve Cardiac Arrest Survival" developed by a Resuscitation Academy in Seattle (United States).[1] The QAS is committed to improving OHCA survival, and runs various strategies that align with the "10 Steps to Improve Cardiac Arrest Survival".



1. Establish a cardiac arrest registry
2. Begin telephone-CPR with ongoing training and quality improvement
3. Begin high-performance paramedic CPR with ongoing training and quality improvement
4. Begin rapid dispatch
5. Measure professional resuscitation using the defibrillator recording



6. Begin an AED program for all first responders, including police officers, guards, & other security personnel
7. Use smart technologies to extend CPR and public access defibrillation programs to notify volunteer bystanders who can respond to nearby arrest to provide early CPR and defibrillation
8. Make CPR and AED training mandatory in School and the Community
9. Work toward accountability
10. Work toward a Culture of Excellence

1 Establish a cardiac registry

The QAS OHCA Collection was established in 1999, and to-date has more than 100,000 cases within. It is a state-wide, population-based database that prospectively collects data from all consecutive OHCA patients attended by the QAS. Comprehensive data collection is the key to measuring and understanding survival outcomes, in order to lead improvements.

Data in the Collection is recorded by the attending clinicians using standardised digital data collection forms, supplemented with data from the Computer-Aided Dispatch system (Figure 3). Through routine data linkage, the OHCA Collection is supplemented with in-hospital and survival data from the Queensland Hospital Admitted Patient Data Collection, the Emergency Data Collection, and the Death Registrations from the Queensland Registry of Births, Deaths and Marriages (Figure 3).

The veracity of the database is maintained through a rigorous process to ensure accuracy and consistency. The data are subject to a comprehensive cleaning process, where missing data are identified and recovered where possible, and inconsistent or conflicting data elements are manually reviewed and corrected. The Collection contains more than 140 variables, including internationally standardised Utstein-style descriptors. Ongoing systematic analysis of data has been critical for service evaluation and quality improvement. The Collection also serves as the basis for transparency of performance via publicly accessible annual reports and research studies.

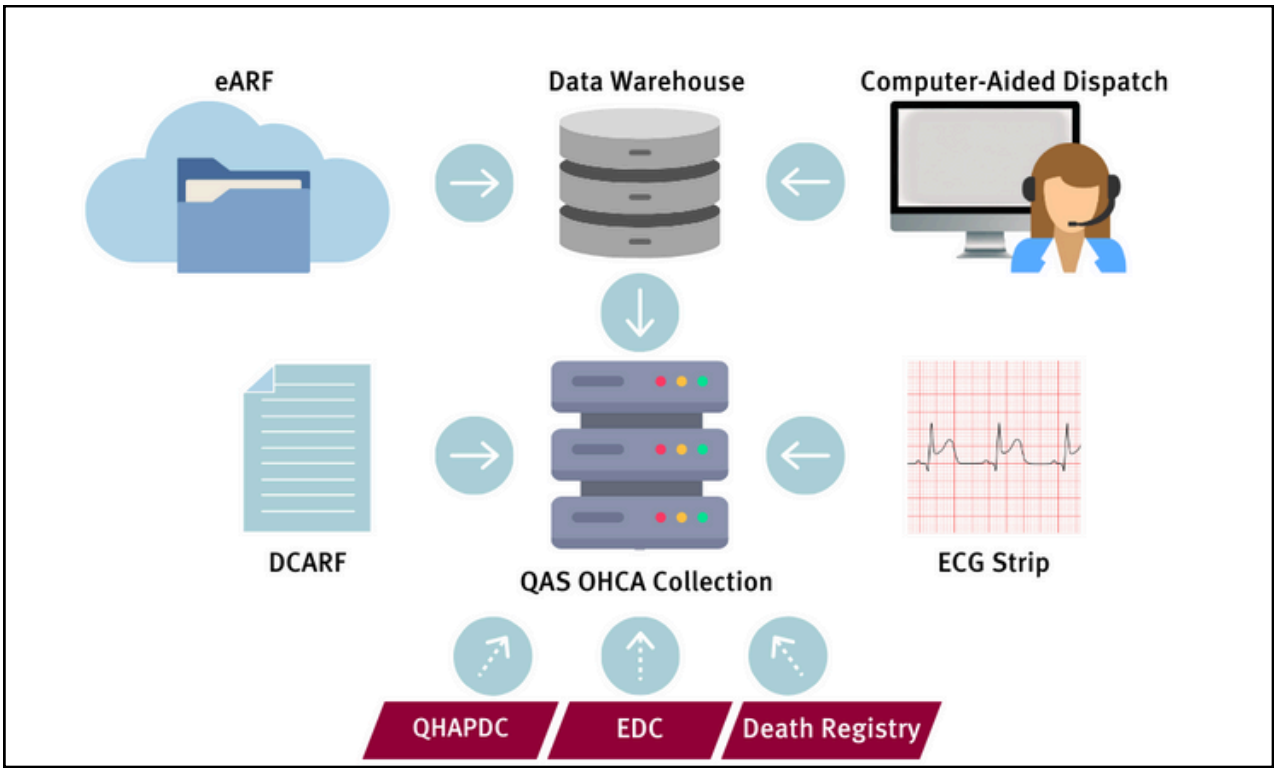
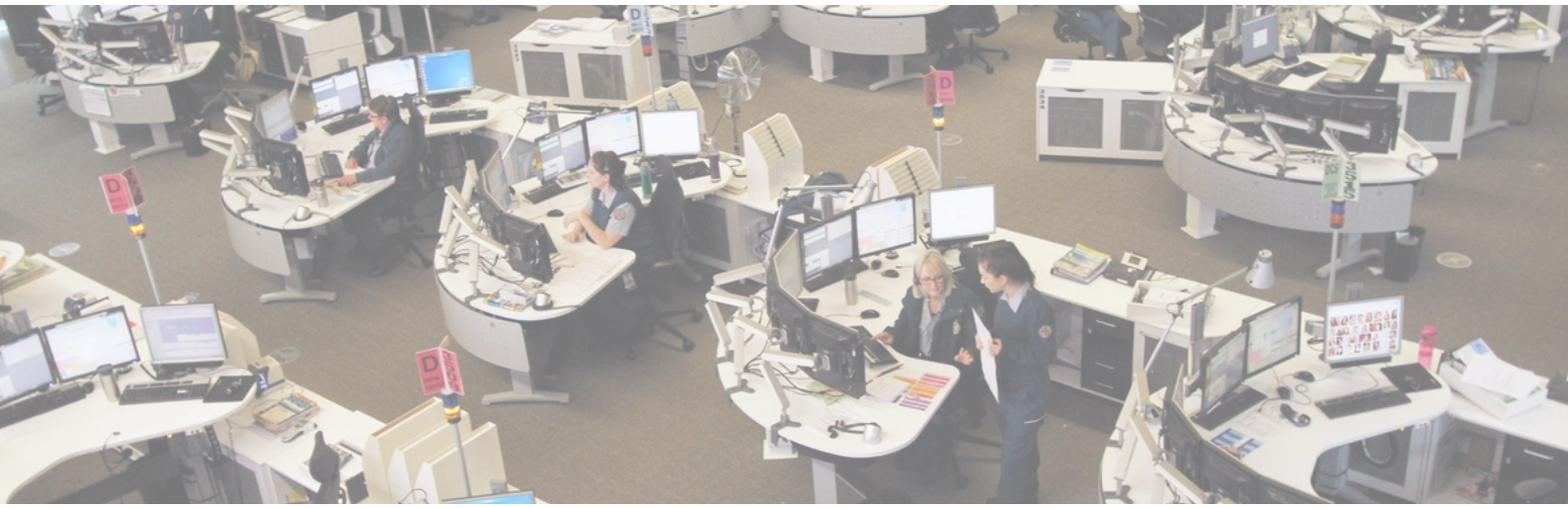


Figure 3. Primary data sources of the QAS OHCA Collection. Broken arrows represent data sources external to the QAS.

2 Begin telephone-CPR with ongoing training and quality improvement

Emergency medical dispatchers (EMDs) are the critical first link in the Chain of Survival. EMDs identify cardiac arrest and provide instructions to the caller over the phone on how to perform CPR (dispatcher-assisted CPR). This plays a pivotal role in increasing the rates of early bystander CPR and outcomes.[9]

Dispatcher-assisted CPR is in place at the QAS, to support community members to deliver CPR whilst awaiting arrival of paramedics. To support evaluation and ongoing development of this approach, the service intends to introduce the following routine metrics: percentage of OHCA cases recognised by EMD, time from Triple Zero call to recognition of arrest by EMD, rate of dispatcher-assisted CPR, and time from Triple Zero call to first dispatcher-assisted compression.



3 Begin high-performance paramedic CPR with ongoing training and quality improvement

The QAS is committed to delivering timely, high-quality and patient-focused ambulance services to the community. In order to support the quality of care for persons suffering OHCA, the QAS considers it fundamental to focus on the delivery of excellence in education and training for all QAS clinicians statewide in cardiac arrest management. At the QAS, a program of high-performance CPR training focuses on performing compressions at the proper depth and rate, allowing for full recoil of the chest, and using a team-based approach to keep compression interruptions to a minimum whilst delivering timed defibrillation.

4 Begin rapid dispatch

QAS Operations Centre staff give cardiac arrests the highest priority and dispatch the closest available resource immediately. Minimising the time between when an emergency call is received to when an ambulance arrives at scene (response time) is critical, and this is a key performance indicator for the QAS.

In FY 2021/22, the median response time was 9 minutes in both metropolitan and rural areas for OHCA where resuscitation was attempted by paramedics (Figure 4). Statewide, response time was within the QAS benchmark of 10 minutes in 58.3% of the patients (metropolitan 57.6%, rural 59.7%) (Figure 4).

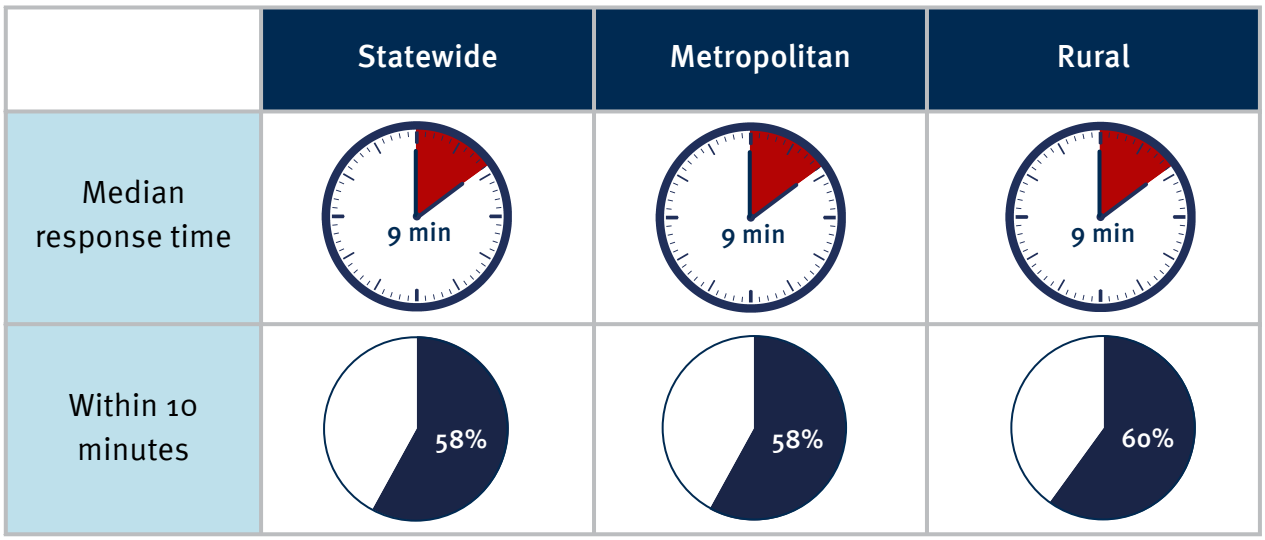


Figure 4. Ambulance response time among attempted-resuscitation patients.

5 Measure professional resuscitation using the defibrillator recording

All QAS Corpuls defibrillators enable capture of metrics on the quality of paramedic-performed CPR (e.g. depth, rate, duration, pause, etc.). Investigations are in progress to enable upload of those data to the cloud, from which the data can be accessed remotely for analysis. Collection and analysis of such data will allow for ongoing evaluation, feedback and improvement.

6 Begin an AED program for all first responders, including police officers, guards, & other security personnel

The QAS is in initial discussion with other government departments and community agencies about the potential to equip responder vehicles with automatic external defibrillators (AED), to provide an augmented first response in the community.

7 Use smart technologies to extend CPR and public access defibrillation programs to notify volunteer bystanders who can respond to nearby arrest to provide early CPR and defibrillation

Smart technologies to alert nearby volunteer responders of a cardiac arrest and identify the location of the nearest AED are currently not implemented by the QAS. However, the QAS runs an AED registry that allows businesses and properties to register their device and its location with the QAS. This allows EMDs to direct someone who has called Triple Zero for a suspected cardiac arrest at the address of a registered AED to retrieve the AED and begin crucial defibrillation before paramedics arrive.

8 Make CPR and AED training mandatory in School and the Community

QAS paramedics and Local Ambulance Committee members have been delivering CPR awareness programs to communities. To further improve public awareness and training in CPR and public access defibrillation, the following may be considered:

- Mandate CPR training at school;
- Mandate the provision of evidence of CPR training for driver licence test/renewal.

9 Work toward accountability

Publication of annual OHCA performance reporting is made available to the public on the QAS website.

10 Work toward a Culture of Excellence

The QAS promotes and embraces a culture of excellence. The QAS vision is for “Excellence in ambulance services”, and it is through this vision that the QAS will achieve timely, quality and appropriate, patient-focused care for all Queenslanders. At the QAS, executives meet regularly to administer and plan all clinical, operational and administrative aspects of the organisation. Routine analysis of data is performed to inform service performance and planning, and the QAS conducts research to push the envelope of knowledge and inform evidence-based practice.

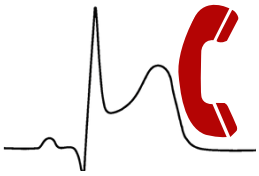
Prehospital ST-segment elevation myocardial infarction (STEMI)

Key STEMI facts at a glance

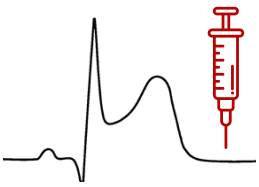
1,309 STEMI patients
identified and treated by paramedics in FY 2021/22

6 minutes
median time from scene arrival to first 12-lead ECG

81%
of patients had first 12-lead ECG within 10 minutes of scene arrival



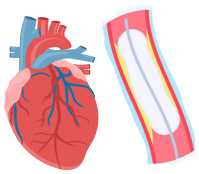
20 minutes
median time from STEMI identification to PCI referral call



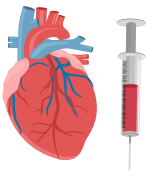
31 minutes
median time from STEMI identification to tenecteplase

53%
of patients had PCI referral call within 20 min of STEMI identification

46%
of patients received tenecteplase within 30 min of STEMI identification



98%
30-day survival rate in direct PCI referral patients



97%
30-day survival rate in prehospital fibrinolysis patients

Demographics and survival outcomes

In FY 2021/22, QAS paramedics identified and treated 1,309 STEMI cases. The majority of patients were males (70.8%), being on average 6 years younger than females (median age 63 versus 69 years). Statewide, 52.3% of patients received direct PCI referral, 11.4% prehospital fibrinolysis, and 36.3% not receiving either reperfusion pathway due to medical contraindications within the QAS reperfusion guidelines.

The median time from paramedic arrival at scene to first 12-lead electrocardiogram (ECG) was 6 minutes (interquartile range [IQR] 3-9). This is the same for both metropolitan and rural areas (Figure 5). Statewide, 81.2% patients had first 12-lead ECG performed within 10 minutes of paramedic arrival at scene (81.8% for metropolitan and 80.2% for rural areas) (Figure 5).

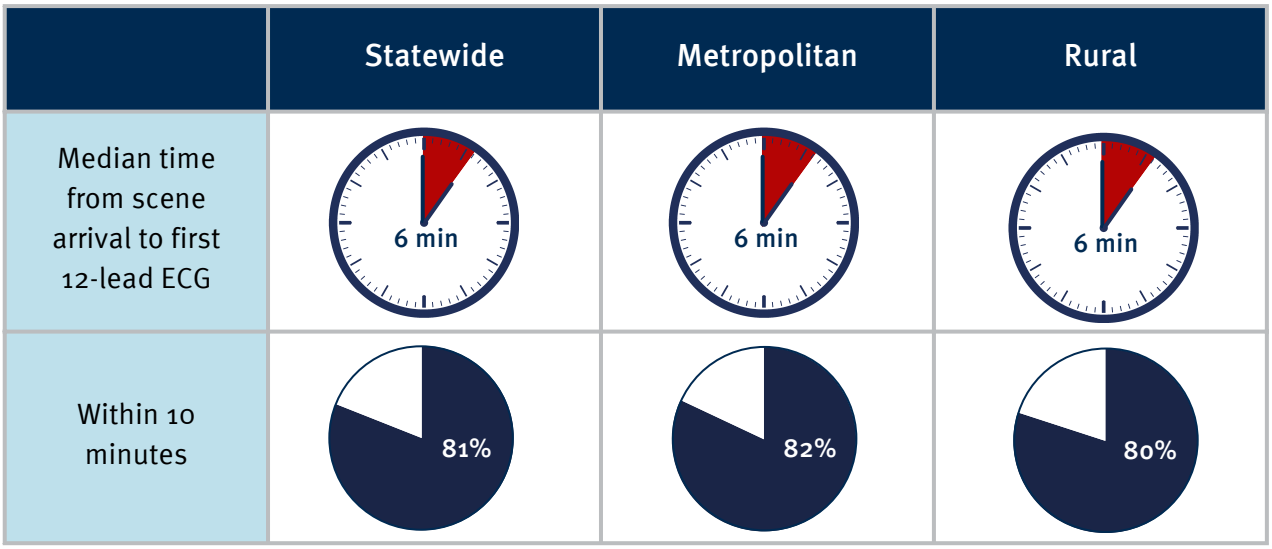


Figure 5. Median time from first paramedic arrival at scene to first 12-lead ECG, and percentage of patients having this time interval within 10 minutes.

The 30-day survival rate for the entire cohort was 92.0%. For direct PCI referral patients 30-day survival was 97.8%, and prehospital fibrinolysis was 97.3%. The corresponding figure for patients who did not receive either reperfusion pathway was 81.9%.

Time from STEMI identification to PCI referral phone call

For direct PCI referral, timely prehospital notification is critical for ensuring early activation of CCL and consequently reducing reperfusion delays. Quantifying delays in prehospital notification, measured from time of STEMI identification through time of PCI referral phone call to the receiving cardiologist, is part of the QAS system performance evaluation.

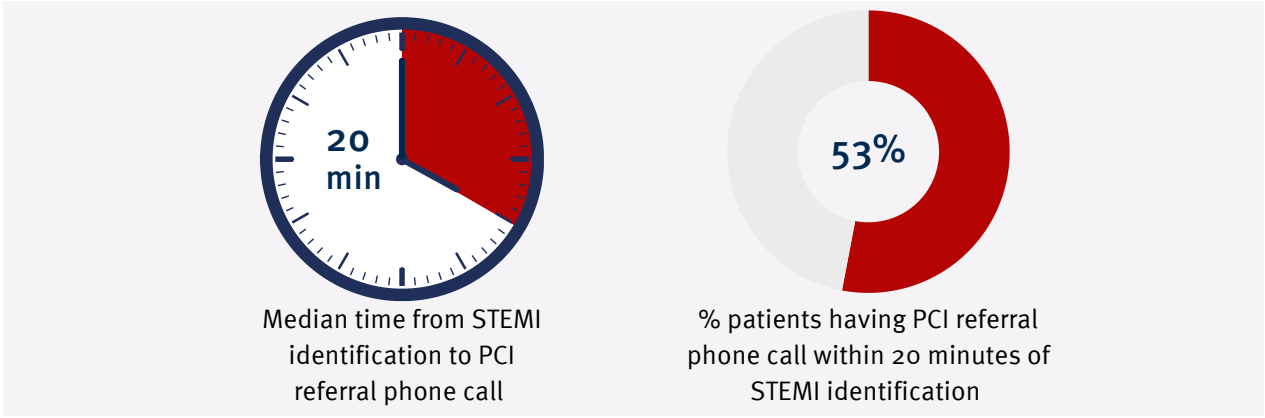


Figure 6. Median time from STEMI identification to PCI referral phone call (left), and percentage of patients having PCI referral phone call within 20 minutes of STEMI identification (right).

For FY 2021/22, the median time from STEMI identification to initiation of the PCI referral phone call was 20 minutes (IQR 13-28) (Figure 6). Waiting for a CCP following STEMI identification is a main driver for delays to referral phone call (Figure 7). It is within the scope of clinical practice for an Advanced Care Paramedic (ACP) to initiate the referral call to a PCI facility prior to the arrival of a Critical Care Paramedic (CCP).

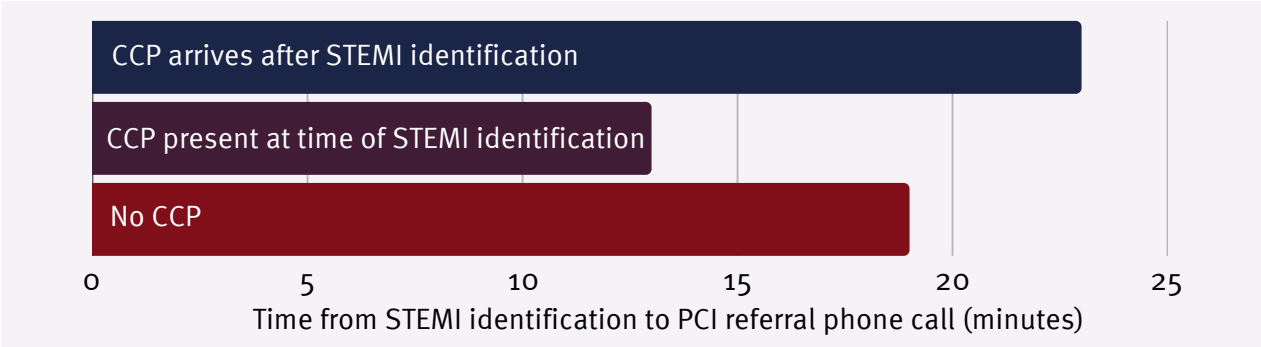


Figure 7. Time from STEMI identification to direct PCI referral phone call, by timing of CCP arrival.

For FY 2021/22, 53.3% of patients had a PCI referral phone call initiated within 20 minutes of STEMI identification (Figure 6). The QAS has set a target to achieve 70% of patients having PCI referral call made within 20 minutes of STEMI identification. The organisation aims to achieve this target through the following:

-Upskilling ACP proficiency and confidence in STEMI recognition and PCI phone referral;

-Streamlining the PCI referral patient checklist;

-Fostering ongoing relationship building between the QAS and receiving hospitals.

Time from STEMI identification to tenecteplase administration

Prehospital fibrinolysis with tenecteplase is a life-saving alternative to direct PCI referral when the latter cannot be performed in a timely fashion. Minimising delays in tenecteplase administration is critical for ensuring timely reperfusion.

For FY 2021/22, the median time from STEMI identification to tenecteplase administration was 31 minutes (IQR 24-44) (Figure 8). Of those who had tenecteplase administered, this occurred within 30 minutes of STEMI identification for 45.6% of patients (Figure 8). Regionality (median 30 minutes for metropolitan and 32 minutes for rural) and time of the day (median 32 minutes for 6.00 am – 5.59 pm versus 31 minutes for 6.00 pm – 5.59 am) does not appear to affect the timeframe for tenecteplase administration.

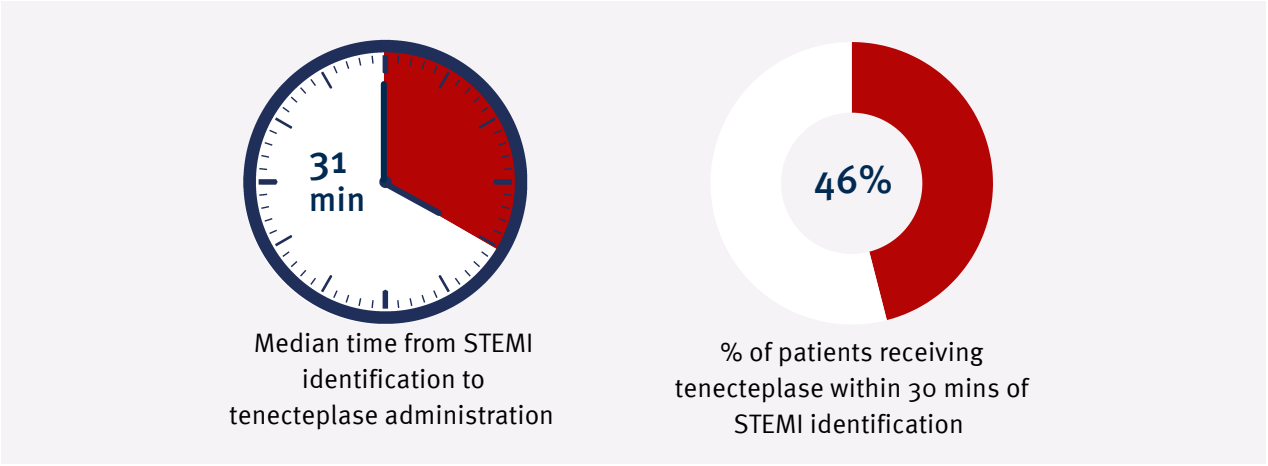


Figure 8. Median time from STEMI identification to tenecteplase adminstration (left), and percentage of patients receiving tenecteplase within 30 minutes of STEMI identification (right).

Conclusions

QAS paramedics continue to deliver outstanding prehospital care to OHCA patients across a vast and diverse geographic region. Our survival outcomes compare favourably with other ambulance jurisdictions nationally and internationally.

Our highly skilled QAS paramedics continue to provide excellent quality prehospital treatment to STEMI patients. Mortality in STEMI patients treated by QAS paramedics is very low, evidencing the effectiveness of our system-wide approach to clinical management that integrates prehospital care into the STEMI treatment cascade.

Contributors

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