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Statewide Cardiac Clinical Network

Queensland Cardiac Outcomes Registry
2017 Annual Report

Interventional Cardiology Audit

Clinical **Excellence** Division
Creating solutions for better healthcare

Queensland Government

Contents

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For all enquiries, please contact the Statewide Cardiac Clinical Informatics Unit at:

scciu@health.qld.gov.au

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1 Message from the SCCN Chair

Introducing this third annual Queensland Cardiac Outcome Registry Report, I am pleased to announce comprehensive engagement across all 8 public cardiac units in Queensland. This report also profiles the addition of two additional modules to the outcomes registry, electrophysiology, and cardiac rehabilitation.

It is the aim of the registry to provide a comprehensive, quality, patient-based profile of cardiac care in Queensland. The benefits of this registry are becoming clear – not only is the registry seeking to provide data, engagement, and confidence to the physicians, surgeons, and clinicians providing care, but it is also providing clear information to administrators, service planners and consumers of health care that first-rate cardiac processes are "standard care". The critical element contributing thus far to the success of this project is that it is clinician-led, and broad. Continuing clinician engagement in supply of data, assessment, and interpretation of data and results of treatment is required for ongoing participation in the registry. The project has also facilitated service collaboration and support for the developing non-metropolitan units and early career practitioners.

In evaluating outcomes, it is now commonly acknowledged that short-term (30-day) outcomes are a very incomplete assessment of the adequacy and quality of medical care. In this report, we have begun to examine more extended follow up of heart failure, structural heart and TAVR patients, for the first time reporting 12-month mortality. It is planned to extend these longer-term outcome profiles to angioplasty and cardiac surgery patients. The registry is also actively investigating the addition of patient-reported outcomes as well as parameters such as length of stay, readmission and repeat presentations for care to supplement the panel of quality outcomes.

With data from consecutive years across all cardiac modalities, it will also now be possible to track multiple patient interventions e.g. revascularisation with both angioplasty and cardiac surgery as well as other cardiac procedures and presentation with subsequent events.

During 2017, the adequacy of outreach services has been a focus for the Queensland Cardiac Clinical Network. QCOR data has allowed us to profile the fact that for the larger metropolitan hospital and health services, 40%–50% of the patients treated live outside the boundaries of the metro health services. This has emphasised the need for the Clinical Network to participate in the provision of pathways for time-critical transfer, referral, and assessment as well as the provision of follow up care to consolidate the results of medical intervention.

2017 has been a very successful year in consolidating the efforts of the Queensland Cardiac Outcomes Registry and the report clearly documents the provision of high-quality safe interventions, very comparable with the results of national and international leaders in cardiac care.

In closing, I give my thanks and congratulations to the clinicians who are maintaining the enthusiasm for this important work, in addition to the QCOR technical and administrative staff without whose assistance this work would not be possible.

Dr Paul Garrahy
Chair
Statewide Cardiac Clinical Network

2 Introduction

The Statewide Cardiac Clinical Network's, Queensland Cardiac Outcomes Registry (QCOR) provides clinicians high quality, valuable clinical data. QCOR draws on multiple data sources to offer superior levels of analysis for stakeholders to use in both clinical decision-making and service improvement within cardiac services in Queensland.

QCOR data collections are governed by clinical committees which report to a central Advisory Committee. This provides direction to the QCOR business unit, the Statewide Cardiac Clinical Informatics Unit (SCCIU). All processes and groups report to the Statewide Cardiac Clinical Network, sponsored by the Clinical Excellence Division within Queensland Health.

A high level of clinical engagement ensures the quality and relevance of the data and, more broadly the Registry itself. QCOR committees are continually evolving and have recently moved to more structured operation and governance.

The SCCIU is responsible for the operation and data management of the QCOR, including data reporting and analysis for clinicians. It also offers data quality and audit functions. A clinician-led unit, the SCCIU coordinates individual QCOR committees.

The SCCIU supports administrative and mandatory reporting such as for financial incentive programs and departmental performance measures. The SCCIU is also responsible for the development and maintenance of registry applications. This QCOR 2017 Annual Report includes two new clinical audits, cardiac rehabilitation and electrophysiology and pacing, with a total of five audits encompassing cardiology and cardiothoracic surgery. With continued development, QCOR aims to support improved health care and outcomes of cardiac patients across Queensland.

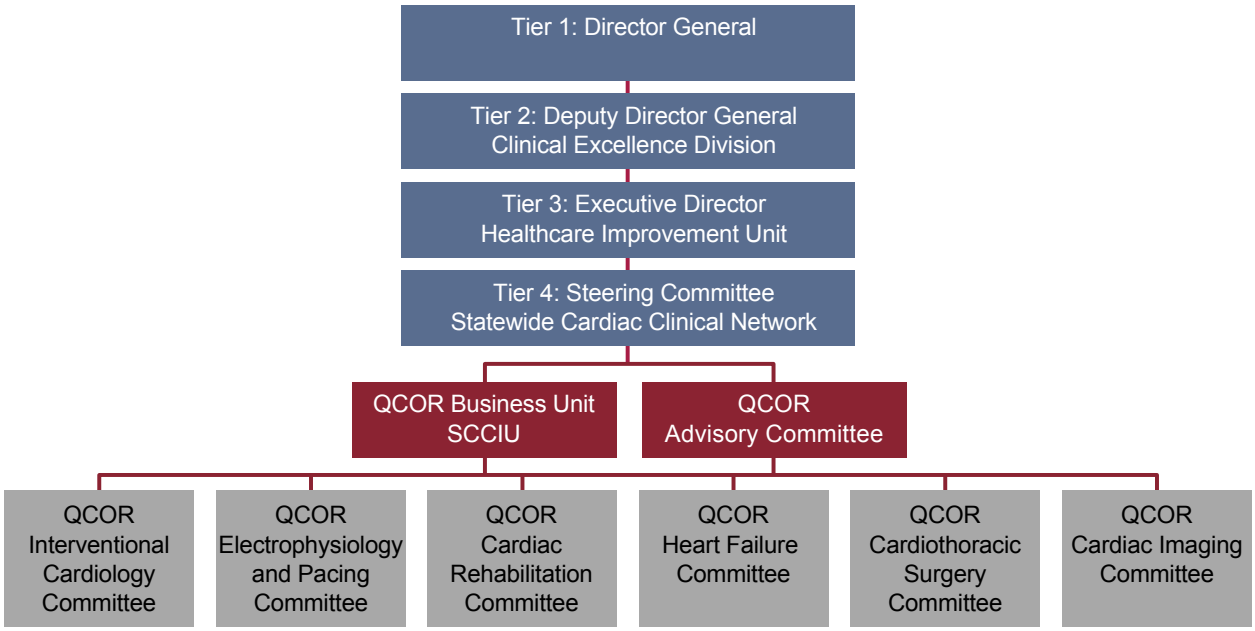


Figure A: Operational structure

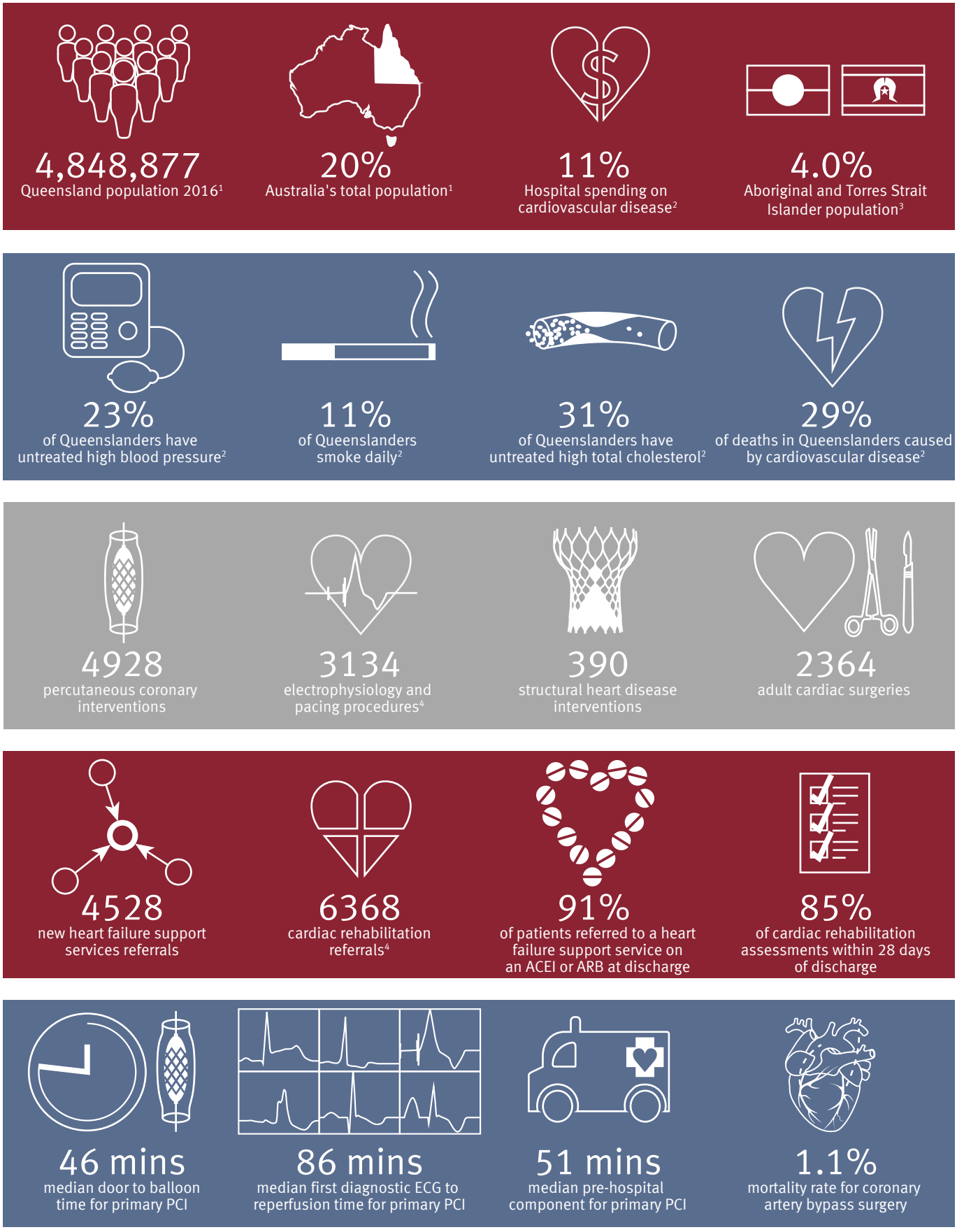


Figure B: QCOR 2017 infographic

3 Executive summary

- 15,293 diagnostic or interventional cases were performed across the 8 cardiac catheterisation laboratory facilities in Queensland public hospitals. Of these, 4,928 were percutaneous coronary intervention (PCI).
- The median age of Aboriginal and Torres Strait Islander patients undergoing PCI is 11 years younger than non- Aboriginal and Torres Strait Islander patients.
- 75% of all PCI patients residing in Queensland had a place of residence within 50km of the nearest PCI capable facility. 12% of patients reside more than 150km from the nearest facility.
- Mortality within 30 days following PCI was 1.9%. Of these 91 deaths, 80% were classed as either salvage or emergency PCI.
- Statewide, a 7-minute improvement in median reperfusion time was observed compared to 2016 PCI analysis.
- Observed rates for cardiac surgery mortality and most results for major morbidities are better than risk scores predict.
- Additions to the cardiac surgery database will allow for calculation of EuroSCORE II, aetiology and microbiology of infective endocarditis, prehospital use of Statins and Anti-hypertensive agents.
- Large proportions of patients have combinations of risk factors, for example obesity and diabetes, smoking and hypertension; emphasising the need for public health programs and primary care for cardiac surgery.
- The reoperation rate for coronary artery bypass graft surgery and deep sternal wound infection in 2017 will be reviewed in detail in the 2018 QCOR annual report.
- 74% of cardiac surgery patients are overweight or obese, including morbid obesity. This will be the focus of the supplement in the next report.
- Seven sites contributed electrophysiology and pacing data with staggered commencement dates for these data collections.
- 3,134 electrophysiology and pacing cases were performed across the 7 participating public Queensland sites.
- 2,131 device procedures and 889 electrophysiology procedures were performed with 114 procedures classed as other.
- The statewide aggregate for all device procedure complications was 4.6%, while all electrophysiology procedures had a 2.6% complication rate overall.
- 6,368 cardiac rehabilitation referrals were made to participating programs in the July–December 2017 period.
- The proportion of Aboriginal and Torres Strait Islander patients receiving a cardiac rehabilitation referral was 6.6%, with wide variation across the state. This population group was more vastly represented in north Queensland.
- A timely cardiac rehabilitation referral (within three days of patient discharge) occurred in 94% of cases.
- Of the timely referrals, a timely cardiac rehabilitation assessment (within 28 days of discharge) occurred in 85% of cases.
- There were 4,528 new heart failure support service referrals in 2017 (13% increase from 2016).
- Benchmarks were achieved for clinical indicators related to timely follow-up of referrals, assessment of left ventricular function, and prescription of angiotensin-converting-enzyme inhibitor or angiotensin II receptor blockers and appropriate beta blockers (bisoprolol, carvedilol, metoprolol sustained release, or nebivolol).
- Beta blocker titration was below recommended benchmarks with only 34% achieving target doses and 70% achieving target or maximum tolerated dose within 6 months from referral.
- Outcomes for the 2016 inpatient referrals highlights substantial disease burden with 14% dying and 58% rehospitalised within 12 months.
- Days alive and out of hospital analysis reveals over 90,000 days lost due to death or hospitalisation in the 2,491 inpatient referral cohort over the following 12 months.

4 Acknowledgements and authors

This collaborative report was produced by the Statewide Cardiac Clinical Informatics Unit, audit lead for the Queensland Cardiac Outcomes Registry for and on behalf of the Statewide Cardiac Clinical Network.

The work of the Queensland Cardiac Outcomes Registry would not be possible without the continued support and funding from the Clinical Excellence Division, Queensland Health. This publication draws on the expertise of many people. In particular, staff from the Statistical Services Branch the Healthcare Improvement Unit and the Queensland Ambulance Service within the Department of Health and Emergency Services each make significant contributions to ensure the success of the program. Furthermore, the tireless work of clinicians who contribute and collate quality data, as part of providing quality patient care, ensures credible analysis, and monitoring of the standard of cardiac services in Queensland.

Interventional Cardiology

Dr Tan Doan
- Research Fellow, Information Support, Research and Evaluation, Queensland Ambulance Service

Dr Paul Garrahy
- Director of Cardiology, Princess Alexandra Hospital
- Chair, Statewide Cardiac Clinical Network

Dr Christopher Hammett
- Interventional Cardiologist, Royal Brisbane and Women's Hospital

A/Prof Richard Lim
- Interventional Cardiologist, Princess Alexandra Hospital

Dr Rohan Poulter
- Director of Cardiology, Sunshine Coast University Hospital

Mr Marcus Prior
- Principal Project Manager, Statewide Cardiac Clinical Informatics Unit

A/Prof Atifur Rahman
- Interventional Cardiologist, Gold Coast University Hospital

Mr Brett Rogers
- Statewide Reperfusion Coordinator, Queensland Ambulance Service

Mr Michael Savage
- Consultant Cardiac Physiologist, The Prince Charles Hospital

Dr Ian Smith
- Biostatistician, Statewide Cardiac Clinical Informatics Unit

Dr Gregory Starmer
- Director of Cardiology, Cairns Hospital
- Chair, QCOR Interventional Cardiology Committee

Mr William Vollbon
- Manager, Statewide Cardiac Clinical Informatics Unit

Cardiac Surgery

Dr Christopher Cole
- Cardiothoracic Surgeon, Princess Alexandra Hospital
- Chair, QCOR Cardiothoracic Surgery Committee

Mr Marcus Prior
- Principal Project Manager, Statewide Cardiac Clinical Informatics Unit

Dr Ian Smith
- Biostatistician, Statewide Cardiac Clinical Informatics Unit

Mr William Vollbon
- Manager, Statewide Cardiac Clinical Informatics Unit

Electrophysiology and Pacing

Mr John Betts
- Consultant Cardiac Physiologist, The Prince Charles Hospital

Mr Andrew Claughton
- Advanced Cardiac Physiologist, Princess Alexandra Hospital

Dr Russell Denman
- Director, Electrophysiology and Pacing, The Prince Charles Hospital

Ms Sanja Doneva
- Consultant Cardiac Physiologist, Princess Alexandra Hospital

A/Prof John Hill
- Director, Electrophysiology and Pacing, Princess Alexandra Hospital
- Chair, QCOR Electrophysiology and Pacing Committee

Dr Paul Martin
- Electrophysiologist, Royal Brisbane and Women's Hospital

Mr Marcus Prior
- Principal Project Manager, Statewide Cardiac Clinical Informatics Unit

Mr William Vollbon
- Manager, Statewide Cardiac Clinical Informatics Unit

Cardiac Rehabilitation

Mr Gary Bennett

- Nurse Unit Manager, Chronic Disease, The COACH Program, Health Contact Centre

Dr Johanne Neill

- Staff Specialist, Cardiology, Ipswich Hospital

Ms Kathy O'Donnell

- Clinical Nurse Consultant, Heart Health and Cardiac Rehabilitation Program, Gold Coast Hospital and Health Service

Ms Samara Phillips

- Project Manager, Statewide Cardiac Rehabilitation Project, Statewide Cardiac Clinical Network

Mr Marcus Prior

- Principal Project Manager, Statewide Cardiac Clinical Informatics Unit

Mr William Vollbon

- Manager, Statewide Cardiac Clinical Informatics Unit

Mr Stephen Woodruffe

- Chair, QCOR Cardiac Rehabilitation Committee
- Exercise Physiologist, Ipswich Cardiac Rehabilitation Program

Heart Failure Support Services

A/Prof John Atherton

- Director of Cardiology, Royal Brisbane and Women's Hospital
- Co-chair, QCOR Heart Failure Services Committee

Ms Annabel Hickey

- Statewide Heart Failure Services Coordinator

Ms Tracey Nunan

- Nurse Practitioner, Sunshine Coast University Hospital
- Co-chair, QCOR Heart Failure Services Committee

Ms Robyn Peters

- Nurse Practitioner, Princess Alexandra Hospital

Mr Marcus Prior

- Principal Project Manager, Statewide Cardiac Clinical Informatics Unit

Mr William Vollbon

- Manager, Statewide Cardiac Clinical Informatics Unit

Dr Yee Weng Wong

- Heart Failure and Cardiac Transplant Cardiologist, The Prince Charles Hospital

5 QCOR Committees

Interventional Cardiology

Dr Christopher Hammett
- Interventional Cardiologist, Royal Brisbane and Women's Hospital

A/Prof Richard Lim
- Interventional Cardiologist, Princess Alexandra Hospital

Dr Rohan Poulter
- Director of Cardiology, Sunshine Coast University Hospital

A/Prof Atifur Rahman
- Interventional Cardiologist, Gold Coast University Hospital

Dr Niranjan Gaikwad
- Interventional Cardiologist, The Prince Charles Hospital

Dr Ryan Schrale
- Interventional Cardiologist, The Townsville Hospital

Dr Gregory Starmer (Chair)
- Director of Cardiology, Cairns Hospital

Dr Michael Zhang
- Director of Cardiology, Mackay Base Hospital

Cardiac Surgery

Dr Christopher Cole (Chair)
- Cardiothoracic Surgeon, Princess Alexandra Hospital

Dr Anand Iyer
- Cardiothoracic Surgeon, The Townsville Hospital

Dr Morgan Windsor
- Director of Thoracic Surgery, Royal Brisbane and Women's Hospital and The Prince Charles Hospital

Dr Anil Prabhu
- Cardiothoracic Surgeon, The Prince Charles Hospital

Dr Andrie Stroebel
- Cardiothoracic Surgeon, Gold Coast University Hospital

Electrophysiology and Pacing

A/Prof Ravinder Batra
- Electrophysiologist, Gold Coast University Hospital

Mr John Betts
- Consultant Cardiac Physiologist, The Prince Charles Hospital

Mr Andrew Claughton
- Advanced Cardiac Physiologist, Princess Alexandra Hospital

Dr Russell Denman
- Director, Electrophysiology and Pacing, The Prince Charles Hospital

Ms Sanja Doneva
- Consultant Cardiac Physiologist, Princess Alexandra Hospital

Ms Kellie Foder
- Advanced Cardiac Physiologist, Royal Brisbane and Women's Hospital

A/Prof John Hill (Chair)
- Director, Electrophysiology and Pacing, Princess Alexandra Hospital

Dr Paul Martin
- Electrophysiologist, Royal Brisbane and Women's Hospital

Dr Robert Park
- Electrophysiologist, The Townsville Hospital

Ms Leanne Slater
- Clinical Nurse Consultant EP, Princess Alexandra Hospital

Dr Steve Sutcliffe
- Cardiologist, Cairns Hospital

Cardiac Rehabilitation

Mr Godfrey Martis Ajgaonkar
- Nurse Practitioner (Cardiac), Mt Isa Hospital

Mr Gary Bennett
- Nurse Unit Manager, Chronic Disease, The COACH Program, Health Contact Centre

Ms Jacqueline Cairns
- Cardiac Rehabilitation Coordinator, Cairns Hospital

Ms Yvonne Martin
- Clinical Nurse Consultant, Chronic Disease Brisbane South

Dr Johanne Neill
- Staff Specialist, Cardiology, Ipswich Hospital

Ms Samara Phillips
- Project Manager, Statewide Cardiac Rehabilitation Project, Statewide Cardiac Clinical Network

Mr Ben Shea
- A/Clinical Nurse Consultant, Princess Alexandra Hospital

Ms Deborah Snow
- Clinical Nurse Consultant, Heart Health and Cardiac Rehabilitation Program, Gold Coast Hospital and Health Service

Ms Marie Steer
- Physiotherapist, Complex Chronic Disease Team, Metro North Hospital and Health Service

Mr Stephen Woodruffe (Chair)
- Exercise Physiologist, Ipswich Cardiac Rehabilitation Program

Heart Failure Support Services

Ms Julie Adsett
- Physiotherapist, Royal Brisbane and Women's Hospital

Mr Godfrey Martis
- Nurse Practitioner (Cardiac), Mt Isa Hospital

A/Prof John Atherton (Co-chair)
- Director of Cardiology, Royal Brisbane and Women's Hospital

A/Prof Charles Denaro
- Director of Internal Medicine and Aged Care, Royal Brisbane and Women's Hospital

Ms Tina Ha
- Pharmacist, Princess Alexandra Hospital

Ms Annabel Hickey
- Statewide Heart Failure Services Coordinator, The Prince Charles Hospital

Dr George Javorsky
- Clinical Director, Advanced Heart Failure and Cardiac Transplant Unit, The Prince Charles Hospital

Dr Dariusz Korczyk
- Cardiologist, Princess Alexandra Hospital

Dr Louise McCormack
- Cardiologist, Royal Brisbane & Women's Hospital

Ms Emma McGlynn
- Clinical Nurse Consultant, Princess Alexandra Hospital

Ms Kellie Mikkelsen
- A/Clinical Nurse Consultant, Heart Failure Service, The Prince Charles Hospital

Ms Tracey Nunan (Co-chair)
- Nurse Practitioner (Cardiology), Sunshine Coast University Hospital

Ms Robyn Peters
- Nurse Practitioner (Cardiology), Princess Alexandra Hospital

Ms Serena Rofail
- Pharmacist, Royal Brisbane and Women's Hospital

Ms Menaka Sabaratnam
- Physiotherapist, Gold Coast University Hospital

Ms Angie Sutcliffe
- Nurse Practitioner (Heart failure), Cairns Hospital

Dr Steve Sutcliffe
- Cardiologist, Cairns Hospital

Ms Karen Uhlmann
- Acute Sector Manager, Heart Foundation Representative

Dr Yee Weng Wong
- Cardiologist, The Prince Charles Hospital

6 Future plans

The QCOR report has expanded this year to include two new modules for statewide cardiac rehabilitation and electrophysiology and pacing services. The continued growth and success of the registry can be largely credited to the commitment of participating cardiac clinical staff across the state. This work has presented new opportunities for more sophisticated reporting and analyses.

Over the next year, the focus will remain on delivering enhanced and innovative information solutions to support Queensland clinicians in delivering world-class patient care.

- Through increasing insight into the care provided to Queensland cardiac patients across participating domains, more complete analyses regarding outcomes for patients attending across multiple cardiac services are now feasible. In reports to come, allowing more complete results to provide more complete insights into the quality of care provided to our cardiac patients as they journey between various clinical specialty groups. Areas which have been highlighted as a focus for future reports include outcomes for patients that have undergone percutaneous coronary intervention and then subsequent cardiac surgery and the inter-relationship between interventional and outpatient services.
- A new QCOR Structural Heart Disease module is currently being developed with deployment expected in early 2019. This QCOR module has been developed to provide superior procedure reporting capabilities for structural heart disease interventions, device closure, and percutaneous valve replacement and repair procedures, and will enable future statewide participation in national quality and safety activities for transcatheter aortic valve replacement.
- The Annual Cardiac Surgery Audit continues to identify future enhancement opportunities. This is highlighted by this year's supplementary report on infective endocarditis surgical interventions, which recommends adding detail about the microbiology and aetiology of endocarditis infection to the registry. Given the tremendous impact and associated healthcare costs for patients undergoing repeat valve surgery due to prosthetic valve endocarditis, these additions are clearly warranted. These improvements as well as data fields allowing EuroSCORE II Risk Adjustment will be delivered in late 2018.
- In 2017/18 the QCOR provided data and reporting for the of the State Government funded Quality Incentive Payment for performance in cardiac rehabilitation. The registry will continue to build upon the excellent levels of clinician engagement to deliver a contemporary and evidence-based clinical indicator program to support quality improvement activities in this field. New system capabilities will be deployed over the next few months to allow more comprehensive assessment of patient activity and exercise levels and assist clinicians to perform everyday tasks and patient care.
- Electrophysiology and pacing services across Queensland have participated in their first QCOR review. This follows the delivery of a bespoke reporting application by the Statewide Cardiac Clinical Network's Cardiac Information Solutions Program. The project has seen a staggered uptake of the new application throughout 2017 with the final site beginning direct entry in early 2018. This has resulted in an unprecedented availability of data across services where reporting had been predominately paper-based. The report has identified several areas for improved data quality, while another focus will be to collaborate with electrophysiology and pacing clinicians to deliver a future clinical indicator program.
- Heart failure support services across Queensland have now been contributing to the QCOR quality registry since 2014. Over time, the growth of the registry has allowed more sophisticated analyses to be undertaken. This is highlighted by this year's reporting of statewide heart failure patient outcomes, which identified several priority areas for further development of the registry. Additional data points relating to mineralocorticoid receptor antagonists will be added to the data collection in late 2018, while an early investigation and scoping of a potentially new and expanded QCOR heart failure application is also underway.
- Contributions from the Queensland Ambulance Service (QAS) have been integral to the composition of this report. Collaboration between Queensland Health and QAS has been bolstered with continued investment by both organisations into cardiac outcomes. The future of this partnership is promising with a shared goal of improving patient outcomes and pre-hospital processes for Queenslanders suffering cardiovascular disease.

Interventional Cardiology Audit

7 Message from the QCOR Interventional Cardiology Committee Chair

The third Annual Report of interventional cardiology activity in Queensland sees further expansion and maturation of this clinical registry and, perhaps more importantly, it has become a component of the much broader analysis of cardiac service provision in Queensland. The interventional cardiology services analysed now include procedures performed at all 8 public cardiology catheter labs in Queensland, encompassing 4 metropolitan sites, and 4 regional sites. The geographical challenges associated with delivering tertiary cardiac care are highlighted in this year's report, with one in four people having to travel more than 50km to a cardiac catheter lab. The report also confirms the health "gap" attributable to cardiovascular disease between Indigenous and non-Indigenous Queenslanders, with the median age of Indigenous patients undergoing percutaneous coronary intervention observed to be 11 years younger than non-Indigenous patients.

One of the aims of this registry is to provide meaningful, quality information to facilitate improvements in systems, care and ultimately, outcomes, and it is therefore pleasing to also observe that there has been a year-on-year improvement in the important metric of "time to open artery" for people having an acute heart attack.

With the ongoing evolution of the Queensland Cardiac Outcomes Registry, the compilation and analysis of this ever-increasing volume of data is a significant undertaking, and I would certainly like to express my gratitude to the entire QCOR team, who are committed to quality improvement in cardiac care for all Queenslanders.

Dr Greg Starmer
Chair
QCOR Interventional Cardiology Committee

8 Key findings

This third audit describes key aspects of the care and treatment of cardiac patients receiving percutaneous coronary interventions (PCI) during 2017.

Key findings include:

- 15,293 diagnostic or interventional cases were performed across the 8 cardiac catheterisation laboratory facilities in Queensland public hospitals. Of these, 4,928 were PCI.
- The proportion of patients identified as Aboriginal and Torres Strait Islander again illustrates a stepwise gradient based on geographical area with the highest proportions found in the north of the state and the lowest in the South East corner. This is consistent with previous analyses.
- The median age of Aboriginal and Torres Strait Islander patients undergoing PCI was 11 years younger than non-Aboriginal and Torres Strait Islander patients.
- A large proportion of PCI patients (77%) were classed as having an unhealthy body mass index over 25kg/m^2.
- 75% of all PCI patients residing in Queensland had a place of residence within 50km of the nearest PCI capable facility, while 12% of patients resided more than 150km from the nearest facility.
- The majority of PCI cases (76%) were classed as urgent, emergent or salvage, highlighting the acute and often unstable patient cohort.
- Drug eluting stents (DES) were used in 85% of cases with a range between 63% and 98% across sites.
- PCI for non-ST elevation myocardial infarction (NSTEMI) represented 29% of all cases, with the median time to angiography of 53 hours. Patients presenting to a non-PCI capable facility have a median wait to coronary angiography 31 hours longer than those who present directly to a PCI capable facility (68 hours vs 37 hours).
- There were 1,434 PCI cases following presentation with ST elevation myocardial infarction (STEMI) in 2017, of which 56% were managed by primary PCI.
- Median time to reperfusion from first diagnostic ECG for STEMI patients presenting within 6 hours of symptom onset was 86 minutes (range 70 minutes to 98 minutes across sites). Statewide, a 7 minute improvement in median reperfusion time was observed compared to 2016.
- Median hospital door to device time for STEMI patients presenting within six hours of symptom onset was 46 minutes (range 34 minutes to 60 minutes across sites). There was a 5 minute improvement in median door to device time compared to 2016 analyses.
- Mortality within 30 days following PCI was 1.9%. Of these 91 deaths, 80% were classed as either salvage or emergency PCI.
- Of all cases, 0.49% recorded a major intra-procedural complication. Coronary artery perforation accounted for the majority (0.37%) of these events.
- Radiation doses were found to be under the high dose threshold in 97.9% of PCI cases across all sites and 99.9% of other coronary procedures.

9 Participating sites

During 2017, there were 8 public hospitals offering cardiac catheter laboratory (CCL) services across both metropolitan and regional Queensland. This includes the Sunshine Coast University Hospital (SCUH) which opened in March 2017, with invasive cardiology services moving from Nambour General Hospital (NGH). Cases for NGH for the earlier part of the year are included under SCUH.

Table 1: Participating sites

Site number	Site name	Acronym
1	Cairns Hospital	CH
2	The Townsville Hospital	TTH
3	Mackay Base Hospital	MBH
4	Sunshine Coast University Hospital	SCUH
5	The Prince Charles Hospital	TPCH
6	Royal Brisbane and Women's Hospital	RBWH
7	Princess Alexandra Hospital	PAH
8	Gold Coast University Hospital	GCUH

9.1 Statewide

Patients came from a wide geographical area with the majority of patients residing on the Eastern Seaboard. More than half of all patients were seen at their local Hospital and Health Service (HHS) except for Royal Brisbane and Women's Hospital, who treated 53% patients from outside their HHS boundary.

Total cases included 65 patients from overseas, accounting for 1.3% of all PCI cases across all sites.

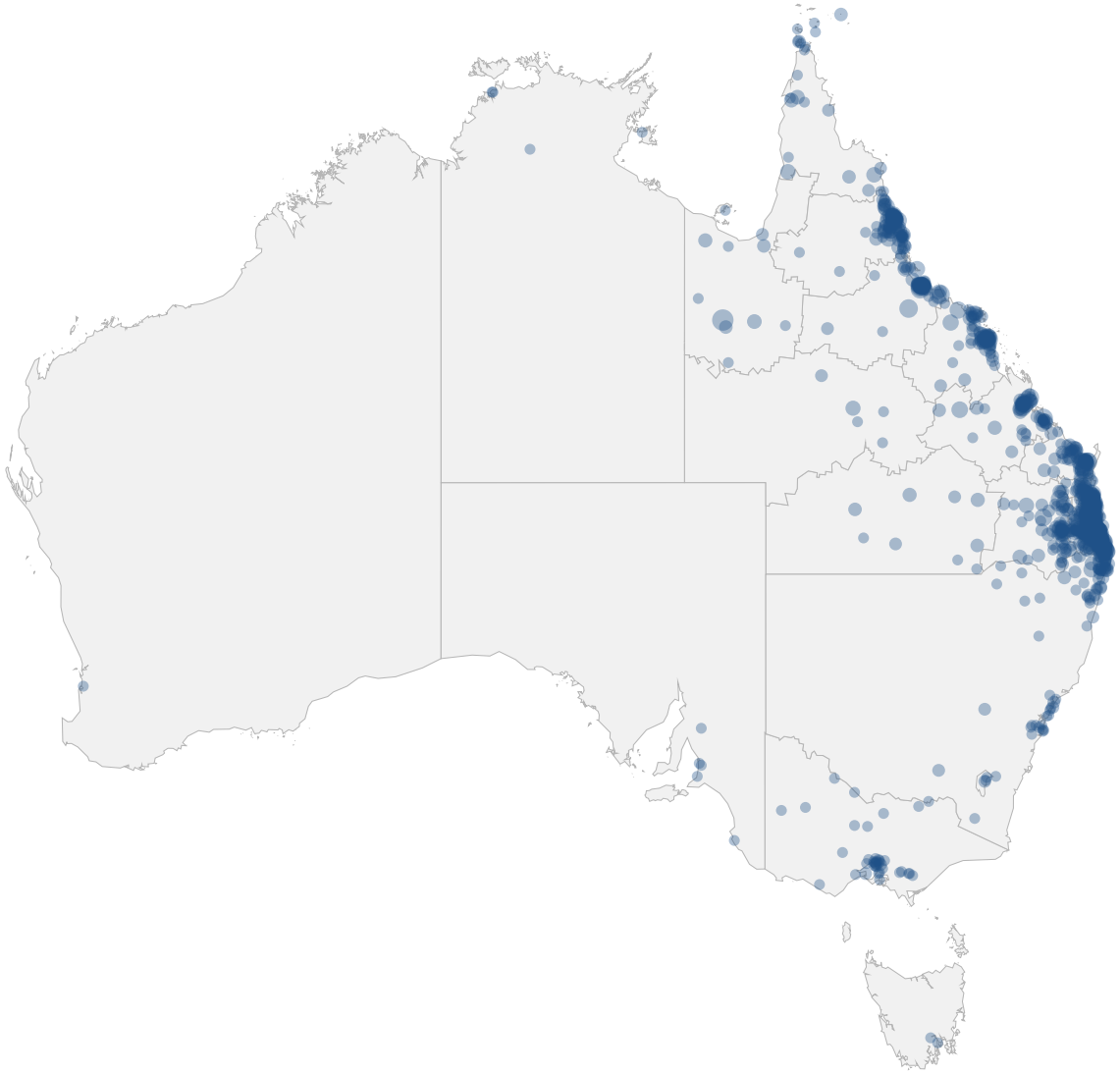


Figure 1: PCI cases by residential postcode

Table 2: Proportion of cases with patient residential postcode within the treating HHS boundaries

Site	Within HHS (%)
Cairns Hospital	80.2
The Townsville Hospital	73.0
Mackay Base Hospital	93.8
Sunshine Coast University Hospital	76.1
The Prince Charles Hospital	62.6
Royal Brisbane and Women's Hospital	47.3
Princess Alexandra Hospital	60.3
Gold Coast University Hospital	73.9

9.2 Cairns Hospital

Figure 2: Cairns Hospital

- Referral hospital for Cairns and Hinterland and Torres and Cape Hospital and Health Services, serving a population of approximately 280,000
- Public tertiary level cardiac services provided at Cairns Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Pacemaker implantations
- One cardiac catheter laboratory with a dedicated service commencing in 2010
- 24/7 PCI service available since April 2015
- 5.4 FTE consultant cardiologists.

9.3 The Townsville Hospital

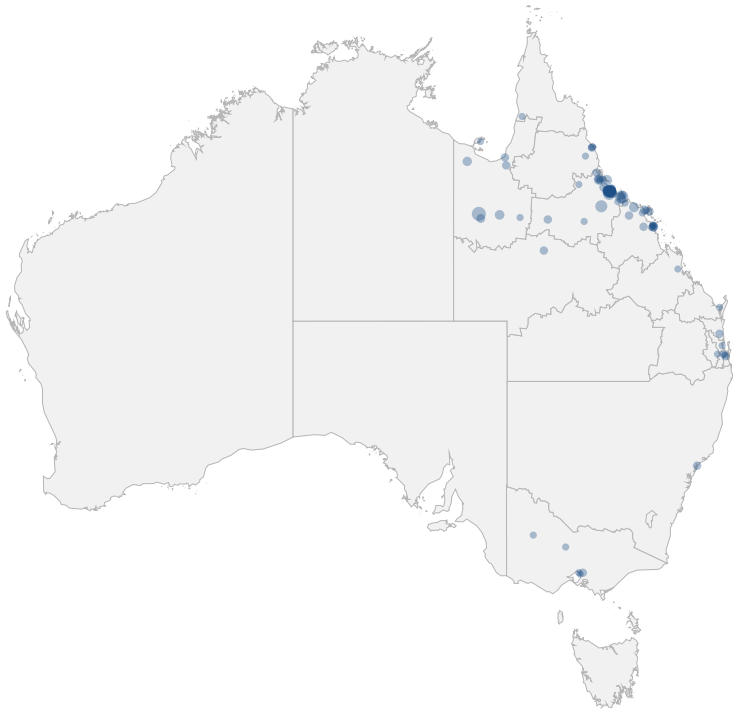


Figure 3: The Townsville Hospital

- Referral hospital for Townsville and North West Hospital and Health Services, serving a population of approximately 295,000
- Public tertiary level cardiac services provided at The Townsville Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
  - Cardiac surgery
- Two cardiac catheter laboratories with a dedicated service commencing in 1994
- 24/7 PCI service available since March 2016
- 7.1 FTE consultant cardiologists

9.4 Mackay Base Hospital

Figure 4: Mackay Base Hospital

- Referral hospital for Mackay and Whitsunday regions, serving a population of approximately 182,000
- Public tertiary level cardiac services provided at Mackay Base Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - ICD and pacemaker implantation
- One cardiac catheter laboratory with a dedicated service commencing in 2014
- 4.6 FTE consultant cardiologists

9.5 Sunshine Coast University Hospital

Figure 5: Sunshine Coast University Hospital

- Referral hospital for Sunshine Coast and Wide Bay Hospital and Health Services, serving a population of approximately 563,000
- Public tertiary level cardiac services provided at SCUH include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
- Three cardiac catheter laboratories with a dedicated service commencing in 2017
- 24/7 PCI service available since March 2017. Replaces NGH
- 9.1 FTE consultant cardiologists

9.6 The Prince Charles Hospital

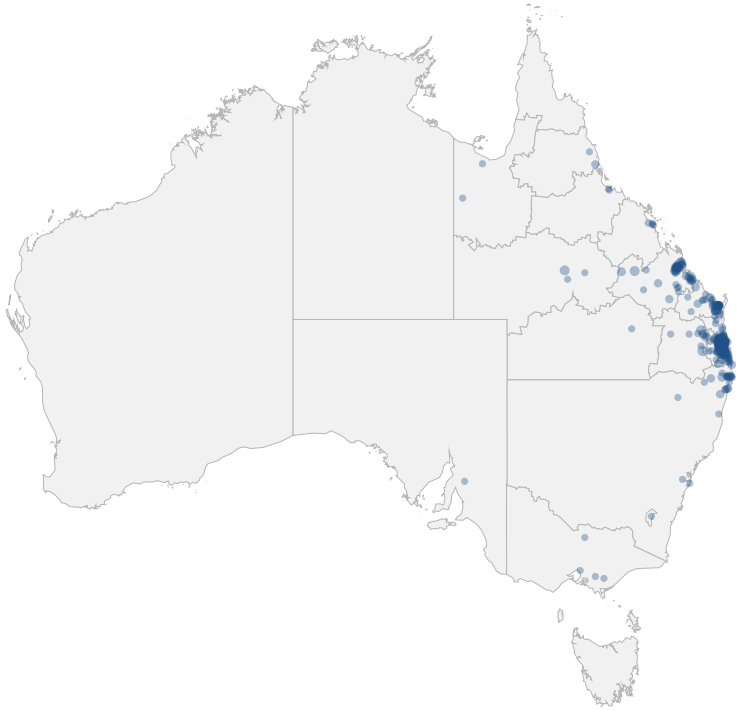


Figure 6: The Prince Charles Hospital

- Referral hospital for Metro North, Wide Bay and Central Queensland Hospital and Health Services, serving a population of approximately 900,000 (shared referral base with the Royal Brisbane and Women's Hospital)
- Public tertiary level cardiac services provided at TPCH include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
  - Cardiac surgery
  - Heart / lung transplant unit
  - Adult congenital heart disease clinic
- Three cardiac catheter laboratories and one hybrid theatre. 24/7 PCI service available since 1995
- 19.89 FTE consultant cardiologists

9.7 Royal Brisbane and Women's Hospital

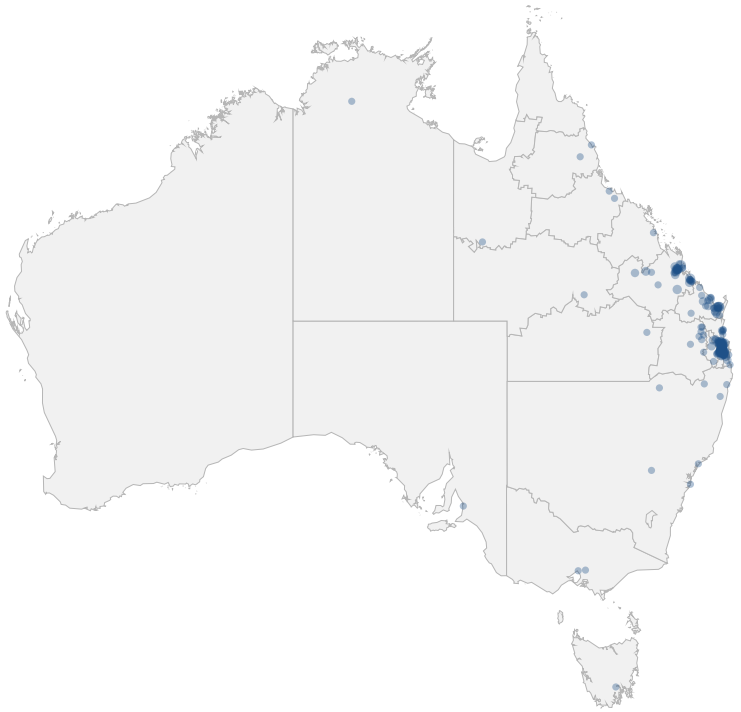


Figure 7: Royal Brisbane and Women's Hospital

- Referral hospital for Metro North, Wide Bay and Central Queensland Hospital and Health Services, serving a population of approximately 900,000 (shared referral base with the Prince Charles Hospital)
- Public tertiary level cardiac services provided at The Royal Brisbane and Women's Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
- Two cardiac catheter laboratories with a dedicated service commencing in 1997
- 24/7 PCI service available since 1997
- 11 FTE consultant cardiologists

9.8 Princess Alexandra Hospital

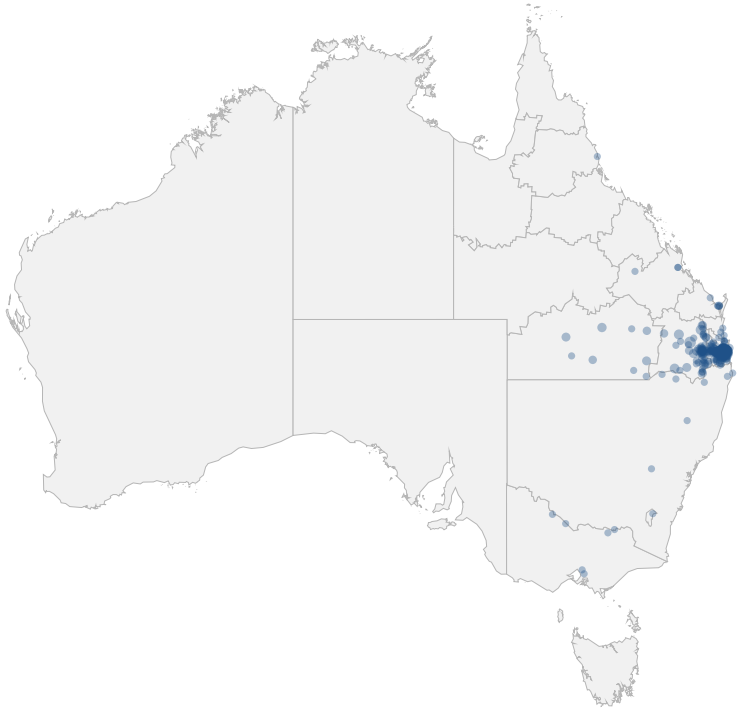


Figure 8: Princess Alexandra Hospital

- Referral hospital for Metro South and South West Hospital and Health Services, serving a population of approximately 1,000,000
- Public tertiary level cardiac services provided at the Princess Alexandra Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
  - Cardiac surgery
- Three cardiac catheter laboratories with a dedicated service commencing in 1998
- 24/7 PCI service available since November 1998
- 11.5 FTE consultant cardiologists

9.9 Gold Coast University Hospital

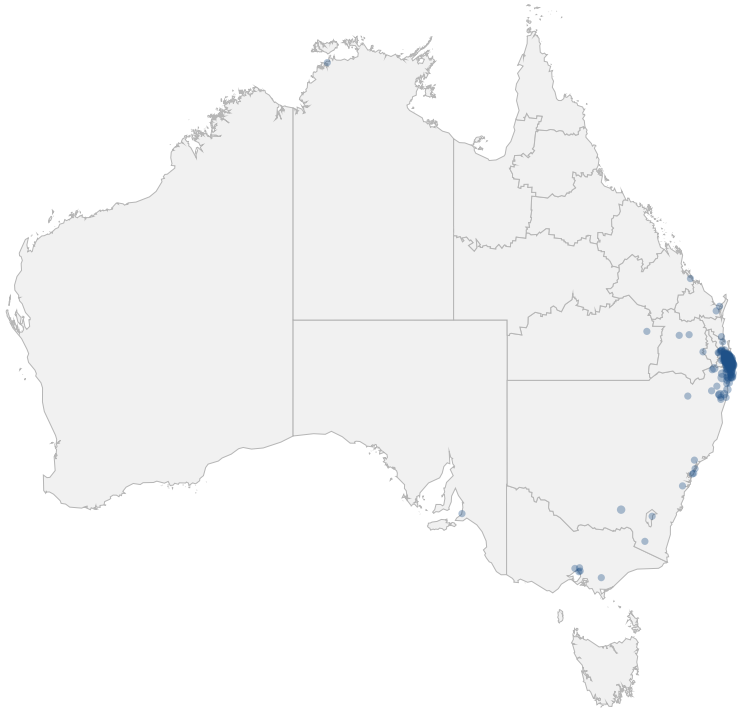


Figure 9: Gold Coast University Hospital

- Referral Hospital for Gold Coast and northern New South Wales regions, serving a population of approximately 700,000
- Public tertiary level cardiac services provided at the Gold Coast University Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
  - Cardiac surgery
- 24/7 PCI service available since 2006
- 8.25 FTE consultant cardiologists

10 Total cases

10.1 Procedure type

In 2017, there were a total of 15,293 coronary cases which were performed across the 8 participating public cardiac catheter laboratories.

Of the total cases, 4,928 (32%) involved percutaneous coronary interventions (PCI), with these cases the main subject of this report. Additional detail for 390 structural heart disease (SHD) cases have been included as a supplement to this report.

Table 3: Total number of cases by procedure category

Site	PCI procedure* n (%)	Other coronary procedure† n (%)	All cases n (%)
CH	501 (34.9)	934 (65.1)	1,435 (100.0)
TTH	398 (29.2)	965 (70.8)	1,363 (100.0)
MBH	258 (26.7)	708 (73.3)	966 (100.0)
SCUH	592 (39.9)	891 (60.1)	1,483 (100.0)
TPCH	1,066 (27.2)	2,847 (72.8)	3,913 (100.0)
RBWH	425 (32.0)	904 (68.0)	1,329 (100.0)
PAH	1,004 (35.2)	1,847 (64.8)	2,851 (100.0)
GCUH	684 (35.0)	1,269 (65.0)	1,953 (100.0)
STATEWIDE	**4,928 (32.2)**	**10,365 (67.8)**	**15,293 (100.0)**

* Includes POBA, coronary stenting, PTCRA/atherectomy and thrombectomy of coronary arteries

† Includes coronary angiography, aortogram, coronary artery bypass graft study, left ventriculography, left heart catheterisation, coronary fistula embolisation, fractional flow reserve, intravascular ultrasound, optical coherence tomography and instantaneous wave free ratio

10.2 Total cases by diagnosis

The most common diagnosis across all cases was of an acute coronary syndrome (ACS), which accounted for approximately one third of all cases (33%), and almost two thirds of all PCI cases (61%).

The most common diagnosis was of Non-ST Elevation ACS (including both NSTEMI and unstable angina) while ST-Elevation ACS cases represented 11% of all cases, and 29% of all PCI cases.

Table 4: Total cases by diagnosis category

Site	STEMI n (%)	NSTEMI n (%)	Unstable angina n (%)	No ACS n (%)	All cases n (%)
CH	166 (11.6)	307 (21.4)	16 (1.1)	946 (65.9)	1,435 (100.0)
TTH	117 (8.6)	249 (18.3)	34 (2.5)	963 (70.7)	1,363 (100.0)
MBH	49 (5.1)	127 (13.1)	77 (8.0)	713 (73.8)	966 (100.0)
SCUH	266 (17.9)	331 (22.3)	32 (2.2)	854 (57.6)	1,483 (100.0)
TPCH	279 (7.1)	665 (17.0)	28 (0.7)	2,941 (75.2)	3,913 (100.0)
RBWH	123 (9.3)	363 (27.3)	26 (2.0)	817 (61.5)	1,329 (100.0)
PAH	494 (17.3)	678 (23.8)	121 (4.2)	1,558 (54.6)	2,851 (100.0)
GCUH	225 (11.5)	283 (14.5)	30 (1.5)	1,415 (72.5)	1,953 (100.0)
STATEWIDE	**1,719 (11.2)**	**3,003 (19.6)**	**364 (2.4)**	**10,207 (66.7)**	**15,293 (100.0)**

Table 5: PCI cases by diagnosis category

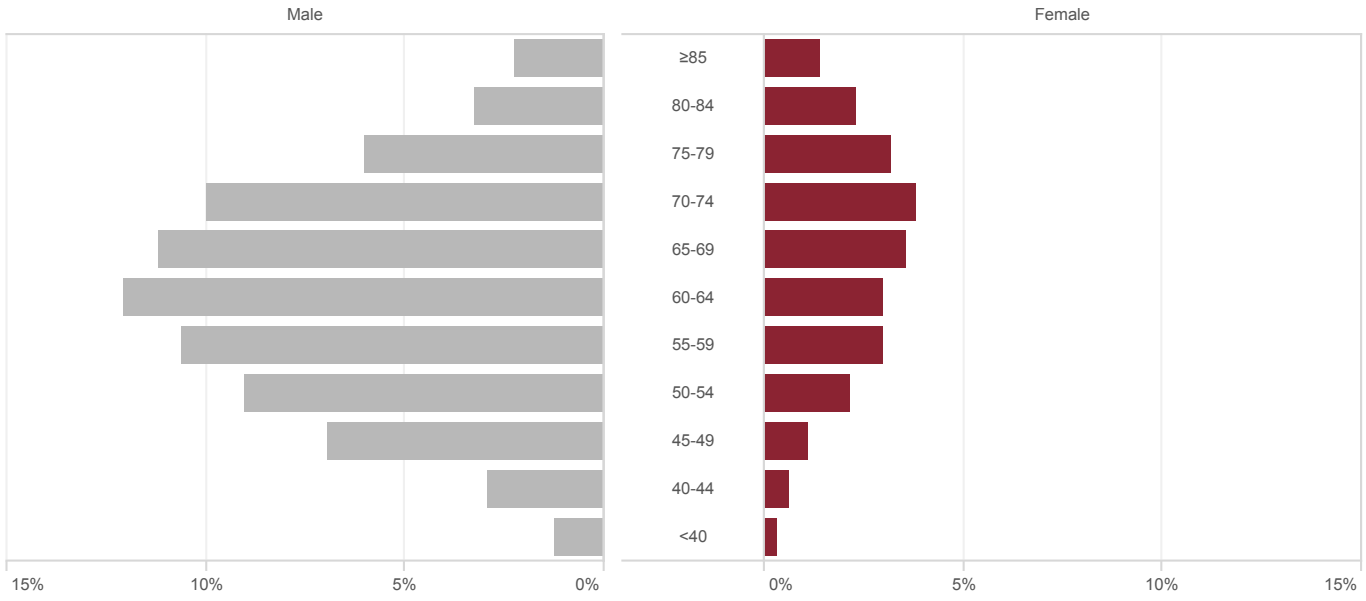
Site	STEMI n (%)	NSTEMI n (%)	Unstable angina n (%)	No ACS n (%)	All PCI cases n (%)
CH	139 (27.7)	164 (32.7)	11 (2.2)	187 (37.3)	501 (100.0)
TTH	104 (26.1)	78 (19.6)	12 (3.0)	204 (51.3)	398 (100.0)
MBH	35 (13.6)	61 (23.6)	22 (8.5)	140 (54.3)	258 (100.0)
SCUH	232 (39.2)	149 (25.2)	11 (1.9)	200 (33.8)	592 (100.0)
TPCH	241 (22.6)	309 (29.0)	5 (0.5)	511 (47.9)	1,066 (100.0)
RBWH	95 (22.4)	174 (40.9)	16 (3.8)	140 (32.9)	425 (100.0)
PAH	388 (38.6)	312 (31.1)	55 (5.5)	249 (24.8)	1,004 (100.0)
GCUH	200 (29.2)	160 (23.4)	12 (1.8)	312 (45.6)	684 (100.0)
STATEWIDE	**1,434 (29.1)**	**1,407 (28.6)**	**144 (2.9)**	**1,943 (39.4)**	**4,928 (100.0)**

11 Patient characteristics

11.1 Age and gender

Age is an important risk factor for developing cardiovascular disease. The median age of patients undergoing PCI was 64 years of age and ranged from 61 years to 67 years across sites.

The median age for females was higher than males (68 years vs. 63 years).



% of total PCI (n=4,928)

Figure 10: Proportion of all PCI cases by gender and age group

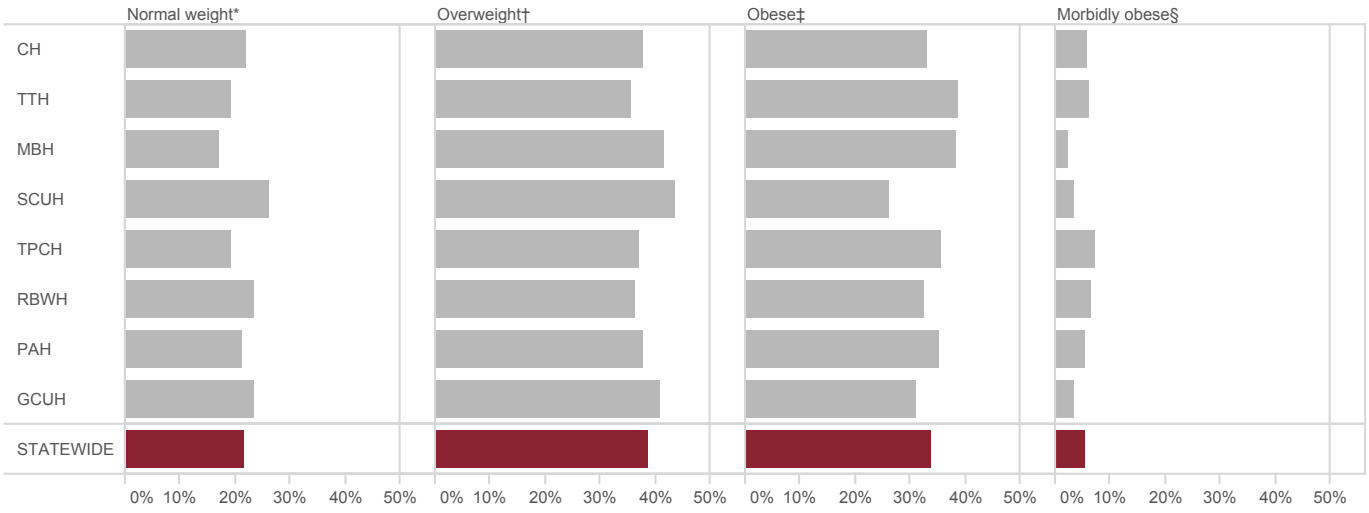
Table 6: Median age by gender for all PCI cases

	Male (years)	Female (years)	All (years)
CH	61.4	62.4	61.6
TTH	61.0	66.2	62.1
MBH	65.8	69.8	66.9
SCUH	65.8	68.0	66.3
TPCH	65.2	68.9	66.2
RBWH	61.4	68.8	62.9
PAH	60.0	65.7	61.3
GCUH	63.0	69.8	64.6
STATEWIDE	**63.1**	**67.8**	**64.1**

11.2 Body mass index

Patients across all sites displayed similar results for body mass index (BMI), with less than one-quarter of patients (22%) in the normal BMI range and 38%, 34% and 5% classified as overweight, obese and morbidly obese respectively. There were 1% of cases classified as underweight.

These analyses compare similarly with 2015 and 2016 data.



* BMI 18.5–24.9 kg/m^2

† BMI 25–29.9 kg/m^2

‡ BMI 30–39.9 kg/m^2

§ BMI ≥40 kg/m^2

Figure 11: Proportion of all PCI cases by body mass index category

11.3 Place of residence

The majority (93%) of patients were recorded as having their usual place of residence within Queensland. This was similar across all sites with the exception of the Gold Coast University Hospital where 23% of PCI patients originated from outside of Queensland.

Of those patients residing in Queensland, the majority (75%) had a place of usual residence which was within 50 kilometres of the nearest PCI facility.

Table 7: PCI cases by place of usual residence

Site	Queensland (%)	Interstate (%)	Overseas (%)
CH	95.4	2.6	2.0
TTH	97.0	2.0	1.0
MBH	96.9	2.3	0.8
SCUH	94.9	3.2	1.9
TPCH	95.1	4.2	0.7
RBWH	95.7	2.8	1.4
PAH	97.3	1.4	1.3
GCUH	77.5	20.7	1.8
STATEWIDE	**93.4**	**5.3**	**1.3**

Table 8: Queensland PCI cases by distance from place of residence to nearest PCI facility

Site	<50 km (%)	50–150 km (%)	>150 km (%)
CH	62.6	25.0	12.5
TTH	61.2	21.9	16.9
MBH	72.0	20.4	7.6
SCUH	76.1	17.0	7.0
TPCH	75.5	7.6	16.9
RBWH	64.2	10.6	25.2
PAH	79.2	13.8	7.0
GCUH	98.7	0.6	0.8
STATEWIDE	**75.3**	**13.2**	**11.5**

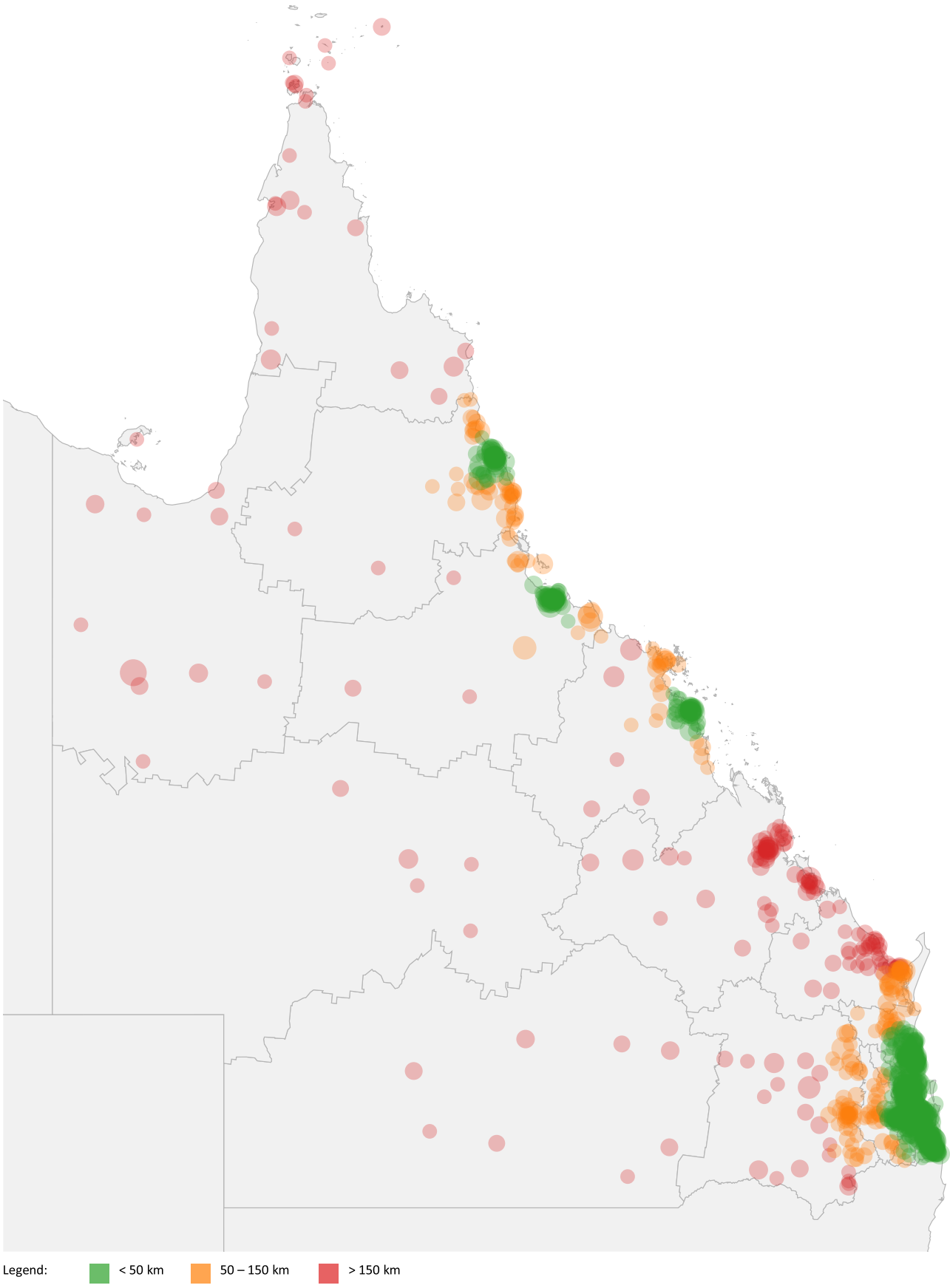


Figure 12: Queensland PCI cases by distance to nearest PCI facility

11.4 Aboriginal and Torres Strait Islander status

Ethnicity is an important determinant of health with a particular impact on the development of cardiovascular disease. It is recognised that the Aboriginal and Torres Strait Islander population have a higher incidence and prevalence of coronary artery disease.

The increased proportion of identified Aboriginal and Torres Strait Islander patients in the northern HHSs (CH, 23.6% and TTH, 15.6%) reflects the resident population within these areas and should be noted for future service provision and planning.

The proportion of identified Aboriginal and Torres Strait Islander patients requiring a PCI procedure across all sites (6.3%) exceeds the estimated proportion of Aboriginal and Torres Strait Islander persons within Queensland (4.0%).[3]

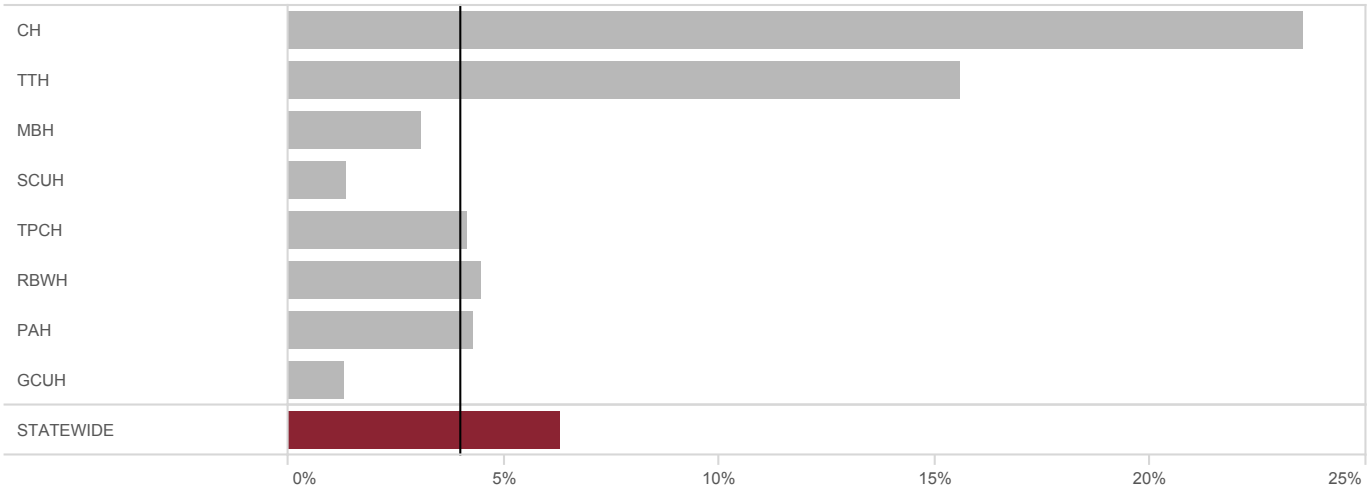
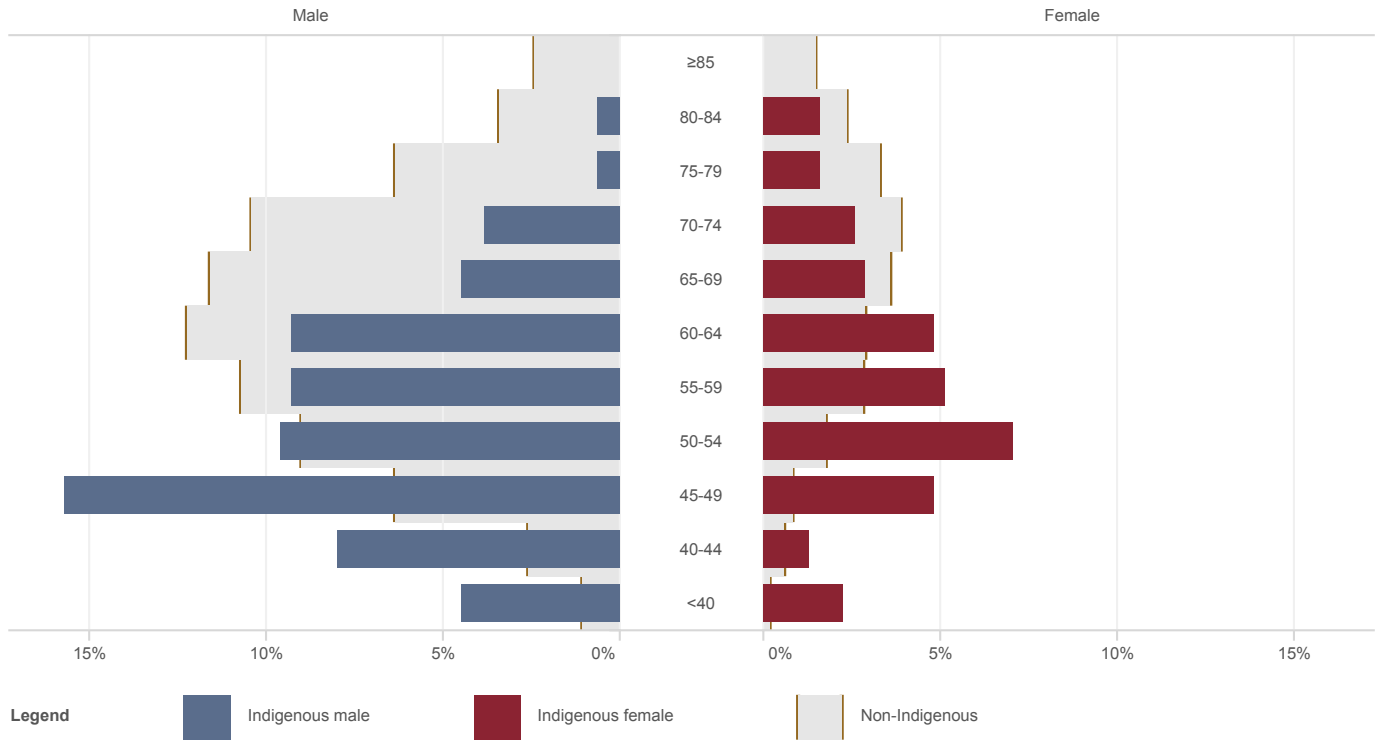


Figure 13: Proportion of all PCI cases by identified Aboriginal and Torres Strait Islander status

The median age of Aboriginal and Torres Strait Islander patients undergoing PCI was lower than that of non-Aboriginal and Torres Strait Islander patients (54 years vs 65 years).



% of total PCI cases (n=4,928)

Figure 14: Proportion of all PCI cases by age group and Aboriginal and Torres Strait Islander status

Table 9: PCI cases median patient age by gender and Aboriginal and Torres Strait Islander status

	Total cases (n)	Male (years)	Female (years)	All (years)
Aboriginal and Torres Strait Islander	311	51.8	56.0	53.7
Non Aboriginal and Torres Strait Islander	4,617	63.6	68.5	64.7
ALL	**4,928**	**63.1**	**67.8**	**64.1**

12 Care and treatment of PCI patients

12.1 Admission status

A total of 4,928 PCI procedures were performed in 2017 by the 8 contributing cardiology centres across Queensland. Patients were classified into admission status defined by the National Cardiovascular Data Registry as follows:[4]

Despite published definitions, the percentage distribution varied considerably between institutions as classification of cases is sometimes operator-dependent.

Table 10: Diagnostic coronary angiography status

Status	Definition
Elective	The procedure can be performed on an outpatient basis or during a subsequent hospitalisation without significant risk of infarction or death. For stable inpatients, the procedure is being performed during this hospitalisation for convenience and ease of scheduling and not because the patient's clinical situation demands the procedure prior to discharge.
Urgent*	The procedure is being performed on an inpatient basis and prior to discharge because of significant concerns that there is risk of ischaemia, infarction and/or death. Patients who are outpatients or in the emergency department at the time the cardiac catheterisation is requested would warrant an admission based on their clinical presentation.
Emergency†	The procedure is being performed as soon as possible because of substantial concerns that ongoing ischaemia and/or infarction could lead to death. "As soon as possible" refers to a patient who is of sufficient acuity that you would cancel a scheduled case to perform this procedure immediately in the next available room during business hours, or you would activate the on call team were this to occur during off-hours.
Salvage‡	The procedure is a last resort. The patient is in cardiogenic shock at the start of the procedure. Within the last ten minutes prior to the start of the procedure the patient has also received chest compressions for a total of at least sixty seconds or has been on unanticipated extracorporeal circulatory support (e.g. extracorporeal membrane oxygenation, cardiopulmonary support)

* Typically includes NSTEMI

† Typically includes STEMI

‡ Haemodynamically unstable

The majority (76%) of PCI cases were classed as urgent, emergent or salvage PCI. This reflects the acute and often complex case mix draining to Queensland public hospitals.

Salvage cases varied between institutions with CH and RBWH performing almost 3% of their PCI cases in these complex clinical scenarios.

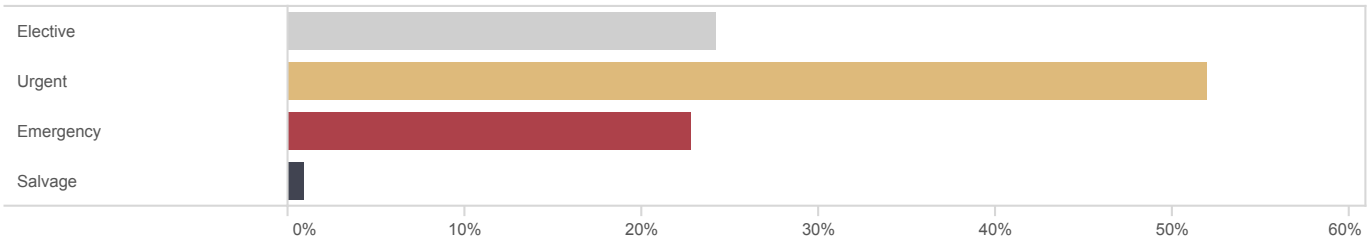


Figure 15: Proportion of all PCI cases by admission status

Table 11: PCI cases by site and admission status

	Total cases (n)	Elective (%)	Urgent (%)	Emergent (%)	Salvage (%)
CH	501	23.4	52.5	21.4	2.8
TTH	398	18.3	62.6	18.3	0.8
MBH	258	44.6	50.8	4.7	0.0
SCUH	592	17.4	50.5	31.8	0.3
TPCH	1,066	33.1	47.0	19.6	0.3
RBWH	425	15.8	61.9	19.5	2.8
PAH	1,004	19.9	53.9	25.8	0.4
GCUH	684	24.6	46.2	28.1	1.2
STATEWIDE	**4,928**	**24.3**	**52.0**	**22.8**	**0.9**

12.2 Access route

Across all sites, the majority of PCI cases (92%) used a single access route, with 57% being via the radial approach, 34% femoral, and less than one per cent via another access route including brachial or ulnar.

The use of the radial approach varied between different PCI centres (23% to 80%).

Multiple access routes were recorded for 8% of cases. This includes the use of a dual approach (both radial and femoral) as well as unsuccessful approaches with subsequent crossover to another access route.

Table 12: PCI access route by site

	Radial (%)	Femoral (%)	Other (%)	Multiple approaches (%)
CH	74.9	16.6	-	8.6
TTH	49.5	46.5	0.8	3.3
MBH	63.8	27.2	-	9.1
SCUH	79.6	13.2	0.5	6.8
TPCH	58.3	27.0	0.1	14.6
RBWH	65.2	25.2	0.2	9.4
PAH	23.3	73.1	-	3.6
GCUH	70.3	20.9	-	8.8
STATEWIDE	**57.2**	**34.3**	**0.2**	**8.3**

12.3 Vessels treated

Of all vessels or grafts treated by PCI, the majority were native vessels. Of the native vessels treated, 45% involved the left anterior descending coronary artery (LAD), followed by the right coronary artery (RCA) at 37%, the circumflex coronary artery (LCx) at 23% and the left main coronary artery (LMCA) at less than three per cent. Coronary artery graft PCI accounted for 3% of case volume.

Table 13: Vessels treated by site

	LAD (%)	LMCA (%)	LCx (%)	RCA (%)	GRAFT (%)
CH	43.3	2.6	23.2	35.7	2.2
TTH	44.0	3.6	21.2	31.9	4.1
MBH	41.7	0.4	25.5	33.2	2.4
SCUH	44.3	2.9	23.8	38.0	3.7
TPCH	44.6	4.2	24.0	38.7	3.4
RBWH	45.8	1.2	22.4	41.0	2.8
PAH	46.3	1.5	19.4	36.1	3.4
GCUH	43.6	1.5	23.4	36.8	1.9
STATEWIDE	**44.5**	**2.5**	**22.6**	**36.9**	**3.1**

12.4 Stent type

Stents are grouped into one of four different types – drug-eluting stents (DES), bare metal stents (BMS), bioresorbable vascular scaffolds (BVS) and covered stents.

Across all centres, an average of 1.5 stents were used for each of the 4,642 PCI cases involving stent deployment. Drug eluting stents were used in 85% of cases, ranging 73% to 98% across centres, while BMS were used in 15% of cases. A BVS or covered stent was used in less than 1% of cases.

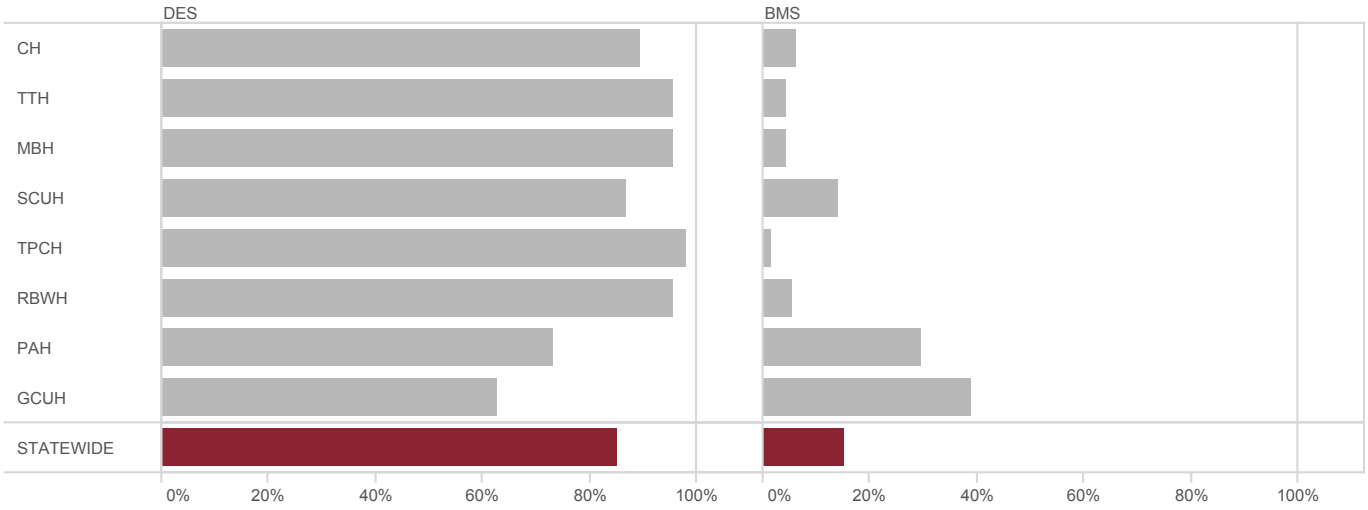


Figure 16: Proportion of cases including at least one stent by site and stent type

Table 14: PCI cases including at least one stent deployed by site and stent type

	Total (n)	DES (%)	BMS (%)	BVS (%)	Covered stent (%)	Stents per case (mean)
CH	458	89.5	6.3	5.0	0.0	1.5
TTH	381	95.8	4.5	0.0	0.5	1.5
MBH	226	95.6	4.4	0.0	0.4	1.4
SCUH	564	86.9	14.0	0.0	0.7	1.5
TPCH	996	98.1	1.5	0.3	0.1	1.6
RBWH	408	95.8	5.6	0.0	0.5	1.7
PAH	976	73.2	29.5	0.0	0.2	1.5
GCUH	633	62.6	39.0	0.0	0.0	1.4
STATEWIDE	**4,642**	**85.3**	**15.2**	**0.6**	**0.3**	**1.5**

12.5 NSTEMI

12.5.1 Case load

Of all PCI and coronary cases performed in cardiac catheter suites during 2017, there were 3,003 (20%) which were coded with a procedural indication of NSTEMI.

NSTEMI cases accounted for 29% of PCI cases across all centres, with site variation ranging from 23% to 41%.

Table 15: NSTEMI cases

Site	Total NSTEMI cases (n)	NSTEMI receiving PCI n (%)	Proportion of all PCI cases (%)
CH	307	164 (53.4)	32.7
TTH	249	78 (31.3)	19.6
MBH	127	61 (46.0)	23.6
SCUH	331	149 (45.0)	25.2
TPCH	665	309 (46.5)	29.0
RBWH	363	174 (47.9)	40.9
PAH	678	312 (46.0)	31.1
GCUH	283	160 (56.5)	23.4
STATEWIDE	**3,003**	**1,407 (46.8)**	**28.6**

12.5.2 Admission source

Overall there were more NSTEMI cases where the patient was transferred from another facility than those presenting directly to the PCI capable facility (54% and 46% respectively).

Considerable variation was observed between participating sites, with the proportion of interhospital transfers for NSTEMI ranging from 41% to 70%.

Table 16: NSTEMI admission source to treating facility

Site	NSTEMI cases (n)	Direct to treating facility (%)	Interhospital transfer (%)
CH	307	59.3	40.7
TTH	249	59.4	40.6
MBH	127	54.3	45.7
SCUH	331	52.0	48.0
TPCH	665	51.1	48.9
RBWH	363	32.8	67.2
PAH	678	30.4	69.6
GCUH	283	49.8	50.2
STATEWIDE	**3,003**	**45.8**	**54.2**

12.5.3 Hospital performance – Time to angiography

Time to coronary angiography for patients presenting to hospital with a NSTEMI continues to be a key clinical quality indicator for QCOR. National and international guidelines remain unchanged since the 2015 report with recommendations stating coronary angiography should be offered and performed within 72 hours of diagnosis.[5]

A major barrier often cited in achieving this target is the time taken to transfer patients from non-PCI capable facilities to the accepting facility. There are multiple reasons delays can occur including capacity constraints and transfer logistics. The overall outcome of this indicator is presented later.

Compared with patients presenting directly to a PCI capable facility, patients arriving from another facility to a non-PCI capable facility have a median wait to coronary angiography of 31 hours longer (68 hours vs 37 hours) and are less likely to have angiography performed within the target timeframe of 72 hours (54% vs 78%).

Analysis was only possible in a proportion of NSTEMI cases as records with missing data or specific exclusion criteria were omitted. This detail is available in the clinical indicator section of this report.

Table 17: Time to angiography – direct to PCI facility

Site	Total cases (n)	Total analysed (n)	Median (hours)	Interquartile range (hours)	Met 72 hour target (%)
CH	182	157	53	23–112	63.1
TTH	148	127	50	32–83	68.5
MBH	69	60	38	23–70	78.3
SCUH	172	162	28	17–56	84.6
TPCH	340	301	27	14–54	84.4
RBWH	119	94	21	14–34	92.6
PAH	206	169	42	21–76	74.0
GCUH	141	138	43	22–72	74.6
STATEWIDE	**1,377**	**1,208**	**37**	**19–68**	**77.7**

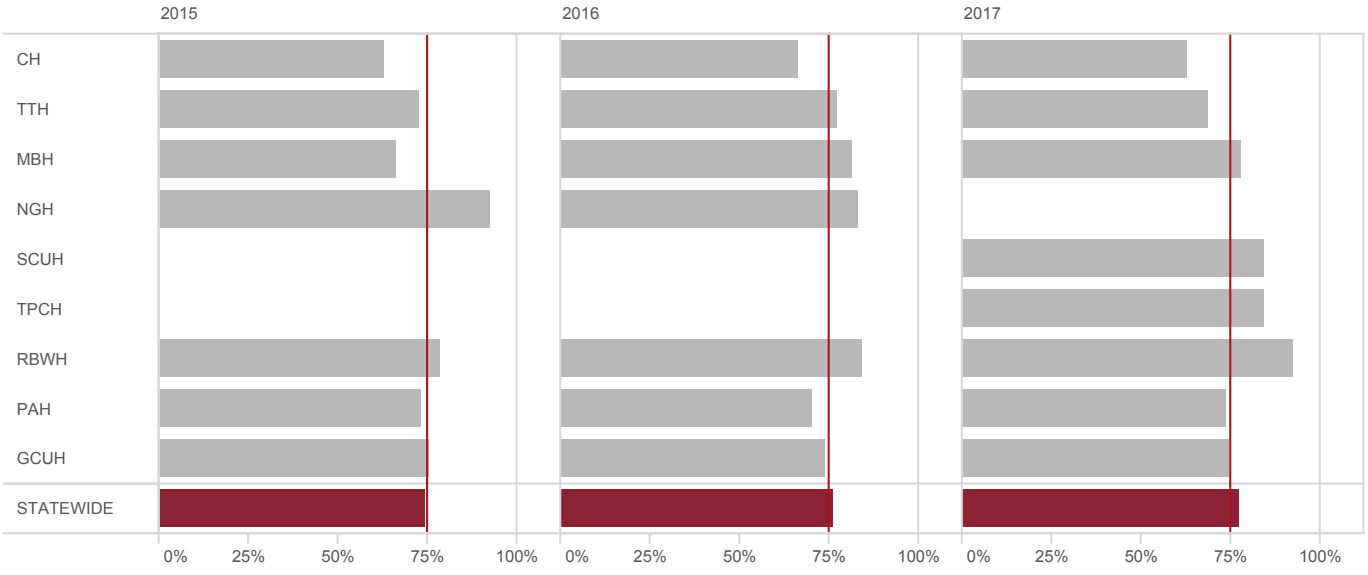


Figure 17: Proportion of NSTEMI direct presenters receiving angiography within 72 hours, 2015 to 2017

These data are similar to those observed in previous QCOR Annual Reports, highlighting the continuing need for overall system improvement and a potential statewide strategy for referring and transferring patients who require coronary angiography following NSTEMI.

Table 18: Time to angiography – interhospital transfers

SITE	Total cases (n)	Total analysed (n)	Median (hours)	Interquartile range (hours)	Met 72 hour target (%)
CH	125	111	73	36–131	47.7
TTH	101	96	71	39–118	52.1
MBH	58	36	38	25–53	80.6
SCUH	159	133	35	22–67	79.7
TPCH	326	284	72	43–117	50.0
RBWH	244	219	65	46–92	57.5
PAH	472	412	82	54–117	43.2
GCUH	142	80	55	35–84	68.8
STATEWIDE	**1,627**	**1,371**	**68**	**41–107**	**53.9**

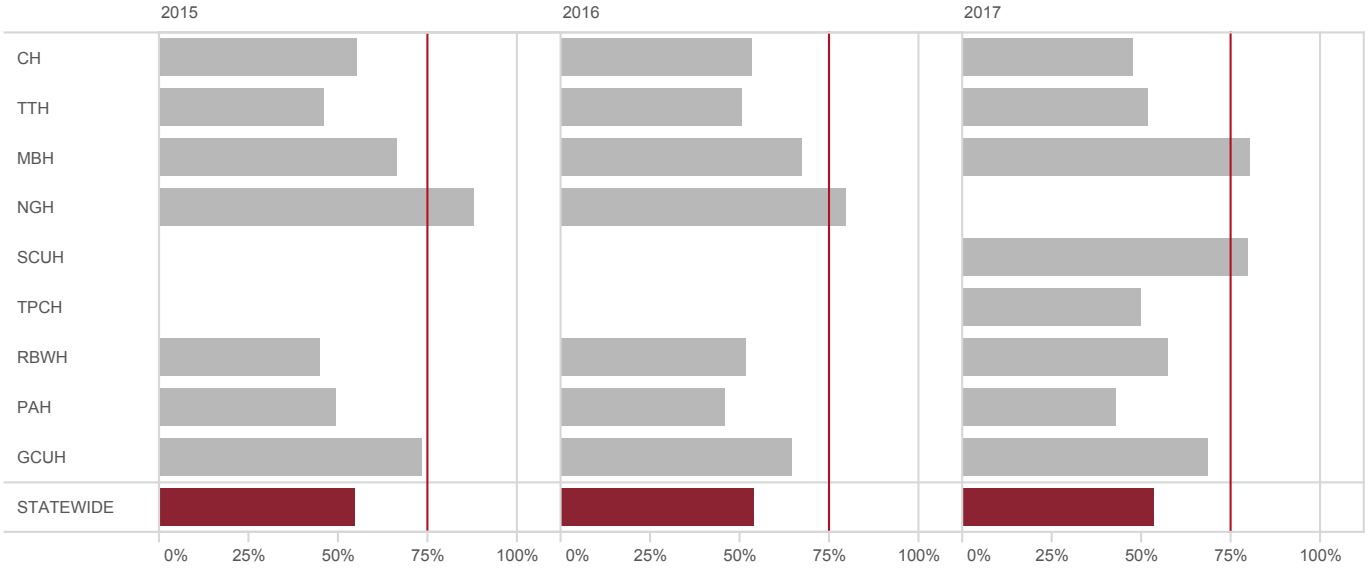


Figure 18: Proportion of NSTEMI interhospital transfers receiving angiography within 72 hours, 2015 to 2017

12.6 PCI following presentation with STEMI

Acute STEMI is a recognised medical emergency in which time to treatment is critical to both short and long-term outcomes. PCI capable hospitals have therefore developed rapid triage and transfer systems to fast-track STEMI patients into the cardiac catheter laboratory for rapid reperfusion (primary PCI).

Decision-making for the method of reperfusion depends on many factors. Timeliness of treatment and patient characteristics indicate which treatment method is appropriate and applicable. If the patient is in a location that allows for timely transportation to a PCI capable hospital, primary PCI is the preferred treatment choice. If the patient is not able to be transported in a timely manner, fibrinolytic therapy is preferable.

Given the time-critical nature of this presentation type, ongoing refinement of hospital and pre-hospital processes is vital to meet the recommended timeframes for reperfusion in STEMI patients.

It is important to recognise there remains a large proportion of STEMI patients who do not present to hospital and are not treated with any form of reperfusion therapy, however this element of care is outside the scope of this registry.

12.6.1 First medical contact

Across all sites, 58% of patients with a STEMI presented via the Queensland Ambulance Service (QAS). A smaller proportion of patients presented to the emergency department (DEM) of either a PCI (on-site DEM) or non-PCI capable (satellite DEM) facility (8% and 28% respectively). The remaining 7% presented to other facilities such as GP clinics, community health facilities or other outpatient clinics.

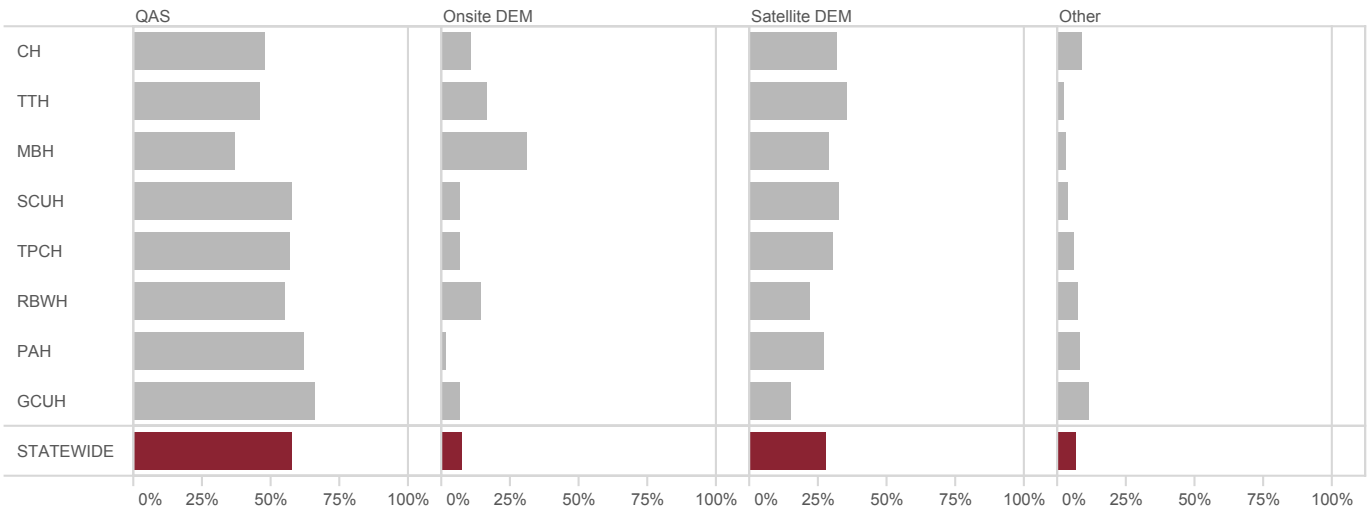


Figure 19: Proportion of STEMI cases by first medical contact

12.6.2 Clinical presentation

In 2017, there were 1,434 documented PCI STEMI cases with more than half (56%) presenting as primary PCI cases and 11% presenting after 12 hours (late presenters).

There were 23% of reperfusion-eligible patients who had received fibrinolysis (lysis), including 6% requiring rescue PCI because lysis had been unsuccessful.

Table 19: Proportion of STEMI cases by presentation

Site	Total STEMI (n)	Transient STEMI (%)	STEMI <6 hours (%)	STEMI 6–12 hours (%)	Late Presentation (%)	Post successful lysis (%)	Rescue PCI (failed lysis) (%)
CH	139	8.6	48.2	4.3	15.8	16.5	6.5
TTH	104	4.8	50.0	2.9	19.2	18.3	4.8
MBH	35	2.9	17.1	2.9	11.4	60.0	5.7
SCUH	232	12.1	46.1	3.9	6.0	22.4	9.5
TPCH	241	6.2	56.0	3.3	11.6	16.6	6.2
RBWH	95	4.2	55.8	9.5	15.8	12.6	2.1
PAH	388	16.5	47.4	3.6	8.8	17.0	6.7
GCUH	200	4.5	69.0	7.0	11.5	4.0	4.0
STATEWIDE	**1,434**	**9.6**	**51.7**	**4.5**	**11.2**	**16.8**	**6.2**

13 Clinical indicators

The clinical quality indicator program is a valuable focus of QCOR. The indicators outlined in this document have been selected after considering international PCI and STEMI treatment guidelines and are in line with current best practice. Many key guidelines advise the use of defined and validated quality indicators as a means to measure and improve patient care.

The clinical indicators reported for diagnostic and interventional cardiology are:

1 Risk adjusted all-cause 30-day mortality post PCI.

2 Proportion of STEMI patients presenting within six hours of symptom onset, who received an intervention within 90 minutes of first diagnostic ECG.

3 Proportion of all NSTEMI patients who received angiography within 72 hours of first hospital admission.

4 Proportion of majorprocedural complications for PCI (perforation requiring intervention, death, tamponade, emergency coronary artery bypass graft or cerebrovascular accident-stroke).

5 Proportion of cases where total entrance dose exceeded the high dose threshold (5Gy).

13.1 Mortality outcomes

13.1.1 Risk adjusted all-cause 30-day mortality post PCI

This clinical indicator includes all patients who die within 30 days of a PCI procedure. It does not necessarily indicate a causal relationship between the PCI procedure and the subsequent death. Overwhelmingly, death in these patients occurs despite successful PCI being performed, from the underlying condition for which PCI is being done.

Table 20 presents unadjusted mortality according to admission status. As should be expected, the risk of death increases according to the severity of the patient's condition (admission status). There were no deaths among stable patients undergoing elective PCI; conversely, mortality was 51% in the critically ill patients who underwent salvage PCI. The overall 30-day unadjusted mortality rate for patients undergoing PCI procedures at hospitals participating in the QCOR analysis for 2017 was 1.9%. This result compares favourably with the 30-day mortality rate of 2.8% presented by the British Cardiovascular Interventional Society (BCIS) in their review of PCI outcomes for the 2014 calendar year (chosen as the comparator as BCIS reports in subsequent years have given in-hospital rather than 30-day mortality).[6]

Table 20: All-cause unadjusted mortality within 30 days post PCI by admission status

Site	Elective n (%)	Urgent n (%)	Emergency n (%)	Salvage n (%)	Case count (n)	Total deaths n (%)
CH	0 (0)	1 (0.4)	2 (1.9)	6 (42.9)	501	9 (1.8)
TTH	0 (0)	2 (0.8)	1 (1.4)	1 (33.3)	398	4 (1.0)
MBH	0 (0)	1 (0.8)	0 (0.0)	–	258	1 (0.4)
SCUH	0 (0)	1 (0.3)	7 (3.7)	2 (100.0)	592	10 (1.7)
TPCH	0 (0)	6 (1.2)	13 (6.7)	3 (100.0)	1,066	22 (2.1)
RBWH	0 (0)	2 (0.8)	2 (2.4)	11 (91.7)	425	15 (3.5)
PAH	0 (0)	5 (0.9)	14 (5.4)	0 (0.0)	1,004	19 (1.9)
GCUH	0 (0)	0 (0.0)	10 (5.2)	1 (12.5)	684	11 (1.6)
STATEWIDE	**0 (0)**	**18 (0.7)**	**49 (4.4)**	**24 (51.1)**	**4,928**	**91 (1.9)**

% of total cases by presentation and site

Figure 20 presents the observed mortality rates by site, superimposed on the predicted mortality rates (with 95% confidence interval) calculated using the Victorian Cardiac Outcomes Registry (VCOR) risk adjustment model.[7] (This analysis used an imputed dataset accounting for missing data; for TPCH, the nature of the distribution of the missing data precludes calculation of a predicted rate).

Reassuringly, mortality rates from all sites are within the expected range for their respective risk-adjusted mortality rates. This is despite the limited risk adjustment model, which only adjusts for 6 factors – ACS, age, LAD involvement, eGFR, LVEF, and cardiogenic shock. Other critical presentations with very high mortality risk, such as out of hospital ventricular fibrillation (VF) arrest with uncertain neurological recovery, are not adjusted for and therefore the model is likely to underestimate true mortality risk. This is relevant in our dataset, where there were marked differences between hospitals in the proportion of high-risk salvage patients taken for PCI. This ranged from 0.3% of cases at SCUH and TPCH, to 2.8% of cases at CH and RBWH.

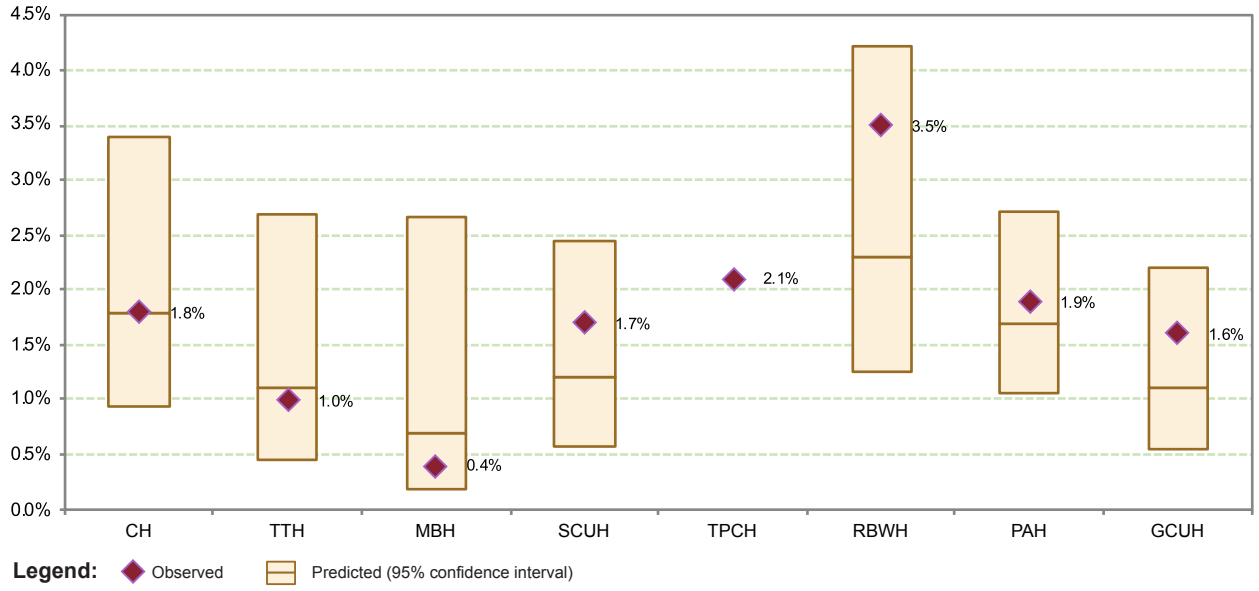
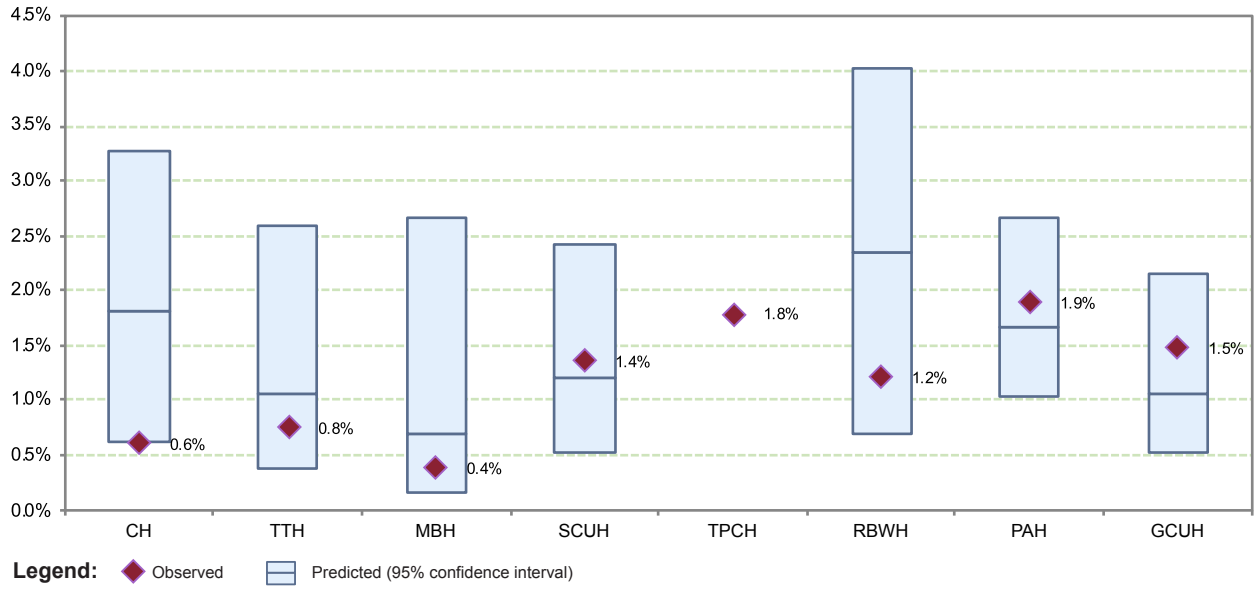


Figure 20: Comparison of observed and predicted mortality rates by site

There were also marked differences in salvage case mortality rates across different hospitals (Table 20). This variation may relate to differences in case-mix at different hospitals, differences in the threshold for performing PCI in critically ill unstable patients, differences in classification of admission status, or a combination of all three factors. Given this variation, and the inability of our current risk prediction model to accurately predict expected mortality in the extreme-risk salvage category, Figure 21 presents the observed and predicted mortality rates excluding salvage.



Excludes salvage cases (n=46)

Figure 21: Comparison of observed and predicted mortality rates by site, excluding salvage

As was outlined in the 2016 report, poorly calibrated risk adjustment is known to introduce bias into the monitoring process. Great care, therefore, needs to be exercised in the choice and use of risk adjustment tools to ensure they are relevant and have adequate performance for the patient cohort under scrutiny. Unfortunately, there are very few universally accepted risk models in interventional cardiology. We determined the VCOR model for risk adjustment of 30-day mortality to have the greatest utility for our dataset, compared to other models such as those of the BCIS[6], and the American College of Cardiology (ACC) CathPCI registry.[8] These models are critically dependant on completeness of data elements. Further effort is needed from all participating sites to improve the completeness of the datasets.

With an expanded dataset of reliable data, a more thorough evaluation of the available risk models (BCIS, ACC, and VCOR) can be explored. This would allow us to recalibrate and adapt one of these models to the specific characteristics of our QCOR dataset, or develop a new, locally relevant model. The variation in salvage cases between different hospitals highlights the importance of this. Some of these cases are STEMI complicated by out of hospital VF arrest, where there is a high yet uncertain chance of dying from a non-cardiac cause (hypoxic brain injury). Small differences in the caseload of such patients, or variation in the likelihood of taking such cases for PCI, would have an undue effect on mortality rates, and yet there is no adjustment for this in the VCOR risk prediction model we are currently applying.

In the ideal model, factors which are known to impact on patient outcomes and which are beyond the control of the clinician or service being monitored, are either controlled for in the analysis, or excluded. In measuring performance outcomes, it is important to maintain focus on the process under scrutiny (PCI outcomes), without distortion by uncorrected bias.

13.1.1 All STEMI mortality

A separate analysis was performed to assess mortality in patients presenting with STEMI. Of the 1,719 documented STEMI cases in 2017, 1,434 cases (83%) included a PCI intervention and are the subject of the following outcomes analyses. For this analysis, patients presenting as salvage are excluded, which allows focus to be retained on the measurement of PCI outcomes.

The outcomes for cohort of STEMI patients who underwent primary PCI remain encouraging.

All-cause mortality rates at 30 days varied from 1.6% to 3.8% with a statewide rate of 3.1%. Of these 1,398 patients analysed, a total of 44 mortalities were recorded using death registry linkage. The majority (89%) of mortalities occurred in-hospital.

Table 21: STEMI mortality up to 30 days in patients who underwent primary PCI

Site	Total cases* (n)	In lab (n)	In hospital (n)	Post discharge to 30 days (n)	Total n (%)
CH	129	0	2	0	2 (1.6)
TTH	101	0	1	1	2 (2.0)
MBH	35	0	1	0	1 (2.9)
SCUH	230	0	6	1	7 (3.0)
TPCH	238	1	8	0	9 (3.8)
RBWH	87	0	2	0	2 (2.3)
PAH	386	2	11	0	13 (3.4)
GCUH	192	0	7	0	7 (3.6)
STATEWIDE	**1,398**	**3**	**39**	**2**	**44 (3.1)**

* Excludes STEMI salvage cases (n=36)

13.1.2 STEMI presentation within 6 hours from symptom onset

Further analysis of the STEMI cohort who underwent primary PCI within 6 hours of symptom onset demonstrates all-cause 30-day mortality rates between 0% and 4.5% across centres, with the statewide rate at 3.7%.

For this analysis, patients presenting as high-risk salvage cases have been excluded.

Table 22: STEMI mortality up to 30 days for patients who underwent a primary PCI and presented within 6 hours of symptom onset

Site	Total cases* (n)	In lab (n)	In hospital (n)	Post discharge to 30 days (n)	Total n (%)
CH	61	0	1	0	1 (1.6)
TTH	51	0	1	0	1 (2.0)
MBH	6	0	0	0	0 (0)
SCUH	105	0	4	1	5 (4.8)
TPCH	133	1	5	0	6 (4.5)
RBWH	48	0	1	0	1 (2.1)
PAH	184	2	6	0	8 (4.3)
GCUH	134	0	4	0	4 (3.0)
STATEWIDE	**723**	**3**	**23**	**1**	**27 (3.7)**

* Excludes STEMI presenting within 6 hours of symptom onset salvage cases (n=19)

13.2 STEMI less than 6 hours from symptom onset – time to reperfusion

The most critical factor influencing outcome for patients who experience a STEMI is the total ischaemic time, defined as the time interval from symptom onset to successful reperfusion. The exact time of symptom onset is often difficult to ascertain, and the time between symptom onset and call for help is primarily a patient-dependent factor.

Therefore, STEMI guidelines worldwide now advocate first diagnostic ECG (FdECG)-to-device time as an important modifiable and objective measure of overall STEMI system performance.[9]

Both the European and American STEMI guidelines recommend a target FdECG-to-device time less than 90 minutes. For patients who present initially to a non-PCI hospital then transfer to a PCI facility (inter-hospital transfer), the accepted FdECG-to-device target is less than 120 minutes.[9,10] It is widely recognised that these targets are ambitious and difficult to achieve in real-world practice as primary PCI becomes more available to larger catchment populations.

Achieving these times requires efficient coordination of care within and between the ambulance service and transferring/receiving hospitals. Accepted strategies to improve reperfusion times include pre-hospital activation of the cardiac catheter laboratory, an immediate response of the on-call PCI team to be operational within 30 minutes of alert and bypass of the emergency department.

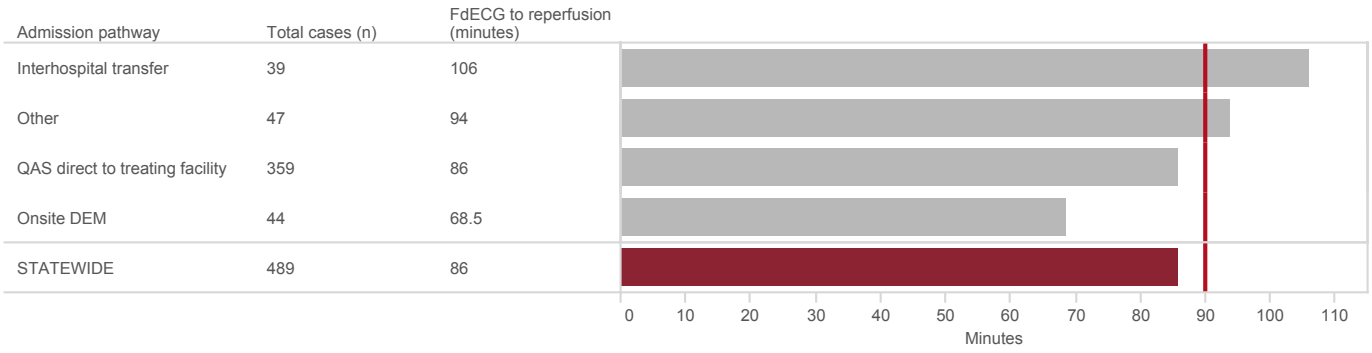
Table 23: Definitions for STEMI time to reperfusion

Time	Definition
First diagnostic ECG	First diagnostic ECG refers to the timestamp when the ECG shows ST-segment elevation (or equivalent) and can be regarded as time zero in the therapeutic pathway. The interpretation of the first diagnostic ECG may be undertaken by ambulance personnel, general practitioners or hospital-based medical staff.
Door time	Door time refers to the timestamp when the patient presents to the PCI hospital and can be regarded as time zero in the therapeutic pathway for patients presenting via this method.
First device time	The first device time, as a surrogate for reperfusion, is the first timestamp recorded of the earliest device used: • first balloon inflation, or • first stent deployment, or • first treatment of lesion (thrombectomy/aspiration device, rotational atherectomy) If the lesion cannot be crossed with a guidewire or device (and thus none of the above applies), the time of guidewire introduction is used. If there is already TIMI 3 flow observed on initial angiography, that timestamp is used instead of first device.

The steering committee established the benchmark target of 75% of patients to receive timely reperfusion measured from first diagnostic ECG to reperfusion as well as from arrival at PCI facility to reperfusion.

In total, there were 742 STEMI primary PCI cases presenting within six hours of symptom onset. Of these, there were 126 cases which had been excluded per the criteria in Table 24 leaving 616 cases which are eligible for the following analysis. Further cases are excluded from the clinical indicators where the timestamps required to measure time to reperfusion were not recorded in the system.

Considerable variation was observed depending on the admission pathway to the treating facility.



Other includes GP, inpatient and outpatient referrals

Figure 22: STEMI presenting within 6 hours of symptom onset – median first diagnostic ECG to first device time by admission pathway

Table 24: STEMI <6 hours cases ineligible for analysis

Summary	**n**
Out of hospital arrest	34
Salvage	19
Significant comorbidities/frailty	16
Previous coronary artery bypass graft surgery	14
Thrombolysis contraindicated	12
Intubation	12
Shock/acute pulmonary oedema	12
Unsuccessful PCI	4
Significant non-cardiac comorbidity	3
Total ineligible	**126**

13.2.1 Time from first diagnostic ECG to first device

The all-site median time from first diagnostic ECG to reperfusion was 86 minutes, with median individual site times ranging from 70 minutes to 98 minutes. These results indicate that overall Queensland public facilities are approaching the ambitious benchmark of 90 minutes from time of first diagnostic ECG to first device. However, only 57% of patients analysed receive timely reperfusion per current guidelines (FdECG to reperfusion)6, supporting the view that the current target is optimistic.

This is currently the focus of international review as more achievable objectives are explored. Nonetheless, the metric of time to reperfusion remains a useful tool for monitoring processes and efficiencies and demonstrates the potential for improvement or maintenance of system and hospital performance.

Table 25: First diagnostic ECG (FdECG) to reperfusion for STEMI presenting within 6 hours of symptom onset

SITE	Total cases (n)	Total analysed (n)	Median (minutes)	Interquartile range (minutes)	Met 90 min target (%)
CH	67	51	70	60–87	74.5
TTH	52	44	76	63–95	70.5
MBH*	6	3	–	–	–
SCUH	107	88	88	72–106	58.0
TPCH†	135	0	–	–	–
RBWH	53	44	82	66–101	65.9
PAH	184	145	98	84–114	39.3
GCUH	138	114	84	69–99	61.4
STATEWIDE	**742**	**489**	**86**	**71–106**	**56.6**

* MBH is not displayed as it has <20 cases for analysis

† TPCH is not included as it has not collected FdECG timestamps until 2018

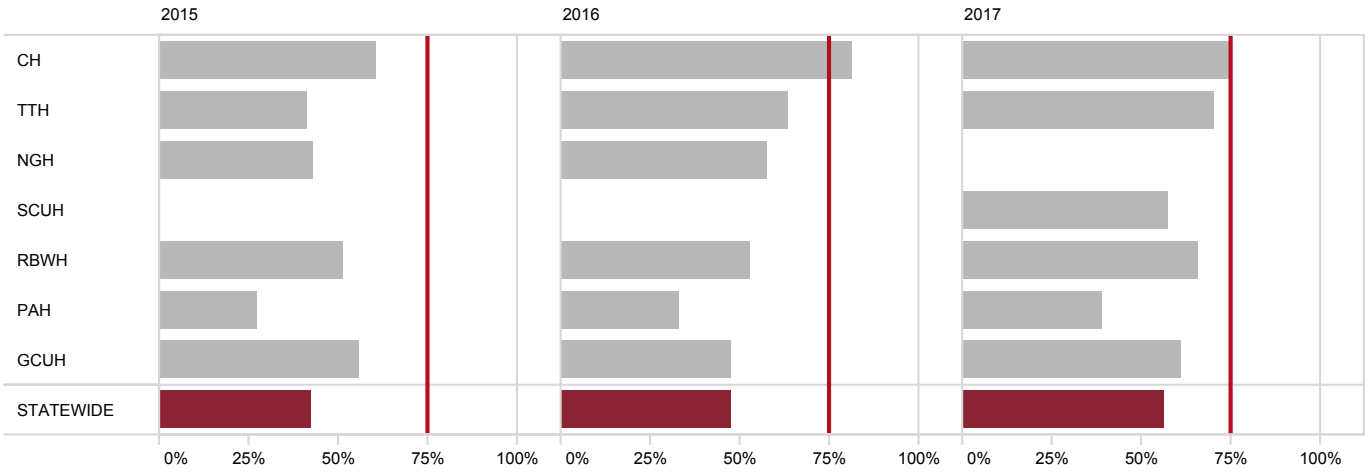
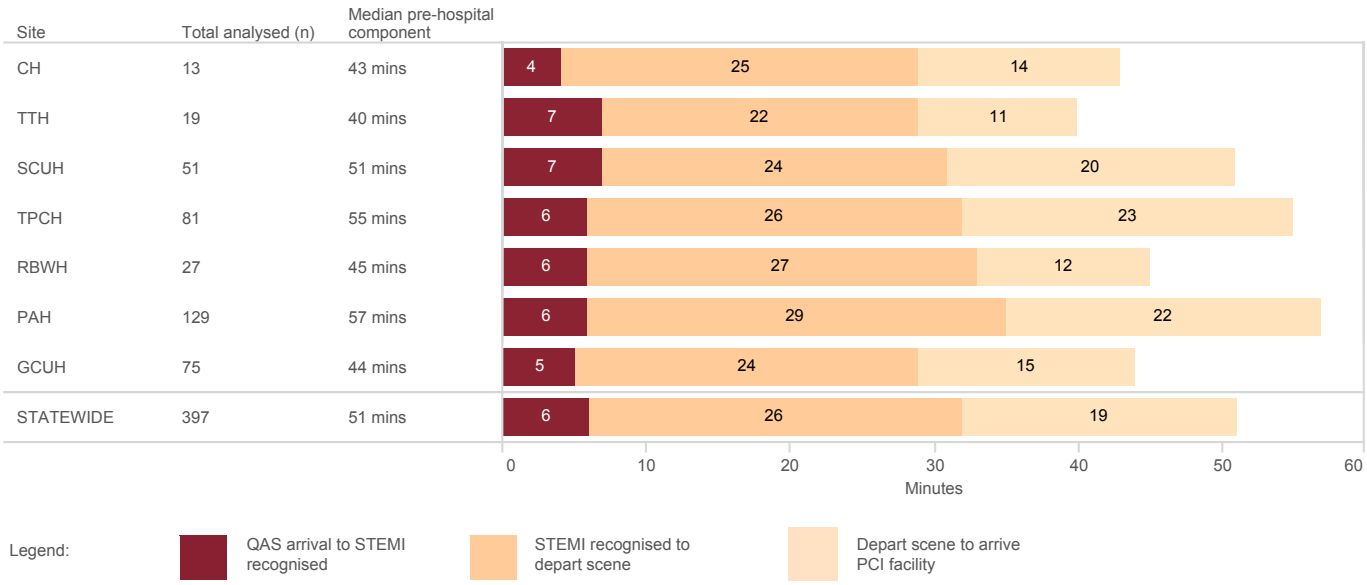


Figure 23: Proportion of STEMI cases (<6 hours of symptom onset) where time from first diagnostic ECG to reperfusion met 90 minute target, 2015–2017

1. Pre-hospital notification processes

The Queensland Ambulance Service has a long-established record of developing pre-hospital processes for the management of STEMI. On recognition of STEMI meeting criteria for primary PCI by a QAS paramedic trained in coronary reperfusion, direct contact is made with the on-call interventional cardiologist of the receiving hospital via a dedicated referral line. A pre-hospital treatment plan is agreed and the cardiac catheter lab is activated. This referral, however, could not occur if a QAS paramedic trained in coronary reperfusion was not available to attend the patient.

Since 2008, Critical Care Paramedics have always been trained in reperfusion and more recently, QAS has implemented a strategy to provide this training to all Advanced Care Paramedics to promote faster activation of the cardiac catheter lab for more STEMI patients. It is likely that as this strategy takes effect, more STEMI patients will be referred earlier.



MBH not displayed due to ‹10 cases available for analysis

Figure 24: STEMI under 6 hours pre-hospital component breakdown – QAS direct to PCI facility

2. Hospital processes

All hospitals have established pathways for notification of and receiving STEMI patients. Some hospital processes vary across the state depending on factors including the time of day or the local requirement of some patients to transit via the Emergency Department.

Although differing processes may explain some variation, this would appear to have minimal impact: when exploring door to device times in the following section, all sites were similar in the time taken to treat patients once they arrived at the PCI capable facility.

13.2.2 Time from arrival PCI capable facility to first device

The time between PCI hospital arrival and reperfusion ('door-to-device time') is currently the accepted measure of PCI hospital system performance in STEMI. Historically, hospitals have worked to a goal of less than 90 minutes, although more recent guidelines have shortened this target time to less than 60 minutes.[7,10]

Results demonstrate that for over half of cases (69%), participating PCI facilities are meeting a target door-to-device time of less than 60 minutes, with an overall all-site median time of 46 minutes (range 34 minutes to 60 minutes).

Table 26: Arrival at PCI hospital to first device for STEMI presenting within 6 hours of symptom onset

SITE	Total cases (n)	Total analysed (n)	Median (minutes)	Interquartile range (minutes)	Met 60 min target (%)
CH	67	47	54	33–75	57.4
TTH	52	43	60	43–87	51.2
MBH	6	3	–	–	–
SCUH	107	87	34	25–58	77.0
TPCH	135	118	39	30–64	73.7
RBWH	53	42	48	35–81	69.0
PAH	184	145	44	32–57	77.9
GCUH	138	106	52	36–78	59.4
STATEWIDE	**742**	**591**	**46**	**31–67**	**69.2**

* MBH is not displayed as it has ‹20 cases for analysis

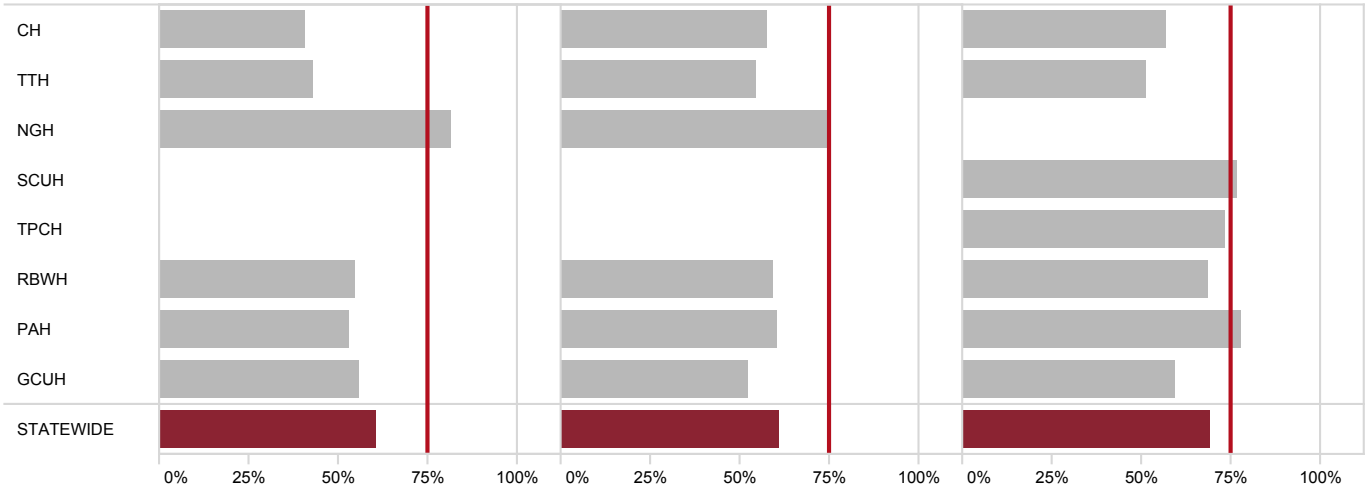


Figure 25: Proportion of cases where door to device ≤60 minutes was met for STEMI presenting within 6 hours of symptom onset, 2015–2017

13.3 NSTEMI – time to angiography

Coronary angiography is necessary to determine the severity of coronary disease with both quality of life and prognostic implications for patients presenting with non-ST elevation acute coronary syndromes. National and international guidelines recommend that coronary angiography should be offered and performed within 72 hours of diagnosis. This duration is reduced to 24 hours for those deemed to be at high risk of major cardiac events.[5]

For this indicator, the QCOR committee recommended that the treatment timeframe for analysis should be 72 hours in order to capture all patients with the working diagnosis of NSTEMI, acknowledging that a universal risk prediction score has not been applied.

Table 27 lists the cases that were excluded from the analysis and the reason for exclusion.

Table 27: NSTEMI time to angiography – cases ineligible for analysis

	n
Admitted with an unrelated principal diagnosis	127
Planned or staged PCI	104
Transferred from an interstate hospital	69
Coronary angiography not performed at index admission	37
Transferred from a private hospital	32
Stable non-admitted patients transferred directly to lab for planned angiography	23
Incomplete data	32
Total ineligible	**424**

The median time to angiography with or without PCI was 53 hours (direct transfers 37 hours vs inter-hospital transfers 68 hours). Of the 3003 NSTEMI cases, 54% were inter-hospital transfers and, 47% received PCI. Figure 26 depicts the proportions of cases meeting the Committee target.

Across the state, the baseline for each PCI centre likely reflects the demographics, logistics and pathways that pertain to that centre. Overall, there appears to be better performance from year to year with room for improvement that may be maximised by auditing local practice.

Table 28: NSTEMI time to angiography by site

SITE	Total NSTEMI cases (n)	Total analysed (n)	Median (hours)	Interquartile range (hours)	Met 72 hour target (%)
CH	307	268	62	27–115	56.7
TTH	249	223	60	35–95	61.4
MBH	127	96	38	23–68	79.2
SCUH	331	295	33	20–61	82.4
TPCH	665	585	47	22–88	67.7
RBWH	363	313	54	27–84	68.1
PAH	678	581	70	42–110	52.2
GCUH	283	218	49	24–77	72.5
STATEWIDE	**3,003**	**2,579**	**53**	**26–91**	**65.1**

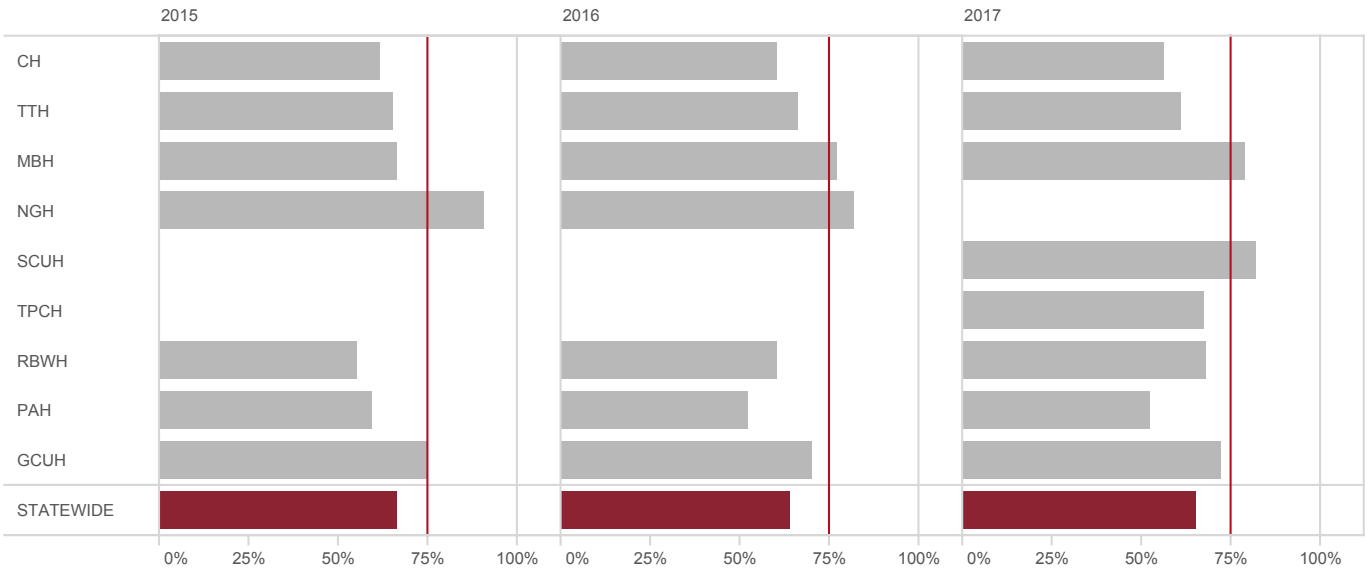


Figure 26: Proportion of NSTEMI cases meeting time to angiography target of 72 hours, 2015–2017

13.4 Major procedural complications

This quality indicator examines in lab intra-procedural complications. In 2017, 24 cases (0.49%) recorded an immediate major procedural complication. Events included in this analysis are coronary artery perforation, in-lab death, pericardial tamponade, emergency coronary artery bypass graft surgery and cerebrovascular accident. Overall, the numbers are far too low for further comment, other than to state that it is obviously reassuring.

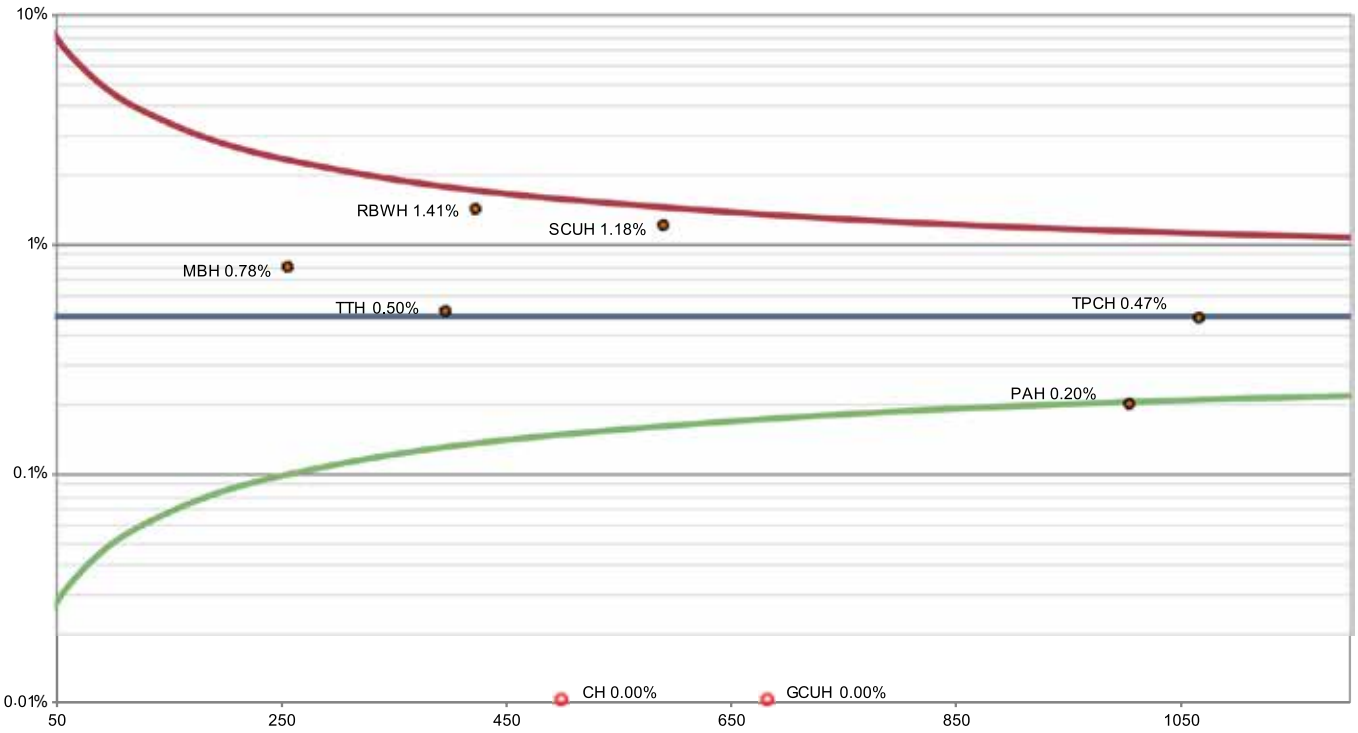


Figure 27: Documented immediate major procedural complications by site

Table 29: All PCI cases by immediate major procedural complication type

Major complication type	Count	%
Coronary artery perforation	18	0.37
In lab death	4	0.08
Tamponade	1	0.02
Emergency CABG	1	0.02
Cerebrovascular accident	0	0.00
No immediate major procedural complication	4,904	99.51
Total	**4,928**	**100.00**

13.5 Safe radiation doses

Staff and patients are exposed to ionising radiation during almost all procedures performed in the cardiac catheter laboratory. Whilst ionising radiation is known to cause both delayed and deterministic (non-delayed) effects, the probability of effect is thought to be dose-related.

Fortunately, conservative thresholds are applied and monitored throughout Queensland. However, as the complexity of procedural work undertaken by interventional cardiologists increases, along with the increase in patients with a large body mass, it is increasingly important to remain vigilant about radiation hygiene. This indicator examines the proportion of cases exceeding the high dose threshold of 5Gy.

Table 30: Proportion of cases meeting the safe dose threshold by case type

Site	PCI procedures (%)	Other coronary procedures (%)
CH	99.8	100.0
TTH	98.5	100.0
MBH	100.0	100.0
SCUH	99.3	99.9
TPCH	97.8	99.9
RBWH	98.1	100.0
PAH	94.2	99.8
GCUH	99.7	99.9
STATEWIDE	**97.9**	**99.9**

14 Conclusions

This 2017 report continues to demonstrate encouraging results for all public cardiac catheter laboratory sites across Queensland. Of the 8 sites it is apparent that there are reassuring mortality and morbidity rates observed despite a varied and sometimes complex cohort of presenting patients.

Collection of supporting risk adjustment data continues to be a challenge given that some of these data elements may not be readily available at the time of urgent or emergency procedures. The efforts of site quality improvement coordinators and data managers are to be commended however, with rates of data completion showing promising improvement throughout 2017. It is hoped that the QCOR data quality audit program will be extended to encompass all sites in the future to facilitate full analyses of risk adjusted outcomes.

The input of the Queensland Ambulance Service in this year's report further demonstrates the positive relationship between the two Government Departments continuing to produce encouraging results. This collaboration will hopefully be the basis for further opportunities for service improvement across both clinical services with the focus on optimising patient outcomes.

With the results demonstrated across all clinical indicators and benchmark activities, Queenslanders can be assured of treatment that exceeds international benchmarks and that the registries developed to promote this care are providing the support and evidence clinicians require.

15 Recommendations

The development of future reports that document the patient journey between QCOR specialty areas is a point of focus for future work. With linkage of patient presentations and participation across other QCOR applications, it is hoped that an overview of the incidence of patients requiring reinvestigation or repeat revascularisation can be developed.

Development of a new QCOR structural heart disease module remains a priority. The module developed to provide superior reporting capabilities for structural heart disease interventions including device closure, and percutaneous valve replacement and repair procedures. Use of the new system is expected to commence in early 2019. It is anticipated that this will enable future statewide participation in national quality and safety activities for transcatheter aortic valve replacement as well as offer an unprecedented insight into the quality of care of patients undergoing interventions in this emerging area of cardiac services.

Facilitating the planning and commissioning of new health infrastructure is also a key aim of publications such as this. With the included geographic analysis, including proximity to treating facility in this years' report, greater insight into the barriers encountered by patients with respect to health access can be demonstrated and should be expanded for future reports. These analyses are particularly pertinent given the current objectives of better cardiac care for all Queenslanders closer to home.

Inclusion of private facilities continues to be an aim for QCOR as a whole, with a particular desire for participation in the interventional cardiology audit program apparent. Future work will be focused on facilitating this participation. Queensland's participation in national registries also continues to be a focus for the group. With the development of a new framework for a nationwide cardiac registry underway, Queensland interventional cardiology practitioners are eagerly awaiting the opportunity to contribute to this important initiative.

16 Supplement: Structural heart disease

The QCOR structural heart disease (SHD) initiative is a continued focus of the the QCOR interventional cardiology committee with the development of a bespoke QCOR module catering towards these procedures underway. The new module has been developed to provide clinicians with enhanced procedure reporting capabilities at the point of care with prospective clinical use expected to commence in early 2019.

This QCOR supplementary report has expanded to encompass SHD interventions performed across all Queensland public cardiac catheterisation laboratories in 2017. In future it is hoped that the registry would be able to extend participation toward private facilities as well.

16.1 Participating sites

In 2017, there were seven participating cardiac catheter laboratories performing a total of 390 SHD interventions.

Table 1: Total SHD cases by participating site

Site	Device closure* n (%)	Valvular intervention† n (%)	Other‡ n (%)	All cases n (%)
CH	13 (72.2)	5 (27.8)	-	18 (100.0)
TTH	10 (62.5)	6 (37.5)	-	16 (100.0)
SCUH	7 (77.8)	2 (22.2)	-	9 (100.0)
TPCH	50 (17.9)	218 (78.1)	11 (3.9)	279 (100.0)
RBWH	1 (33.3)	2 (66.7)	-	3 (100.0)
PAH	15 (29.4)	33 (64.7)	3 (5.9)	51 (100.0)
GCUH	5 (35.7)	9 (64.3)	-	14 (100.0)
STATEWIDE	**101 (25.9)**	**275 (70.5)**	**14 (3.6)**	**390 (100.0)**

* Includes percutaneous closure of ASD, PFO, PDA, LAA, paravalvular leak and VSD

† Percutaneous valve replacement and valvuloplasty

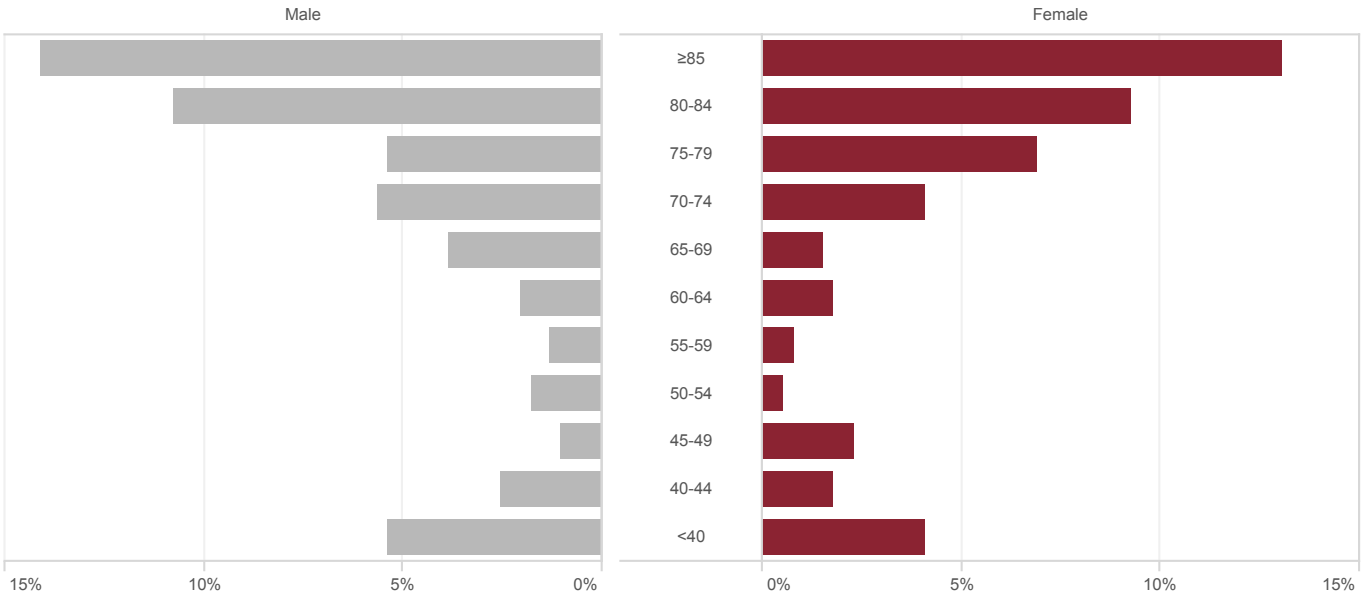
‡ Myocardial septal ablation, ASD balloon occlusion and percutaneous insertion of pulmonary arterial pressure monitoring device

16.2 Patient characteristics

16.2.1 Age and gender

Patients undergoing an SHD intervention were almost evenly distributed between genders at 54% male and 46% female.

Age varied considerably by procedure category, with patients undergoing a valvular intervention having an overall median age of 82 years compared to 49 years for device closure procedures.



% of total (n=390)

Figure 1: Proportion of all SHD cases by gender and age group

Table 2: Median age by gender and procedure category

	Male (years)	Female (years)	All cases (years)
Device closures	50	49	49
Valvular intervention	82	83	82
Other	63	63	63
ALL	**79**	**80**	**79**

16.3 Care and treatment of SHD patients

16.3.1 Device closures

In 2017 there were a total of 101 device closures performed across participating centres. The most common procedures were for the correction of a patent foramen ovale (PFO), followed by atrial septal defect (ASD) at 40% and 36% of overall case volumes respectively.

Table 3: Device closure procedures by participating site

Site	Aortic Pseudo-aneurysm n (%)	ASD* n (%)	PDA† n (%)	LAA‡ n (%)	Para-valvular leak n (%)	PFO§ n (%)	VSD‖ n (%)	All n (%)
CH	-	5 (38.5)	-	-	-	8 (61.5)	-	13 (100.0)
TTH	-	7 (70.0)	-	-	-	3 (30.0)	-	10 (100.0)
SCUH	-	2 (28.6)	-	-	1 (14.3)	4 (57.1)	-	7 (100.0)
TPCH	2 (4.0)	12 (24.0)	3 (6.0)	11 (22.0)	3 (6.0)	17 (34.0)	2 (4.0)	50 (100.0)
RBWH	-	1 (100.0)	-	-	-	-	-	1 (100.0)
PAH	-	8 (53.3)	-	-	2 (13.3)	4 (26.7)	1 (6.7)	15 (100.0)
GCUH	-	1 (20.0)	-	-	-	4 (80.0)	-	5 (100.0)
STATEWIDE	**2 (2.0)**	**36 (35.6)**	**3 (3.0)**	**11 (10.9)**	**6 (5.9)**	**40 (39.6)**	**3 (3.0)**	**101 (100.0)**

* Atrial septal defect

† Patent ductus arteriosus (includes 2 device closures and 1 device coiling of PDA)

‡ Left atrial appendage

§ Patent foramen ovale

‖ Ventricular septal defect

16.3.2 Valvular interventions

In 2017, there were 275 valvular interventions performed across 7 participating sites. Valvular interventions comprised of transcatheter valvular repair (Table 6) and transcatheter valve replacement (Table 7) procedures. Valvular interventions were almost evenly distributed with 137 transcatheter valve replacements and 138 transcatheter valve repairs.

The aortic valve was the most common valve requiring intervention and accounted for 86% of overall cases and majority of cases across all participating sites.

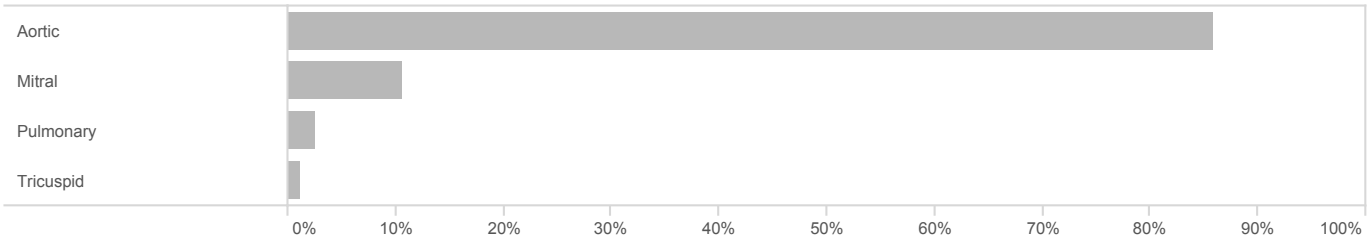


Figure 2: Proportion of all transcatheter valvular interventions by valve type

Table 4: Transcatheter valvular interventions by type of valve

Site	Aortic n (%)	Mitral n (%)	Pulmonary n (%)	Tricuspid n (%)	All cases n (%)
CH	5 (100.0)	-	-	-	5 (100.0)
TTH	4 (66.7)	2 (33.3)	-	-	6 (100.0)
SCUH	2 (100.0)	-	-	-	2 (100.0)
TPCH	184 (84.4)	26 (11.9)	5 (2.3)	3 (1.4)	218 (100.0)
RBWH	2 (100.0)	-	-	-	2 (100.0)
PAH	30 (90.9)	1 (3.0)	2 (6.1)	-	33 (100.0)
GCUH	9 (100.0)	-	-	-	9 (100.0)
STATEWIDE	**236 (85.8)**	**29 (10.5)**	**7 (2.5)**	**3 (1.1)**	**275 (100.0)**

Table 5: Transcatheter valvular interventions

Site	Transcatheter valvuloplasty n (%)	Transcatheter valve replacement n (%)	All cases n (%)
CH	5 (100.0)	-	5 (100.0)
TTH	6 (100.0)	-	6 (100.0)
SCUH	2 (100.0)	-	2 (100.0)
TPCH	107 (49.1)	111 (50.9)	218 (100.0)
RBWH	2 (100.0)	-	2 (100.0)
PAH	11 (33.3)	22 (66.7)	33 (100.0)
GCUH	5 (55.6)	4 (44.4)	9 (100.0)
STATEWIDE	**138 (50.2)**	**137 (49.8)**	**275 (100.0)**

Table 6: Transcatheter interventional valve procedures

Site	Balloon aortic valvuloplasty n (%)	Balloon mitral valvuloplasty n (%)	MitraClip n (%)	PASCAL n (%)	REDUCE FMR Trial n (%)	Balloon pulmonary valvuloplasty n (%)	Balloon tricuspid valvuloplasty n (%)
CH	5 (100.0)	-	-	-	-	-	-
TTH	4 (66.7)	2 (33.3)	-	-	-	-	-
SCUH	2 (100.0)	-	-	-	-	-	-
TPCH	81 (75.7)	3 (2.8)	12 (11.2)	3 (2.8)	4 (3.7)	1 (0.9)	3 (2.8)
RBWH	2 (100.0)	-	-	-	-	-	-
PAH	9 (81.8)	1 (9.1)	-	-	-	1 (9.1)	-
GCUH	5 (100.0)	-	-	-	-	-	-
STATEWIDE	**108 (78.3)**	**6 (4.3)**	**12 (8.7)**	**3 (2.2)**	**4 (2.9)**	**2 (1.4)**	**3 (2.2)**

Table 7: Transcatheter valve replacement procedures

Site	TAVR* n (%)	TMVR† n (%)	TPVR‡ n (%)
TPCH	103 (92.8)	4 (3.6)	4 (3.6)
PAH	21 (95.5)	-	1 (4.5)
GCUH	4 (100.0)	-	-
STATEWIDE	**128 (93.4)**	**4 (2.9)**	**5 (3.6)**

* Transcatheter aortic valve replacement

† Transcatheter mitral valve replacement

‡ Transcatheter pulmonary valve replacement

Table 8: Other structural heart disease interventions

Site	ASD* balloon occlusion n (%)	Myocardial septal ablation n (%)	Pulmonary arterial pressure monitoring device n (%)
TPCH	1 (9.1)	5 (45.5)	5 (45.5)
PAH	-	3 (100.0)	-
STATEWIDE	**1 (7.1)**	**8 (57.1)**	**5 (35.7)**

* Atrial septal defect

16.4 Patient outcomes

16.4.1 All cause 30 day mortality

For the participating sites performing structural heart disease interventions within 2017, there was an overall all cause unadjusted mortality rate within 30 days of 4.1%.

Table 9: All cause unadjusted 30 day mortality post SHD intervention by procedure category and site

Site	Total cases (n)	Device closure n (%)	Valvular intervention n (%)	Other n (%)	Total deaths n (%)
CH	18	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
TTH	16	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
SCUH	9	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
TPCH	279	1 (2.0)	12 (5.5)	1 (9.1)	14 (5.0)
RBWH	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
PAH	51	1 (6.7)	1 (3.0)	0 (0.0)	2 (3.9)
GCUH	14	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
STATEWIDE	**390**	**2 (2.0)**	**13 (4.7)**	**1 (7.1)**	**16 (4.1)**

16.4.2 All TAVR cases

2017 cases

Of the three sites performing TAVR in 2017, the overall all cause unadjusted mortality rate within 30 days of the procedure was 3.1%.

Table 10: All cause unadjusted 30 day mortality post SHD intervention by site

Site	Total cases (n)	30 day mortality n (%)
TPCH	103	4 (3.9)
PAH	21	0 (0.0)
GCUH	4	0 (0.0)
STATEWIDE	**128**	**4 (3.1)**

2016 cases

Of the two sites performing TAVR within 2016, the overall all cause unadjusted mortality rate within 30 days of the procedure was 1.0%, and 9.8% at 365 days.

Table 11: All cause unadjusted 30 day and 365 day mortality post SHD intervention by site, 2016

Site	Total cases (n)	30 day mortality n (%)	365 day mortality n (%)
TPCH	86	1 (1.1)	9 (10.3)
PAH	15	0 (0.0)	1 (6.7)
STATEWIDE	**101**	**1 (1.0)**	**10 (9.8)**

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59 Glossary

ACC	American College of Cardiology
ACEI	Angiotensin Converting Enzyme Inhibitor
ACS	Acute Coronary Syndromes
ANZSCTS	Australian and New Zealand Society of Cardiac and Thoracic Surgeons
ARB	Angiotensin II Receptor Blocker
ARNI	Angiotensin Receptor-Neprilysin Inhibitors
ASD	Atrial Septal Defect
BCIS	British Cardiovascular Intervention Society
BiV	Biventricular
BMI	Body Mass Index
BMS	Bare Metal Stent
BVS	Bioresorbable Vascular Scaffold
CABG	Coronary Artery Bypass Graft
CCL	Cardiac Catheter Laboratory
CH	Cairns Hospital
CHF	Congestive Heart Failure
CI	Clinical Indicator
CR	Cardiac Rehabilitation
CRT	Cardiac Resynchronisation Therapy
CS	Cardiac Surgery
CV	Cardiovascular
CVA	Cerebrovascular Accident
DAOH	Days Alive and Out of Hospital
DEM	Department of Emergency Medicine
DES	Drug Eluting Stent
DOSA	Day Of Surgery Admission
DSWI	Deep Sternal Wound Infection
ECG	12 lead Electrocardiograph
eGFR	Estimated Glomerular Filtration Rate
EP	Electrophysiology
FdECG	First Diagnostic Electrocardiograph
FTE	Full Time Equivalent
GCUH	Gold Coast University Hospital
GP	General Practitioner
HF	Heart Failure
HFpEF	Heart Failure with Preserved Ejection Fraction
HFrEF	Heart Failure with Reduced Ejection Fraction
HFS	Heart Failure Service
HFSS	Heart Failure Support Service
HHS	Hospital and Health Service
IC	Interventional Cardiology
ICD	Implantable Cardioverter Defibrillator
ICD-10	International Classification of Diseases 10th edition
IHT	Interhospital Transfer
IVDU	Intravenous Drug Use
KPI	Key Performance Indicator
LAA	Left Atrial Appendage
LAD	Left Anterior Descending Artery
LCX	Circumflex Artery
LOS	Length Of Stay
LV	Left Ventricle
LVEF	Left Ventricular Ejection Fraction
MBH	Mackay Base Hospital
MI	Myocardial Infarction
MRA	Mineralocorticoid Receptor Antagonists
MSSA	Methicillin-sensitive Staphylococcus aureus
NCDR	The National Cardiovascular Data Registry
NGH	Nambour General Hospital
NOAC	Non-Vitamin K Antagonist Oral Anticoagulants
NP	Nurse Practitioner
NRBC	Non-Red Blood Cells
NSTEMI	Non ST-Elevation Myocardial Infarction
PAH	The Princess Alexandra Hospital
PCI	Percutaneous Coronary Intervention
PDA	Patent Ductus Arteriosus
PFO	Patent Foramen Ovale
QAS	Queensland Ambulance Service
QCOR	Queensland Cardiac Outcomes Registry
QE II	Queen Elizabeth II Jubilee Hospital
QH	Queensland Health
QHAPDC	Queensland Hospital Admitted Patient Data Collection
QIP	Quality Incentive Payment
RBC	Red Blood Cells
RBWH	The Royal Women's and Brisbane Hospital
RCA	Right Coronary Artery
RHD	Rheumatic Heart Disease
SCCIU	Statewide Cardiac Clinical Informatics Unit
SCCN	Statewide Cardiac Clinical Network
SHD	Structural Heart Disease
STEMI	ST-Elevation Myocardial Infarction
STS	Society of Thoracic Surgery
TAVR	Transcatheter Aortic Valve Replacement
TMVR	Transcatheter Mitral Valve Replacement
TPCH	The Prince Charles Hospital
TPVR	Transcatheter Pulmonary Valve Replacement
TTH	The Townsville Hospital
VCOR	Victorian Cardiac Outcomes Registry
VF	Ventricular Fibrillation
VSD	Ventricular Septal Defect

60 Upcoming initiatives

- Improved collaboration with the Rheumatic Heart Disease (RHD) Register and Control Program is a key objective in the recently published RHD Action Plan. As of September 2018, rheumatic heart disease is a notifiable condition in Queensland. QCOR will work with the RHD Register to improve the quality and ease of access to related information. The QCOR currently reports to relevant National clinical registries and its currently participating in the development of the National Cardiac Registry and the National Cardiac Rehabilitation Registry.
- Cardiac outreach services are delivered to regional and remote sites across Queensland, primarily by staff from large tertiary hospitals. There is limited data about the quality and effectiveness of these services. QCOR will develop and deploy a centralised data collection and reporting module to enhance coordination of services and monitor the care provided to patients residing in rural and remote locations in Queensland. The new QCOR module is anticipated to be in place in early 2019.
- The final project for delivery from the Statewide Cardiac Clinical Network's Cardiac Information Solutions Program is currently being deployed. The ECG Flash: 24/7 Clinical Advice and ECG Interpretation Service connects clinical staff in rural and remote locations with cardiologists in metropolitan facilities. The system allows rapid inter-hospital clinical interpretation of 12-lead ECG readings and clinical advice for patients with challenging clinical presentation. To date, the system has been deployed in 5 Hospital and Health Services and will be deployed in most services by the end of 2019.

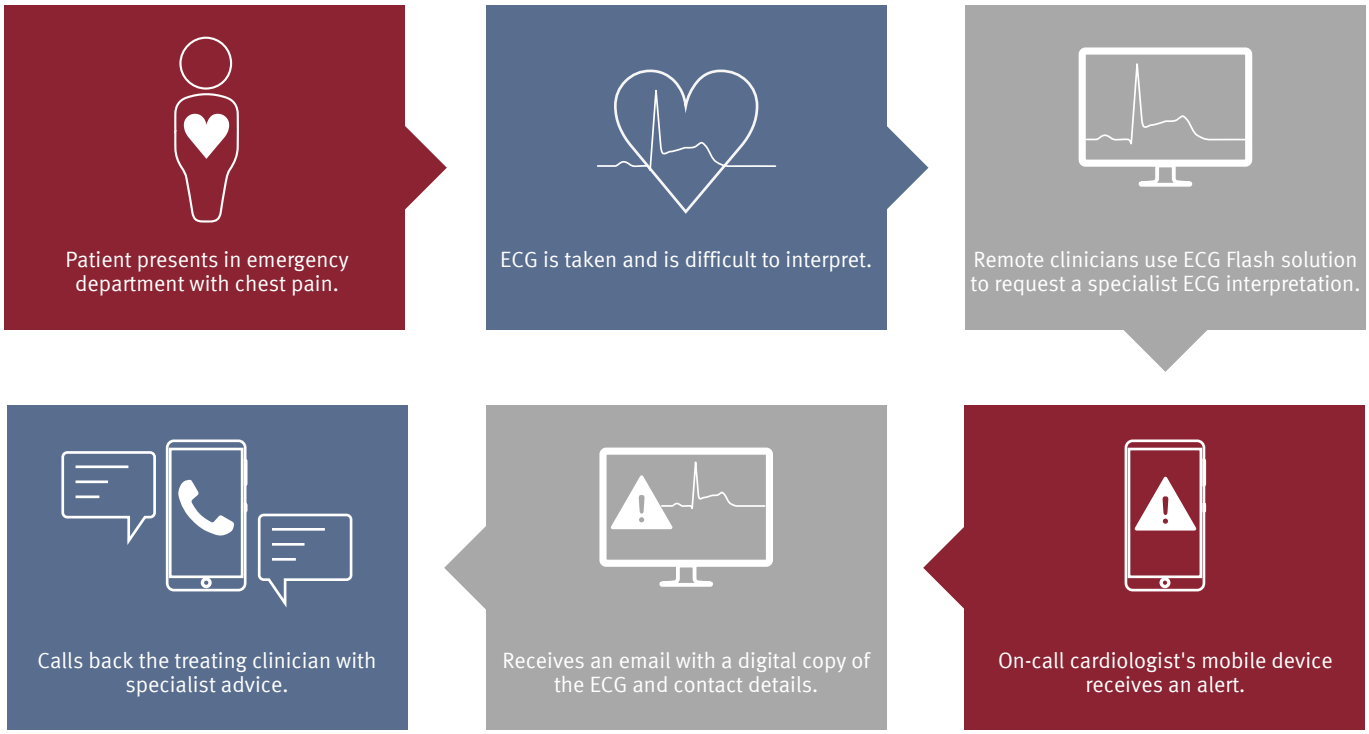

Figure C: Concept model for rapid inter-hospital clinical interpretation of 12-lead ECGs (CISP ECG Flash Project)