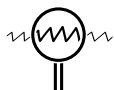
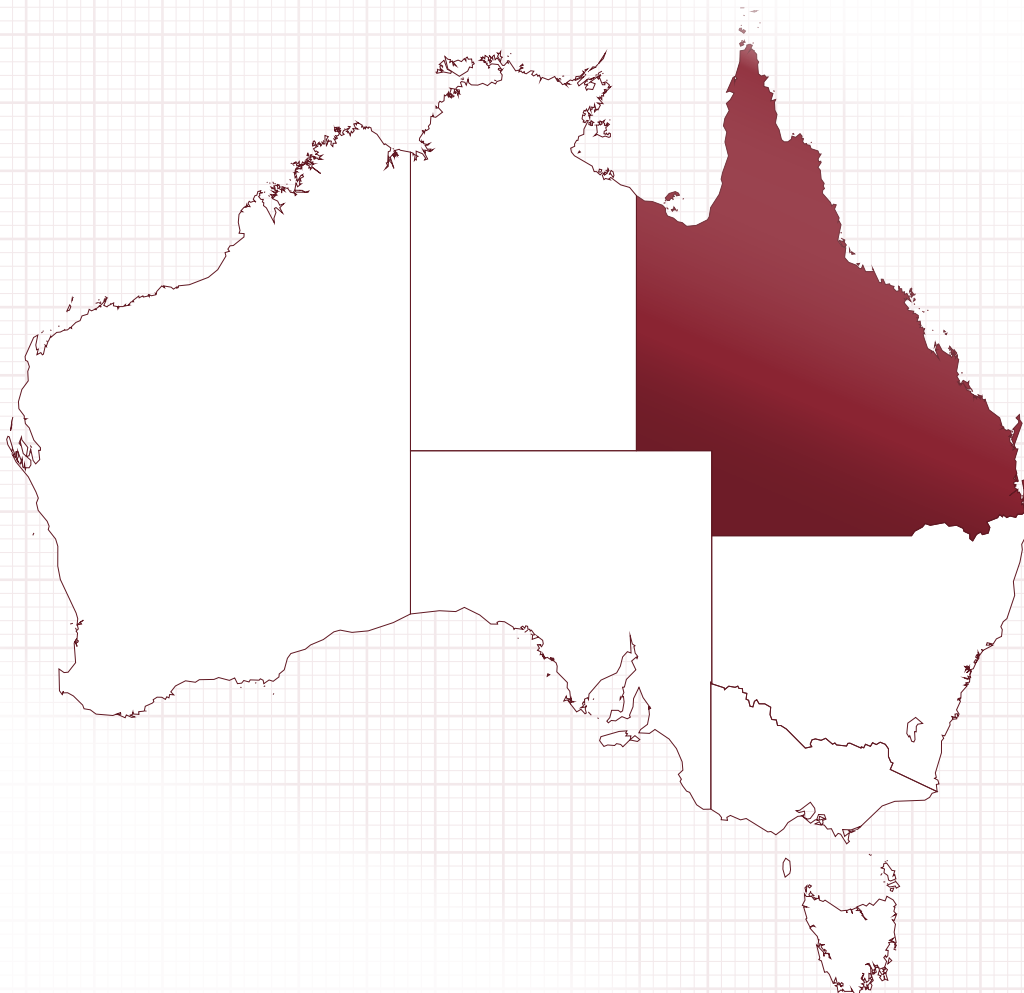


Statewide Cardiac Clinical Network

Queensland Cardiac Outcomes Registry

2018 Annual Report

Cardiac Rehabilitation Audit



Improvement | Transparency | Patient Safety | Clinician Leadership | Innovation



Queensland
Government

Queensland Cardiac Outcomes Registry 2018 Annual Report

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1 Foreword

As Director General of Queensland Health, I am pleased to present the ***Queensland Cardiac Outcomes Registry (QCOR) 2018 Annual Report***. The Annual Report provides detailed information on the performance of our clinical care for, and outcomes of, people with cardiac disorders.

The Annual Report examines a range of clinical areas including cardiac and thoracic surgery, cardiac rehabilitation, cardiac catheter interventions, electrophysiology and pacing, and heart failure support services. This year's Annual Report includes additional analysis of specific areas of interest to enable examination of clinical issues faced by practitioners at the face of patient care.

The Annual Report exemplifies how Queensland Health is meeting its objective to *enable safe, high quality services*. The results show that Queenslanders are receiving some of the best cardiac care in the country, and often the world. Queensland Health is committed to empowering our people to provide the best possible healthcare, to be transparent in our work and importantly use information to inform and improve the health outcomes of our patients.

The high level of clinical engagement extends beyond clinical practice to working collaboratively with Queensland Health administrators to improve the efficiency of our organisation. Recently, cardiac clinicians and administrators collaborated and used QCOR data to improve the purchasing process of clinical products resulting in savings of \$5 million. These funds will now be available in the relevant Hospital and Health Services to reinvest into patient care.

QCOR data allows us to be responsive to the needs of our patients and community. It is actively used to inform how we improve the access, equity, safety, efficiency and effectiveness of our cardiac healthcare.

I would like to acknowledge the ongoing effort of the Statewide Cardiac Clinical Network and its many clinicians and colleagues, who have collaborated to produce this Annual Report.



**Dr John Wakefield ^{PSM}
Director-General
Queensland Health**

2 Message from the SCCN Chair

It is my pleasure to introduce the 4th Queensland Cardiac Outcome Registry (QCOR) Annual Report. The activities of QCOR continue to mature, and this report gives us yet another opportunity to re-examine the reasons for continuing this work, as well as forming a stimulus to reinvigorate our efforts. The chance to ask, “Why are we doing this?” – a lot of effort, repeated committee meetings, some late nights, and occasional irritation with colleagues, as a counterpoise to the ingrained clinician desire to do the absolute best for every patient we care for and to have data to prove it. The ledger is strongly tilted in the affirmative.

Queensland is now acknowledged as having some of the most comprehensive cardiac data in the country, and the success of this program absolutely rests on the sustained clinician participation on which the programme is built. Every step from patient care, through recording of data, to submission, reverification and analysis is heavily invested by the clinicians. This intensive participation towards a common goal has certainly drawn the cardiac community together and we can be rightly proud of the cohesiveness of the efforts to improve care across the state.

The report this year further extends important elements of patient care – we have a strong collaboration with Queensland Ambulance Service (QAS), and now have access to quite comprehensive prehospital care including QAS administered thrombolysis and outcomes. In a state as large as Queensland it is critical that we track these important aspects of care. The documentation of post hospital cardiac rehabilitation and heart failure management continues to provide a more comprehensive picture extending the window of acute admission and without doubt adding to the safety of our acute interventions.

It is gratifying to see that procedural outcomes across all of the participating institutions remain stable and of high quality.

Finally, one of the important reasons which clinicians originally identified supporting participation in the program has come to fruition – the cardiac data derived from QCOR has now led to specific investment by the state government in the processes of cardiac care. In the coming year, in an initial investment roll out, hospitals in Cairns and Townsville will significantly expand their outreach into rural and remote centres in Torres and Cape and across to the North West Hospital and Health Service. QCOR data has clearly profiled both the need and the shortfall of cardiac services in these areas and has led to a recognition of our responsibilities for delivering safe and efficacious treatment both for patients who live close to major centres, but also especially for those far removed. This programme will extend to the remaining Hospital and Health Services in a multi-year investment.

Again, I give thanks to all of the clinicians who continue to participate in this important work. In the coming year, QCOR will have the capacity to invite private cardiac providers in the state to submit data to QCOR, so that we can obtain a more complete picture both public and private, of cardiac services across the state.

A special thanks is given to the Statewide Cardiac Clinical Informatics Unit technical and administrative staff who continue to supply superb assistance to the program and who are truly integral to the quality of the attached report.

Dr Paul Garrahy
Chair
Statewide Cardiac Clinical Network

3 Introduction

The Queensland Cardiac Outcomes Registry (QCOR) is an ever-evolving clinical information collection which enables clinicians and other key stakeholders access to quality, contextualised clinical and procedural data. On the background of significant investment and direction from the Statewide Cardiac Clinical Network (SCCN) and under the auspices of Clinical Excellence Queensland, QCOR provides analytics and overview for several clinical information systems and databases. By utilising extensive ancillary complementary administrative datasets, a sophisticated level of multi-purpose reporting and insight has been gained.

QCOR data collections are governed by bespoke clinical committees which provide oversight and direction to reporting content and analysis as well as informing decision-making for future endeavours. These committees are supported by Statewide Cardiac Clinical Informatics Unit (SCCIU) who form the business unit of QCOR. All processes and groups report to the SCCN, which is facilitated by Clinical Excellence Queensland.

The strength of the Registry would not be possible without significant clinician input. Assisting to maintain quality, relevance and context through QCOR committees, clinicians are continually developing and evolving the analysis and focus of each specific group. The SCCIU performs the role of coordinating these individual QCOR committees which each have their individual direction and unique requirements.

The SCCIU provide the reporting, analysis, and development of the many clinical cardiology and cardiothoracic surgical applications and systems in use across Queensland Health. The SCCIU also provides data quality and audit functions as well as expert technical and informatics resources for development, maintenance and continual improvement of specialised clinical applications and relevant secondary uses.

The SCCIU team consists of:

- Mr Graham Browne – Database Administrator
- Mr Michael Mallouhi – Clinical Analyst
- Mr Marcus Prior – Informatics Analyst
- Dr Ian Smith, PhD – Biostatistician
- Mr William Vollbon – Manager
- Mr Karl Wortmann – Application Developer

This 2018 QCOR report now includes a total of 6 clinical audits. The addition of the thoracic surgery audit report complements the existing cardiac surgery report to enable a clearer picture of the work undertaken by cardiac and thoracic surgeons in Queensland. This work reflects efforts in this space and the highlights the vast patient cohort that are encountered by clinicians working in this specialty. It is with this continual development and evolution of clinical reporting maturity that QCOR hopes to further support cardiothoracic clinical informatics into the future.

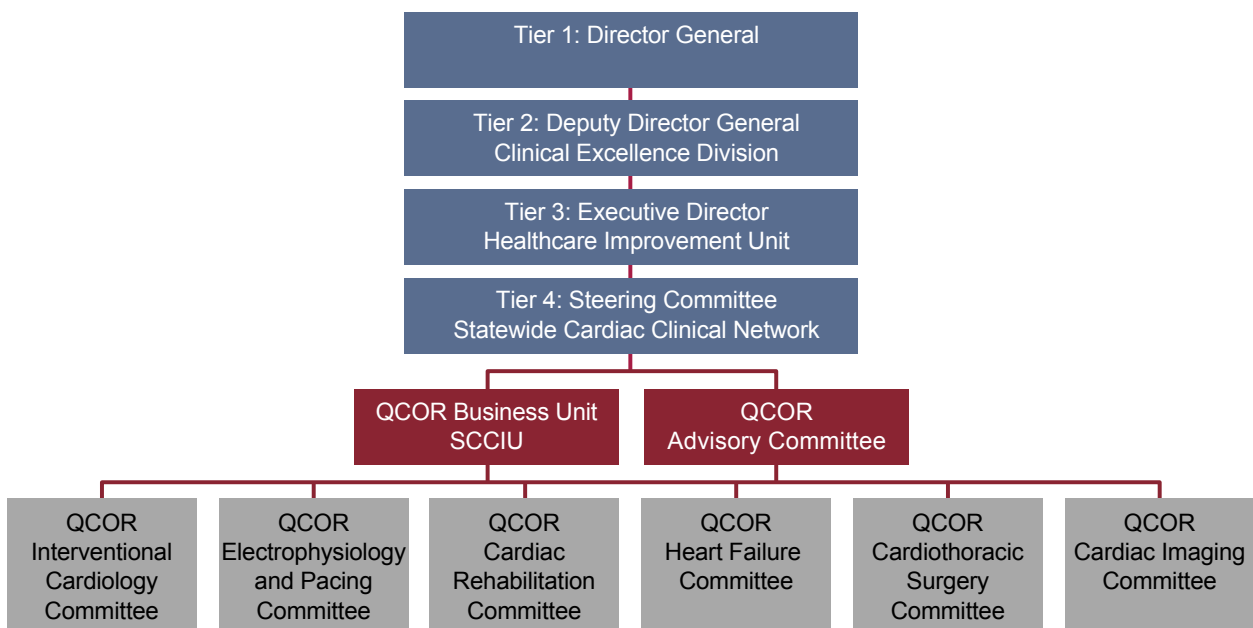
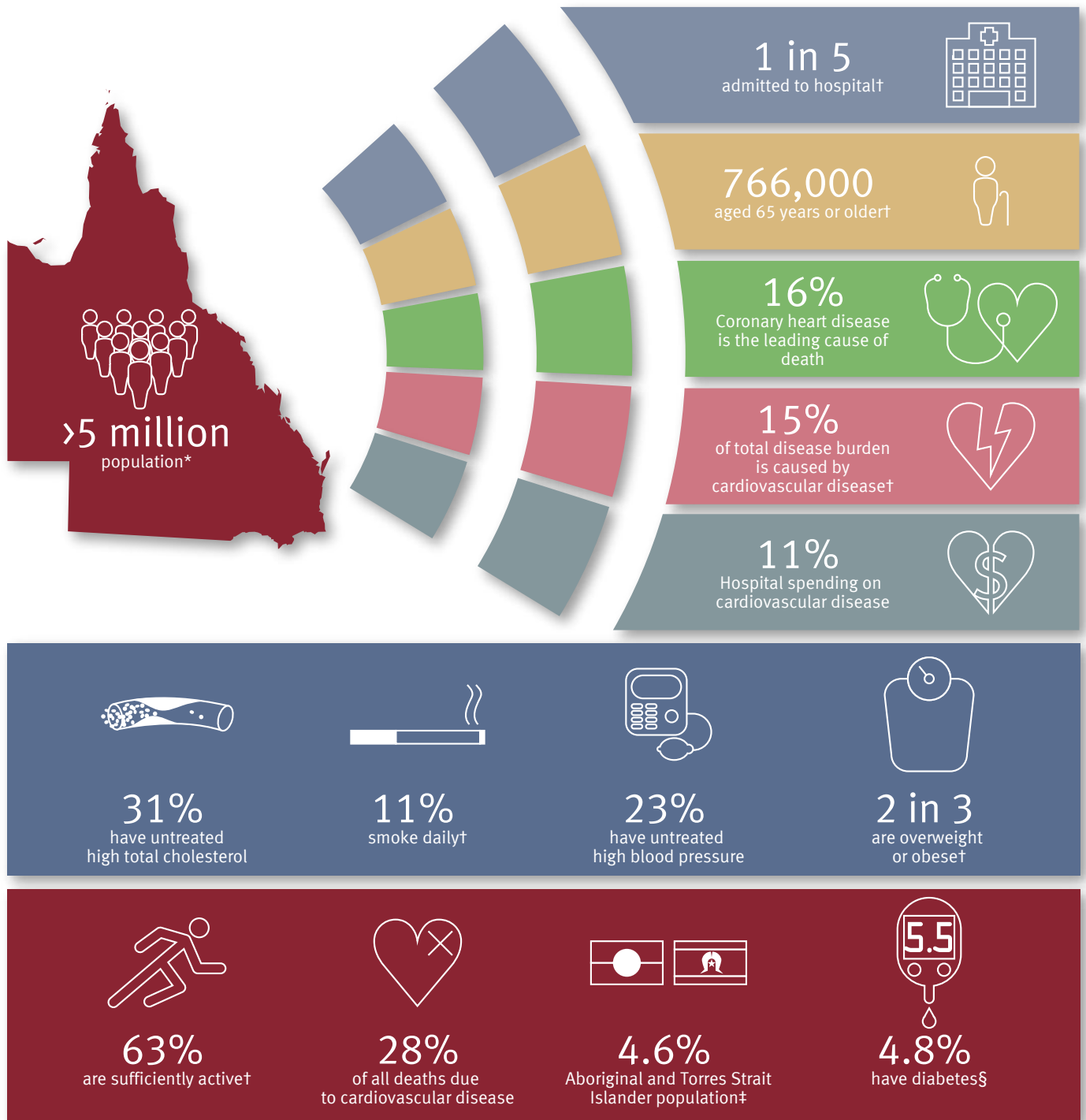


Figure A: Operational structure

Queensland Cardiac Outcomes Registry

The health of Queenslanders



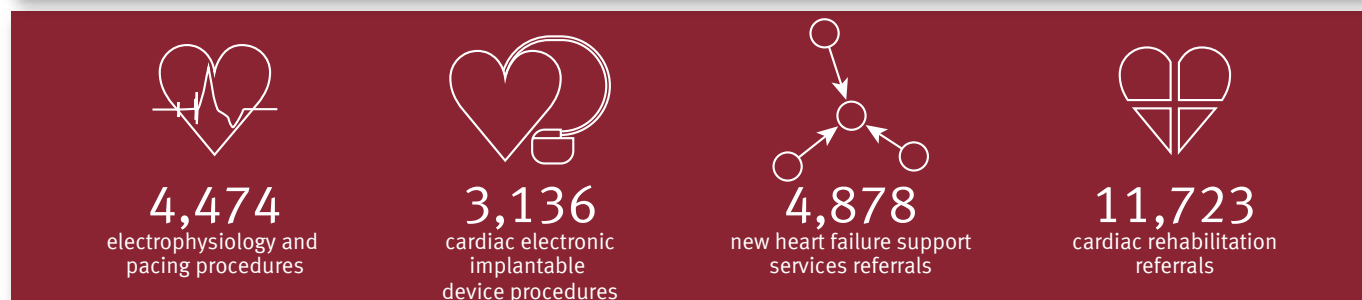
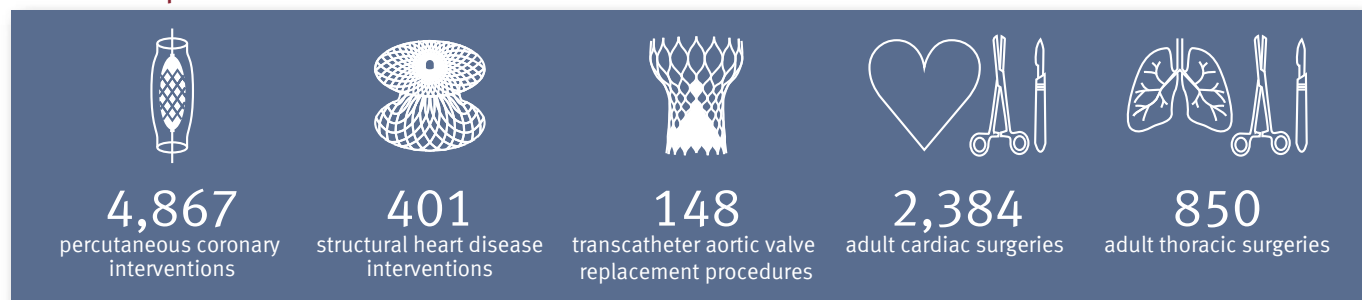
What's new?

Thoracic Surgery Audit	Interhospital transfer for coronary intervention review
Electrophysiology and pacing clinical indicators	Cardiac rehabilitation patient outcome measures
Thrombolysis for STEMI analysis	Body mass index in cardiac surgery investigation

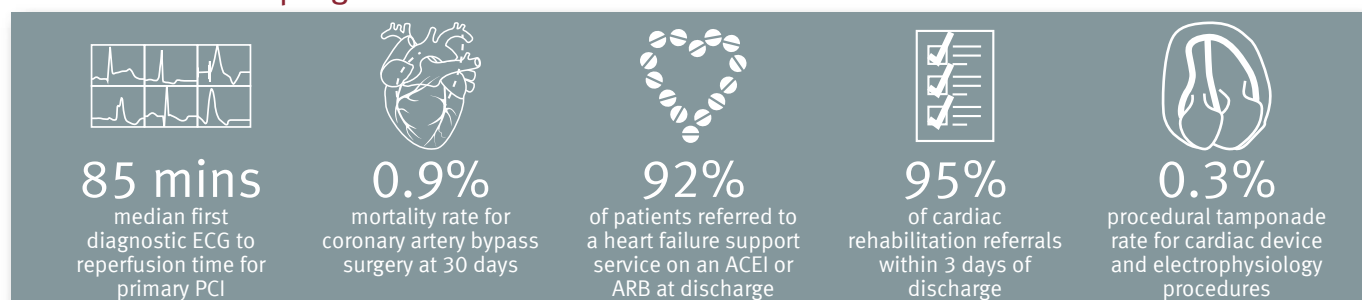
Figure B: QCOR 2018 infographic

2018 Activity at a Glance

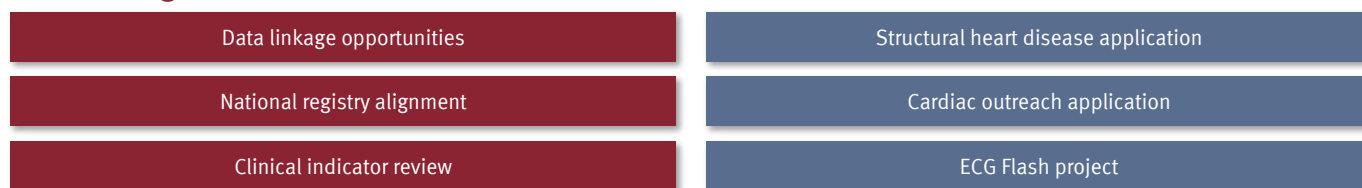
Case and patient volumes



Clinical indicator progress



Continuing our work



- * Australian Bureau of Statistics. Regional population growth, Australia, 2017-2018. Cat. no. 3218.o. ABS:Canberra; 2019
- † Queensland Health (2018).The health of Queenslanders 2018. Report of the Chief Health Officer Queensland. Brisbane. Queensland Government
- ‡ Australian Bureau of Statistics. Estimates of Aboriginal and Torres Strait Islander Australians, June 2016. Cat. no 3238.055001. ABS: Canberra; 2018
- § Diabetes Australia. State statistical snapshot: Queensland. As at 30 June 2018; 2018

4 Executive summary

This report encompasses procedures and cases for 8 cardiac catheterisation laboratories (CCL) and electrophysiology and pacing (EP) facilities and 5 cardiothoracic surgery units operating across Queensland public hospitals. It also includes referrals to clinical support and rehabilitation services for the management of heart disease including 22 heart failure support services and 55 cardiac rehabilitation outpatient facilities.

- 15,436 diagnostic or interventional cases were performed across the 8 public cardiac catheterisation laboratory facilities in Queensland hospitals. Of these, 4,867 involved percutaneous coronary intervention (PCI).
- Patient outcomes following PCI remain encouraging. The 30 day mortality rate following PCI was 1.9%, and of the 94 deaths observed, 74% were classed as either salvage or emergency PCI.
- In analysis for patients with STEMI, the median time from FdECG to reperfusion and arrival at PCI facility to reperfusion was observed at 85 minutes and 42 minutes. This compares favourably to results for previous years and internationally.
- Across the four sites with a cardiac surgery unit, a total of 2,384 cases were performed including 1,414 CABG and 1,005 valve procedures.
- As in previous years, observed rates for cardiac surgery mortality and morbidity are either within the expected range or better than expected, depending on the risk model used to evaluate these outcomes. Once again the exception was the rate of deep sternal wound infection.
- The Cardiac Surgery Audit includes a focused supplement on obesity in cardiac surgery. This report highlights the increased rate of post-operative morbidity and mortality for patients with a higher BMI ($>30 \text{ kg/m}^2$).
- The five public hospitals providing thoracic surgery services in 2018 performed a total of 850 cases. Almost one-third (30%) of surgeries followed a preoperative diagnosis of primary lung cancer or pleural disease (33%). This is the first QCOR Annual Report to examine thoracic surgery, and this will be expanded in future years.
- At the 8 public EP sites, a total of 4,474 cases were performed, which included 3,136 cardiac device procedures and 1,061 electrophysiology procedures. This audit includes expanded reporting around clinical indicators for EP cases.
- This Electrophysiology and Pacing Audit identified a median wait time of 81 days for complex ablation procedures, and 33 days for elective ICD implants.
- There were a total of 11,723 referrals to one of the 55 public cardiac rehabilitation services in 2018. Most referrals (77%) followed an admission at a public hospital in Queensland.
- The vast majority of referrals to CR were created within three days of the patient being discharged from hospital (95%), while over half of patients went on to complete an initial assessment by CR within 28 days of discharge (59%).
- There were 4,878 new referrals to a heart failure support service in 2018. Clinical indicator benchmarks were achieved for timely follow-up of referrals, and prescription of angiotensin-converting-enzyme inhibitor (ACEI) or angiotensin II receptor blockers (ARB) and appropriate beta blockers as per clinical guidelines.

5 Acknowledgements and authors

This collaborative report was produced by the SCCIU, audit lead for QCOR for and on behalf of the Statewide Cardiac Clinical Network.

The work of QCOR would not be possible without the continued support and funding from Clinical Excellence Queensland. This publication draws on the expertise of many teams and individuals. In particular, the assistance of the Statistical Services Branch, Healthcare Improvement Unit and Queensland Ambulance Service each make significant contributions to ensure the success of the program. Metro North Hospital and Health Service are also recognised through their stake in supporting and hosting the SCCIU operational team.

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. The following provided writing assistance with this year's report:

Interventional Cardiology

Dr Sugeet Baveja

- The Townsville Hospital

Dr Niranjan Gaikwad

- The Prince Charles Hospital

Dr Christopher Hammett

- Royal Brisbane and Women's Hospital

A/Prof Richard Lim

- Princess Alexandra Hospital

Dr Rohan Poulter

- Sunshine Coast University Hospital

A/Prof Atifur Rahman

- Gold Coast University Hospital

Dr Shantisagar Vaidya

- Mackay Base Hospital

Dr Gregory Starmer (Chair)

- Cairns Hospital

Queensland Ambulance Service

Dr Tan Doan, PhD

Mr Brett Rogers

Cardiothoracic Surgery

Dr Anil Prabhu

- The Prince Charles Hospital

Dr Andrie Stroebel

- Gold Coast University Hospital

Dr Morgan Windsor

- Royal Brisbane and Women's Hospital

- The Prince Charles Hospital

Dr Sumit Yadav

- The Townsville Hospital

Dr Christopher Cole (Chair)

- Princess Alexandra Hospital

Electrophysiology and Pacing

Mr John Betts

- The Prince Charles Hospital

Mr Anthony Brown

- Sunshine Coast University Hospital

Mr Andrew Claughton

- Princess Alexandra Hospital

Dr Naresh Dayananda

- Sunshine Coast University Hospital

Dr Russell Denman

- The Prince Charles Hospital

Mr Braden Dinham

- Gold Coast University Hospital

Ms Sanja Doneva

- Princess Alexandra Hospital

Mr Nathan Engstrom

- The Townsville Hospital

Ms Kellie Foder

- Royal Brisbane and Women's Hospital

Dr Bobby John

- The Townsville Hospital

Dr Paul Martin

- Royal Brisbane and Women's Hospital

Ms Sonya Naumann

- Royal Brisbane and Women's Hospital

Dr Kevin Ng

- Cairns Hospital

Dr Robert Park

- Gold Coast University Hospital

A/Prof John Hill (Chair)

- Princess Alexandra Hospital

Cardiac Rehabilitation

Ms Michelle Aust

- Sunshine Coast University Hospital

Ms Maura Barnden

- Metro North Hospital and Health Service

Mr Gary Bennett

- Health Contact Centre

Ms Jacqueline Cairns

- Cairns Hospital

Ms Yvonne Martin

- Chronic Disease Brisbane South

Dr Johanne Neill

- Ipswich Hospital

Ms Samara Phillips

- Statewide Cardiac Rehabilitation Coordinator

Ms Deborah Snow

- Gold Coast Hospital and Health Service

Ms Natalie Thomas

- South West Hospital and Health Service

Mr Stephen Woodruffe (Chair)

- West Moreton Hospital and Health Service

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- Queen Elizabeth II Hospital

Ms Tina Ha

- Princess Alexandra Hospital

Ms Helen Hannan

- Rockhampton Hospital

Ms Annabel Hickey

- Statewide Heart Failure Services Coordinator

Dr Rita Hwang, PhD

- Princess Alexandra Hospital

Ms Alicia McClurg

- West Moreton Hospital and Health Service

Dr Kevin Ng

- Cairns Hospital

Ms Robyn Peters

- Princess Alexandra Hospital

Ms Serena Rofail

- Royal Brisbane and Women's Hospital

Dr Yee Weng Wong

- The Prince Charles Hospital

A/Prof John Atherton (Chair)

- Royal Brisbane and Women's Hospital

Statewide Cardiac Clinical Informatics Unit

Mr Michael Mallouhi

Mr Marcus Prior

Dr Ian Smith, PhD

Mr William Vollbon

6 Future plans

Continual progress with expanded analyses and uses of clinical data has been a focus for QCOR in 2018. This is evident through new report elements encompassing thoracic surgery and extended examination of patients undergoing thrombolysis for myocardial infarction. Similarly, obesity and cardiac surgery have been examined and have unveiled key findings that are highly relevant given the increasing incidence of obesity within the general population. Intending to provide clinically relevant analysis, the future work of QCOR is exciting.

The utilisation of linkage data provided by administrative datasets continues to enable and assist QCOR data collections. These data enable information from different sources to be brought together to create a new, richer dataset. Examples of future opportunities for the use of supplementary datasets are medication detail from discharge summaries and pathology investigations undertaken within public Queensland facilities. With access to these expanded data collections, there are opportunities to be seized across many fronts including enhanced risk adjustment options, expanded clinical indicator programs and streamlined participation in national registry activities. Furthermore, this will enable efficiencies in data collections where elements are either not available or practical for collection at the point-of-care, and thereby reduce duplication of entry across clinical systems.

Opportunities exist to better integrate QCOR clinical applications with enterprise systems such as the acclaimed Queensland Health application, The Viewer. It is envisaged that cardiac rehabilitation referrals and assessment forms will be incorporated within the patient record, along with procedure reports generated by the upcoming QCOR structural heart disease application. These developments are set to complement the existing report sharing functionality present within the QCOR electrophysiology system. Further opportunities have been flagged across the heart failure support services and cardiothoracic surgery space to enhance these applications to meet the bespoke requirements of the clinical specialty areas. By embracing opportunities to share valuable clinical data kept in various QCOR systems, investment in QCOR applications will be further realised and valued.

Continual development, revision, and optimisation of clinical indicator programs is essential to the ongoing relevance of the Registry. QCOR will continue to collaborate with experts in all clinical domains to expand the scope of our existing analyses. This will be undertaken with a view to maintain and enhance the quality of reporting and improve the timeliness and relevance of the information provided for clinical leads. Such areas where reporting will be enhanced for next year's Annual Report include:

- Time to angiography for patients receiving thrombolysis
- Expanded radiation safety analyses for diagnostic and interventional cardiology
- Review of risk adjustment models for interventional cardiology
- EuroSCORE II risk adjustment for cardiac surgery patients
- MRA prescription rates for HFrEF patients
- CR referrals rates following cardiac intervention

QCOR is actively investigating opportunities within several areas including the implementation of new patient-reported outcomes and quality-of-life measures and realising further efficiencies concerning statewide procurement of medical devices. New areas of research and research partners and opportunities to contribute to works underway across Queensland Health, and at a national level, are continually being pursued and engaged.

7 Facility profiles

7.1 Cairns Hospital

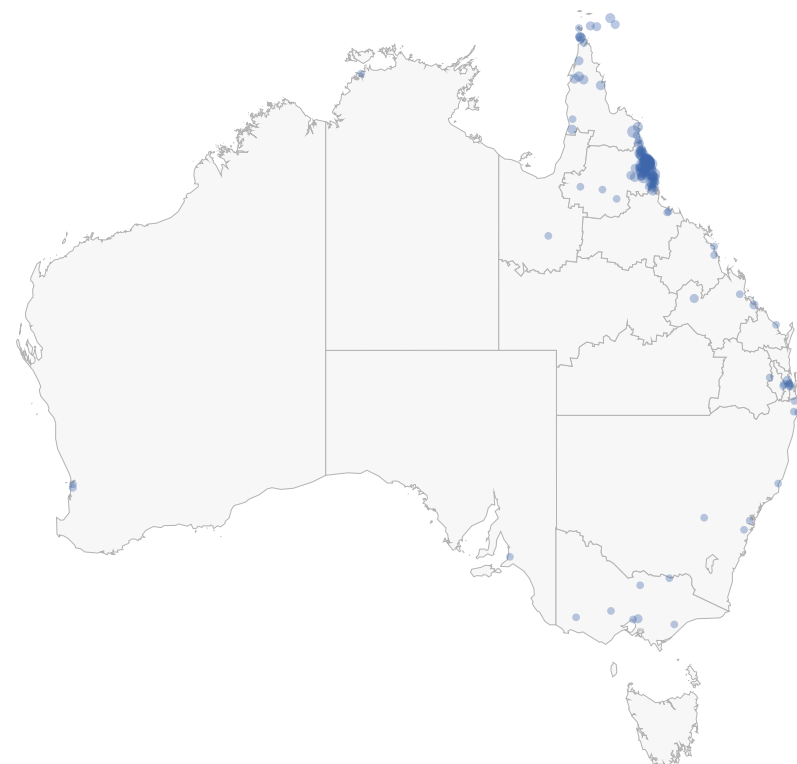


Figure 1: Cairns Hospital

- Referral hospital for Cairns and Hinterland and Torres and Cape Hospital and Health Services, serving a population of approximately 280,000
- Public tertiary level invasive cardiac services provided at Cairns Hospital include:
 - Coronary angiography
 - Percutaneous coronary intervention
 - Structural heart disease intervention
 - ICD, CRT and pacemaker implantation

7.2 The Townsville Hospital

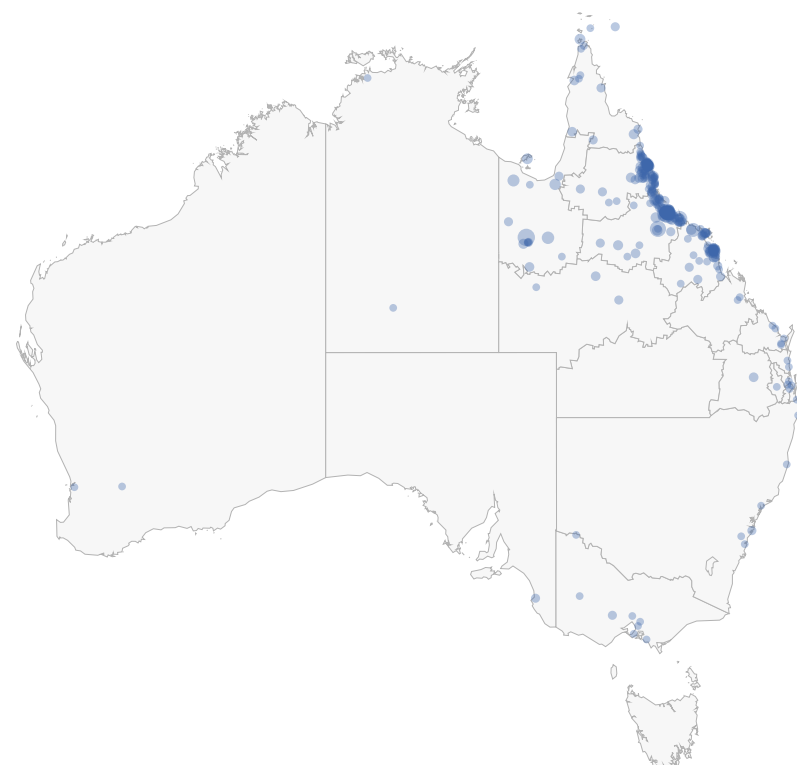


Figure 2: The Townsville Hospital

- Referral hospital for Townsville and North West Hospital and Health Services, serving a population of approximately 295,000
- Public tertiary level invasive cardiac services provided at The Townsville Hospital include:
 - Coronary angiography
 - Percutaneous coronary intervention
 - Structural heart disease intervention
 - Electrophysiology
 - ICD, CRT and pacemaker implantation
 - Cardiothoracic surgery

7.3 Mackay Base Hospital

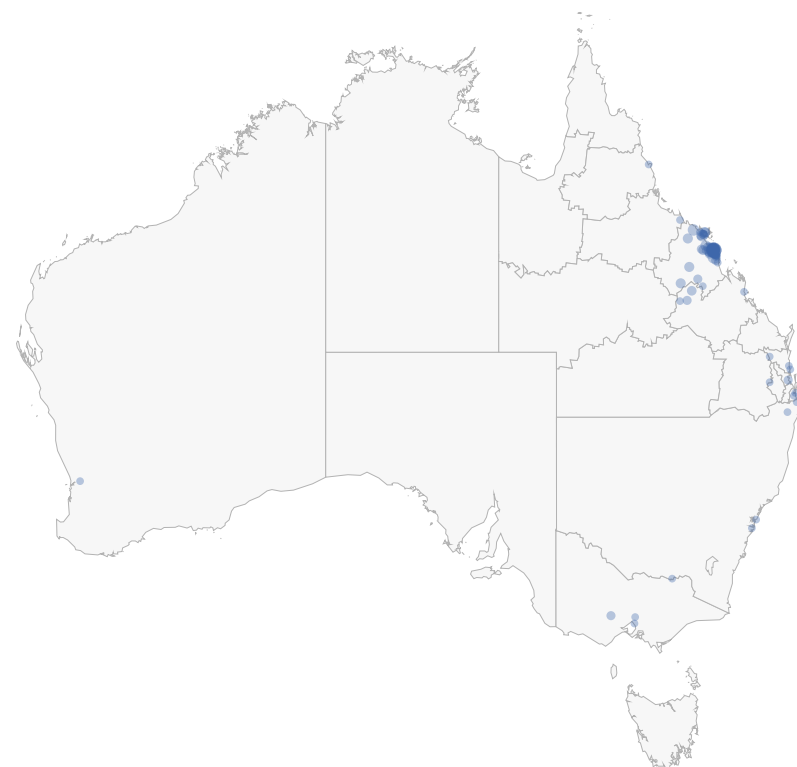


Figure 3: Mackay Base Hospital

- Referral hospital for Mackay and Whitsunday regions, serving a population of approximately 182,000
- Public tertiary level invasive cardiac services provided at Mackay Base Hospital include:
 - Coronary angiography
 - Percutaneous coronary intervention
 - Pacemaker and defibrillator implants

7.4 Sunshine Coast University Hospital

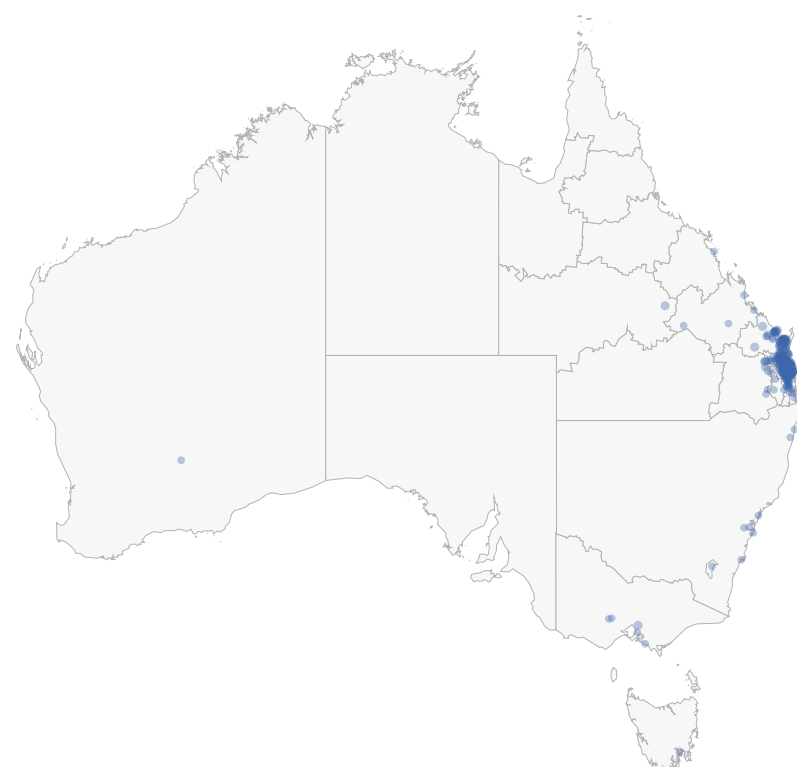


Figure 4: Sunshine Coast University Hospital

- Referral hospital for Sunshine Coast and Wide Bay Hospital and Health Services, serving a population of approximately 563,000
- Public tertiary level invasive cardiac services provided at Sunshine Coast University Hospital include:
 - Coronary angiography
 - Percutaneous coronary intervention
 - Structural heart disease intervention
 - Electrophysiology
 - ICD, CRT and pacemaker implantation

7.5 The Prince Charles Hospital

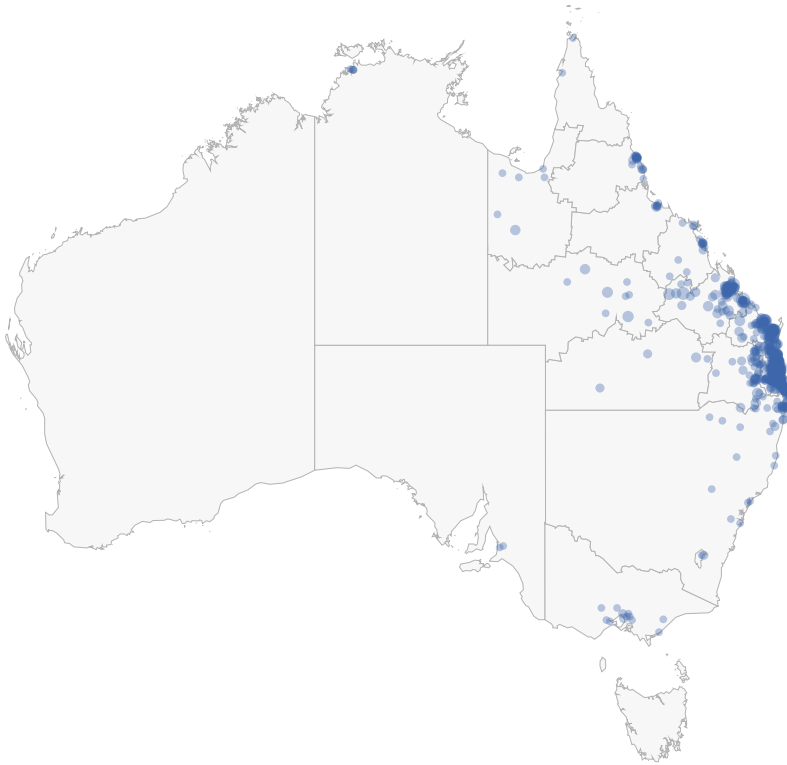


Figure 5: The Prince Charles Hospital

- 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 invasive cardiac services provided at The Prince Charles Hospital include:
 - Coronary angiography
 - Percutaneous coronary intervention
 - Structural heart disease intervention
 - Electrophysiology
 - ICD, CRT and pacemaker implantation
 - Cardiothoracic surgery
 - Heart/lung transplant unit
 - Adult congenital heart disease unit

7.6 Royal Brisbane and Women's Hospital

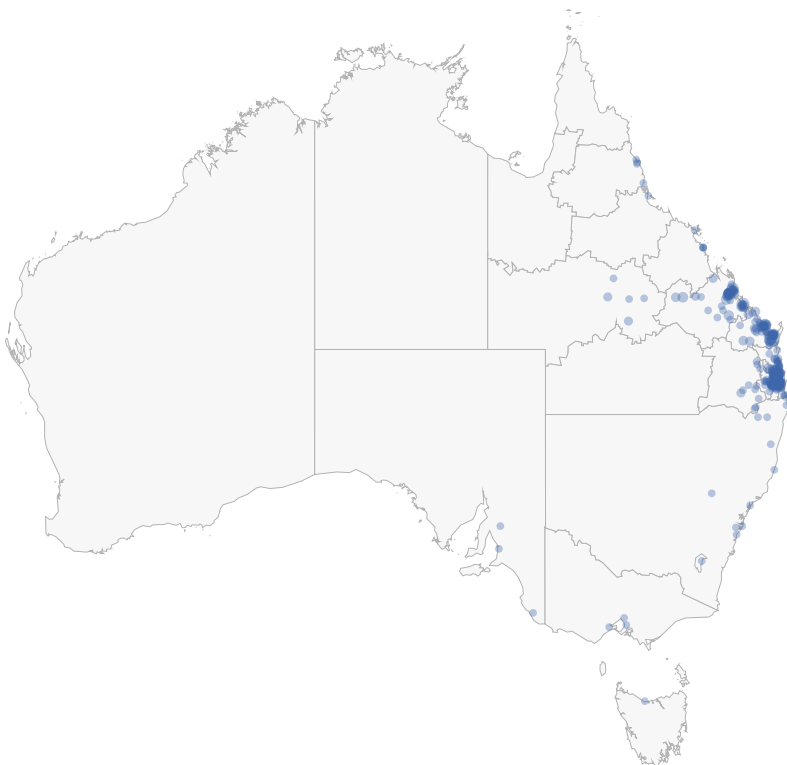


Figure 6: Royal Brisbane and Women's Hospital

- 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 invasive 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
 - Thoracic surgery

7.7 Princess Alexandra Hospital

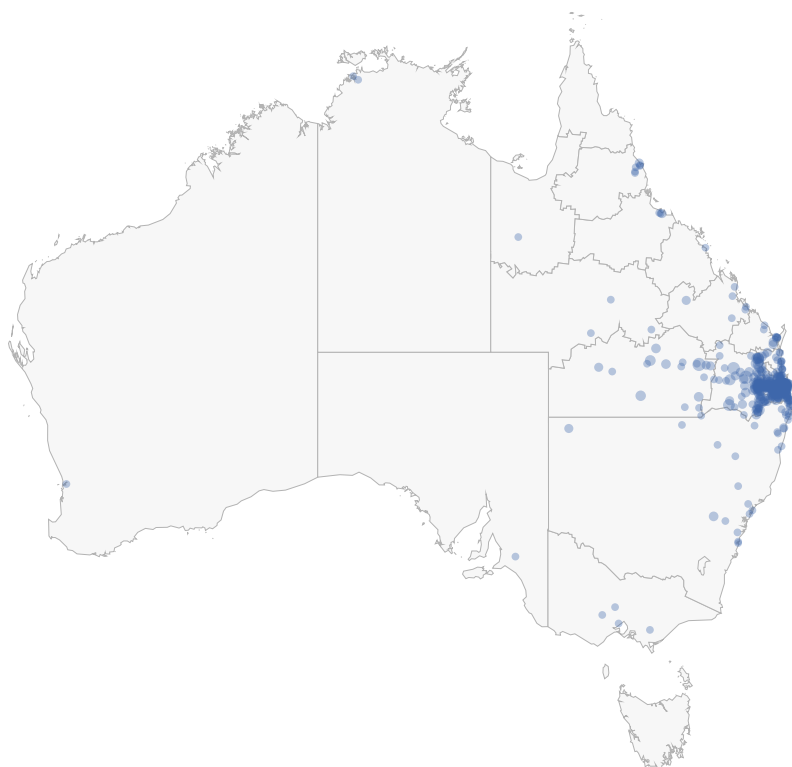


Figure 7: Princess Alexandra Hospital

- Referral hospital for Metro South and South West Hospital and Health Services, serving a population of approximately 1,000,000
- Public tertiary level invasive cardiac services provided at the Princess Alexandra Hospital include:
 - Coronary angiography
 - Percutaneous coronary intervention
 - Structural heart disease intervention
 - Electrophysiology
 - ICD, CRT and pacemaker implantation
 - Cardiothoracic surgery

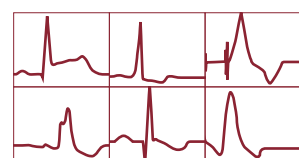
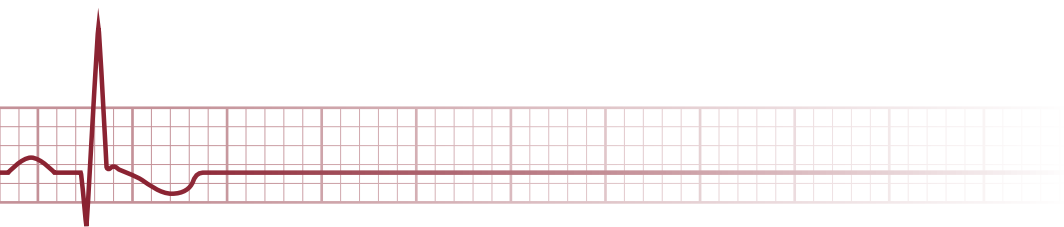
7.8 Gold Coast University Hospital

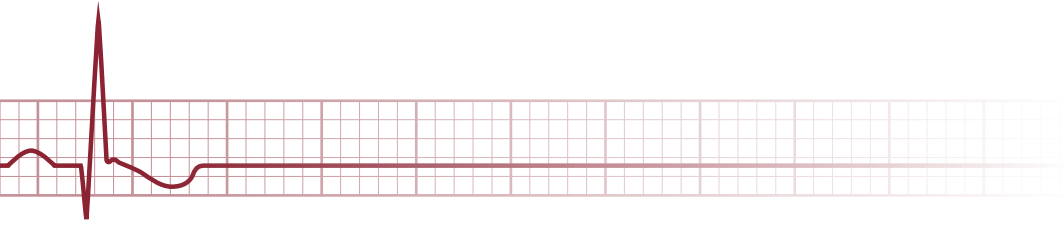


Figure 8: Gold Coast University Hospital

- Referral Hospital for Gold Coast and northern New South Wales regions, serving a population of approximately 700,000
- Public tertiary level invasive 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
 - Cardiothoracic surgery

Cardiac Rehabilitation Audit





1 Message from the QCOR Cardiac Rehabilitation Committee Chair

It is my sincere pleasure to introduce the second QCOR Cardiac Rehabilitation Audit. This is the first annual report to document a full year of data collection for our statewide cardiac rehabilitation services. The previous audit reported just a 6 month period of data collection from July to December 2017, whereas this report documents a full calendar year of data collection through 2018. This will also be our first opportunity to compare data collection year to year. Also, while the 2017 report documented solely admission (preassessment) data, this 2018 report will present some limited post program data. This will be our first insight into the effectiveness of cardiac rehabilitation, at a local level and on a statewide scale.

Data collection has centred around the inclusion of service performance measures (timely referral, timely assessment) and patient clinical indicators (e.g. medications, risk factors, exercise tolerance, mental health) on both admission and completion of cardiac rehabilitation programs.

This report presents that a total of 11,723 patients were referred to one of the 53 cardiac rehabilitation sites accessible through Queensland Health in 2018. Of these, 95% of patients were referred to cardiac rehabilitation in a timely manner (within 3 days) and 62% were assessed within 28 days of referral. Analysis has highlighted the higher incidence of cardiovascular disease in the Aboriginal and Torres Strait Islander population through the increased rate of referral to cardiac rehabilitation. The median age of these patients is 10 years younger than that of non-Indigenous Queenslanders, further reflecting the impacts on this population group.

I would sincerely like to thank the hardworking nurses and allied health professionals responsible for the hours of data entry involved in collecting this information. This tool is the envy of many of our sister state departments of health. The QCOR Cardiac Rehabilitation tool is unique in that it is a point-of-care assessment tool and data collection device in one, with education capabilities built-in. I am very proud of the efforts of our cardiac rehabilitation clinicians, the committee responsible for overseeing the collection of this data and very thankful for the ongoing support of the SCCIU team.

Stephen Woodruffe

Chair

QCOR Cardiac Rehabilitation Committee

2 Key findings

This second QCOR Cardiac Rehabilitation (CR) Audit examines referrals to one of 55 participating public outpatient CR sites for 2018. Key findings include:

- A total of 11,723 referrals were made to public CR sites across Queensland.
- Approximately 77% of all referrals originated from an inpatient setting, while 14% of referrals originated from outside of Queensland Health.
- Male patients accounted for 70% of all referrals to CR.
- Approximately 15% of all referrals were for patients aged 65 years to 69 years of age.
- The median age of all patients was 66 years. There was considerable variation between Aboriginal and Torres Strait Islander patients (56 years) and non-Indigenous patients (66 years).
- The total proportion of Aboriginal and Torres Strait Islander patients was 6.3%. Large geographical variance was noted with North Queensland sites having a significantly higher proportion of Aboriginal and Torres Strait Islander patients.
- Overall, 65% of referrals had a pre assessment diagnosis of ischaemic heart disease.
- At pre assessment, 79% of patients were classed as being an unhealthy weight with 38% classed as overweight, 36% obese and 5% morbidly obese.
- Only 36% of patients were recorded as being sufficiently active at pre assessment.
- Completion of a timely referral (within 3 days of discharge from hospital) was achieved in 95% of cases.
- A timely overall journey occurred in 59% of cases (referred within 3 days of discharge and assessed by CR program within 28 days of discharge).
- In total, 40% of patients who completed a pre assessment continued CR to the completion of a post assessment.

3 Participating sites

In 2018, there were 60 public CR sites operated across 14 Hospital and Health Services (HHS) and one Queensland Health division (Health Support Queensland) located in rural and metropolitan Queensland. Of these, 55 participated in QCOR.

Table 1: Participating CR sites

Legend: ● Engaged and contributing ● Partially contributing (<50% of referrals) ○ Not contributing

HHS/Organisation	CR program	Locations	2017	2018
Cairns and Hinterland	Cairns Outpatient CR Program	Cairns	●	●
	Cassowary Area CR	Innisfail, Tully	●	●
	Tablelands CR	Atherton, Mareeba	●	●
	Mossman CR and Prevention Program	Mossman	●	●
Central Queensland	Community Health CR	Gladstone	●	●
	Biloela CR Program	Biloela	●	●
	CR Outpatient Program	Rockhampton, Capricorn Coast	●	●
Central West	Longreach and Central West CR Program	Longreach	●	●
		Blackall*	-	●
Darling Downs	Toowoomba Hospital Heart Care	Toowoomba	●	●
	Warwick CR Service	Warwick	●	●
	Chinchilla-Miles CR Service	Chinchilla, Miles	●	●
	Dalby-Tara CR Service	Dalby, Tara	●	●
	Kingaroy Hospital South Burnett CR	Kingaroy	●	●
	Goondiwindi CR	Goondiwindi	○	○
	Stanthorpe Health CR Program	Stanthorpe	○	○
Gold Coast	Gold Coast Heart Health Service	Robina	●	●
HSQ†	COACH Program	Health Contact Centre	●	●
Mackay	Mackay Heart Health Service	Mackay	●	●
		Proserpine	●	●
		Bowen	○	○
Metro North	Complex Chronic Disease	Caboolture, Chermside, North Lakes, Redcliffe	●	●
Metro South	Bayside CR Program	Redland	●	●
	Brisbane South Heart Smart	Eight Mile Plains, Inala	●	●
	Logan-Beaudesert CR Service	Browns Plains	●	●
	PAH Heart Recovery Program	Princess Alexandra Hospital	●	●
North West	Mount Isa CR Program	Mount Isa	●	●
South West	South West CR Services	Charleville, Roma	●	●
		St George*	-	●
Sunshine Coast	Cardiac Rehab	Caloundra, Gympie, Maroochydore, Nambour, Noosa	●	●
Townsville	Townsville CR Outpatient Program	Townsville	●	●
	Ingham CR Outpatient Program	Ingham	●	●
	Charters Towers Community Health CR	Charters Towers	○	●
	Ayr Health Service	Ayr	○	○
	Hughenden CR Program	Hughenden	○	○
West Moreton	Ipswich and West Moreton CR	Ipswich, Boonah, Esk, Gatton, Laidley	●	●
Wide Bay	Fraser Coast CR	Hervey Bay, Maryborough	●	●
	Wide Bay Rural and Allied Health*	Biggenden, Eidsvold, Gayndah, Mundubbera	-	●

* New CR service commencing in 2018

† Health Support Queensland

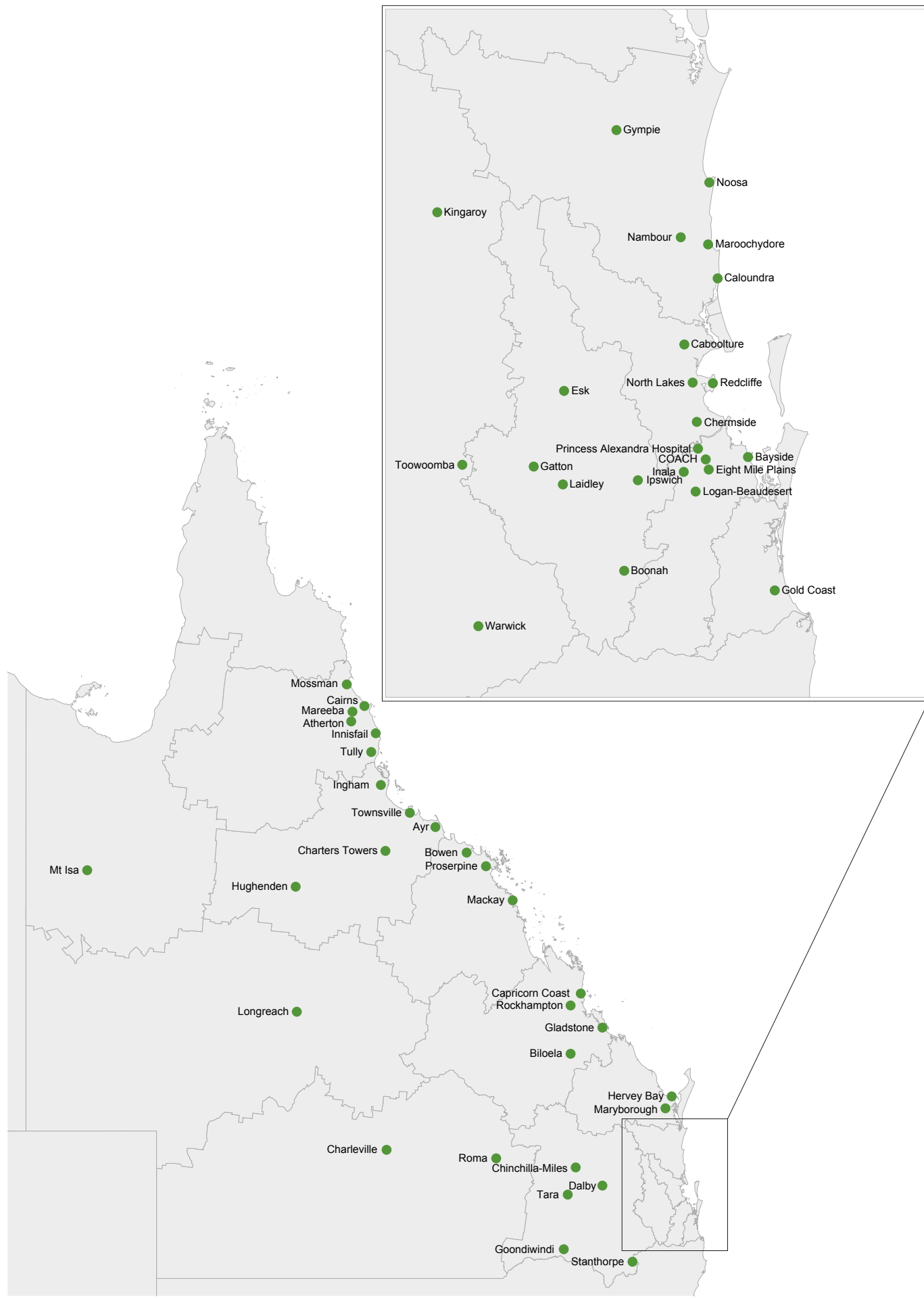


Figure 1: Map of Queensland public CR sites

4 Total referrals

4.1 Statewide

The volume of CR referrals entered into QCOR expanded through 2018 to include 11,723 new referrals for the year, bringing the overall total to over 18,000 referrals since the system was launched and CR data collection commenced in July 2017 (Figure 2).

The initial implementation of the QCOR CR module had a specific focus towards patients discharged from a public hospital. Referral patterns have continued to be consistent throughout the calendar year of 2018, with the majority of referrals (77%) originating from an inpatient setting.

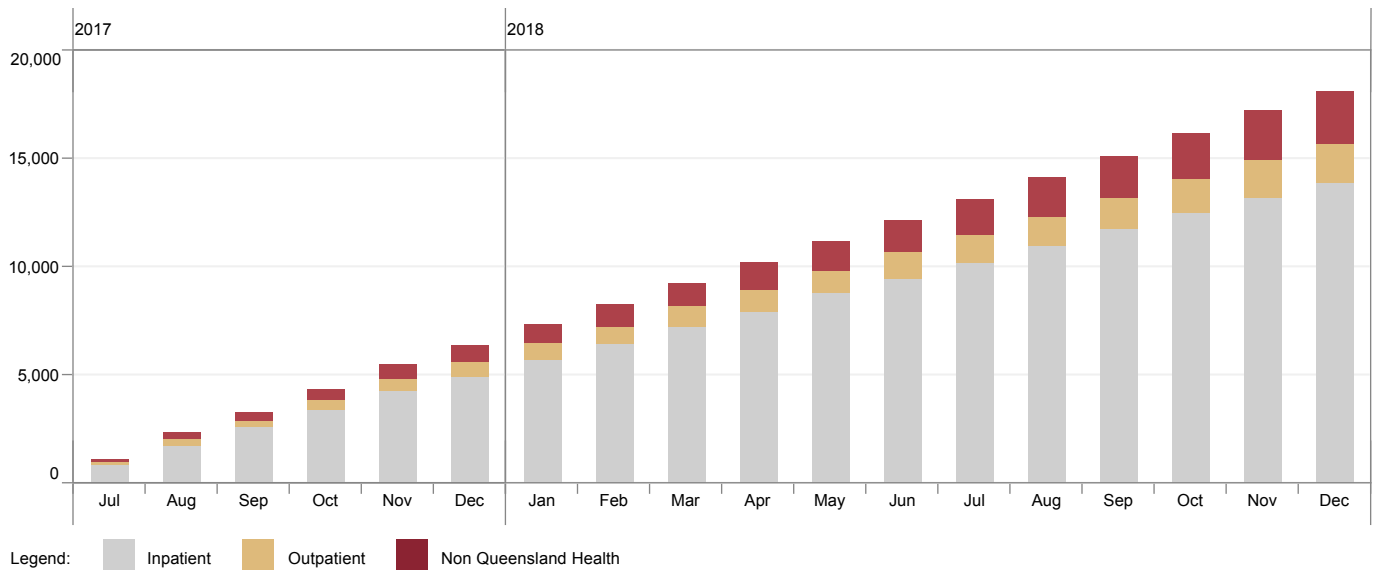


Figure 2: Cumulative total CR referrals by month, 2017–2018

Table 2: Total referrals by admission source, 2017–2018

Referral origin	2017 %	2018 %
Inpatient	78.0	76.5
Outpatient	9.6	10.0
Non Queensland Health	12.5	13.5

Patients were located across a wide geographical area with the majority residing in population centres along the eastern seaboard. Just under half (49%) of all patients were residing in major cities, and the remainder in regional and remote areas of Queensland. This reflects the decentralised distribution of the population within the state.

It is important to note that referrals for patients residing interstate or overseas are not generally accepted. The inclusion of these referrals is reflective of local site processes and may also vary based on available resources. While some sites leverage QCOR to maintain a record of overall referral volumes, others utilise different processes and as such may not represent all inpatient activity which does not lead to a referral to a Queensland public CR program.

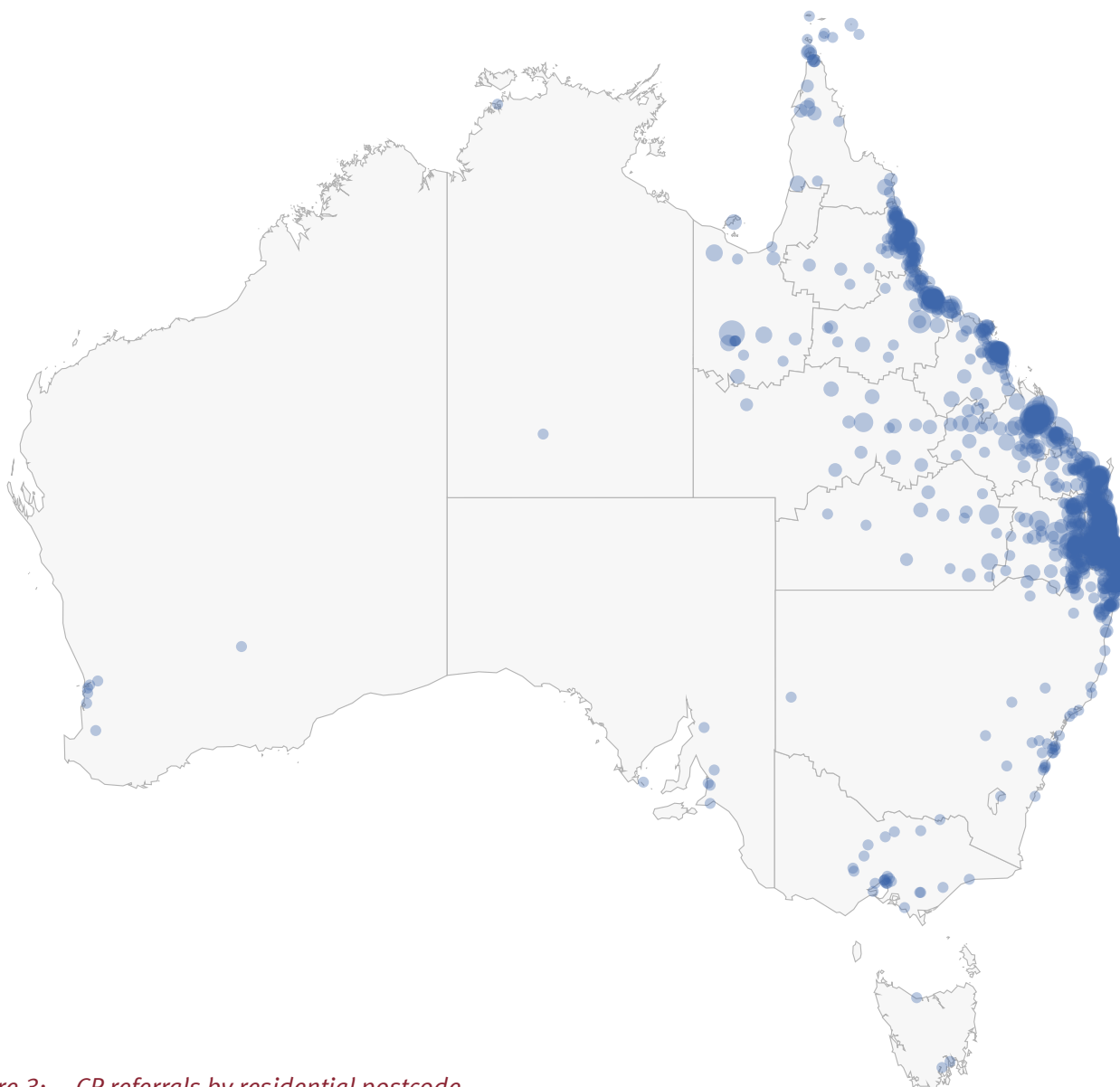


Figure 3: CR referrals by residential postcode

Table 3: CR referrals by remoteness classification

Remoteness classification*	%
Major Cities of Australia	49.3
Inner Regional Australia	30.4
Outer Regional Australia	16.8
Remote Australia	1.3
Very Remote Australia	2.2
ALL	100.0

* Classified by Accessibility and Remoteness Index of Australia

4.2 Origin of referrals

The majority of referrals (77%) originated from an inpatient setting, with smaller proportions of referrals flowing to CR from an outpatient setting (10%) and outside of Queensland Health (14%).

There were considerable variations across participating HHS in the proportion of referrals from external sources, which ranged from 1% to 31%. This indicates not all sites are entering details for patients referred from general practitioners, private hospitals or external specialists.

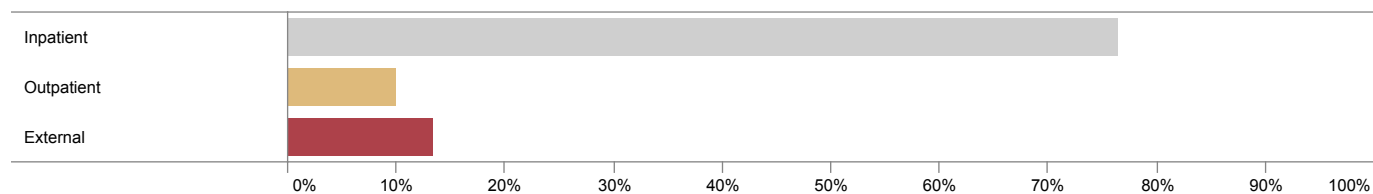


Figure 4: Proportion of referrals by referral source

Table 4: Referral sources by outpatient program HHS

HHS/division	Total referrals n	Inpatient* n (%)	Outpatient* n (%)	External n (%)
Cairns and Hinterland	725	598 (82.5)	53 (7.3)	74 (10.2)
Central Queensland	1,368	909 (66.4)	233 (17.0)	226 (16.5)
Central West	39	19 (48.7)	20 (51.3)	–
Darling Downs	474	333 (70.3)	41 (8.6)	100 (21.1)
Gold Coast	1,598	1,247 (78.0)	189 (11.8)	162 (10.1)
Health Support Queensland	1,567	1,389 (88.6)	144 (9.2)	34 (2.2)
Mackay	298	247 (82.9)	47 (15.8)	4 (1.3)
Metro North	1,175	825 (70.2)	82 (7.0)	268 (22.8)
Metro South	1,647	1,194 (72.5)	98 (6.0)	355 (21.6)
North West	79	56 (70.9)	20 (25.3)	3 (3.8)
South West	45	26 (57.8)	10 (22.2)	9 (20.0)
Sunshine Coast	969	867 (89.5)	37 (3.8)	65 (6.7)
Townsville	624	507 (81.3)	98 (15.7)	19 (3.0)
West Moreton	828	510 (61.6)	65 (7.9)	253 (30.6)
Wide Bay	287	237 (82.6)	40 (13.9)	10 (3.5)
Statewide	11,723	8,964 (76.5)	1,177 (10.0)	1,582 (13.5)

* Includes referrals from a Queensland Health public facility

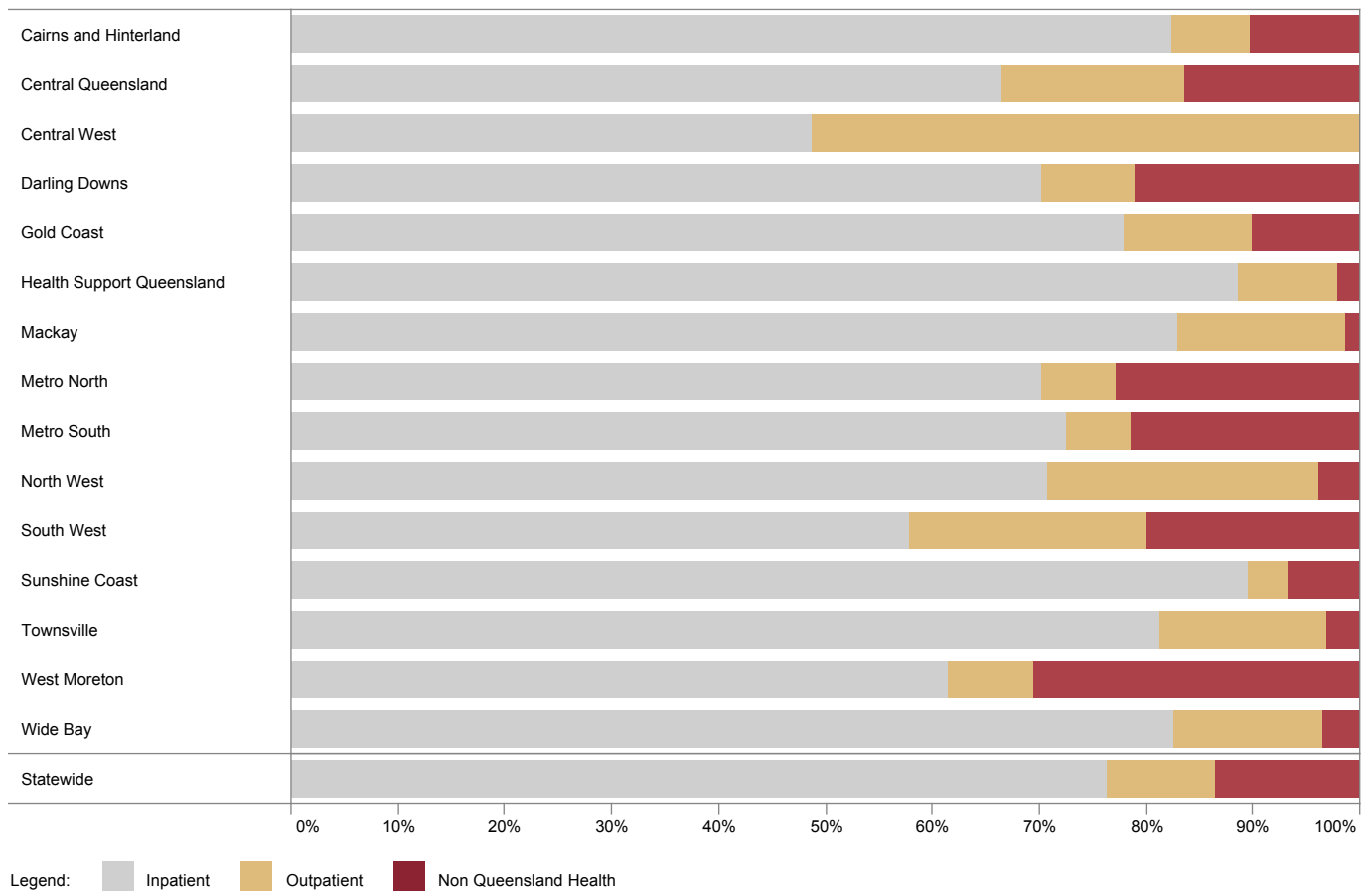


Figure 5: Proportion of referrals by referral source and outpatient program HHS

4.3 Inpatient referrals

For referrals originating from an inpatient setting, the largest referrer was Metro North Hospital and Health Service which accounted for almost one-quarter (24%) of referrals. The largest CR program was the COACH Program (Health Support Queensland) which received 16% of all inpatient referrals.

Table 5: CR inpatient referrals by source and destination HHS

HHS/organisation	Outgoing inpatient referrals n (%)	Incoming inpatient referrals n (%)
Cairns and Hinterland	500 (5.6)	598 (6.7)
Central Queensland	724 (8.1)	909 (10.1)
Central West	3 (<0.1)	19 (0.2)
Darling Downs	108 (1.2)	333 (3.7)
Gold Coast	1,251 (14.0)	1,247 (13.9)
Health Support Queensland	–	1,389 (15.5)
Mackay	240 (2.7)	247 (2.8)
Mater Health Services	113 (1.3)	–
Metro North	2,178 (24.3)	825 (9.2)
Metro South	1,748 (19.5)	1,194 (13.3)
North West	2 (<0.1)	56 (0.6)
South West	–	26 (0.3)
Sunshine Coast	826 (9.2)	867 (9.7)
Townsville	957 (10.7)	507 (5.7)
West Moreton	208 (2.3)	510 (5.7)
Wide Bay	106 (1.2)	237 (2.6)
Statewide	8,964 (100.0)	8,964 (100.0)

The flow of inpatient referrals from the originating HHS or organisation (acute site) to the CR outpatient program HHS is illustrated in Figure 6. The majority of inpatient referrals remained within the originating HHS, though there was some variation noted.

It should be highlighted that there are no outpatient programs for Mater Health Services, and conversely Health Support Queensland provides an outpatient service only.

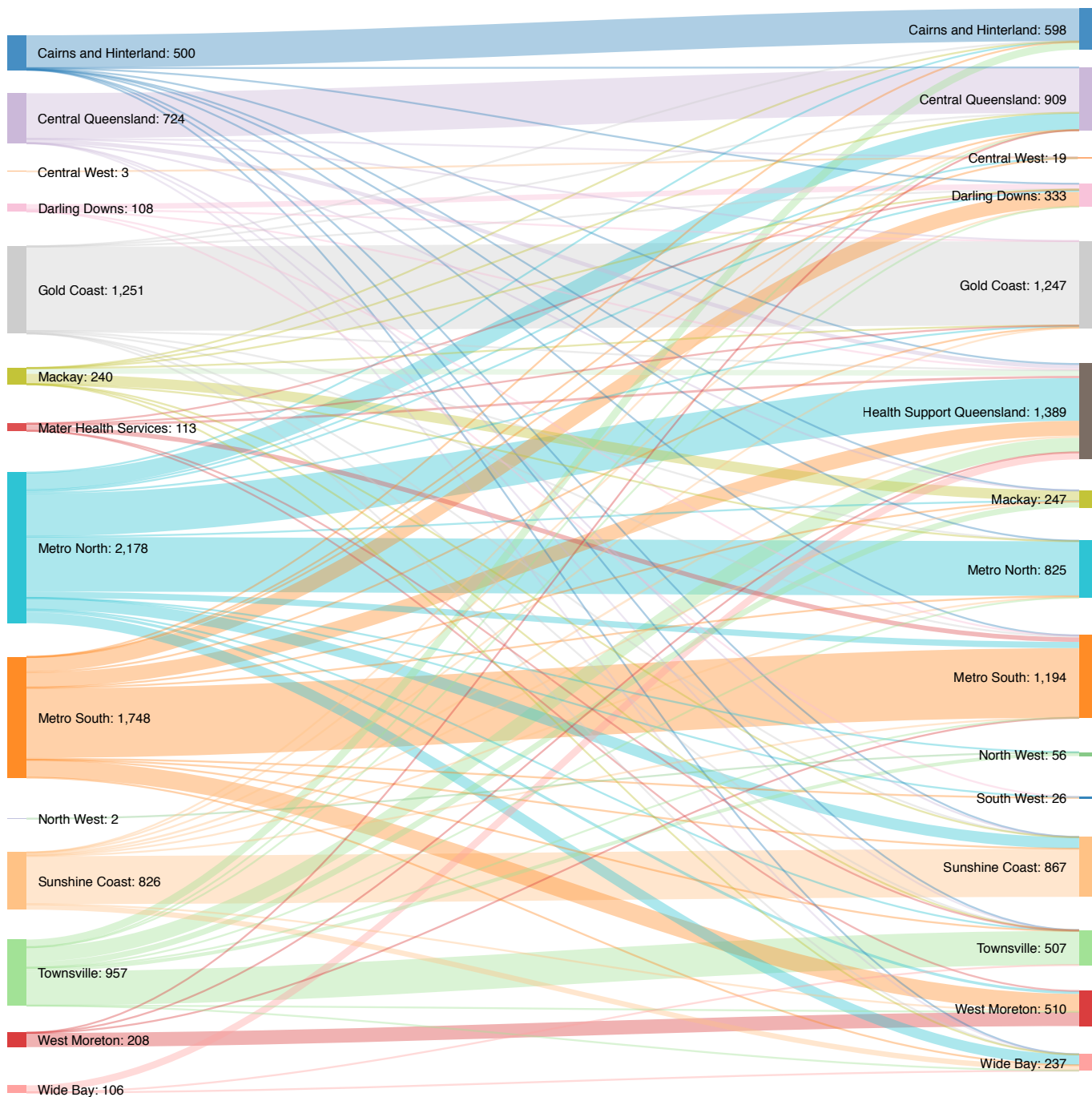


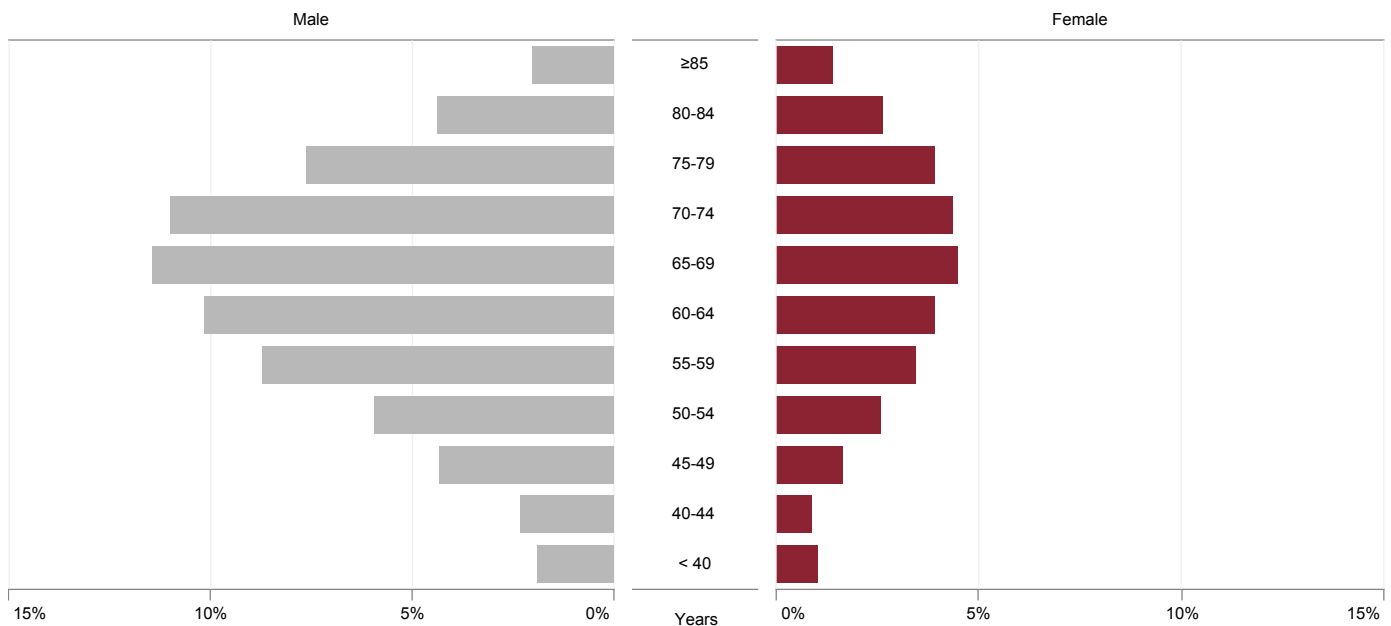
Figure 6: Number of CR inpatient referrals by source and destination HHS/organisation

5 Patient characteristics

5.1 Age and gender

Development of cardiovascular disease is related to age. Overall, 70% of patients were male and 30% female, while the age distribution of referrals was similar for genders.

The highest proportion of referrals for both males and females was in the 65 years to 69 years age group which accounted for 16% of all referrals.



% of total referrals (n=11,723)

Figure 7: Referrals by patient gender and age group

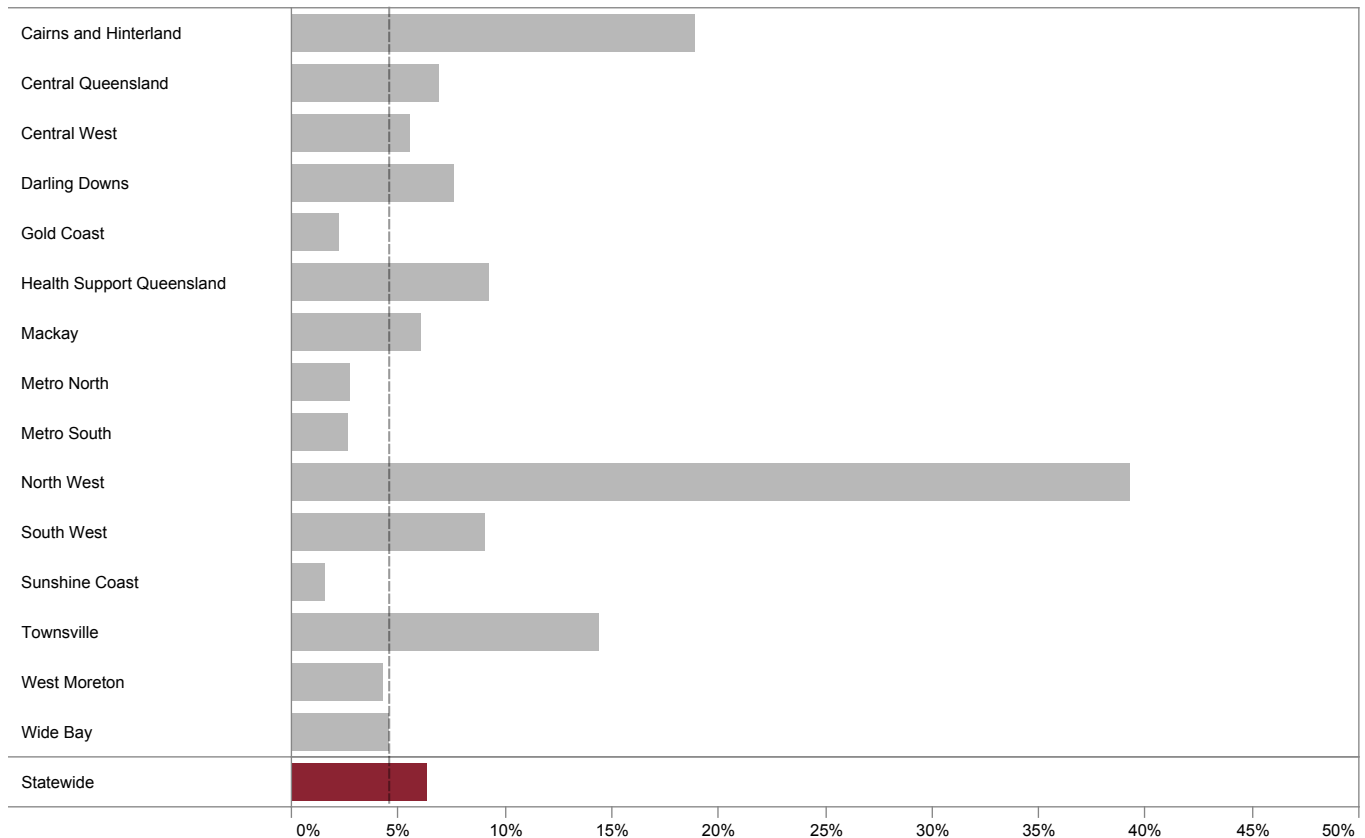
Table 6: Median patient age by gender and HHS

Outpatient HHS/division	Male years	Female years	ALL years
Cairns and Hinterland	64	63	64
Central Queensland	68	68	68
Central West	66	62	64
Darling Downs	67	66	66
Gold Coast	68	70	68
Health Support Queensland	64	67	65
Mackay	61	66	63
Metro North	66	67	67
Metro South	64	66	64
North West	60	57	60
South West	67	58	61
Sunshine Coast	67	70	68
Townsville	65	65	65
West Moreton	66	64	66
Wide Bay	69	67	68
Statewide	66	67	66

5.2 Aboriginal and Torres Strait Islander status

Ethnicity is an important determinant in the development of cardiovascular disease. It is recognised that the Aboriginal and Torres Strait Islander population has a higher incidence and prevalence of coronary artery disease. In this patient set, Aboriginal and Torres Strait Islander patients represented 6.3% of all statewide referrals with considerable variation observed across all HHS.

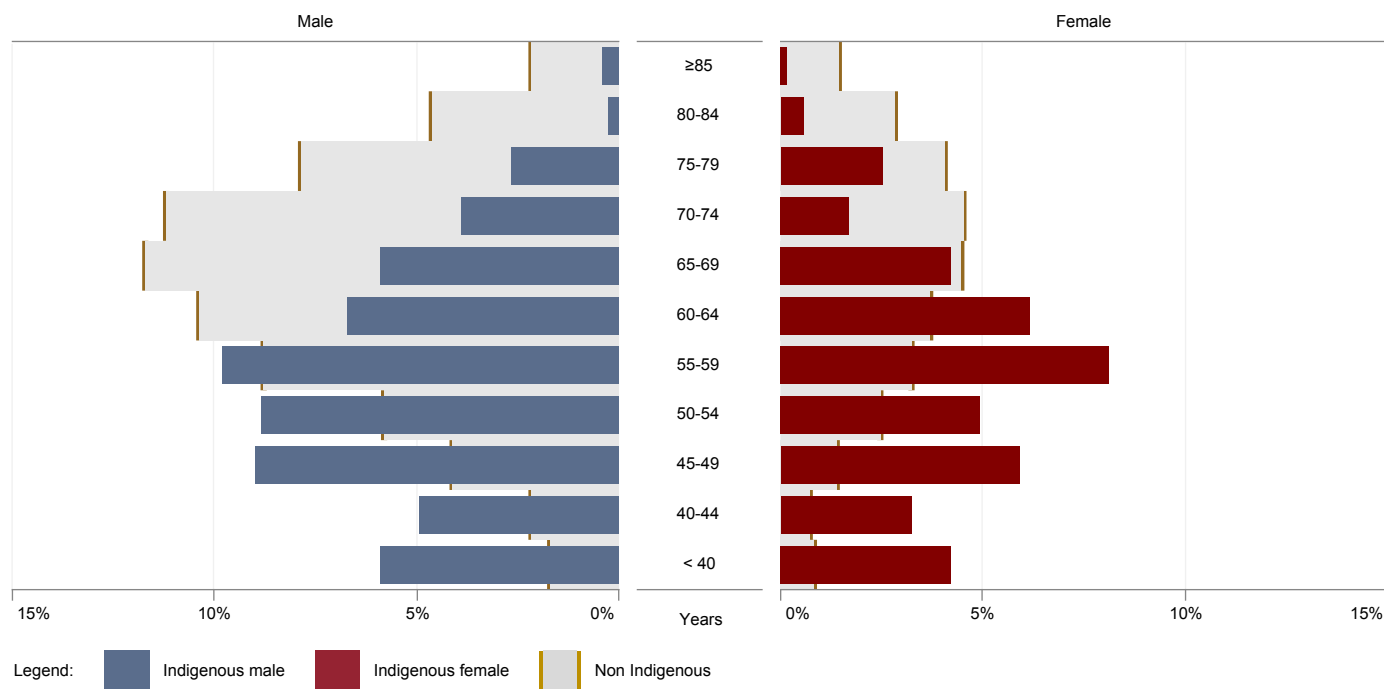
Larger proportions of Aboriginal and Torres Strait Islander patients were referred to CR programs in northern and western HHS with Cairns and Hinterland, North West, Townsville and South West HHS all reporting greater than 10% of patients identifying as Aboriginal and Torres Strait Islander.



Excludes missing data (3.9%)

Figure 8: Proportion of identified Aboriginal and Torres Strait Islander patients by outpatient HHS

The proportion of Aboriginal and Torres Strait Islander patients referred to CR had a median age considerably lower than other patients (56 years vs 66 years respectively). This finding is consistent with other QCOR Audits, which suggests the presence of a cardiovascular disease health gap for Aboriginal and Torres Strait Islander patients.



Excludes missing data (3.9%)

Figure 9: Proportion of all CR referrals by age group and Indigenous status

Table 7: Patient age by gender and Indigenous status

	Male years	Female years	All years
Aboriginal and Torres Strait Islander	55	57	56
Non Aboriginal and Torres Strait Islander	66	68	66
ALL	66	67	66

6 Program participation

6.1 Pre assessment stage

The assessment of a patient by CR comprises a comprehensive cardiovascular disease risk factor review. This extends beyond a patient's presenting medical and social history to encompass overall health, physical well-being, psychological factors, availability of social support and patient-reported quality of life.

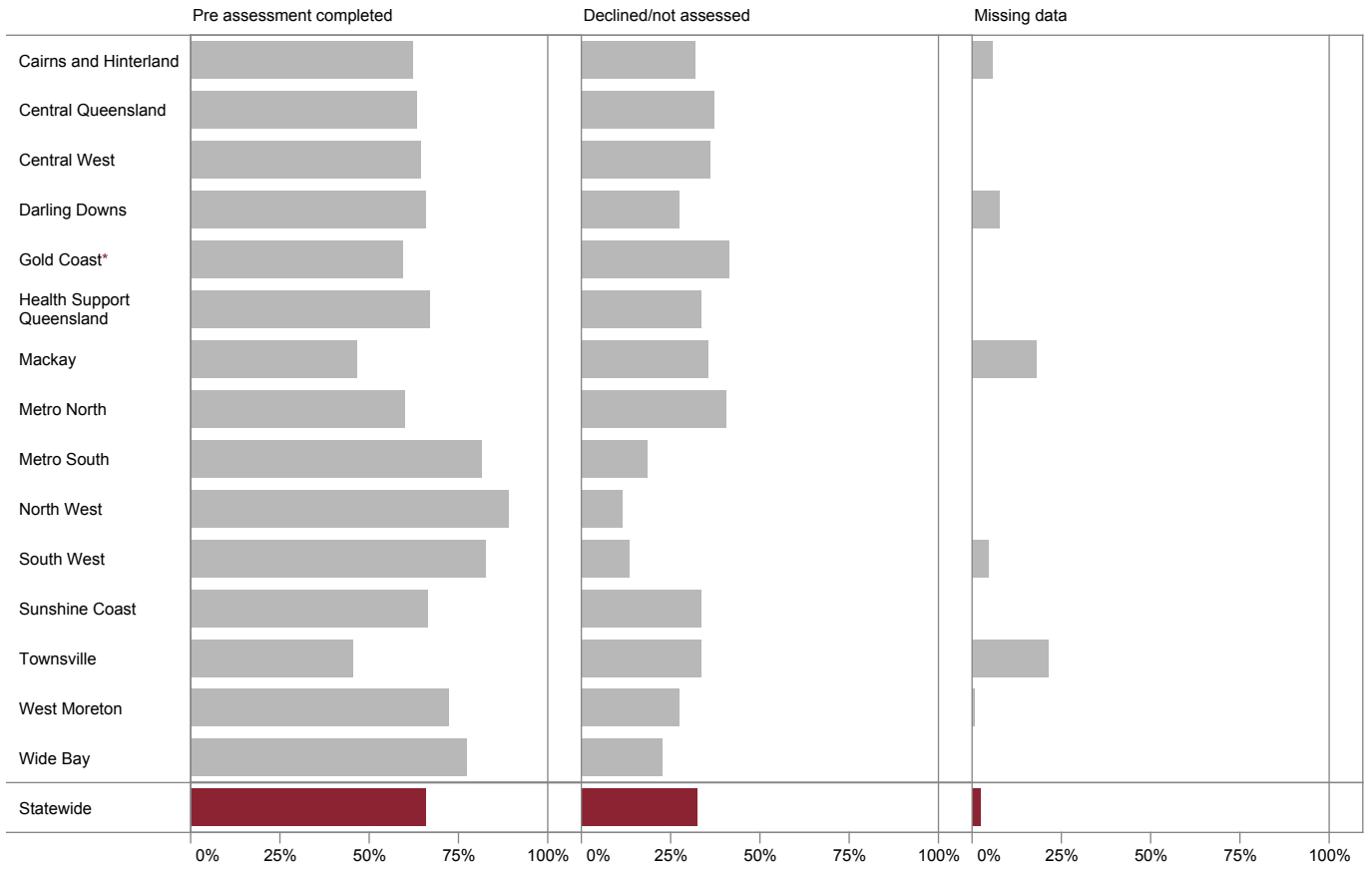
An assessment by outpatient CR is generally conducted in two stages which occur before and after a patient attends the specialist CR program. These stages are referred to as the pre assessment and post assessment. The pre assessment signifies the successful uptake and recruitment of a patient onto the CR program. Assessments may be undertaken over the phone or face-to-face.

The proportion of total referrals which proceeded to a pre assessment within any timeframe was 65%. It should be noted that this is a very limited metric which should be interpreted with caution. This is due to varying processes across the state for patients refusing or not interested in attending CR, as well as patients residing overseas and interstate. These issues are discussed later in the report.

Table 8: Total pre assessments completed by HHS

Outpatient HHS/division	Pre assessment completed n (%)	Declined/not assessed n (%)	Missing data n (%)
Cairns and Hinterland	451 (62.2)	231 (31.9)	43 (5.9)
Central Queensland	862 (63.0)	506 (37.0)	–
Central West	25 (64.1)	14 (35.9)	–
Darling Downs	310 (65.4)	129 (27.2)	35 (7.4)
Gold Coast	944 (59.1)	654 (40.9)*	–
Health Support Queensland	1,042 (66.5)	525 (33.5)	–
Mackay	139 (46.6)	105 (35.2)	54 (18.1)
Metro North	701 (59.7)	474 (40.3)	–
Metro South	1,337 (81.2)	310 (18.8)	–
North West	70 (88.6)	9 (11.4)	–
South West	37 (82.2)	6 (13.3)	2 (4.4)
Sunshine Coast	642 (66.3)	327 (33.7)	–
Townsville	282 (45.2)	209 (33.5)	133 (21.3)
West Moreton	597 (72.1)	228 (27.5)	3 (0.4)
Wide Bay	222 (77.4)	65 (22.6)	–
Statewide	7,661 (65.4)	3,792 (32.3)	270 (2.3)

* Total for Gold Coast HHS includes 23% of referrals for patients residing interstate, who are typically referred for CR outside of Queensland Health



* Total for Gold Coast HHS includes 23% of referrals for patients residing interstate, who are typically referred for CR outside of Queensland Health

Figure 10: Proportion of CR referrals proceeding to pre assessment by HHS

6.2 Post assessment stage

The post assessment is representative of completion and graduation from the specialist CR outpatient program. This provides an opportunity for the patient and clinician to reflect upon the targets defined at the pre assessment. Of 7,661 completed pre assessments, there were an overall 40% of patients who proceeded to a completed post assessment.

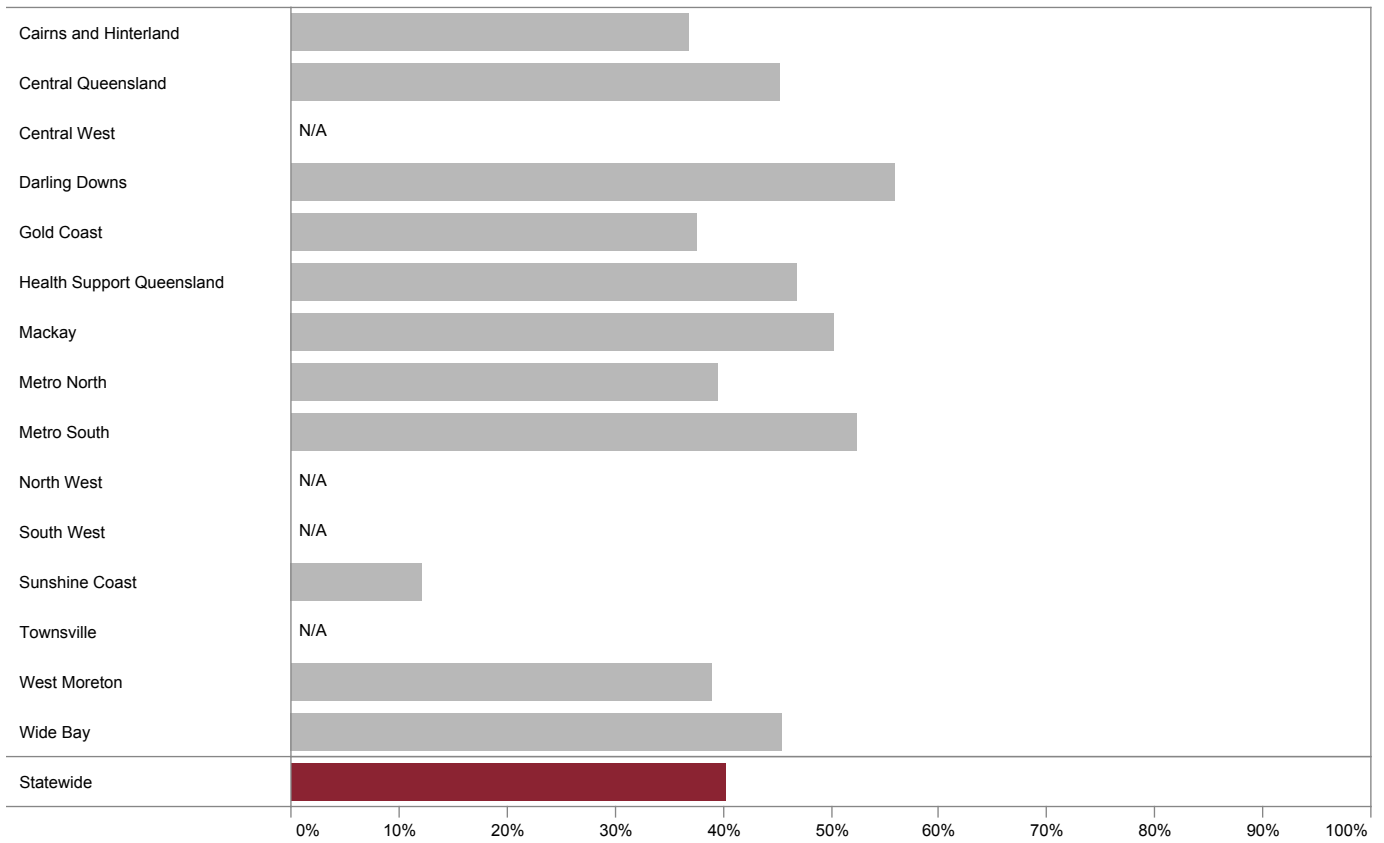
Completion rates and median time delays from post assessment to pre assessment varied considerably by HHS. The median time from pre assessment to post assessment was 82 days, ranging from 55 days to 167 days across outpatient HHS. There was also a considerable variation in the proportion of cases where a post assessment had been completed, indicating that local practices towards post assessment completion and data entry vary considerably at a local level. Furthermore, a range of issues may contribute to completion of the post assessment, which may include timing, patient availability or other factors outside the control of the program.

This has been identified as an area for future focus and expanding of reporting, as it would allow more comprehensive analysis around outcomes and patient benefits for CR. The data reported in this section uses a minimum 90 day window for post assessment completion, which may skew results for sites using longer program timeframes.

Table 9: Total post assessments completed by HHS

Outpatient HHS/division	Post assessment completed n (%)	Median time to post assessment days
Cairns and Hinterland	166 (36.8)	76
Central Queensland	391 (45.4)	74
Central West	14 (56.0)	N/A
Darling Downs	173 (55.8)	65
Gold Coast	354 (37.5)	76
Health Support Queensland	488 (46.8)	167
Mackay	70 (50.4)	68
Metro North	277 (39.5)	106
Metro South	701 (52.4)	71
North West	13 (18.6)	N/A
South West	15 (40.5)	N/A
Sunshine Coast	78 (12.1)	97
Townsville	10 (3.5)	N/A
West Moreton	232 (38.9)	73
Wide Bay	101 (45.5)	55
Statewide	3,083 (40.2)	82

N/A: Not displayed due to <20 post assessments for analysis



N/A: Not displayed due to <20 post assessments for analysis

Figure 11: Proportion of CR pre assessments proceeding to post assessment

6.3 Program outcomes

The following sections use paired observations from the pre assessment and post assessment stages to identify changes in health status for patients participating in CR. Measures included in this analysis include patient reported outcome measures (PROMs) and other functional or pathological investigations.

A limiting factor for this analysis is availability of data for the post assessment stage. Specifically, the availability of updated pathology and other investigations, and specific model of care employed by the CR program may result in limited data from which conclusions can be drawn.

Table 10: Outline of CR program outcome measures

Program outcome	Measure	Category
1	Lipid profile	Pathology
2	Six minute walk test	Functional
3	Patient Health Questionnaire	PROMs
4	Assessment of Quality of Life	PROMs

6.3.1 Lipid profile

Data for lipid values such as total cholesterol was available for a smaller proportion of patients completing CR. A barrier to reporting this outcome is that updated pathology results are not always available for the post assessment stage.

In this analysis, HDL-C values remained consistent while total cholesterol, LDL-C, and triglycerides showed a favorable trend. This is consistent with improvement in lipid profile post CR.

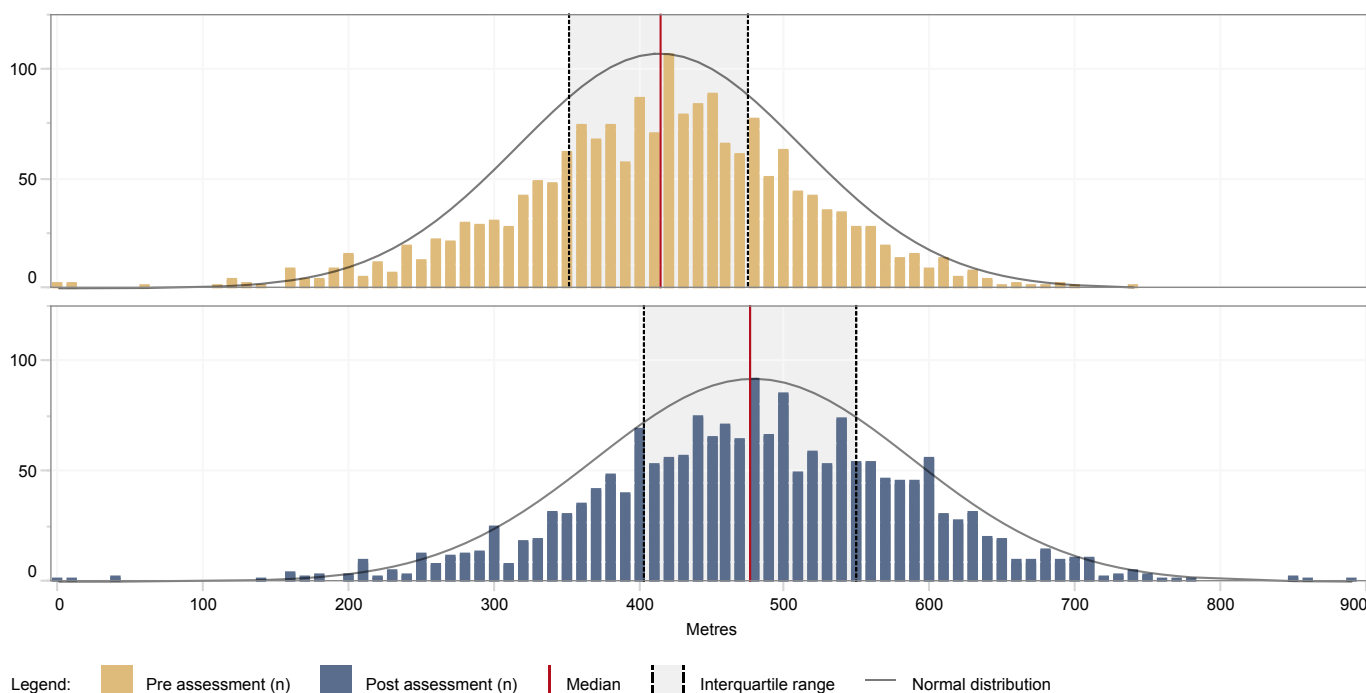
Table 11: Summary of lipid values

	Total analysed n	Pre assessment Mean \pm SD	Post assessment Mean \pm SD	Change in value Mean \pm SD
Total cholesterol (mmol/L)	398	4.7 \pm 1.4	3.8 \pm 1.0	-0.9 \pm 1.3
Triglycerides (mmol/L)	364	1.7 \pm 1.0	1.4 \pm 0.8	-0.3 \pm 0.9
HDL-C (mmol/L)	338	1.1 \pm 0.3	1.1 \pm 0.4	0.0 \pm 0.3
LDL-C (mmol/L)	329	2.7 \pm 1.2	1.8 \pm 0.9	-0.9 \pm 1.2

6.3.2 Six minute walk test

A functional measure is indicated prior to implementing an exercise program in order to determine exercise prescription and measure improvement. The six minute walk test (6MWT) is a standardised investigation of submaximal exercise capacity that is often used in patients with cardiopulmonary disease. Changes in walk distance are useful in assessing functional capacity and the efficacy of therapeutic interventions such as pharmacotherapy and CR.²³

For the 3,083 post assessments completed, there were 1,884 cases where the patient had completed a 6MWT at both the pre assessment and post assessment stages. The 6MWT is not always feasible for data collection due to the different models of care that exist, with some programs not offering an exercise component. In the majority of these instances (75%) patients demonstrated an improvement in 6MWT, with 57% showing an increase of greater than 50 metres (Table 13).



Results rounded to 10 metres

Figure 12: Comparison of pre assessment and post assessment 6MWT results

Table 12: Summary of 6MWT results

	Total analysed n	Pre assessment Mean ± SD	Post assessment Mean ± SD	Change Mean ± SD
Distance travelled (metres)	1,884	410 ± 98	475 ± 109	65 ± 64

Table 13: Change in 6MWT results

	n (%)
Improved ≥50 metres	1,076 (57.1)
Improved 25–49 metres	347 (18.4)
No change (±25 metres)	377 (20.0)
Worsened ≥25 metres	84 (4.5)
ALL	1,884 (100.0)

6.3.3 Patient Health Questionnaire

The CR assessment often includes a brief screening for anxiety and depressive disorders, both of which are significant risk factors for patients suffering coronary artery disease associated with adverse cardiovascular outcomes independent of other risk factors.

The Patient Health Questionnaire-4 (PHQ-4) is a validated tool for screening anxiety and depressive disorders.²⁴ This instrument is a four-item composite measure derived from the Generalized Anxiety Disorder-7 scale (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9). Each of the four items on the PHQ-4 is scored using a four point scale with categories of high psychological distress being scored 9–12 points and mild psychological distress scoring between 3–5 points. A score of 0–2 points suggests minimal depression and anxiety.

A total of 2,546 paired data were available for analysis. Almost one-third of patients (32%) demonstrated an improved PHQ-4 score at post assessment.

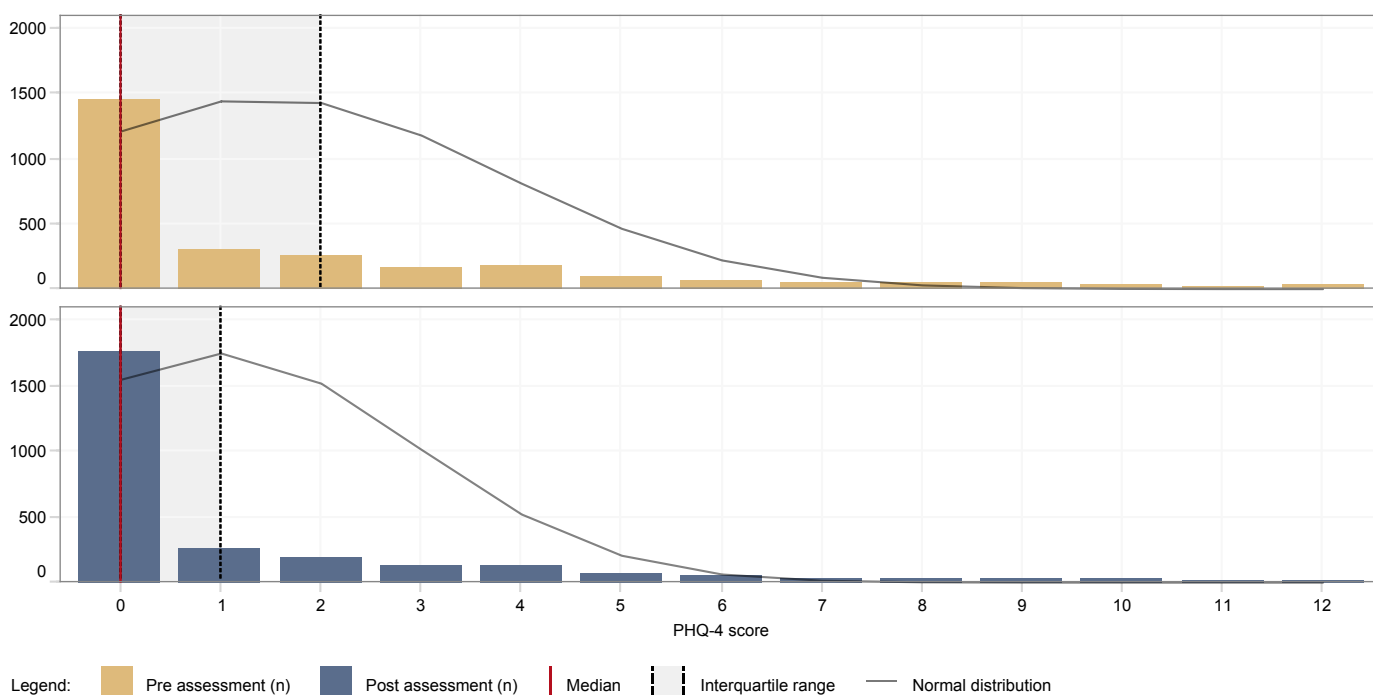


Figure 13: Comparison of pre assessment and post assessment PHQ-4 results

Table 14: Summary of PHQ-4 results

	Total analysed n	Pre assessment Mean ± SD	Post assessment Mean ± SD	Change in score Mean ± SD
Depression score (PHQ-2)	2,546	0.7 ± 1.2	0.5 ± 1.1	-0.2 ± 1.2
Anxiety score (GAD-2)	2,546	0.8 ± 1.4	0.6 ± 1.2	-0.3 ± 1.3
Overall score	2,546	1.5 ± 2.3	1.0 ± 2.0	-0.5 ± 2.1

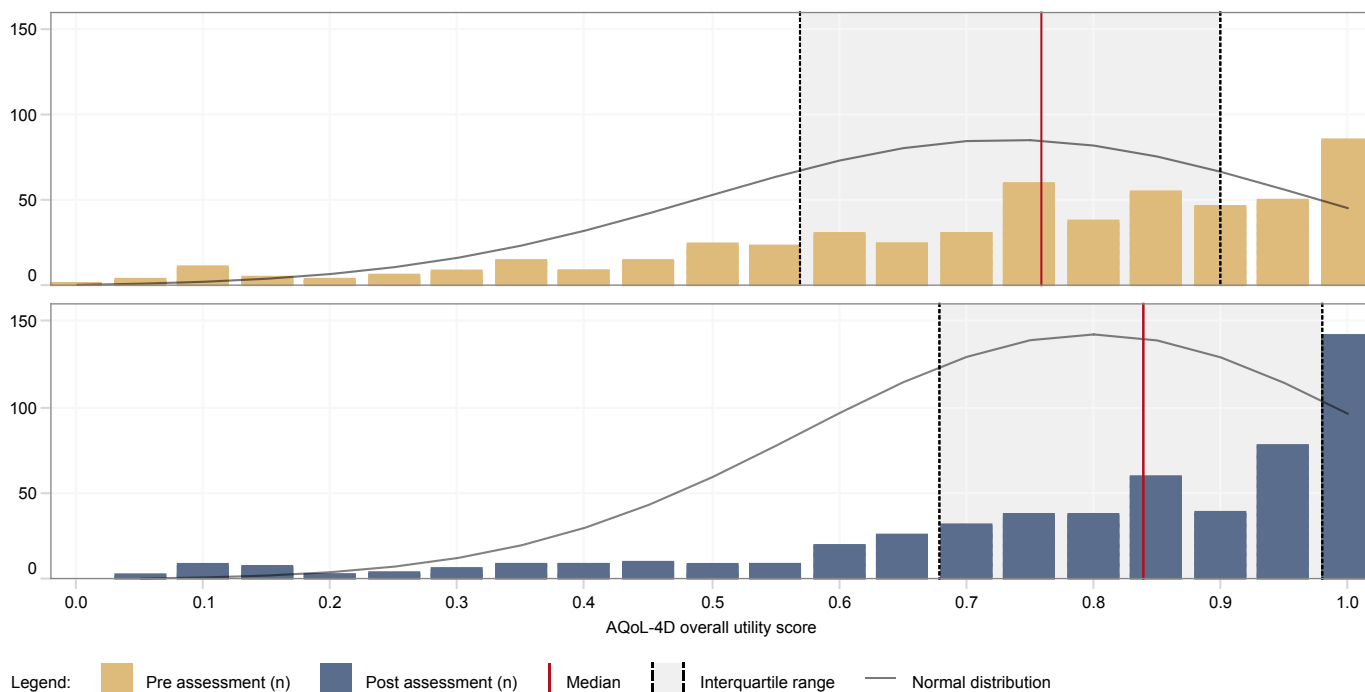
Table 15: Change in PHQ-4 results

	n (%)
Any improvement	819 (32.2)
No change	1,336 (52.5)
Any worse result	391 (15.4)
ALL	2,546 (100.0)

6.3.4 Assessment of Quality of Life

The Assessment of Quality of Life (AQoL-4D) is a multi-attribute utility instrument developed to assess health-related quality of life. It measures PROMs across four domains of health, scored individually, as well as providing an overall score. AQoL-4D utility scores range from 0.00–1.00, with scores closer to 1.00 indicating higher satisfaction of patients reporting the status of their own health.

For the 545 records available at the pre and post CR timeframes, the mean overall pre assessment AQoL-4D utility score was 0.71 which compares similarly to expected results for patients with a cardiovascular diagnosis.²⁵ This utility score improved to 0.78 at the post assessment stage, where 59% of patients demonstrated an improved overall utility score after CR intervention (Table 16 and Table 17).



Results rounded to 0.05 utility score

Figure 14: Comparison of pre assessment and post assessment AQoL-4D results

Table 16: Summary of AQoL-4D results

	Total analysed n	Pre assessment Mean ± SD	Post assessment Mean ± SD	Change in score Mean ± SD
Independent living	545	0.89 ± 0.19	0.95 ± 0.13	0.06 ± 0.16
Relationships	545	0.91 ± 0.15	0.93 ± 0.15	0.02 ± 0.16
Senses	545	0.94 ± 0.10	0.94 ± 0.09	0.01 ± 0.09
Mental health	545	0.90 ± 0.12	0.92 ± 0.12	0.02 ± 0.13
Overall score	545	0.71 ± 0.24	0.78 ± 0.23	0.07 ± 0.22

Table 17: Change in AQoL-4D results

	n (%)
Any improvement	321 (58.9)
No change	74 (13.6)
Any worse result	150 (27.5)
ALL	545 (100.0)

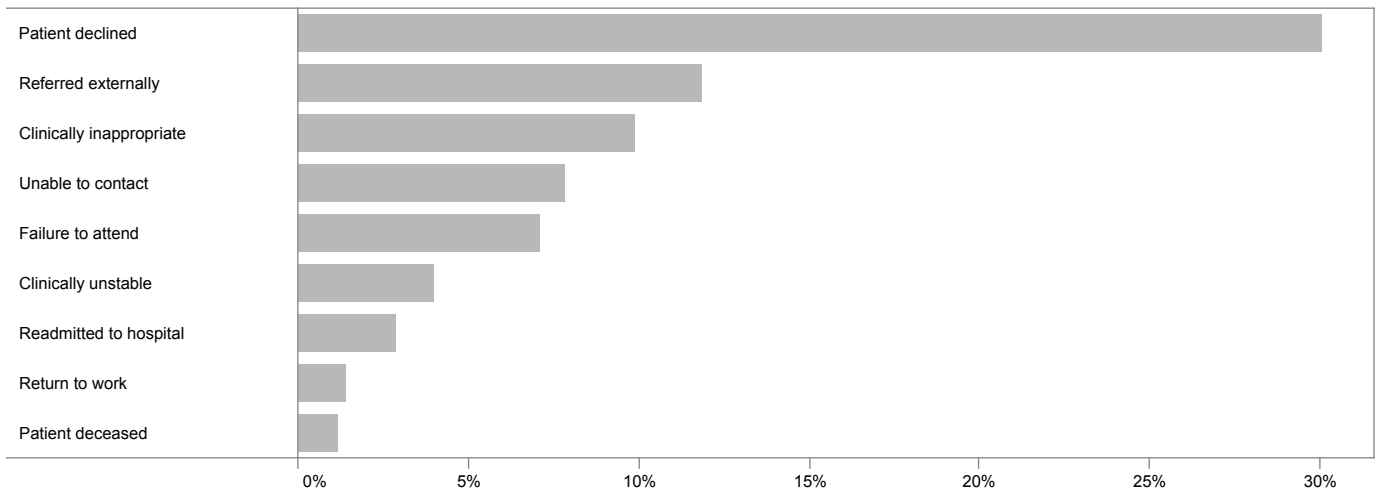
6.4 Failure to participate

It is well known that there are several reasons patients may not participate in a CR program. This was identified as a point for future focus through last year's Audit. Subsequently, QCOR has been enhanced to provide increased granularity which will allow future reports to include more specific detail around reasons this may occur. In this cohort the most common reason for not participating was that the patient would decline or opt not to participate (30%).

Aside from patients that declined the service, there are a number of specific reasons a referral may not proceed to pre assessment. These include patients who are uncontactable, failed to attend their appointments or are medically unsuitable. Interstate referrals also accounted for a large number of referrals which did not proceed through to an assessment. This is particularly relevant for the Gold Coast HHS where a high proportion (23%) of patients referred to this CR program are residents of northern New South Wales and followed up outside of Queensland Health.

It is important to recognise that in some instances, the clinician may still provide opportunistic education and advice to a patient who declined to participate, though this is difficult to incorporate into outcome measure reporting. Furthermore, there is an unmeasured subset of patients who refuse the initial referral to CR and are currently outside the scope of this registry.

Further information relating to the patients who had declined to participate in CR is included in section 8 of this report.



Other reasons not displayed (24%)

Figure 15: Reasons for no pre assessment being conducted

7 Clinical presentation

7.1 Diagnosis

Patients attending a CR pre assessment have been grouped into a diagnosis category for the following analysis based on information provided on the referral to CR. The majority of assessments (65%) followed a previous diagnosis of ischaemic heart disease (IHD).

Table 18: Pre assessments by diagnosis category

Diagnosis category	n	%
Ischaemic heart disease*	4,982	65.0
Valvular disease	637	8.3
Other†	2,042	26.7
ALL	7,661	100.0

* STEMI, NSTEMI and angina

† Typically includes arrhythmia, congestive heart failure and any other diagnosis

7.2 Most recent procedure

The most common procedure preceding referral to CR was percutaneous coronary intervention (PCI), which had been documented for 39% of all referrals and approximately half (52%) of referrals for patients with IHD.

There were 14% of cases where the most recent procedure had not been identified. This could be attributable to missing data or patients presenting and subsequently being conservatively managed thus having no procedure applicable. This ambiguity has been identified as a point for future improvements to QCOR.

Table 19: Most recent procedure by diagnosis category

Most recent procedure	Ischaemic heart disease n (%)	Valvular disease n (%)	Other n (%)	ALL n (%)
PCI	2,593 (52.0)	5 (0.8)	400 (19.6)	2,998 (39.1)
Coronary angiogram	921 (18.5)	25 (3.9)	429 (21.0)	1,375 (17.9)
CABG	798 (16.0)	47 (7.4)	270 (13.2)	1,115 (14.6)
Valve procedure	11 (0.2)	452 (71.0)	76 (3.7)	539 (7.0)
Device procedure	16 (0.3)	2 (0.3)	156 (7.6)	174 (2.3)
CABG + valve procedure	66 (1.3)	62 (9.7)	25 (1.2)	153 (2.0)
Other	61 (1.2)	12 (1.9)	173 (8.5)	246 (3.2)
Not specified	516 (10.4)	32 (5.0)	513 (25.1)	1,061 (13.8)

7.3 Risk factors and comorbidities

The following risk factors and comorbidities are discussed with the patient through the assessment phase and generally self-reported by the patient. With all self-reporting instances, it is important to note that sometimes responses are not accurately conveyed while the patient and clinician are in the establishment phase of their relationship. As a result, some of the risk factor metrics may be understated.

7.3.1 Smoking

At the time of the pre-assessment, 9% of patients were identified as current smokers (defined as smoking within 30 days), while 51% were classed as former smokers and 40% reported never having smoked.

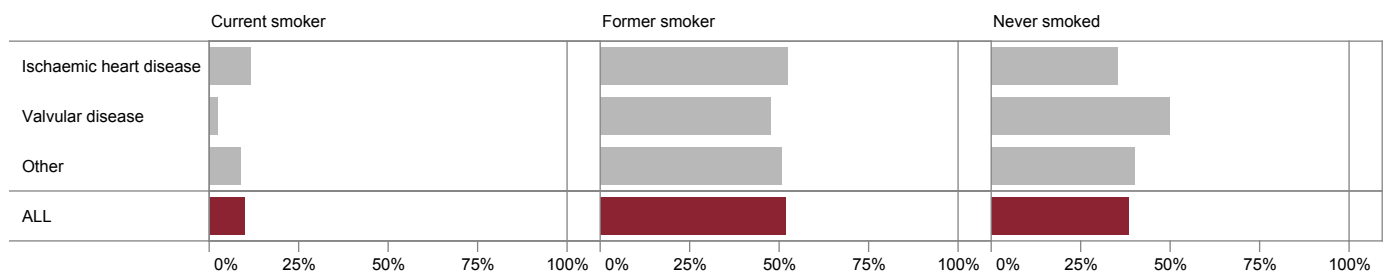
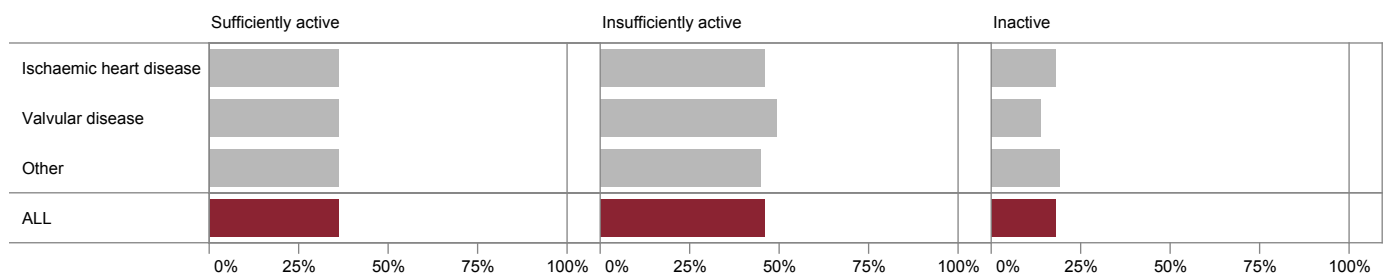


Figure 16: Smoking status by diagnosis category

7.3.2 Activity level

There were only 36% of patients who met the physical activity guidelines for their age and were sufficiently active. Conversely, 18% of patients were classed as inactive, which had been defined as only undertaking activities associated with daily living. The remaining 46% of patients were classed as insufficiently active according to current guidelines.

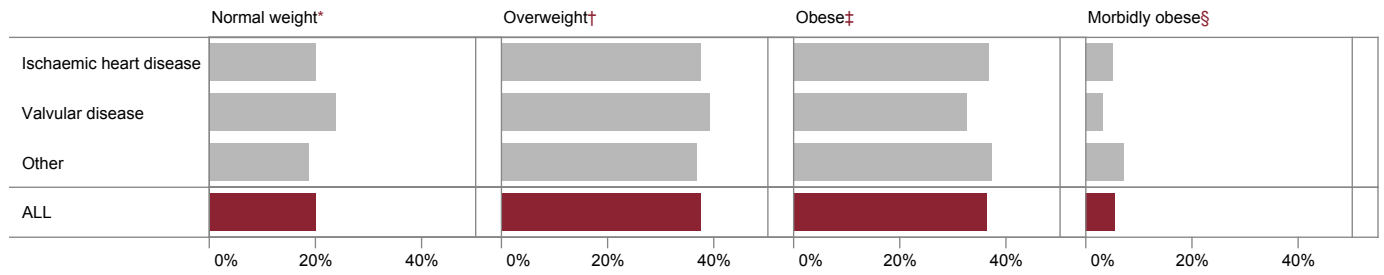


Excludes COACH assessments (n=1,042)

Figure 17: Activity level by diagnosis category

7.3.3 Body mass index

Less than one-quarter (20%) of patients were identified as having a body mass index (BMI) within the normal range, while the majority (80%) of patients attending outpatient CR were classified as overweight, obese or morbidly obese. Less than one percent of patients were classified as underweight (BMI <18.5 kg/m²).



Underweight category (<1%) not displayed

- * BMI 18.5–24.9 kg/m²
- † BMI 25–29.9 kg/m²
- ‡ BMI 30–39.9 kg/m²
- § BMI ≥40 kg/m²

Figure 18: BMI category by diagnosis category

7.3.4 Diabetes

Overall, 27% of patients had diabetes as a comorbidity with considerable variation observed between diagnosis categories, ranging from 16% for valvular disease to 28% in the IHD and other diagnosis categories.

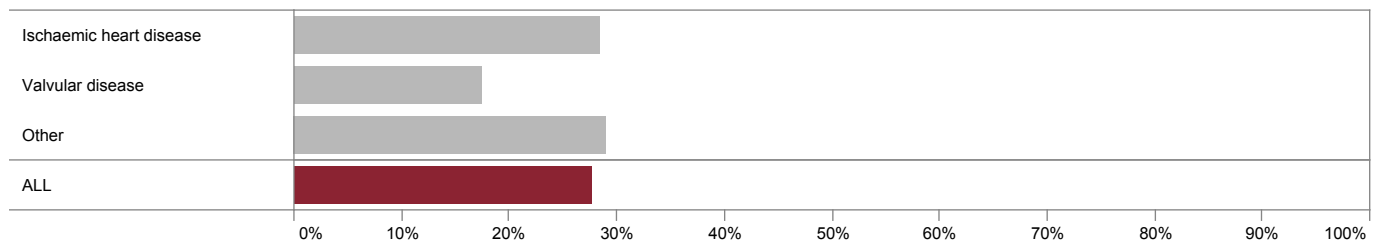
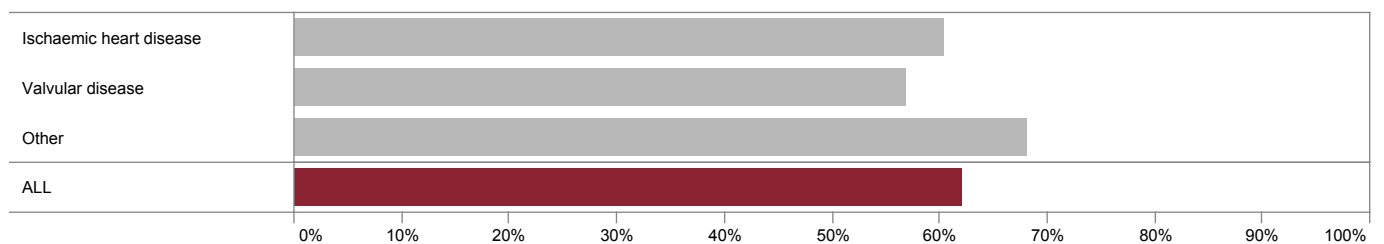


Figure 19: Diabetes status by diagnosis category

7.3.5 High blood pressure

More than half of patients assessed (62%) were identified as having hypertension, ranging from 57% to 68% across diagnosis categories.



Excludes COACH assessments (n=1,042)

Figure 20: High blood pressure by diagnosis category

7.3.6 Abnormal cholesterol

The majority of patients (89%) had a history of abnormal cholesterol levels or had been prescribed lipid lowering therapy by the time of assessment. This ranged from 64% to 95% across diagnosis categories.

Abnormal cholesterol levels for patients with known cardiovascular disease include measures of:

- Total cholesterol >4.0 mmol/L
- HDL <1.0 mmol/L
- LDL >2.0 mmol/L
- Triglycerides >2.0 mmol/L.²⁶

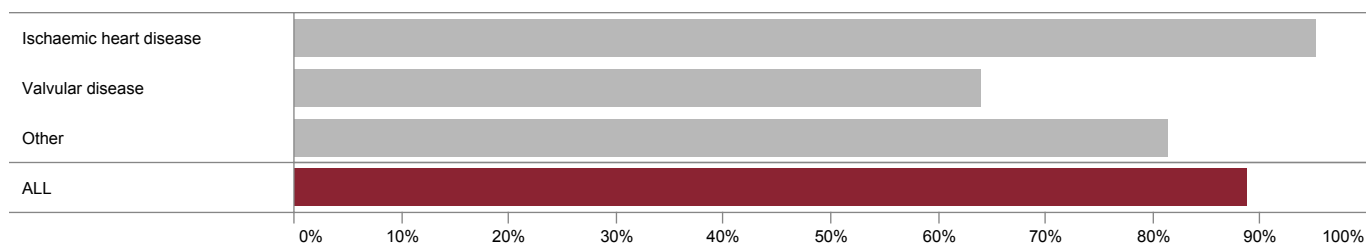


Figure 21: Abnormal cholesterol by diagnosis category

7.3.7 Family history of cardiovascular disease

Less than half (44%) of patients had a family history of cardiovascular disease. This had been defined as having a first degree relative diagnosed with cardiovascular disease by the age of 60 years.

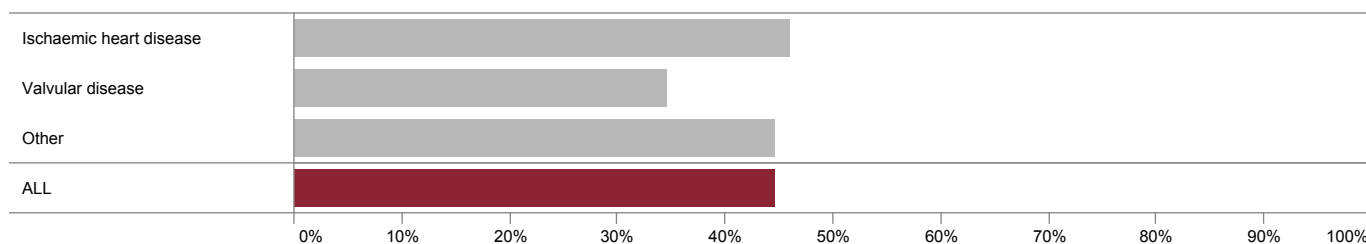
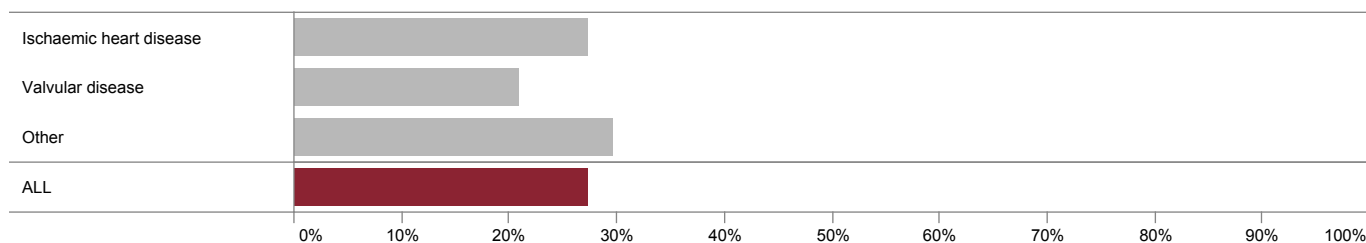


Figure 22: Family history of cardiovascular disease by diagnosis category

7.3.8 History of depression

Over one-quarter of patients (27%) had a history of depression prior to the referral to CR.



Excludes COACH assessments (n=1,042)

Figure 23: History of depression by diagnosis category

7.3.9 Heart failure

Overall there were 12% of patients assessed by outpatient CR who were documented as having heart failure. This was higher in the other diagnosis category, which includes the proportion of patients having heart failure as a principal diagnosis.

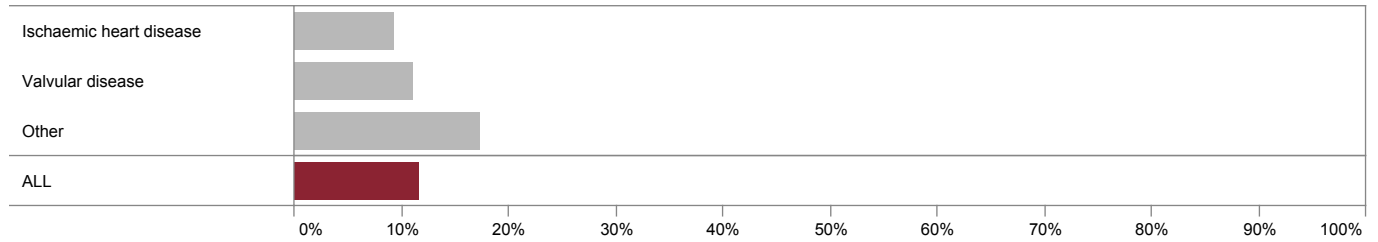
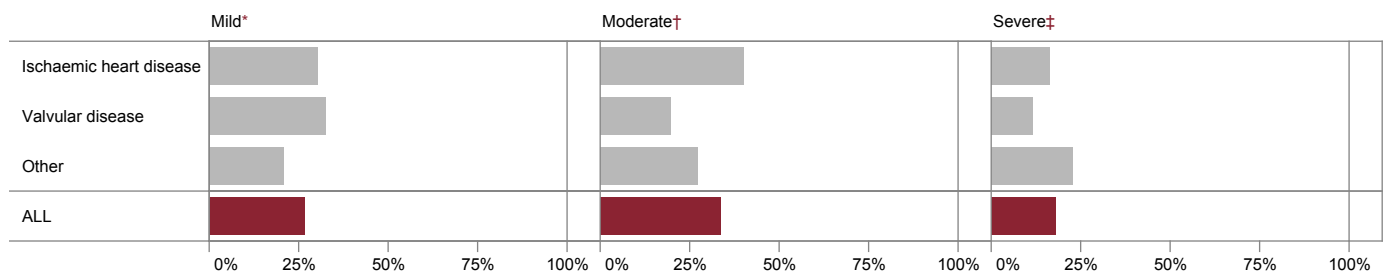


Figure 24: Heart failure by diagnosis category

Heart failure and left ventricular (LV) dysfunction

Of the patients documented to have heart failure (Figure 24), 79% were classed as having HF with a reduced left ventricular ejection fraction (LVEF <50%). Of these, 27% had mild LV dysfunction, 33% with moderate LV dysfunction and 18% with severe LV dysfunction.

The remainder (21%) were documented as having heart failure associated with a preserved ejection fraction (LVEF ≥50%).



* LVEF 40–49%

† LVEF 30–39%

‡ LVEF <30%

Figure 25: Proportion of HF patients with reduced ejection fraction by LV dysfunction and diagnosis category

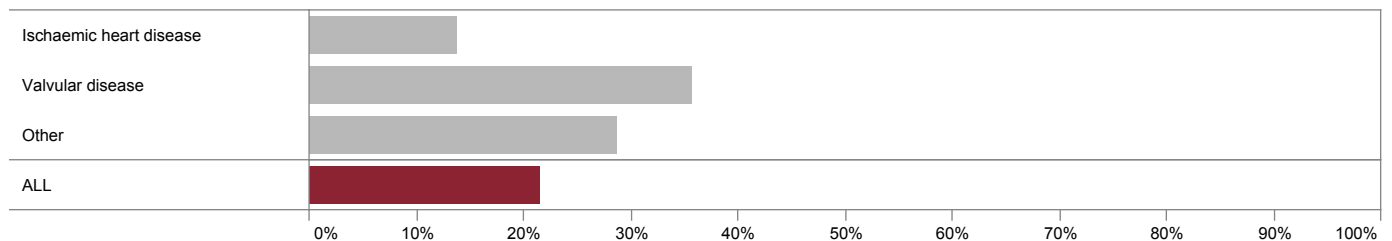


Figure 26: Proportion of HF patients with preserved ejection fraction by diagnosis category

7.4 Current medications

Over three-quarters of patients were being treated with aspirin (83%) and lipid lowering medications (84%). As expected, there was variation in medication across diagnosis categories. Patients with IHD tended to use antiplatelet and sublingual nitrate medications more than patients with valvular disease which is consistent with the different disease processes.

Table 20: Current medications by diagnosis category

Medications	IHD %	Valvular disease %	Other %	ALL %
Aspirin	90.9	64.3	69.1	82.9
ACEI/ARB	65.7	39.8	57.5	61.4
Antiplatelet	66.0	9.5	34.1	52.9
Anticoagulant	16.8	46.8	25.1	21.5
Beta blocker	65.8	45.6	60.2	62.6
Diabetic medications	22.4	13.8	23.9	22.1
Dual antiplatelet	62.2	7.0	29.1	48.8
Lipid lowering	90.8	57.3	74.1	83.6
Sublingual nitrate	58.1	6.0	27.3	45.6
Other	59.3	77.1	67.3	62.9

8 Clinical indicators

The CR clinical indicator program remains focused towards the timely referral and uptake to CR for admitted patients being discharged from public hospitals. This requires collaboration between the acute and outpatient services, each having their own targets (clinical indicator 1 and 2 respectively).

Overall system performance is measured through clinical indicator 3, which requires the acute and outpatient services to both meet their respective targets. For the purpose of this indicator, any referrals crossing between HHS are counted under both the referring and receiving HHS.

A future focus for the committee will be to expand the scope of the CR clinical indicators. Several areas have been highlighted including referrals from a non-acute setting and improvement at the post assessment stage. Discussion has highlighted a need for consistent CR practice and robust data entry prior to implementation of any new clinical quality indicators.

Table 21: Cardiac rehabilitation clinical indicators

#	Clinical indicator	Description
1	Timely referral	Documented referral to CR within three days of discharge
2	Timely assessment	Initial CR pre assessment completed within 28 days of discharge
3	Timely journey	Composite of timely referral and assessment

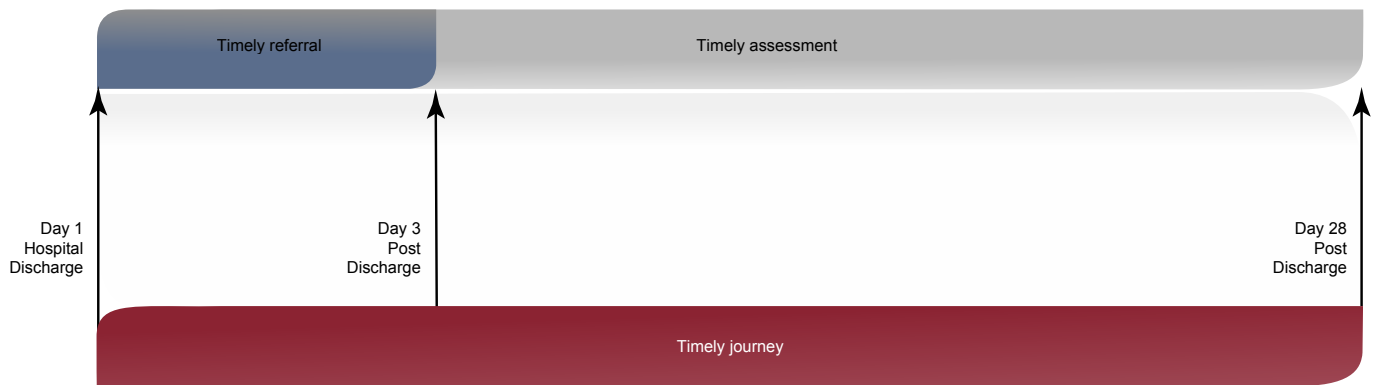


Figure 27: Timely referral, assessment and overall journey

8.1.1 Timely referral

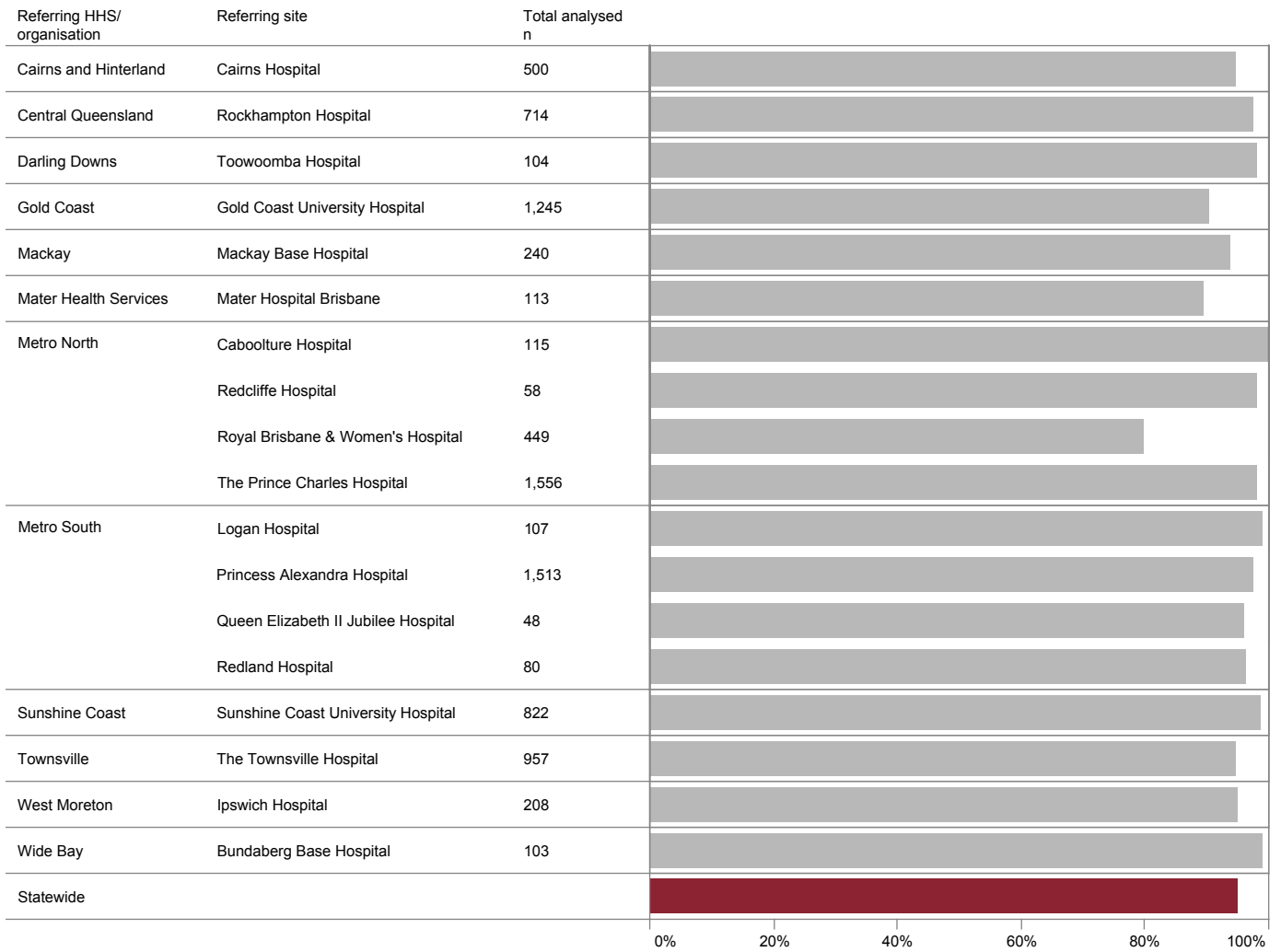
This indicator examines the proportion of inpatient referrals to CR originating from a public hospital which had been provided to the CR program in a timely manner. This requires the referral to be submitted to the outpatient program within three days of the patient being discharged from hospital.

Overall performance is high, with 95% of referrals contributed to QCOR being submitted within three days of discharge.

Table 22: Timely referrals by referring HHS

Referring HHS/organisation	Total inpatient referrals n	Target met n (%)
Cairns and Hinterland	500	473 (94.6)
Central Queensland	724	703 (97.1)
Central West	3	N/A
Darling Downs	108	105 (97.2)
Gold Coast	1,251	1,128 (90.2)
Mackay	240	225 (93.8)
Mater Health Services	113	101 (89.4)
Metro North	2,178	2,058 (94.5)
Metro South	1,748	1,703 (97.4)
North West	2	N/A
Sunshine Coast	826	814 (98.5)
Townsville	957	906 (94.7)
West Moreton	208	198 (95.2)
Wide Bay	106	102 (96.2)
Statewide	8,964	8,519 (95.0)

N/A = Not displayed due to <20 referrals eligible for analysis



Sites with <20 referrals eligible for analysis not displayed

Figure 28: Timely referrals by referring hospital

8.1.2 Timely assessment

This indicator examines the proportion of referrals to CR which proceed to an assessment within 28 days of discharge.

In order to retain focus on the performance of the outpatient CR program, referrals which are not provided in a timely manner (less than three days from discharge) have been excluded from the analysis. Further to this, other ineligibility criteria are outlined in Table 20. The exclusions are applied where information is available and has been documented in the application.

Overall, more than half of all patients (62%) are being assessed in a timely manner, however there was some variation across health services.

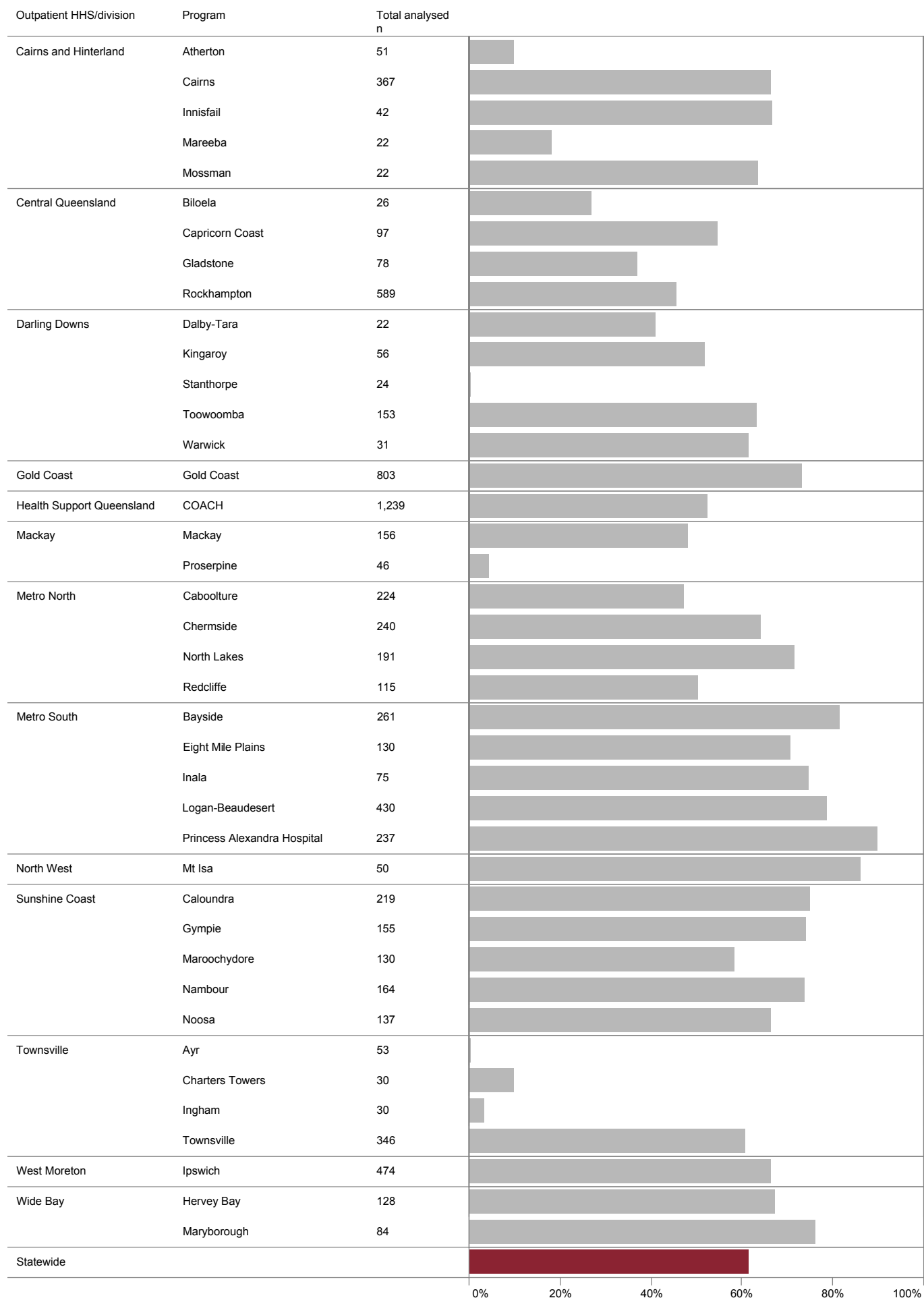
Table 23: Summary of referrals ineligible for timely assessment clinical indicator

Summary	n
Referred outside of Queensland Health	525
Referral submitted >3 days after discharge	388
Patient already attending CR program	101
Readmitted to hospital	88
Patient deceased	37
Total ineligible	1,139

Table 24: Timely assessment indicator by outpatient HHS

Outpatient HHS/division	Total inpatient referrals n	Total eligible for analysis n	Target met n (%)
Cairns and Hinterland	598	521	309 (59.3)
Central Queensland	909	790	358 (45.3)
Central West	19	13	N/A
Darling Downs	333	309	161 (52.1)
Gold Coast	1,247	803	588 (73.2)
Health Support Queensland	1,389	1,239	652 (52.6)
Mackay	247	218	77 (35.3)
Metro North	825	770	455 (59.1)
Metro South	1,194	1,133	912 (80.5)
North West	56	50	43 (86.0)
South West	26	24	14 (58.3)
Sunshine Coast	867	805	567 (70.4)
Townsville	507	464	214 (46.1)
West Moreton	510	474	315 (66.5)
Wide Bay	237	212	150 (70.8)
Statewide	8,964	7,825	4,818 (61.6)

N/A = Not displayed due to <20 referrals eligible for analysis



Sites with <20 pre assessments eligible for analysis not displayed

Figure 29: Timely assessment by outpatient program

8.1.3 Timely journey

This patient-centric measure of overall system performance requires strong coordination and links between the referring acute and outpatient CR sites. It measures the proportion of eligible inpatient referrals submitted by the acute site within three days of discharge, as well as the ability of the receiving CR program to meet the target of completing a pre assessment within 28 days of discharge.

Referrals are excluded from the analysis for the reasons outlined in Table 25. The exclusions are applied where information is available and has been documented in the application.

It is important to note that for the purpose of this indicator, any referral which crosses between HHS is counted against both participating services.

Table 25: Summary of referrals ineligible for timely journey clinical indicator

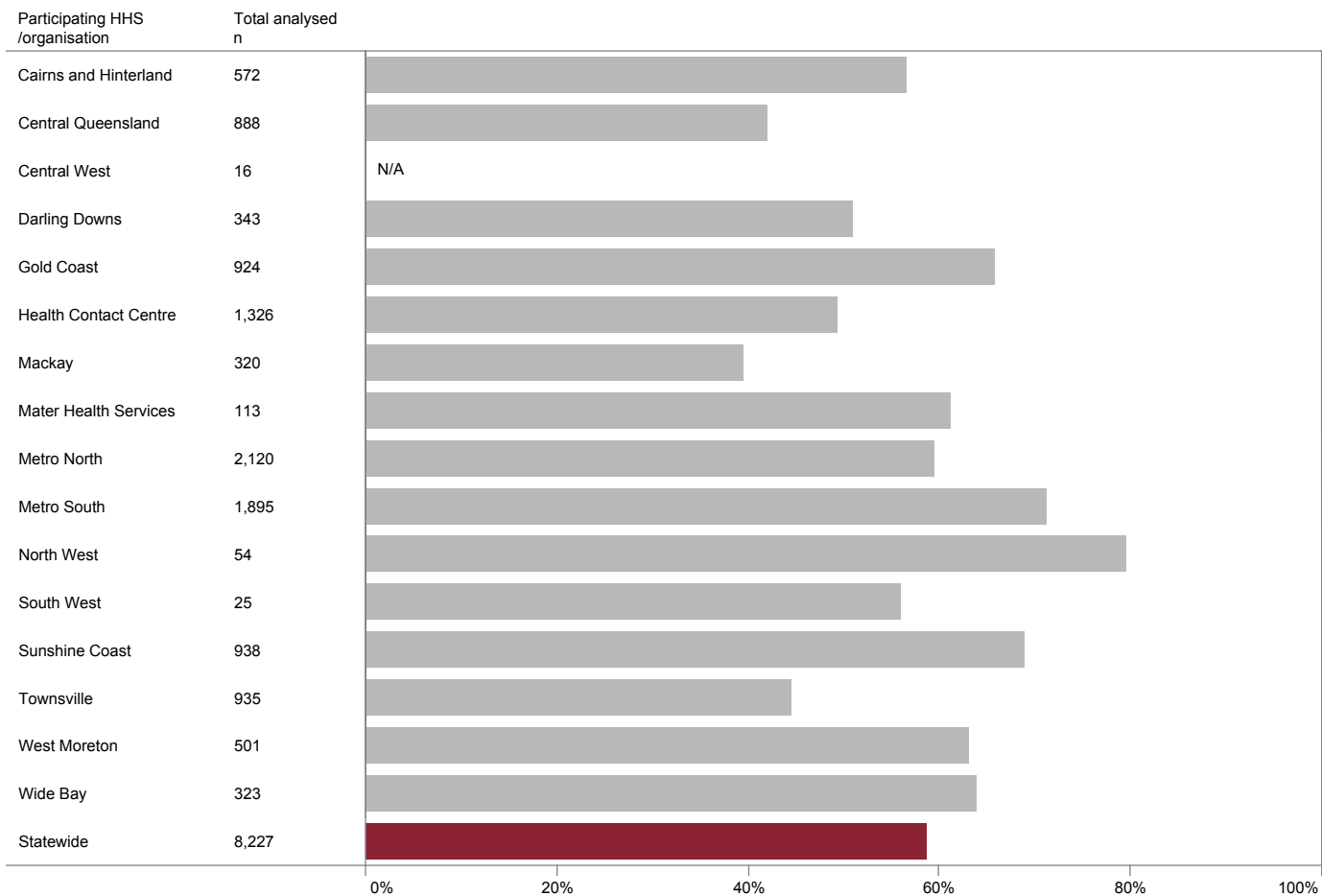
Summary	n
Referred outside of Queensland Health	525
Patient already attending CR program	101
Readmitted to hospital	88
Patient deceased	37
Total ineligible	751

Table 26: Timely journey indicator by participating HHS/organisation

Participating HHS/organisation	Total inpatient referrals*	Total eligible for analysis	Target met
	n	n	n (%)
Cairns and Hinterland	624	572	324 (56.6)
Central Queensland	979	885	372 (42.0)
Central West	19	16	N/A
Darling Downs	361	343	175 (51.0)
Gold Coast	1,290	920	607 (66.0)
Health Support Queensland	1,389	1,326	652 (49.2)
Mackay	337	319	126 (39.5)
Mater Health Services	113	113	69 (61.1)
Metro North	2,214	2,115	1,259 (59.5)
Metro South	1,939	1,894	1,347 (71.1)
North West	56	54	43 (79.6)
South West	26	25	14 (56.0)
Sunshine Coast	998	936	646 (69.0)
Townsville	970	934	415 (44.4)
West Moreton	514	501	316 (63.1)
Wide Bay	340	320	206 (64.4)
Statewide	8,964	8,213	4,818 (58.7)

N/A = Not displayed due to <20 referrals eligible for analysis

* Includes both incoming and outgoing referrals



N/A: Not displayed due to <20 referrals eligible for analysis

Figure 30: Timely journey indicator by participating HHS/organisation

9 Declined referrals

An initiative of the 2017 CR audit was to further define the subset of patients who did not uptake CR for whatever reason, with the aim to increase the level of detail available to describe the barriers to participation.

The cohort of patients who declined to participate in CR have been examined with an aim to identify common themes and opportunities for clinicians to improve patient participation rates. A limiting factor for this analysis is the amount of data available to describe this cohort, which is limited to the information included on the initial referral only.

9.1 Age and gender

Patients most likely to decline CR participation are males aged 70 years to 74 years (12%). The largest group of females to decline CR were aged in the 80 years to 84 years category (5%).

Conversely, patients aged 65 years to 69 years (17%) were the most likely to complete a CR program.

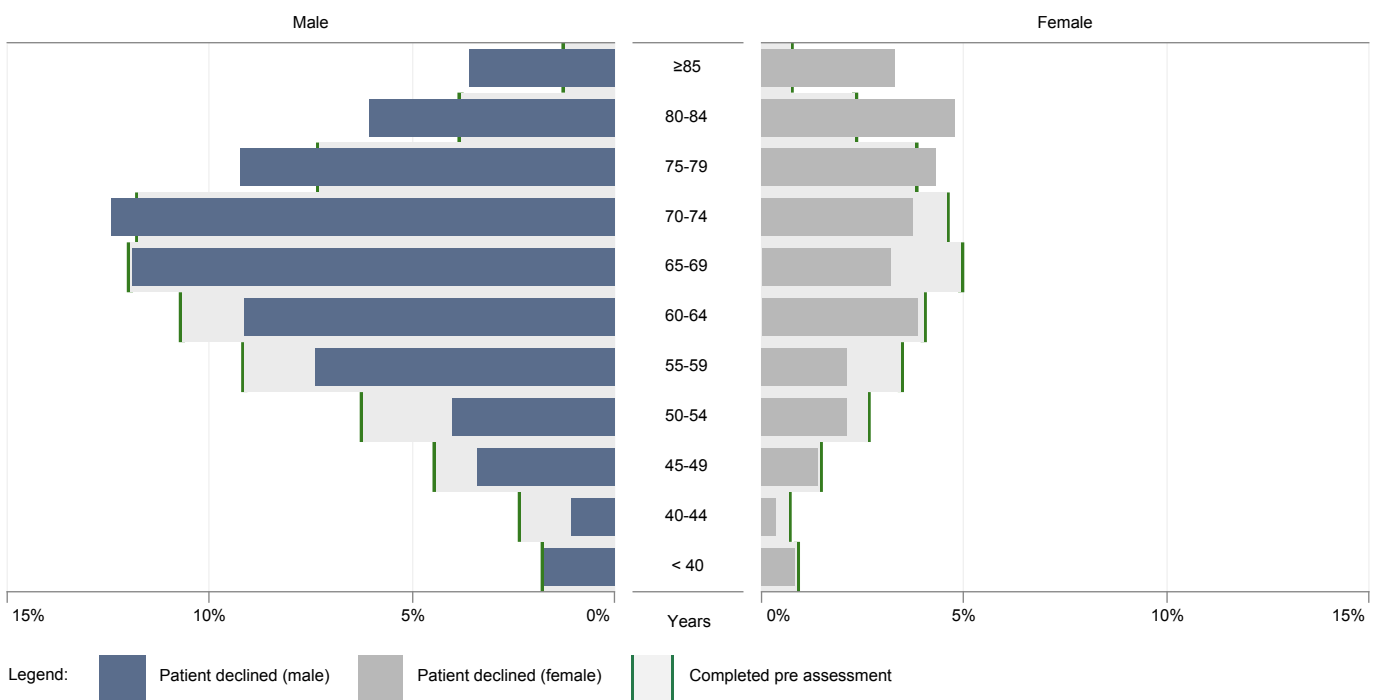


Figure 31: Patient CR program participation status by age group and gender

Table 27: Patient age (years) by program participation status

	Male Median (IQR)	Female Median (IQR)	ALL Median (IQR)
Patient declined	68 (60–75)	71 (61–81)	69 (60–77)
Fully assessed	65 (57–72)	67 (58–74)	66 (57–73)

9.2 Diagnosis category

Of the patients who declined, 42% had a diagnosis of ischaemic heart disease and 5% valvular disease. By comparison, patients who had completed an initial assessment were more commonly associated with ischaemic heart disease and valvular heart disease (65% and 8% respectively). Most patients (53%) who declined CR had an other diagnosis.

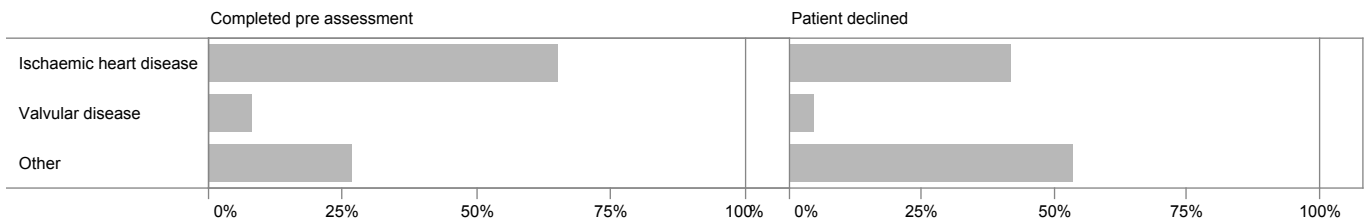


Figure 32: Proportion of cases by diagnosis category and program participation status

Table 28: Diagnosis category by program participation status

Diagnosis category	Completed pre assessment n (%)	Patient declined n (%)
Ischaemic heart disease	4,982 (65.0)	459 (42.0)
Valvular disease	637 (8.3)	50 (4.6)
Other	2,042 (26.7)	583 (53.4)
ALL	7,661 (100.0)	1,092 (100.0)

9.3 Most recent procedure

Overall, 20% of patients that had declined to participate in CR were recorded as having undergone PCI, while approximately 5% had undergone CABG. Almost half of patients (46%) who declined CR had no recent procedure specified.

For the cohort that proceeded to assessment, their most recent procedure was more closely related to their participation status. This data suggests that patients who went on to uptake onto a CR program may be more likely to have undergone an invasive cardiac procedure prior to referral. However, care should be taken when interpreting these findings as this data element is not always completed at the time of referral. Therefore, it may not fully represent the preceding patient medical history.

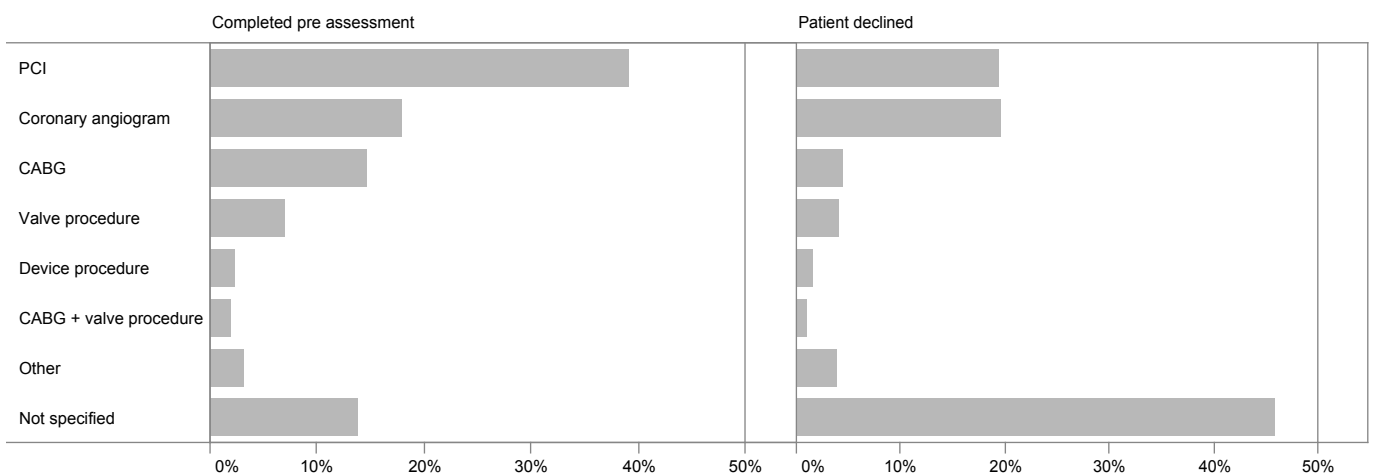


Figure 33: Proportion of cases by most recent procedure and program participation status

Table 29: Most recent procedure by program participation status

Most recent procedure	Completed pre assessment n (%)	Patient declined n (%)
PCI	2,998 (39.1)	213 (19.5)
Coronary angiogram	1,375 (17.9)	215 (19.7)
CABG	1,115 (14.6)	48 (4.4)
Valve procedure	539 (7.0)	45 (4.1)
Device procedure	174 (2.3)	18 (1.6)
CABG + valve procedure	153 (2.0)	10 (0.9)
Other	246 (3.2)	42 (3.8)
Not specified	1,061 (13.8)	501 (45.9)
ALL	7,661 (100.0)	1,092 (100.0)

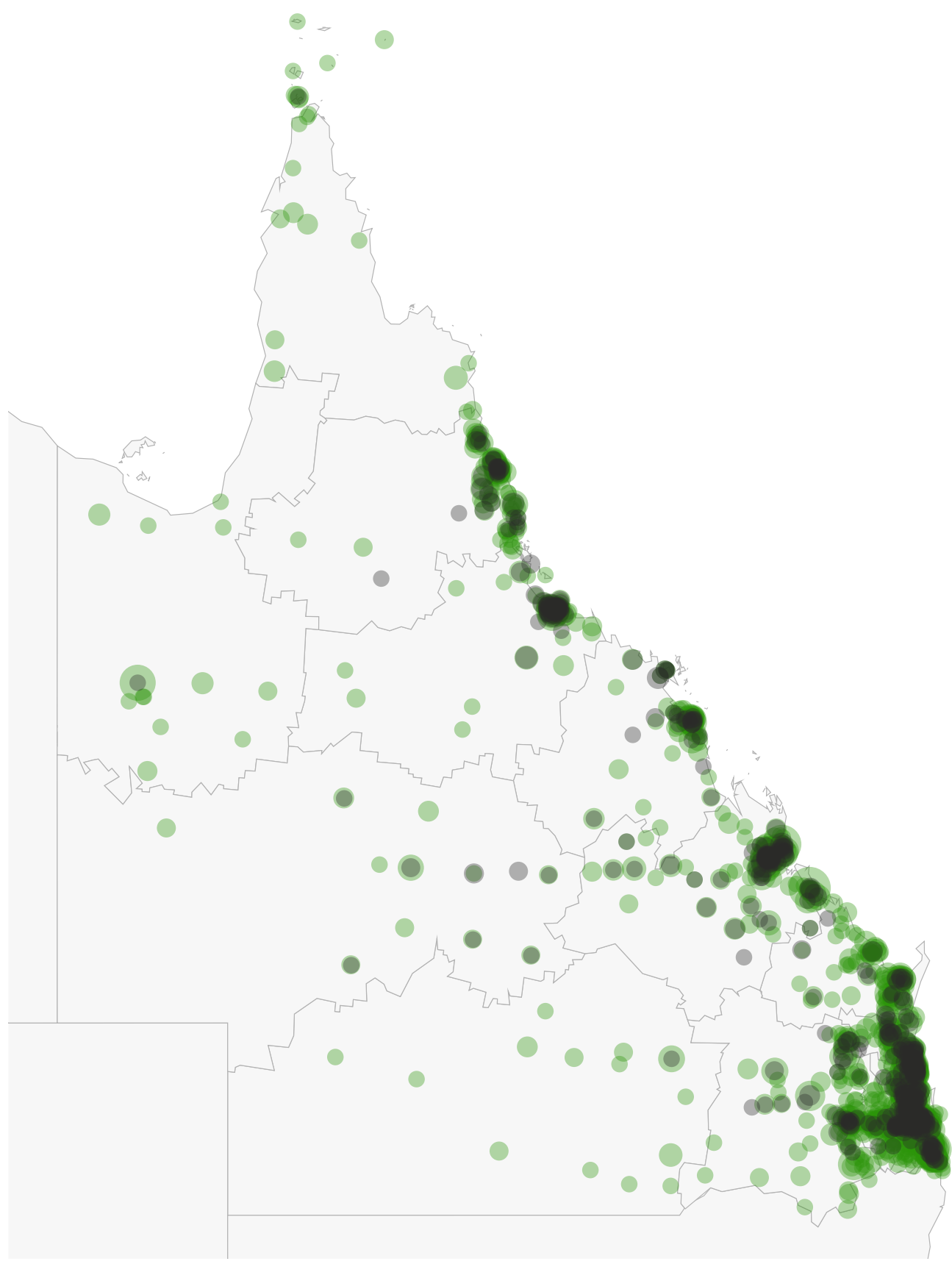
9.4 Place of residence

A higher proportion (49%) of patients declining to participate in CR resided in major cities of Australia. Irrespective of geographic location, there were similar proportionate rates for those who had taken up CR and those who had declined.

Table 30: Remoteness classification by program participation status

Remoteness classification*	Completed pre assessment n (%)	Patient declined n (%)
Major Cities of Australia	4,030 (52.6)	536 (49.1)
Inner Regional Australia	2,283 (29.8)	332 (30.4)
Outer Regional Australia	1,073 (14.0)	182 (16.7)
Remote Australia	92 (1.2)	14 (1.3)
Very Remote Australia	176 (2.3)	24 (2.2)
ALL	7,661 (100.0)	1,092 (100.0)

* Classified by Accessibility and Remoteness Index of Australia



Legend: ■ Patient participating in CR ■ Patient decline of CR

Figure 34: Patient residential postcode by program participation status

10 Conclusions

This report is the first to add a full year of data regarding patients referred to any of the 60 public CR sites in Queensland. In particular, for the 55 sites which had contributed data to QCOR for 2018. This adds to a growing body of information describing the baseline demographics, clinical presentation and risk factors affecting patients referred to a public CR service.

The data offers rich insight into the process of care for 11,723 new referrals in 2018. Across the analysis, the data is reassuring and shows the majority of patients had been referred for and received an initial assessment in a timely manner (95% and 62% meeting respective benchmarks). Where post assessment data were available, it is also gratifying to see over half of patients had been documented with an improved health status across the majority of metrics analysed.

Through the increased scope of the CR Audit, clear variations in practice have been identified across the state. This is highlighted by the deliberate inclusion of several sites (Goondiwindi, Stanthorpe, Bowen, Ayr and Hughenden) which have yet to contribute data through QCOR. It is hoped this inclusion may draw attention to staffing and resource availability for those sites. Across the state the relative lack of descriptive data for staffing and practitioner disciplines, and inability to correlate reported results against the model of care employed by each site hinders the analysis and makes it difficult to draw firm conclusions at this time.

Similarly, the report highlights varying practices towards patients assumed eligible for CR but not receiving a referral for whatever reason. This may occur at the behest of the patient or through other circumstances outside of the patient's control. It must be acknowledged there are clear limitations in reporting for patients who had refused or otherwise had not been referred for CR. This forms a gap in the current analysis and limits the ability to fully describe such barriers to participation. This is despite the spotlight on patients who refused or rejected to attend a CR program as further investigation is clearly warranted.

The initial examination of post assessment outcomes yields promising results suggesting clear benefits for patients who completed both the pre assessment and post assessment stages. However, these findings must be interpreted with caution due to the reduced cases included in these analyses and inconsistent post assessment completion rates. Hence there is potential for a selection bias to be in play. Nevertheless, the initial data speaks volumes for the unique potential for CR data to satisfy questions regarding patient-reported outcomes and experiences in post-discharge care.

As the data collection continues to mature and evolve, it is expected that this will allow more sophisticated analyses in future audits. This would include linkages between the CR report data and other QCOR data collections, which would follow the overall registry's direction towards a more patient-centric and disease-based model of reporting. The continued support of CR clinicians is recognised and vital to ensuring the ongoing success and development of CR services, and achieving quality patient outcomes across Queensland.

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Cardiac Rehabilitation Audit

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Glossary

6MWT	Six Minute Walk Test	ICD	Implantable Cardioverter Defibrillator
ACC	American College of Cardiology	IHT	Inter-hospital Transfer
ACEI	Angiotensin Converting Enzyme Inhibitor	IPCH	Ipswich Community Health
ACOR	Australasian Cardiac Outcomes Registry	LAA	Left Atrial Appendage
ACS	Acute Coronary Syndromes	LAD	Left Anterior Descending Artery
ANZSCTS	Australian and New Zealand Society of Cardiac and Thoracic Surgeons	LCX	Circumflex Artery
AQoL	Assessment of Quality of Life	LGH	Logan Hospital
ARB	Angiotensin II Receptor Blocker	LOS	Length Of Stay
ARNI	Angiotensin Receptor-Neprilysin Inhibitors	LV	Left Ventricle
ASD	Atrial Septal Defect	LVEF	Left Ventricular Ejection Fraction
ATSI	Aboriginal and Torres Strait	LVOT	Left Ventricular Outflow Tract
AV	Atrioventricular	MBH	Mackay Base Hospital
AVNRT	Atrioventricular Nodal Re-entry Tachycardia	MI	Myocardial Infarction
BCIS	British Cardiovascular Intervention Society	MIH	Mt Isa Hospital
BiV	Biventricular	MRA	Mineralocorticoid Receptor Antagonists
BMI	Body Mass Index	MTHB	Mater Adult Hospital, Brisbane
BMS	Bare Metal Stent	NCDR	The National Cardiovascular Data Registry
BNH	Bundaberg Hospital	NOAC	Non-Vitamin K Antagonist Oral Anticoagulants
BSSLTX	Bilateral Sequential Single Lung Transplant	NP	Nurse Practitioner
BVS	Bioresorbable Vascular Scaffold	NRBC	Non-Red Blood Cells
CABG	Coronary Artery Bypass Graft	NSTEMI	Non ST-Elevation Myocardial Infarction
CAD	Coronary Artery Disease	OR	Odds Ratio
CBH	Caboolture Hospital	PAH	Princess Alexandra Hospital
CCL	Cardiac Catheter Laboratory	PAPVD	Partial Anomalous Pulmonary Venous Drainage
CH	Cairns Hospital	PCI	Percutaneous Coronary Intervention
CHF	Congestive Heart Failure	PDA	Patent Ductus Arteriosus
CI	Clinical Indicator	PFO	Patent Foramen Ovale
CR	Cardiac Rehabilitation	PHQ	Patient Health Questionnaire
CRT	Cardiac Resynchronisation Therapy	QAS	Queensland Ambulance Service
CS	Cardiac Surgery	QCOR	Queensland Cardiac Outcomes Registry
CV	Cardiovascular	QEII	Queen Elizabeth II Hospital
CVA	Cerebrovascular Accident	QH	Queensland Health
DAOH	Days Alive and Out of Hospital	QHAPDC	Queensland Hospital Admitted Patient Data Collection
DES	Drug Eluting Stent	RBC	Red Blood Cells
DOSA	Day Of Surgery Admission	RBWH	Royal Brisbane and Women's Hospital
DSWI	Deep Sternal Wound Infection	RCA	Right Coronary Artery
ECG	12 lead Electrocardiograph	RDH	Redcliffe Hospital
ECMO	Extracorporeal Membrane Oxygenation	RHD	Rheumatic Heart Disease
ED	Emergency Department	RKH	Rockhampton Hospital
eGFR	Estimated Glomerular Filtration Rate	RLH	Redland Hospital
EP	Electrophysiology	SCCIU	Statewide Cardiac Clinical Informatics Unit
FdECG	First Diagnostic Electrocardiograph	SCCN	Statewide Cardiac Clinical Network
FTR	Failure To Rescue	SCUH	Sunshine Coast University Hospital
GAD	Generalized Anxiety Disorder	SHD	Structural Heart Disease
GCCH	Gold Coast Community Health	STEMI	ST-Elevation Myocardial Infarction
GCUH	Gold Coast University Hospital	STS	Society of Thoracic Surgery
GLH	Gladstone Hospital	TAVR	Transcatheter Aortic Valve Replacement
GP	General Practitioner	TMVR	Transcatheter Mitral Valve Replacement
GYH	Gympie Hospital	TNM	Tumour, Lymph Node, Metastases
HBH	Hervey Bay Hospital (includes Maryborough)	TPCH	The Prince Charles Hospital
HF	Heart Failure	TPVR	Transcatheter Pulmonary Valve Replacement
HFpEF	Heart Failure with Preserved Ejection Fraction	TTH	The Townsville Hospital
HFrEF	Heart Failure with Reduced Ejection Fraction	TWH	Toowoomba Hospital
HFSS	Heart Failure Support Service	VAD	Ventricular Assist Device
HHS	Hospital and Health Service	VATS	Video-Assisted Thoracic Surgery
HOCM	Hypertrophic Obstructive Cardiomyopathy	VCOR	Victorian Cardiac Outcomes Registry
HSQ	Health Support Queensland	VF	Ventricular Fibrillation
IC	Interventional Cardiology	VSD	Ventricular Septal Defect

Ongoing initiatives

Whilst continually refining and improving data collection and reporting practices for the benefit of public facilities, QCOR is also beginning the investigation of a method to collect and analyse clinical data for private healthcare facilities. Following interest from various private providers, QCOR is looking to extend its quality and safety focus to accommodate the requirements of these facilities. It is anticipated that QCOR will provide a role in the delivery of reports and benchmarking activities whilst also acting as a conduit to the various national registries in existence and development.

Cardiac outreach continues to expand in Queensland with formalised and newly funded services having commenced between Cairns and Hinterland and Torres and Cape Hospital and Health Service intending to provide cardiac care in many of these communities for the first time. Services will commence in January 2020 between Townsville and North West. The forward plan for the rollout of this model across the state has been developed in partnership with consumers and clinicians. A new system, the QCOR Outreach application has been developed to track activity, service provision and patient outcomes. This ground-up development specifically for cardiac outreach finished testing and goes live for use in late 2019.

The QCOR Structural Heart Disease module is currently in advanced stages of development with wider deployment expected in 2020. 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. It will enable participation in national quality and safety activities for transcatheter aortic valve replacement as well as allow clinicians to utilise the application for collecting pre and post-procedural data in unprecedented detail. The application has been through rigorous testing with user training and further enhancements planned for the near future.

The ECG Flash initiative of the SCCN has continued to be implemented at several sites throughout 2018 and 2019. Deployment of hardware to spoke sites has been via a staged approach with uptake being varied based on local site workload and workforce. Integration of ECG Flash with workflow within hub sites continues to evolve with sites now taking the initiative to embrace and feedback to sites regarding the appropriate use of the system. Analysis of the utility of the system is beginning to take place with a focus on clinical efficacy and benefit. It is anticipated that QCOR will be able to support this new initiative through procedural linkage and outcome monitoring for the subset of patients whose clinical path utilised ECG Flash and went on to subsequent investigation or management.

Opportunities for participation in the formative stages of national registries and initiatives have been embraced by Queensland clinicians. These important initiatives which are in various stage of development will be critical to the future of clinical registries in Australia. It is anticipated that with further involvement from local stakeholders that these entities will evolve into relevant and useful tools for patient-centred reporting and outcomes.

