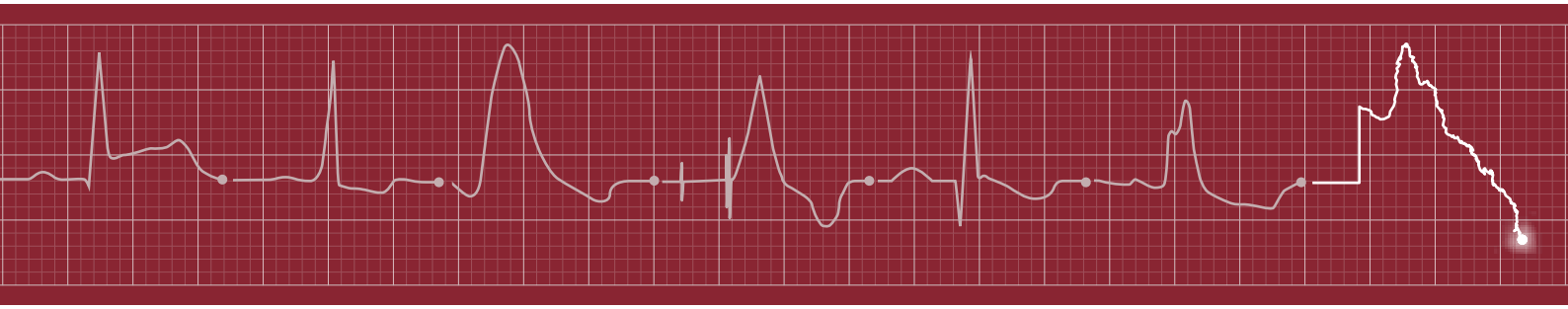
Statewide Cardiac Clinical Network

Queensland Cardiac Outcomes Registry
2020 Annual Report
Heart Failure Support Services Audit



Queensland Cardiac Outcomes Registry 2020 Annual Report

Published by the State of Queensland (Queensland Health), December 2021

For more information contact:
Statewide Cardiac Clinical Network,
Department of Health, GPO Box 48,
Brisbane QLD 4001,
email scciu@health.qld.gov.au, phone 07 3328 9771.

An electronic version of this document is available at:
clinicalexcellence.qld.gov.au/priority-areas/clinician-engagement/statewide-clinical-networks/cardiac

Contents

1 Foreword

Dr John Wakefield PSM
Director-General
Queensland Health

I am pleased to present the Queensland Cardiac Outcomes Registry (QCOR) 2020 Annual Report. The Annual Report provides a detailed audit of six clinical services spanning cardiac and thoracic interventions and surgeries to outpatient services for patients dealing with this complex chronic disease.

The Report also analyses the effect of the COVID-19 pandemic on cardiac services. Whilst there have been many challenges, it is evident that the resilient nature of cardiac clinicians has shone through with service volumes continuing to experience growth or modest variation in case numbers. The report also begins to examine the positive impact of the implementation of the Networked Cardiac Care model for coordination and outreach services in regional and remote Queensland. We can now measure and monitor the effect and outcome of investment into preventative and specialist medical care provided close to home.

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. It is pleasing to see this Report evolve and adapt to the needs of its stakeholders year-on-year.

Clinical engagement has continued to extend beyond clinical practice, where procurement activities for clinical consumable items has resulted in significant cost savings. The utilisation of QCOR data has been at the crux of these initiatives, empowering clinicians and administrators to confidently negotiate better value for money for high-cost, high-volume prostheses.

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

I would like to acknowledge the ongoing effort of the Statewide Cardiac Clinical Network and the ongoing commitment and dedication of our hard-working clinicians and teams across Queensland who have collaborated to produce this Annual Report.

2 Message from the SCCN Chair

This sixth QCOR Annual Report once again underpins the importance of data in ensuring quality outcomes in healthcare. The COVID-19 pandemic has also underscored how reliant we are on data to inform decision making and to monitor service delivery. To date, Queensland public health services have been spared in comparison to interstate and international services. Nonetheless, clinicians have collaborated to prepare for a staged, whole-system approach, should it be required, to ensure consistency of service delivery. QCOR data has supported these processes.

QCOR has continued to expand its breadth including a new module to support cardiac outreach services. Outreach services are an integral part of delivering quality care to patients for whom cardiac care is less accessible, due to their remoteness from traditional facility-based services. These models of care were embraced throughout the 2020 COVID-19 pandemic due to travel restrictions and lockdowns necessitating services to adapt to maintain high levels of clinical care. QCOR's analysis of this program highlights the investment and efforts of clinicians to ensure the best possible care is provided regardless of distance and location.

This year we welcome the contribution of quality data and outcomes from the Queensland Paediatric Cardiac Service. Initially focusing on paediatric cardiac surgery this small, highly specialised community perform high risk, low volume procedures requiring expert levels of evaluation and contextualisation. The database will provide a unique platform for population-based studies. It will also lay the foundation for long-term outcome studies in a local population.

It is again reassuring to see Queensland cardiac services performing strongly against, often-aspirational, targets, even in the face of an uncertain healthcare landscape. An unwavering commitment to clinical quality has seen the registry continue to evolve including the review and adjustment of clinical indicators across all areas of interest.

QCOR data has continued to underpin clinician-led, bulk purchase arrangements and subsequent savings for the purchase of cardiac prostheses. This data has informed the process and outcomes of the initiative resulting in over $3.8 million per annum savings across coronary stents and balloons, cardiac pacemakers, defibrillators and implantable loop recorders. The program has demonstrated the value of QCOR and its ability to not only support improved clinical outcomes but deliver significant efficiencies to the organisation that enable cost savings and reinvestment into front line services and new technologies. This program provides a template for other areas of the public health system to emulate.

The many dedicated staff involved in cardiac services throughout all of Queensland should be applauded, not only for their commitment to delivering quality clinical outcomes but for their willingness to collaborate, continually review, adapt and improve.

Dr Rohan Poulter and Dr Peter Stewart
Co-chairs, Statewide Cardiac Clinical Network

3 Introduction

The Queensland Cardiac Outcomes Registry (QCOR) is an ever-evolving clinical registry and quality program established by the Statewide Cardiac Clinical Network (SCCN) in partnership with statewide cardiac clinicians and made possible through the funding and support of Clinical Excellence Queensland. QCOR provides access to quality, contextualised clinical and procedural data to inform and improve patient care and support quality improvement activities across cardiac and cardiothoracic surgical services in Queensland.

QCOR is a clinician-led program, and the strength of the Registry would not be possible without this input. The Registry is governed by clinical committees providing direction and oversight over Registry activities for each cardiac and cardiothoracic specialty area, with each committee reporting to the SCCN and overarching QCOR Advisory Committee. Through the QCOR committees, clinicians are continually developing and shaping the scope of the Registry based on contemporary best practices and the unique requirements of each clinical domain.

Registry data collections and application are maintained and administered by the Statewide Cardiac Clinical Informatics Unit (SCCIU), which forms the business unit of QCOR. The SCCIU performs data quality, audit and analysis functions, and coordinates individual QCOR committees, whilst also providing expert technical and informatics resources and subject matter expertise to support continuous improvement and development of specialist Registry application modules and reporting.

The SCCIU team consists of:

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

* Principal contact officer/QCOR program lead

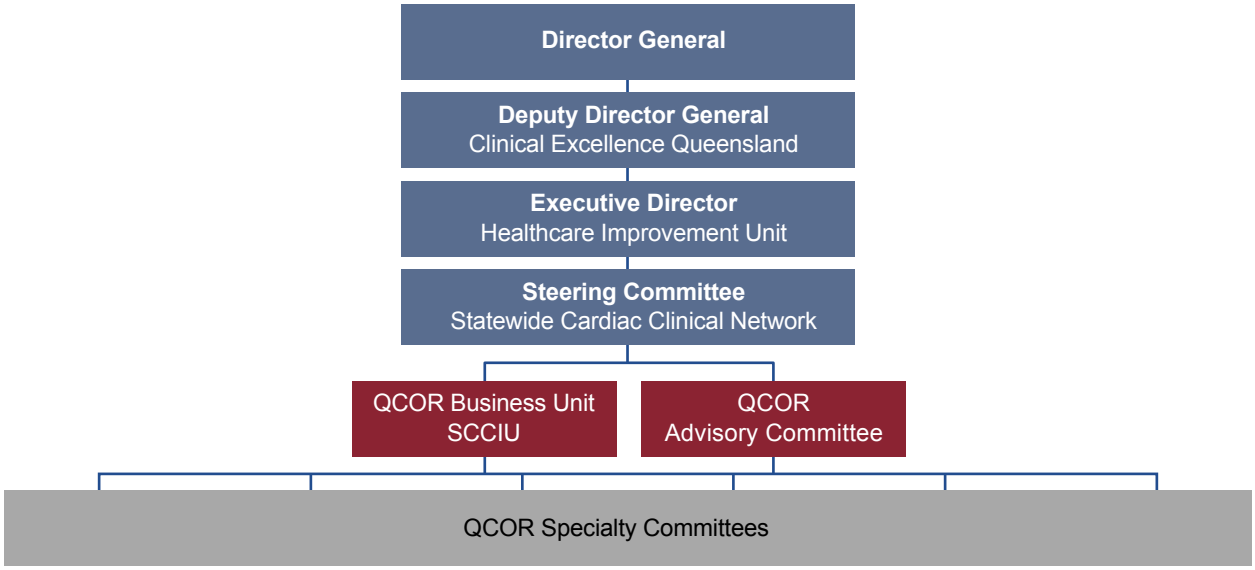
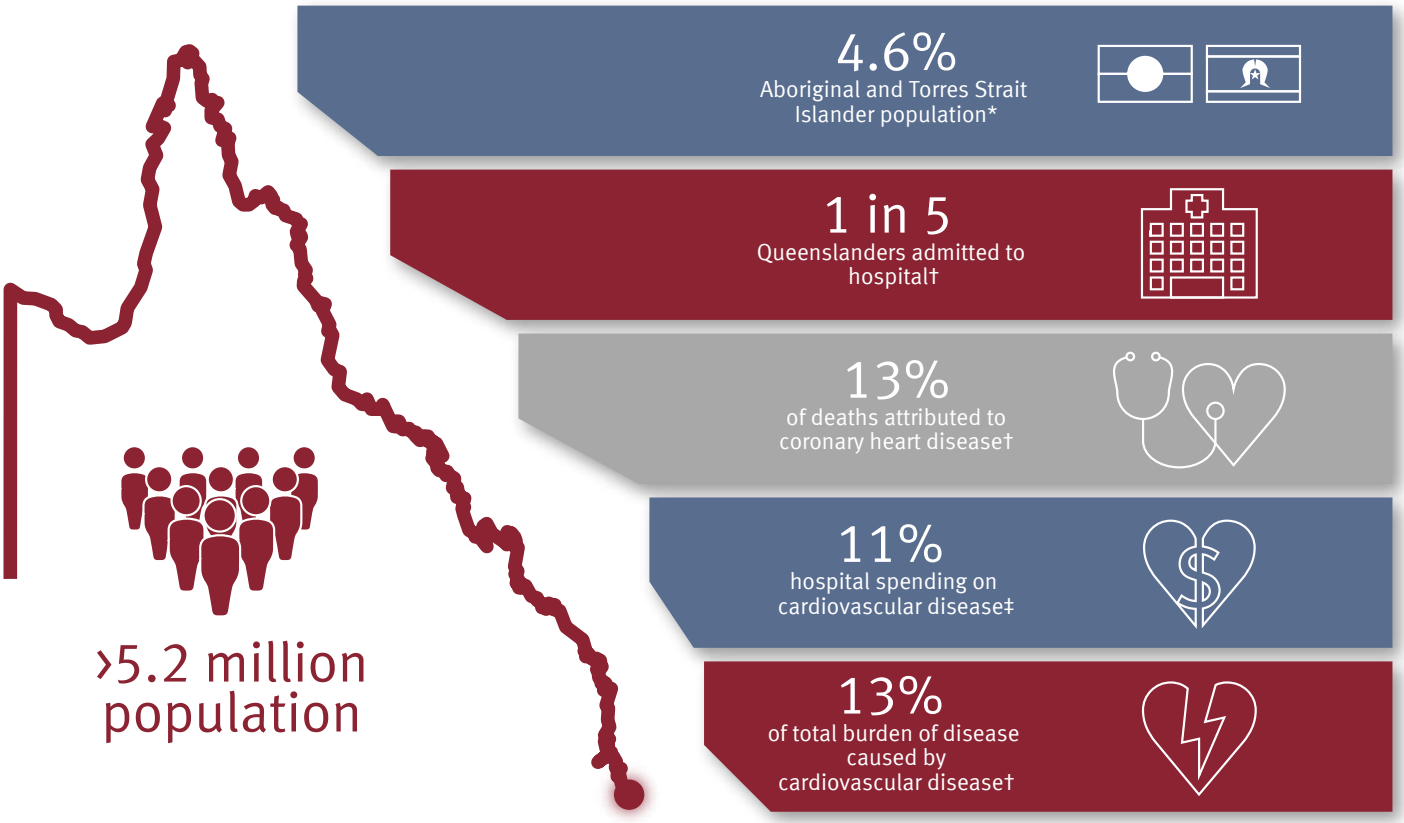


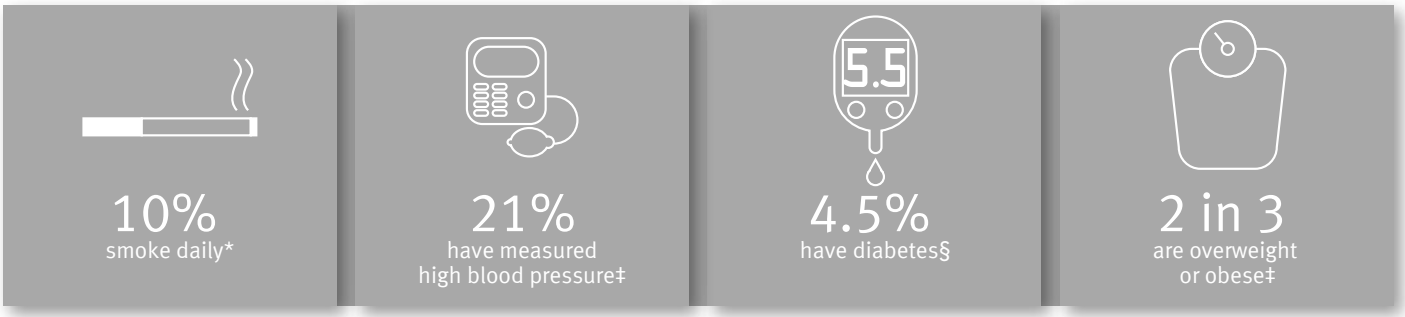
Figure 1: Governance structure

Queensland Cardiac Outcomes Registry

The Health of Queenslanders



Comorbidities



Mortality

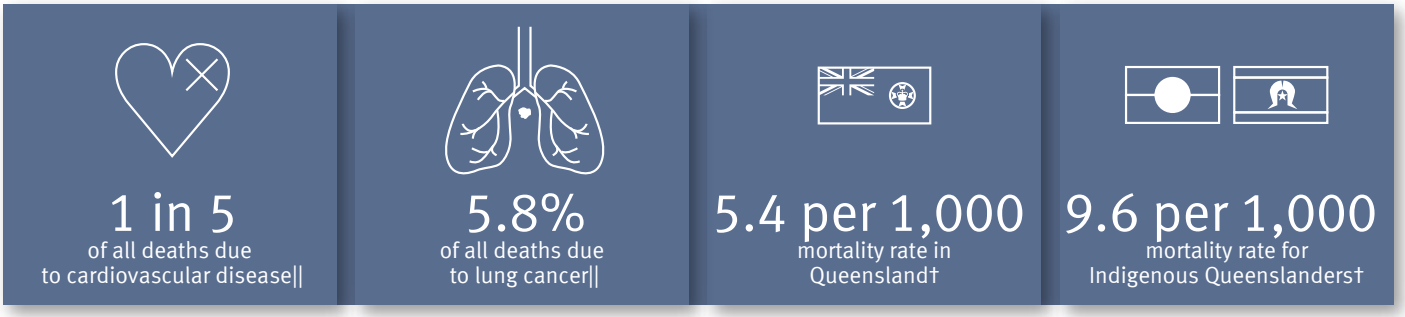


Figure 2: QCOR 2020 infographic

* Australian Bureau of Statistics. (2018). *Estimates of Aboriginal and Torres Strait Islander Australians*, June 2016. Cat. no 3238.055001. ABS: Canberra

† Queensland Health. (2020). The health of Queenslanders 2020. *Report of the Chief Health Officer Queensland*. Queensland Government: Brisbane

‡ Australian Bureau of Statistics. (2019). *National health survey: first results, 2017-18*. Cat. no. 4364.0.55.001. ABS: Canberra.

§ Diabetes Australia. (2018). *State statistical snapshot: Queensland*. As at 30 June 2018

|| Australian Institute of Health and Welfare (2021). MORT (Mortality Over Regions and Time) books: State and territory, 2015–2019. https://www.aihw.gov.au/getmedia/8967a11e-905f-45c6-848b-6a7dd4ba89cb/MORT_STE_2015_2019.xlsx.aspx

2020 Activity at a Glance

What's New?

- Paediatric cardiac surgery spotlight
- COVID-19 impact analysis
- STEMI <6 hours in and out of hours audit
- Expanded cardiac outreach reporting
- Expanded pre-hospital notification for PCI analysis
- Cardiac rehabilitation declined referral analysis

Interventional Cardiology

4,966
percutaneous coronary interventions

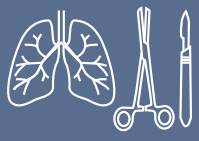
468
structural heart disease interventions

249
transcatheter aortic valve replacements

15,491
total coronary procedures

Cardiothoracic Surgery

2,651
adult cardiac surgeries



1,093
adult thoracic surgeries

Electrophysiology & Pacing

5,201
electrophysiology and pacing procedures

3,551
cardiac implantable electronic device procedures

Heart Failure Support Services

5,664
heart failure support services referrals

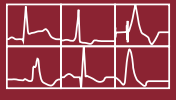
Cardiac Rehabilitation

11,177
cardiac rehabilitation referrals

Rheumatic Heart Disease

483
unknown rheumatic heart disease patients identified

Clinical Indicator Progress



81 mins
median first diagnostic ECG to reperfusion time for primary PCI

0.2%
procedural tamponade rate for cardiac device and electrophysiology procedures

92%
of patients referred to a heart failure support service on an ACEI, ARB or ARNI at discharge

93%
of cardiac rehabilitation referrals within 3 days of discharge

1.4%
mortality rate for coronary artery bypass surgery at 30 days

QCOR Yearly Trends

Interventional Cardiology

15,491
coronary cases in 2020
– up from 15,293 in 2018

4,966
PCI cases in 2020
– up from 4,867 in 2018

5 minute
improvement in median time to reperfusion for STEMI PCI
– 2017 to 2020

11%
increase in primary PCI cases meeting 90 minute target for timely reperfusion
– 2017 to 2020

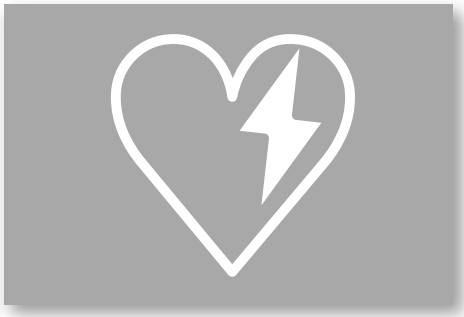
Cardiothoracic Surgery

12%
increase in cardiac surgery cases
– 2017 to 2020

29%
increase in thoracic surgery cases
– 2017 to 2020

Electrophysiology & Pacing

16%
increase in cases
– up from 4,474 in 2018



67%
increase in complex EP cases
– 2018 to 2020

Outpatient Support Services

›34,000
cardiac rehabilitation referrals
– 2018 to 2020

25%
increase in HFSS referrals
– 2017 to 2020

4 Acknowledgements

This collaborative report was produced by the SCCIU, audit lead for QCOR for and on behalf of the Statewide Cardiac Clinical Network. This would not be possible without the tireless work of clinicians in contributing quality data and providing quality patient care, while the contributions of QCOR committee members and others who had provided writing or other assistance with this year's Annual Report is also gratefully acknowledged.

QCOR Interventional Cardiology Committee

- Dr Sugeet Baveja, Townsville University Hospital
- Dr Niranjan Gaikwad, The Prince Charles Hospital
- Dr Paul Garrahy, Princess Alexandra Hospital
- Dr Christopher Hammett, Royal Brisbane & Women's 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, Cairns Hospital (Chair)

QCOR Cardiothoracic Surgery Committee

- Dr Anil Prabhu, The Prince Charles Hospital
- Dr Pallav Shah, Townsville University Hospital
- Dr Andrie Stroebel, Gold Coast University Hospital
- Dr Morgan Windsor, Metro North Hospital and Health Service
- Dr Christopher Cole, Princess Alexandra Hospital (Chair)

QCOR Cardiac Rehabilitation Committee

- Ms Michelle Aust, Sunshine Coast University Hospital
- Ms Maura Barnden, Metro North Hospital and Health Service
- 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 Madonna Prenzler, West Moreton Hospital and Health Service
- Ms Deborah Snow, Gold Coast Hospital and Health Service
- Ms Natalie Thomas, South West Hospital and Health Service
- Mr Gary Bennett, Health Contact Centre (Chair)

Statewide Cardiac Clinical Informatics Unit

- Mr Michael Mallouhi
- Mr Marcus Prior
- Dr Ian Smith, PhD
- Mr William Vollbon

QCOR Electrophysiology and Pacing Committee

- 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, Townsville University Hospital
- A/Prof John Hill, Princess Alexandra Hospital
- Dr Bobby John, Townsville University Hospital
- Dr Paul Martin, Royal Brisbane & Women's Hospital
- Ms Sonya Naumann, Royal Brisbane & Women's Hospital
- Dr Kevin Ng, Cairns Hospital
- Dr Robert Park, Gold Coast University Hospital

QCOR Heart Failure Support Services Committee

- Mr Ben Shea, Ipswich Hospital
- Ms Angie Sutcliffe, Cairns 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
- Dr Kevin Ng, Cairns Hospital
- Ms Robyn Peters, Princess Alexandra Hospital
- Ms Serena Rofail, Royal Brisbane & Women's Hospital
- Dr Yee Weng Wong, The Prince Charles Hospital
- A/Prof John Atherton, Royal Brisbane & Women's Hospital (Chair)

Queensland Ambulance Service

- Dr Tan Doan, PhD
- Mr Brett Rogers

5 Executive summary

This report comprises an account for cases performed in the eight cardiac catheterisation laboratories (CCL), nine electrophysiology and pacing (EP) facilities, along with five cardiothoracic surgery units operating across Queensland public hospitals in 2020. All referrals to heart failure support (HFSS) and cardiac rehabilitation (CR) services have also been included in this Annual Report.

- 15,491 diagnostic or interventional cases were performed across the eight public CCL facilities in Queensland hospitals. Percutaneous coronary intervention (PCI) was performed in 4,966 of these cases.
- Patient outcomes following PCI remain encouraging. The 30 day mortality rate following PCI was 1.5%, and of the 75 deaths observed, over two thirds (69%) were classed as either salvage or emergency PCI.
- When analysing the ST segment elevation myocardial infarction (STEMI) patient cohort, the median time from first diagnostic electrocardiograph (ECG) to reperfusion was 81 minutes, while the median time from arrival at PCI facility to reperfusion was measured at 40 minutes.
- For STEMI presenting within six hours of symptom onset the median time from arrival to PCI facility to reperfusion was 32 minutes for cases performed in working hours (8am to 6pm, Monday to Friday), while cases occurring out of hours had a median time of 44 minutes.
- STEMI cases presenting within six hours of symptom onset with no pre-hospital notification had a longer median time from arrival PCI facility to reperfusion compared to cases where the cardiologist was notified pre-hospital (81 minutes vs. 32 minutes).
- There were 468 structural heart interventions performed across participating CCL facilities, including 313 transcatheter valve procedures, and 249 transcatheter aortic valve replacement procedures. The all-cause 30 day mortality rate for all SHD interventions was 1.1%, ranging from 0.0% to 1.8% across participating centres.
- Across the four sites with a cardiac surgery unit, a total of 2,651 cases were performed including 1,581 cases involving coronary artery bypass grafting and 1,142 valve procedures.
- The 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. This is consistent with the results of previous Audits.
- Across the period of 2016 to 2020, 1,372 children underwent cardiac surgery, including 279 children in 2020.
- There were 1,505 paediatric cardiac surgical procedures performed across 2016–2020, either with or without cardiopulmonary bypass (1,147 and 358 procedures respectively).
- Thirty day mortality after paediatric cardiac surgery was observed at 0.9% between 2016–2020.
- A total of 1,093 thoracic surgery (TS) cases were performed across the five public hospitals providing thoracic surgery services in 2020. Almost a quarter (24%) of surgeries followed a surgical indication of primary lung cancer, whereas pleural disease accounted for nearly a third of all cases (29%).
- The unadjusted all-cause 30 day mortality rate following TS was 0.7%, increasing to 1.9% at 90 days post surgery.
- At the nine public EP sites, a total of 5,201 cases were performed, which included 3,551 cardiac device procedures and 1,286 cardiac electrophysiology procedures.
- The EP clinical indicator audit identified a median wait time of 104 days for complex ablation procedures, and 36 days for elective implantable cardioverter defibrillator (ICD) implants. Meanwhile the median wait time for a standard ablation procedure was 99 days.
- There was a total of 11,177 referrals to public CR services in 2020. Three quarters of referrals followed an admission at a public hospital in Queensland.
- Nearly two thirds (64%) of CR referrals proceeded to pre assessment by a CR service. The most common reason this did not take place was that the patient declined or was not interested.
- The vast majority (93%) of referrals to CR were created within three days of the patient being discharged from hospital, while over half of patients went on to complete an initial assessment by CR within 28 days of discharge (58%). This result is consistent with performance data for 2019.
- There were 5,664 new referrals to a HFSS in 2020, a seven percent increase over the previous year.
- Upon discharge from hospital, the prescription of an ACEI, ARB or ARNI, beta blocker, and MRA for heart failure with reduced ejection fraction (HFrEF) patients was measured at 92%, 92% and 46% respectively.
- At the time of beta blocker titration review, 77% of HFrEF patients had achieved the guideline target or maximum tolerated beta blocker dosage.

6 Spotlight: Cardiac Outreach

The first stages of the Networked Cardiac Services (NCS) program has enabled significant and tangible system reform as well as improved healthcare for patients. From 2019 to present, cardiology services and their partners across the state have begun to adopt this integrated model of care, underpinned by strong regional capability and accountability.

In 2017/18, the Statewide Cardiac Clinical Network commissioned an investigative Report on the state of cardiac care and outreach services provided by Queensland Health. This led to the development of the Implementation Framework for Networked Cardiac Care and Outreach Services in Queensland (2018), written in partnership with the Aboriginal and Torres Strait Islander Division (then, Branch). In 2019, the Ministerial Rapid Results Program nominated to support, progressively fund, and implement the Framework (Networked Cardiac Services) across the state (Figure 1).

The initial investigative Report identified several key opportunities for improvement:

- Significant variations in health care and outcomes across Queensland. People living in rural and remote locations and Aboriginal and Torres Strait Islander people are admitted to hospital for cardiac-related conditions two to three times more than the broader population.
- Inequitable access to health care due to Queensland's vast geographical size and dispersed population.
- Lack of integration and continuity between and within health care sectors.
- Poor access to and/or use of technology.
- Limited or no data about or evaluation of existing services.
- Unreliable funding and disparate resource allocation.
- Historical models of care persist, whereby patients and clinicians travel past the closest health care facility, creating inefficiency, inequitable resource allocation, untapped potential, uncoordinated and potentially unsafe care.
- Successful, existing improvement initiatives in the field are not leveraged or spread to other jurisdictions.

In response, an implementation framework recommended the following improvements:

Improve access, equity, quality & safety, and efficiency

- **Care close to home, delivered by consistent, regional teams**

  It was identified that the eight cardiac tertiary hospital services spread along the east coast of Queensland and their adjacent healthcare services should be enabled and accountable for providing quality, cardiac care for their own communities – 'networked' or 'hub' and 'spoke' model of care.

  Restructure cardiac services to reflect natural patient flow and harness full potential of services i.e., eight cardiac specialist 'hubs' and adjacent 'spokes'.

  Build capability and capacity of regional teams to provide care for their own communities.

- **Coordination and integration**

  High-value, patient care-coordination model and shared care across health sectors (public and private, primary health, and Aboriginal and Torres Strait Islander health services).

- **Evidence, evaluation, and improvement**

  Evidence-based care informed by data.

- **Technology**

  Regional teams provided with and enabled to use technology to support healthcare.

- **Sustainable funding and resources**

  Funding model that resolves initial inequity and ongoing sustainability, including activity and value-based approaches.

- **Governance and accountability**

  Regions lead and are responsible for clinical and service outcomes via stakeholder engagement, formal governance arrangements and access to information.

- **Harness existing investments and programs**

  For exponential benefits and efficiency.

Since 2019, eight Hospital and Health Services (HHSs) have progressively implemented the roll-out of NCS. All remaining HHSs have participated in planning for and endorsed implementation of NCS, given financial support from the Queensland Department of Health (Table 1). Business Cases have been approved by the Rapid Results Cardiac Steering Committee. Funding for the remaining stages is yet to be identified.

Implementing quality improvements and sustainable change takes time and, therefore, full outcomes from the program are not anticipated to be seen until at least 12 months postimplementation.

Through 2018–2019, the SCCIU and Rapid Results Program collaborated with staff and subject matter experts across the various Queensland Health cardiac outreach units to develop a new QCOR module specifically oriented towards this work. The new QCOR Outreach Module establishes a foundation for cardiac outreach care coordination across the health system, and a reporting platform which allows an unprecedented amount of information to be available for an area otherwise characterised by relative paucity of data.

The QCOR Outreach Module provides Queensland Health practitioners with:

- Patient-centric clinical case management – tailored towards the outreach setting,
- Improved follow up and activity-based reporting for outreach patients and services,
- Reporting of outreach-specialty clinical indicators and other key performance measures, and
- Potential for future integration with other Queensland Health and QCOR systems.

The new QCOR Outreach Module was deployed from 2019 as part of a staggered rollout, with the Far North Queensland Outreach Unit as the first site commencing in November 2019. Further units have been added to the system over the following year as either new outreach programs are established or existing services transition to the system.

Table 1: QCOR cardiac outreach module – participating outreach units

Cardiac outreach unit	Hub facility	Commenced date
Far North Queensland Cardiac Outreach	Cairns Hospital	November 2019
Townsville and North West Queensland Cardiac Outreach	Townsville University Hospital	January 2020
Princess Alexandra Hospital Cardiac Outreach	Princess Alexandra Hospital	July 2020
Toowoomba Hospital Cardiac Outreach	Toowoomba Hospital	August 2020
Ipswich Hospital Cardiac Outreach	Ipswich Hospital	November 2020

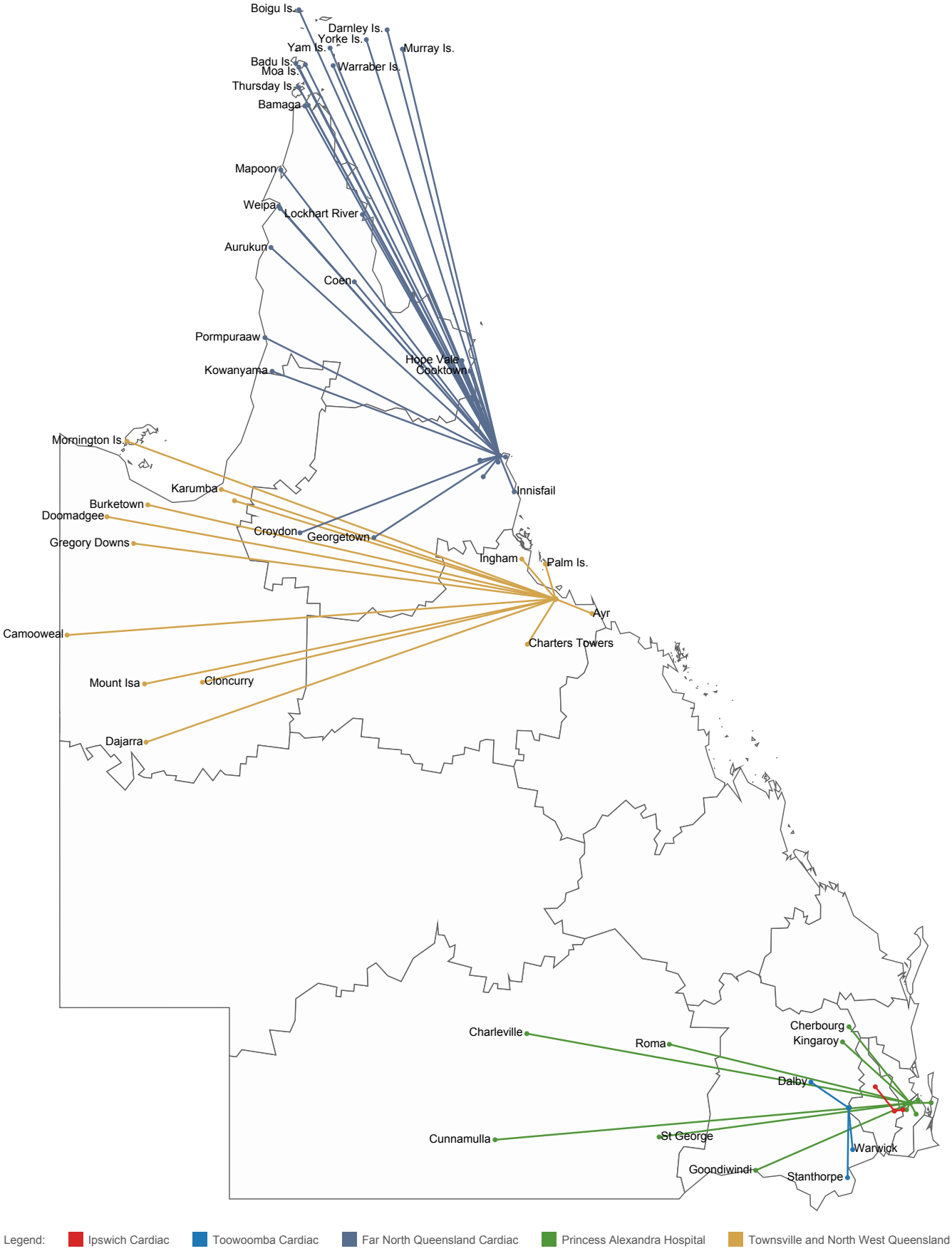


Figure 1: Cardiac outreach hub and spoke locations

Cardiac outreach units each have a responsibility to provide services to a differing number of spoke sites. Each spoke site has its own requirements and workflow which requires units to be agile and able to adapt to many different clinic environments. Spoke sites numbers may change over time with new services being identified based on need and the capacity for the hub units to provide services.

Table 2: Networked cardiac outreach – total spoke sites by outreach unit

Cardiac outreach unit	All spokes n
Far North Queensland Cardiac Outreach	33
Townsville and North West Queensland Cardiac Outreach	14
Princess Alexandra Hospital Cardiac Outreach	13
Toowoomba Hospital Cardiac Outreach	3
Ipswich Hospital Cardiac Outreach	2
Total	**65**

Over the course of 2020, there were 266 clinics operated through the NCS model. Not all units were operating at full capacity for the entire duration of the year which is reflected in Table 3 below. Some units took on clinic sites that were previously operated by other services whilst some units continued their previous work which were services offered for many years but transitioned to the NCS model.

Table 3: Networked cardiac outreach – participating outreach unit total clinics

Cardiac outreach unit	All clinics* n
Far North Queensland Cardiac Outreach	96
Townsville and North West Queensland Cardiac Outreach	84
Princess Alexandra Hospital Cardiac Outreach	67
Toowoomba Hospital Cardiac Outreach	9
Ipswich Hospital Cardiac Outreach	10
Total	**266**

* Note varying start dates of some services

There have been 3,396 total consults delivered as part of the NCS program. Larger and more established hub sites comprise of the greatest numbers which is also reflective of the higher number of clinics performed and number of spoke sites the unit is responsible for.

Table 4: Networked cardiac outreach total consults performed and total distinct patients per hub site

Cardiac outreach unit	All consults n	All patients n
Far North Queensland Cardiac Outreach	1,341	1,112
Townsville and North West Queensland Cardiac Outreach	901	775
Princess Alexandra Hospital Cardiac Outreach	1,053	899
Toowoomba Hospital Cardiac Outreach	69	62
Ipswich Hospital Cardiac Outreach	32	31
Total	**3,396**	**2,879**

There were 2,879 patients enrolled in the NCS outreach service since its inception. Of these patients 1,601 (59%) were male. The largest subgroup of this cohort were males aged between 60 years and 69 years and males aged between 70 years and 79 years. The largest proportion of females was in the cohort aged between 60 years and 69 years of age.

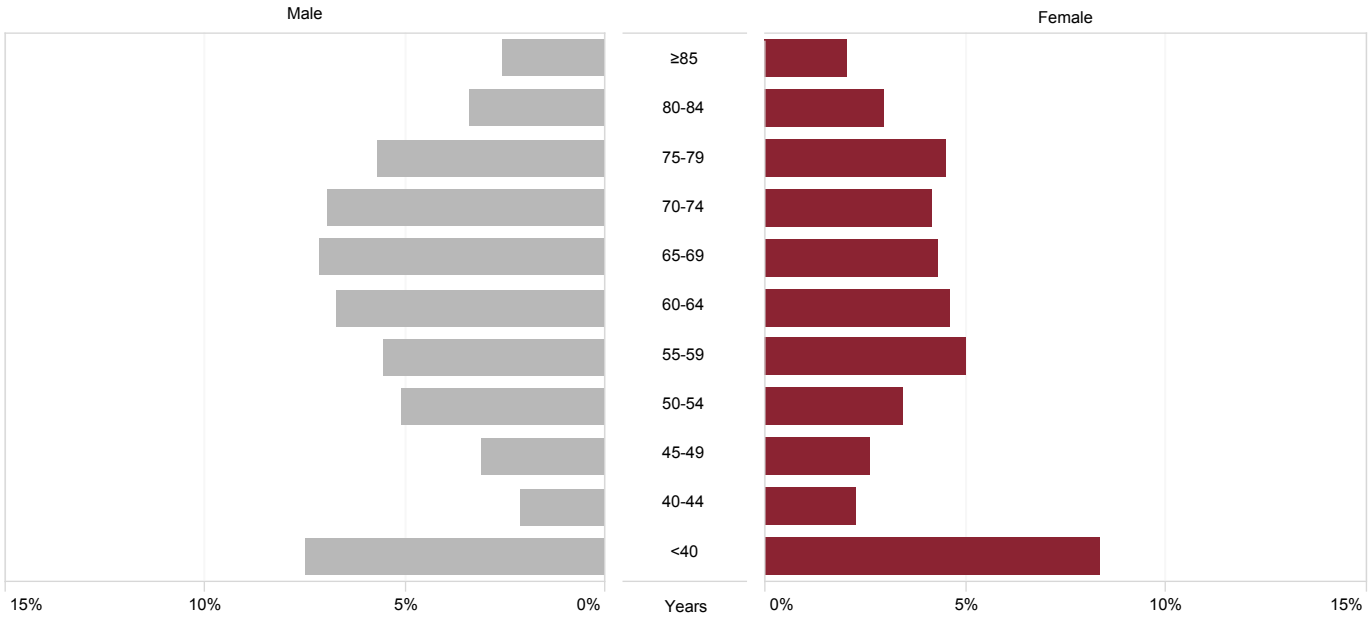


Figure 2: Proportion of outreach consults by age and gender

Table 5: Networked cardiac outreach number of patients by age group and gender at all sites

Gender	Age group	All patients n (%)
Male	<40	227 (7.9)
	40–49	154 (5.3)
	50–59	305 (10.6)
	60–69	393 (13.7)
	70–79	355 (12.3)
	80–89	156 (5.4)
	≥90	14 (0.5)
Female	<40	249 (8.6)
	40–49	149 (5.2)
	50–59	248 (8.6)
	60–69	257 (8.9)
	70–79	236 (8.2)
	80–89	130 (4.5)
	≥90	13 (0.5)
Total		**2,879 (100.0)**

Of the overall cohort enrolled in NCS outreach programs, 2,879 distinct patients were seen by teams. Aboriginal and Torres Strait Islander patients accounted for 39% of the group. This is considerably higher than the resident proportion of Aboriginal and Torres Strait Islander population of Queensland of 4.6%.

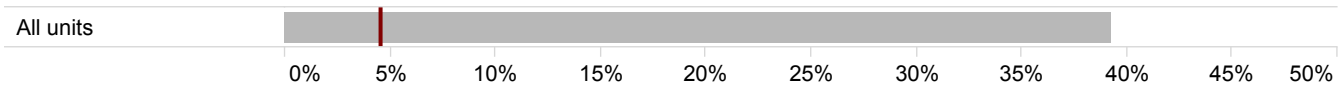


Figure 3: Proportion of Aboriginal and Torres Strait Islander patients seen in cardiac outreach

Patients who reside in the Torres and Cape HHS account for the largest proportion (20%) of patients seen. This is followed closely by the Cairns and Hinterland HHS (19%) and Darling Downs HHS (15%). A small proportion of patients resided interstate at the time of their encounter (1.3%). It should be noted that some patients may temporarily reside in one HHS but their permanent address is elsewhere but for the purpose of this analysis, permanent address is presented.

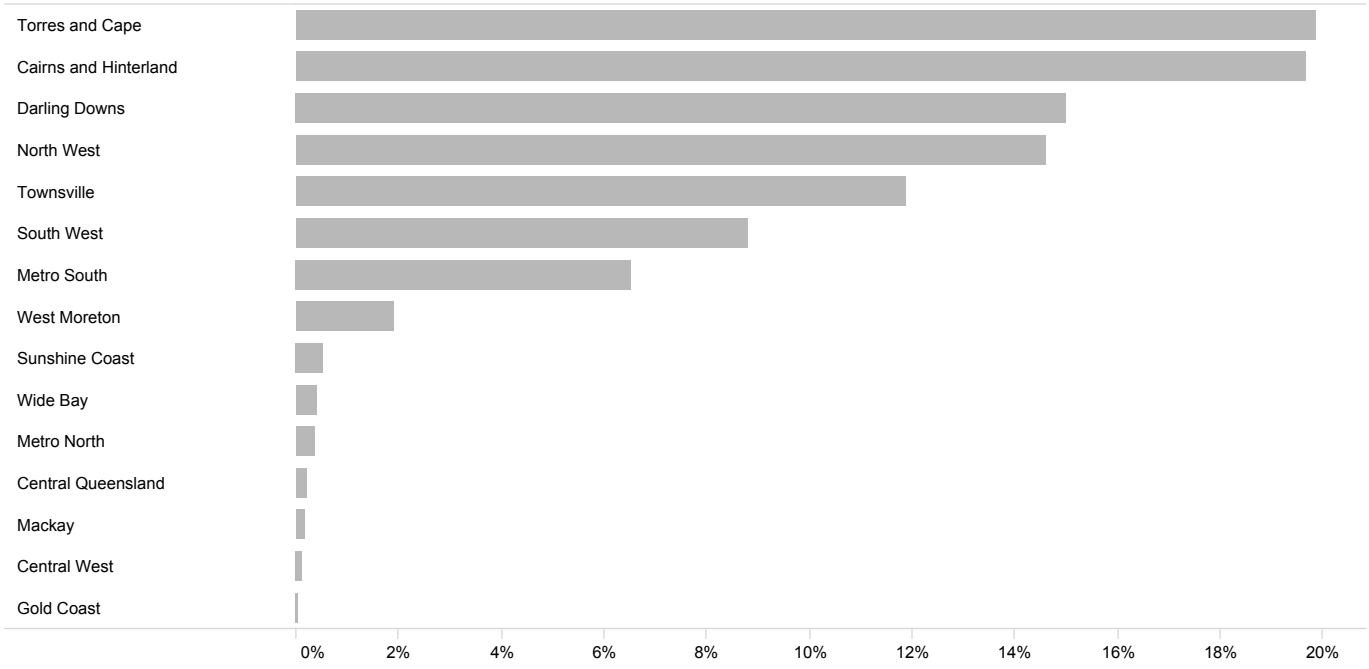


Figure 4: Proportion of patients by HHS of residence since commencement

Of the 3,396 total consults delivered as part of the NCS program, just under half of these consults were new encounters (45%), which represents a large volume of clinical work and focus to establish patient rapport, assess often complex medical history, and formulate a plan of treatment and management. It would be anticipated that over time, the proportion of new to review patients will shift, reflective of the fact that cardiac conditions are mostly a chronic disease.

Table 6: Number and proportion of new and review cardiac outreach consults

Consult type	n (%)
New	1,527 (45.0)
Review	1,869 (55.0)
ALL	**3,396 (100.0)**

Integrated outreach services are flexible and look to add value where opportunity presents. Opportunistic specialist review of inpatients while treating teams are in regional facilities allows for expert clinical treatment and efficient facilitation of treatment and escalation for transfer where appropriate (in person, non-clinic). NCS teams are also instrumental in the organisation and provision of telehealth consultations which are performed both in clinic and in other non-clinic locations such as GP practices and other healthcare facilities (telehealth, non-clinic). Due to the COVID-19 pandemic, larger than anticipated numbers of telehealth consultations were performed (29%).

Table 7: Number and proportion of in person and telehealth consults by clinic mode

Delivery mode	Clinic n (%)	Non-clinic n (%)	All n (%)
In person	2,350 (97.2)	67 (2.8)	2,417 (71.2)
Telehealth	551 (56.3)	428 (43.7)	979 (28.8)
Total	**2,901 (85.4)**	**495 (14.6)**	**3,396 (100.0)**

The majority of patients seen in outreach resided less than 50 kilometres from their consult location (80%), demonstrating that outreach services are meeting their objective to provide care closer to home. A smaller proportion of patients (8%) still needed to travel more than 150 kilometres to access specialist care, which highlights the barriers to care and travel distances faced by Queenslanders living in regional and remote locations.

Table 8: Number and proportions of patients by driving distance to consult

Driving distance – home to consult	n (%)
≤50 km	2,707 (79.7)
50 km–100 km	322 (9.5)
100 km–150 km	57 (1.7)
›150 km	276 (8.1)
Incomplete data	34 (1.0)
ALL	**3,396 (100.0)**

Outreach services offered large travel distance savings as a result of patients attending clinics at spoke sites instead of travelling to the hub site. These values are determined by calculating the difference in driving distance between the patient's place of residence to the hub site and the patient's place of residence to the spoke site. The largest travel distance savings were observed in the cohort residing furthest from the outreach unit hub.

Table 9: Median distance of patient address to hub sites

Distance category	Median distance km
›50 km–100 km	80
100 km–150 km	112
›150 km	474

The ability to perform cardiac investigations on site at the time the patient is in attendance at the outreach clinic further demonstrates savings in travel, increases treatment efficiency due to immediate availability of information and decreases complexity of investigations for patients who often have significant barriers to care. The most frequently performed investigation during outreach was 12 lead electrocardiography (ECG) followed by transthoracic echocardiography.

Table 10: Number of investigations performed in outreach clinics

Investigation	n
12 lead ECG	1,662
Transthoracic echocardiography	995
Cardiac implantable electronic device interrogation	29
Exercise stress test	19
24 hour Holter ECG monitor	3
Other	34
ALL	**2,742**

7 Spotlight: ECG Flash

ECG Flash is a Statewide Cardiac Clinical Network initiative that allows rural and remote clinicians 24/7 access to urgent specialist cardiology advice. When a patient presents at emergency or within a healthcare facility and an ECG is taken, the system lets clinicians send time-critical and difficult to interpret ECGs straight to an on call cardiologist for rapid analysis. The on call cardiologist receives a digital copy of the ECG to review and will call the treating clinician back to provide treatment advice. ECG Flash has been implemented to use as a hub and spoke model of care where larger facilities with specialist staff cardiologists act as the hub to smaller regional and remote centres (spoke sites).

Spoke sites use a digitally enabled ECG cart that automatically transmits all ECGs taken to an enterprise clinical data storage application. This digital storage solution for ECGs is available at each site and from there, clinicians can selectively transmit time-critical, difficult to interpret, urgent or technically challenging ECGs directly to the on call cardiologist at their referring tertiary hospital (hub site). They are also able to access ECGs taken at other participating hospitals within their HHS, allowing them to have access to patients' ECGs across multiple facilities.

In 2020, 55 rural sites were utilising the ECG Flash solution, with 229 time-sensitive ECGs escalated through to six receiving cardiology departments for clinical interpretation. These were often in the context of patients presenting in a critically unwell state. Further use of ECG Flash data to complement existing QCOR data collections will be a focus for future work.

Table 1: ECG Flash – participating tertiary sites

ECG Flash hub sites	Commenced date	Number of spoke sites
Thursday Island	January 2020	10
Cairns Hospital	September 2018	13
Townsville University Hospital	June 2019	7
Mackay Base Hospital	February 2019	7
Bundaberg Hospital	August 2019	8
Princess Alexandra Hospital	August 2018	10

Figure 1: ECG Flash hub and spoke locations as at November 2020

8 Spotlight: Rheumatic Heart Disease Program

8.1 Background

The Queensland Rheumatic heart disease register and control program (RHD Program) was established in 2009 to address rheumatic heart disease (RHD) as the leading cause of cardiovascular disparity between Aboriginal and Torres Strait Islander peoples and Australians of other descent. The program supports existing healthcare services by maintaining a skilled health workforce, promoting culturally appropriate care, supporting education and health promotion for patients and communities, and working with patients and primary health care staff to optimise delivery of secondary prophylaxis.

The program further delivers, advocates for, and supports primordial, primary and secondary prevention activities aimed at preventing, identifying, managing and treating acute rheumatic fever (ARF) and RHD.

The World Health Organization recommends a coordinated, public health approach in areas where there are substantial populations with ARF or RHD. The Australian Guideline for prevention, diagnosis and management of ARF and RHD* states that 'Comprehensive RHD control programs which span action in the social and environmental determinants of health and primary and secondary prevention of ARF, can provide an effective approach to reducing the burden of RHD.' It is with this structure and suggested methodology that the Queensland RHD Program has been established.

8.2 The disease

ARF is an acute illness causing a generalised, autoimmune inflammatory response following repeated exposure to and infection with Group A Streptococcal bacteria. The inflammatory response occurs predominantly in the heart, joints, brain and skin. Presentations are often subtle, clients typically present with a history of a sore throat and/or infected skin sores, pain and swelling in one or more joints, fever and chest pain. Chorea (jerky, uncoordinated movements of the hands, feet, tongue and face), skin and subcutaneous manifestations are uncommon but do appear to vary in frequency across populations, gender and age.* Clinical investigations may identify prolonged atrioventricular junctional arrhythmias on an electrocardiogram, a heart murmur or carditis.

Once the initial acute illness has resolved, ARF leaves no lasting damage to the joints or skin however, sustained inflammation of the brain in clients with Sydenham's chorea can cause permanent damage and lead to the development of mental health and neurological sequalae. Similarly, the autoimmune response that inflames the heart can lead to permanent damage to the heart valves known as rheumatic heart disease (RHD). Repeated episodes of ARF inevitably lead to the development or worsening of RHD.

Severe RHD usually requires surgical intervention in the form of valve repair and/or replacement. Individuals receiving mechanical valves require lifelong anticoagulation. Every year, RHD kills people and devastates lives, particularly those of young Aboriginal and Torres Strait Islander Queenslanders. The disease process begins with symptoms as simple as a sore throat or skin infection which can be easily treated with common antibiotics, however if left untreated, it can lead to valve disease requiring cardiac surgery, stroke and sometimes death. Efforts to prevent ARF and RHD currently centre on primary prevention (of the sore throat or skin infection), and secondary prevention via delivery of secondary prophylactic antibiotics to prevent recurrent episodes.

* RHD Australia (ARF/RHD writing group) (2020). *The 2020 Australian guideline for prevention, diagnosis and management of acute rheumatic fever and rheumatic heart disease* (3rd edition). Retrieved from https://www.rhdaustralia.org.au/arf-rhd-guideline

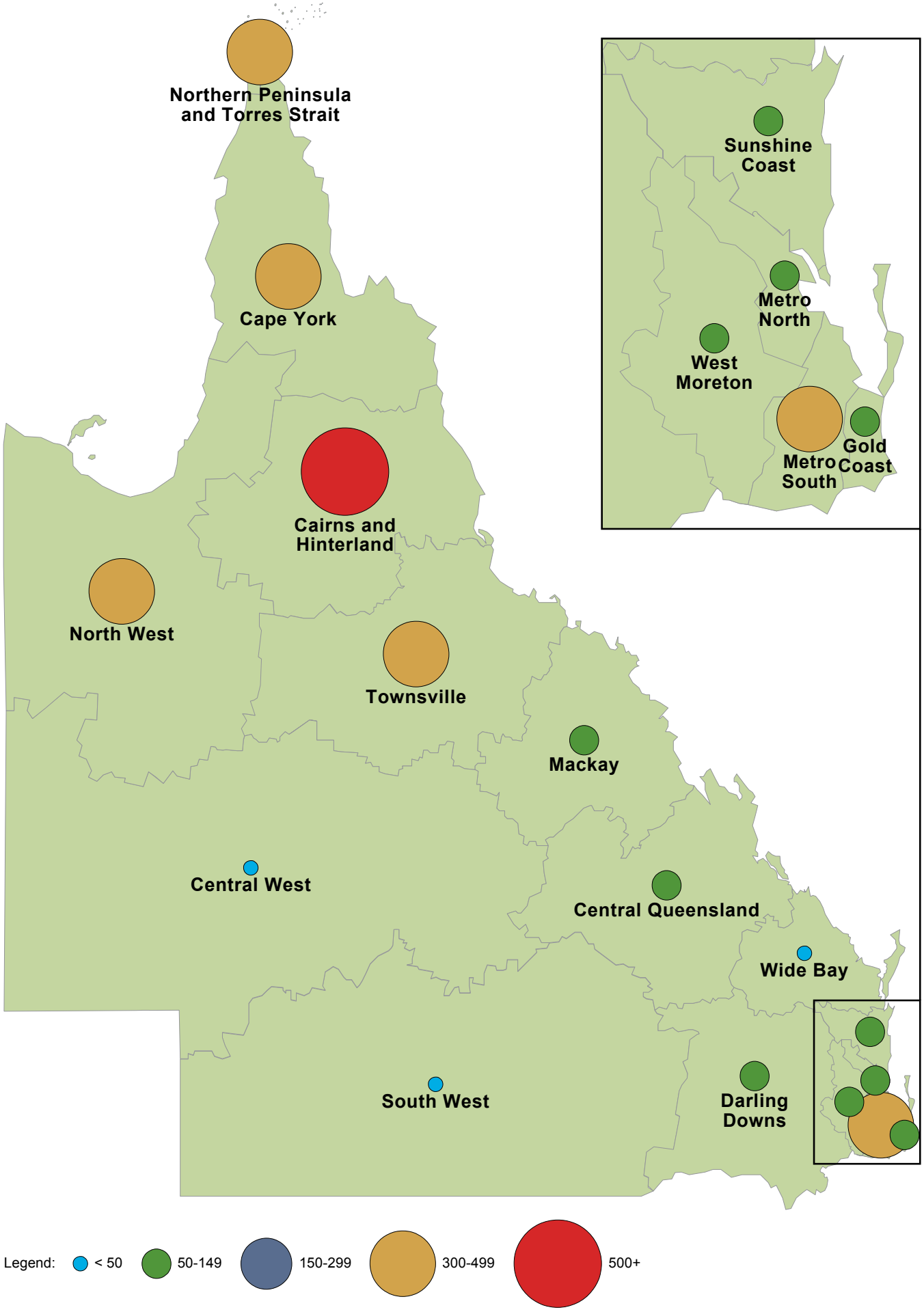


Figure 1: Rheumatic Heart Disease active clients by area of residence

8.3 Disease demographics

Across Australia, sustained improvements to the conditions in which we are born, grow, live and work have permanently reduced the rates of preventable infectious diseases. Unfortunately, this progress is inequitable and Aboriginal and Torres Strait Islander people have not benefitted from the same improvements in health and living outcomes as the rest of Australia. Household disadvantage, poor-quality living conditions, poverty and overcrowding all contribute to health inequalities in at-risk populations.

ARF and RHD are diseases that exemplify the 'gap' between Aboriginal and Torres Strait Islander peoples and Australians of other descent. In Queensland, 2019 the rate of ARF cases was 41.6 per 100,000 Aboriginal and Torres Strait Islander Australians whereas for all Queenslanders the rate was 2.2 per 100,000.† The prevalence of RHD was 627.4 cases per 100,000 Aboriginal and Torres Strait Islander Australians whereas for Australians of other descent the rate was 15.9 per 100,000.†

8.4 The costs of ARF and RHD

Eliminating RHD means preventing all new cases of ARF. Preventing ARF is as simple as early diagnosis and treatment of a Streptococcal infection. This cost is negligible in comparison to the long-term management of what would become chronic disease.

8.4.1 Human cost of RHD

ARF and RHD contribute to increased death and disability in Queensland. RHD accrues early in life, with 17% of people on the Queensland RHD Register under 18 years of age and 23% of all ARF and RHD clients having had or will require valvular surgery.

8.4.2 Financial cost of ARF and RHD

The estimated costs of ARF and RHD diagnosis and management are outlined in Table 1.‡

Table 1: Costs of diagnosis and management of ARF and RHD

	Child $	Adult $
Management of acute disease requiring hospitalisation		
ARF – Inpatient	12,075	12,912
RHD – Non-Surgical	11,798	9,787
RHD – Surgical	74,915	72,042
ARF/RHD Management (per year)		
ARF with/without mild RHD	2,048	2,048
Severe RHD	3,920	3,920

† Australian Institute of Health and Welfare (2020). *Acute rheumatic fever and rheumatic heart disease in Australia, 2015–2019*. Retrieved from https://www.aihw.gov.au/reports/heart-stroke-vascular-diseases/acute-rheumatic-fever-and-rheumatic-heart-disease/data

‡ Wyber, R., Noonan, K., Halkon, C., Enkel, S., Ralph, A., … Carapetis, J. (2020.). *The RHD Endgame Strategy: A Snapshot. The blueprint to eliminate rheumatic heart disease in Australia by 2031*. Perth: The END RHD Centre of Research Excellence, Telethon Kids Institute

8.5 Disease prevention

Interventions to eradicate ARF and RHD in Australia require strategies that target the underlying economic, social and environmental conditions. These are structural and health system considerations that include moving away from a silo-based culture and transitioning towards functional multiagency, multidisciplinary teams. By actioning disparities in the environmental, social, cultural and economic determinants of health, primary and secondary prevention strategies for ARF and RHD can be developed. These then lend themselves to effective tertiary care which provides clients with high-quality medical and surgical management of their RHD.

8.6 Queensland RHD Program and Queensland Cardiac Outcomes Registry

In September 2018, RHD became a notifiable condition in Queensland. Since April 2019, QCOR and the RHD program have collaborated to enhance the reporting of all RHD-identified echocardiograms to the RHD register for Cairns, Townsville, Mackay and Rockhampton hospitals. Interaction between the RHD Register and QCOR acts as a supporting notification mechanism, assisting to identify those patients who have not previously been or were escalated for notification of RHD at the time of their clinical encounter.

Between 2020–2021 QCOR, reporting of positive RHD findings by echocardiography has resulted in 147 previously unknown clients with RHD being added to the Register.

Table 2: QCOR echocardiography module RHD notifications

	Positive RHD findings n	Unknown RHD clients identified n
Cairns	503	55
Townsville	206	60
Mackay	45	18
Rockhampton	26	14
Total	**780**	**147**

During 2020–2021 QCOR cardiac surgery RHD notification reports, 336 previously unknown clients requiring surgery for their RHD have been added to the RHD register.

Table 3: QCOR cardiac surgery module RHD notifications

	Positive RHD findings n	Unknown RHD clients identified n
Townsville	182	33
Gold Coast	59	44
Princess Alexandra Hospital	48	40
The Prince Charles Hospital	325	217
Total	**614**	**336**

9 Spotlight: COVID-19 pandemic

9.1 Introduction

Health services in the state of Queensland have been significantly impacted by restrictions and limitations related to the COVID-19 pandemic. The first case of COVID-19 in Queensland was detected in late January 2020, after which a series of public health measures subsequently followed that significantly changed the way that healthcare was delivered.

Following the declaration of a global pandemic by the World Health Organisation on 11 March 2020, Australia entered the first stage of a nationwide shutdown on 23 March 2020, which limited activity, travel and social interaction.

In preparation for a surge in patients requiring hospital treatment for COVID-19 infection, the provision of cardiac services changed with reductions to the number of elective admissions and procedures as well as diagnostic studies and outpatient consultations. The slowdown in activity associated with COVID-19 had several effects, one of which was a reduction in trauma admissions due to less social activity and a resultant increase in hospital bed availability. The view was postulated that a delay in diagnosis of patients with cardiac disease would result in more urgent and emergent cases, but these impacts appear to have been minimal.

The use of personal protective equipment and protocols set up by hospital emergency departments, catheterisation laboratories, operating theatres and cardiac wards collectively impacted processes involved in patient care – resulting in increased difficulties in assessing patients and delays in commencing and administering treatment.

Outpatient support services such as cardiac rehabilitation and heart failure support services were also affected. Some community health facilities pivoted to provide COVID-19 testing support while some outpatient programs were temporarily closed due to the redeployment of staff to other areas of healthcare, or the reclaiming of gym spaces to deliver pop up COVID-19 screening clinics and vaccination hubs. Public health directives also placed restrictions on outpatient programs by limiting the number of people per square metre and mandating the use of face masks. Outpatient programs responded to these challenges while maintaining service provision, and many adapted their services to deliver these via alternative means such as telehealth.

With all these effects plus the likely negative influence on patient presentations to medical facilities and under-utilisation of hospital resources, this special section was added to this year's Report, aiming to characterise the effects the pandemic had on cardiac services in Queensland in 2020.

9.2 Procedure volumes

In the Queensland public health system, the utilisation of most cardiac services declined during April 2020 more than expected based on seasonal variation alone. Similar findings have been well documented both nationally and internationally across many medical and surgical specialties, with particular impacts noted on the rates of hospitalisation for acute coronary syndromes.*,†

Interventional cardiology

An overall reduction in cardiac catheterisation laboratory cases was observed in April 2020. This is owed mainly to a decreased volume of elective procedures. Case volumes returned to pre-pandemic volumes by June 2020 and tapered toward the end of the year as is usual for that time of year due to Christmas period service closures.

Total case volumes for all of 2020 only decreased by 0.7% for PCI procedures, which is reassuring considering April 2020 volumes declined considerably. Similarly, case numbers for other diagnostic coronary procedures were stable with only a 0.8% decrease compared to the previous year.

Cardiac surgery

In 2020, there were 2,651 cardiac surgery procedures which was a marginal increase (1.1%) on 2019. Soon after the announcement of the global COVID-19 pandemic, cardiac surgery case volumes exhibited a marked decrease in April 2020. Case numbers had increased by June, and later reached a peak in September.

There was a reduction in valve surgeries and other procedures during April 2020, whilst CABG numbers remained steady in comparison to previous months. Aortic procedures and other cardiac surgeries were also scaled back during this time.

Thoracic surgery

There was a 4.9% increase in thoracic surgery cases performed in 2020 compared to 2019 despite the challenges of the COVID-19 pandemic. However, it was evident that during the peak month of April 2020 case numbers fell considerably. There was a notable decrease in operations for all other indications except primary lung cancer.

The decrease in surgical volume in September 2020, could be attributable to the larger than average cardiac surgical volumes in the same period, given this surgical specialty shares resources and clinicians. Reduced case volumes in December are consistent with usual variation in service capacity for this time of year.

Electrophysiology and pacing

Electrophysiology and pacing services saw a 12% growth in cases from 2019 to 2020. A small portion of this growth can be attributed to extra case detail captured for Toowoomba Hospital (n=86). As exhibited across other service lines, there was a reduction in cases in April 2020 which saw most electrophysiology and ablation cases cease. The months following demonstrated an upward trend in case numbers, presumably related to cases which had been scheduled but not performed in April.

Table 1: Total cases for interventional cardiology, cardiac surgery, thoracic surgery and electrophysiology and pacing by year, 2019–2020

Service line	2019 n	2020 n
Interventional cardiology	5,002	4,966
Cardiac surgery	2,622	2,651
Thoracic surgery	1,042	1,093
Electrophysiology and pacing	4,654	5,201

* Solomon, M.D., McNulty, E.J., Rana, J.S., Leong, T., Lee, C., Sung, S., … Go, A.S. (2020). The COVID-19 pandemic and the incidence of acute myocardial infarction. *N Engl J Med, 383*(1), 691-693. doi: 10.1056/NEJMc2015630.

† De Filippo, O., D'Ascenzo, F., Angelini, F., Bocchino, P.B., Conrotto, F., Saglietto, A., … De Ferrari, G. (2020). Reduced rate of hospital admissions for ACS during Covid-19 outbreak in northern Italy. *N Engl J Med, 383*(1), 88-89. doi: 10.1056/NEJMc2009166.

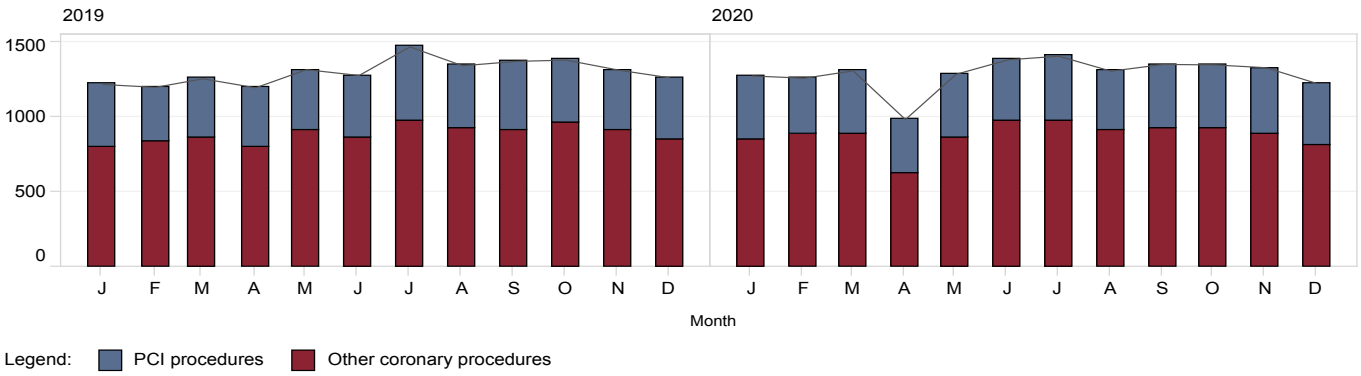


Figure 1: Proportion of all diagnostic and interventional cardiology cases by case category and month, 2019–2020

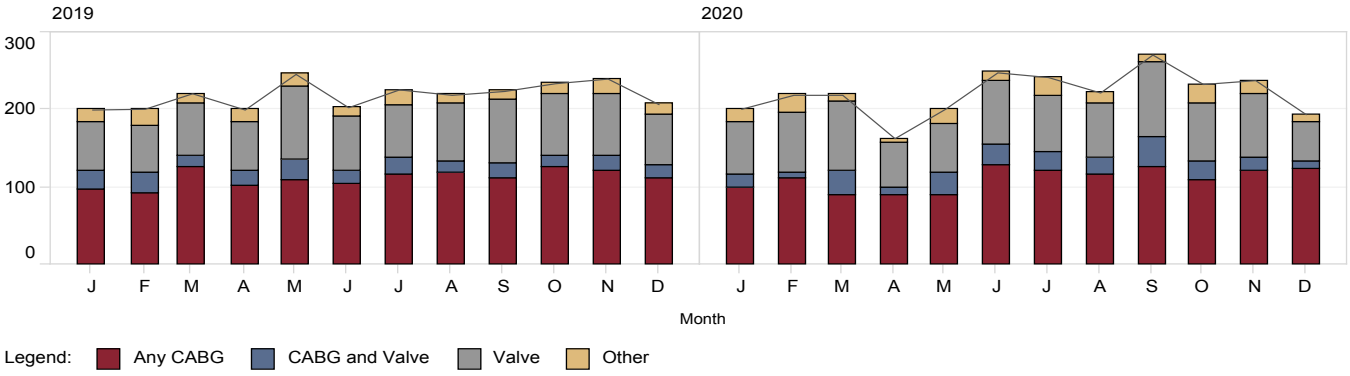


Figure 2: Proportion of all cardiac surgery cases by procedure category and month, 2019–2020

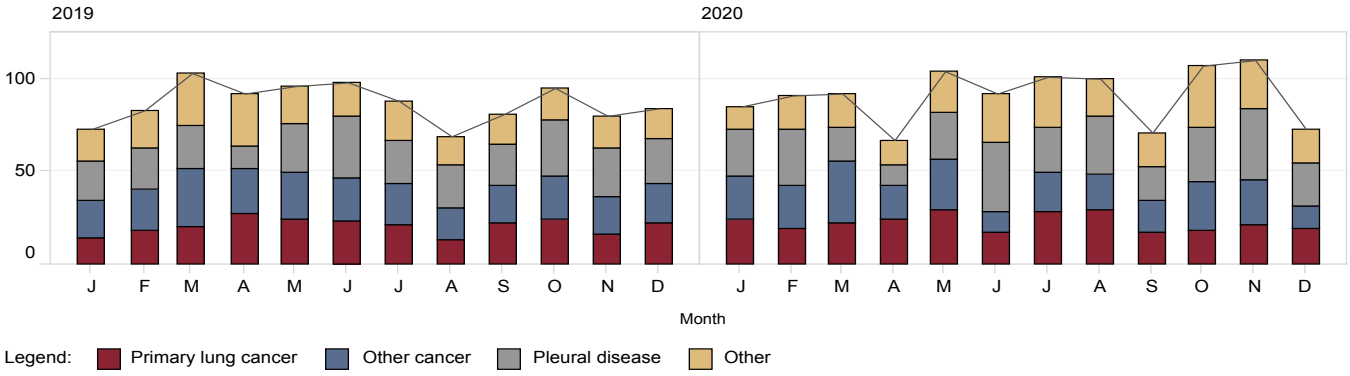


Figure 3: Proportion of all thoracic surgery cases by indication and month, 2019–2020

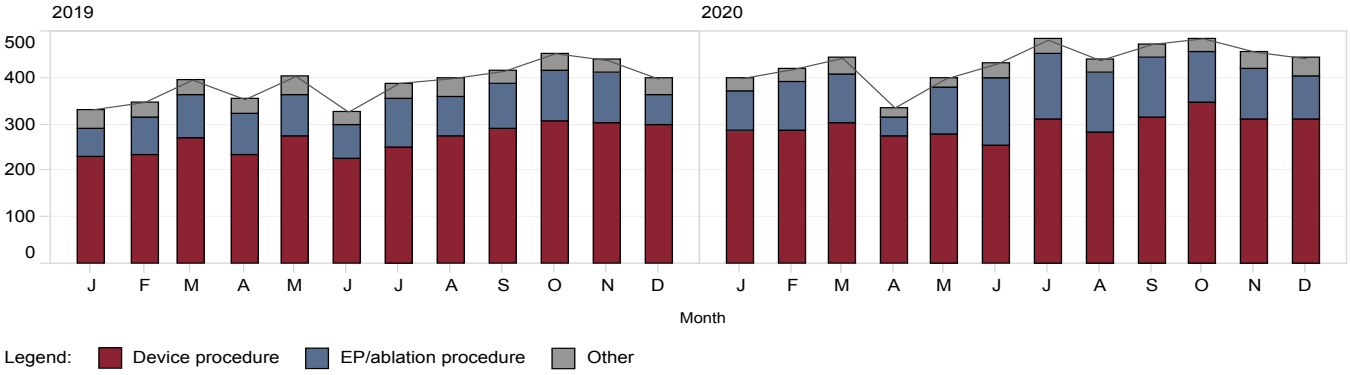


Figure 4: Proportion of all electrophysiology and pacing cases by procedure category and month, 2019–2020

9.3 Interstate and international patients

When examining the place of residence for patients undergoing cardiac interventions between 2019 and 2020, a notable decrease in the proportion of interstate and overseas patients was observed. The proportion of interstate patients reduced from 5.7% to 4.5%, while the proportion of overseas patients was almost halved (0.7% to 0.4%). This is reflective of travel restrictions in place, limiting international and interstate travel for a large part of 2020.

Table 2: Patient place of residence at time of procedure, 2019–2020

Service line	2019	2020
Queensland, %	93.6	95.1
Interstate, %	5.7	4.5
Overseas, %	0.7	0.4

Excludes missing data (0.1%)

9.4 Admission status

There was a reduced proportion of elective procedures and category 3 procedures observed across all service lines from 2019 to 2020. The reduction in elective cases appears to be concentrated around April 2020, coinciding with the announcement of the COVID-19 pandemic. These findings are likely reflective of the redistribution of clinical services in response to the pandemic as well as public health directives leading to a reduction in elective procedure bookings.

Table 3: Procedure status for interventional cardiology, cardiac surgery, thoracic surgery and electrophysiology and pacing by year, 2019–2020

Service line	2019	2020
Interventional cardiology, n	5,002	4,966
Elective, %	1,094 (21.9)	1,059 (21.3)
Urgent, %	2,719 (54.3)	2,585 (52.1)
Emergent, %	1,104 (22.1)	1,252 (25.2)
Salvage, %	87 (1.7)	70 (1.4)
Cardiac Surgery, n	2,622	2,651
Elective, %	1,523 (58.1)	1,472 (55.5)
Urgent, %	913 (34.8)	990 (37.3)
Emergent, %	169 (6.4)	185 (7.0)
Salvage, %	17 (0.6)	4 (0.2)
Thoracic surgery, n	1,042	1,093
Elective, %	730 (70.1)	719 (65.8)
Urgent, %	254 (24.4)	282 (25.8)
Emergent, %	58 (5.6)	92 (8.4)
Electrophysiology and pacing, n	4,654*	5,201†
Category 1, %	2,636 (56.6)	3,051 (58.7)
Category 2, %	1,143 (24.6)	1,365 (26.2)
Category 3, %	548 (11.8)	459 (8.8)

Category 1: Clinically indicated within 30 days

Category 2: Clinically indicated within 90 days

Category 3: Clinically indicated within 365 days

* 7.0% missing data

† 6.3% missing data

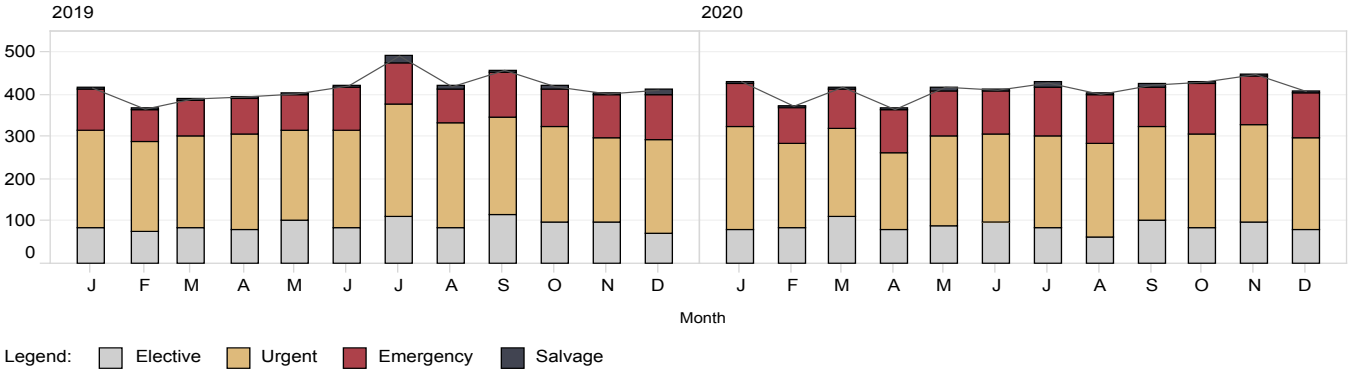


Figure 5: Proportion of all interventional cardiology cases by admission status and month, 2019–2020

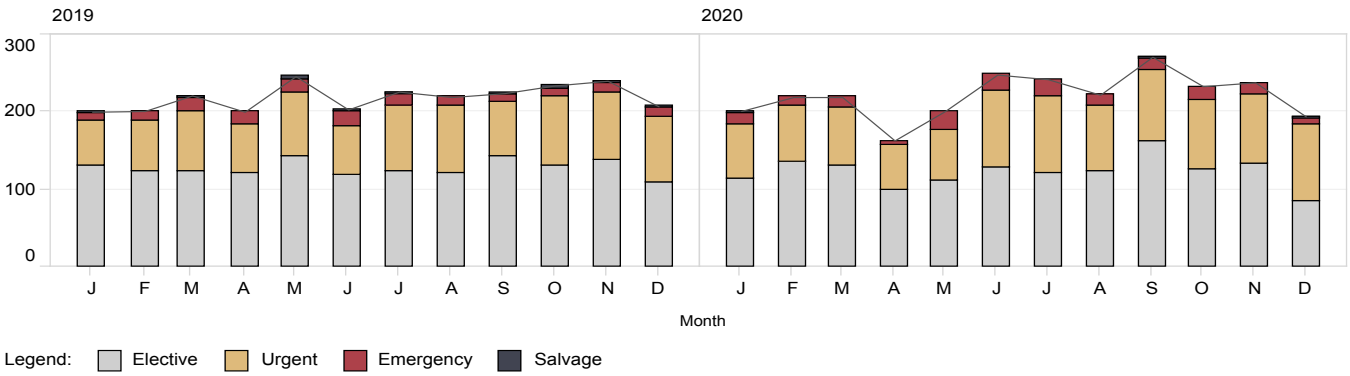


Figure 6: Proportion of all cardiac surgery cases by admission status and month, 2019–2020

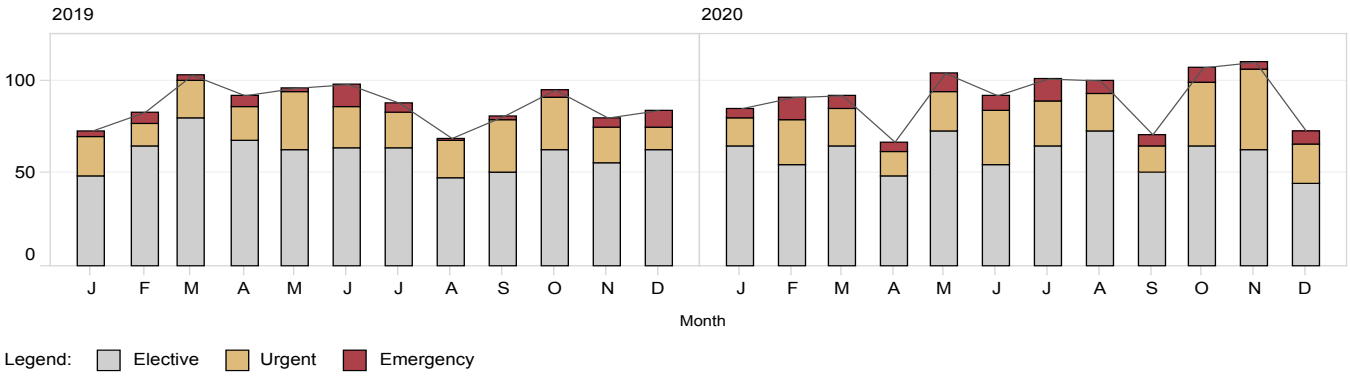
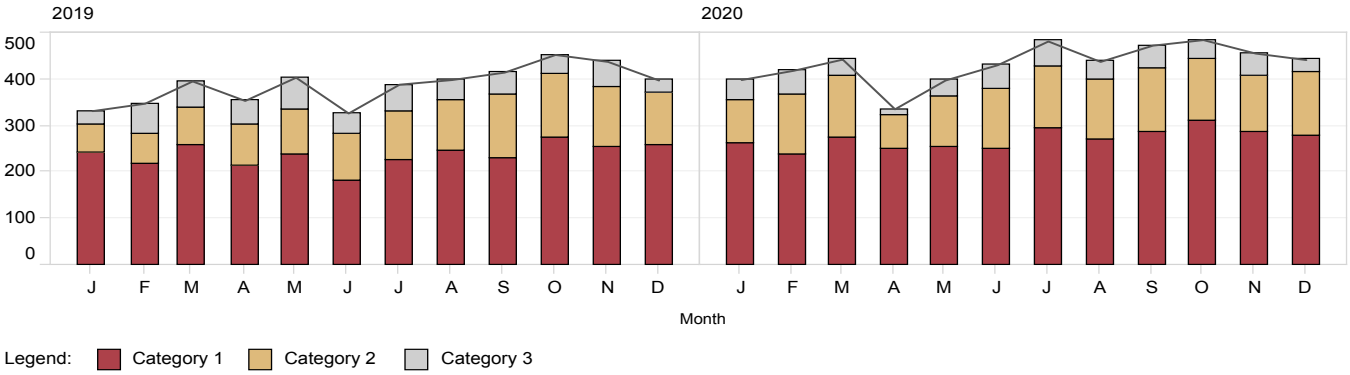


Figure 7: Proportion of all thoracic surgery cases by admission status and month, 2019–2020



Note: imputed missing data

Figure 8: Proportion of all electrophysiology and pacing cases by urgency status and month, 2019–2020

9.5 Outpatient support services

Cardiac rehabilitation services across the state were subject to disruption due to resources being redistributed to support the state's COVID-19 response. The overall number of referrals in 2020 was slightly less than 2019, with a total of 11,547 referrals vs. 11,177 referrals respectively. The greatest decline in incoming referrals was identified in April 2020 with a return to usual capacity over the following months.

Heart failure support services showed a 6.8% increase in referrals received in 2020 compared to 2019. As with most other cardiac services there was a decline in referrals in April 2020, followed by a steady increase in referrals through to December. The impacts on heart failure support services appear to have been limited.

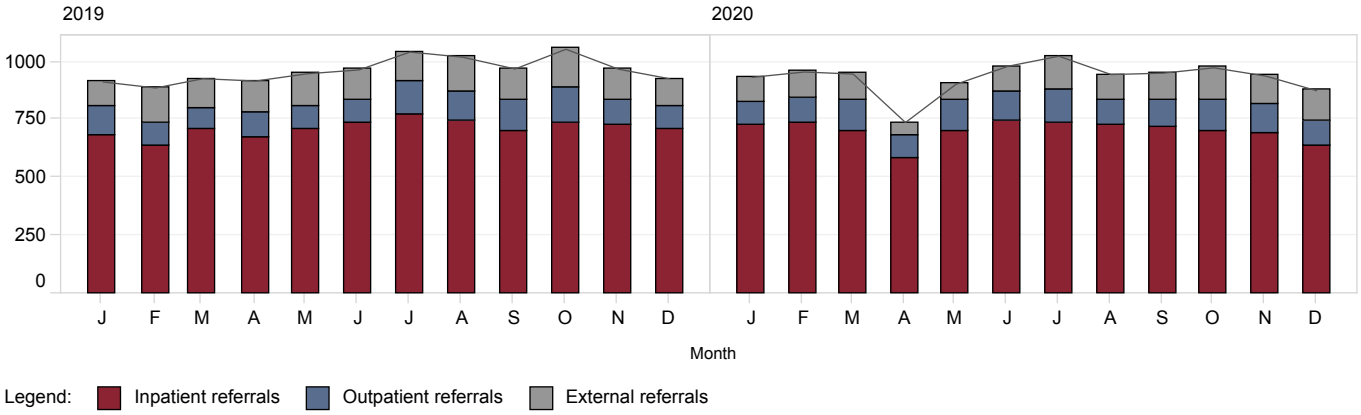


Figure 9: Cardiac rehabilitation referral source, 2019–2020

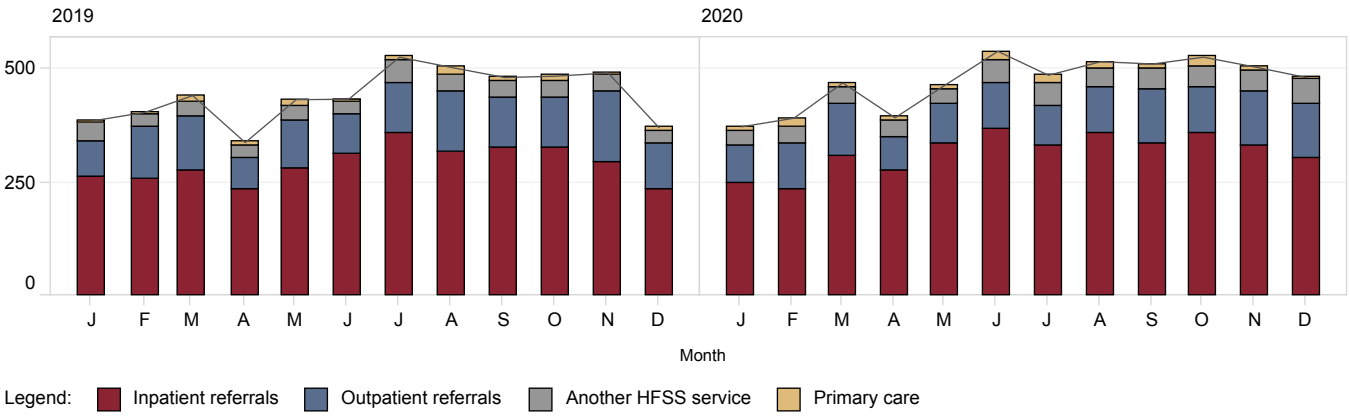


Figure 10: Heart failure support services referral source, 2019–2020

Table 4: Outpatient support services referral volumes, 2019–2020

Service line	2019 n	2020 n
Cardiac rehabilitation	11,547	11,177
Heart failure support services	5,304	5,664

9.6 Clinical performance indicators

Key clinical performance indicators for Queensland cardiac services in 2020 were largely improved compared to the previous year, though there were some areas where performance appears to have been negatively impacted by disruptions to scheduling and patient flow. It is difficult to draw conclusion as any impact is likely to be multifactorial. These issues are examined in more detail in the relevant sections of this report. However these results are suggestive that Queensland cardiac services have been largely insulated from significant impacts to service and performance as a result of the COVID-19 pandemic.

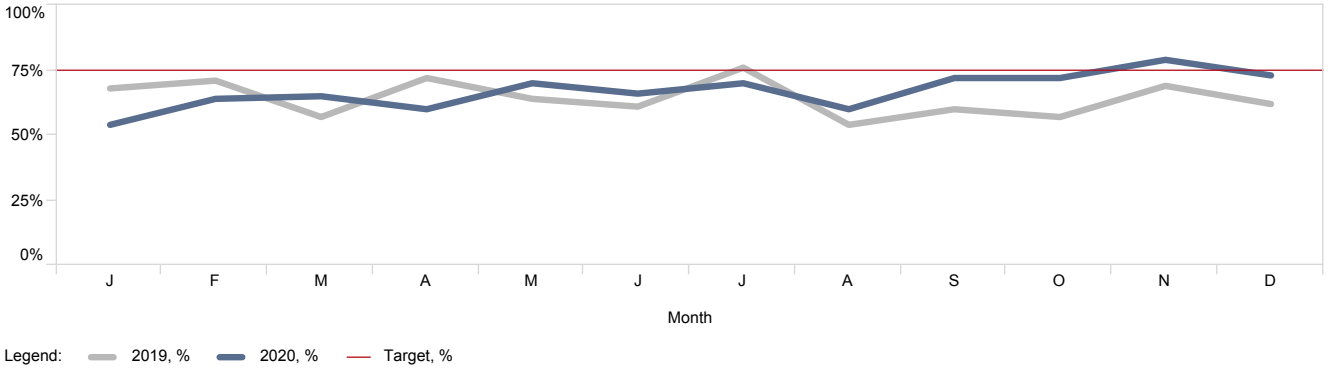


Figure 11: Proportion of ST-elevation myocardial infarction patients presenting within six hours of symptom onset who received an intervention within 90 minutes of first diagnostic electrocardiograph, 2019–2020

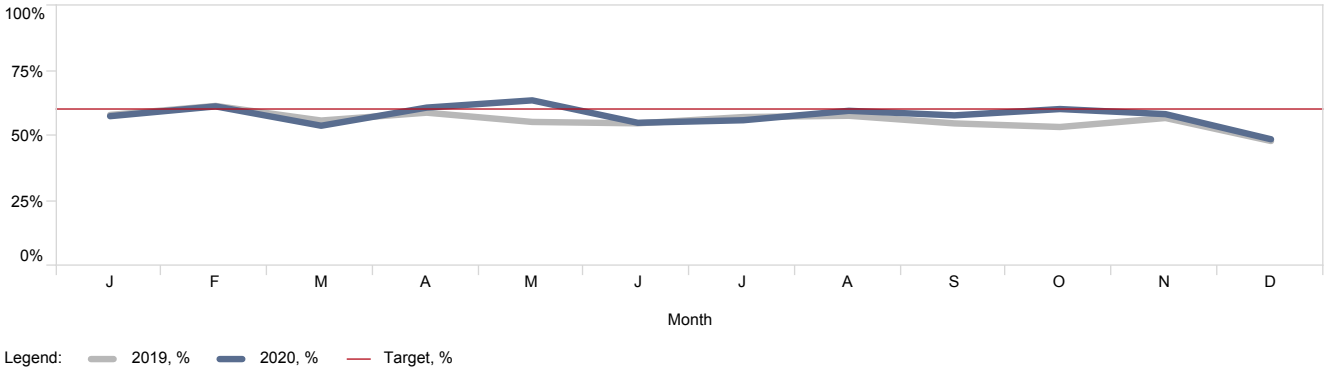


Figure 12: Cardiac rehabilitation performance measure, 2019–2020

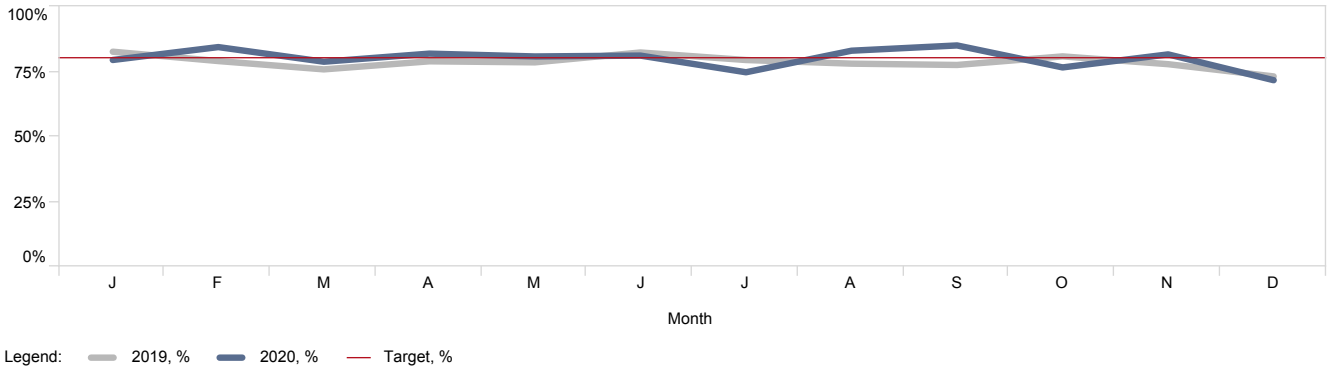


Figure 13: Heart failure support services clinical follow-up of acute patients within two weeks, 2019–2020

Table 5: Performance measures for interventional cardiology, electrophysiology and pacing, cardiac rehabilitation and heart failure support services by year, 2019–2020

Service line	2019	2020
Interventional cardiology		
Proportion of STEMI* patients presenting within six hours of symptom onset who received an intervention within 90 minutes of first diagnostic ECG (%)	65	67
Proportion of STEMI* patients with arrival at PCI facility to first device time less than 60 minutes (%)	70	70
Proportion of all NSTEMI† patients who received angiography within 72 hours of first hospital admission (%)	60	69
Electrophysiology and pacing		
Median wait time for elective pacemaker implantation (days)	21	3
Median wait time for elective ICD‡ implantation (days)	32	36
Median wait time for elective standard ablation (days)	117	99
Median wait time for elective complex ablation (days)	65	104
Cardiac rehabilitation		
Timely referral – documented referral to CR within three days of discharge (%)	94	93
Timely assessment (inpatients) – initial CR pre assessment completed within 28 days of discharge date (%)	59	62
Timely assessment (non acute patients) – proportion of CR patients completing a CR pre assessment within 28 days of referral date (%)	61	57
Timely journey (inpatients) – composite of timely referral and assessment (%)	56	58
Heart failure support services		
Follow-up of acute patients within two weeks (%)	79	80
Follow-up of non acute patients within four weeks (%)	82	84
Assessment of left ventricular ejection fraction within two years (%)	96	96
ACEI/ARB§ or ARNI‖ prescription at hospital discharge (%)	92	92
ACEI/ARB§ or ARNI‖ at first clinical review (%)	90	92
Beta blocker prescription at hospital discharge (%)	89	92
Beta blocker prescription at first clinical review (%)	91	92
Prescription of MRA# for HFrEF** at time of hospital discharge (%)	45	46
Prescription of MRA# for HFrEF†† at time of first HFSS clinical review (%)	43	46
Beta blocker titration status review at six months post referral (%)	67	75
Beta blocker achievement of guideline recommended target (%)	35	32
Beta blocker achievement of guideline recommended target dose or maximum tolerated dose (%)	75	77

* ST-elevation myocardial infarction

† Non-ST-elevation myocardial infarction

‡ Implantable cardioverter defibrillator

§ Angiotensin converting enzyme inhibitor/angiotensin II receptor blocker

‖ Angiotensin receptor-neprilysin inhibitor

Mineralocorticoid receptor antagonists

** Heart failure with reduced ejection fraction

†† Heart failure with preserved ejection fraction

10 Facility profiles

10.1 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

10.2 Townsville University 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 Townsville University Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
  - Cardiothoracic surgery

10.3 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
  - ICD and pacemaker implants

10.4 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

10.5 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

10.6 Royal Brisbane & 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

10.7 Queensland Children's Hospital

- Children's Health Queensland is a specialist statewide Hospital and Health Service dedicated to caring for children and young people from across Queensland and northern New South Wales
- Public tertiary level invasive cardiac services provided at the Queensland Children's Hospital include:
  - Percutaneous congenital cardiac abnormality diagnostics and intervention
  - Electrophysiology
  - ICD and pacemaker implantation
  - Paediatric cardiac and thoracic surgery

10.8 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 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

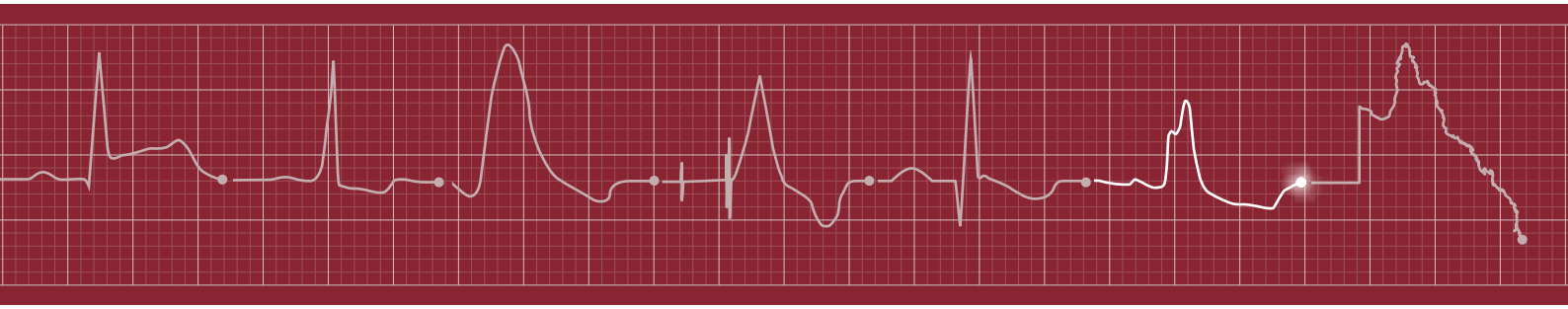
10.9 Toowoomba Hospital

- Referral hospital for Darling Downs Hospital and Health Services, servicing a population of approximately 280,000
- Public invasive cardiac services provided at the Toowoomba Hospital include:
  - ICD, CRT and pacemaker implantation

10.10 Gold Coast University Hospital

- 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

Heart Failure Support Services Audit



1 Message from the Heart Failure Steering Committee Chair

Patients living with symptomatic chronic heart failure have the opportunity to be supported by heart failure services until their condition is stabilised and therapy is optimised. Every new referral is audited, and outcomes are followed for 12 months. Between 2016 and 2020 there have been 24,395 audits of 19,000 unique patients.

Clinical indicators measure the timeliness of follow-up of referrals, evaluation of ejection fraction, and the prescription and titration of key heart failure medications. The performance on clinical indicators is accompanied by a coordinated program of education and quality improvement activities to address systems of care. Outcome measures include rehospitalisations, survival and time alive and out of hospital.

The Statewide Cardiac Clinical Informatics Unit (SCCIU) work closely with clinical leads to develop the registry including the introduction of new indicators and patient management tools. Next year an indicator will be introduced on the prescription of sodium-glucose co-transporter-2 (SGLT2) inhibitor as the evidence supporting their use has changed rapidly in the last two years.

I would like to thank the heart failure service nurses who collects the data as part of everyday clinical practice, demonstrating an ongoing commitment to quality improvement and dedication to patient care.

Finally, I wish to acknowledge those living with chronic heart failure. This registry will inform care to improve or maintain quality of life (which includes good symptom control, endurance, emotional support, and less time hospitalised) and prevent disease progression.

Associate Professor John Atherton
Chair
QCOR Heart Failure Committee

2 Key findings

Characteristics of referrals to a Heart Failure Support Service (HFSS)

The majority of the 5,664 referrals were male (68%), non-Indigenous (95.1%), referred to South East Queensland HFSS (82%), from an inpatient setting (67%) and diagnosed with HFrEF (80.9%).

The median age of referrals was 69 years old with male patients presenting younger than females (68 years vs. 71 years respectively). Aboriginal and Torres Strait Islander peoples represented a younger cohort compared with non-Indigenous patients (56 years vs. 70 years respectively), while HFrEF patients were younger than HFpEF patients (67 years vs. 76 years respectively). Patients aged 80 years or older represented over 21% of total cases.

Clinical indicator performance

Most indicators met benchmarks at a statewide level except for prescription of mineralocorticoid receptor antagonists for HFrEF (clinical indicator 5a and 5b) and the review and titration of beta blockers (clinical indicator 6a, 6b and 6c).

There is variation in practice with many of the 21 HFSS below benchmarks for clinical indicators 1a (follow-up of inpatient referrals in two weeks) and 6a, 6b and 6c (beta blocker review and titration).

Prescribing of guideline directed medications met benchmarks for all sites except for MRA (clinical indicator 5) which was uniformly below benchmarks.

Table 1: Summary of statewide clinical indicator performance

#	Clinical indicator	% referrals
1a	Follow-up of acute patients within 2 weeks	80.0*
1b	Follow-up of non acute patients within 4 weeks	84.0*
2	Assessment of left ventricular ejection fraction within 2 years	96.3*
3a	ACEI/ARB or ARNI† prescription at hospital discharge	91.7*
3b	ACEI/ARB or ARNI† at first clinical review	92.0*
4a	Beta blocker‡ prescription at hospital discharge	91.6*
4b	Beta blocker‡ prescription at first clinical review	91.7*
5a	Prescription of MRA§ for HFrEF at time of hospital discharge	46.3
5b	Prescription of MRA§ for HFREF at time of first HFSS clinical review	46.3
6a	Beta blocker‡ titration status review at six months post referral	74.9
6b	Beta blocker‡ achievement of guideline recommended target	32.0
6c	Beta blocker‡ achievement of guideline recommended target dose or maximum tolerated dose	77.2

* Benchmark met (benchmark is 80% achievement except for 6b which is 50%)

† Angiotensin-converting-enzyme inhibitor (ACEI), angiotensin II receptor blockers (ARB) or angiotensin receptor neprilysin inhibitor (ARNI)

‡ Bisoprolol, carvedilol, metoprolol sustained release or nebivolol

§ Mineralocorticoid receptor antagonists

Patient outcomes

Patient outcomes are based on inpatient referrals from the previous year to allow for 12 month follow-up from the index hospitalisation. Key findings are summarised in Table 2.

Table 2: Summary of outcomes for patients referred from a hospital setting

#	Measures post index hospitalisation*	30 days	1 year
1	All-cause mortality	1.4%	13.4%
2	a) All-cause rehospitalisation	18.1%	53.9%
	b) Heart failure rehospitalisation	5.7%	22.0%
3	Composite all-cause hospitalisation or all-cause mortality	18.5%	55.0%
4	Days alive and out of hospital†	N/A	364 median days

* Commences from date of discharge for index admission

† A single measure of mortality, readmissions and length of stay

3 Participating sites

Heart Failure Support Services (HFSS) consists of teams of specialised nurses, with medical support and allied health services. There are 21 services which contributed data to this year's annual report and the locations and services offered are shown in Figure 1 and Table 4 respectively.

Table 3: Queensland Heart Failure Support Services (HFSS) facilities and acronyms

Hospital and Health Service (HHS)	HFSS Facility	Acronym
Cairns and Hinterland	Cairns Hospital	CH
Central Queensland	Gladstone Hospital	GLH
	Rockhampton Hospital	RKH
Darling Downs	Toowoomba Hospital	TWH
Gold Coast	Gold Coast Community Health	GCCH
Mackay	Mackay Base Hospital	MKH
Metro North	Caboolture Hospital	CBH
	Redcliffe Hospital	RDH
	Royal Brisbane & Women's Hospital	RBWH
	The Prince Charles Hospital	TPCH
Metro South	Logan Hospital	LGH
	Princess Alexandra Hospital	PAH
	Queen Elizabeth II Hospital	QEII
	Redland Hospital	RLH
North West	Mt Isa Hospital	MIH
Sunshine Coast	Gympie Hospital	GYH
	Sunshine Coast University Hospital	SCUH
Townsville	Townsville Hospital	TTH
West Moreton	Ipswich Community Health	IPCH
Wide Bay	Bundaberg Hospital	BNH
	Hervey Bay Hospital (includes Maryborough)	HBH

Figure 1: Heart Failure Support Service (HFSS) locations

Table 4: Components of Queensland Heart Failure Support Services (HFSS)

		HFSS disciplines				Modes of service (telephone + ...)				
HHS	**Facility**	**Nurse**	**NP***	**Pharm†**	**Physio or AEP‡**	**In-patient**	**Nurse or MD clinics**	**Home visits**	**Rehab programs**	**Medical mentor§**
Cairns and Hinterland	CH	Y	Y	–	Y	Y	Y	Y	Y	Y
Central Queensland	GLH	Y	–	–	Y	–	–	–	Y	Video clinic
	RKH	Y	Y	Y	Y	Y	Y	–	Y	Y
Darling Downs	TWH	Y	–	Y	R	–	Y	Y		Y
Gold Coast	GCCH	Y	–	Y	Y	Y	Y	Y	Y	Y
Mackay	MKH	Y	–	–	Y	Y	Y	–	Y	Y
Metro North	CBH	Y	–	Y	–	–	Y	–	–	Y
	RDH	Y	Y	Y	–	–	–	Y	–	Y
	RBWH	Y	–	Y	Y	Y	Y	–	Y	Y
	TPCH	Y	Y	Y	Y	Y	Y	–	Y	Y
Metro South	LGH	Y	Y	Y	Y	Y	Y	Y	Y	Y
	PAH	Y	Y	Y	Y	Y	Y	Y	Y	Y
	QEII	Y	Y	Y	R	Y	Y	Y	–	Y
	RLH	Y	Y	–	Y	Y	Y	Y	Y	Y
North West	MIH	Y	Y	Y	R	Y	Y	Y	–	Outreach
Sunshine Coast	GYH	Y	–	–	–	Y	Y	Y	–	Y
	SCUH	Y	Y	–	R	Y	Y	Y	–	Y
Townsville	TTH	Y	Y	Y	R	Y	Y	Y	–	Y
West Moreton	IPCH	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wide Bay	BNH	Y	–	–	R	–	Y	–	–	Y
	HBH	Y	Y	–	Y	Y	Y	Y	Y	Video clinic
Statewide		100%	62%	62%	86%	76%	90%	62%	57%	100%

* Nurse practitioner who can prescribe medications

† Pharmacist

‡ Physiotherapist or accredited exercise physiologist

§ The HFSS has a cardiologist or general physician mentor

R Referral for exercise that is routinely accepted by another program such as cardiac or pulmonary rehabilitation

4 New referrals

There were 5,664 new referrals reported by the 21 participating HFSS, with Metropolitan sites comprising 51% of all referrals. Five year trends in referral to HFSS can be seen in the figure below. Between 2016 and 2020 referral volumes increased by 41%.

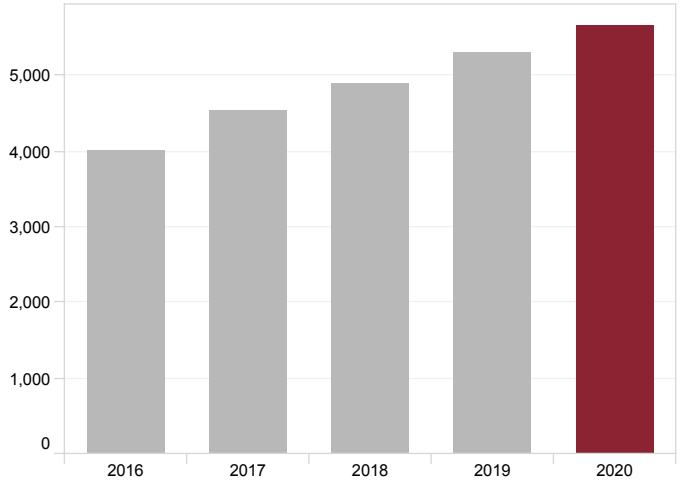


Figure 2: Total yearly HF referrals, 2016–2020

Table 5: Yearly HF referral volume, 2016–2020

	2016 n	2017 n	2018 n	2019 n	2020 n
Yearly referrals	4,021	4,528	4,878	5,304	5,664

4.1 Location of referrals

Table 6: Distribution of new referrals by HFSS location

Referrals per HHS	n (%)	Referrals per facility	n (%)
Cairns and Hinterland	150 (2.6)	Cairns Hospital	150 (2.6)
Central Queensland	234 (4.1)	Gladstone Hospital	15 (0.3)
		Rockhampton Hospital	219 (3.9)
Darling Downs	50 (0.9)	Toowoomba Hospital	50 (0.9)
Gold Coast	550 (9.7)	Gold Coast Community Health	550 (9.7)
Mackay	105 (1.9)	Mackay Base Hospital	105 (1.9)
Metro North	1,764 (31.1)	Caboolture Hospital	194 (3.4)
		Redcliffe Hospital	158 (2.8)
		Royal Brisbane & Women's Hospital	454 (8.0)
		The Prince Charles Hospital HFS	958 (16.9)
Metro South	1,416 (25.0)	Logan Hospital	432 (7.6)
		Princess Alexandra Hospital	618 (10.9)
		Queen Elizabeth II Hospital	162 (2.9)
		Redland Hospital	204 (3.6)
North West	47 (0.8)	Mt Isa Hospital	47 (0.8)
Sunshine Coast	522 (9.2)	Gympie	82 (1.4)
		Sunshine Coast University Hospital	440 (7.8)
Townsville	260 (4.6)	Townsville Hospital	260 (4.6)
West Moreton	397 (7.0)	Ipswich Community Health	397 (7.0)
Wide Bay	169 (3.0)	Bundaberg Hospital	105 (1.9)
		Hervey Bay/Maryborough Hospitals	64 (1.1)
Statewide			**5,664 (100.0)**

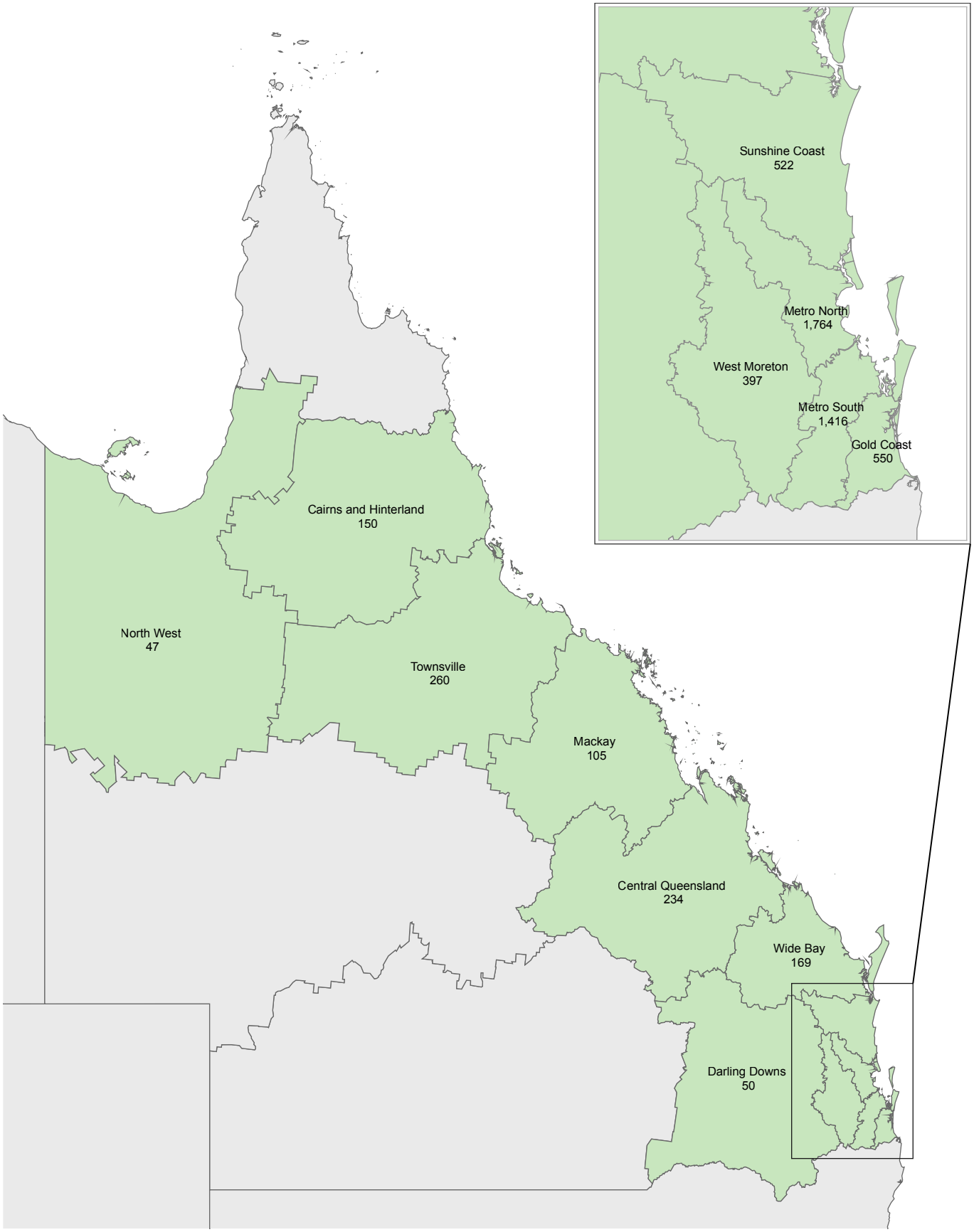


Figure 3: Regional distribution of new referrals

4.2 Referral source

Most referrals originated from an inpatient setting (67%), with smaller proportions originating from an outpatient setting (21%) or as a transfer from another service (9%).

Few referrals came directly from primary care (3%), which is expected as most referrals flow to specialty outpatient clinics for diagnosis and treatment optimisation prior to referral to an HFSS.

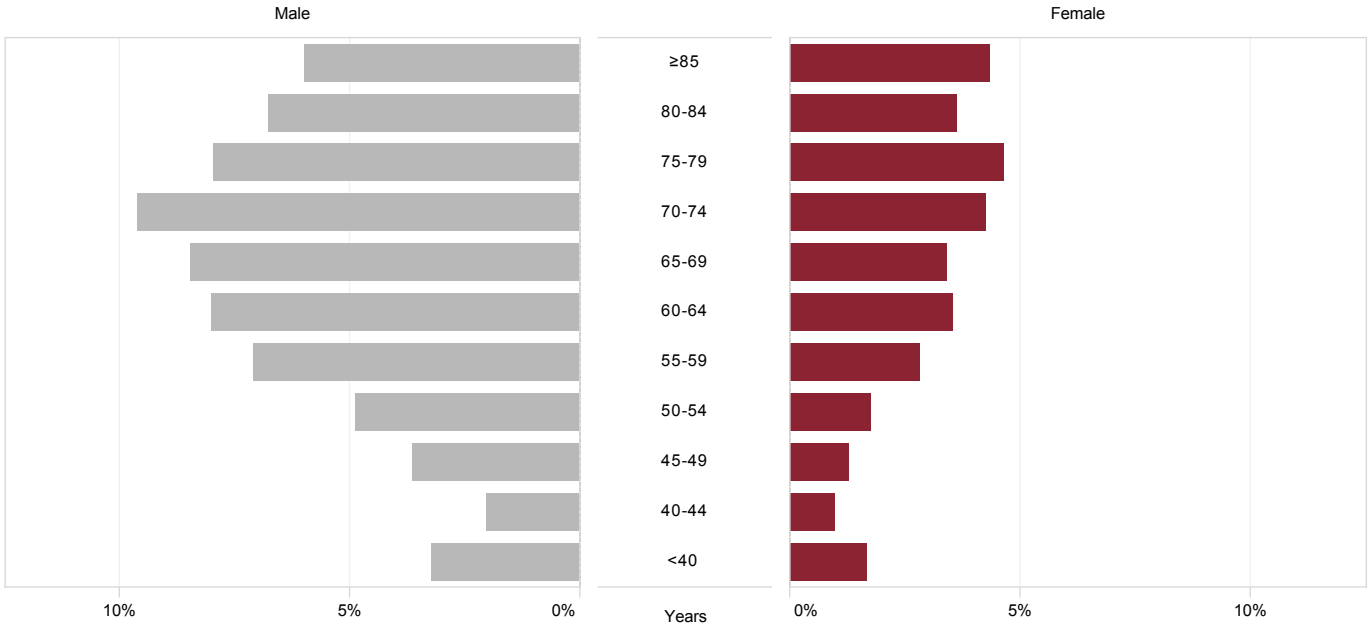
Table 7: Source of HFSS referral

HHS	HFSS	Inpatient n (%)	Outpatient n (%)	Another HFSS n (%)	Primary care n (%)
Cairns and Hinterland	Cairns Hospital	93 (62.0)	54 (36.0)	1 (0.7)	2 (1.3)
Central Queensland	Gladstone Hospital	7 (46.7)	4 (26.7)	4 (26.7)	–
	Rockhampton Hospital	147 (67.1)	40 (18.3)	4 (1.8)	28 (12.8)
Darling Downs	Toowoomba Hospital	6 (12.0)	44 (88.0)	–	–
Gold Coast	Gold Coast Community Health	389 (70.7)	118 (21.5)	25 (4.5)	18 (3.3)
Mackay	Mackay Base Hospital	51 (48.6)	51 (48.6)	3 (2.9)	–
Metro North	Caboolture Hospital	35 (18.0)	51 (26.3)	33 (17.0)	75 (38.7)
	Redcliffe Hospital	24 (15.2)	84 (53.2)	50 (31.6)	–
	Royal Brisbane & Women's Hospital	351 (77.3)	96 (21.1)	7 (1.5)	–
	The Prince Charles Hospital	870 (90.8)	81 (8.5)	6 (0.6)	1 (0.1)
Metro South	Logan Hospital	271 (62.7)	28 (6.5)	125 (28.9)	8 (1.9)
	Princess Alexandra Hospital	558 (90.3)	51 (8.3)	9 (1.5)	–
	Queen Elizabeth II Hospital	109 (67.3)	33 (20.4)	19 (11.7)	1 (0.6)
	Redland Hospital	61 (29.9)	65 (31.9)	77 (37.7)	1 (0.5)
North West	Mt Isa Hospital	9 (19.1)	30 (63.8)	–	8 (17.0)
Sunshine Coast	Gympie Hospital	34 (41.5)	11 (13.4)	35 (42.7)	2 (2.4)
	Sunshine Coast University Hospital	332 (75.5)	93 (21.1)	15 (3.4)	–
Townsville	Townsville Hospital	153 (58.8)	105 (40.4)	1 (0.4)	1 (0.4)
West Moreton	Ipswich Community Health	206 (51.9)	124 (31.2)	60 (15.1)	7 (1.8)
Wide Bay	Bundaberg Hospital	62 (59.0)	25 (23.8)	15 (14.3)	3 (2.9)
	Hervey Bay Hospital	14 (21.9)	16 (25.0)	30 (46.9)	4 (6.3)
Statewide		**3,782 (66.8)**	**1,204 (21.3)**	**519 (9.2)**	**159 (2.8)**

5 Patient characteristics

5.1 Age and gender

The statewide median age of patients managed by an HFSS was 69 years. The median age of women (71 years) was three years older than men. One third of patients (33%) were 75 years of age and older.



% of total (n=5,664)

Figure 4: Proportion of all referrals by gender and age group

Table 8: Median age in years by gender and HFSS

HHS	HFSS	Male years	Female years	All years
Cairns and Hinterland	Cairns Hospital	65	70	66
Central Queensland	Gladstone Hospital	72	65	68
	Rockhampton Hospital	68	68	68
Darling Downs	Toowoomba Hospital	62	63	62
Gold Coast	Gold Coast Community Health	70	74	71
Mackay	Mackay Base Hospital	70	68	69
Metro North	Caboolture Hospital	70	71	70
	Redcliffe Hospital	72	75	74
	Royal Brisbane & Women's Hospital	71	73	71
	The Prince Charles Hospital	69	74	70
Metro South	Logan Hospital	66	69	67
	Princess Alexandra Hospital	66	68	66
	Queen Elizabeth II Hospital	69	69	69
	Redland Hospital	68	73	70
North West	Mt Isa Hospital	57	59	58
Sunshine Coast	Gympie Hospital	76	74	76
	Sunshine Coast University Hospital	69	71	69
Townsville	Townsville Hospital	63	61	63
West Moreton	Ipswich Community Health	70	69	70
Wide Bay	Bundaberg Hospital	68	73	69
	Hervey Bay Hospital	72	79	74
Statewide		**68**	**71**	**69**

5.2 Gender

The majority of patients were male (68%), ranging from 51% to 78% across participating sites.

Table 9: Referrals by gender and HFSS

HHS	HFSS	Male n (%)	Female n (%)
Cairns and Hinterland	Cairns Hospital	117 (78.0)	33 (22.0)
Central Queensland	Gladstone Hospital	11 (73.3)	4 (26.7)
	Rockhampton Hospital	145 (66.2)	74 (33.8)
Darling Downs	Toowoomba Hospital	37 (74.0)	13 (26.0)
Gold Coast	Gold Coast Community Health	370 (67.3)	180 (32.7)
Mackay	Mackay Base Hospital	74 (70.5)	31 (29.5)
Metro North	Caboolture Hospital	143 (73.7)	51 (26.3)
	Redcliffe Hospital	101 (63.9)	57 (36.1)
	Royal Brisbane & Women's Hospital	292 (64.3)	162 (35.7)
	The Prince Charles Hospital	617 (64.4)	341 (35.6)
Metro South	Logan Hospital	297 (68.8)	135 (31.3)
	Princess Alexandra Hospital	452 (73.1)	166 (26.9)
	Queen Elizabeth II Hospital	103 (63.6)	59 (36.4)
	Redland Hospital	135 (66.2)	69 (33.8)
North West	Mt Isa Hospital	24 (51.1)	23 (48.9)
Sunshine Coast	Gympie Hospital	53 (64.6)	29 (35.4)
	Sunshine Coast University Hospital	313 (71.1)	127 (28.9)
Townsville	Townsville Hospital	184 (70.8)	76 (29.2)
West Moreton	Ipswich Community Health	247 (62.2)	150 (37.8)
Wide Bay	Bundaberg Hospital	78 (74.3)	27 (25.7)
	Hervey Bay Hospital	45 (70.3)	19 (29.7)
Statewide		**3,838 (67.8)**	**1,826 (32.2)**

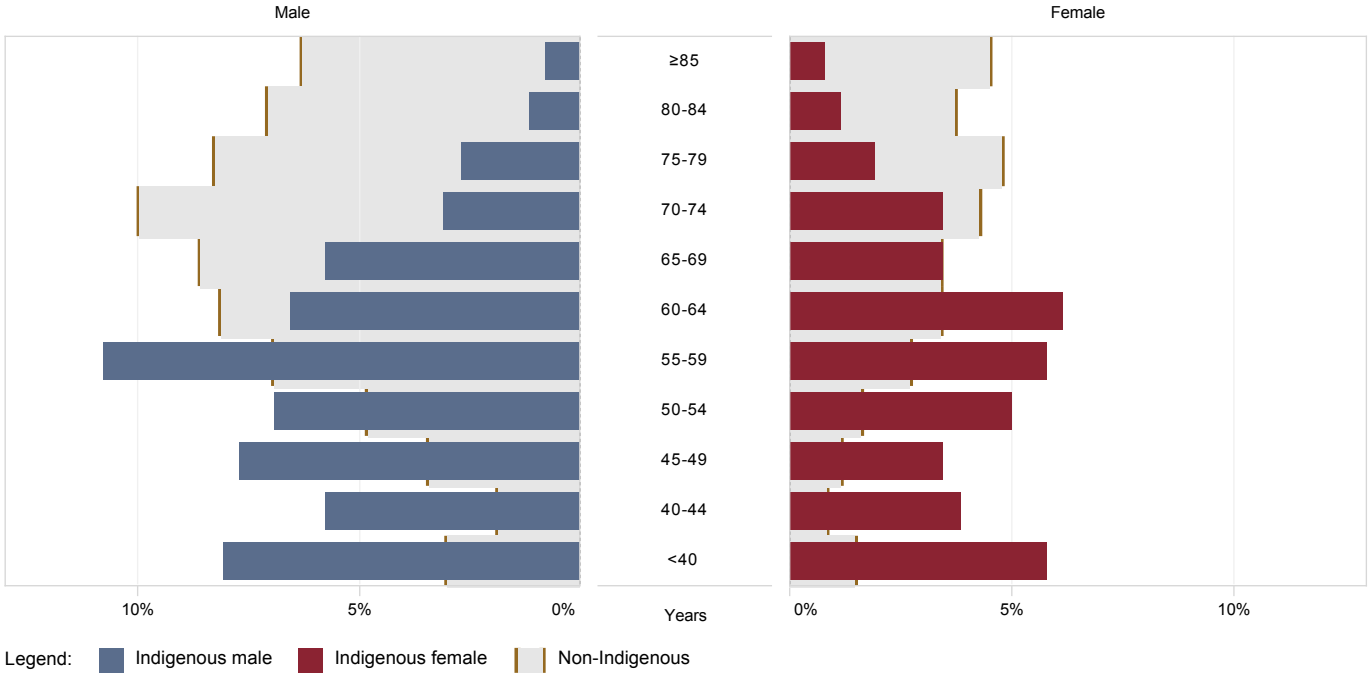
5.3 Aboriginal and Torres Strait Islander status

Patients of identified Aboriginal and Torres Strait Islander status made up 4.6% of all referrals. The number of referrals (260) was consistent with the previous year (243). Aboriginal and Torres Strait Islander patients were significantly younger than other Queenslanders. The proportion of caseload of Aboriginal and Torres Strait Islander patients was highest in Mount Isa (43% of all referrals), followed by Cairns (19%) and Townsville (16%).

The number of Aboriginal and Torres Strait Islander referrals in the Greater Brisbane area (Metro North and Metro South HHS) was 110 (42% of referrals statewide for Indigenous Australians).

Table 10: Aboriginal and Torres Strait Islander HFSS referrals as a proportion of caseload

HHS	HFSS	Indigenous n (%)	Non-Indigenous n (%)	Not stated / unknown n (%)
Cairns and Hinterland	Cairns Hospital	29 (19.3)	121 (80.7)	–
Central Queensland	Gladstone Hospital	–	15 (100.0)	–
	Rockhampton Hospital	23 (10.5)	196 (89.5)	–
Darling Downs	Toowoomba Hospital	2 (4.0)	47 (94.0)	1 (2.0)
Gold Coast	Gold Coast Community Health	6 (1.1)	541 (98.4)	3 (0.5)
Mackay	Mackay Base Hospital	5 (4.8)	100 (95.2)	–
Metro North	Caboolture Hospital	4 (2.1)	190 (97.9)	–
	Redcliffe Hospital	6 (3.8)	152 (96.2)	–
	Royal Brisbane & Women's Hospital	16 (3.5)	437 (96.3)	1 (0.2)
	The Prince Charles Hospital	34 (3.5)	920 (96.0)	4 (0.4)
Metro South	Logan Hospital	13 (3.0)	419 (97.0)	–
	Princess Alexandra Hospital	29 (4.7)	589 (95.3)	–
	Queen Elizabeth II Hospital	4 (2.5)	158 (97.5)	–
	Redland Hospital	4 (2.0)	200 (98.0)	–
North West	Mt Isa Hospital	20 (42.6)	27 (57.4)	–
Sunshine Coast	Gympie Hospital	–	82 (100.0)	–
	Sunshine Coast University Hospital	5 (1.1)	435 (98.9)	–
Townsville	Townsville Hospital	41 (15.8)	214 (82.3)	5 (1.9)
West Moreton	Ipswich Community Health	17 (4.3)	379 (95.5)	1 (0.3)
Wide Bay	Bundaberg Hospital	2 (1.9)	103 (98.1)	–
	Hervey Bay Hospital	–	64 (100.0)	–
Statewide		**260 (4.6)**	**5,389 (95.1)**	**15 (0.3)**



% of total Indigenous (n=260) vs. total non-Indigenous (n=5,389). Excludes missing data (0.3%)

Figure 5: Proportion of all referrals by age group and identified Aboriginal and Torres Strait Islander status

Table 11: Median patient age by gender and Indigenous status

	Total referrals n	Male years	Female years	All years
Aboriginal and Torres Strait Islander	260	56	57	56
Non Aboriginal and Torres Strait Islander	5,389	69	72	70
Total	**5,649**	**68**	**71**	**69**

Excludes missing data (0.3%)

5.4 Phenotype of heart failure

The table below shows rates of different HF phenotypes referred to each HFSS, these include:

- HFrEF: heart failure with reduced ejection fraction, where the left ventricular ejection fraction is less than 50% at time of diagnosis,
- HFpEF: heart failure with preserved ejection fraction, where the left ventricular ejection fraction is 50% or greater at time of diagnosis,
- Primary right heart failure e.g. cor pulmonale.

The most common referral to a HFSS was for HFrEF (81%). The median age for HFrEF was nine years younger than for patients with HFpEF (67 vs. 76 years respectively). More men had HFrEF than women (72% male), whereas HFpEF did not have a significant gender difference (48% male and 52% female).

Table 12: Proportion of patients by heart failure phenotype

HHS	HFSS	HFrEF* n (%)	HFpEF† n (%)	Primary right HF n (%)	Unsure/ unknown n (%)
Cairns and Hinterland	Cairns Hospital	141 (94.0)	6 (4.0)	1 (0.7)	2 (1.3)
Central Queensland	Gladstone Hospital	13 (86.7)	1 (6.7)	–	1 (6.7)
	Rockhampton Hospital	179 (81.7)	31 (14.2)	6 (2.7)	3 (1.4)
Darling Downs	Toowoomba Hospital	31 (62.0)	6 (12.0)	–	13 (26.0)
Gold Coast	Gold Coast Community Health	450 (81.8)	77 (14.0)	10 (1.8)	13 (2.4)
Mackay	Mackay Base Hospital	100 (95.2)	4 (3.8)	–	1 (1.0)
Metro North	Caboolture Hospital	165 (85.1)	25 (12.9)	–	4 (2.1)
	Redcliffe Hospital	118 (74.7)	28 (17.7)	5 (3.2)	7 (4.4)
	Royal Brisbane & Women's Hospital	372 (81.9)	74 (16.3)	2 (0.4)	6 (1.3)
Metro South	The Prince Charles Hospital	666 (69.5)	224 (23.4)	29 (3.0)	39 (4.1)
	Logan Hospital	363 (84.0)	55 (12.7)	8 (1.9)	6 (1.4)
	Princess Alexandra Hospital	548 (88.7)	54 (8.7)	13 (2.1)	3 (0.5)
	Queen Elizabeth II Hospital	131 (80.9)	25 (15.4)	2 (1.2)	4 (2.5)
	Redland Hospital	158 (77.5)	33 (16.2)	8 (3.9)	5 (2.5)
North West	Mt Isa Hospital	23 (48.9)	6 (12.8)	2 (4.3)	16 (34.0)
Sunshine Coast	Gympie Hospital	57 (69.5)	21 (25.6)	4 (4.9)	–
	Sunshine Coast University Hospital	403 (91.6)	27 (6.1)	5 (1.1)	5 (1.1)
Townsville	Townsville Hospital	238 (91.5)	13 (5.0)	5 (1.9)	4 (1.5)
West Moreton	Ipswich Community Health	288 (72.5)	80 (20.2)	22 (5.5)	7 (1.8)
Wide Bay	Bundaberg Hospital	91 (86.7)	9 (8.6)	5 (4.8)	–
	Hervey Bay Hospital	50 (78.1)	10 (15.6)	4 (6.3)	–
Statewide		**4,585 (80.9)**	**809 (14.3)**	**131 (2.3)**	**139 (2.5)**

* Heart failure with reduced ejection fraction (LVEF <50%)

† Heart failure with preserved ejection fraction (LVEF ≥50%)

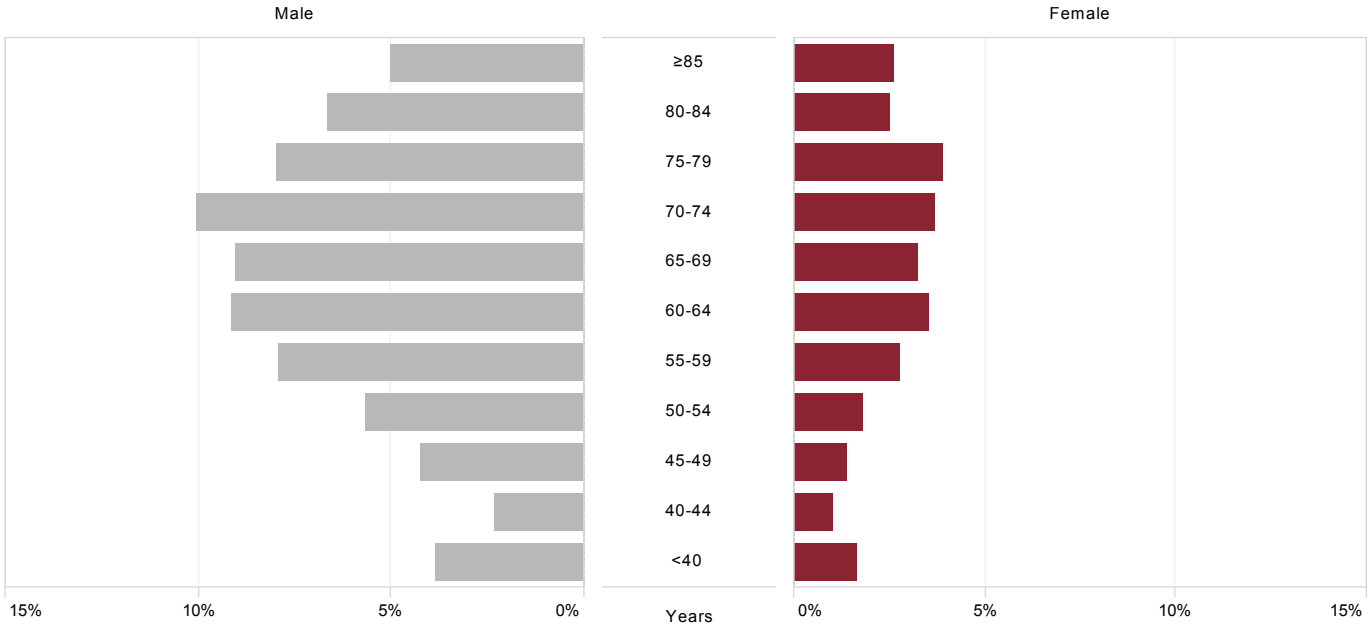
Table 13: Summary of patient age, gender and Indigenous status by heart failure phenotype

	HFrEF* n	HFpEF† n	Primary right HF n
Number	4,585	809	131
Age (median years)	67	76	76
% male	71.8	48.3	53.4
% Aboriginal and Torres Strait Islander	4.8	2.7	3.8

Excludes unsure/unknown HF phenotype (2.5%)

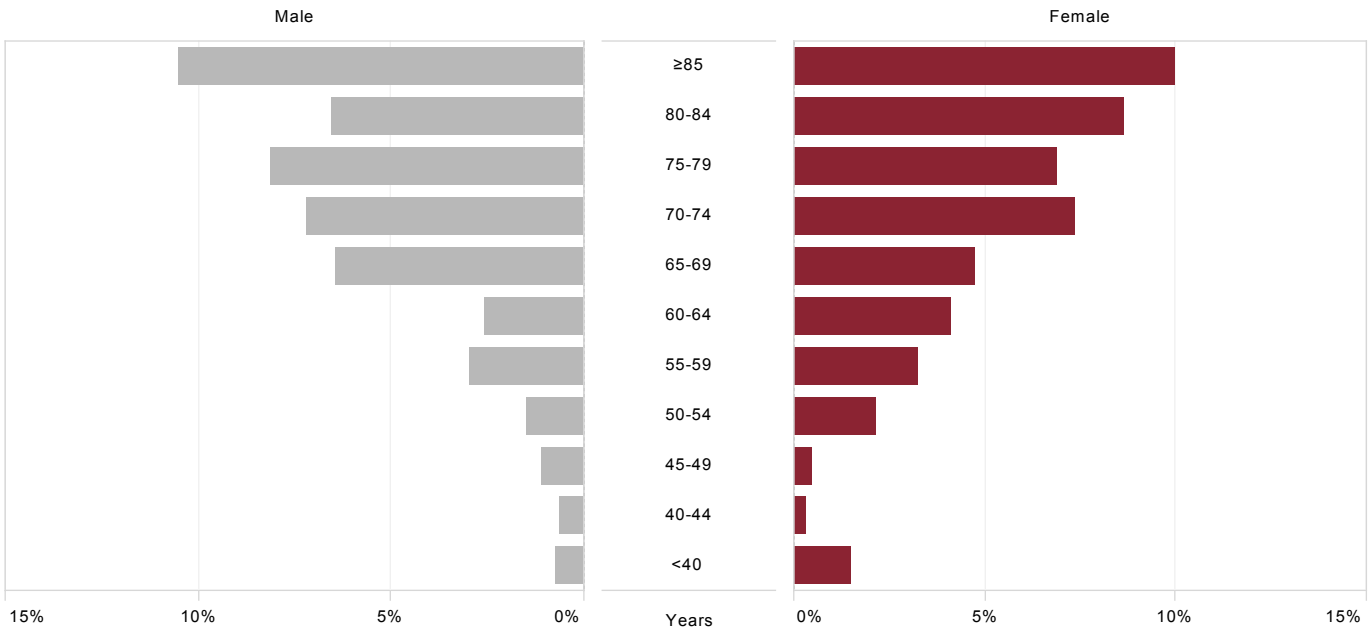
* Heart failure with reduced ejection fraction (LVEF ‹50%)

† Heart failure with preserved ejection fraction (LVEF ≥50%)



% of total with HFrEF (n=4,585)

Figure 6: Proportion of HFrEF referrals by gender and age group



% of total with HFpEF (n=809)

Figure 7: Proportion of HFpEF referrals by gender and age group

5.5 Summary of patient characteristics

A summary of patient characteristics from all referrals to an HFSS are shown below.

Table 14: Summary of patient characteristics

Characteristic	Summary
Participating HFSS	21
New referrals	5,664
Referrals from South East Queensland	82.0%
Referral source:	
Inpatient	66.8%
Outpatient	21.3%
Another HFSS	9.2%
Primary care	2.8%
Age (median years):	
All (median, range by service)	69 (58–76) years
Male vs. Female	68 vs. 71 years
Indigenous vs. non-Indigenous	56 vs. 69 years
HFrEF* vs. HFpEF†	67 vs. 76 years
Age group:	
80 years and over	20.7%
Males	67.8%
Aboriginal and Torres Strait Islander patients	4.6%
Heart failure phenotype:	
HFrEF*	80.9%
HFpEF†	14.3%
Primary right HF	2.3%
Unsure/unknown	2.5%

* Heart failure with reduced ejection fraction (LVEF <50%)

† Heart failure with preserved ejection fraction (LVEF ≥50%)

6 Clinical indicators

The number of clinical indicators is limited so that data entry is sustainable and part of routine clinical practice. The six clinical indicators selected are shown in Table 15.

The target benchmark for all indicators was set at 80%, except for 6b (beta blocker titration to clinical guideline target dose at six months) where the benchmark was set at 50%. The lower benchmark of 50% acknowledges that target doses derived from clinical trials may be inappropriate in clinical practice where patients are often older with greater disease severity and associated comorbidities compared to patients recruited to large drug trials.[37]

Table 15: Clinical process indicators

Indicator #	Process measures
1	**Timely follow-up and first clinical review** 1a) First clinical review within two weeks for inpatient referrals 1b) First clinical review within four weeks for non acute referrals
2	**Left ventricular ejection fraction (LVEF) assessed within 2 years of referral to HFSS**
3	**Prescription of angiotensin-converting-enzyme inhibitor (ACEI), angiotensin II receptor blockers (ARB) or angiotensin receptor neprilysin inhibitor (ARNI) for HFrEF** 3a) Prescription at time of hospital discharge (inpatient referrals) 3b) Prescription at time of first clinical review (all referrals)
4	**Prescription of guideline recommended beta blockers (bisoprolol, carvedilol, metoprolol sustained release or nebivolol) for HFrEF** 4a) Prescription at time of hospital discharge (inpatient referrals) 4b) Prescription at time of first clinical review (all referrals)
5	**Prescription of mineralocorticoid receptor antagonists (MRA) for patients with HFrEF** 5a) Prescription at time of hospital discharge (inpatient referrals) 5b) Prescription at time of first clinical review (all referrals)
6	**Beta blocker review and titration** 6a) Titration review conducted within 6 months of first clinical review 6b) Guideline target dose achieved at time of titration review 6c) Either target or maximum dose achieved at time of titration review

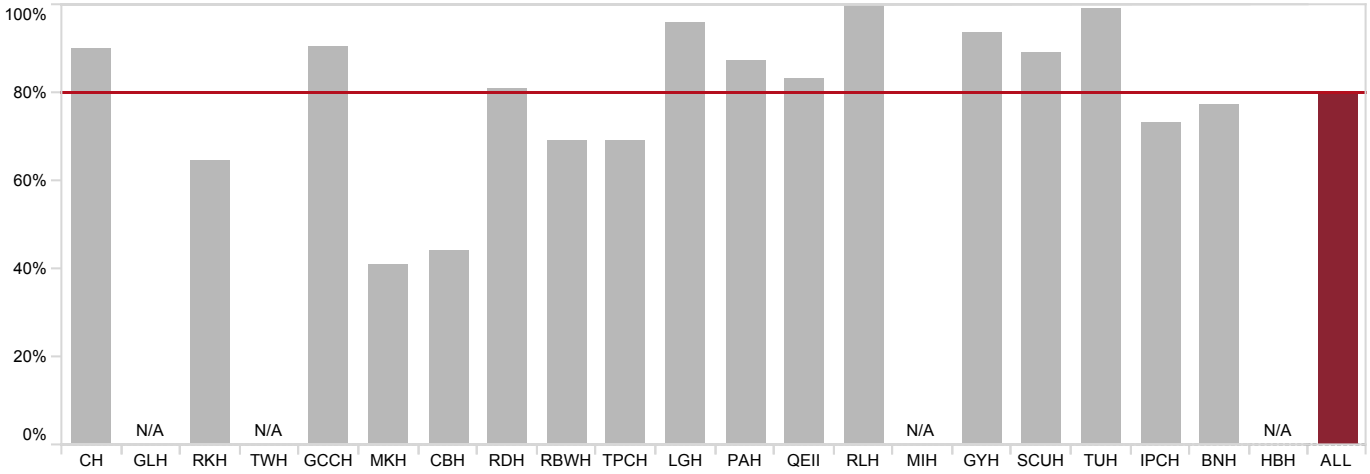
6.1 First clinical review

The HFSS review is defined as a clinical (rather than administrative) intervention and can be conducted face to face (clinic, gym or home visit) or virtually (phone, videoconference). Patients were excluded if they died, were referred to another HFSS, declined follow-up or could not be contacted.

1a First clinical review by Heart Failure Support Service within two weeks of hospital discharge or date of referral if after discharge (for inpatient referrals)

Early post discharge follow-up is recommended for patients with HF to monitor symptoms, provide education and support self-management principles. The appropriate review timeframe chosen for this intervention was within two weeks of hospital discharge or date of referral after recent hospitalisation.

Of the 3,782 patients referred from an acute setting, 80% received a clinical review by an HFSS within two weeks of hospital discharge. Variation in performance was observed between services and is demonstrated in the figure below.



N/A: Eligible referrals <20

Figure 8: Inpatients who received first HFSS clinical review within two weeks of hospital discharge

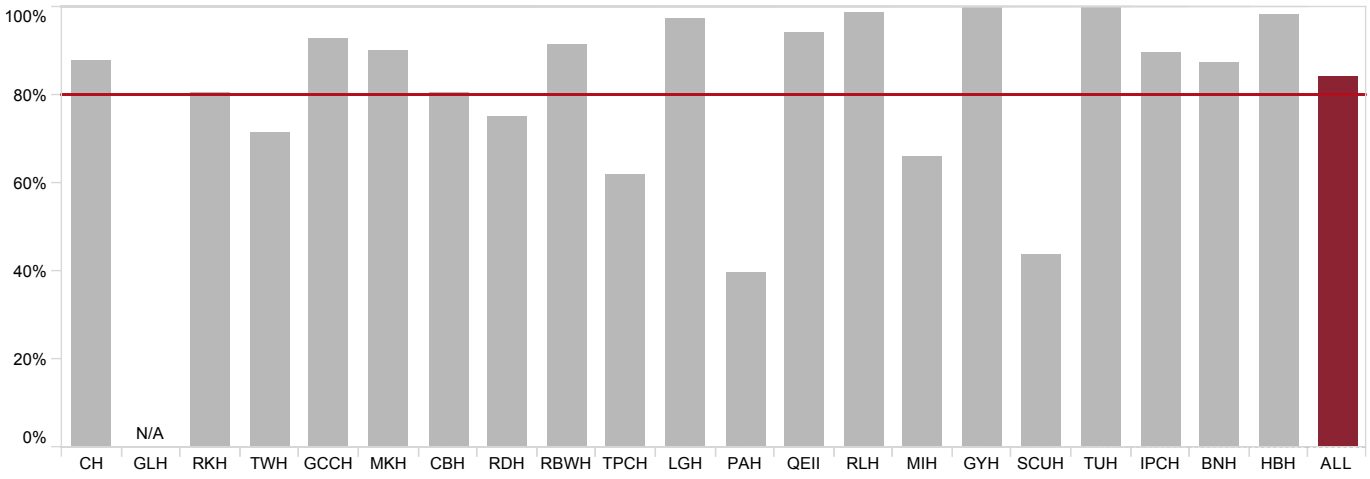
Table 16: Inclusion details for clinical indicator 1a: Inpatients receiving first HFSS clinical review within two weeks of hospital discharge

	n	%
Eligible for analysis	2,629	
Achieved benchmark	2,104	80.0
Benchmark not achieved	525	20.0
Ineligible	1,152	
Referred to another HFSS	636	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	146	
Patient declined service	131	
Patient could not be contacted, lives out of area or repeated failure to attend	108	
HF no longer prime issue (palliative care, high care nursing home etc.)	73	
Patient deceased	44	
Other reason	14	
Missing data	1	
Total inpatient referrals	**3,782**	

1b First Heart Failure Support Service clinical review within four weeks for non acute referrals

For non acute referrals, clinical follow-up should be within four weeks of the referral date.

Referrals for 1,882 patients came from non acute services, of which 84% of the cases eligible for analysis received a clinical review within four weeks of referral. Variation in performance amongst services was observed and is outlined below.



N/A: Eligible referrals <20

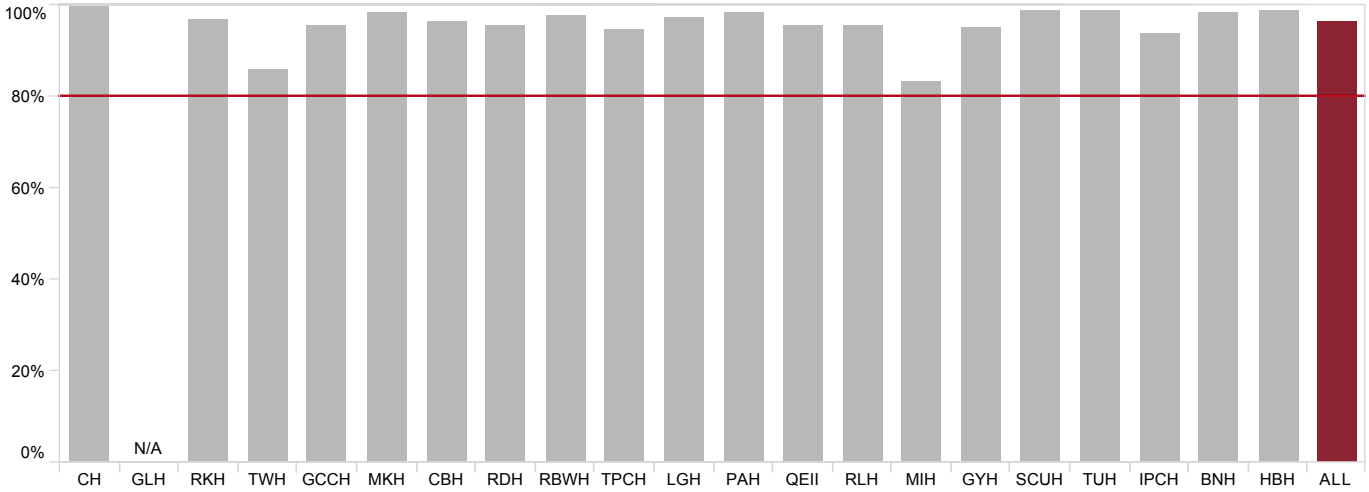
Figure 9: Proportion of non acute patients who received first HFSS clinical review within four weeks of referral

Table 17: Inclusion details for clinical indicator 1b: Non acute patients receiving first HFSS clinical review within four weeks of referral

	n	%
Eligible for analysis	1,705	
Achieved benchmark	1,433	84.0
Benchmark not achieved	272	16.0
Ineligible	165	
Patient declined service	50	
Referred to another HFSS	37	
Patient could not be contacted, lives out of area or repeated failure to attend	34	
HF no longer prime issue (palliative care, high care nursing home etc.)	16	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	10	
Patient deceased	7	
Other reason	11	
Missing data	12	
Total non acute patients	**1,882**	

6.2 Left ventricular ejection fraction (LVEF) assessed within two years of referral to HFSS

Australian clinical guidelines recommend that all patients with heart failure should have an assessment of left ventricular function.[36] In 96% of cases, LVEF was assessed within two years of referral to an HFSS. Little variation in performance was observed and is demonstrated in the analysis below.



N/A: Eligible referrals <20

Figure 10: Proportion of all patients who had LVEF assessed within two years of referral to HFSS

Table 18: Inclusion details for clinical indicator 2: Patients who had LVEF assessed within two years of referral

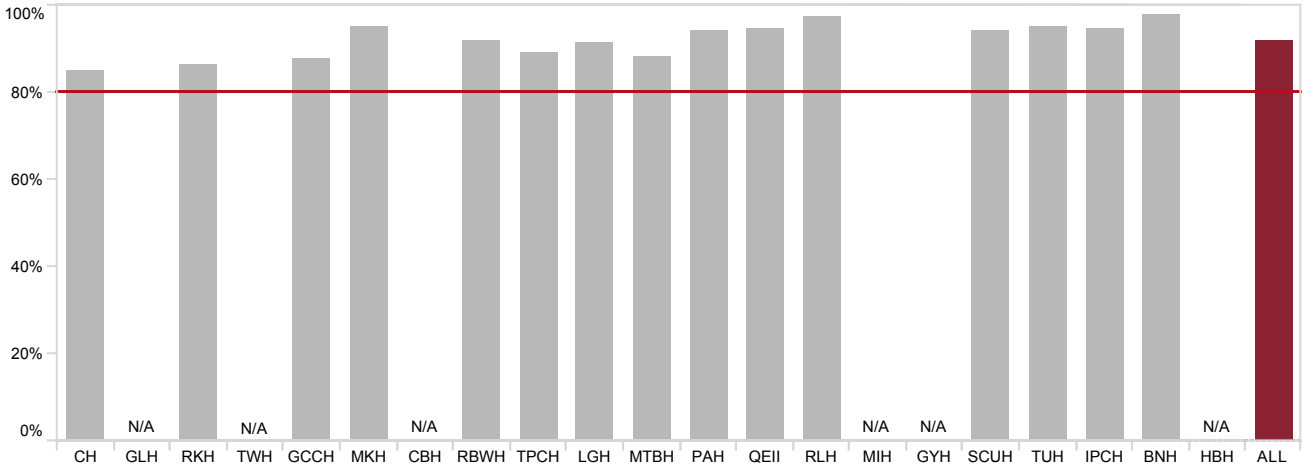
	n	%
Eligible for analysis	5,664	
Achieved benchmark	5,661	96.3
Benchmark not achieved	208	3.7
Ineligible	N/A	
Missing data	3	
Total referrals	**5,304**	

6.3 Prescription of ACEI, ARB or ARNI for patients with HFrEF

Angiotensin-converting-enzyme inhibitor (ACEI), angiotensin II receptor blockers (ARB) or angiotensin receptor neprilysin inhibitor (ARNI) have been shown to reduce mortality and morbidity in patients with HFrEF and are recommended for all patients unless contraindicated or not tolerated.[36]

3a ACEI, ARB or ARNI prescription for HFrEF at hospital discharge

Prescription benchmarks for ACEI, ARB or ARNI therapy on hospital discharge was met for 92% of eligible patients.



N/A: Eligible referrals <20

Figure 11: Proportion of patients who were on ACEI, ARB or ARNI at time of hospital discharge

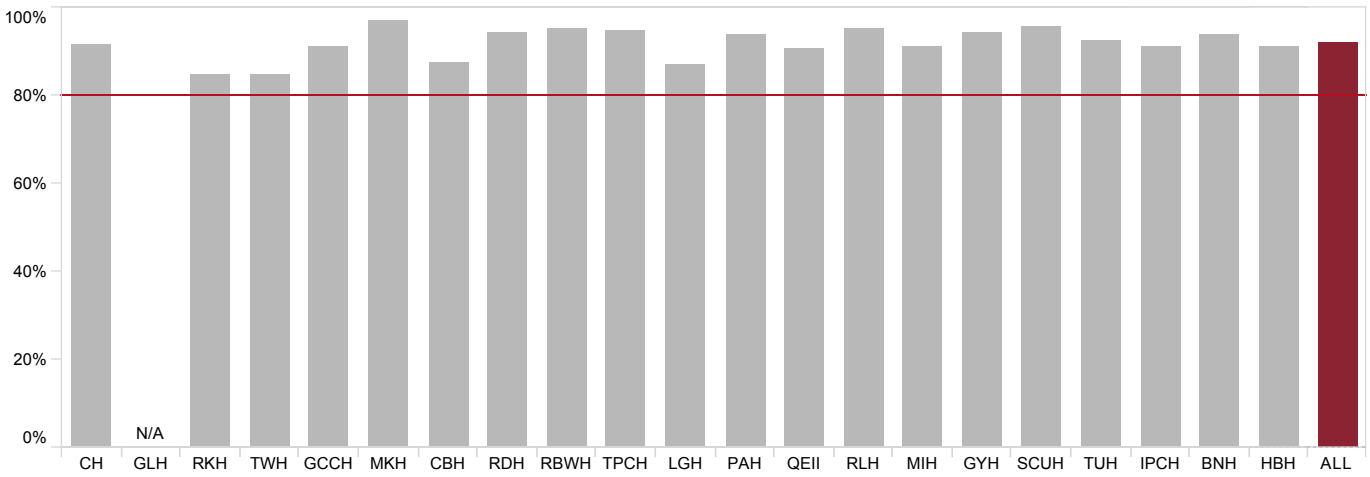
Table 19: Inclusion details for clinical indicator 3a: Inpatients on ACEI, ARB or ARNI at time of hospital discharge

	n	%
Eligible for analysis	2,820	
Achieved benchmark	2,585	91.7
Benchmark not achieved	235	8.3
Ineligible		
Documented contraindication*	166	
Incomplete data	2	
Total inpatient referrals analysed	**2,988**	

* Adverse reaction to ACEI/ARB or ARNI, palliative intent to treatment, pregnancy, eGFR <30mL/min/1.73m², severe aortic stenosis, renal artery stenosis, serum potassium >5.5 mmol/L, symptomatic hypotension

3b ACEI, ARB or ARNI prescription for HFrEF at time of first HFSS clinical review

At the time of first clinical review, the target for prescription of ACEI, ARB or ARNI was met for 92% of eligible patients.



N/A: Eligible referrals <20

Figure 12: Proportion of patients on ACEI, ARB or ARNI at time of first clinical review by site

Table 20: Inclusion details for clinical indicator 3b: Patients on ACEI, ARB or ARNI at first clinical review

	n	%
Eligible for analysis	3,359	
Achieved benchmark	3,089	92.0
Benchmark not achieved	270	8.0
Ineligible		
Documented contraindication*	149	
Incomplete data	13	
Total referrals analysed	**3,521**	

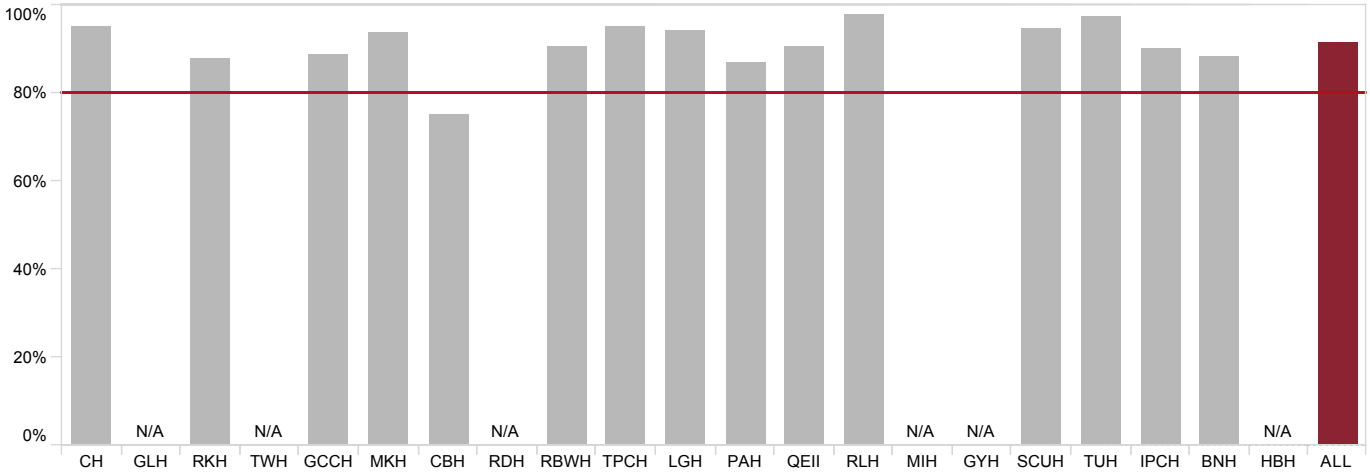
* Adverse reaction to ACEI/ARB or ARNI, palliative intent to treatment, pregnancy, eGFR <30mL/min/1.73m², severe aortic stenosis, renal artery stenosis, serum potassium >5.5 mmol/L, symptomatic hypotension

6.4 Prescription of guideline recommended beta blockers for HFrEF

Guideline recommended beta blockers have been shown to reduce mortality and morbidity in patients with HFrEF and are recommended for all patients unless contraindicated or not tolerated.[35,36] Guideline recommended beta blockers include bisoprolol, carvedilol, metoprolol sustained release or nebivolol. Results pertain only to these beta blocker medications.

4a Beta blocker prescription for HFrEF at time of hospital discharge

At hospital discharge, 92% of eligible patients were prescribed guideline recommended beta blockers.



N/A: Eligible referrals <20

Figure 13: Proportion of patients on guideline recommended beta blocker at hospital discharge by site

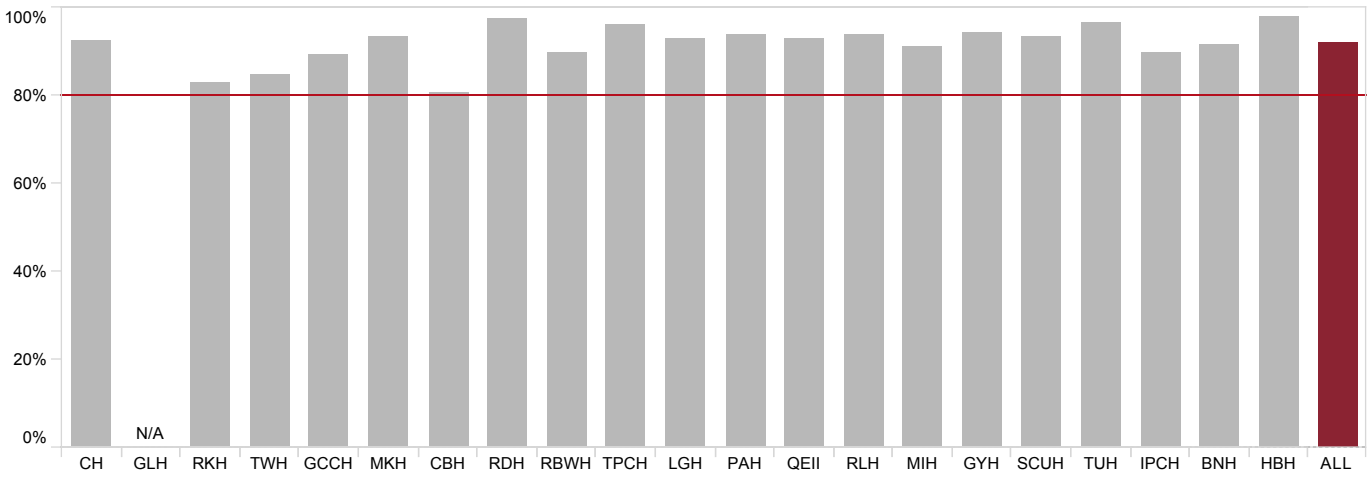
Table 21: Inclusion details for clinical indicator 4a: Patients on guideline recommended beta blocker at hospital discharge

	n	%
Eligible for analysis	2,912	
Achieved benchmark	2,667	91.6
Benchmark not achieved	245	8.4
Ineligible		
Documented contraindication*	74	
Incomplete data	2	
Total inpatient referrals analysed	**2,988**	

* Adverse reaction to beta blocker, palliative intent to treatment, pregnancy, bradycardia (HR <50bpm), symptomatic hypotension, severe COPD, asthma/reversible airways disease

4b Beta blocker prescription for HFREF at time of first HFSS clinical review

At the first clinical review, 92% of eligible referrals to HFSS were reported to be on a guideline recommended beta blocker.



N/A: Eligible referrals <20

Figure 14: Proportion of patients on guideline recommended beta blocker therapy at first clinical review by site

Table 22: Inclusion details for clinical indicator 4b: Patients on guideline recommended beta blocker at first clinical review

	n	%
Eligible for analysis	3,440	
Achieved benchmark	3,156	91.7
Benchmark not achieved	284	8.3
Ineligible		
Documented contraindication*	68	
Incomplete data	13	
Total referrals analysed	**3,521**	

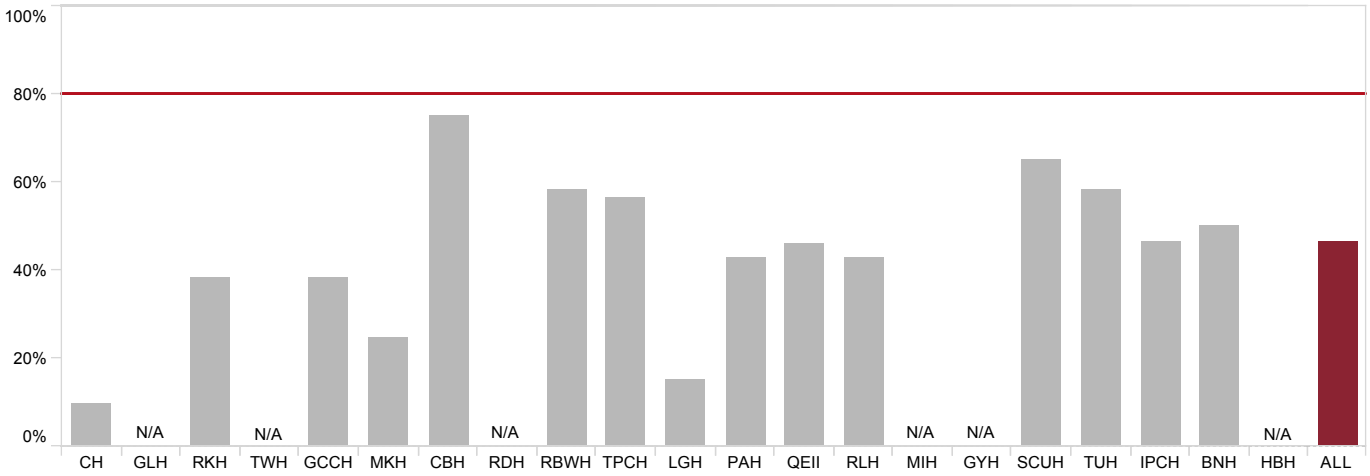
* Adverse reaction to beta blocker, palliative intent to treatment, pregnancy, bradycardia (HR <50bpm), symptomatic hypotension, severe COPD, asthma/reversible airways disease

6.5 Prescription of mineralocorticoid receptor antagonists (MRA) for patients with HFrEF

Guideline recommended mineralocorticoid receptor antagonists have been shown to reduce mortality and morbidity in patients with HFrEF and are recommended for all patients unless contraindicated or not tolerated.[35, 36] Guideline recommended MRAs include eplerenone and spironolactone. All sites were below the benchmark.

5a Prescription of MRA for HFrEF at time of hospital discharge

At the time of discharge from hospital, 46% of eligible patients referred to an HFSS were prescribed an MRA.



N/A: Eligible referrals <20

Figure 15: Proportion of patients on guideline recommended MRA at hospital discharge by site

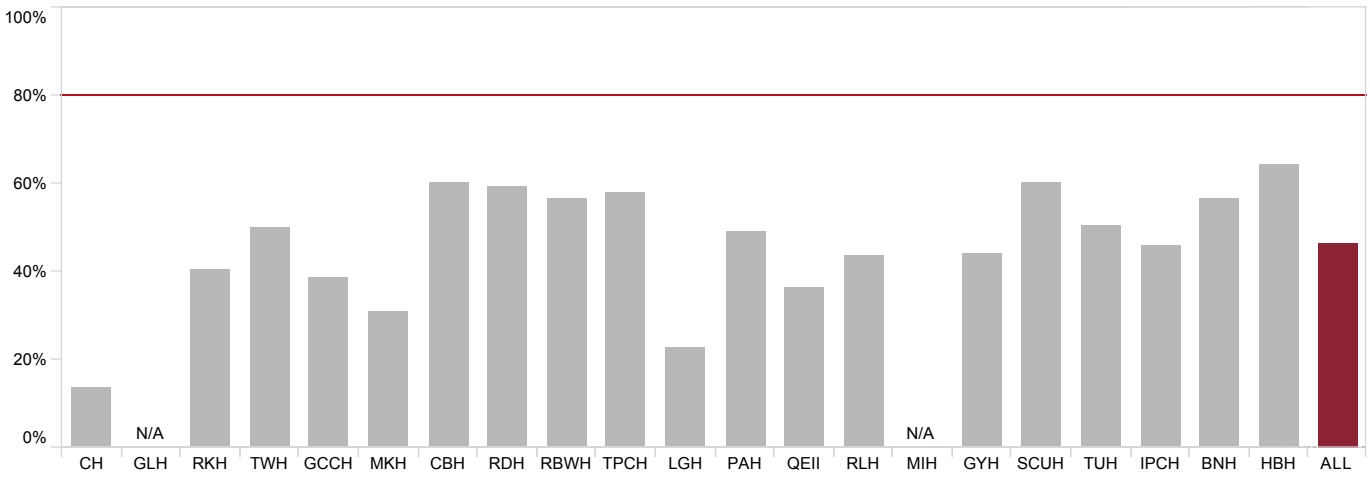
Table 23: Inclusion details for clinical indicator 5a: Patients on guideline recommended MRA at hospital discharge

	n	%
Eligible for analysis	2,664	
Achieved benchmark	1,234	46.3
Benchmark not achieved	1,430	53.7
Ineligible		
Documented contraindication*	322	
Missing data	2	
Total inpatient referrals analysed	**2,988**	

* Adverse reaction to MRA, palliative intent to treatment, serum potassium >5 mmol/L, pregnancy, eGFR <30mL/min/1.73m², previous gynaecomastia, Addison's disease, symptomatic hypotension or LVEF returned to >50%

5b Prescription of MRA for HFREF at time of first HFSS clinical review

At the time of first clinical review, 46% of eligible referrals to an HFSS were reported to be on a guideline recommended MRA. All sites were below the benchmark.



N/A: Eligible referrals <20

Figure 16: Proportion of patients on guideline recommended MRA at first clinical review site

Table 24: Inclusion details for clinical indicator 5b: Patients on guideline recommended MRA at first clinical review

	n	%
Eligible for analysis	3,138	
Achieved benchmark	1,452	46.3
Benchmark not achieved	1,686	53.7
Ineligible		
Documented contraindication*	370	
Missing data	13	
Total referrals analysed	**3,521**	

* Adverse reaction to MRA, palliative intent to treatment, serum potassium >5 mmol/L, pregnancy, eGFR <30mL/min/1.73m², previous gynaecomastia, Addison's disease, symptomatic hypotension or LVEF returned to >50%

6.6 Beta blocker titration

This indicator looks at the progress of titration of guideline recommended beta blockers at six months following hospital discharge or when deactivated from the HFSS, whichever is sooner. The timeframe is taken from the first clinical review by HFSS (usually at four weeks from referral or hospital discharge).

The indicator measures three components of beta blocker titration at six months, including:

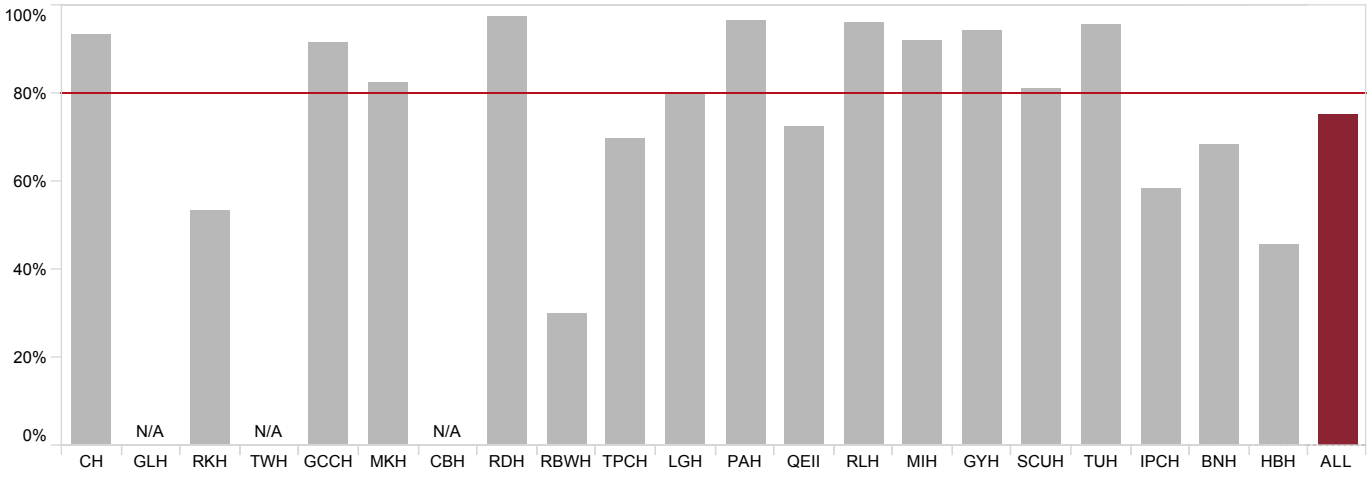
a) Review of titration status undertaken,

b) Achievement of target dose, and

c) Achievement of target or maximum tolerated dose.

6a Beta blocker titration review conducted within six months of first HFSS clinical review

At six months from referral or at the time of deactivation from the HFSS (whichever was sooner), 75% of patients received a beta blocker titration review which is below the benchmark. Variation in performance amongst services was observed and is demonstrated in the figure below.



N/A: Eligible referrals <20

Figure 17: Proportion of patients who had a beta blocker titration review conducted within six months by site

Table 25: Inclusion details for clinical indicator 6a: Patients who had a beta blocker titration review within six months

	n	%
Eligible for analysis	1,783	
Achieved benchmark	1,336	74.9
Benchmark not achieved	447	25.1
Ineligible	1,515	
Patient on target dose at the time of referral	784	
Patient could not be contacted, lives out of area or repeated failure to attend	139	
Patient declined service	115	
Referred to another HFSS	94	
HF no longer prime issue (palliative care, high care nursing home etc.)	70	
Patient deceased	59	
Medical follow-up only (GP, private or public physician)	48	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	30	
Documented contraindication*	26	
Patient on max tolerated dose	7	
Other reason	143	
Missing data	14	
Total analysed	**3,312**	

* Adverse reaction to beta blocker, palliative intent to treatment, pregnancy, bradycardia (HR <50bpm), symptomatic hypotension, severe COPD, asthma/reversible airways disease

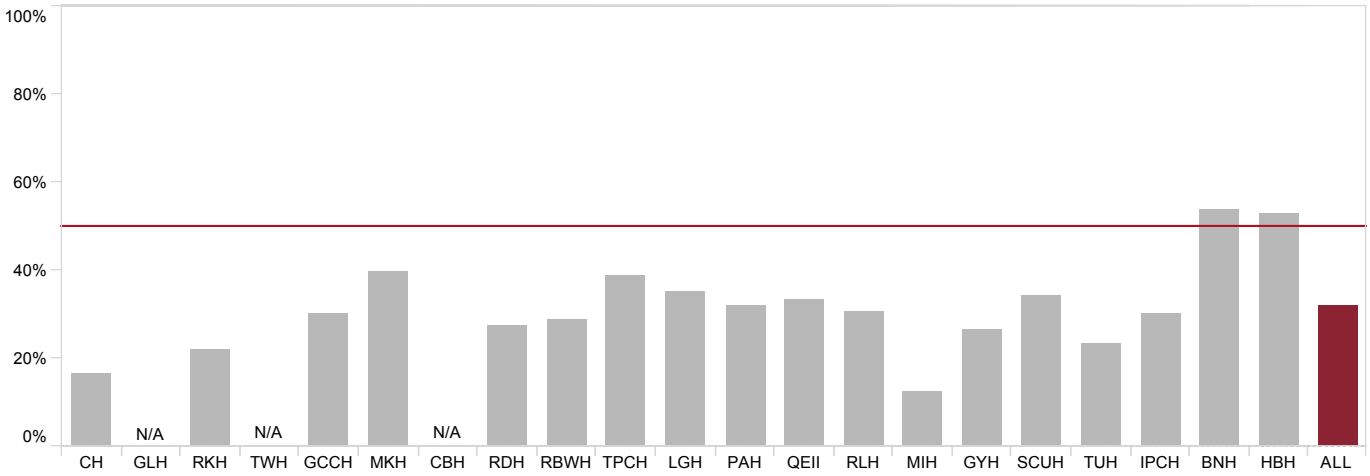
6b Beta blocker clinical guideline target dose achieved at time of titration review

The benchmark for target dose beta blocker titration was set lower than the other indicators at 50%. This lower benchmark is to accommodate differences in patients recruited to clinical trials compared to patients presenting in clinical practice who are older with more comorbidities.

Guideline recommended target dose was achieved for 32% of referrals within six months or at deactivation, with only two sites exceeding the benchmark (see Figure 18).

Daily target doses are:

- Carvedilol 50–100 mg
- Metoprolol sustained release 190 mg
- Bisoprolol 10 mg
- Nebivolol 10 mg



N/A: Eligible referrals <20

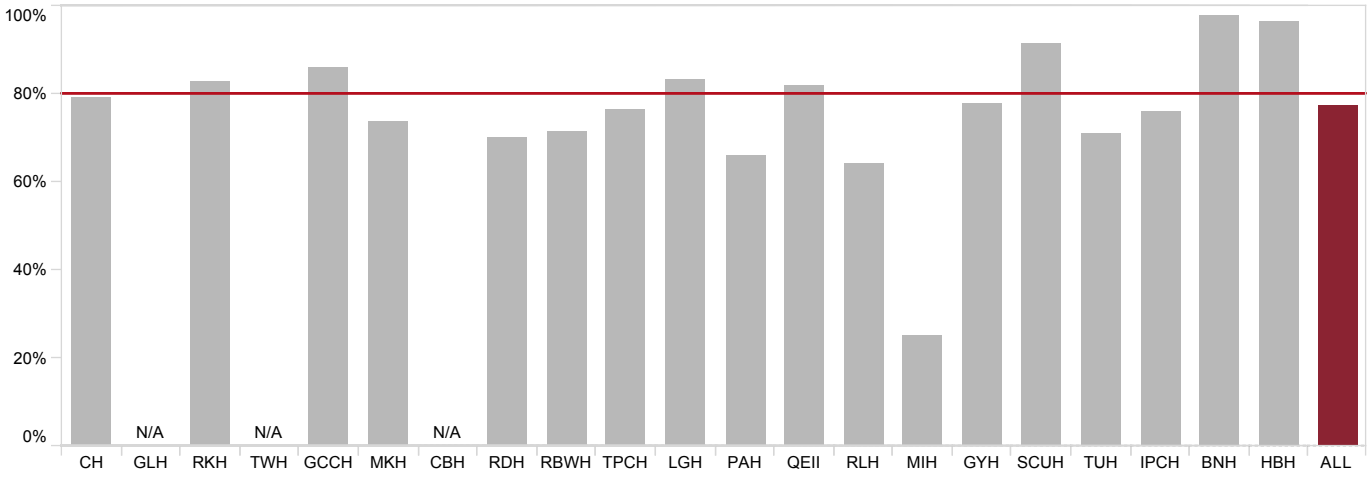
Figure 18: Proportion of patients who achieved target beta blocker dose at time of titration review by site

Table 26: Inclusion details for clinical indicator 6b: Patients who achieved target beta blocker dose at time of titration review

	n	%
Eligible for analysis	1,783	
Achieved benchmark	571	32.0
Benchmark not achieved	1,212	68.0
Ineligible	N/A	
Total titration reviews conducted	**1,783**	

6c Beta blocker titration clinical guideline target or maximum tolerated dose achieved at time of titration review

Maximum tolerated dose of beta blockers is based on a clinical judgement balancing the harm and benefit of up-titration. The number of patients reaching the target dose or maximum tolerated dose of guideline recommended beta blocker medication by the time of the titration review was 77% (below the 80% benchmark).



N/A: Eligible referrals <20

Figure 19: Proportion of patients who achieved target beta blocker dose or maximum tolerated dose at time of titration review

Table 27: Inclusion details for clinical indicator 6c: Patients who achieved target or maximum tolerated beta blocker dose at time of titration review

	n	%
Eligible for analysis	1,783	
Achieved benchmark	1,376	77.2
Benchmark not achieved	407	22.8
Ineligible	N/A	
Total titration reviews conducted	**1,783**	

6.7 Summary of clinical indicators

Table 28: Summary of clinical process indicator performance by site

	Clinical indicator achievement (%)											
HFSS	**1a**	**1b**	**2**	**3a**	**3b**	**4a**	**4b**	**5a**	**5b**	**6a**	**6b**	**6c**
Cairns Hospital	90	88	99	93	91	95	92	10	14	93	16	79
Gladstone Hospital	–	–	–	–	–	–	–	–	–	–	–	–
Rockhampton Hospital	65	81	97	84	85	88	83	38	41	53	22	83
Toowoomba Hospital	–	71	86	–	85	–	85	–	50	–	–	–
Gold Coast Community Health	91	93	95	89	91	89	89	38	39	91	30	86
Mackay Base Hospital	41	90	98	98	97	94	93	24	31	82	40	74
Caboolture Hospital	44	81	96	100	87	75	81	75	60	–	–	–
Redcliffe Hospital	81	75	96	–	94	–	97	–	59	98	28	70
Royal Brisbane & Women's Hospital	69	91	98	95	95	91	90	58	56	30	29	72
The Prince Charles Hospital	69	62	95	93	94	95	96	56	58	70	39	77
Logan Hospital	96	97	97	83	87	94	93	15	23	80	35	83
Princess Alexandra Hospital	88	40	98	94	94	87	94	43	49	96	32	66
Queen Elizabeth II Hospital	83	94	96	90	91	90	93	46	37	72	33	82
Redland Hospital	100	99	96	97	95	98	93	43	44	96	31	64
Mt Isa Hospital	–	66	83	–	91	–	91	–	–	92	13	25
Gympie Hospital	94	100	95	–	94	–	94	–	44	94	27	78
Sunshine Coast University Hospital	89	44	99	95	96	95	93	65	60	81	34	91
Townsville Hospital	99	100	99	91	92	97	96	58	50	96	23	71
Ipswich Community Health	73	90	94	88	91	90	90	46	46	58	30	76
Bundaberg Hospital	77	87	98	92	94	88	91	50	56	68	54	98
Hervey Bay Hospital	–	98	98	–	91	–	98	–	64	46	53	96
Statewide	**80**	**84**	**96**	**92**	**92**	**92**	**92**	**46**	**46**	**75**	**32**	**77**

Legend:

1a Follow-up of acute patients within two weeks (Benchmark: 80%)

1b Follow-up of non acute patients within four weeks (Benchmark: 80%)

2 Assessment of left ventricular ejection fraction within two years (Benchmark: 80%)

3a ACEI, ARB or ARNI prescription at hospital discharge (Benchmark: 80%)

3b ACEI, ARB or ARNI prescription at first clinical review (Benchmark: 80%)

4a Guideline recommended beta blocker prescription at hospital discharge (Benchmark: 80%)

4b Guideline recommended beta blocker prescription at first clinical review (Benchmark: 80%)

5a Guideline recommended MRA prescription at hospital discharge (Benchmark: 80%)

5b Guideline recommended MRA prescription at first clinical review (Benchmark: 80%)

6a Beta blocker titration status review at six months post referral (Benchmark: 80%)

6b Beta blockers achievement of guideline recommended target dose (Benchmark: 50%)

6c Beta blockers achievement of guideline recommended target dose or maximum tolerated dose (Benchmark: 80%)

7 Patient outcomes

Chronic heart failure is associated with recurrent hospitalisation and increased mortality. Support from multidisciplinary HF disease management programmes (such as an HFSS) and adherence to recommended therapies are associated with improved outcomes.

7.1 Methods

This analysis used the previously reported 2019 patient cohort to examine the early (30 day) and one year clinical outcomes (rehospitalisation and mortality) among patients referred to HFSS. This was performed using data linkage with the Queensland Hospital Admitted Patient Data Collection (QHAPDC) and Queensland Registry of Births, Deaths and Marriages.

For this report, only HFSS referrals initiated during an inpatient encounter for 2019 were included. The earliest admission of the calendar year was considered the index admission (which may not be the first time that a patient has been hospitalised with heart failure).

Eligibility criteria for the mortality and readmission analysis cohort were applied at the time of the index admission. The eligibility status for days alive and out of hospital (DAOH) analysis was reviewed at all subsequent admissions over 12 months to exclude patients who were transferred to private hospitals or interstate.

The patient outcome indicators of interest are summarised in Table 28. Survival curves were constructed using the Kaplan–Meier method and cumulative incidence function was used to estimate the risk of all-cause and HF-related rehospitalisation to account for the competing risk of death.

DAOH was calculated to reflect the burden of recurrent hospitalisation, hospital length of stay and death, and was expressed as both median values, interquartile range, and mean values. Categorical variables were summarised as frequencies and percentages.

Table 29: Patient outcome indicators

Indicator #	Measure
1	All-cause mortality within one year after index hospitalisation discharge
2	Rehospitalisation within one year after index hospitalisation discharge a) All-cause rehospitalisation b) Heart failure rehospitalisation*
3	Composite of all-cause hospitalisation or all-cause mortality within one year after index hospitalisation discharge
4	Days alive and out of hospital within one year of index hospital discharge date

* ICD10AM codes: E87.7, I13.0, I13.2, I25.5, I42.0, I42.1, I42.2, I42.5, I42.6, I42.7, I42.8, I42.9, I46.0, I46.1, I46.9, I50, J81, J90, R18, R57.0, R60.1

7.2 Findings

There were 3,490 inpatient referrals of which 96% were successfully linked with the QHAPDC data. There were 339 patients who were ineligible for readmission and mortality analysis for the reasons shown in Table 30. A further 37 patients (1%) did not have complete follow up over one year to allow DAOH to be calculated.

Table 30: Eligibility criteria for patient outcome indicators

	n	%
Total 2019 inpatient referrals	**3,490**	**100.0**
Ineligible at index admission		
Duplicate patient record	155	4.4
Died during index admission	29	0.8
Not a Queensland resident	81	2.3
Transferred to private hospital	31	0.9
Index admission is not overnight	21	0.6
No linkage data available	125	3.6
Included in readmission and mortality analysis	**3,048**	**87.3**
Ineligible at subsequent admission over 1 year		
Transferred to private hospital	35	1.0
Moved outside of Queensland	2	<0.1
Included in days alive and out of hospital analysis	**3,011**	**86.3**

7.2.1 All-cause mortality

Among patients referred to HFSS during an inpatient encounter, the 30 day and one year unadjusted all-cause mortality rates were 1.4% and 13.4%. The Kaplan-Meier survival analyses below (Figures 20 to 22) suggest that older age was associated with increased mortality rates at all time points and particularly at 12 months.

Table 31: Cumulative all-cause unadjusted mortality rate from 30 to 365 days after discharge

	30 days n (%)	90 days n (%)	180 days n (%)	365 days n (%)
Total deaths identified	44 (1.4)	130 (4.3)	223 (7.3)	408 (13.4)
Died during subsequent admission*	26 (0.9)	85 (2.8)	140 (4.6)	244 (8.0)
All other deaths	18 (0.6)	45 (1.5)	83 (2.7)	164 (5.4)
Total at risk	**3,004 (98.6)**	**2,918 (95.7)**	**2,825 (92.7)**	**2,640 (86.6)**

* Data available for Queensland public hospitals only

Table 32: Cumulative all-cause unadjusted mortality by patient characteristic

Characteristic	Total patients n	30 days n (%)	90 days n (%)	180 days n (%)	365 days n (%)
Gender					
Male	2,047	31 (1.5)	85 (4.2)	138 (6.7)	276 (13.5)
Female	1,001	13 (1.3)	45 (4.5)	85 (8.5)	132 (13.2)
Age group					
<65 years	1,129	9 (0.8)	25 (2.2)	43 (3.8)	74 (6.6)
65–74 years	776	13 (1.7)	28 (3.6)	42 (5.4)	89 (11.5)
≥75 years	1,143	22 (1.9)	77 (6.7)	138 (12.1)	245 (21.4)
Heart failure phenotype					
HFrEF	2,425	34 (1.4)	87 (3.6)	150 (6.2)	279 (11.5)
HFpEF	569	9 (1.6)	37 (6.5)	64 (11.2)	113 (19.9)
Missing/unsure	54	1 (1.9)	6 (11.1)	9 (16.7)	16 (29.6)
ALL	**3,048**	**44 (1.4)**	**130 (4.3)**	**223 (7.3)**	**408 (13.4)**

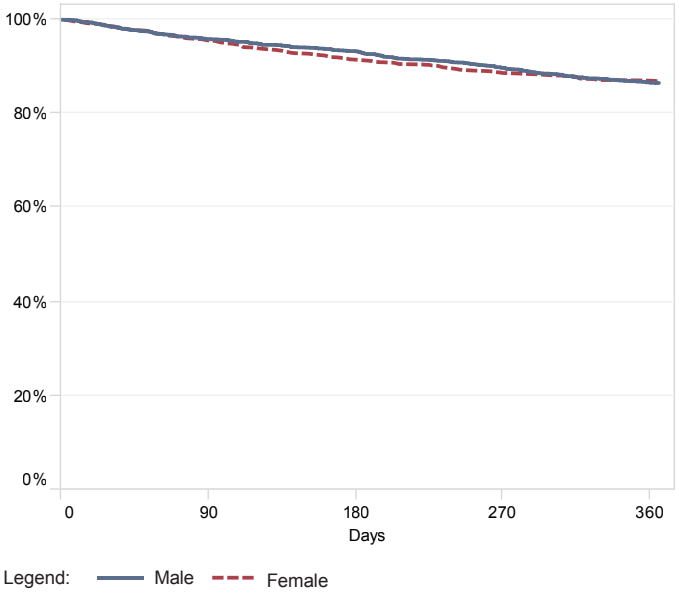


Figure 20: Heart failure survival by gender

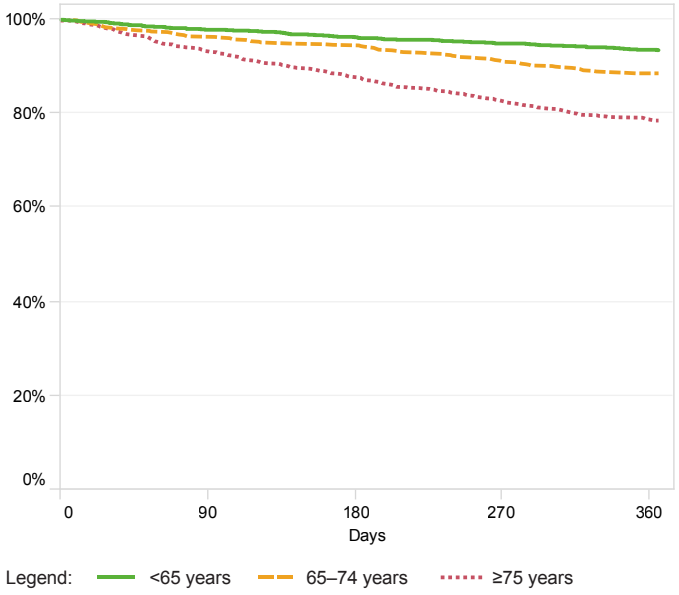


Figure 21: Heart failure survival by age group

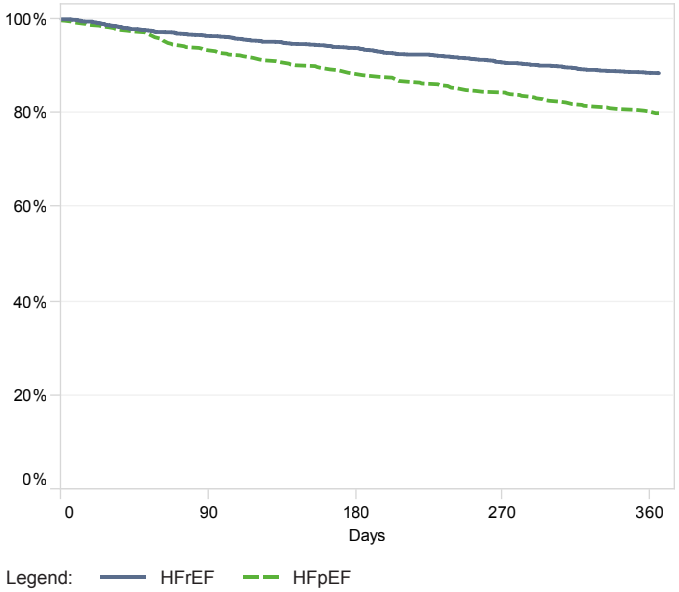


Figure 22: Heart failure survival by phenotype

7.2.2 All-cause and heart failure rehospitalisation

Cumulative incidence curves for all-cause and HF hospitalisation are shown in Figures 23 and 24. Of the 3,490 eligible patients referred to HFSS during 2019, the unadjusted rate of all-cause hospitalisation was 18.1% at 30 days, increasing to 53.9% at one year. Hospitalisations relating to HF (as identified by discharge diagnosis coding) were 5.7% and 22.0% at 30 days and one year respectively.

The overall risk of hospitalisation or death within 12 months post the index admission was 55.0% (Figure 25). Almost a third of patients referred to an HFSS were rehospitalised at least twice in the subsequent 12 months (Table 33).

Table 33: Number of rehospitalisations per patient in the year post initial discharge

Total in one year	All-cause n (%)	Heart failure n (%)
0	1,443 (47.3)	2,429 (79.7)
1	727 (23.9)	404 (13.3)
2	385 (12.6)	127 (4.2)
3	212 (7.0)	53 (1.7)
4	103 (3.4)	16 (0.5)
≥5	178 (5.8)	19 (0.6)

Table 34: Cumulative incidence of all-cause rehospitalisation from 30 to 365 days post discharge

Characteristic	Total patients n	30 days n (%)	90 days n (%)	180 days n (%)	365 days n (%)
Gender					
Male	2,047	367 (18.0)	629 (31.0)	823 (40.7)	1,035 (51.8)
Female	1,001	182 (18.3)	329 (33.2)	443 (45.1)	570 (58.2)
Age group					
<65 years	1,129	182 (16.2)	304 (27.1)	391 (34.9)	487 (43.8)
65–74 years	776	138 (17.9)	237 (30.9)	310 (40.5)	392 (51.6)
≥75 years	1,143	229 (20.1)	417 (36.9)	565 (50.5)	726 (65.7)
Heart failure phenotype					
HFrEF	2,425	415 (17.2)	709 (29.5)	935 (39.0)	1,176 (49.5)
HFpEF	569	121 (21.4)	225 (40.0)	302 (54.1)	391 (70.7)
Missing/unsure	54	13 (24.1)	24 (46.2)	29 (56.9)	38 (76.0)
ALL	**3,048**	**549 (18.1)**	**958 (31.7)**	**1,266 (42.1)**	**1,605 (53.9)**

Table 35: Cumulative incidence of heart failure rehospitalisation from 30 to 365 days post discharge

Characteristic	Total patients n	30 days n (%)	90 days n (%)	180 days n (%)	365 days n (%)
Gender					
Male	2,047	117 (5.8)	218 (10.9)	300 (15.3)	405 (21.4)
Female	1,001	54 (5.5)	105 (10.8)	156 (16.5)	214 (23.2)
Age group					
<65 years	1,129	48 (4.3)	93 (8.3)	127 (11.5)	173 (16.0)
65–74 years	776	42 (5.5)	79 (10.4)	116 (15.4)	155 (21.3)
≥75 years	1,143	81 (7.2)	151 (13.8)	213 (20.1)	291 (28.9)
Heart failure phenotype					
HFrEF	2,425	132 (5.5)	240 (10.1)	329 (14.1)	438 (19.3)
HFpEF	569	36 (6.4)	78 (14.3)	121 (22.7)	172 (33.9)
Missing/unsure	54	3 (5.6)	5 (10.2)	6 (13.0)	9 (23.1)
ALL	**3,048**	**171 (5.7)**	**323 (10.9)**	**456 (15.6)**	**619 (22.0)**

Table 36: Cumulative incidence of all-cause rehospitalisation or death from 30 to 365 days post discharge

Characteristic	Total patients n	30 days n (%)	90 days n (%)	180 days n (%)	365 days n (%)
Gender					
Male	2,047	377 (18.4)	646 (31.6)	848 (41.4)	1,084 (53.0)
Female	1,001	188 (18.8)	340 (34.0)	461 (46.1)	592 (59.1)
Age group					
<65 years	1,129	186 (16.5)	310 (27.5)	400 (35.4)	503 (44.6)
65–74 years	776	144 (18.6)	245 (31.6)	320 (41.2)	409 (52.7)
≥75 years	1,143	235 (20.6)	431 (37.7)	589 (51.5)	764 (66.8)
Heart failure phenotype					
HFrEF	2,425	428 (17.6)	728 (30.0)	964 (39.8)	1,227 (50.6)
HFpEF	569	124 (21.8)	232 (40.8)	313 (55.0)	407 (71.5)
Missing/unsure	54	13 (24.1)	26 (48.1)	32 (59.3)	42 (77.8)
ALL	**3,048**	**565 (18.5)**	**986 (32.3)**	**1,309 (42.9)**	**1,676 (55.0)**

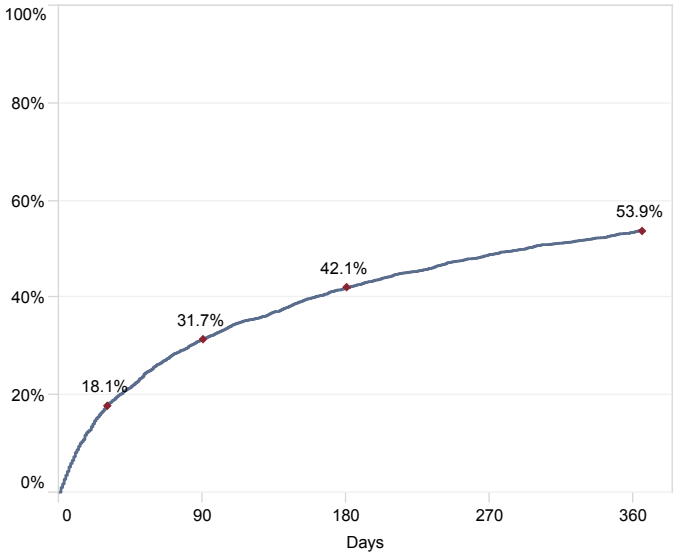


Figure 23: Cumulative incidence of all-cause rehospitalisation

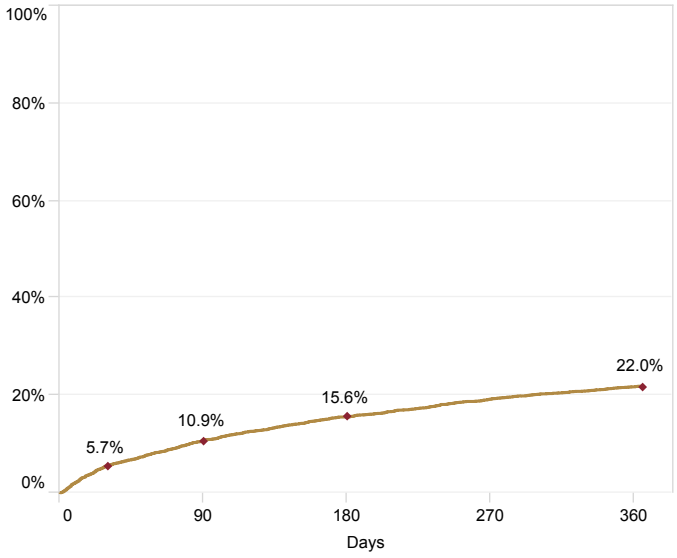


Figure 24: Cumulative incidence of heart failure rehospitalisation

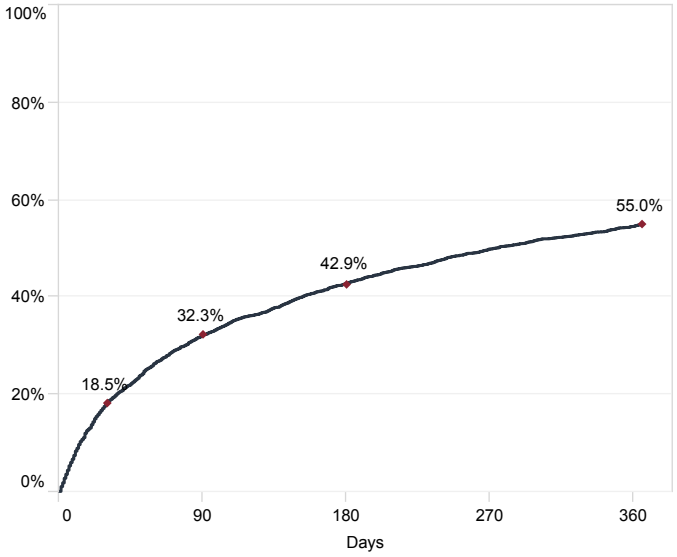


Figure 25: Cumulative incidence of all-cause rehospitalisation or death

7.2.3 Days alive and out of hospital

Days alive and out of hospital (DAOH) incorporates mortality and all hospitalisations (including length of hospital stay) within one year of discharge. This single measure demonstrates the post discharge time alive and not in hospital as a combined measure.

Almost 46% of patients survived more than a year without rehospitalisation, with a median of 364 days for the whole group. The mean days alive and out of hospital was 329.7, which equates to over 105,000 days lost due to death or hospitalisation over 12 months in 3,011 patients.

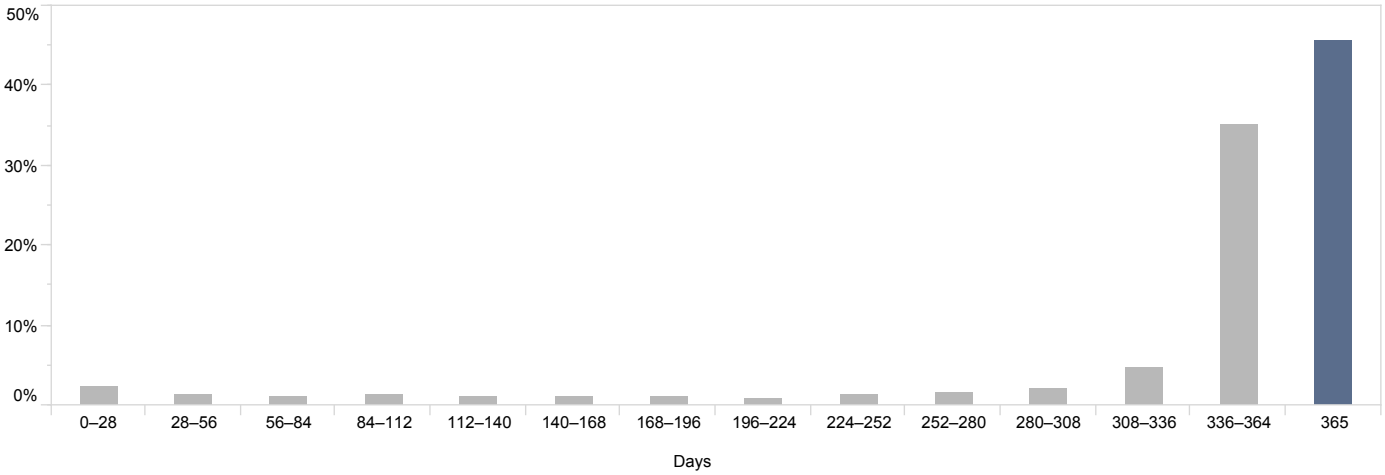
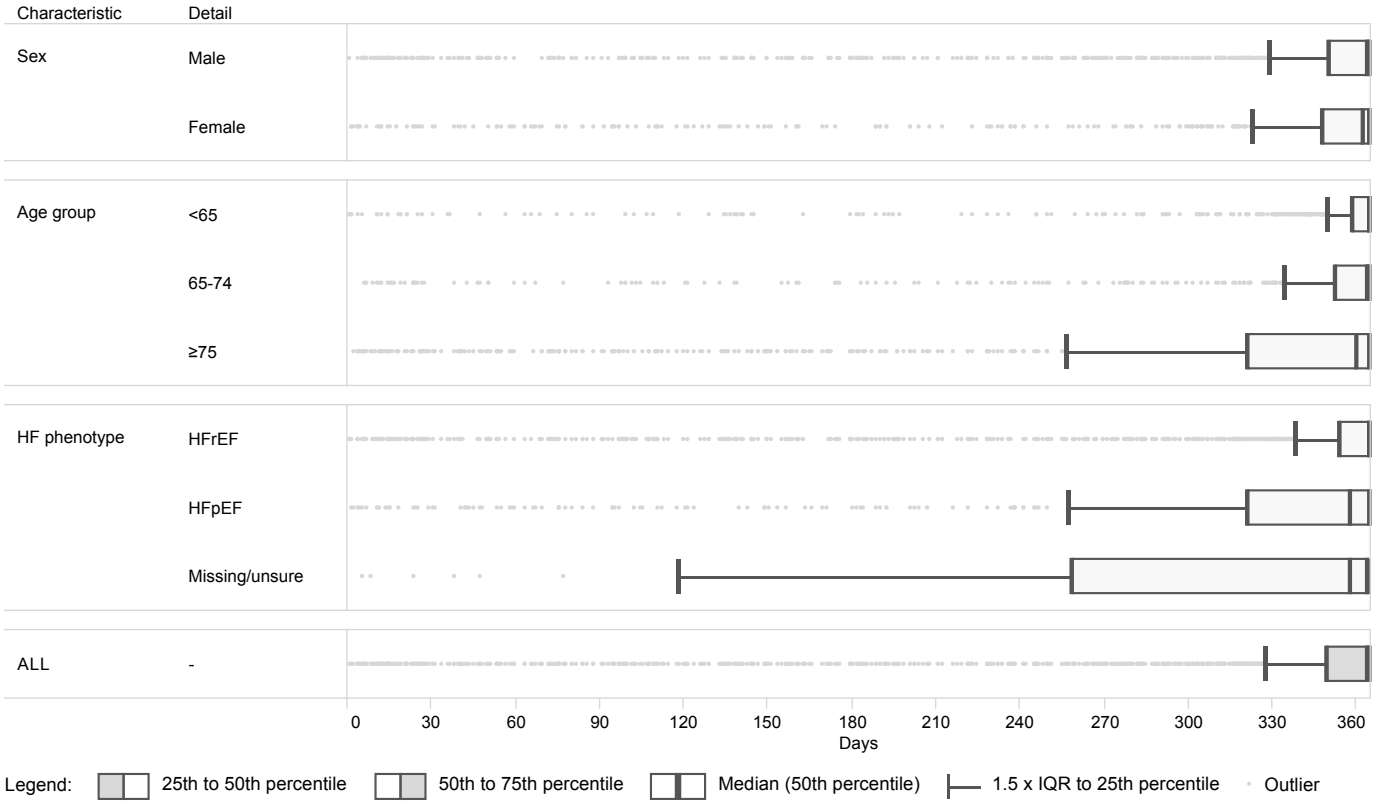


Figure 26: Days alive and out of hospital within one year after hospital discharge.

Table 37: Days alive and out of hospital within one year of discharge by patient characteristic

Characteristic	Detail	n	Mean	Median (IQR)
Sex	Male	2,027	330.9	364 (350–365)
	Female	984	327.2	363 (348–365)
Age group	<65	1,119	345.3	365 (359–365)
	65–74	767	334.0	364 (352–365)
	≥75	1,125	311.2	360 (321–365)
HF phenotype	HFrEF	2,403	334.5	365 (354–365)
	HFpEF	555	312.3	358 (322–365)
	Missing/unsure	53	291.5	358 (259–364)
ALL		**3,011**	**329.7**	**364 (350–365)**

The box and whisker plots in Figure 27 illustrate the distribution of DAOH for different characteristics. The median DAOH is close to 365 days for most categories (the box shows the middle 50% of scores). The whiskers stretching to the left illustrate that many patients spent subsequent time in hospital or died. The DAOH was much lower for patients who were over 75 years old.



Mean, median and interquartile range (IQR) are given in days

Figure 27: Days alive and out of hospital within one year of discharge by patient characteristic

References

Heart Failure Support Services Audit

35 Yancy, C. W., Jessup, M., Bozkurt, B., Butler, J., Casey, D.E., Drazner, M. H., … Wilkoff, B. L. (2013). ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation, 128(1), e240–e327. https://doi.org/10.1161/CIR.0b013e31829e8776.

36 Atherton, J., Branagan, M., Sindone, A., Abhayaratna, W., Driscoll, A., Pasquale, C. D., … Thomas, L. (2018). The National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand Guidelines for the Prevention, Detection, and Management of Chronic Heart Failure in Australia 2018. *Heart, Lung and Circulation, 27*(10), 1123-208. doi: 10.1016/j.hlc.2018.06.1042.

37 Atherton, J. J. and A. Hickey (2017). "Is Medication Titration in Heart Failure too Complex?" *Cardiac Failure Review 3*(1): 25-32. doi: 10.15420/cfr.2017:1:2

Glossary

6MWT	Six Minute Walk Test
ACC	Aristotle Comprehensive Complexity
ACEI	Angiotensin Converting Enzyme Inhibitor
ACP	Advanced Care Paramedic
ACS	Acute Coronary Syndromes
AEP	Accredited Exercise Physiologist
ANZCORS	Australia and New Zealand Congenital Outcomes Registry for Surgery
ANZSCTS	Australian and New Zealand Society of Cardiac and Thoracic Surgeons
AQoL	Assessment of Quality of Life
ARB	Angiotensin II Receptor Blocker
ARF	Acute Rheumatic Fever
ARNI	Angiotensin Receptor-Neprilysin Inhibitors
ASD	Atrial Septal Defect
AV	Atrioventricular
AVNRT	Atrioventricular Nodal Re-entry Tachycardia
BCIS	British Cardiovascular Intervention Society
BiV	Biventricular
BMI	Body Mass Index
BMS	Bare Metal Stent
BNH	Bundaberg Hospital
BSSLTX	Bilateral Sequential Single Lung Transplant
BVS	Bioresorbable Vascular Scaffold
CABG	Coronary Artery Bypass Graft
CAD	Coronary Artery Disease
CBH	Caboolture Hospital
CCL	Cardiac Catheter Laboratory
CCP	Critical Care Paramedic
CH	Cairns Hospital
COVID-19	Coronavirus disease 2019
CI	Clinical Indicator
CPB	Cardiopulmonary Bypass
CR	Cardiac Rehabilitation
CRT	Cardiac Resynchronisation Therapy
CS	Cardiac Surgery
CVA	Cerebrovascular Accident
DAOH	Days Alive and Out of Hospital
DES	Drug Eluting Stent
DOSA	Day of Surgery Admission
DSWI	Deep Sternal Wound Infection
ECG	12 lead Electrocardiograph
ECMO	Extracorporeal membrane oxygenation
ED	Emergency Department
eGFR	Estimated Glomerular Filtration Rate
EP	Electrophysiology
FdECG	First Diagnostic Electrocardiograph
FMC	First Medical Contact
FTR	Failure to Rescue
GAD	Generalized Anxiety Disorder
GCCH	Gold Coast Community Health
GCS	Glasgow Coma Scale
GCUH	Gold Coast University Hospital
GLH	Gladstone Hospital
GP	General Practitioner
GYH	Gympie Hospital
HBH	Hervey Bay Hospital (includes Maryborough)
HCC	Health Contact Centre
HF	Heart Failure
HFpEF	Heart Failure with Preserved Ejection Fraction
HFrEF	Heart Failure with Reduced Ejection Fraction
HFSS	Heart Failure Support Service
HHS	Hospital and Health Service
HOCM	Hypertrophic Obstructive Cardiomyopathy
HSQ	Health Support Queensland
IC	Interventional Cardiology
ICD	Implantable Cardioverter Defibrillator
IE	Infective Endocarditis
IHT	Interhospital Transfer
IPCH	Ipswich Community Health
IVDU	Intravenous Drug Use
LAA	Left Atrial Appendage
LAD	Left Anterior Descending Artery
LCX	Circumflex Artery
LGH	Logan Hospital
LOS	Length Of Stay
LV	Left Ventricle
LVEF	Left Ventricular Ejection Fraction
LVOT	Left Ventricular Outflow Tract
MBH	Mackay Base Hospital
MI	Myocardial Infarction
MIH	Mt Isa Hospital
MKH	Mackay Base Hospital
MRA	Mineralocorticoid Receptor Antagonists
MSSA	Methicillin Susceptible Staphylococcus Aureus
MTHB	Mater Adult Hospital, Brisbane
NCDR	The National Cardiovascular Data Registry

NCR	National Cardiac Registry
NCS	Networked Cardiac Services
NP	Nurse Practitioner
NRBC	Non-Red Blood Cells
NSTEMI	Non-ST Elevation Myocardial Infarction
OR	Odds Ratio
OOHCA	Out of Hospital Cardiac Arrest
ORIF	Open Reduction Internal Fixation
PAH	Princess Alexandra Hospital
PAPVD	Partial Anomalous Pulmonary Venous Drainage
PCI	Percutaneous Coronary Intervention
PDA	Patent Ductus Arteriosus
PFO	Patent Foramen Ovale
PHQ	Patient Health Questionnaire
PICU	Paediatric intensive care unit
PROMS	Patient Reported Outcome Measures
QAS	Queensland Ambulance Service
QCOR	Queensland Cardiac Outcomes Registry
QEII	Queen Elizabeth II Jubilee Hospital
QHAPDC	Queensland Hospital Admitted Patient Data Collection
RBC	Red Blood Cells
RBWH	Royal Brisbane & Women's Hospital
RCA	Right Coronary Artery
RDH	Redcliffe Hospital
RHD	Rheumatic Heart Disease
RKH	Rockhampton Hospital
RLH	Redland Hospital
SCCIU	Statewide Cardiac Clinical Informatics Unit
SCCN	Statewide Cardiac Clinical Network
SCUH	Sunshine Coast University Hospital
SHD	Structural Heart Disease
SMoCC	Self Management of Chronic Conditions
STEMI	ST-Elevation Myocardial Infarction
STS	Society of Thoracic Surgery
TAVR	Transcatheter Aortic Valve Replacement
TMVR	Transcatheter Mitral Valve Replacement
TNM	Tumour, Lymph Node, Metastases
TPCH	The Prince Charles Hospital
TPVR	Transcatheter Pulmonary Valve Replacement
TUH	Townsville University Hospital
TWH	Toowoomba Hospital
VAD	Ventricular Assist Device
VATS	Video Assisted Thoracic Surgery
VCOR	Victorian Cardiac Outcomes Registry
VF	Ventricular Fibrillation
VSD	Ventricular Septal Defect

clinicalexcellence.qld.gov.au