Statewide Cardiac Clinical Network
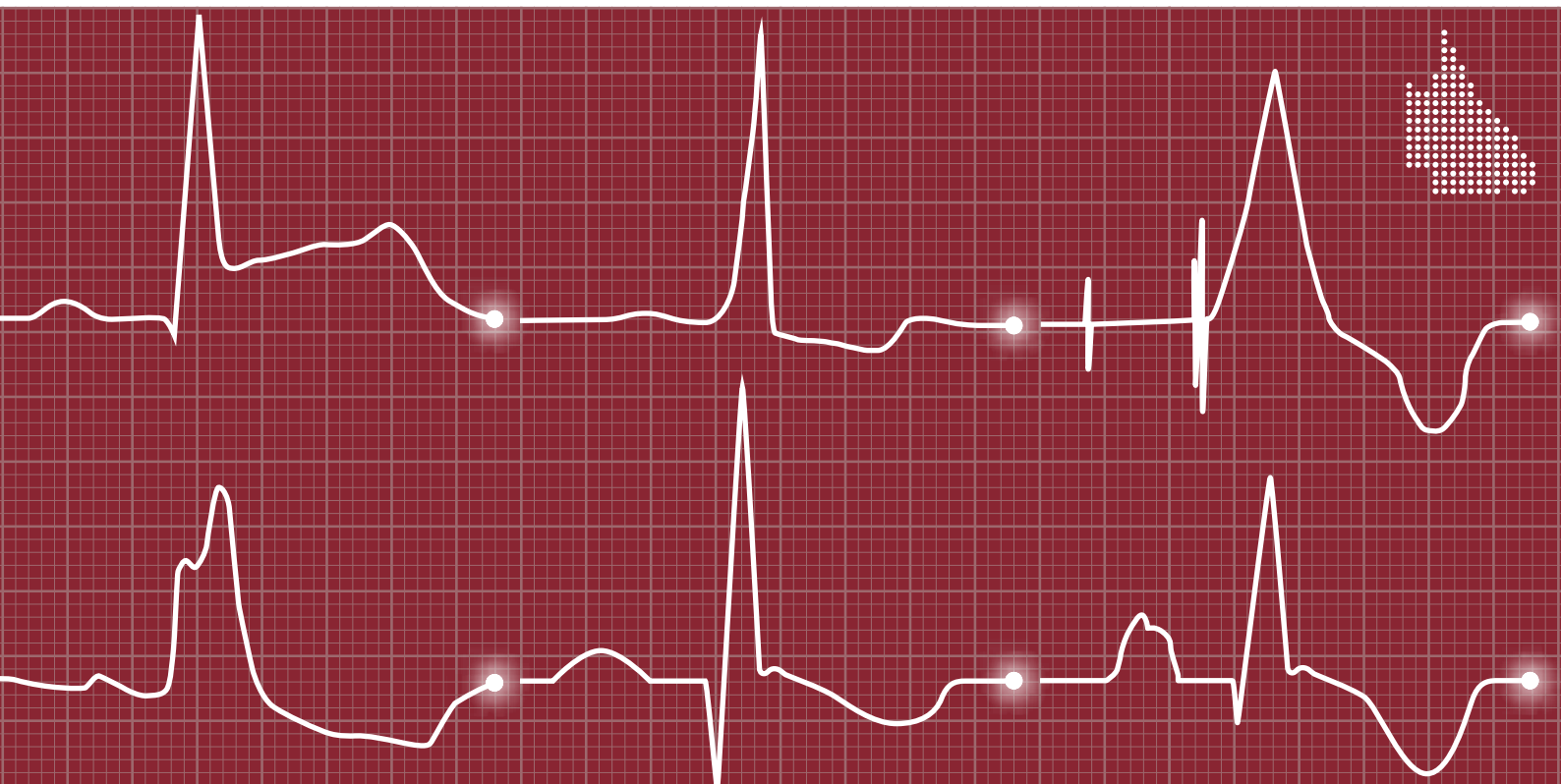## Queensland Cardiac Outcomes Registry
2019 Annual Report
Heart Failure Support Services Audit

Improvement | Transparency | Patient Safety | Clinician Leadership | Innovation

Queensland Government

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1   Message from the SCCN Chair

We are pleased to present the 2019 Queensland Cardiac Outcomes Registry (QCOR) Annual Report, which marks five years of publication. Yet again, the Report documents the world-class quality of care offered by practitioners within the Queensland public health system. The QCOR program is driven by the passion of Queensland's clinicians to not only report on the quality, performance and outcomes of cardiac services delivered to Queenslanders, but to enable and provide a comprehensive platform to directly support frontline cardiac services and be a driving force for continuous improvement. The result has been collaboration on a statewide scale, with QCOR directly supporting the efforts of hundreds of clinicians across often incredible distances.

The breadth of QCOR is highlighted by the development of a new module to support cardiac outreach services, starting with the Far North Queensland outreach unit in late 2019. Outreach services are an important part of delivering quality care to patients for whom cardiac care is less accessible, due to their remoteness from traditional facility-based services. This initial reporting will be expanded as additional units are established or come online over following years. This Report also shines a spotlight on the new partnership between QCOR and the Queensland Rheumatic Heart Disease (RHD) Registry. Despite being in its infancy, this collaboration has already led to the identification and development of specialised care plans for almost two hundred Queenslanders suffering from RHD. These are outcomes which are seldom linked to traditional research-focused registries and reflect a far greater vision at the core of this clinician-led initiative.

Clinical quality has again continued to be a focus of this report, with several new clinical indicators having been added to these audits for the new year to align with ever-changing international guidelines for the management and treatment of patients. As such, the registry continues to evolve and clinical indicators across all areas of interest will continue to be reviewed and expand accordingly over future years. It is yet again reassuring to see performance of Queensland services strong when compared to these often optimistic benchmarks and targets.

Investment in the collection of clinical data is now recognised as a valuable means of returning on investment and identifying areas of efficiency that subsequently enable cost savings and redirection of health funding to areas of need or emerging clinical technologies. QCOR data has underpinned bulk purchase arrangements and continues to demonstrate the ability to negotiate strongly with industry via commercial processes and ensure that each health funding dollar is spent wisely and carefully. Future processes now have the potential to increase in scope which will drive further financial realisation on investment that compound and grow over time.

The tireless work of Queensland cardiac clinicians and administrative staff must be recognised, not only for delivering high quality clinical outcomes but for their engagement, understanding and enthusiasm for quality clinical processes that are supported by quality data, and we look forward to future expansion that seeks to apply a similar scope and high standard of reporting to echocardiography and structural heart disease.

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

2   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 modules 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 Michael Mallouhi, Clinical Analyst
Mr Marcus Prior, Informatics Analyst	Ms Bianca Sexton, Project Manager
Dr Ian Smith, PhD, Biostatistician	Mr Karl Wortmann, Application Developer
Mr William Vollbon, Manager*	

* Principal contact officer/QCOR program lead
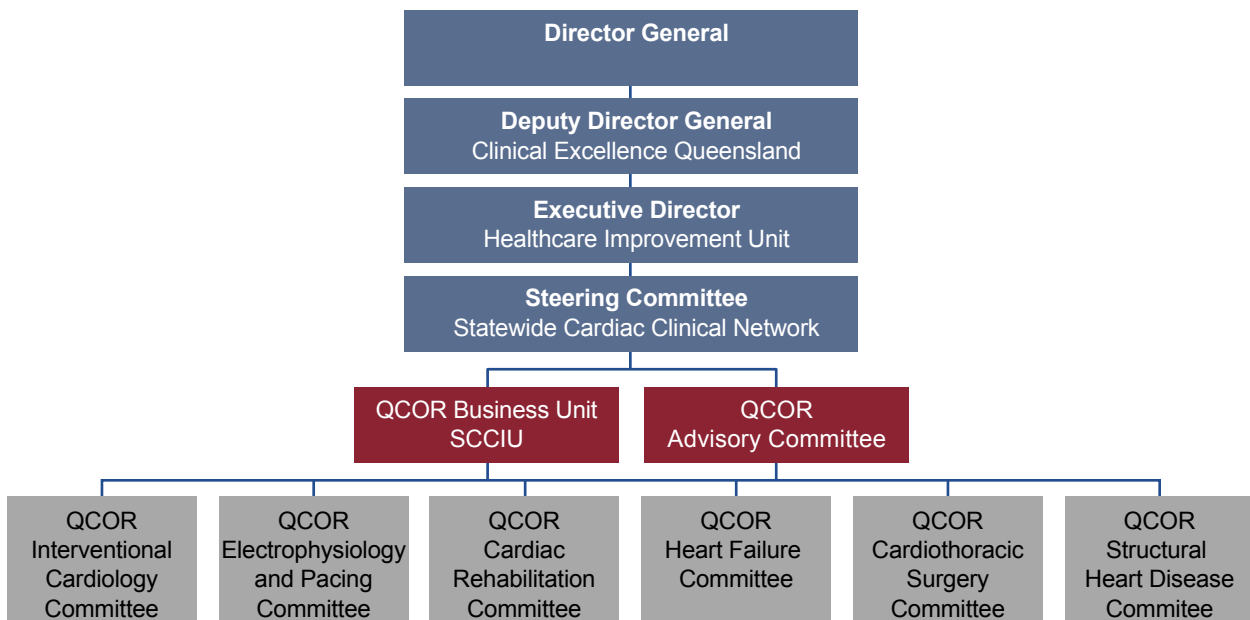
Figure 1:   Governance structure

Queensland Cardiac Outcomes Registry

The Health of Queenslanders

>5 million population

4.6%
Aboriginal and Torres Strait
Islander population*

1 in 5
Queenslanders admitted to
hospital†

13%
of deaths attributed to
coronary heart disease†

11%
hospital spending on
cardiovascular disease‡

13%
of total burden of disease
caused by
cardiovascular disease†

Comorbidities

10%
smoke daily*

21%
have measured
high blood pressure‡

4.5%
have diabetes§

2 in 3
are overweight
or obese‡

Mortality

1 in 5
of all deaths due
to cardiovascular disease||

5.8%
of all deaths due
to lung cancer||

5.4 per 1,000
mortality rate in
Queensland†

9.6 per 1,000
mortality rate for
Indigenous Queenslanders†

Figure 2:   QCOR 2019 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 Bureau of Statistics. (2019). *Deaths, Australia, 2018*. Cat. no. 3302.0. ABS: Canberra.

2019 Activity at a Glance

What's New?

Rheumatic heart disease, cardiac outreach and ECG Flash spotlights	Expanded thrombolysis for STEMI analysis
Cardiac surgery EuroSCORE II risk adjustment analysis	Cardiac surgery remoteness investigation
New timely non-acute assessments cardiac rehabilitation indicator	New mineralocorticoid antagonist prescription heart failure indicator

Interventional Cardiology
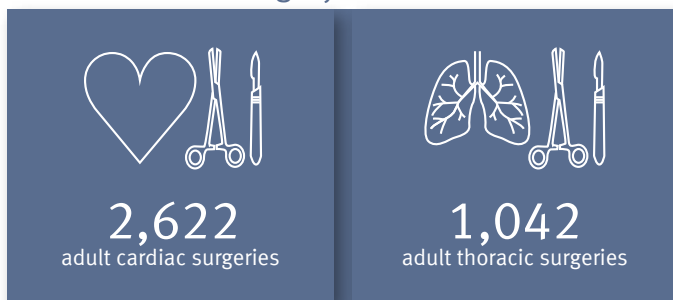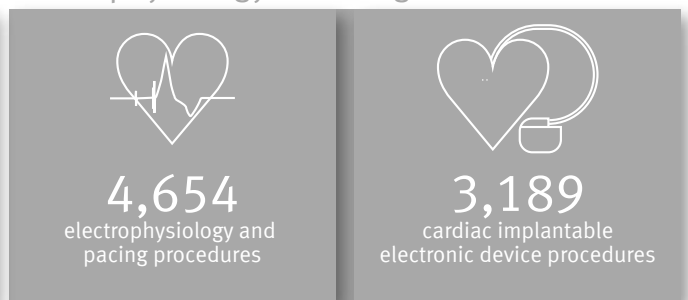
5,002 percutaneous coronary interventions

477 structural heart disease interventions

249 transcatheter aortic valve replacements

15,615 all coronary procedures

Cardiothoracic Surgery

2,622 adult cardiac surgeries

1,042 adult thoracic surgeries

Electrophysiology & Pacing

4,654 electrophysiology and pacing procedures

3,189 cardiac implantable electronic device procedures

Heart Failure Support Services

5,304 heart failure support services referrals

Cardiac Rehabilitation

11,547 cardiac rehabilitation referrals

Rheumatic Heart Disease

179 unknown RHD patients identified

Clinical Indicator Progress

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

0.3% 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

94% of cardiac rehabilitation referrals within 3 days of discharge

1.0% mortality rate for coronary artery bypass surgery at 30 days

QCOR Yearly Trends

Interventional Cardiology

15,615
cases in 2019
– up from 15,293 in 2017

5,002
PCI cases in 2019
– up from 4,867 in 2018

3 minute
improvement in median time to reperfusion
for STEMI PCI
from 2017 to 2019
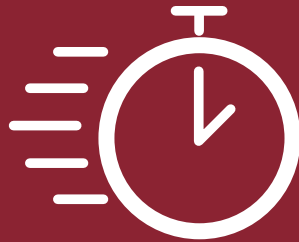
8%
increase in primary PCI cases meeting
90 minute target for timely reperfusion
– 2017 to 2019

Cardiothoracic Surgery

11%
increase in cardiac surgery cases
– 2017 to 2019

23%
increase in thoracic surgery cases
– 2018 to 2019

Electrophysiology & Pacing

4,654
cases in 2019
– up from 4,474 in 2018

22%
increase in complex EP cases
– 2018 to 2019

Outpatient Support Services

23,000+
cardiac rehabilitation referrals
– 2018 and 2019
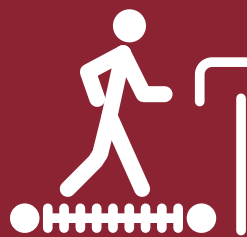
17%
increase in new heart failure
support services referrals
– 2017 to 2019

3 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
- A/Prof Richard Lim, Princess Alexandra Hospital
- Dr Rohan Poulter, Sunshine Coast University Hospital
- A/Prof Atifur Rahman, Gold Coast University Hospital
- Dr Shantisagar Vaidya, Mackay Base Hospital
- Dr Gregory Starmer, 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
- Ms Bianca Sexton
- 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

4   Executive summary

This report comprises an account for cases performed in the eight cardiac catheterisation laboratories (CCL) and nine electrophysiology and pacing (EP) facilities, along with five cardiothoracic surgery units operating across Queensland public hospitals in 2019. Referrals to the 21 heart failure support and 57 cardiac rehabilitation services for the management of heart disease have also been included in this Audit.

- 15,615 diagnostic or interventional cases were performed across the eight public CCL facilities in Queensland hospitals. Percutaneous coronary intervention (PCI) was performed in 5,002 of these cases.

- Patient outcomes following PCI remain encouraging. The 30 day mortality rate following PCI was 2.2%, and of the 108 deaths observed, 77% 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 and arrival at PCI facility to reperfusion was observed at 83 minutes and 42 minutes.

- Across the four sites with a cardiac surgery unit, a total of 2,622 cases were performed including 1,567 coronary artery bypass grafting (CABG) and 1,104 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.

- Approximately 4% of all cardiac surgical patients resided in remote or very remote Australia.

- Patients in Outer Regional and Remote/Very Remote areas were two to four times more likely to have a postoperative length of stay >14 days (Outer Regional: OR 2.02, p<0.01), Remote/Very Remote: OR 4.05, p <0.001).

- Patients residing outside of a Major City of Australia had a higher likelihood of having a length of stay <6 days (Inner Regional: OR 1.61 p=0.009, Outer Regional: OR 1.45 p=0.044).

- A total of 1,042 thoracic surgery cases were performed across the five public hospitals providing thoracic surgery services in 2019. Almost a quarter (24%) of surgeries followed a preoperative diagnosis of primary lung cancer, whereas pleural disease accounted for nearly a third of all cases (32%).

- At the nine public Electrophysiology and Pacing (EP) sites, a total of 4,654 cases were performed, which included 3,189 cardiac device procedures and 1,058 electrophysiology procedures. This year's EP Audit sees the addition of Toowoomba Hospital, which began direct entry in November 2019.

- The EP clinical indicator audit identified a median wait time of 81 days for complex ablation procedures, and 32 days for elective implantable cardioverter defibrillator (ICD) implants. Meanwhile the median wait time for a standard ablation procedure was 117 days.

- There was a total of 11,547 referrals to one of the 57 public cardiac rehabilitation (CR) services in 2019. Almost three quarters of referrals (74%) followed an admission at a public hospital in Queensland.

- The vast majority of referrals to CR were created within three days of the patient being discharged from hospital (94%), while over half of patients went on to complete an initial assessment by CR within 28 days of discharge (56%). This performance measure is consistent with the data observed in 2018.

- There were 5,304 new referrals to a heart failure support service in 2019. Clinical indicator benchmarks were achieved for timely follow-up of referrals and appropriate medication prescriptions as per clinical guidelines for all medications except mineralocorticoid receptor antagonists.

5 Cardiac Outreach Spotlight

The development and implementation of the QCOR Cardiac Outreach module is an initiative of the Statewide Cardiac Clinical Network in partnership with the Healthcare Improvement Unit and the Health Minister's 'Rapid Results Program'.

People living in rural and remote locations (such as North Queensland) and Aboriginal and Torres Strait Islander people are admitted to hospital for cardiac related conditions at two to three times the rate of the broader Queensland population*. Equitable access to health care across Queensland can be a challenge due to its vast size and dispersed population, which can require patients to travel significant distances to access cardiac care. Furthermore, due to the vast distances this patient cohort need to travel to access tertiary care, their healthcare journey is often fragmented contributing to poorer access and health outcomes. The foundation of this model is based on a coordinated approach which supports the patient journey by linking to services. Through the outreach model, patients in a remote setting can access support from a team of practitioners much closer to home including a specialist cardiologist, cardiac scientists, nurses and health workers.

As well as seeing a cardiologist for initial consultation, review or follow-up, patients attending a cardiac outreach clinic can have specialised tests such as echocardiograms and stress tests, as well as the potential for referral to tertiary care for more complex procedures. Close links with other Queensland Health outpatient services such as cardiac rehabilitation programs or heart failure support services are also an advantage of this model of care. These services are further supplemented by telehealth and remote cardiac testing capabilities.

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

* Australian Commission on Safety and Quality in Health Care (ACSQHC) and Australian Institute of Health and Welfare. (2017). The second Australian atlas of healthcare variation. Sydney: ACSQHC.
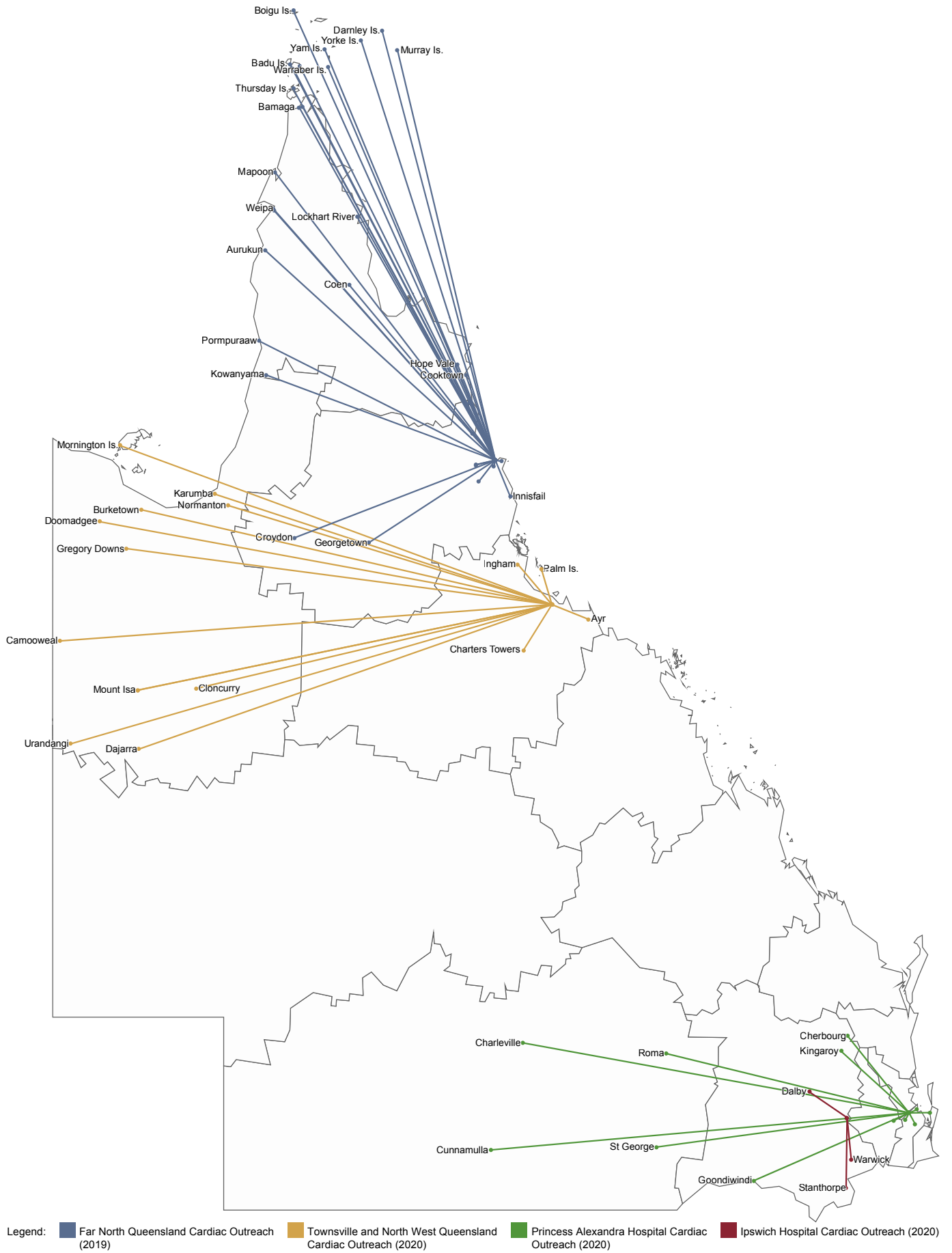
Figure 3:   Cardiac outreach hub and spoke locations

Legend:
- Far North Queensland Cardiac Outreach (2019)
- Townsville and North West Queensland Cardiac Outreach (2020)
- Princess Alexandra Hospital Cardiac Outreach (2020)
- Ipswich Hospital Cardiac Outreach (2020)

6   ECG Flash Spotlight

ECG Flash, a Statewide Cardiac Clinical Network initiative, aims to give rural and remote clinicians 24/7 access to urgent specialist cardiology advice. When a patient presents at emergency and an ECG is taken, the system lets clinicians send time critical, 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 a hub and spoke model of care where larger facilities with specialist staff cardiologists act as the hub to smaller regional and remote centres.

Regional and remote sites (spoke sites) use a digitally enabled ECG cart which 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 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 2019, there were 30 rural sites utilising the ECG Flash solution and they sent 252 ECGs through to five receiving cardiology departments.

Implementation at an additional 51 rural sites and 3 hub sites is planned for 2020. Further use of ECG Flash data to complement existing QCOR data collections will be the focus for future work.

Table 2:   ECG Flash – participating hub sites

ECG Flash hub	Commenced date	Number of spoke sites 2019	Number of spoke sites 2020
Princess Alexandra Hospital	August 2018	9	9
Cairns Hospital	September 2018	10	19
Mackay Base Hospital	February 2019	7	7
Townsville University Hospital	June 2019	4	6
Bundaberg Hospital	February 2020	–	8

Patient presents in emergency department with chest pain.	ECG is taken and is difficult to interpret.	Remote clinicians use ECG Flash solution to request a specialist ECG interpretation.
Calls back the treating clinician with specialist advice.	Receives an email with a digital copy of the ECG and contact details.	On-call cardiologist's mobile device receives an alert.

Figure 4:   ECG Flash process flow

Legend: ECG Flash in use | ECG Flash planned | No ECG Flash usage | ◆ Hub site | ● Spoke site (current) | ○ Spoke site (future)
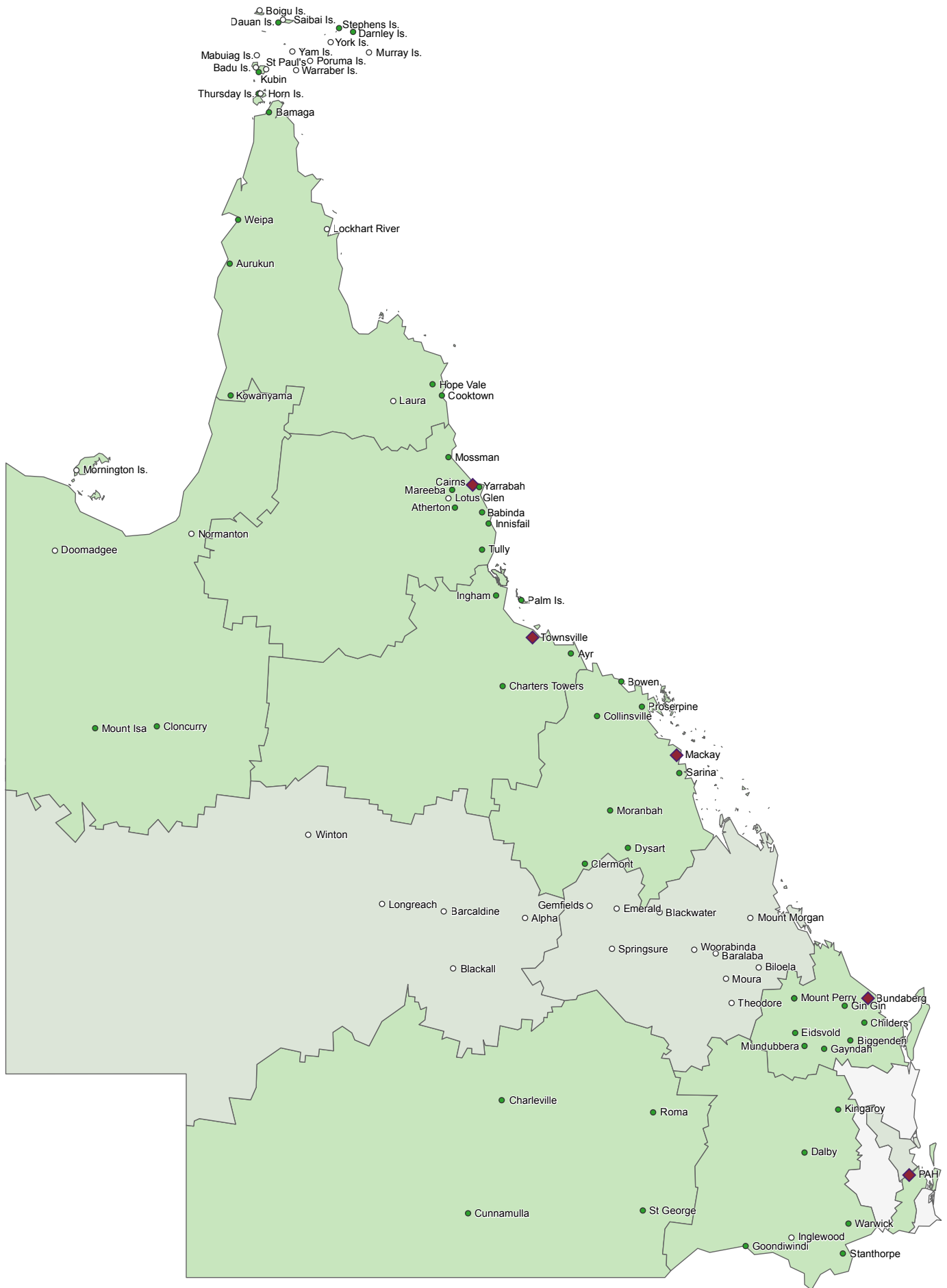
Figure 5:   ECG Flash hub and spoke locations as at November 2020

7   RHD Spotlight

7.1   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 with client care 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 timely delivery of secondary prophylaxis.

The program further advocates for and supports activities aimed at preventing, identifying, managing and treating acute rheumatic fever (ARF) and RHD, and promotes primordial, primary and secondary prevention aimed at preventing initial episodes of ARF and development of RHD. This includes the development and distribution of ARF/RHD education and health promotion-focused resources such as client and family educational material to improve health literacy, and information on diversionary therapy aids and reward/incentive products.

Additional strategies are being undertaken to enhance the quality of support the program provides including, creation and distribution of reports for outreach clinics, HHS, service providers and health service planning managers. Individual client information and clinical advice is being provided to healthcare providers including, diagnostic criteria, notification process, treatment and follow-up requirements (point of care information).

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 (3rd edition)* 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.

7.2   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. Clients typically present with a history of a sore throat and/or infected skin sores, pain and swelling in one or more joints, fever, malaise, a skin rash, chorea (jerky, uncoordinated movements of the hands, feet, tongue and face) and sometimes chest pain. 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, any remaining damage to the brain can cause ongoing mental health and neurological issues. Similarly, anatomical changes occur affecting the heart valves with the ensuing clinical sequalae known as 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 modest as a sore throat or skin infection which can be easily treated with common antibiotics, however if left untreated, it can lead to stroke and valve disease requiring cardiac surgery, often in an adolescent population. 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.

7.3 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 2017, there was a rate of 111 ARF cases per 100,000 Aboriginal and Torres Strait Islander Australians whereas for Australians of other descent the rate was 1 per 100,000. (Australian Institute of Health and Welfare (AIHW) 2019).† Between the ages of 5 years to 24 years, Aboriginal and Torres Strait Islander peoples are three times more likely to die from RHD than Australians of other descent.

7.4 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.

ARF and RHD contribute to increased death and disability in Queensland. RHD accrues early in life, with 20% of people on the Queensland RHD Register under 18 years of age and 26% of all ARF and RHD clients having had or will require valvular surgery.

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

Table 3:   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

7.5 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.

*   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

†   Australian Institute of Health and Welfare (2020). *Acute rheumatic fever and rheumatic heart disease in Australia, 2014–2018*. Retrieved from https://www.aihw.gov.au/reports/heart-stroke-vascular-diseases/acute-rheumatic-fever/contents/summary

‡   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

7.6   Queensland RHD Program and QCOR

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.

Through QCOR, reporting of positive RHD findings by echocardiography has resulted in 172 previously unknown clients with RHD being added to the Register.

Table 4:   QCOR echocardiography module RHD notifications

	Positive RHD findings n	Unknown RHD clients identified n
Cairns	494	66
Townsville	150	62
Mackay	47	26
Rockhampton	28	18
Total	**719**	**172**

Through the QCOR cardiac surgery RHD notification reports, seven previously unknown clients requiring surgery for their RHD have been added to the RHD register since October 2019.

Table 5:   QCOR cardiac surgery module RHD notifications

	Positive RHD findings n	Unknown RHD clients identified n
Statewide cardiac surgery	14	7

8 Facility profiles

8.1 Cairns Hospital
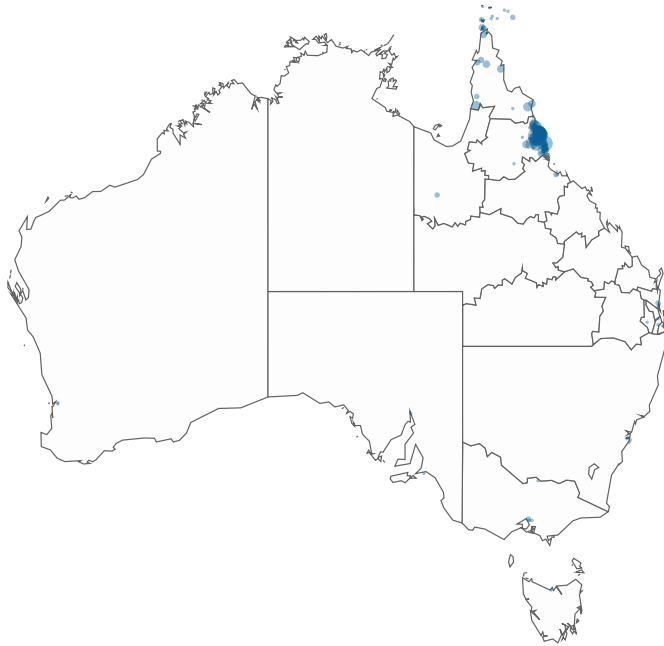
Figure 6: Cairns Hospital

- 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

8.2 Townsville University Hospital
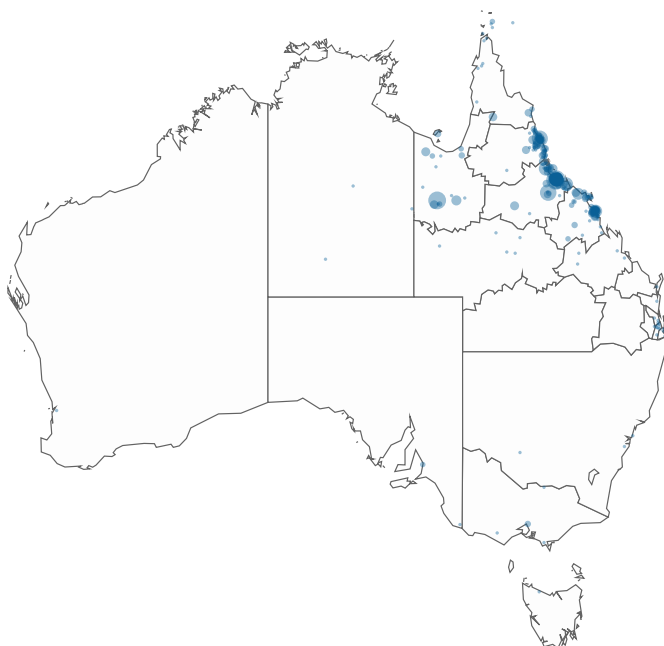
Figure 7: Townsville University Hospital

- 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

8.3   Mackay Base Hospital
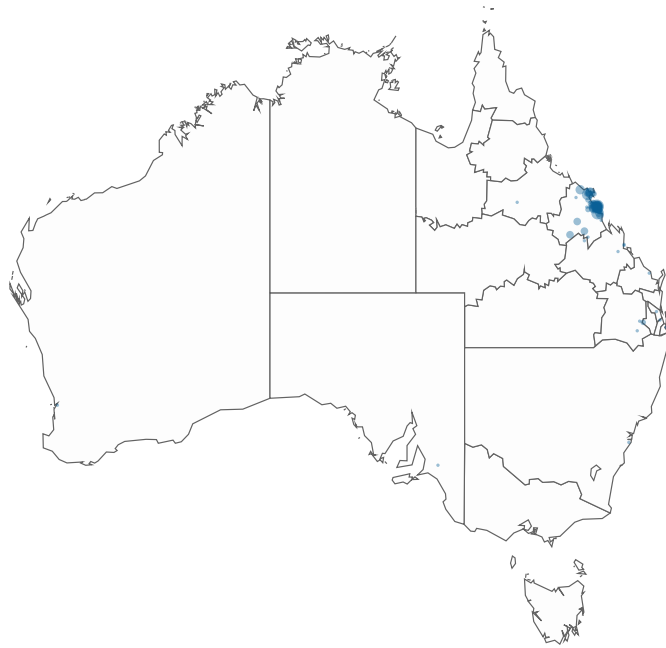
Figure 8:   Mackay Base Hospital

- 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

8.4   Sunshine Coast University Hospital
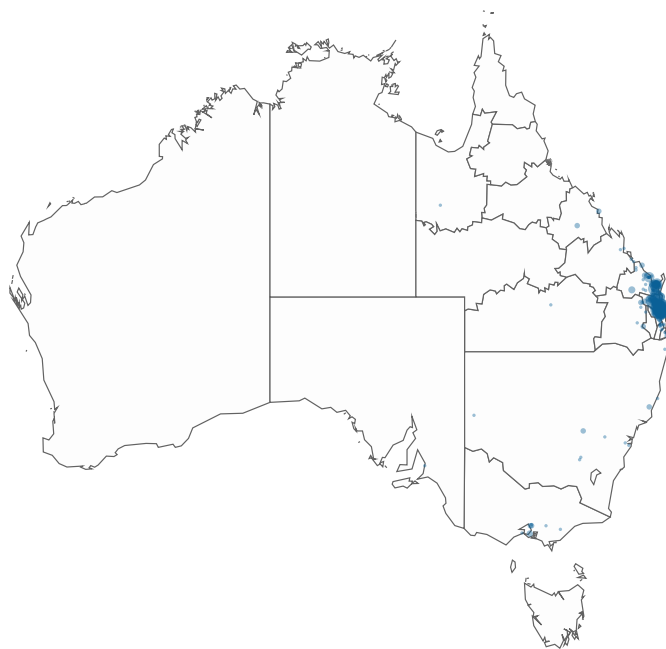
Figure 9:   Sunshine Coast University Hospital

- 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

8.5   The Prince Charles Hospital
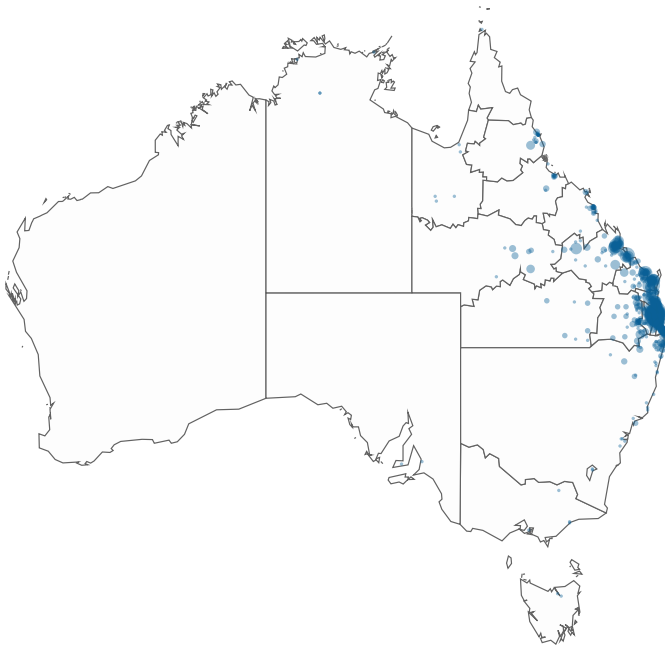
Figure 10: The Prince Charles Hospital

- 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 & 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

8.6   Royal Brisbane & Women's Hospital
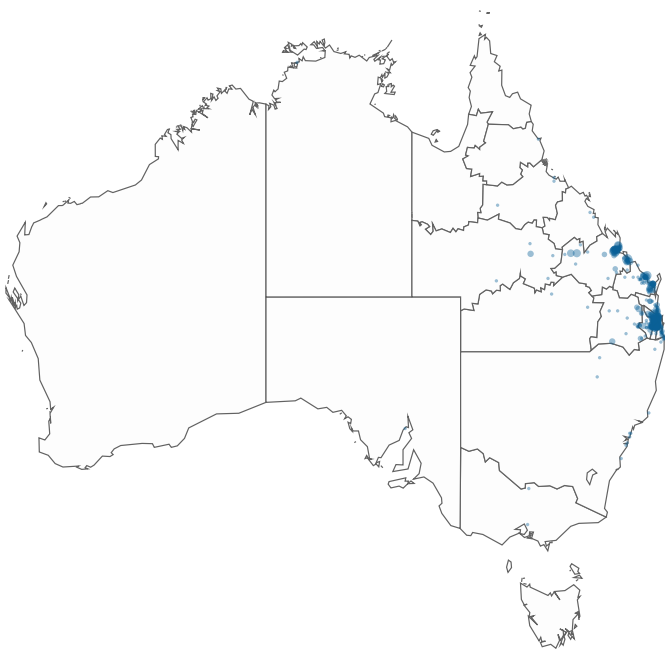
Figure 11: Royal Brisbane & Women's Hospital

- 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 & Women's Hospital include:

  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
  - Thoracic surgery

8.7   Princess Alexandra Hospital

Figure 12: Princess Alexandra Hospital
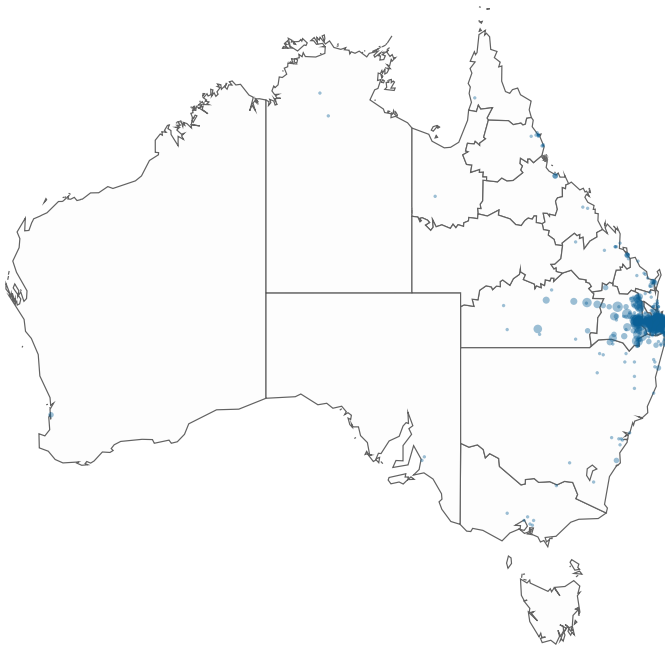
- Referral hospital for Metro South and South West Hospital and Health Services, serving a population of approximately 1,000,000
- Public tertiary level invasive cardiac services provided at the Princess Alexandra Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
  - Cardiothoracic surgery

8.8   Gold Coast University Hospital

Figure 13: Gold Coast University Hospital

- Referral Hospital for Gold Coast and northern New South Wales regions, serving a population of approximately 700,000
- Public tertiary level invasive cardiac services provided at the Gold Coast University Hospital include:
  - Coronary angiography
  - Percutaneous coronary intervention
  - Structural heart disease intervention
  - Electrophysiology
  - ICD, CRT and pacemaker implantation
  - Cardiothoracic surgery

Heart Failure Support Services Audit

Heart Failure Support Services

1   Message from the Heart Failure Steering Committee Chair

Since 2016, data collected by the QCOR Heart Failure module have helped to inform clinical practice for patients referred to multidisciplinary heart failure support services across the state. Patients living with chronic heart failure are at the centre of our attempts to understand and improve our practice so that they can live longer with a better quality of life and stay safely out of hospital.

The Audit monitors patient demographics, and measures performance against a range of clinical indicators ranging from referral times to several pharmacological prescribing and titration practices. Outcome measures include rehospitalisations, survival and time alive out of hospital.

This year we have included a new indicator for the prescribing of mineralocorticoid receptor antagonists (MRAs). MRAs represent the third arm of guideline-directed medical therapy for heart failure with a reduced ejection fraction (HFrEF). The recommended medications used in combination have been shown to substantially reduce mortality and morbidity in patients with HFrEF than when used in isolation.

Once again, I would like to thank all the clinicians who enter data as part of their everyday clinical practice, the Statewide Cardiac Clinical Informatics Unit, and especially acknowledge the patients themselves.

Associate Professor John Atherton
Chair
QCOR Heart Failure Support Services Committee

Heart Failure Support Services

2 Key findings

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

The majority of the 5,304 referrals were male (69%), non-Indigenous (95.3%), referred to South East Queensland HFSS (81%), from an inpatient setting (66%) and diagnosed with HFrEF (81.4%).

The median age of referrals was 69 years old with male patients presenting younger than females (68 years vs. 73 years respectively). Aboriginal and Torres Strait Islander peoples represented a younger cohort compared with non-Indigenous patients (58 years vs. 70 years respectively), and HFrEF patients are younger than HFpEF patients (68 years vs. 76 years respectively). Patients aged 80 years or older represented over 20% 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).

Prescription rates 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	78.8
1b	Follow-up of non-acute patients within 4 weeks	82.4*
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	90.2*
4a	Beta blocker‡ prescription at hospital discharge	89.0*
4b	Beta blocker‡ prescription at first clinical review	91.3*
5a	Prescription of MRA§ for HFrEF at time of hospital discharge	44.6
5b	Prescription of MRA§ for HFREF at time of first HFSS clinical review	42.9
6a	Beta blocker‡ titration status review at six months post referral	66.8
6b	Beta blocker‡ achievement of guideline recommended target	34.7
6c	Beta blocker‡ achievement of guideline recommended target dose or maximum tolerated dose	74.9

* 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

Heart Failure Support Services

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	1.6%	13.5%
2	a) All-cause rehospitalisation	17.8%	54.5%
	b) Heart failure rehospitalisation	5.8%	22.7%
3	Composite all-cause hospitalisation or all-cause mortality	18.4%	55.5%
4	Days alive and out-of-hospital†	N/A	363.7 median days‡

*   Commences from date of discharge for index admission

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

‡   Approximately 55% of patients had additional time in hospital

Heart Failure Support Services

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
	Mater Adult Hospital, Brisbane	MTHB
	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 University Hospital	TUH
West Moreton	Ipswich Community Health	IPCH
Wide Bay	Bundaberg Hospital	BNH
	Hervey Bay Hospital (includes Maryborough)	HBH

*   Not participating in the 2019 audit

Heart Failure Support Services

Figure 1:   Heart Failure Support Service (HFSS) locations

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

Hospital and Health Service	Facility	HFSS disciplines				Modes of service (telephone + …)				Medical mentor‡
		Nurse	NP†	Pharm*	Physio or AEP#	In-patient	Nurse or MD clinics	Home visits	Rehab programs	
Cairns and Hinterland	CH	Y	Y	–	Y	Y	Y	Y	Y	Y
Central Queensland	GLH	Y	–	–	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	MBH	Y	–	–	Y	Y	Y	–	Y	Y
Metro North	CBH	Y	–	Y	–	–	Y	–	–	Y
	RDH	Limited service available 2019				–	–	–	–	–
	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
	MTHB	Y	Y	–	R	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	TUH	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%	59%	50%	82%	77%	95%	68%	59%	100%

*   Nurse practitioner who can prescribe medications

†   Pharmacist

§   The HFSS has a cardiologist or general physician mentor

‡   Physiotherapist or accredited exercise physiologist

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

Heart Failure Support Services

4 New referrals

There were 5,304 new referrals reported by the 21 participating HFSS, with Metropolitan sites comprising 55% of all referrals.
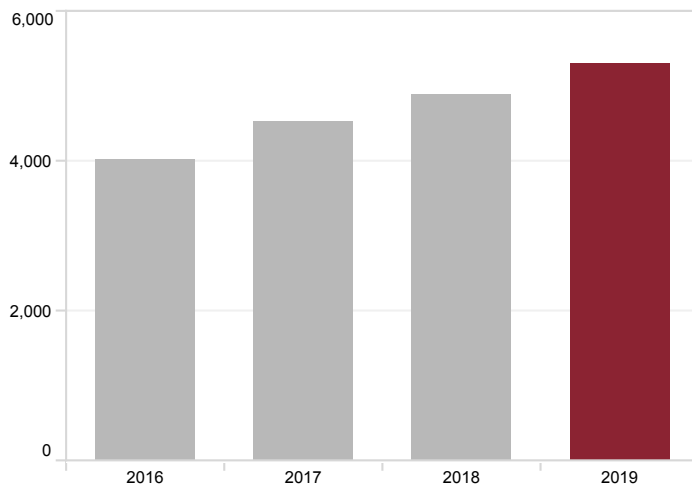
Figure 2:   Total yearly HF referrals, 2016–2019

4.1   Location of referrals

Table 5:   Distribution of new referrals by HFSS location

Referrals per HHS	n (%)	Referrals per facility in each HHS	n (%)
Cairns and Hinterland	127 (2.4)	Cairns Hospital	127 (2.4)
Central Queensland	224 (4.2)	Gladstone Hospital	23 (0.4)
		Rockhampton Hospital	201 (3.8)
Darling Downs	80 (1.5)	Toowoomba Hospital	80 (1.5)
Gold Coast	497 (9.4)	Gold Coast Community Health	497 (9.4)
Mackay	122 (2.3)	Mackay Base Hospital	122 (2.3)
Metro North	1,454 (27.4)	Caboolture Hospital	104 (2.0)
		Royal Brisbane & Women's Hospital	445 (8.4)
		The Prince Charles Hospital	905 (17.1)
Metro South	1,460 (27.5)	Logan Hospital	382 (7.2)
		Mater Adult Hospital	71 (1.3)
		Princess Alexandra Hospital	708 (13.3)
		Queen Elizabeth II Hospital	117 (2.2)
		Redland Hospital	182 (3.4)
North West	36 (0.7)	Mt Isa Hospital	36 (0.7)
Sunshine Coast	527 (9.9)	Gympie Hospital	102 (1.9)
		Sunshine Coast University Hospital	425 (8.0)
Townsville	259 (4.9)	Townsville University Hospital	259 (4.9)
West Moreton	345 (6.5)	Ipswich Community Health	345 (6.5)
Wide Bay	173 (3.3)	Bundaberg Hospital	97 (1.8)
		Hervey Bay Hospital	76 (1.4)
Statewide			**5,304 (100.0)**

Heart Failure Support Services
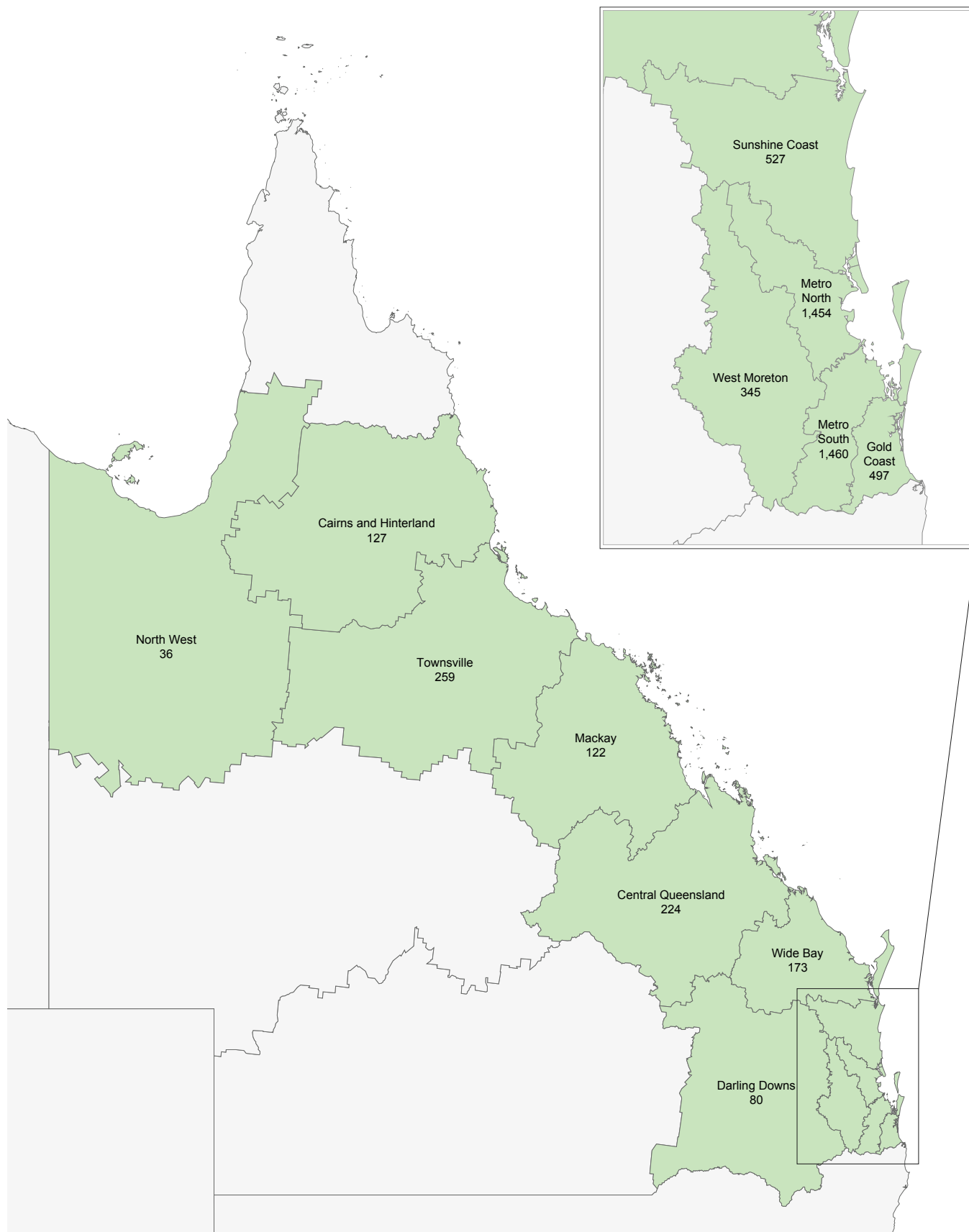
Figure 3:   Regional distribution of new referrals

4.2   Referral source

Most referrals originated from an inpatient setting (66%), with smaller proportions originating from an outpatient setting (24%) or as a transfer from another service (8%).

Few referrals came directly from primary care (2%), which is expected as most referrals flow to specialty outpatient clinics for diagnosis and treatment optimisation prior to referral to an HFSS.

Table 6:   Source of HFSS referral

HHS	HFSS	Inpatient n (%)	Outpatient n (%)	Another HFSS n (%)	Primary care n (%)
Cairns and Hinterland	Cairns Hospital	78 (61.4)	49 (38.6)	–	–
Central Queensland	Gladstone Hospital	11 (47.8)	–	9 (39.1)	3 (13.0)
	Rockhampton Hospital	97 (48.3)	80 (39.8)	5 (2.5)	19 (9.5)
Darling Downs	Toowoomba Hospital	1 (1.2)	79 (98.8)	–	–
Gold Coast	Gold Coast Community Health	333 (67.0)	115 (23.1)	23 (4.6)	26 (5.2)
Mackay	Mackay Base Hospital	24 (19.7)	97 (79.5)	1 (0.8)	–
Metro North	Caboolture Hospital	16 (15.4)	46 (44.2)	2 (1.9)	40 (38.5)
	Royal Brisbane & Women's Hospital	326 (73.3)	113 (25.4)	6 (1.3)	–
	The Prince Charles Hospital	733 (81.0)	168 (18.6)	4 (0.4)	–
Metro South	Logan Hospital	230 (60.2)	50 (13.1)	98 (25.7)	4 (1.0)
	Mater Adult Hospital	59 (83.1)	12 (16.9)	–	–
	Princess Alexandra Hospital	664 (93.8)	34 (4.8)	10 (1.4)	–
	Queen Elizabeth II Hospital	78 (66.7)	29 (24.8)	10 (8.5)	–
	Redland Hospital	49 (26.9)	57 (31.3)	74 (40.7)	2 (1.1)
North West	Mt Isa Hospital	7 (19.4)	27 (75.0)	1 (2.8)	1 (2.8)
Sunshine Coast	Gympie Hospital	50 (49.0)	11 (10.8)	39 (38.2)	2 (2.0)
	Sunshine Coast University Hospital	358 (84.2)	51 (12.0)	16 (3.8)	–
Townsville	Townsville University Hospital	152 (58.7)	107 (41.3)	–	–
West Moreton	Ipswich Community Health	155 (44.9)	132 (38.3)	53 (15.4)	5 (1.4)
Wide Bay	Bundaberg Hospital	59 (60.8)	11 (11.3)	20 (20.6)	7 (7.2)
	Hervey Bay Hospital	10 (13.2)	18 (23.7)	47 (61.8)	1 (1.3)
Statewide		**3,490 (65.8)**	**1,286 (24.2)**	**418 (7.9)**	**110 (2.1)**

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 (73 years) was five years older than men. One third of patients (33%) were 75 years of age and older.
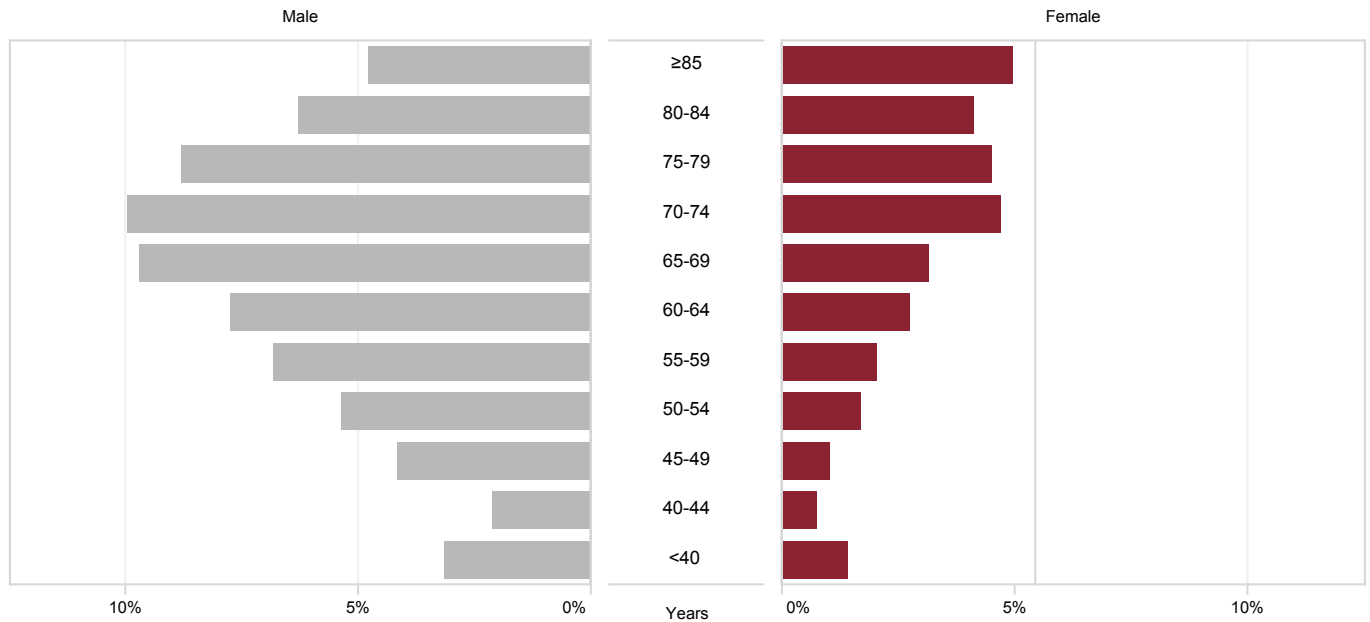
% of total (n=5,304)

Figure 4:   Proportion of referrals to HFSS by gender and age group

Table 7:   Median age (years) of referrals by gender

HHS	HFSS	Male years	Female years	ALL years
Cairns and Hinterland	Cairns Hospital	62	62	62
Central Queensland	Gladstone Hospital	70	75	72
	Rockhampton Hospital	68	73	69
Darling Downs	Toowoomba Hospital	66	68	67
Gold Coast	Gold Coast Community Health	69	76	71
Mackay	Mackay Base Hospital	65	71	66
Metro North	Caboolture Hospital	74	72	73
	Royal Brisbane & Women's Hospital	68	76	70
	The Prince Charles Hospital	68	74	71
Metro South	Logan Hospital	65	73	67
	Mater Adult Hospital	69	75	72
	Princess Alexandra Hospital	68	73	69
	Queen Elizabeth II Hospital	65	77	71
	Redland Hospital	69	75	71
North West	Mt Isa Hospital	57	56	57
Sunshine Coast	Gympie Hospital	73	75	74
	Sunshine Coast University Hospital	68	74	71
Townsville	Townsville University Hospital	66	64	66
West Moreton	Ipswich Community Health	66	67	67
Wide Bay	Bundaberg Hospital	67)	73	68
	Hervey Bay Hospital	72	76	74
Statewide		**68**	**73**	**69**

Heart Failure Support Services

5.2   Gender

The majority of patients were male (69%), ranging from 53% to 79% across participating sites.

Table 8:   Number and proportion of referrals to HFSS by gender

HHS	HFSS	Male n (%)	Female n (%)
Cairns and Hinterland	Cairns Hospital	94 (74.0)	33 (26.0)
Central Queensland	Gladstone Hospital	15 (65.2)	8 (34.8)
	Rockhampton Hospital	143 (71.1)	58 (28.9)
Darling Downs	Toowoomba Hospital	62 (77.5)	18 (22.5)
Gold Coast	Gold Coast Community Health	363 (73.0)	134 (27.0)
Mackay	Mackay Base Hospital	96 (78.7)	26 (21.3)
Metro North	Caboolture Hospital	73 (70.2)	31 (29.8)
	Royal Brisbane & Women's Hospital	313 (70.3)	132 (29.7)
	The Prince Charles Hospital	587 (64.9)	318 (35.1)
Metro South	Logan Hospital	266 (69.6)	116 (30.4)
	Mater Adult Hospital	45 (63.4)	26 (36.6)
	Princess Alexandra Hospital	515 (72.7)	193 (27.3)
	Queen Elizabeth II Hospital	73 (62.4)	44 (37.6)
	Redland Hospital	130 (71.4)	52 (28.6)
North West	Mt Isa Hospital	19 (52.8)	17 (47.2)
Sunshine Coast	Gympie Hospital	68 (66.7)	34 (33.3)
	Sunshine Coast University Hospital	284 (66.8)	141 (33.2)
Townsville	Townsville University Hospital	178 (68.7)	81 (31.3)
West Moreton	Ipswich Community Health	214 (62.0)	131 (38.0)
Wide Bay	Bundaberg Hospital	75 (77.3)	22 (22.7)
	Hervey Bay Hospital	48 (63.2)	28 (36.8)
Statewide		**3,661 (69.0)**	**1,643 (31.0)**

Heart Failure Support Services

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 (243) was consistent with the previous year (258). Aboriginal and Torres Strait Islander patients were significantly younger than other Queenslanders. Table 9 shows that the proportion of Aboriginal and Torres Strait Islander patient referrals was highest in Mt Isa (47%), followed by Cairns (22%) and Townsville (11%).

A smaller proportion of total referrals (42%) of all Aboriginal and Torres Strait Islander patients were referred to facilities in the Greater Brisbane area (Metro North HHS or Metro South HHS).

Table 9:   Proportion of site referrals identified as Aboriginal and Torres Strait Islander

HHS	Facility	Indigenous n (%)	Non-Indigenous n (%)	Not stated / unknown n (%)
Cairns and Hinterland	Cairns Hospital	28 (22.0)	99 (78.0)	–
Central Queensland	Gladstone Hospital	–	23 (100.0)	–
	Rockhampton Hospital	16 (8.0)	185 (92.0)	–
Darling Downs	Toowoomba Hospital	7 (8.8)	73 (91.3)	–
Gold Coast	Gold Coast Community Health	5 (1.0)	491 (98.8)	1 (0.2)
Mackay	Mackay Base Hospital	11 (9.0)	111 (91.0)	–
Metro North	Caboolture Hospital	1 (1.0)	103 (99.0)	–
	Royal Brisbane & Women's Hospital	14 (3.1)	431 (96.9)	–
	The Prince Charles Hospital	27 (3.0)	878 (97.0)	–
Metro South	Logan Hospital	22 (5.8)	360 (94.2)	–
	Mater Adult Hospital	3 (4.2)	64 (90.1)	4 (5.6)
	Princess Alexandra Hospital	26 (3.7)	682 (96.3)	–
	Queen Elizabeth II Hospital	2 (1.7)	115 (98.3)	–
	Redland Hospital	8 (4.4)	174 (95.6)	–
North West	Mt Isa Hospital	17 (47.2)	19 (52.8)	–
Sunshine Coast	Gympie Hospital	2 (2.0)	100 (98.0)	–
	Sunshine Coast University Hospital	6 (1.4)	419 (98.6)	–
Townsville	Townsville University Hospital	28 (10.8)	231 (89.2)	–
West Moreton	Ipswich Community Health	10 (2.9)	334 (96.8)	1 (0.3)
Wide Bay	Bundaberg Hospital	7 (7.2)	90 (92.8)	–
	Hervey Bay Hospital	3 (3.9)	73 (96.1)	–
Statewide		**243 (4.6)**	**5,055 (95.3)**	**6 (0.1)**

Heart Failure Support Services

Male   Female
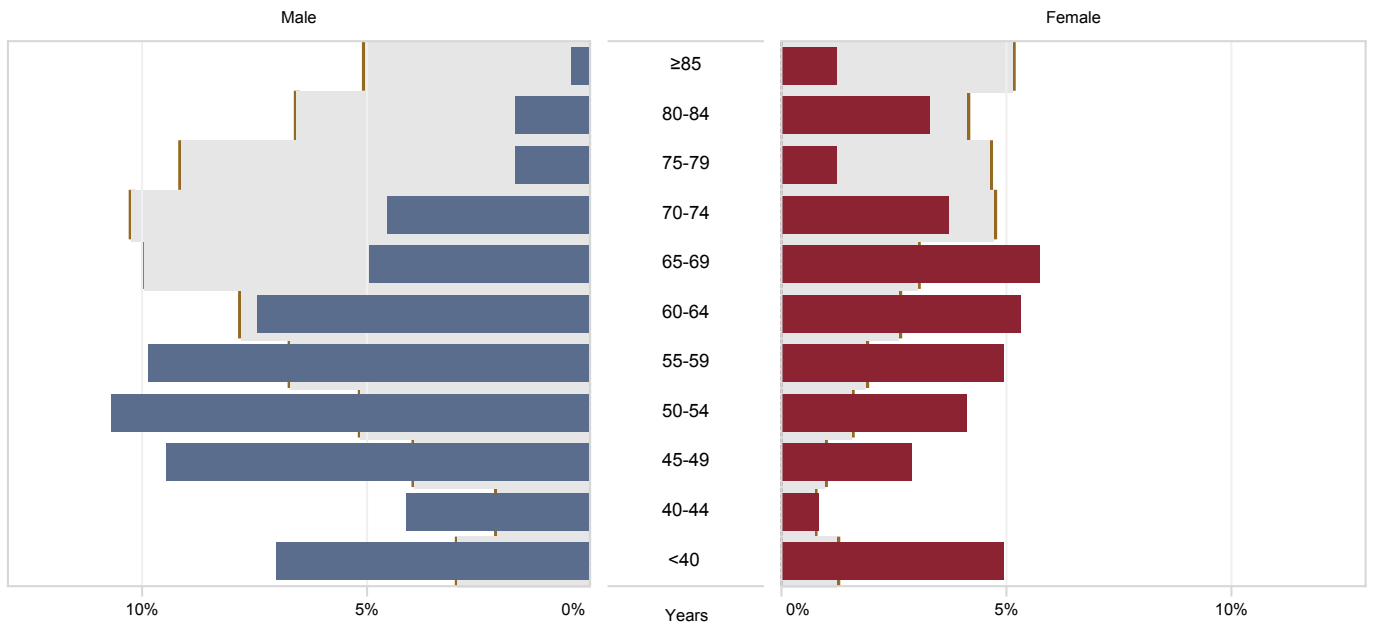
% of total Indigenous (n=243) vs. total non-Indigenous (n=5,055). Excludes missing data (0.1%)

Figure 5:   *Proportion of all referrals by age group and Indigenous status*

Table 10:   *Median patient age by gender and Indigenous status*

HHS	Total referrals n	Male years	Female years	ALL years
Aboriginal and Torres Strait Islander	243	54	61	58
Non-Aboriginal and Torres Strait Islander	5,055	68	74	70
ALL	**5,298**	**68**	73	**69**

Excludes missing data (0.1%)

Heart Failure Support Services

5.4   Classification of heart failure by left ventricular ejection fraction

Patients were classified as predominately HFrEF, heart failure with preserved ejection fraction (HFpEF) or primary right heart failure. HFrEF was defined as a left ventricular ejection fraction (EF) less than 50% at time of diagnosis. The EF may return to normal for some patients but still require ongoing medications to manage HFrEF.[29] HFrEF was attributed to 81% of patients in the 2019 cohort. The table below shows the rates of different HF phenotypes.

Many patients with HFrEF were males (73%), with a median age of nine years younger than for HFpEF patients (68 years vs 77 years respectively). There were similar numbers of men and women making up patients with HFpEF (males 47.9% vs. females 52.1%).

Table 11:   Proportion of patients by heart failure type

HHS	HFSS	HFrEF* n (%)	HFpEF† n (%)	Primary right HF n (%)	Unsure/ Unknown n (%)
Cairns and Hinterland	Cairns Hospital	125 (98.4)	1 (0.8)	1 (0.8)	–
Central Queensland	Gladstone Hospital	19 (82.6)	3 (13.0)	1 (4.3)	–
	Rockhampton Hospital	156 (77.6)	35 (17.4)	6 (3.0)	4 (2.0)
Darling Downs	Toowoomba Hospital	60 (75.0)	4 (5.0)	–	16 (20.0)
Gold Coast	Gold Coast Community Health	388 (78.1)	81 (16.3)	17 (3.4)	11 (2.2)
Mackay	Mackay Base Hospital	116 (95.1)	4 (3.3)	1 (0.8)	1 (0.8)
Metro North	Caboolture Hospital	75 (72.1)	20 (19.2)	1 (1.0)	8 (7.7)
	Royal Brisbane & Women's Hospital	371 (83.4)	65 (14.6)	5 (1.1)	4 (0.9)
	The Prince Charles Hospital	658 (72.7)	182 (20.1)	36 (4.0)	29 (3.2)
Metro South	Logan Hospital	324 (84.8)	42 (11.0)	13 (3.4)	3 (0.8)
	Mater Adult Hospital	55 (77.5)	12 (16.9)	–	4 (5.6)
	Princess Alexandra Hospital	633 (89.4)	54 (7.6)	20 (2.8)	1 (0.1)
	Queen Elizabeth II Hospital	90 (76.9)	21 (17.9)	3 (2.6)	3 (2.6)
	Redland Hospital	145 (79.7)	24 (13.2)	7 (3.8)	6 (3.3)
North West	Mt Isa Hospital	35 (97.2)	–	–	1 (2.8)
Sunshine Coast	Gympie Hospital	58 (56.9)	30 (29.4)	11 (10.8)	3 (2.9)
	Sunshine Coast University Hospital	364 (85.6)	46 (10.8)	7 (1.6)	8 (1.9)
Townsville	Townsville University Hospital	238 (91.9)	14 (5.4)	2 (0.8)	5 (1.9)
West Moreton	Ipswich Community Health	261 (75.7)	51 (14.8)	21 (6.1)	12 (3.5)
Wide Bay	Bundaberg Hospital	83 (85.6)	8 (8.2)	2 (2.1)	4 (4.1)
	Hervey Bay Hospital	64 (84.2)	7 (9.2)	5 (6.6)	–
Statewide		**4,318 (81.4)**	**704 (13.3)**	**159 (3.0)**	**123 (2.3)**

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

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

Table 12: *Summary of patient age, gender and Indigenous status by type of heart failure*

	HFrEF*	HFpEF†	Primary right HF
Number	4,318	704	159
Age (median years)	68	77	73
% male	73.4	47.9	52.8
% Aboriginal and Torres Strait Islander	5.1	1.8	5.0

Excludes unsure/unknown HF phenotype (2.3%)

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

†   Heart failure with preserved ejection fraction (LVEF ≥50%)
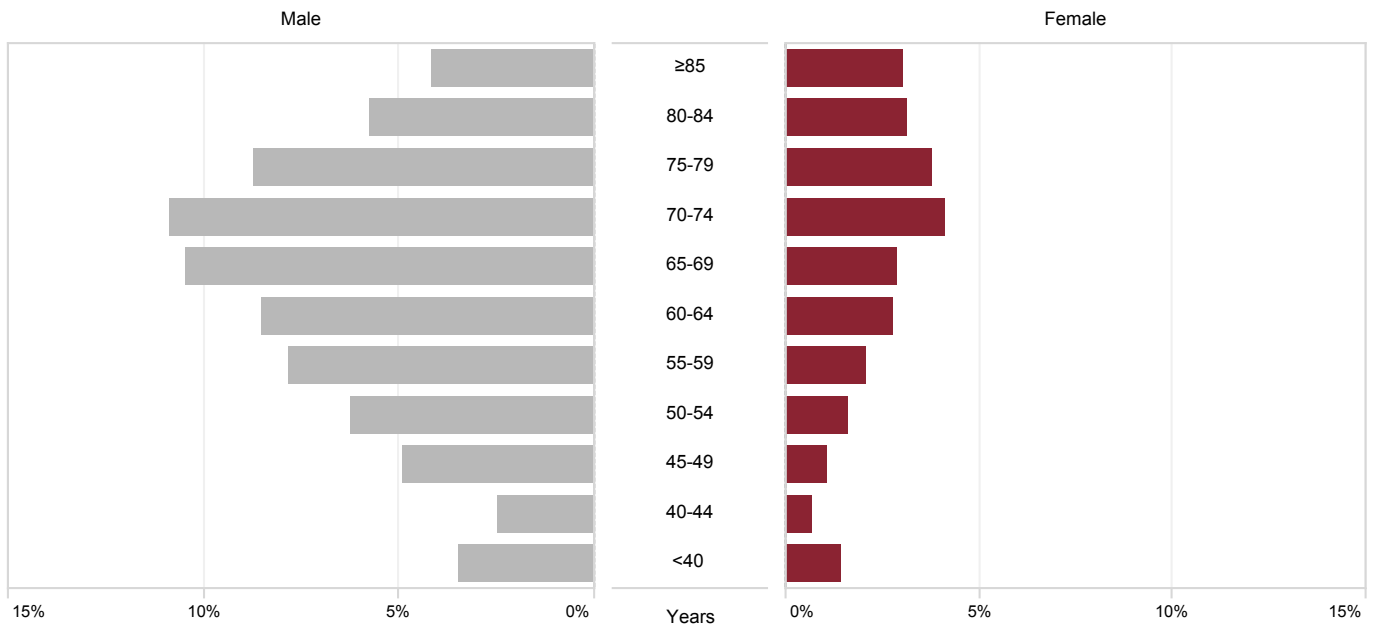
% of total with HFrEF (n=4,318)

Figure 6:   *Proportion of HFrEF referrals by gender and age group*
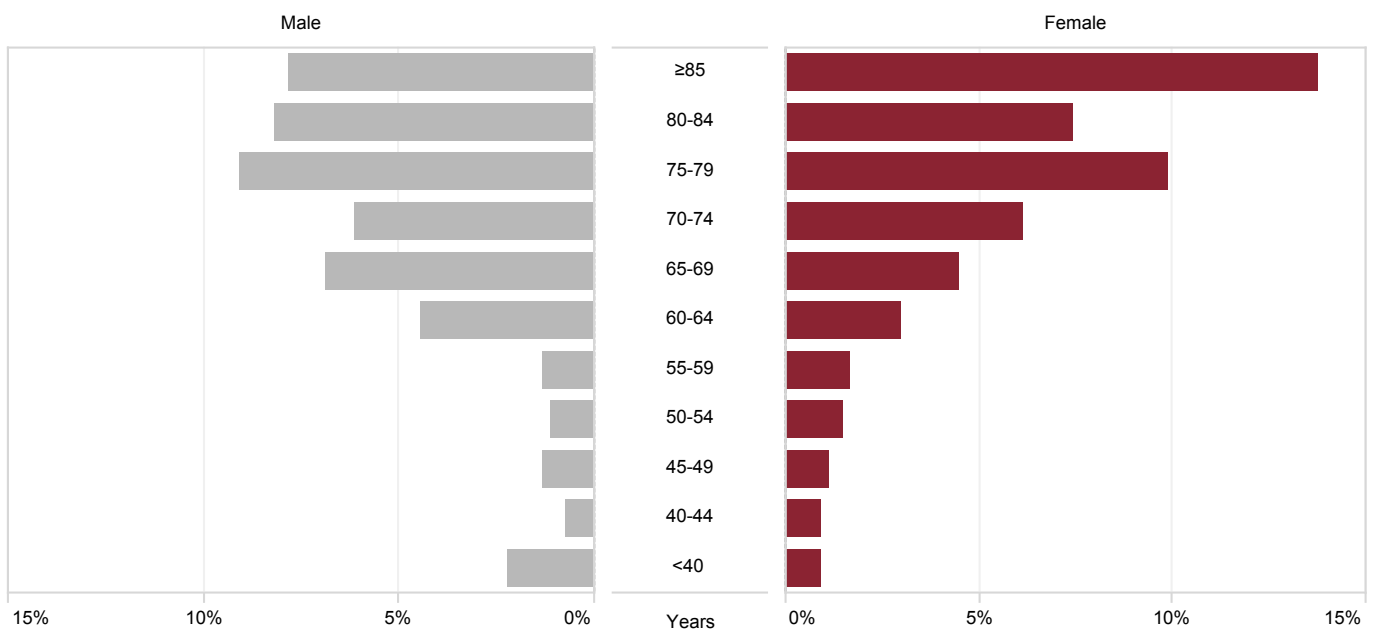
% of total with HFpEF (n=704)

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

Heart Failure Support Services

5.5 Summary of patient characteristics

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

Table 13: Summary of patient characteristics

Characteristic	Summary
Participating HFSS	21
New referrals	5,304
Referrals from South East Queensland	80.8%
Referral source:	
Inpatient	65.8%
Outpatient	24.2%
Another HFSS	7.9%
Primary care	2.1%
Age (median years):	
All (median, range by service)	69 (62–74) years
Male vs. Female	68 vs. 72 years
Indigenous vs. non-Indigenous	58 vs. 69 years
HFrEF*vs. HFpEF†	68 vs. 77 years
Age group:	
80 years and over	20.2%
Males	69.0%
Aboriginal and Torres Strait Islander patients	4.6%
HFrEF*	81.4%
HFpEF†	13.3%
Primary right HF	3.0%
Uncertain diagnosis	2.3%

*   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 14.

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.[30]

Table 14:   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

Heart Failure Support Services

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 3,490 patients referred from an acute setting, 79% received a clinical review by an HFSS within two weeks of hospital discharge.
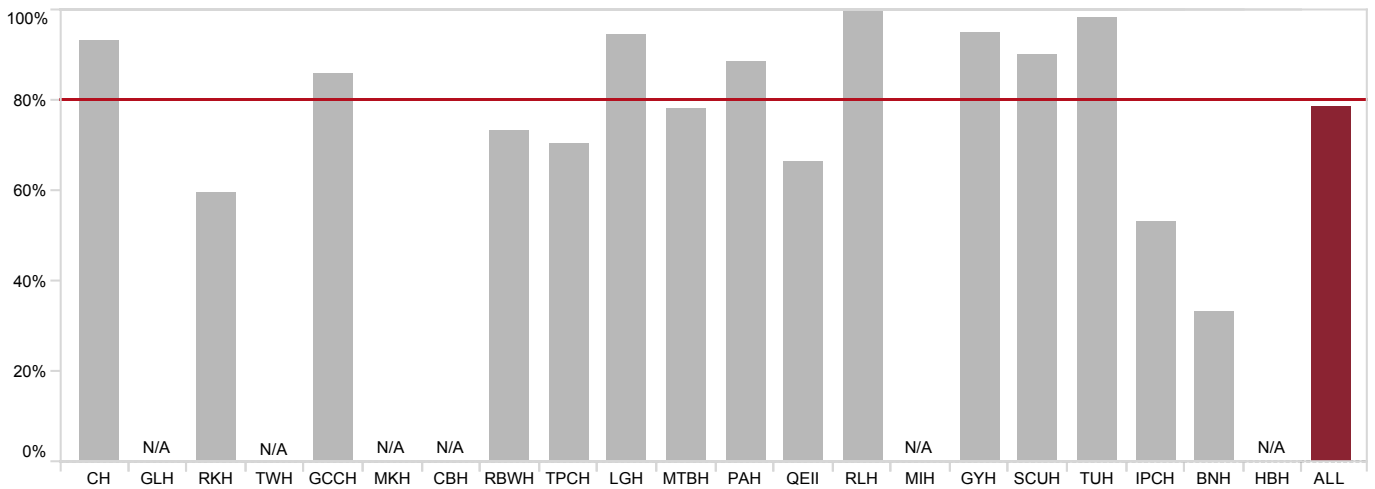
N/A: Eligible referrals <20

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

Table 15:   Inclusion details for clinical indicator 1a: Inpatients receiving first HFSS clinical review within two weeks of hospital discharge

	n	%
Eligible for analysis	2,288	
Achieved benchmark	1,804	78.8
Benchmark not achieved	484	21.2
Ineligible	1,202	
Referred to another HFSS	603	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	175	
Patient could not be contacted, lives out of area or repeated failure to attend	146	
Patient declined service	121	
HF no longer prime issue (palliative care, high care nursing home etc.)	72	
Patient deceased	51	
Medical follow-up only (GP, private or public physician)	23	
Other reason	11	
Total inpatient referrals	**3,490**	

Heart Failure Support Services

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

For non-acute patients, the Statewide HF Steering Committee determined four weeks following referral to be the recommended timeframe for first clinical review.

Referrals for 1,814 patients came from non-acute services, of which 82% received a clinical review within four weeks of referral.
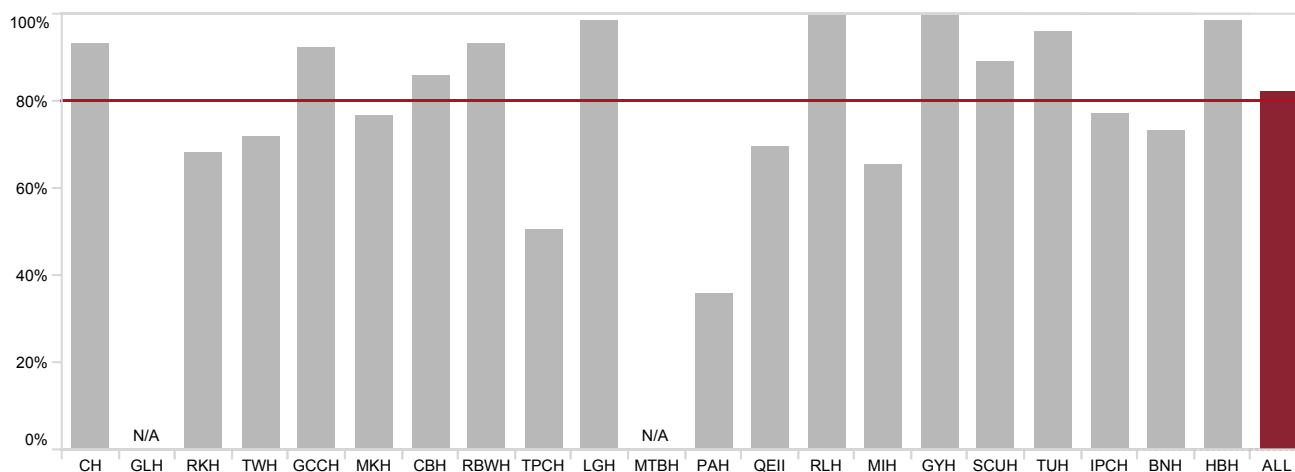
N/A: Eligible referrals <20

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

Table 16:   Inclusion details for clinical indicator 1b: Non-acute patients receiving first HFSS clinical review within four weeks of referral

	n	%
Eligible for analysis	1,594	
Achieved benchmark	1,314	82.4
Benchmark not achieved	280	17.6
Ineligible	220	
Patient could not be contacted, lives out of area or repeated failure to attend	72	
Patient declined service	60	
Referred to another HFSS	46	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	15	
HF no longer prime issue (palliative care, high care nursing home etc.)	10	
Patient deceased	5	
Medical follow-up only (GP, private or public physician)	4	
Other reason	8	
Total non-acute patients	1,814	

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.[29] In 96% of cases, LVEF was assessed within two years of referral to an HFSS.
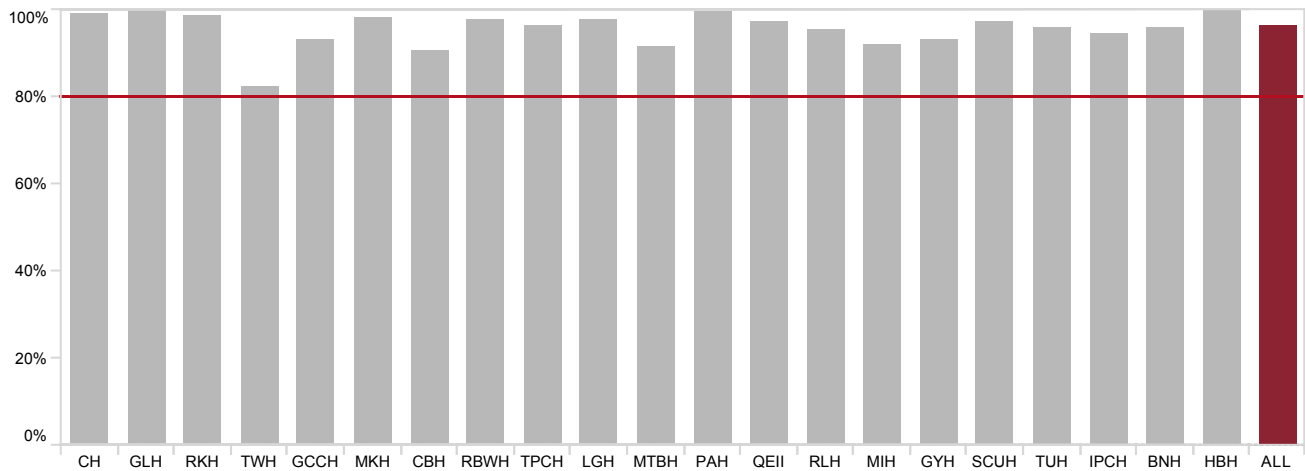
N/A: Eligible referrals <20

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

Table 17:　Inclusion details for clinical indicator 2: Patients who had LVEF assessed within two years of referral

	n	%
Eligible for analysis	5,304	
Achieved benchmark	5,109	96.3
Benchmark not achieved	195	3.7
Ineligible	N/A	
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 symptomatic patients unless contraindicated or not tolerated.

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 patients.
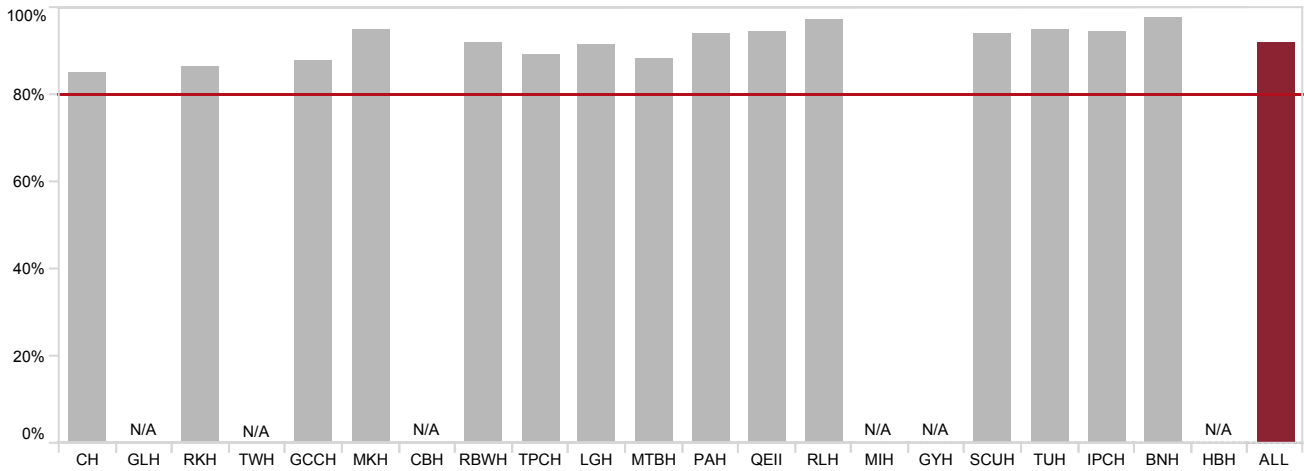
N/A: Eligible referrals <20

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

Table 18:   Inclusion details for clinical indicator 3a: Inpatients on ACEI, ARB or ARNI at time of hospital discharge

	n	%
Eligible for analysis	2,626	
Achieved benchmark	2,409	91.7
Benchmark not achieved	217	8.3
Ineligible		
Documented contraindication*	158	
Total inpatient referrals analysed	**2,784**	

*   Adverse reaction to ACEI/ARB or ARNI, palliative intent to treatment, pregnancy, eGFR <30mL/min/1.73m^2, 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 90% of patients.
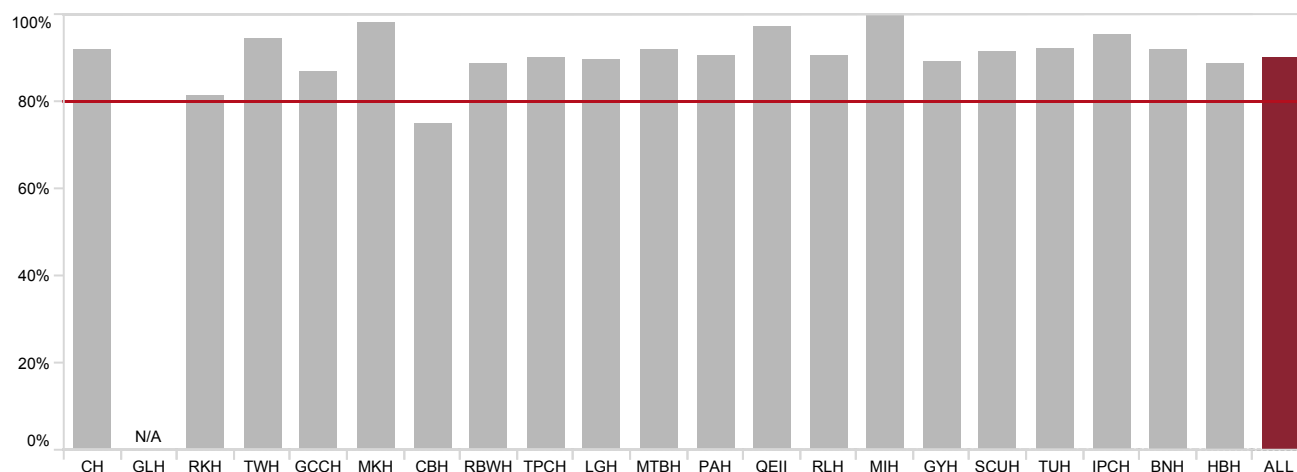
N/A: Eligible referrals ‹20

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

Table 19: Inclusion details for clinical indicator 3b: Patients on ACEI, ARB or ARNI at first clinical review

	n	%
Eligible for analysis	3,102	
Achieved benchmark	2,797	90.2
Benchmark not achieved	305	9.8
Ineligible	1,482	
Referred to another HFSS	649	
Patient could not be contacted, lives out of area or repeated failure to attend	218	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	190	
Patient declined service	181	
HF no longer prime issue (palliative care, high care nursing home etc.)	82	
Documented contraindication*	60	
Patient deceased	56	
Medical follow-up only (GP, private or public physician)	27	
Other reason	19	
Total referrals	4,584	

*   Adverse reaction to ACEI/ARB or ARNI, palliative intent to treatment, pregnancy, eGFR ‹30mL/min/1.73m^2, 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 symptomatic patients unless contraindicated or not tolerated.[29] 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, 89% of patients were prescribed guideline recommended beta blockers.
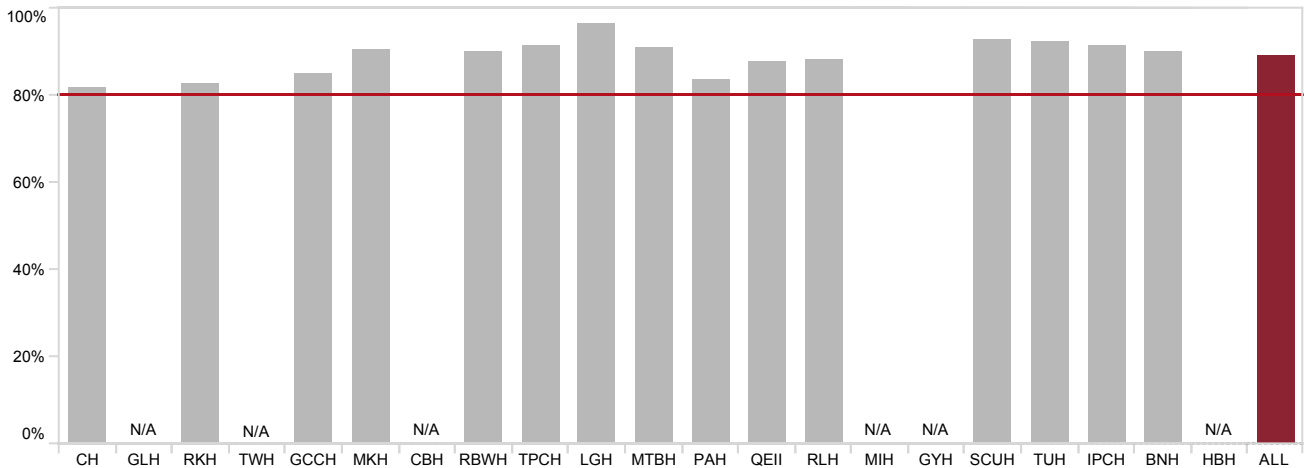
N/A: Eligible referrals <20

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

Table 20:   Inclusion details for clinical indicator 4a: Patients on guideline recommended beta blocker at hospital discharge

	n	%
Eligible for analysis	2,716	
Achieved benchmark	2,418	89.0
Benchmark not achieved	298	11.0
Ineligible		
Documented contraindication*	68	
Total inpatient referrals analysed	**2,784**	

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

Heart Failure Support Services

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

At the first clinical review, 91% of referrals to HFSS were reported to be on a guideline recommended beta blocker.
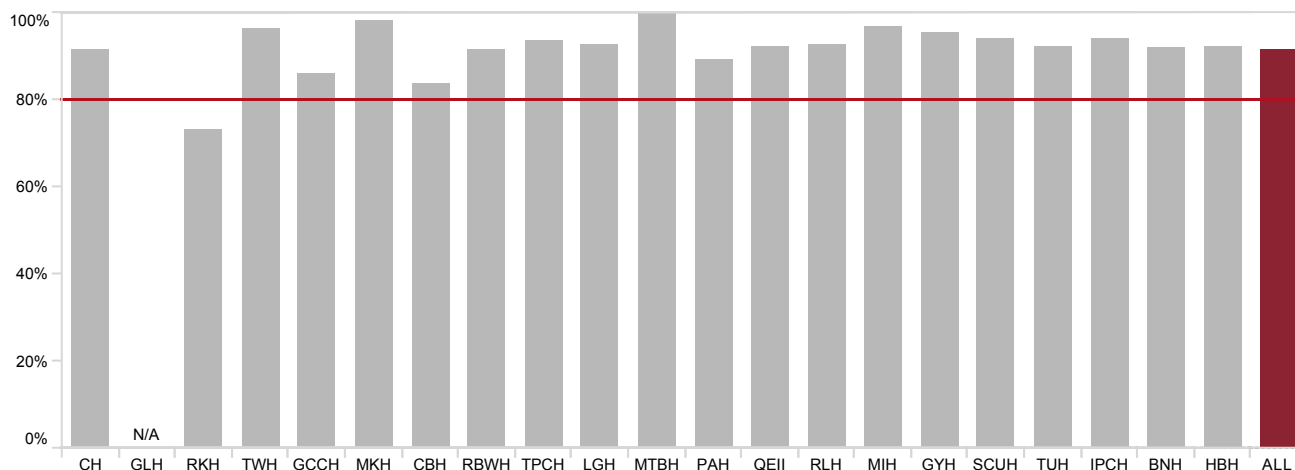
N/A: Eligible referrals <20

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

Table 21:   Inclusion details for clinical indicator 4b: Patients on guideline recommended beta blocker at first clinical review

	n	%
Eligible for analysis	3,085	
Achieved benchmark	2,817	91.3
Benchmark not achieved	268	8.7
Ineligible	1,498	
Referred to another HFSS	649	
Patient could not be contacted, lives out of area or repeated failure to attend	218	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	190	
Patient declined service	181	
HF no longer prime issue (palliative care, high care nursing home etc.)	82	
Documented contraindication*	76	
Patient deceased	56	
Medical follow-up only (GP, private or public physician)	27	
Other reason	19	
Incomplete data	1	
Total referrals analysed	4,584	

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

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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 symptomatic patients unless contraindicated or not tolerated.[29] 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, 45% of patients referred to an HFSS were prescribed an MRA.
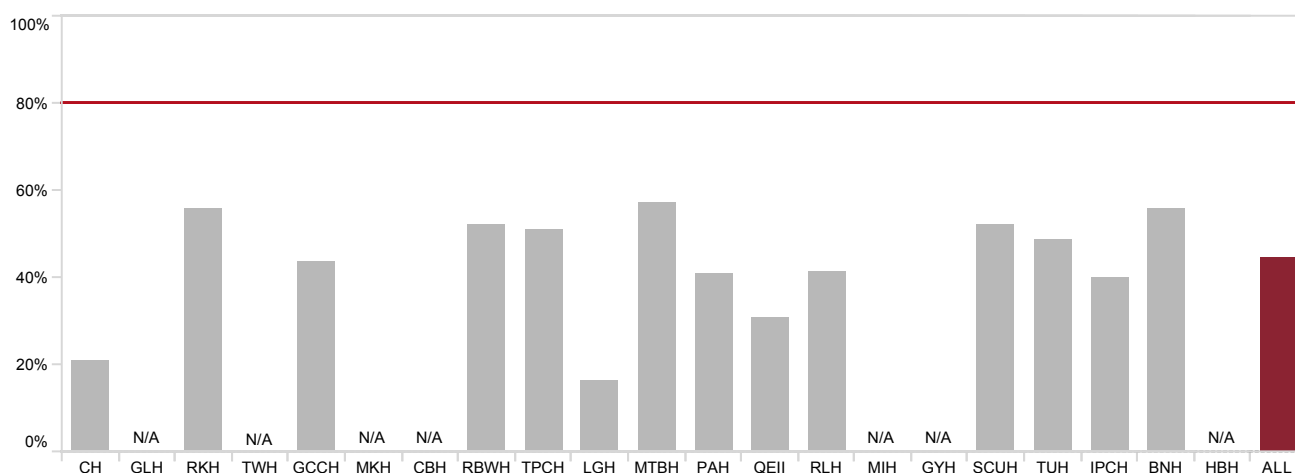
N/A: Eligible referrals <20

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

Table 22: Inclusion details for clinical indicator 5a: Patients on guideline recommended MRA at hospital discharge

	n	%
Eligible for analysis	2,448	
Achieved benchmark	1,091	44.6
Benchmark not achieved	1,357	55.4
Ineligible		
Documented contraindication*	336	
Total inpatient referrals analysed	**2,784**	

*   Adverse reaction to MRA, palliative intent to treatment, serum potassium >5 mmol/L, pregnancy, eGFR <30mL/min/1.73m^2, previous gynaecomastia, Addison's disease, symptomatic hypotension or LVEF returned to >50%

Heart Failure Support Services

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

At the time of first clinical review, 43% of referrals to an HFSS were reported to be on a guideline recommended MRA. All sites were below the benchmark.
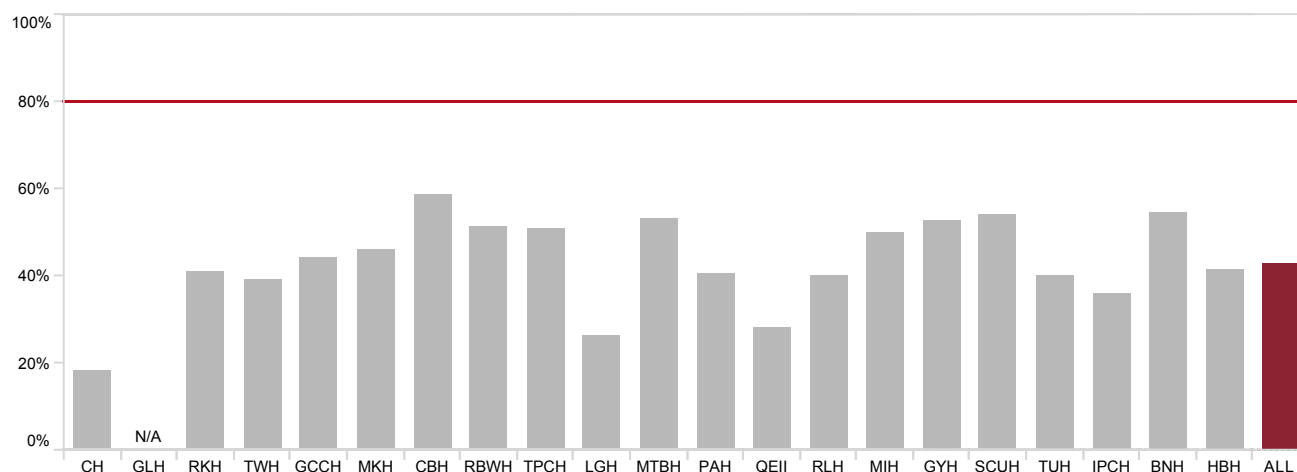
N/A: Eligible referrals ‹20

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

Table 23: Inclusion details for clinical indicator 5b: Patients on guideline recommended MRA at first clinical review

	n	%
Eligible for analysis	2,810	
Achieved benchmark	1,205	42.9
Benchmark not achieved	1,605	57.1
Ineligible	1,774	
Referred to another HFSS	646	
Documented contraindication*	352	
Patient could not be contacted, lives out of area or repeated failure to attend	203	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	187	
Patient declined service	178	
HF no longer prime issue (palliative care, high care nursing home etc.)	73	
Patient deceased	55	
Medical follow-up only (GP, private or public physician)	12	
Total referrals analysed	4,584	

* Adverse reaction to MRA, palliative intent to treatment, serum potassium ›5 mmol/L, pregnancy, eGFR ‹30mL/min/1.73m^2, 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 time frame 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), 67% of patients received a beta-blocker titration review which is below the benchmark.
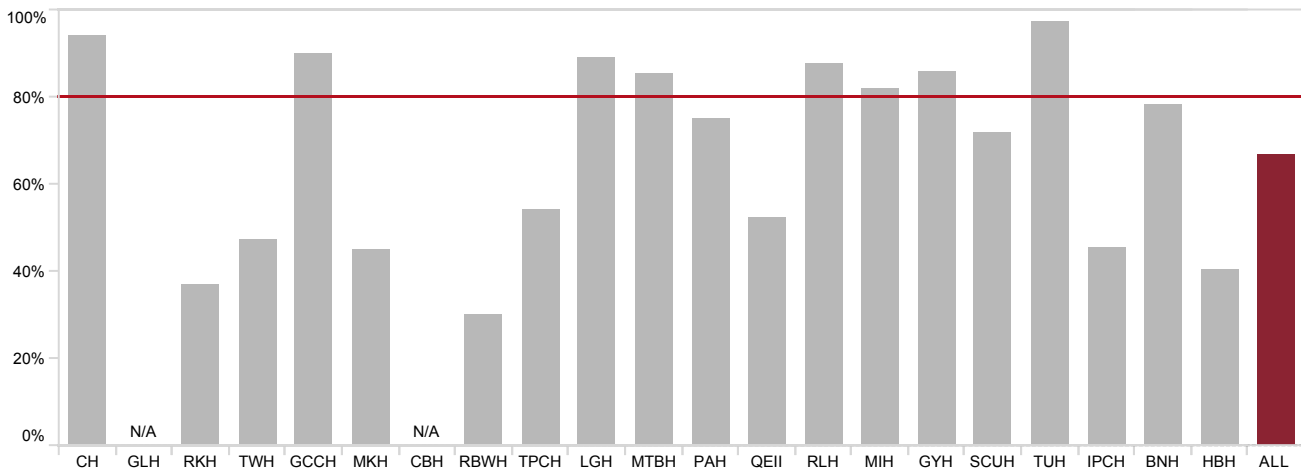
N/A: Eligible referrals <20

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

Table 24: *Inclusion details for clinical indicator 6a: Patients who had a beta blocker titration review within six months*

	n	%
Eligible for analysis	1,687	
Achieved benchmark	1,127	66.8
Benchmark not achieved	560	33.2
Ineligible	1,405	
Patient on target dose at the time of referral	681	
Patient could not be contacted, lives out of area or repeated failure to attend	116	
Documented contraindication*	109	
Patient declined service	105	
Patient deceased	78	
Referred to another HFSS	77	
Medical follow-up only (GP, private or public physician)	76	
HF no longer prime issue (palliative care, high care nursing home etc.)	36	
Referred to another service (e.g. cardiac rehabilitation or community nursing)	23	
HFSS is at capacity workload	15	
Patient on max tolerated dose	6	
Other reason	83	
Incomplete data	44	
Total analysed	**3,136**	

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

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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 35% 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
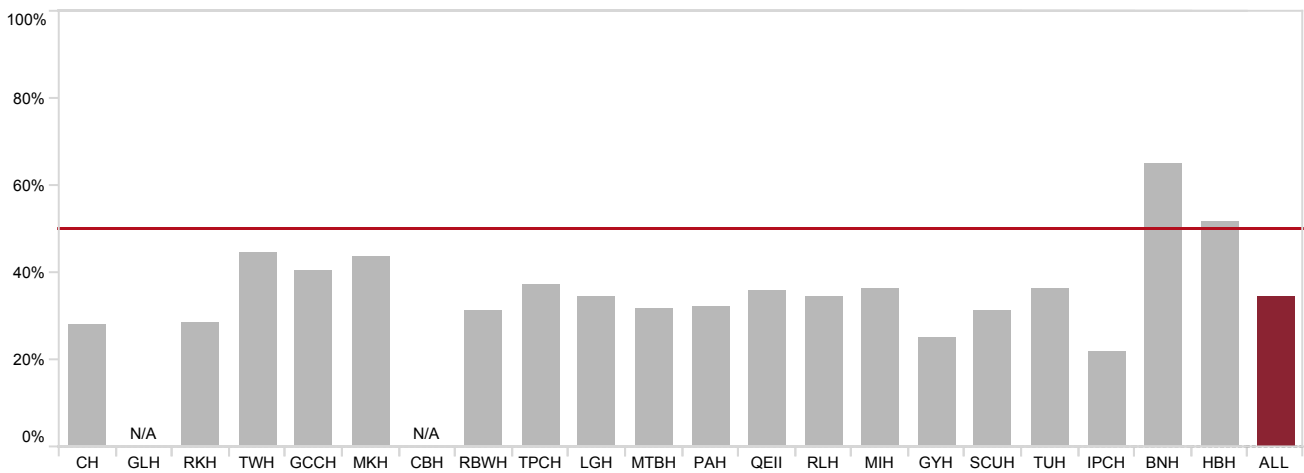
N/A: Eligible referrals <20

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

Table 25:   Inclusion details for clinical indicator 6b: Patients who achieved target beta blocker dose at time of titration review

	n	%
Eligible for analysis	1,687	
Achieved benchmark	585	34.7
Benchmark not achieved	1,102	65.3
Ineligible	N/A	
Total titration reviews conducted	**1,687**	

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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 medical 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 75% (below the benchmark).
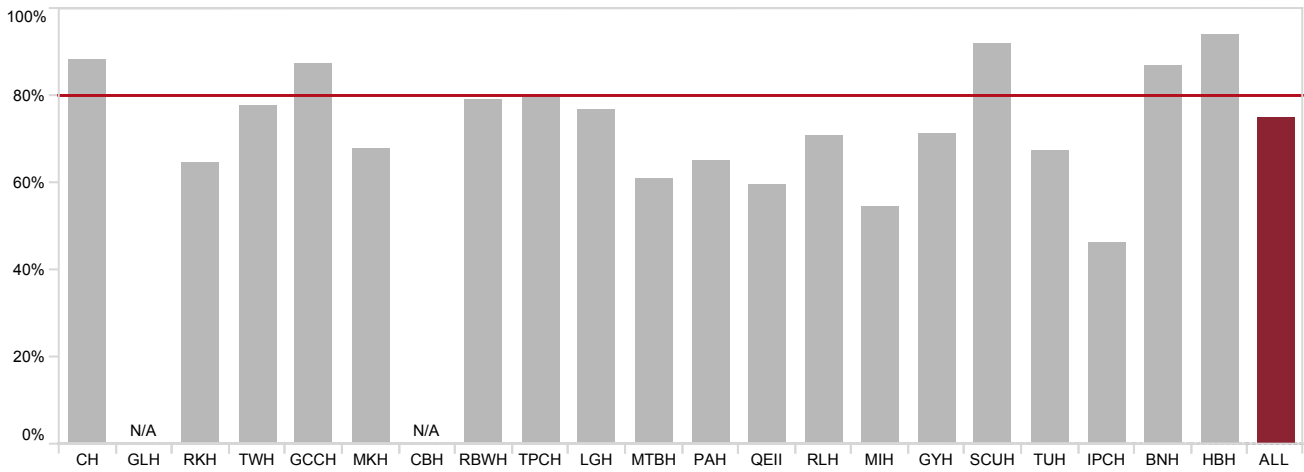
N/A: Eligible referrals <20

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

Table 26: *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	1,687	
Achieved benchmark	1,264	74.9
Benchmark not achieved	423	25.1
Ineligible	N/A	
Total titration reviews conducted	1,687	

Heart Failure Support Services

6.7 Summary of clinical indicators

Table 27: Summary of clinical process indicator performance by site

Facility	1a	1b	2	3a	3b	4a	4b	5a	5b	6a	6b	6c
Cairns Hospital	93	93	99	85	92	82	92	21	18	98	25	93
Gladstone Hospital	–	–	100	–	–	–	–	–	–	–	–	–
Rockhampton Hospital	59	69	99	87	82	83	73	56	41	27	35	78
Toowoomba Hospital	–	72	83	–	95	–	96	–	39	–	–	–
Gold Coast Community Health	86	92	93	88	87	85	86	44	44	96	46	90
Mackay Base Hospital	–	77	98	95	98	91	98	–	46	87	52	83
Caboolture Hospital	–	86	90	–	75	–	84	–	59	–	–	–
Royal Brisbane & Women's Hospital	73	93	98	92	89	90	91	52	51	42	46	80
The Prince Charles Hospital	70	50	96	89	90	92	94	51	51	80	42	81
Logan Hospital	95	99	98	92	89	96	93	17	26	96	36	79
Mater Adult Hospital	78	–	92	88	92	91	100	58	53	100	17	50
Princess Alexandra Hospital	89	36	99	94	91	84	89	41	41	96	37	71
Queen Elizabeth II Hospital	66	69	97	95	97	88	93	31	28	–	–	–
Redland Hospital	100	100	96	97	90	88	93	41	40	83	45	90
Mt Isa Hospital	–	65	92	–	100	–	97	–	50	–	–	–
Gympie Hospital	95	100	93	–	89	–	96	–	53	83	22	74
Sunshine Coast University Hospital	90	89	97	94	91	93	94	52	54	89	29	94
Townsville University Hospital	98	96	96	95	93	92	93	49	40	100	37	71
Ipswich Community Health	53	77	94	94	96	91	94	40	36	57	24	57
Bundaberg Hospital	33	73	96	98	92	90	92	56	55	82	64	91
Hervey Bay Hospital	–	99	100	–	89	–	92	–	41	63	46	96
Statewide	**79**	**82**	**96**	**92**	**90**	**89**	**91**	**45**	**43**	**67**	**32**	**72**

Legend:

1a Follow-up of acute patients within 2 weeks (Benchmark: 80%)

1b Follow-up of non-acute patients within 4 weeks (Benchmark: 80%)

2 Assessment of left ventricular ejection fraction within 2 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%)

Heart Failure Support Services

7 Patient outcomes

Heart failure hospitalisations are 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 2018 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 2018 were included. Where patients had multiple referrals to an HFSS during this period, 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 re-hospitalisation 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 with 25th and 75th percentiles as well as mean values. Categorical variables were summarised as frequencies and percentages.

Table 28:   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

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7.2   Findings

There were 3,413 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 29. A further 52 patients (1.5%) did not have complete follow up over one year to allow DAOH to be calculated.

Table 29:   Eligibility criteria for patient outcome indicators

	n	%
Total 2018 inpatient referrals	**3,413**	**100.0**
Ineligible at index admission		
Duplicate patient record	166	4.9
Died during index admission	25	0.7
Not a Queensland resident	88	2.6
Index admission is not overnight	31	0.9
Transferred to private hospital	29	0.8
No linkage data available	136	4.0
Included in readmission and mortality analysis	**2,938**	**86.1**
Ineligible at subsequent admission over 1 year		
Transferred to private hospital	50	1.5
Moved outside of Queensland	2	<0.1
Included in days alive and out-of-hospital analysis	**2,886**	**84.6**

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 1.6% and 13.5%. 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 30:   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	48 (1.6)	149 (5.1)	268 (9.1)	397 (13.5)
Died during subsequent admission*	31 (1.1)	98 (3.3)	169 (5.8)	244 (8.3)
All other deaths	17 (0.6)	51 (1.7)	99 (3.4)	153 (5.2)
Total at risk	**2,890 (98.4)**	**2,789 (94.9)**	**2,670 (90.9)**	**2,541 (86.5)**

*   Data available for Queensland public hospitals only

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Table 31: 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	1,942	33 (1.7)	99 (5.1)	175 (9.0)	267 (13.7)
Female	996	15 (1.5)	50 (5.0)	93 (9.3)	130 (13.1)
Age group					
‹65 years	1,077	7 (0.6)	24 (2.2)	52 (4.8)	75 (7.0)
65–74 years	771	9 (1.2)	38 (4.9)	61 (7.9)	93 (12.1)
≥75 years	1,090	32 (2.9)	87 (8.0)	155 (14.2)	229 (21.0)
Heart failure phenotype					
HFrEF	2,311	31 (1.3)	100 (4.3)	186 (8.0)	280 (12.1)
HFpEF	533	13 (2.4)	41 (7.7)	65 (12.2)	96 (18.0)
Missing/unsure	94	4 (4.3)	8 (8.5)	17 (18.1)	21 (22.3)
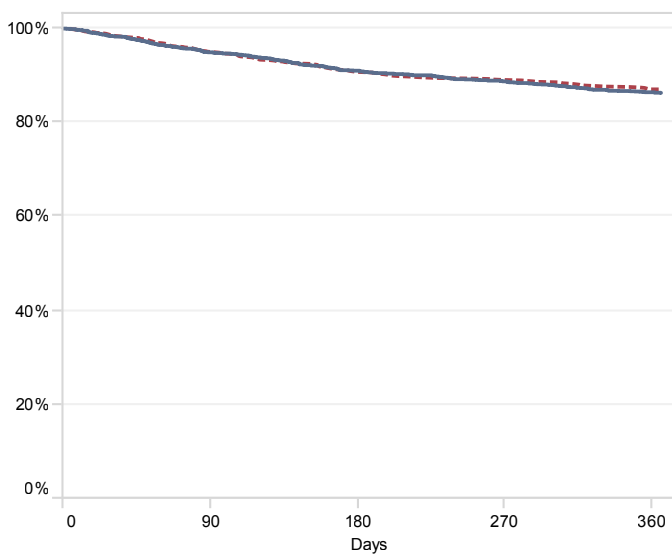
Legend: —— Male – – Female

Figure 20: Heart failure survival by gender
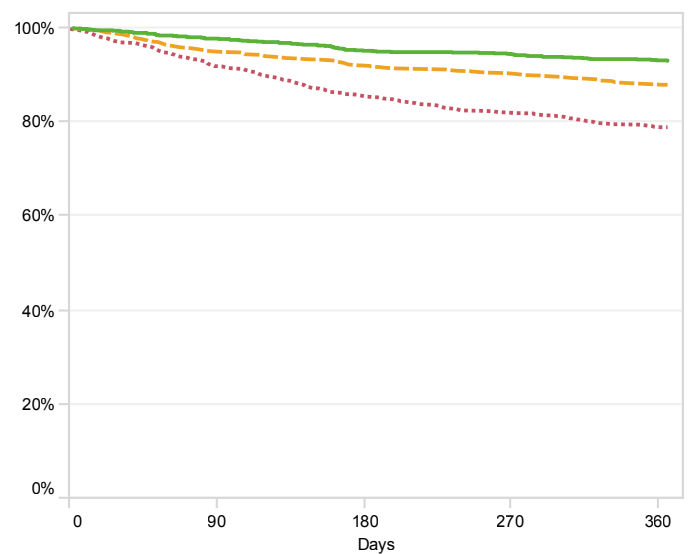
Legend: —— <65 years – – 65–74 years ···· ≥75 years

Figure 21: Heart failure survival by age group
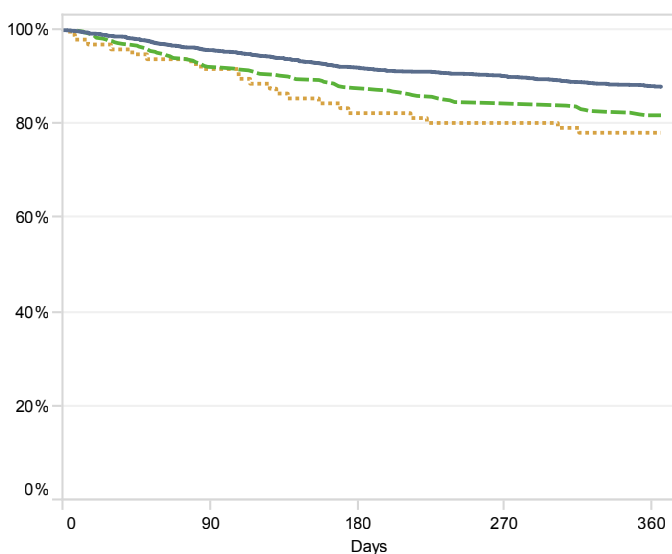
Legend: —— HFrEF – – HFpEF ···· Missing/unsure

Figure 22: Heart failure survival by phenotype

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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 2,938 eligible patients referred to HFSS during 2018, the unadjusted rate of all-cause hospitalisation was 17.8% at 30 days, increasing to 54.5% at one year. Hospitalisations relating to HF (as identified by discharge diagnosis coding) were 5.8% and 22.7% at 30 days and one year respectively.

The overall risk of hospitalisation or death within 12 months post the index admission was 55.5% (Figure 25). Almost a third of patients referred to an HFSS were rehospitalised at least two times in the subsequent 12 months (Table 32).

Table 32: Number of rehospitalisations per patient in the year post initial discharge

Total in one year	All-cause n (%)	Heart failure n (%)
0	1,371 (46.7)	2,324 (79.1)
1	697 (23.7)	390 (13.3)
2	385 (13.1)	133 (4.5)
3	193 (6.6)	43 (1.5)
4	120 (4.1)	25 (0.9)
≥5	172 (5.9)	23 (0.8)

Table 33: 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	1,942	334 (17.4)	616 (32.3)	802 (42.2)	1,013 (53.5)
Female	996	186 (18.8)	338 (34.2)	443 (45.2)	555 (56.7)
Age group					
<65 years	1,077	153 (14.3)	285 (26.8)	361 (34.2)	476 (45.1)
65–74 years	771	147 (19.1)	258 (33.7)	335 (43.9)	420 (55.4)
≥75 years	1,090	220 (20.4)	411 (38.5)	549 (51.7)	672 (63.4)
Heart failure phenotype					
HFrEF	2,311	386 (16.8)	691 (30.3)	910 (40.1)	1,158 (51.2)
HFpEF	533	116 (21.9)	225 (42.7)	285 (54.2)	352 (67.0)
Missing/unsure	94	18 (19.6)	38 (42.2)	50 (56.8)	58 (65.9)
ALL	2,938	520 (17.8)	954 (32.9)	1,245 (43.2)	1,568 (54.5)

Table 34: 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	1942	109 (5.7)	218 (11.6)	288 (15.8)	397 (22.2)
Female	996	60 (6.1)	123 (12.8)	166 (17.7)	217 (23.6)
Age group					
<65 years	1,077	43 (4.0)	90 (8.5)	115 (11.1)	170 (16.5)
65–74 years	771	53 (6.9)	84 (11.2)	112 (15.3)	157 (21.7)
≥75 years	1,090	73 (6.8)	167 (16.2)	227 (22.9)	287 (30.1)
Heart failure phenotype					
HFrEF	2,311	122 (5.3)	239 (10.7)	306 (14.0)	425 (19.9)
HFpEF	533	40 (7.6)	85 (16.6)	123 (24.7)	161 (33.2)
Missing/unsure	94	7 (7.8)	17 (19.5)	25 (29.8)	28 (33.7)
ALL	2,938	169 (5.8)	341 (12)	454 (16.4)	614 (22.7)

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Table 35: *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	1,942	351 (18.1)	648 (33.4)	843 (43.4)	1,060 (54.6)
Female	996	191 (19.2)	347 (34.8)	458 (46.0)	572 (57.4)
Age group					
‹65 years	1,077	159 (14.8)	298 (27.7)	381 (35.4)	497 (46.1)
65–74 years	771	150 (19.5)	264 (34.2)	343 (44.5)	433 (56.2)
≥75 years	1,090	233 (21.4)	433 (39.7)	577 (52.9)	702 (64.4)
Heart failure phenotype					
HFrEF	2,311	402 (17.4)	722 (31.2)	953 (41.2)	1,208 (52.3)
HFpEF	533	120 (22.5)	231 (43.3)	292 (54.8)	360 (67.5)
Missing/unsure	94	20 (21.3)	42 (44.7)	56 (59.6)	64 (68.1)
ALL	**2,938**	**542 (18.4)**	**995 (33.9)**	**1,301 (44.3)**	**1,632 (55.5)**
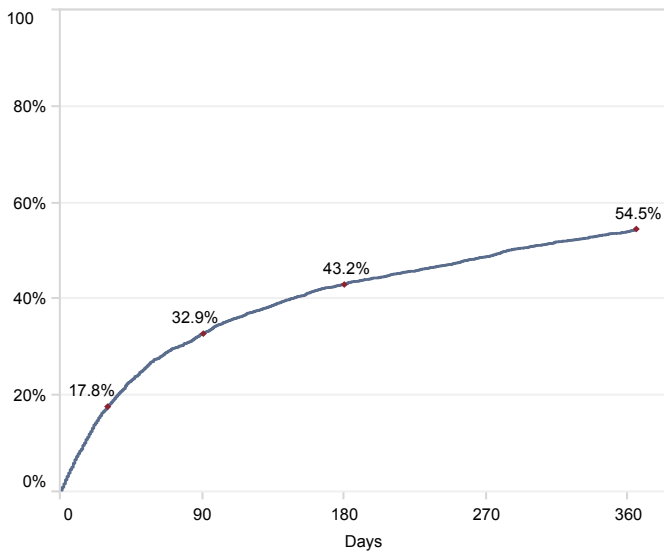
Figure 23: *Cumulative incidence of all-cause rehospitalisation*
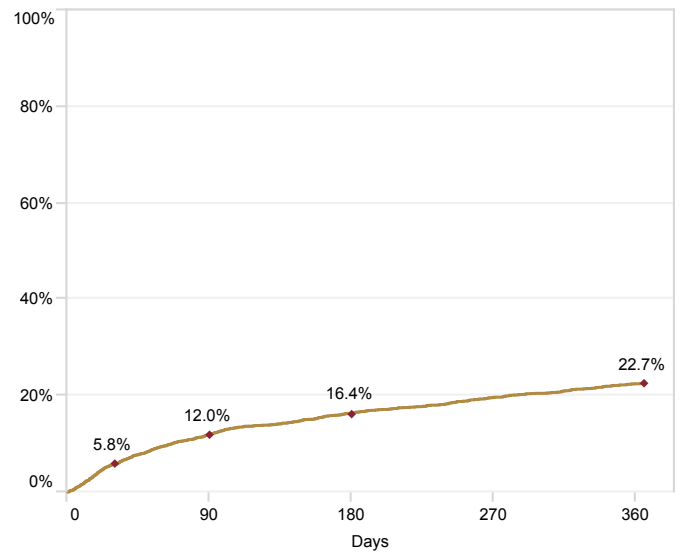

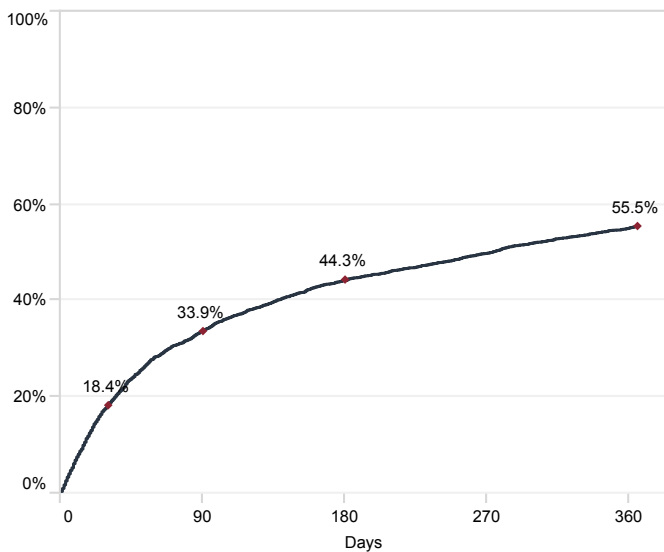**Figure 24:** *Cumulative incidence of heart failure rehospitalisation*

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

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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 43% of patients survived more than a year without rehospitalisation, with a median of 363 days for the whole group. The mean days alive and out-of-hospital was 327.2, which equates to almost 110,000 days lost due to death or hospitalisation over 12 months in 2,886 patients.

The box and whisker plots in Figure 27 illustrate the distribution of DAOH for different characteristics. The median of the data 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.
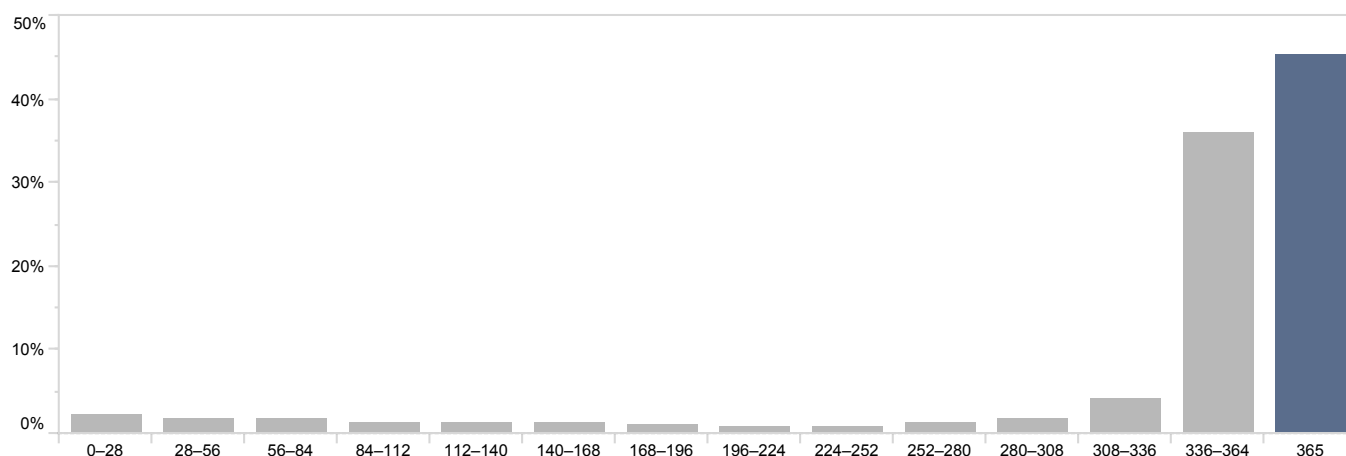
Figure 26: Days alive and out-of-hospital within one year after hospital discharge

Table 36:   Days alive and out-of-hospital within one year of discharge by patient characteristic

Characteristic	Detail	n	Mean	Median (IQR)
Sex	Male	1,909	326.8	364.0 (350–365)
	Female	977	328.1	363.4 (351–365)
Age group	<65	1,068	342.8	365.0 (358–365)
	65–74	755	330.7	363.3 (351–365)
	≥75	1,063	309.2	360.8 (326–365)
HF phenotype	HFrEF	2,271	331.5	364.3 (354–365)
	HFpEF	522	313.2	358.9 (326–365)
	Missing/unsure	93	302.2	359.7 (306–365)
Statewide		**2,886**	**327.2**	**363.7 (350–365)**

Characteristic	Detail
Sex	Male
	Female
Age group	<65
	65-74
	≥75
HF phenotype	HFrEF
	HFpEF
	Missing/unsure
ALL	-

Days

Legend: ☐ 25th to 50th percentile   ☐ 50th to 75th percentile   ☐ Median (50th percentile)   ⊢ 1.5 x IQR to 25th percentile   · Outlier
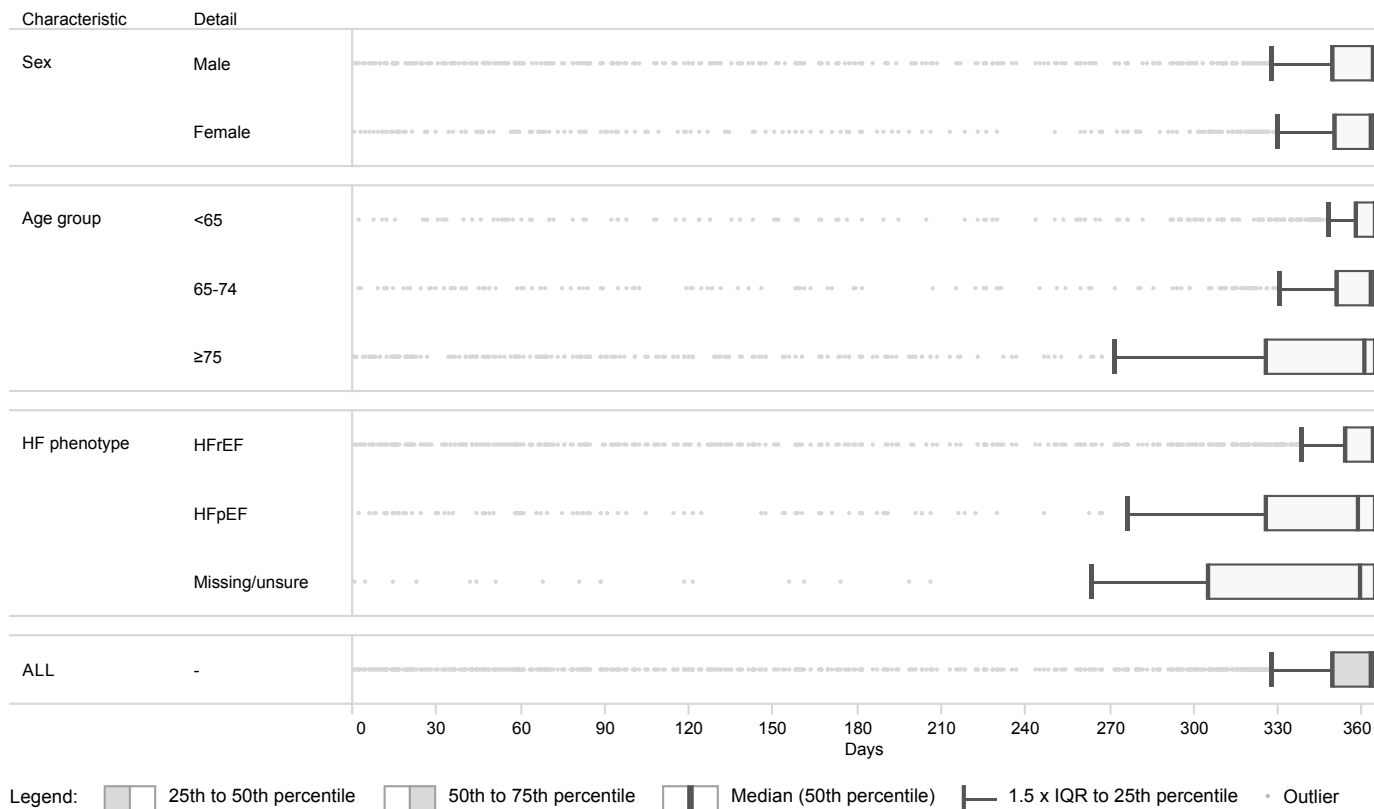
Mean, median and interquartile range (IQR) are given in days

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

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8 Conclusions

The 2019 report collected information on 5,304 newly referred patients to 21 HFSSs across Queensland, a 9% increase from the previous year. Aboriginal and Torres Strait Islander Queenslanders make up 4.6% of referrals and had a median age 12 years younger than patients of other descent.

As with previous reports, most referrals to HFSS are for patients with HFrEF, even though evidence suggests that patients with HFpEF also benefit from support. Barriers to referring patients with HFpEF and right heart failure could be the limited evidence base for specific medical therapies, the older age of patients with HFpEF, reduced capacity to identify patients on general medicine wards and limited resources to grow caseloads.

Prescribing practices for ACEI/ARB or ARNIs and beta blockers have remained consistently high over the four years. Titration of beta blockers to target dose continues to be low at 32% (benchmark is 50%). This percentage is only for those patients who had their betablocker reviewed by the HFSS (67%). Monitoring and keeping track of titration is difficult over months when there may be no regular contact with a patient. When a GP or private cardiologist is managing titration, obtaining dose information is time consuming for the HFSS. Despite the difficulties in tracking patients in the community for several months, the current dataset is rich and one of the few registries routinely collecting titration information post discharge.

This year we introduced the measurement of MRA prescription which confirmed our observations that prescribing for eligible patients is low (45% at hospital discharge and 43% at first clinical follow-up; well below the benchmark of 80%). This is an area that could benefit from extensive promotion among clinical staff.

Patient outcomes (rehospitalisation, survival and DAOH) were collected on inpatient referrals from the previous year to allow for reporting of outcomes at 12 months post the index admission (n=3,413). The burden of the disease remains high with rehospitalisation or death rates of 34% and 56% at 6 and 12 months respectively. HFpEF continues to have a higher unadjusted mortality rate than HFrEF.

Future plans include refining the data collection to include data such as comorbidities and phenotyping, to allow for risk adjusted outcomes to be reported, and capturing information related to other therapies including sodium–glucose co-transporter-2 inhibitors and exercise prescription. New fields were added to the database midway through 2019 to recording rates of cardiac implantable electronic devices use in patients referred to a HFSS. These new fields will be investigated for 2020 reporting, once a complete annual data set is available. Work is also in progress to improve the user functionality of the QCOR Heart Failure module and provide functionality to assist in patient referral management.

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References

Heart Failure Support Services Audit

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30 Atherton, J. J., & Hickey, A. (2017). Expert Comment: Is Medication Titration in Heart Failure too Complex? *Cardiac Failure Review*, 03(01), 25.

Glossary

6MWT	Six Minute Walk Test
ACC	American College of Cardiology
ACEI	Angiotensin Converting Enzyme Inhibitor
ACP	Advanced Care Paramedic
ACS	Acute Coronary Syndromes
AEP	Accredited Exercise Physiologist
ANZSCTS	Australian and New Zealand Society of Cardiac and Thoracic Surgeons
APC	Argon Plasma Coagulation
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
CI	Clinical Indicator
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
FTR	Failure to Rescue
GAD	Generalized Anxiety Disorder
GCCH	Gold Coast Community Health
GCUH	Gold Coast University Hospital
GLH	Gladstone Hospital
GP	General Practitioner
GYH	Gympie Hospital
HBH	Hervey Bay Hospital (includes Maryborough)
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	Inter-hospital Transfer
IPCH	Ipswich Community Health
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
NOAC	Non Vitamin K Antagonist Oral Anticoagulants
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
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
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