



Statewide Cardiac Clinical Network

Queensland Cardiac Outcomes Registry
2017 Annual Report

Heart Failure Support Services Audit

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This report is available online at:

<https://clinicalexcellence.qld.gov.au/priority-areas/clinician-engagement/statewide-clinical-networks/cardiac>

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1 Message from the SCCN Chair

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

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

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

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

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

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

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

Dr Paul Garrahy
Chair
Statewide Cardiac Clinical Network

2 Introduction

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

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

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

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

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

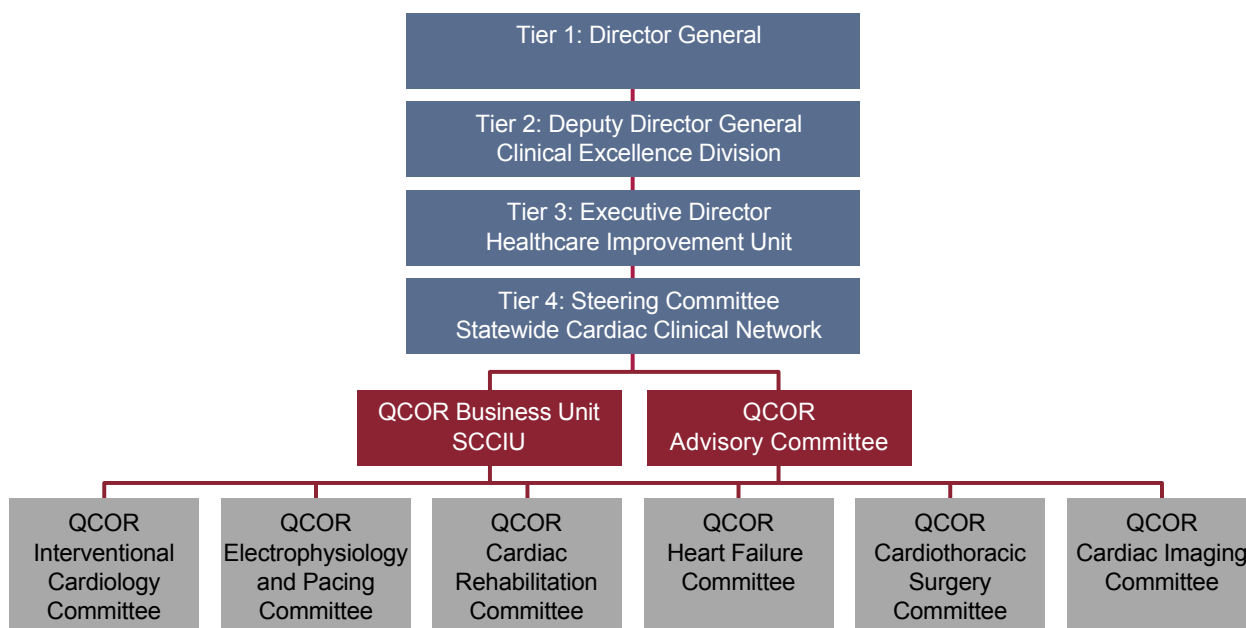


Figure A: Operational structure

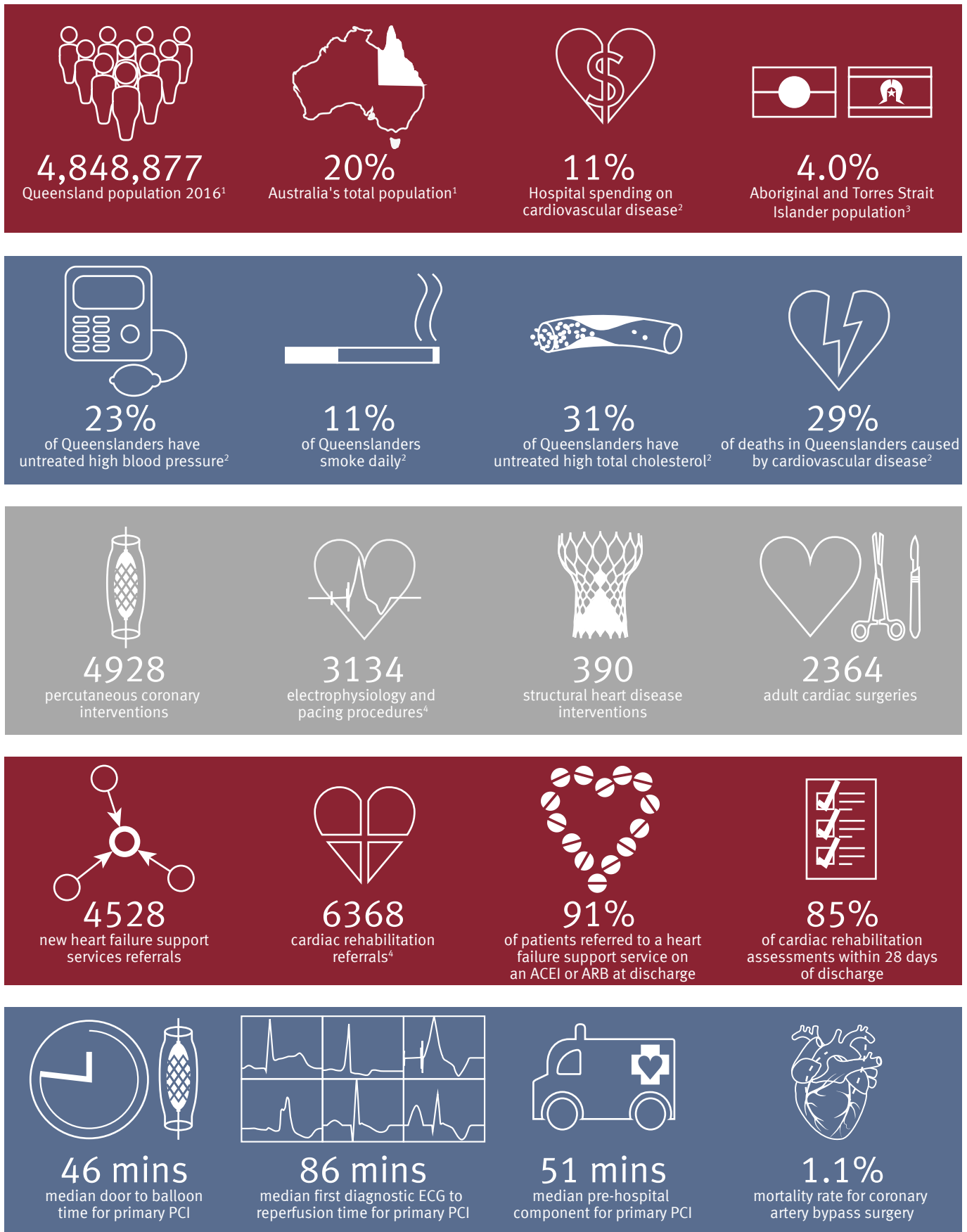


Figure B: QCOR 2017 infographic

3 Executive summary

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

4 Acknowledgements and authors

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

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

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6 Future plans

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

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

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

Heart Failure Support Services Audit



48 Message from the Heart Failure Services Steering Committee Chairs

It is our pleasure to release the second annual report of clinical performance for Heart Failure Support Services (HFSS) in Queensland Health. The 2017 report presents findings for patients with a diagnosis of heart failure who are referred to one of the 23 multidisciplinary support services across Queensland Health.

Similar to last year, this report presents findings on a range of clinical performance indicators for patients referred to the services in the 2017 calendar year. In addition, this year we are pleased to present 30-day through to 12-month outcome data (mortality, readmission, and time out of hospital) for the 2016 cohort.

The report includes information on a select group of clinical indicators reflective of best practice at a state-wide and local level. Patient outcomes are reported at a statewide level.

We would like to thank the dedicated heart failure nurses and other healthcare providers whose commitment to data collection allows the monitoring of both process and outcome measures of healthcare. This report provides reassurance regarding a number of quality performance measures, and reveals some variations in practice, which will inform healthcare planning and practice at a local level. This report also allows for benchmarking with other jurisdictions and provides valuable information about overall standards of care for patients with chronic heart failure in Queensland.

Finally, we would like to acknowledge the patients and their families referred to heart failure services who have to manage a multitude of factors as a consequence of their chronic condition. We hope that the monitoring of our clinical practice is one small, but important contribution to ensuring that patients receive the best possible clinical care to ultimately live longer and achieve the best quality of life.

A/Prof John Atherton and Ms Tracey Nunan
Co-chairs
Queensland Heart Failure Services Steering Committee of the SCCN

49 Key findings

Heart Failure Support Services (HFSS) help patients at high risk of hospitalisation and are comprised of multidisciplinary teams with specialist medical support. Audit findings are summarised below:

Characteristics of referrals to the 21 participating HFSS for 2017

- There were 4,528 new referrals (13% increase from 2016)
- Identified Aboriginal and Torres Strait Islander patients made up 4.1% of all referrals
- Most referrals to HFSS were: located in South East Queensland (84%); from inpatient settings (71%); male (65%) and with heart failure associated with a reduced left ventricular ejection fraction (HFrEF) (79%)
- The overall median age was 70 years with: males younger than females (69 vs 74 years); and those with HFrEF ten years younger than those with a preserved left ventricular ejection fraction (HFpEF) (68 vs 78 years).
- A higher proportion of patients with HFpEF were female (55%), whereas patients with HFrEF were predominately male (67%).

Clinical indicators for 2017

Process indicators measured the proportion of eligible patients who received specific interventions. At a statewide level, most indicators met benchmarks except for those relating to beta blocker titration review and achievement.

Table 1: Summary of clinical process indicator performance

#	Clinical process indicator measure	% referrals
1a	First clinical review within 2 weeks for inpatient referrals	79
1b	First clinical review within 4 weeks for non-acute referrals	87*
2	Left ventricular ejection fraction (LVEF) assessed within 2 years of referral	94*
3a	ACEI/ARB† prescription at hospital discharge	91*
3b	ACEI/ARB† prescription at time of first clinical review	92*
4a	Beta blocker‡ prescription at hospital discharge	88*
4b	Beta blocker‡ prescription at time of first clinical review	89*
5a	Beta blocker‡ titration review within six months of first clinical review	71
5b	Beta blocker‡ clinical guideline target dose achieved at time of titration review	34
5c	Beta blocker‡ clinical guideline target or maximum tolerated dose achieved at time of titration review	70

* Benchmark met (benchmark is 80% achievement except for 5b which is 50%)

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

‡ Bisoprolol, Carvedilol, Metoprolol sustained release, or Nebivolol

Patient outcomes

Patient outcomes analyses are based on the 2016 cohort to allow for measures to be applied up to 12 months from the index hospitalisation discharge date. Key findings for patients referred from an inpatient setting are summarised in Table 2. Subgroup analysis suggests differences in outcomes according to age and heart failure phenotype.

Table 2: Summary of patient outcomes within one year

#	Measures post index hospitalisation*	30 days	1 year
1	All-cause mortality	1.6%	13.6%
2	a) All-cause rehospitalisation	18.3%	57.7%
	b) Heart failure rehospitalisation	5.8%	22.5%
3	Composite all-cause hospitalisation or all-cause mortality	18.7%	58.7%
4	Days alive and out of hospital†	N/A	363 median days‡

* Commences from date of discharge for index admission

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

‡ Approximately 60% of patients had additional time in hospital

Recommendations

Overall performance with respect to clinical indicators is very high, however the review and titration of beta blockers for up to 6 months remains a challenge for most services. Initial works are currently underway to provide patient management tools to assist HFSS with patient tracking. Departmental resourcing considerations and strategies such as increased nurse-led titration clinics may also assist in ensuring patients receive optimal therapies.

Patient outcomes provide important baseline information and will be further enhanced with the collection of clinical data necessary for risk adjustment. While the majority of reported clinical indicators are pharmacological, the dataset should be extended so that non-pharmacological interventions, such as exercise programs, which also impact upon patient outcomes are included for analysis.

50 Participating sites

Queensland HFSS are multidisciplinary teams that assist patients with heart failure (HF) to adhere to treatment and manage symptoms. These teams are comprised of HF nurses with specialist medical support. Some services may include pharmacists, physiotherapists or exercise physiologists, and other allied health professionals.

Statewide coordination of these services provides training and promotes an evidence-based, consistent approach in delivery of care across the state.

Services provided by Queensland HFSS include:

- Active case finding throughout the hospital with an opt-out approach
- Patient and carer education during and post hospitalisation
- Discharge coordination between the inpatient treating team and primary care services, including GP
- Heart failure multidisciplinary clinic and/or telephone-based follow-up or home visits or exercise program
- Medical follow-up that may include heart failure, general cardiology or medical outpatient clinics depending on local resources and patient preferences.

HF nurses entered data relating to all patients referred to their HFSS as part of routine care, using a web-based system which allows reporting of patient characteristics and benchmarking on five clinical indicators. Nurses are provided with weekly reminders regarding fields that require completion and patients due for a review of medication titration status at six months post referral.

When patients are referred onto another HFSS, the audit is completed only for the specific aspect of the journey of care delivered by the site.

Of the 23 HFSS in Queensland, 21 contributed data to this report. The Advanced Heart Failure and Cardiac Transplant Unit (a quaternary unit for Queensland at The Prince Charles Hospital) was not included this year due to interrupted data entry. Toowoomba Hospital was excluded from analysis due to incomplete data, leaving 20 HFSS included in the reporting of clinical indicators.



Figure 1: Heart Failure Support Service (HFSS) locations

Table 3 shows the range of activities offered by Queensland HFSS in 2017. All HFSS provide telephone support.

Table 3: Activities offered by Queensland HFSS

HHS*	HFSS	Inpatient support	Pharmacist	Exercise therapist	Group rehab	Nurse clinics	Home visits	NP†	Specialist medical review onsite‡
Cairns and Hinterland	Cairns Hospital	Y	-	Y	Y	Y	Y	Y	Y
Central Queensland	Gladstone Hospital	-	-	Y	Y	-	Y	-	Telehealth
	Rockhampton Hospital	Y	Y	Y	Y	Y	Y	Y	Y
Darling Downs	Toowoomba Hospital	Y	-	Y	-	Y	Y	-	Y
Gold Coast	Gold Coast Community Health	Y	Y	Y	Y	Y	Y	-	Y
Mackay	Mackay Base Hospital	Y	-	Y	Y	Y	Y	-	Y
Metro North	Caboolture Hospital	Y	Y	-	-	Y	-	-	Y
	Redcliffe Hospital	-	-	-	-	-	Y	-	Y
	RBWH§	Y	Y	Y	Y	Y	-	-	Y
	TPCH	Y	Y	Y	Y	Y	Y	Y	Y
Metro South	Logan Hospital	Y	Y	Y	Y	Y	Y	Y	Y
	Mater Adult Brisbane	Y	-	-	-	Y	Y	Y	Y
	PAH#	Y	Y	Y	Y	Y	Y	Y	Y
	QEII**	Y	Y	-	-	Y	Y	Y	Y
	Redland Hospital	Y	-	Y	Y	Y	Y	Y	Y
North West	Mt Isa	Y	-	-	-	-	Y	Y	Outreach
Sunshine Coast	Gympie Hospital	Y	-	-	-	Y	Y	Y	Outreach
	SCUH‡‡	Y	-	-	-	Y	Y	Y	Y
Townsville	Townsville Hospital	Y	Y	Y	-	Y	Y	Y	Y
West Moreton	Ipswich Community Health	Y	Y	Y	Y	Y	Y	Y	Y
Wide Bay	Bundaberg	Y	-	Y	Y	-	-	-	Y
	Hervey Bay Hospital	Y	-	Y	Y	Y	Y	Y	Telehealth
STATEWIDE		91%	45%	73%	64%	82%	86%	64%	82%

* Hospital and Health Service

† Nurse practitioner who can prescribe medications

‡ Review by cardiologist or general physician with interest in heart failure

§ Royal Brisbane & Women's Hospital

|| The Prince Charles Hospital

Princess Alexandra Hospital

** Queen Elizabeth II Hospital

‡‡ Includes Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital (SCUH) in March 2017

51 New referrals

In 2017, there were 4,528 new referrals reported by 21 participating HFSS. This represents a 12.6% increase from the first Queensland Cardiac Outcomes Registry (QCOR) HFSS annual report in 2016, where the total number of referrals reported was 4,021.

Patients readmitted to hospital whilst being monitored by a HFSS are not counted as a new referral. Most patients are monitored for at least six months to review medication titration.

51.1 Location of referrals

The two services reporting the highest number of new referrals were Princess Alexandra Hospital (n=721), followed by The Prince Charles Hospital (n=576).

Table 4: Distribution of new referrals by HFSS location

HHS	HFSS	n	%
Cairns and Hinterland	Cairns Hospital	128	2.8%
Central Queensland	Gladstone Hospital	33	0.7%
	Rockhampton Hospital	197	4.4%
Darling Downs	Toowoomba Hospital	-	-
Gold Coast	Gold Coast Community Health	421	9.3%
Mackay	Mackay Base Hospital	102	2.3%
Metro North	Caboolture Hospital	181	4.0%
	Redcliffe Hospital	92	2.0%
	Royal Brisbane & Women's Hospital	307	6.8%
	The Prince Charles Hospital	576	12.7%
Metro South	Logan Hospital	350	7.7%
	Mater Adult Hospital	111	2.5%
	Princess Alexandra Hospital	721	15.9%
	Queen Elizabeth II Hospital	116	2.6%
	Redland Hospital	165	3.6%
North West	Mt Isa Hospital	22	0.5%
Sunshine Coast	Gympie Hospital	125	2.8%
	Sunshine Coast University Hospital*	365	8.1%
Townsville	Townsville Hospital	175	3.9%
West Moreton	Ipswich Community Health	286	6.3%
Wide Bay	Bundaberg Hospital	-	-
	Hervey Bay Hospital	55	1.2%
STATEWIDE		4,528	100.0%

* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

The distribution of referrals between South East Queensland (84%) and the rest of the state (16%) is consistent with the findings of the previous QCOR annual report.

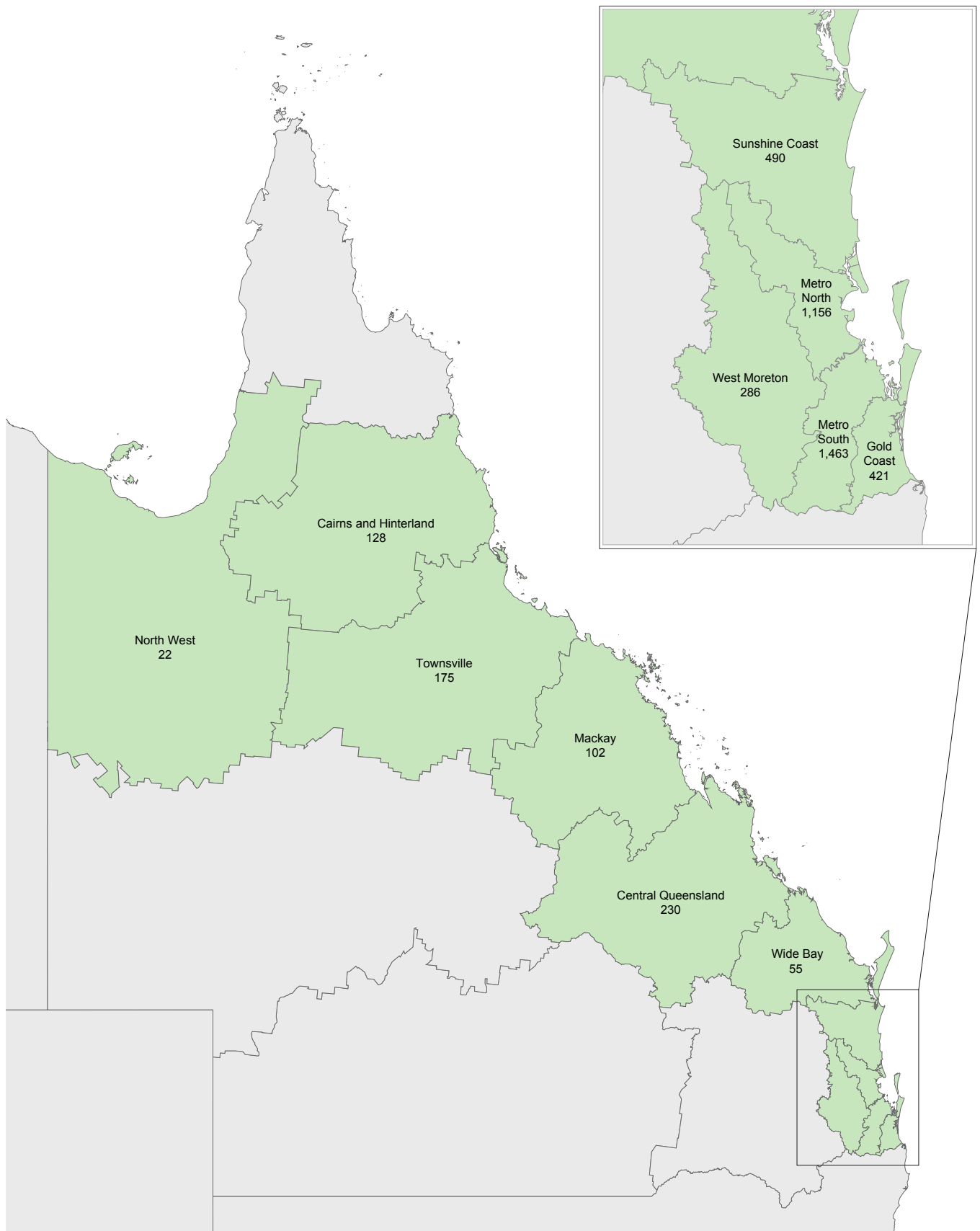


Figure 2: Regional distribution of new referrals

51.2 Referral source

Most referrals originate from an inpatient setting (71%).

Few non-acute referrals came directly from primary care (4%), which may be due to these referrals flowing to specialty outpatient clinics for diagnosis and treatment optimisation prior to referral to a HFSS.

Table 5: Proportion by referral source

HHS	HFSS	Inpatient n (%)	Outpatient n (%)	Another HFSS n (%)	Primary care n (%)
Cairns and Hinterland	Cairns Hospital	58 (45.3)	68 (53.1)	2 (1.6)	-
Central Queensland	Gladstone Hospital	13 (39.4)	1 (3.0)	18 (54.5)	1 (3.0)
	Rockhampton Hospital	104 (52.8)	48 (24.4)	14 (7.1)	31 (15.7)
Gold Coast	Gold Coast Community Health	291 (69.1)	82 (19.5)	18 (4.3)	30 (7.1)
Mackay	Mackay Base Hospital	56 (54.9)	42 (41.2)	3 (2.9)	1 (1.0)
Metro North	Caboolture Hospital	26 (14.4)	53 (29.3)	2 (1.1)	100 (55.2)
	Redcliffe Hospital	77 (83.7)	13 (14.1)	2 (2.2)	-
	Royal Brisbane & Women's Hospital	249 (81.1)	54 (17.6)	4 (1.3)	-
	The Prince Charles Hospital	533 (92.5)	35 (6.1)	7 (1.2)	1 (0.2)
Metro South	Logan Hospital	253 (72.3)	29 (8.3)	67 (19.1)	1 (0.3)
	Mater Adult Hospital	87 (78.4)	23 (20.7)	1 (0.9)	-
	Princess Alexandra Hospital	680 (94.3)	30 (4.2)	11 (1.5)	-
	Queen Elizabeth II Hospital	87 (75.0)	18 (15.5)	10 (8.6)	1 (0.9)
	Redland Hospital	60 (36.4)	33 (20.0)	69 (41.8)	3 (1.8)
North West	Mt Isa Hospital	5 (22.7)	16 (72.7)	-	1 (4.5)
Sunshine Coast	Gympie Hospital	68 (54.4)	18 (14.4)	38 (30.4)	1 (0.8)
	Sunshine Coast University Hospital*	312 (85.5)	44 (12.1)	7 (1.9)	2 (0.5)
Townsville	Townsville Hospital	110 (62.9)	57 (32.6)	3 (1.7)	5 (2.9)
West Moreton	Ipswich Community Health	133 (46.5)	106 (37.1)	46 (16.1)	1 (0.3)
Wide Bay	Hervey Bay Hospital	5 (9.1)	15 (27.3)	31 (56.4)	4 (7.3)
STATEWIDE		3,207 (70.8)	785 (17.3)	353 (7.8)	183 (4.0)

* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

52 Patient characteristics

52.1 Age

The statewide median age of patients managed by a HFSS was 70 years. The median age of women (74 years) was five years older than for men.

The Mt Isa Hospital reported the youngest median age of 56 years and Redcliffe Hospital the oldest median of 79 years. Nearly a quarter of patients were 80 years of age and older.

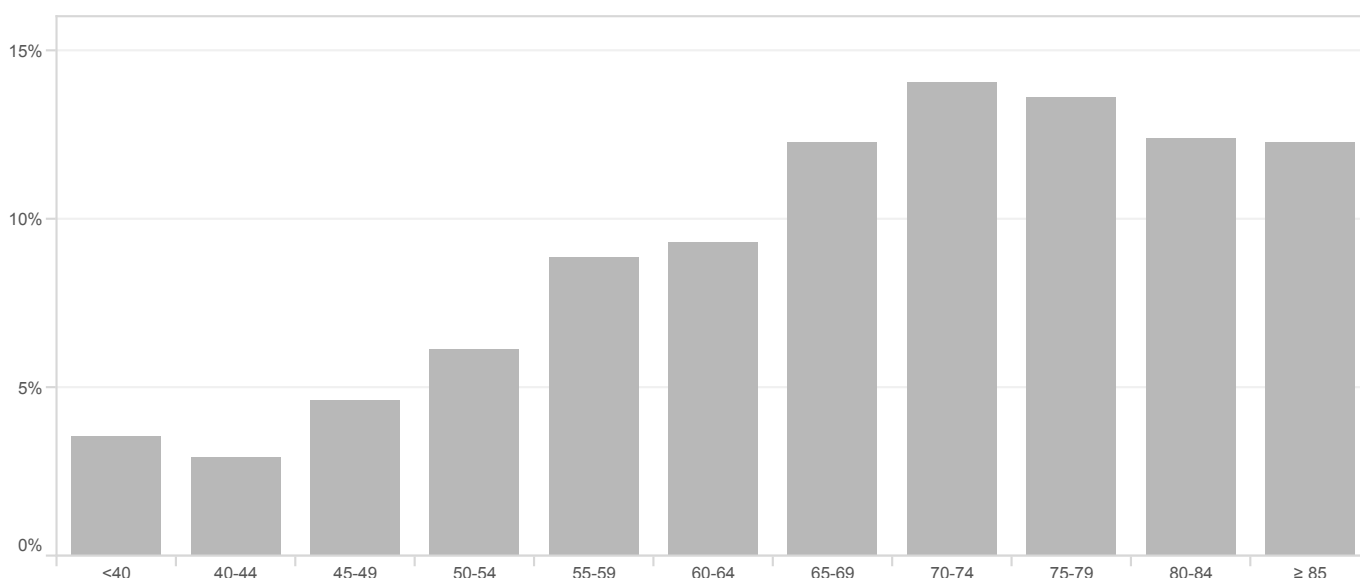


Figure 3: Age groups at referral to a HFSS

Table 6: Median age (years) of referrals by gender

HHS	HFSS	Male	Female	ALL
Cairns and Hinterland	Cairns Hospital	62	63	62
Central Queensland	Gladstone Hospital	66	63	64
	Rockhampton Hospital	67	71	68
Gold Coast	Gold Coast Community Health	71	77	73
Mackay	Mackay Base Hospital	72	65	69
Metro North	Caboolture Hospital	71	69	70
	Redcliffe Hospital	78	79	79
	Royal Brisbane & Women's Hospital	67	71	68
	The Prince Charles Hospital	72	78	74
Metro South	Logan Hospital	68	74	70
	Mater Adult Hospital	67	69	68
	Princess Alexandra Hospital	66	71	67
	Queen Elizabeth II Hospital	73	75	74
	Redland Hospital	71	73	71
North West	Mt Isa Hospital	57	44	56
Sunshine Coast	Gympie Hospital	74	78	76
	Sunshine Coast University Hospital*	70	77	72
Townsville	Townsville Hospital	63	69	64
West Moreton	Ipswich Community Health	67	70	67
Wide Bay	Hervey Bay Hospital	72	72	72
STATEWIDE		69	74	70

* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

52.2 Gender

The majority of referrals were males (65%), ranging from 53% to 74% across sites.

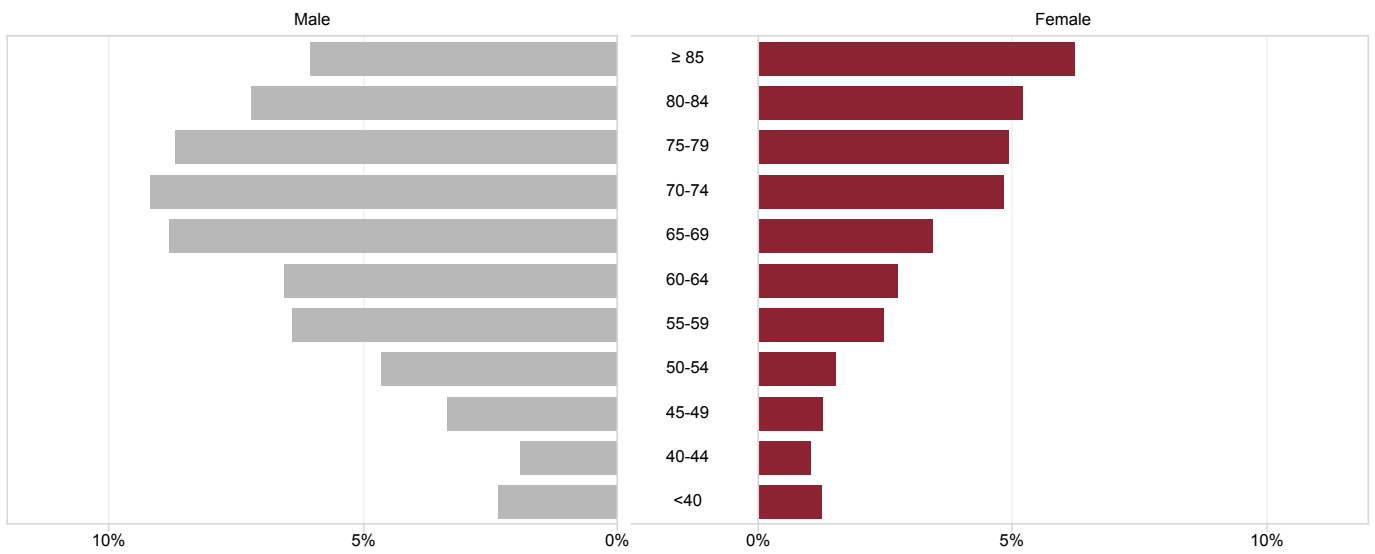
Table 7: Number and proportion of referrals to HFSS by gender

HHS	HFSS	Male n (%)	Female n (%)
Cairns and Hinterland	Cairns Hospital	84 (65.6)	44 (34.4)
Central Queensland	Gladstone Hospital	21 (63.6)	12 (36.4)
	Rockhampton Hospital	127 (64.5)	70 (35.5)
Gold Coast	Gold Coast Community Health	277 (65.8)	144 (34.2)
Mackay	Mackay Base Hospital	74 (72.5)	28 (27.5)
Metro North	Caboolture Hospital	118 (65.2)	63 (34.8)
	Redcliffe Hospital	49 (53.3)	43 (46.7)
	Royal Brisbane & Women's Hospital	215 (70.0)	92 (30.0)
	The Prince Charles Hospital	386 (67.0)	190 (33.0)
Metro South	Logan Hospital	211 (60.3)	139 (39.7)
	Mater Adult Hospital	63 (56.8)	48 (43.2)
	Princess Alexandra Hospital	493 (68.4)	228 (31.6)
	Queen Elizabeth II Hospital	66 (56.9)	50 (43.1)
	Redland Hospital	99 (60.0)	66 (40.0)
North West	Mt Isa Hospital	15 (68.2)	7 (31.8)
Sunshine Coast	Gympie Hospital	73 (58.4)	52 (41.6)
	Sunshine Coast University Hospital*	240 (65.8)	125 (34.2)
Townsville	Townsville Hospital	114 (65.1)	61 (34.9)
West Moreton	Ipswich Community Health	179 (62.6)	107 (37.4)
Wide Bay	Hervey Bay Hospital	41 (74.5)	14 (25.5)
STATEWIDE		2,945 (65.0)	1,583 (35.0)

* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

52.2.1 Gender by age group

The age distribution of referrals differed for gender. The highest proportion of referrals for males was in the 70 to 74 years age group (9% of all referrals or 14% of males), and for females the over 85 years category (6% of all referrals or 18% of females).



% of total (n=4,528)

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

52.3 Aboriginal and Torres Strait Islander status

Ethnicity is an important determinant of health with a particular impact on the development of cardiovascular disease. In Aboriginal and Torres Strait Islander populations a higher age-adjusted incidence and prevalence of hypertension, coronary artery disease, and rheumatic heart disease has been observed. These are well-recognised pathological precursors for the pathogenesis of symptomatic HF.²⁶

Patients of identified Aboriginal and Torres Strait Islander status made up 4.1% of all HFSS referrals, with considerable variation between services. Cairns, Mount Isa, and Townsville all reported greater than 15% of case load as being Aboriginal and Torres Strait Islander.

The highest proportion of Aboriginal and Torres Strait Islander patient referrals was reported by Mt Isa Hospital (46%), while the highest absolute number of referrals for Aboriginal and Torres Strait Islander patients reported by Princess Alexandra Hospital (n=33), followed by Townsville Hospital (n=28).

Table 8: Proportion of identified Aboriginal and Torres Strait Islander patients by HFSS

HHS	HFSS	n	%
Cairns and Hinterland	Cairns Hospital	23	18.0
Central Queensland	Gladstone Hospital	2	6.1
	Rockhampton Hospital	13	6.6
Gold Coast	Gold Coast Community Health	2	0.5
Mackay	Mackay Base Hospital	4	3.9
Metro North	Caboolture Hospital	4	2.2
	Redcliffe Hospital	0	0.0
	Royal Brisbane & Women's Hospital	15	4.9
	The Prince Charles Hospital	12	2.1
Metro South	Logan Hospital	10	2.9
	Mater Adult Hospital	5	4.5
	Princess Alexandra Hospital	33	4.6
	Queen Elizabeth II Hospital	2	1.7
	Redland Hospital	3	1.8
North West	Mt Isa Hospital	10	45.5
Sunshine Coast	Gympie Hospital	2	1.6
	Sunshine Coast University Hospital*	3	0.8
Townsville	Townsville Hospital	28	16.0
West Moreton	Ipswich Community Health	12	4.2
Wide Bay	Hervey Bay Hospital	2	3.6
STATEWIDE		185	4.1

* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

52.4 Classification of heart failure by left ventricular ejection fraction

Heart failure with reduced left ventricular ejection fraction (HFrEF) was defined as patients with an ejection fraction (EF) less than 50% at time of diagnosis. Some patients may return to a normal ejection fraction (greater than 50%) but still require ongoing medications to manage HFrEF.²⁷

The majority (79%) of patients had HFrEF at the time of diagnosis. While information about EF was missing for 5% of patients there was a lot of variation between sites. This suggests that diagnosis is less than optimal at some sites due to poor access to echocardiography.

Table 9: Proportion of patients by heart failure type

HHS	HFSS	HFrEF* n (%)	HFpEF† n (%)	Missing/unsure n (%)
Cairns and Hinterland	Cairns Hospital	123 (96.1)	4 (3.1)	1 (0.8)
Central Queensland	Gladstone Hospital	29 (87.9)	1 (3.0)	3 (9.1)
	Rockhampton Hospital	170 (86.3)	26 (13.2)	1 (0.5)
Gold Coast	Gold Coast Community Health	301 (71.5)	107 (25.4)	13 (3.1)
Mackay	Mackay Base Hospital	97 (95.1)	5 (4.9)	-
Metro North	Caboolture Hospital	139 (76.8)	32 (17.7)	10 (5.5)
	Redcliffe Hospital	38 (41.3)	22 (23.9)	32 (34.8)
	Royal Brisbane & Women's Hospital	255 (83.1)	44 (14.3)	8 (2.6)
	The Prince Charles Hospital	406 (70.5)	116 (20.1)	54 (9.4)
Metro South	Logan Hospital	233 (66.6)	92 (26.3)	25 (7.1)
	Mater Adult Hospital	96 (86.5)	6 (5.4)	9 (8.1)
	Princess Alexandra Hospital	610 (84.6)	99 (13.7)	12 (1.7)
	Queen Elizabeth II Hospital	90 (77.6)	20 (17.2)	6 (5.2)
	Redland Hospital	118 (71.5)	15 (9.1)	32 (19.4)
North West	Mt Isa Hospital	21 (95.5)	1 (4.5)	-
Sunshine Coast	Gympie Hospital	78 (62.4)	40 (32.0)	7 (5.6)
	Sunshine Coast University Hospital‡	311 (85.2)	50 (13.7)	4 (1.1)
Townsville	Townsville Hospital	162 (92.6)	6 (3.4)	7 (4.0)
West Moreton	Ipswich Community Health	236 (82.5)	47 (16.4)	3 (1.0)
Wide Bay	Hervey Bay Hospital	46 (83.6)	9 (16.4)	-
STATEWIDE		3,559 (78.6)	742 (16.4)	227 (5.0)

* Heart failure with reduced ejection fraction

† Heart failure with preserved ejection fraction

‡ Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

The median age for patients with HFrEF was 68 years, compared to a median age of 78 years for patients with HFpEF. The higher proportion of patients with HFpEF were female (55%), whereas patients with HFrEF were predominately male (70%).

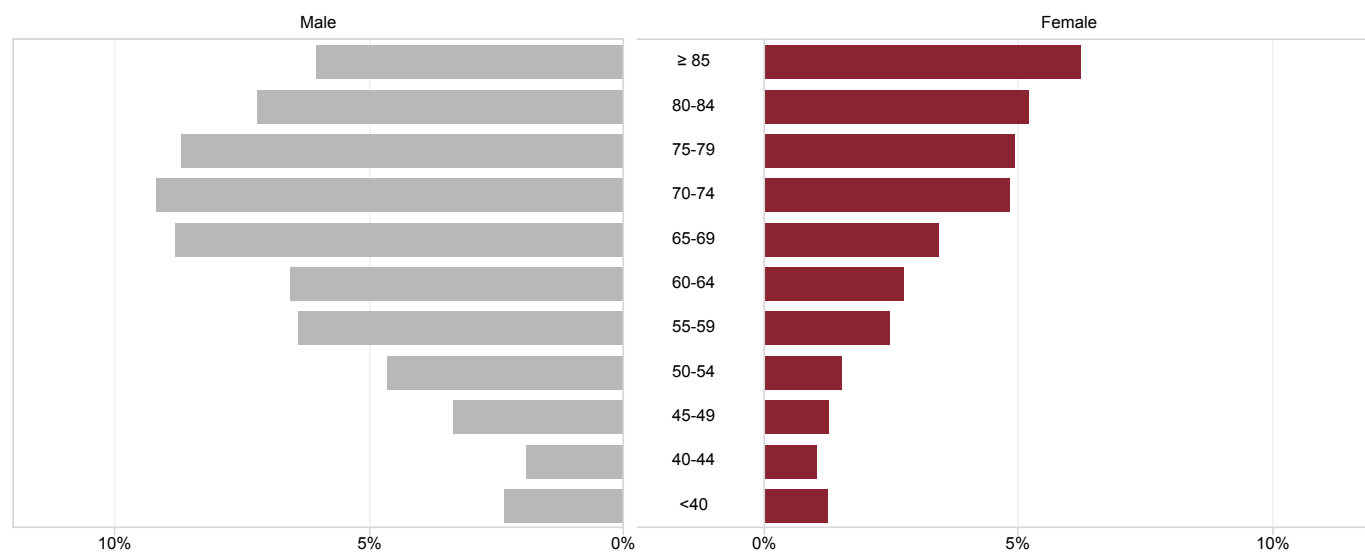
Table 10: Type of heart failure by age, gender, and Aboriginal and Torres Strait Islander status

	HFrEF*	HFpEF†
Number	3,559	742
Age (median years)	68	78
Male %	69.8%	45%
Indigenous %	4.4%	3.2%

Excluding missing data (5.0%)

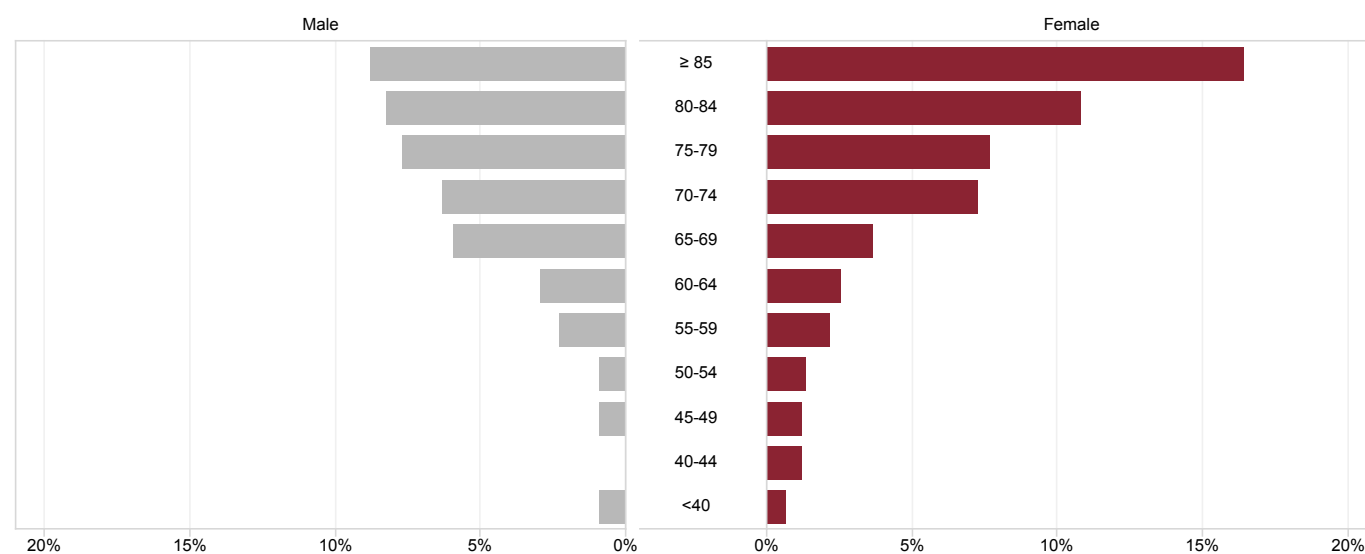
* Heart failure with reduced ejection fraction

† Heart failure with preserved ejection fraction



% of total with HFrEF (n=3,559)

Figure 5: Proportion of HFrEF referrals by gender and age group



% of total with HFpEF (n=742)

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

52.5 Summary of patient characteristics

An outline of patient characteristics for all referrals to HFSS is included below.

Table 11: Summary of patient characteristics

Characteristic	Summary
Participating HFSS	21
New referrals	4,528
Referrals from South East Queensland	84.3%
Referral source:	
Inpatient	70.8%
Outpatient	17.3%
Another HFSS	7.8%
Primary care	4.0%
Age (median years):	
All (median, range by service)	70 (56–79) years
Male vs. Female	74 vs 69 years
Indigenous vs. non-Indigenous	55 vs 71 years
80 years and over	24.6%
Males	65.1%
Indigenous	4.1%
HFrEF*	78.6% (69.8% male, median age 68 years)
HFpEF†	16.4% (45.0% male, median age 78 years)

* Heart failure with reduced ejection fraction

† Heart failure with preserved ejection fraction

53 Clinical indicators

The number of clinical indicators collected was intentionally limited to allow pragmatic data entry as part of routine clinical practice. Consensus on the content and methods of collecting data was reached following a Delphi method involving all HFSS in Queensland. Five process indicators were agreed upon as shown in Table 12. The target benchmark for all indicators was set at 80%, except for 5b (beta blocker titration to clinical guideline target dose at six months) where the benchmark was set at 50%.²⁸

Table 12: Clinical indicators

Indicator #	Process measures
1	First Clinical Review: Timeliness of follow-up by a HFSS for inpatient and outpatient referrals 1a) First clinical review within 2 weeks for inpatient referrals 1b) First clinical review within 4 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) or angiotensin II receptor blockers (ARB) for patients with HFrEF 3a) ACEI/ARB prescription at hospital discharge 3b) ACEI/ARB prescription at time of first clinical review
4	Prescription of guideline recommended beta blockers for HFrEF (Bisoprolol, Carvedilol, Metoprolol sustained release, or Nebivolol) 4a) Beta blocker prescription at hospital discharge 4b) Beta blocker prescription at time of first clinical review
5	Beta blocker review and titration 5a) Beta blocker titration review within six months of first clinical review 5b) Beta blocker clinical guideline target dose achieved at time of titration review 5c) Beta blocker clinical guideline target or maximum tolerated dose achieved at time of titration review

53.1 First clinical review

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

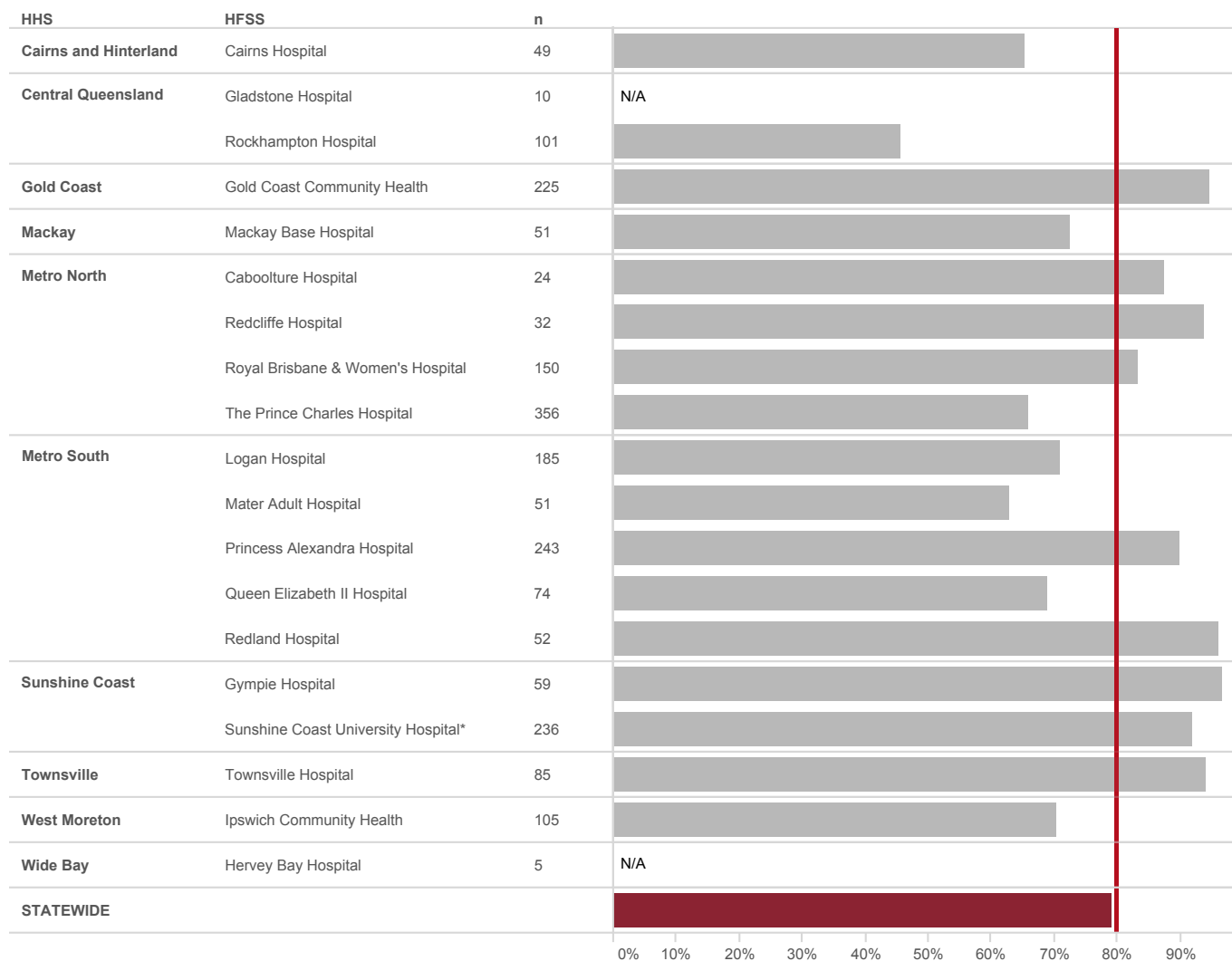
1a First clinical review by Heart Failure Support Service within 2 weeks of hospital discharge or date of referral if after discharge (for inpatient referrals).

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

Of the 2,097 eligible patients referred from an acute setting, 79% received a clinical review by HFSS within two weeks of hospital discharge. The desired benchmark of 80% was achieved by 9/17 (53%) of HFSS that had more than 20 cases eligible for analysis.

Table 13: Inpatients receiving first HFSS clinical review within 2 weeks of hospital discharge

	n	%
Eligible for analysis	2,097	
Achieved benchmark	1,656	79.0%
Benchmark not achieved	441	21.0%
Ineligible	1,078	
Referred to another HFS	603	
Other reason	212	
Patient declined service	144	
Patient could not be contacted	80	
Patient deceased	39	
Missing data	32	
Total acute patients	3,207	



Note: Mt Isa Hospital (North West HHS) is not displayed due to no cases eligible for analysis

* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 7: Proportion of inpatients who received first HF Support Service clinical review within 2 weeks of hospital discharge or date of referral if received after discharge

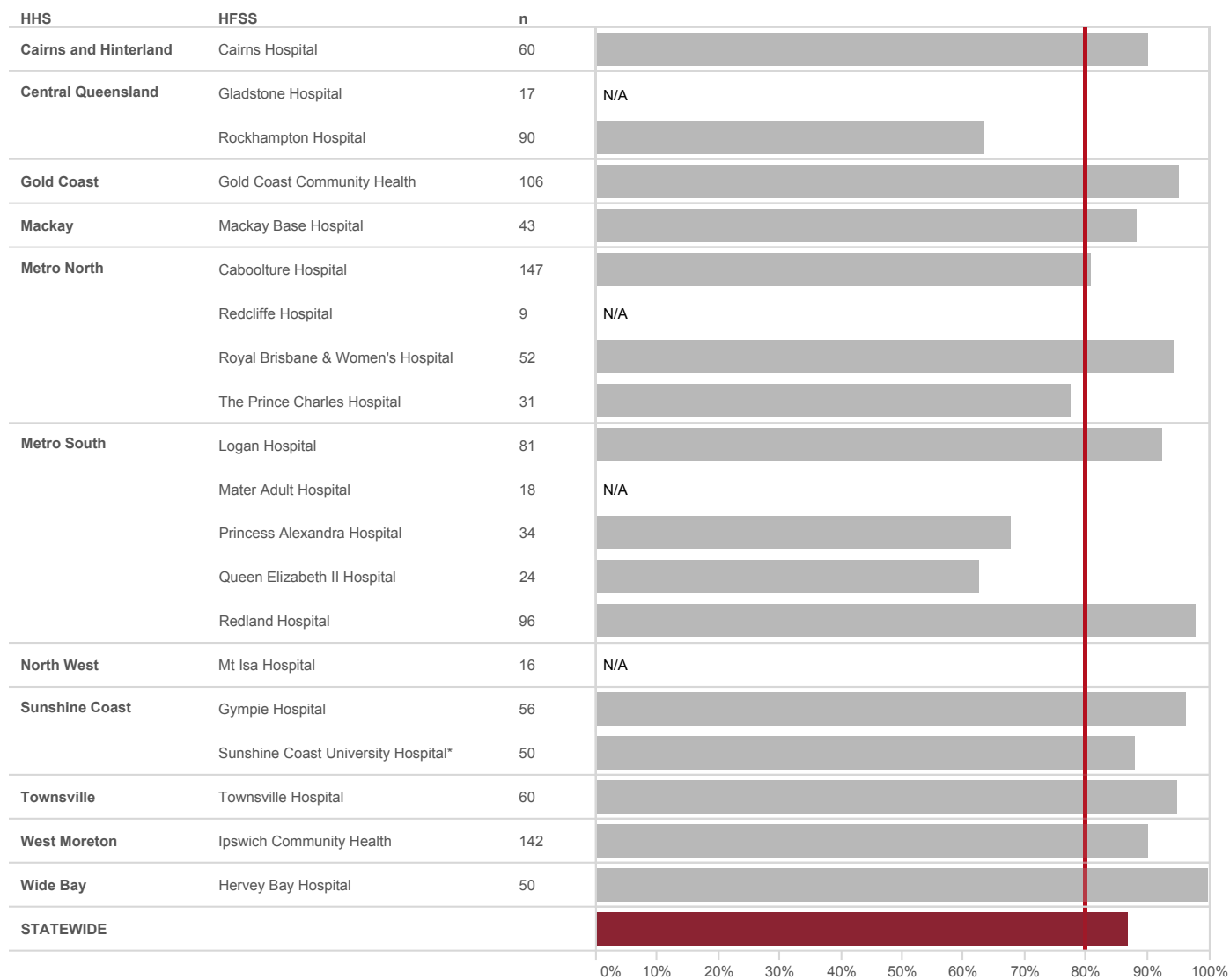
1b First Heart Failure Support Service clinical review within 4 weeks for non-acute referrals

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

Referrals for 1,182 eligible patients came from non-acute services, of which 87% received a clinical review within 4 weeks of referral. The desired benchmark of 80% was achieved by 12/16 (75%) of HFSS that had more than 20 cases eligible for analysis.

Table 14: Non-acute patients receiving first HFSS clinical review within 4 weeks of referral

	n	%
Eligible for analysis	1,182	
Achieved benchmark	1,026	86.8%
Benchmark not achieved	156	13.2%
Ineligible	126	
Patient declined service	39	
Other reason	31	
Patient could not be contacted	29	
Referred to another HFS	21	
Patient deceased	6	
Incomplete data	13	
Total non-acute patients	1,321	



* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 8: Proportion of non-acute patients who received first HFSS clinical review within 4 weeks of referral

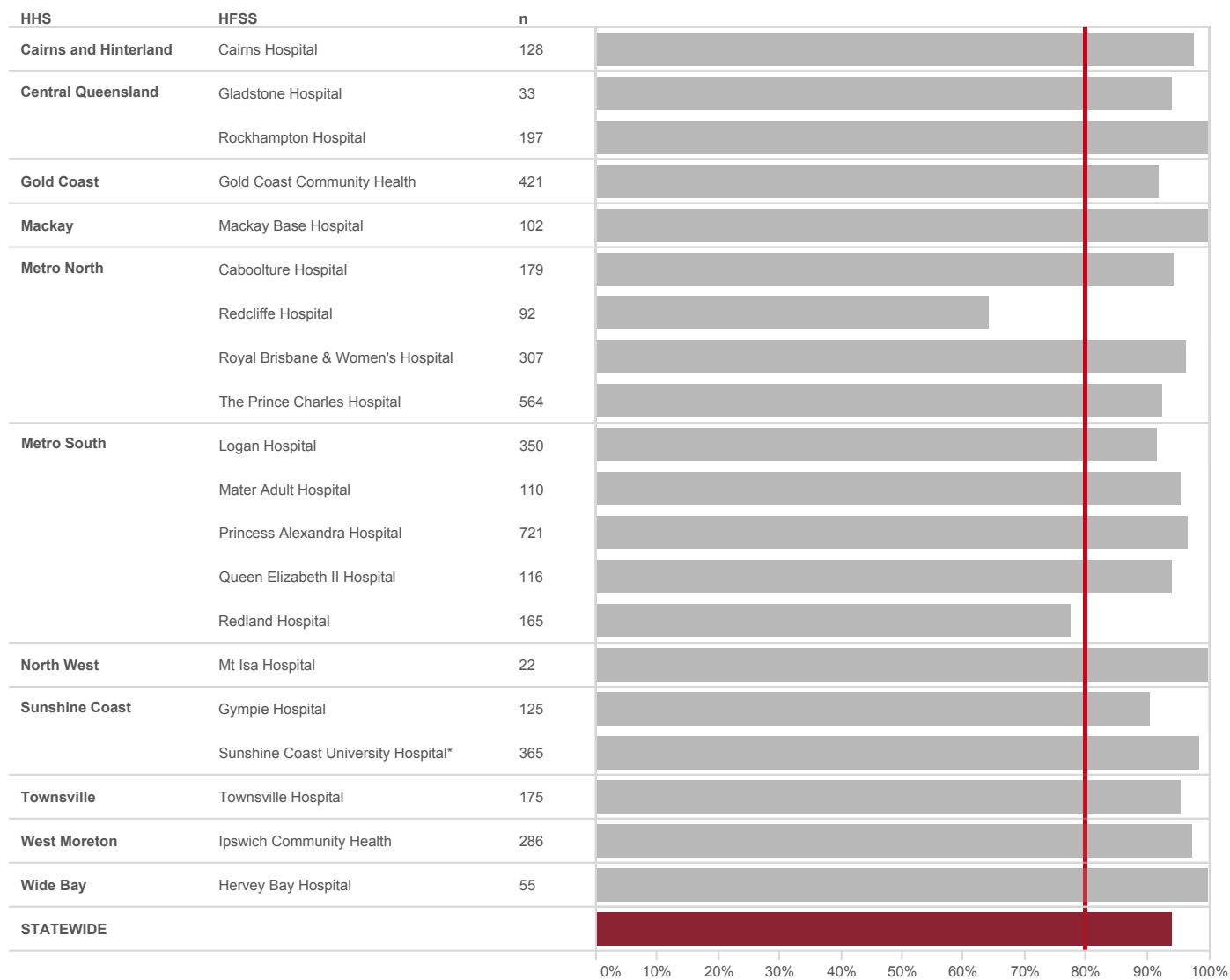
53.2 Left ventricular ejection fraction (LVEF) assessed within 2 years of referral to HFSS

Australian clinical guidelines recommend that all patients with HF should have an assessment of left ventricular function.²⁷ In 94% of cases, LVEF was assessed within two years of referral to HFSS.

The benchmark of 80% was achieved by 18 out of 20 (90%) HFSS that had more than 20 cases eligible for analysis.

Table 15: Patients who had LVEF assessed within two years of referral

	n	%
Eligible for analysis	4,513	
Achieved benchmark	4,243	94.0%
Benchmark not achieved	270	6.0%
Ineligible	N/A	
Incomplete data	15	
Total referrals	4,528	



* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 9: Proportion of all patients who had LVEF assessed within two years of referral to HFSS

53.3 Prescription of ACEI or ARB for patients with HFrEF

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

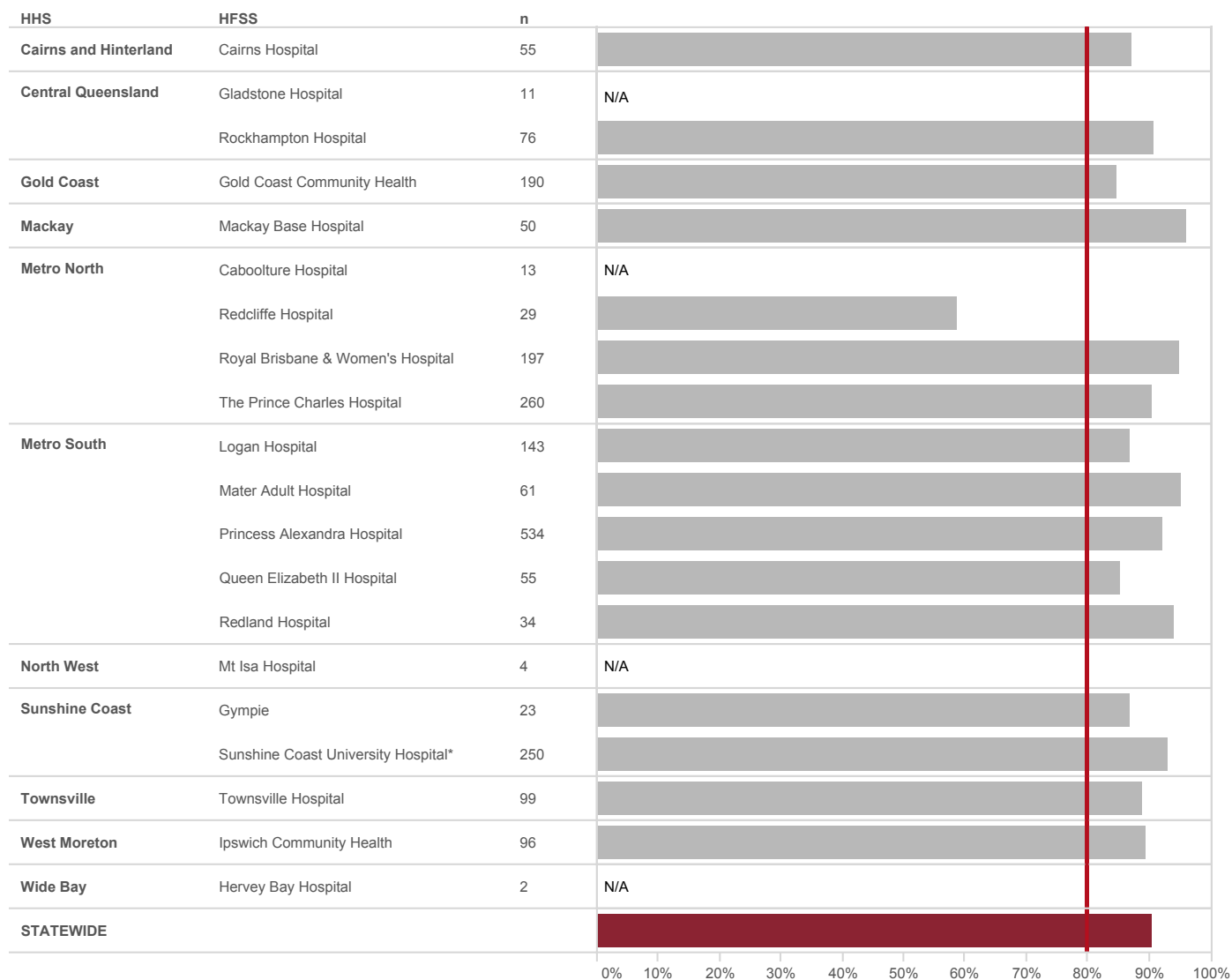
3a ACEI or ARB prescription for HFrEF at hospital discharge

In 2017, 91% of patients referred to a HFSS were prescribed an ACEI or ARB therapy on hospital discharge. The benchmark of 80% was achieved by 16/17 (90%) of HFSS that had more than 20 cases eligible for analysis.

Table 16: Inpatients on ACEI or ARB at time of hospital discharge

	n	%
Eligible for analysis	2,182	
Achieved benchmark	1,974	90.5%
Benchmark not achieved	208	9.5%
Ineligible	907	
Documented contraindication*	159	
Not HFrEF	613	
LV Function assessment not available	135	
Incomplete data	118	
Total acute patients	3,207	

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



* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 10: Proportion of patients who were on ACEI or ARB therapy at time of hospital discharge

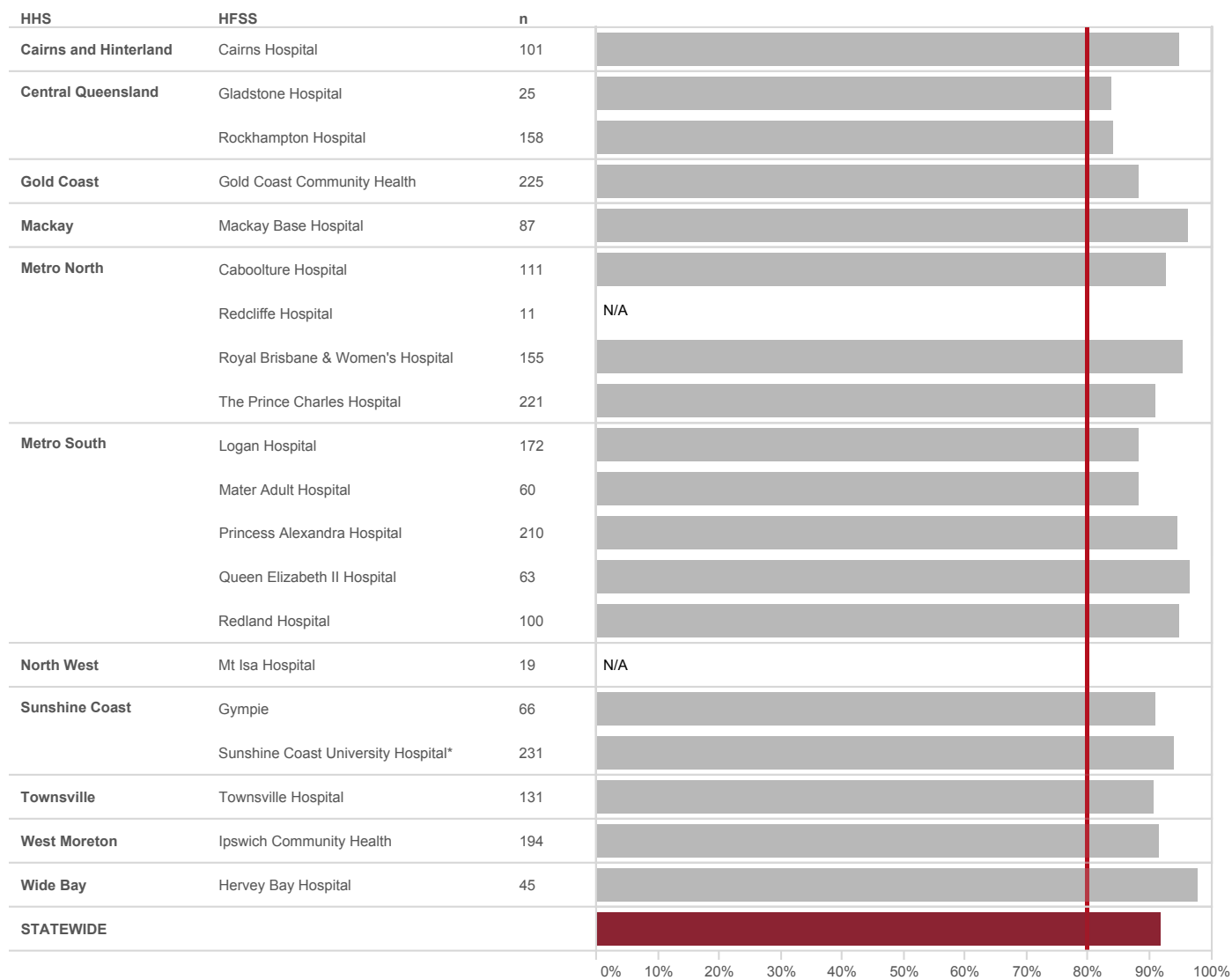
3b ACEI or ARB prescription for HFrEF at time of first HFSS clinical review

At the time of first clinical review, the target for prescription of ACEI or ARB was met for 92% of patients. The benchmark of 80% was achieved by 18/18 (100%) of HFSS that had more than 20 cases eligible for analysis.

Table 17: Patients on an ACEI or ARB at first clinical review

	n	%
Eligible for analysis	2,385	
Achieved benchmark	2,191	91.9%
Benchmark not achieved	194	8.1%
Ineligible	2,053	
Referred to another HFSS	624	
Not HFrEF	608	
Other reason	243	
Patient declined service	183	
Documented contraindication*	141	
Patient could not be contacted	109	
LV function assessment not available	100	
Patient deceased	45	
Incomplete data	90	
Total referrals	4,528	

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



* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 11: Proportion of patients on ACEI or ARB therapy at time of first clinical review by site

53.4 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.²⁷ Guideline recommended beta blockers include: Bisoprolol, Carvedilol, Metoprolol sustained release, or Nebivolol. Results pertain only to these beta blocker medications.

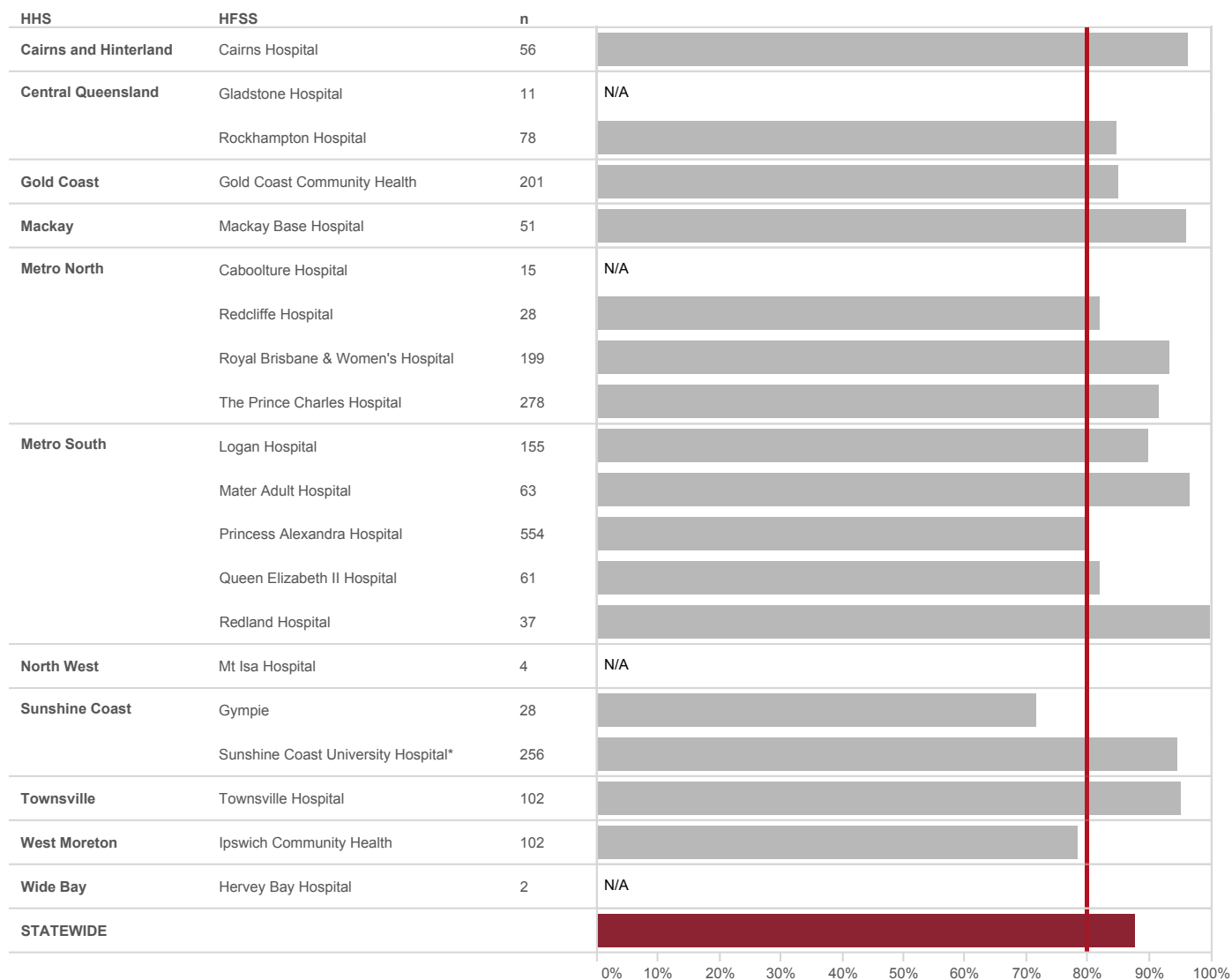
4a Beta blocker prescription for HFrEF at time of hospital discharge

In 2017, 88% of referrals were reported to be on a guideline recommended beta blocker at the time of discharge from hospital. The benchmark of 80% was achieved by 13 out of 16 (81%) of HFSS that had more than 20 cases eligible for analysis.

Table 18: Patients on guideline recommended beta blocker at hospital discharge

	n	%
Eligible for analysis	2,281	
Achieved benchmark	2,003	87.8%
Benchmark not achieved	278	12.2%
Ineligible	808	
Not HFrEF	613	
LV Function assessment not available	135	
Documented contraindication*	60	
Incomplete data	118	
Total acute patients	3,207	

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



* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 12: Proportion of patients on guideline recommended beta blocker at hospital discharge by site

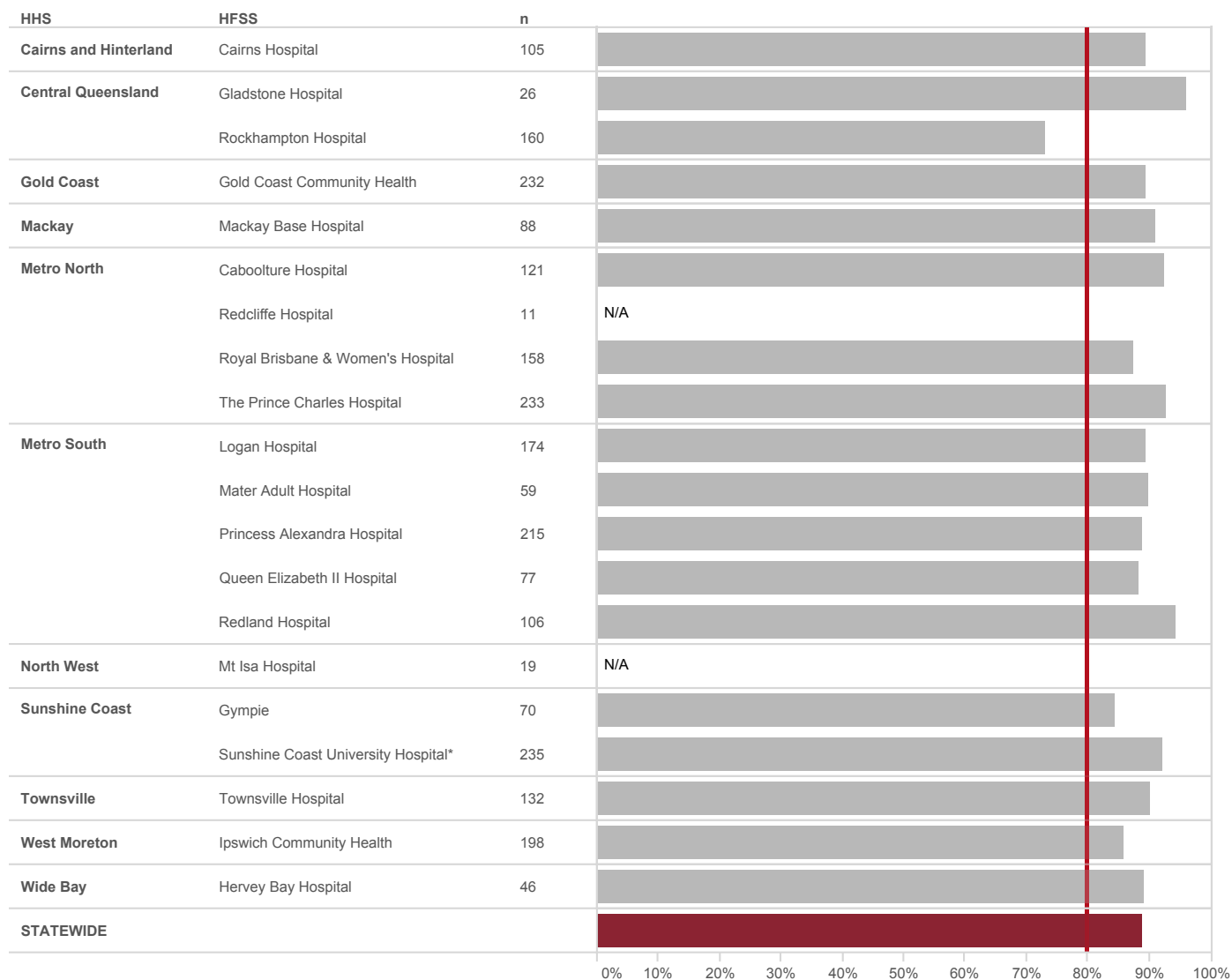
4b Beta blocker prescription for HFREF at time of first HFSS clinical review

In 2017, 89% of referrals to HFSS were reported to be on a guideline recommended beta blocker at the time of first clinical review. The desired benchmark of 80% was achieved by 17 out of 18 (94%) of HFSS that had more than 20 cases eligible for analysis.

Table 19: Patients on guideline recommended beta blocker at first clinical review

	n	%
Eligible for analysis	2,465	
Achieved benchmark	2,193	89.0%
Benchmark not achieved	272	11.0%
Ineligible	1,971	
Referred to another HFSS	624	
Not HFREF	608	
Other reason	243	
Patient declined service	183	
Patient could not be contacted	109	
LV function assessment not available	100	
Documented contraindication	59	
Patient deceased	45	
Incomplete data	92	
Total referrals	4,528	

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



* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 13: Proportion of patients on guideline recommended beta blocker therapy at first clinical review by site

53.5 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.

5a Beta blocker titration review conducted within six months of first HFSS clinical review

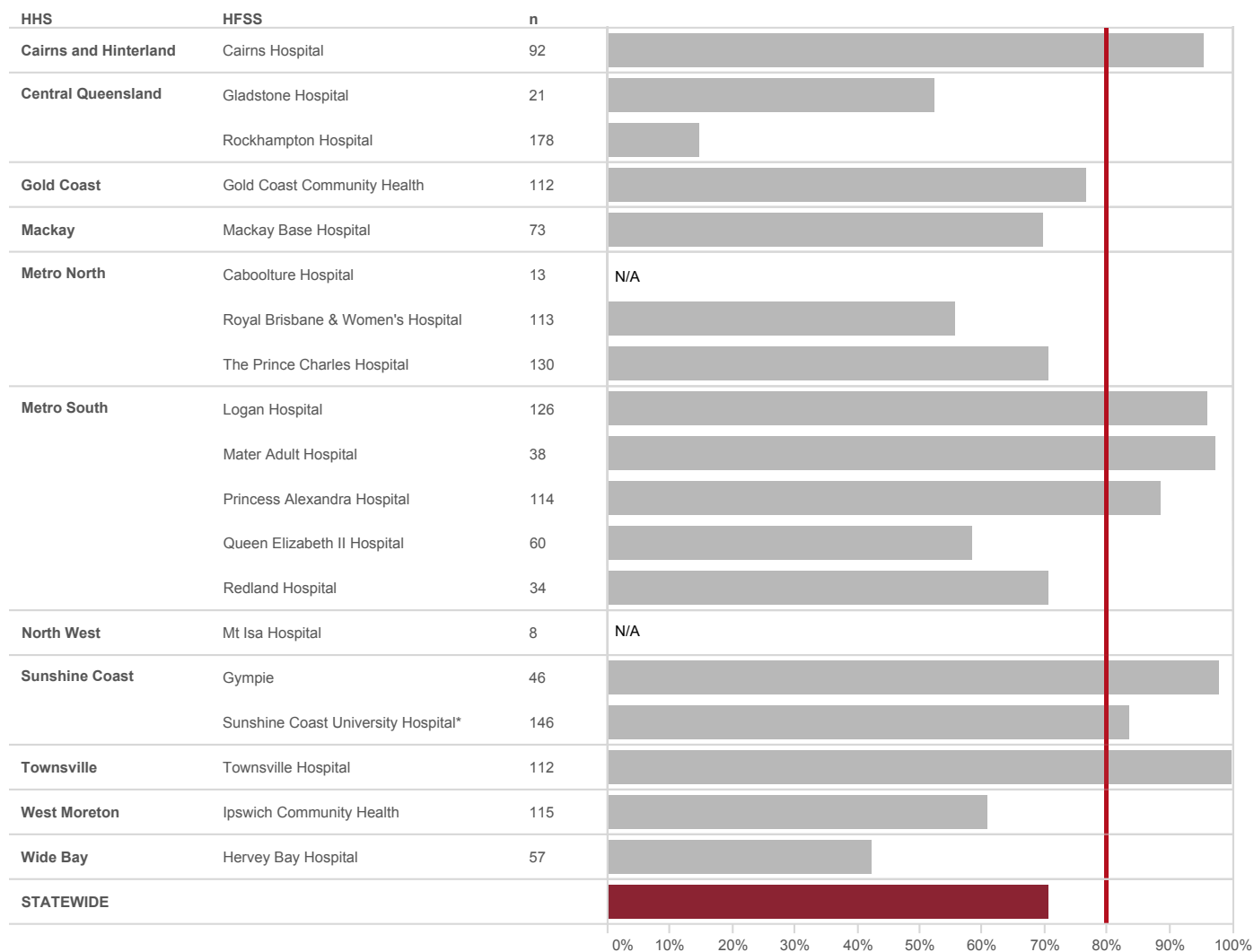
Patients who received a beta blocker titration review at six months from referral or at the time of deactivation from the HFSS (whichever is sooner).

In 2017, 71% of patients received a beta blocker titration review at six months from referral or at the time of deactivation from the HFSS (whichever was sooner). The benchmark of 80% was achieved by 7/17 (41%) of HFSS that had more than 20 cases eligible for analysis.

Table 20: Patients who had a beta blocker titration review within six months

	n	%
Eligible for analysis	1,588	
Achieved benchmark	1,123	70.7%
Benchmark not achieved	465	29.3%
Ineligible	1,624	
Not HFrEF	547	
Patient on target dose at the time of referral	395	
Other reason	242	
LV function assessment not available	93	
Patient declined service	91	
Referred to another HFSS	84	
Documented contraindication*	66	
Patient could not be contacted	62	
Patient deceased	44	
Incomplete data	95	
Cases due for beta blocker review	3,313	

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



* Note: Redcliffe Hospital (Metro North HHS) is not displayed due to no cases eligible for analysis

† Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 14: Proportion of patients who had a beta blocker titration review conducted within six months by site

5b Beta blocker clinical guideline target dose achieved at time of titration review

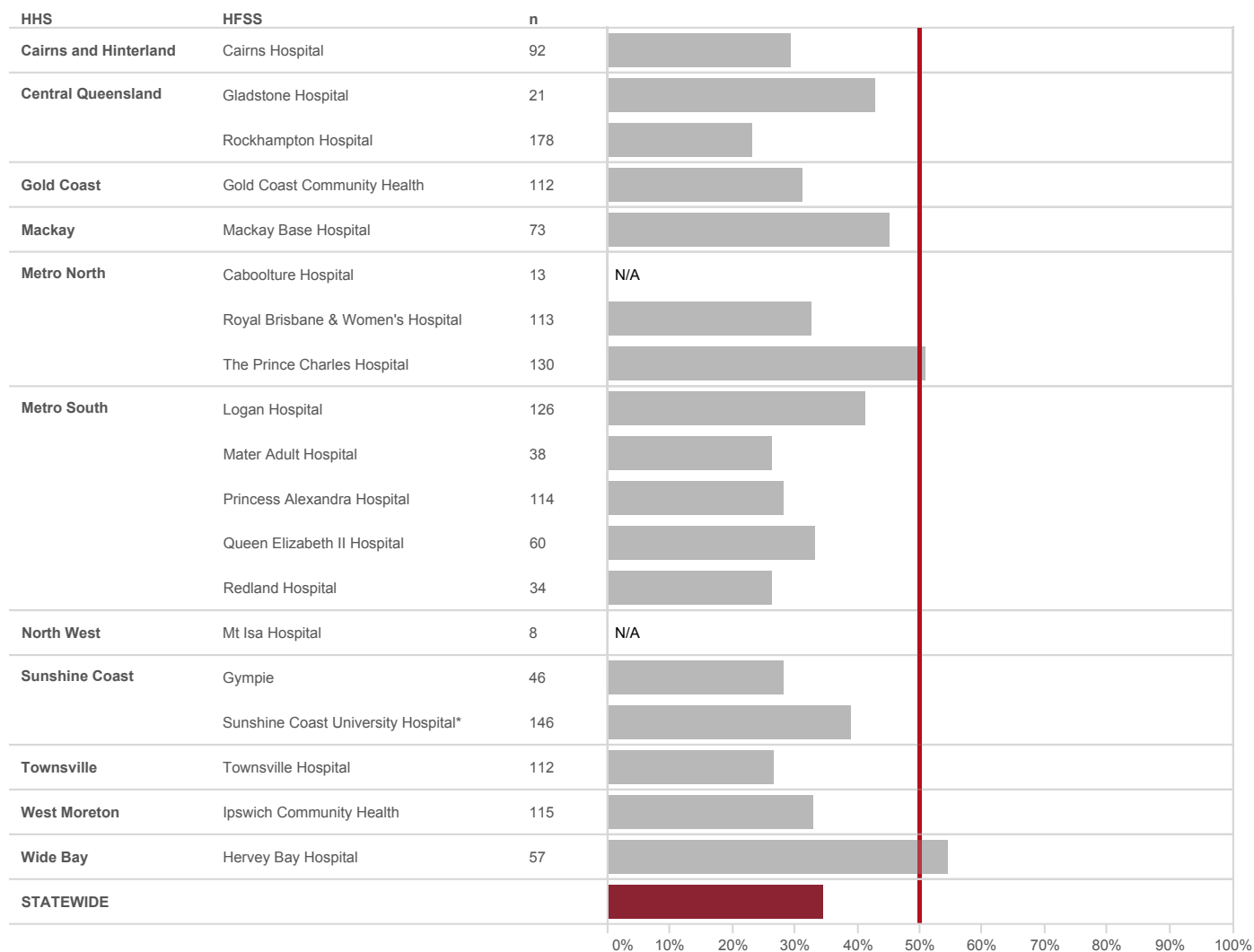
Daily target doses are:

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

Only 34% of referrals achieved target dose for guideline recommended beta blocker medication by the time of titration review at six months. The benchmark of 50% was achieved by 2 out of 17 (12%) of HFSS that had more than 20 cases eligible for analysis.

Table 21: Patients who achieved target beta blocker dose at time of titration review

	n	%
Titration reviews conducted	1,588	
Achieved benchmark	545	34.3%
Benchmark not achieved	1,043	65.7%



* Note: Redcliffe Hospital (Metro North HHS) is not displayed due to no cases eligible for analysis

† Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

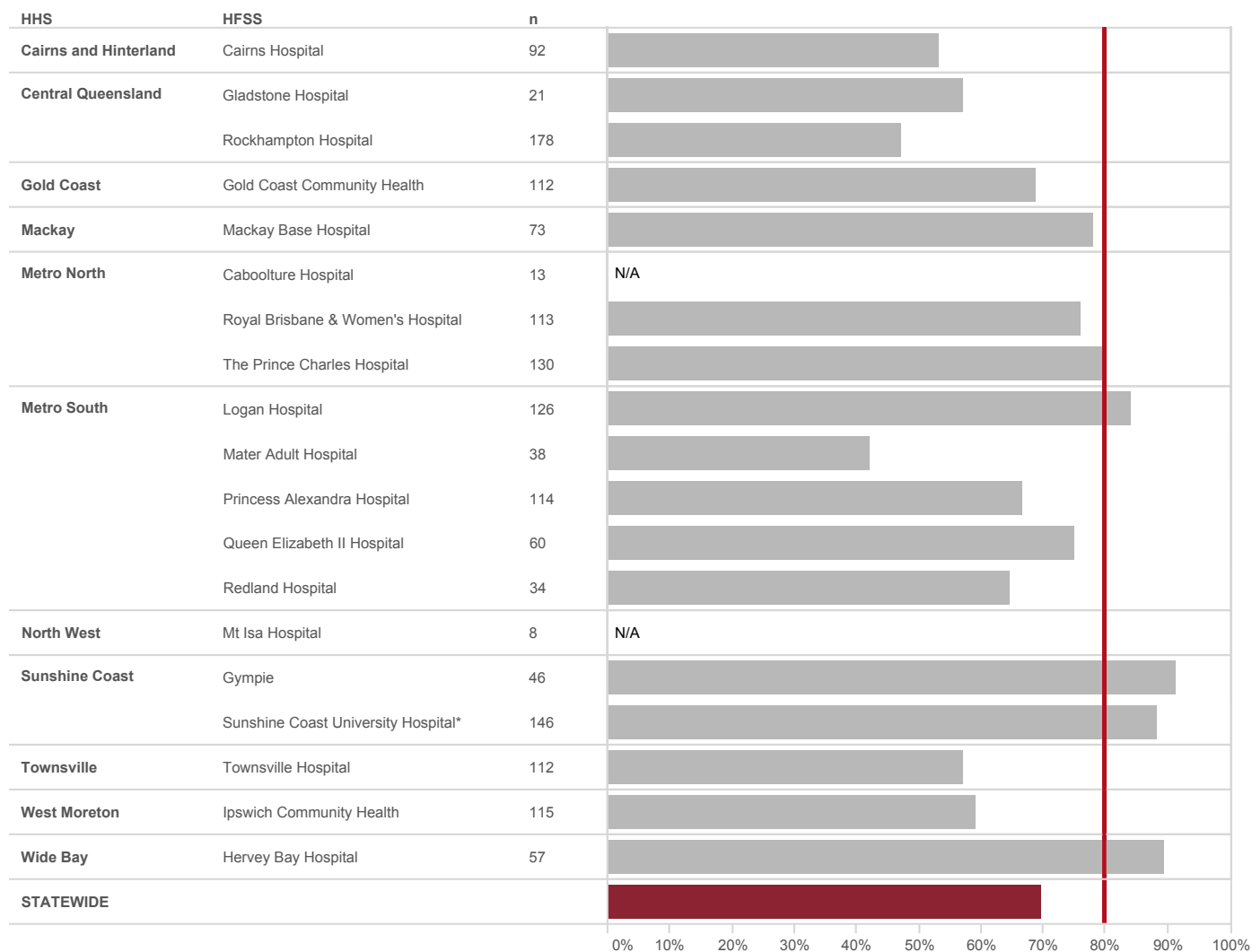
Figure 15: Proportion of patients who achieved target beta blocker dose at time of titration review by site

5c Beta blocker titration clinical guideline target or maximum tolerated dose achieved at time of titration review

The number of patients reaching the target dose or maximum tolerated dose of guideline recommended beta blocker medication by the time of titration review at six months was 70%. The benchmark of 80% was achieved by 5/17 (29%) of HFSS that had more than 20 cases eligible for analysis.

Table 22: Patients who achieved target or maximum tolerated beta blocker dose at time of titration review

	n	%
Titration reviews conducted	1,588	
Achieved benchmark	1,106	69.6%
Benchmark not achieved	482	30.4%



* Note: Redcliffe Hospital (Metro North HHS) is not displayed due to no cases eligible for analysis

† Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Figure 16: Proportion of patients who achieved target beta blocker dose or maximum tolerated dose at time of titration review

53.6 Summary of clinical indicators

The performance on clinical indicators is summarised in the Table 23, showing the proportions of all eligible (ideal) patients who received specific interventions. Benchmarks were set at 80% for all indicators except 5b (titration of beta blockers to clinical guideline target dose), which was 50%.

Performance was at or above benchmarks for:

- CI 1b (follow-up of non-acute patients in four weeks)
- CI 2 (LVEF assessment within two years)
- CI 3 (ACEI/ARB prescription at hospital discharge and at first clinical review)
- CI 4a and 4b (beta blocker prescription at hospital discharge and at first clinical review).

Areas in need of improvement were:

- CI 1a (follow-up of inpatients in two weeks); and
- CI 5a, 5b and 5c (beta blocker titration review and achievement of clinical guideline target dose). Variation between sites allows for targeted quality improvement interventions.

Table 23: Summary of clinical process indicator performance by site

HHS	HFSS	Clinical Indicator achievement %									
		1a	1b	2	3a	3b	4a	4b	5a	5b	5c
Cairns and Hinterland	Cairns Hospital	65	90	98	87	95	96	90	96	29	53
Central Queensland	Gladstone Hospital	-	-	94	-	84	-	96	52	43	57
	Rockhampton Hospital	46	63	100	91	84	85	73	15	23	47
Gold Coast	Gold Coast Community Health	95	95	92	85	88	85	90	77	31	69
Mackay	Mackay Base Hospital	73	88	100	96	97	96	91	70	45	78
Metro North	Caboolture Hospital	88	81	94	-	93	-	93	-	-	-
	Redcliffe Hospital	94	-	64	59	-	82	-	-	-	-
	Royal Brisbane & Women's Hospital	83	94	96	95	95	93	87	56	33	76
	The Prince Charles Hospital HFS	66	77	93	90	91	92	93	71	51	80
Metro South	Logan Hospital	71	93	92	87	88	90	90	96	41	84
	Mater Adult Hospital	63	-	96	95	88	97	90	97	26	42
	Princess Alexandra Hospital	90	68	97	92	95	80	89	89	28	67
	Queen Elizabeth II Hospital	69	63	94	86	97	82	88	58	33	75
	Redland Hospital	96	98	78	94	95	100	94	71	26	65
North West	Mt Isa Hospital	-	-	100	-	-	-	-	-	-	-
Sunshine Coast	Gympie Hospital	97	96	90	87	91	71	84	98	28	91
	Sunshine Coast University Hospital*	92	88	99	93	94	95	92	84	39	88
Townsville	Townsville Hospital	94	95	95	89	91	95	90	100	27	57
West Moreton	Ipswich Community Health	70	90	97	90	92	78	86	61	33	59
Wide Bay	Hervey Bay Hospital	-	100	100	-	98	-	89	42	54	89
STATEWIDE		79	87	94	91	92	88	89	71	34	70

* Totals include Nambour General Hospital prior to HFSS relocation to Sunshine Coast University Hospital in March 2017

Legend:

- 1a Follow-up of acute patients within 2 weeks
- 1b Follow-up of non-acute patients within 4 weeks
- 2 Assessment of left ventricular ejection fraction within 2 years
- 3a Angiotensin-converting-enzyme inhibitor or angiotensin II receptor blockers prescription at hospital discharge
- 3b Angiotensin-converting-enzyme inhibitor or angiotensin II receptor blockers prescription at first clinical review
- 4a Guideline recommended beta blocker prescription at hospital discharge
- 4b Guideline recommended beta blocker prescription at first clinical review
- 5a Beta blocker titration status review at six months post referral
- 5b Beta blockers achievement of guideline recommended target dose (bench mark 50%)
- 5c Beta blockers achievement of guideline recommended target dose or maximum tolerated dose

54 Patient outcomes

Heart failure hospitalisations are associated with subsequent increased risk of mortality and recurrent hospitalisation. Multidisciplinary HF disease management programmes such as HFSS and adherence to guideline recommended therapies are associated with improved post-discharge outcomes.

As part of this continuing quality improvement initiative, we sought to report the clinical outcomes of inpatient referrals to HFSS during 2016.

54.1 Methods

54.1.1 Data source

This analysis utilised the previously reported 2016 patient cohort²⁹ in the QCOR HFSS registry to examine the early (30-day) and one year clinical outcomes (rehospitalisation and mortality) among patients referred to HFSS through probabilistic data linkage using Queensland Hospital Admitted Patient Data Collection (QHAPDC) and Queensland Registry of Births, Deaths and Marriages.

54.1.2 Analysis eligibility criteria

For the purpose of this report, only HFSS referrals initiated during an inpatient encounter for 2016 were included. Where patients had multiple referrals to a HFSS during this period, the earliest admission of the calendar year was considered as the index admission (which may not be the first time that a patient has been hospitalised with heart failure).

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

54.1.3 Clinical outcome measures and statistical analysis

The patient outcome measures of interest are summarised in Table 24. All-cause mortality survival curves were constructed using the Kaplan–Meier method. 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 and mean values. Differences in DAOH between sub-groups were compared using Mann-Whitney test. Categorical variables were summarised as frequencies and percentages.

Table 24: 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

54.2 Findings

In 2016, there were 2,868 inpatient referrals reported of which 2,608 referrals were eligible for data linkage. The success rate for linking referrals to administrative and death registry data was 95.5% (n=2,491).

A further 51 (1.8%) patients did not have complete follow up of 365 days to allow calculation of DAOH (Table 25).

Table 25: Eligibility criteria for patient outcome indicators

	n	%
Total 2016 inpatient referrals	2,868	100.0
Ineligible at index admission:		
Duplicate patient record	124	4.3
Not a Queensland resident	65	2.3
Transferred to private hospital	25	0.9
Index admission is not overnight	24	0.8
Died during index admission	22	0.8
No linkage data available	117	4.1
Included in readmission and mortality analysis	2,491	86.9
Ineligible at subsequent admissions for 1 year:		
Transferred to private hospital	49	1.7
Moved outside of Queensland	2	0.1
Included in days alive and out of hospital analysis	2,440	85.1

54.2.1 All-cause mortality

Among patients referred to HFSS during an inpatient encounter, the 30-day and one year unadjusted all-cause mortality rate were 1.6% and 13.6% respectively (Table 26). Survival curves suggest that gender was not associated with all-cause mortality at one year (Figure 17). In contrast, older age was associated with increased all-cause mortality at one year (Figure 18).

As an exploratory analysis, we examined the univariate association between the documented HF phenotype and subsequent all-cause mortality (Figure 3). Among this cohort of patients (i.e. those referred to HFSS), patients with documented HFpEF phenotype was associated with increased mortality. However, patients with either unknown or missing HF phenotype documentation were associated with the worst un-adjusted mortality risk (Figure 19).

Table 26: Cumulative all cause unadjusted mortality rate from 30 to 365 days after index discharge date

	30 days n (%)	90 days n (%)	180 days n (%)	365 days n (%)
Total deaths identified	41 (1.6)	125 (5.0)	201 (8.0)	340 (13.6)
Died during subsequent admission*	28 (1.1)	75 (3.0)	123 (4.9)	208 (8.4)
All other deaths	13 (0.5)	50 (2.0)	77 (3.1)	132 (5.3)
Total at risk	2,450 (98.4)	2,365 (95.0)	2,288 (92.0)	2,149 (86.4)

* Data available for Queensland public hospitals only

Table 27: Cumulative all cause unadjusted mortality by patient characteristic

	Total patients (n)	30 days n (%)	90 days n (%)	180 days n (%)	365 days n (%)
Gender					
Male	1,621	27 (1.7)	88 (5.4)	137 (8.4)	231 (14.3)
Female	870	14 (1.6)	37 (4.3)	64 (7.4)	109 (12.5)
Age group					
<65 years	852	8 (0.9)	21 (2.5)	29 (3.4)	50 (5.9)
65–74 years	662	12 (1.8)	33 (5.0)	49 (7.4)	78 (11.8)
≥75 years	977	21 (2.1)	71 (7.3)	123 (12.6)	212 (21.7)
Heart failure phenotype					
HFrEF	1,898	30 (1.6)	85 (4.5)	128 (6.7)	225 (11.9)
HFpEF	486	7 (1.4)	29 (6.0)	53 (10.9)	89 (18.3)
Missing/unsure	107	4 (3.7)	11 (10.3)	20 (18.7)	26 (24.3)

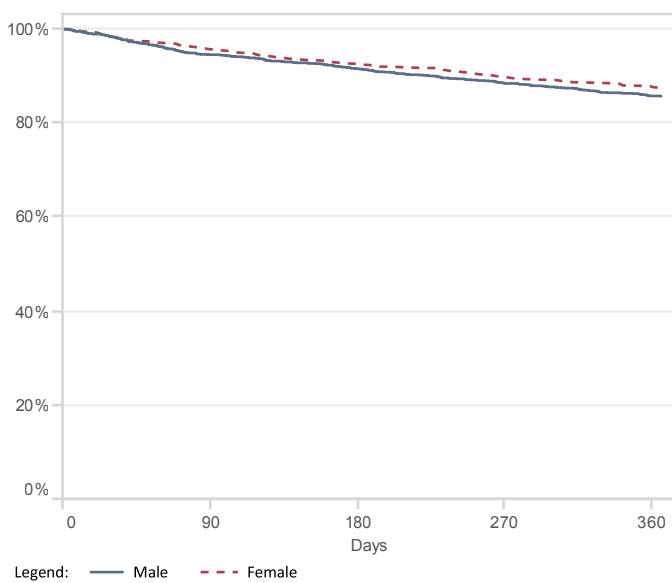


Figure 17: Heart failure survival by gender

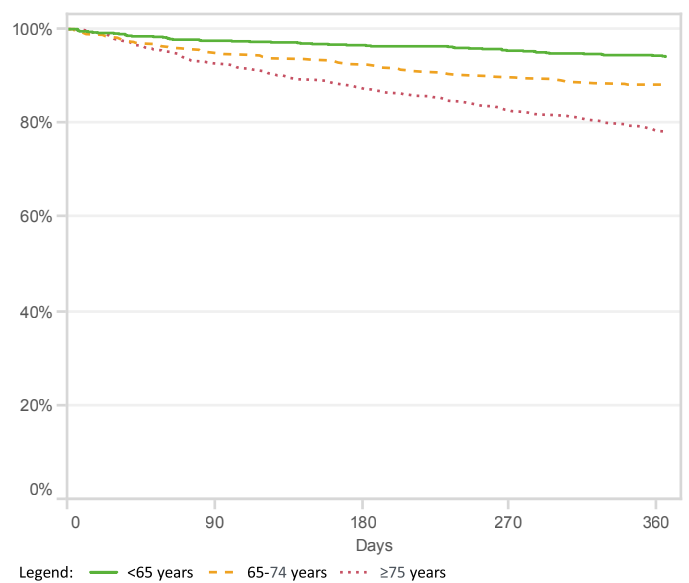


Figure 18: Heart failure survival by age group

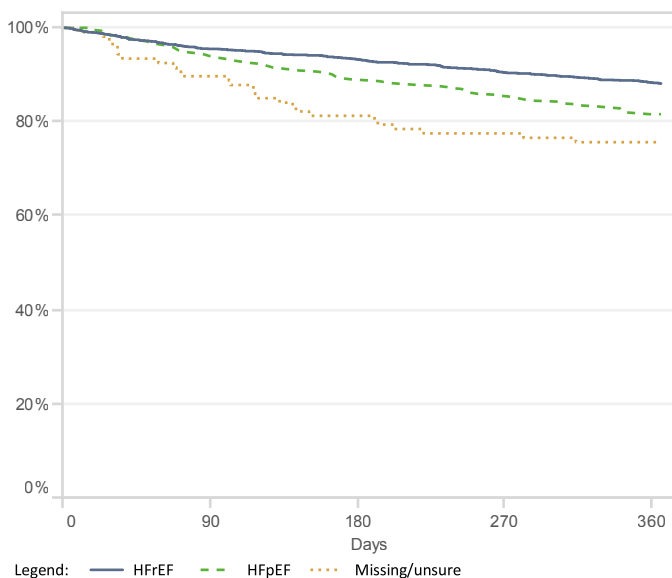


Figure 19: Heart failure survival by phenotype

54.2.2 All-cause and heart failure rehospitalisation

Cumulative incidence curves for all-cause and HF hospitalisation are shown in Figure 20 and 21. Of the 2,491 eligible patients referred to HFSS during 2016, the unadjusted rate of all-cause hospitalisation was 18.3% at 30-day, increasing to 57.7% at one year. HF related hospitalisation rates, as defined by primary discharge diagnosis coding (Appendix A), were 5.8% and 22.5% at 30-day and one year respectively.

Collectively, the risk of hospitalisation or death within 12 months after initial discharge among patients referred to HFSS during a hospitalisation was 58.7% at one year (Figure 22). Over 30% of patients referred to HFSS experienced two or more rehospitalisation during the subsequent year (Table 28).

Table 28: Number of rehospitalisations per patient over one year since discharge

	All cause rehospitalisation n (%)	Heart failure rehospitalisation n (%)
None	1,091 (43.8)	1,975 (79.3)
1 rehospitalisation	642 (25.8)	318 (12.8)
2 rehospitalisations	318 (12.8)	123 (4.9)
3 rehospitalisations	182 (7.3)	42 (1.7)
4 rehospitalisations	106 (4.3)	16 (0.6)
≥5 rehospitalisations	152 (6.1)	17 (0.7)

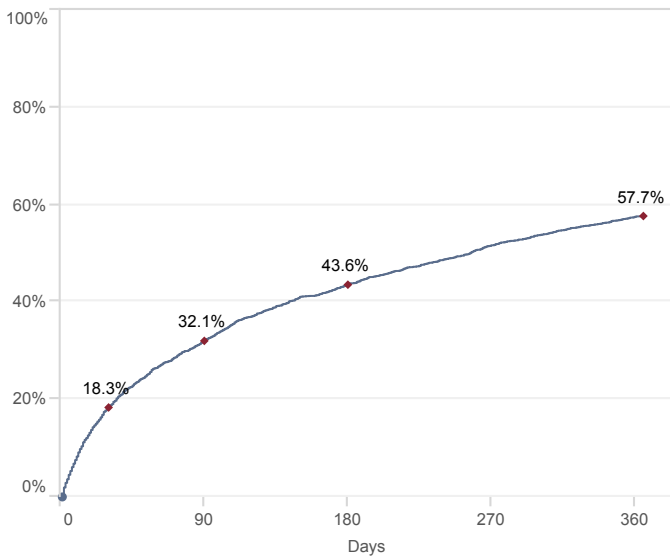


Figure 20: Cumulative incidence of all cause rehospitalisation

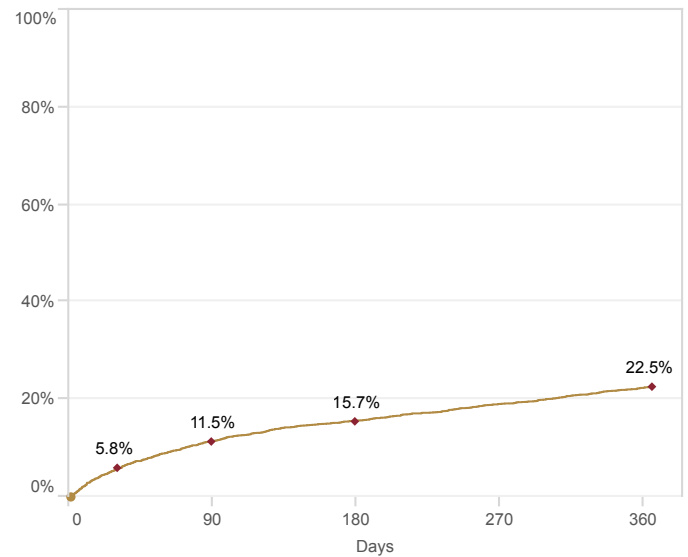


Figure 21: Cumulative incidence of heart failure rehospitalisation

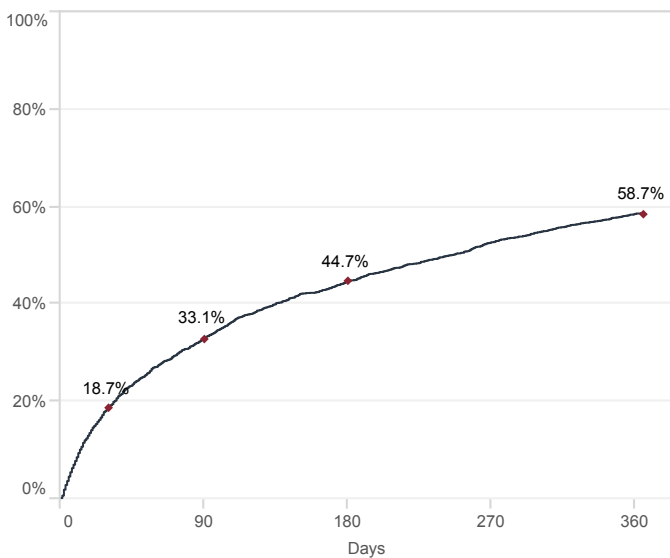


Figure 22: Cumulative incidence of all-cause rehospitalisation or death
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54.2.2 Days alive and out of hospital

Days alive and out of hospital (DAOH) incorporates mortality and all hospitalisations (including length of hospital stay) within one year of discharge into a single measure that reflects the patient’s experience of living with this chronic condition. Although the median DAOH was 363.3 days, only approximately 40% of patients managed to spend no additional time in hospital after initial discharge.

Given that days lost due to early mortality or rehospitalisation with prolonged length of stay were driven by a small proportion of patients, we also present mean values to better capture overall burden for the patient cohort (with over 90,000 days lost due to death or hospitalisation in the total cohort of 2,440 patients over 12 months).

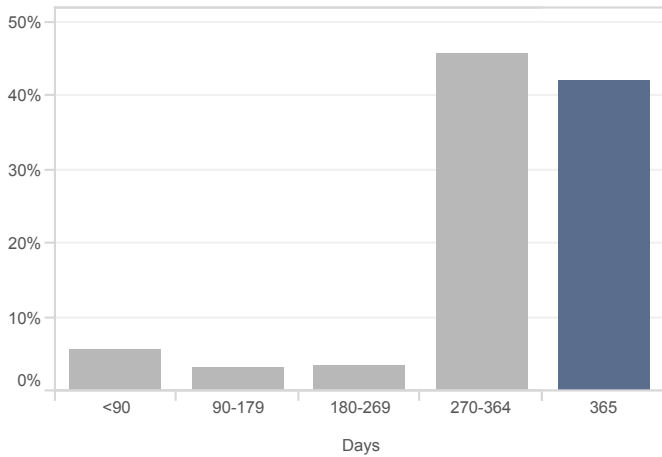
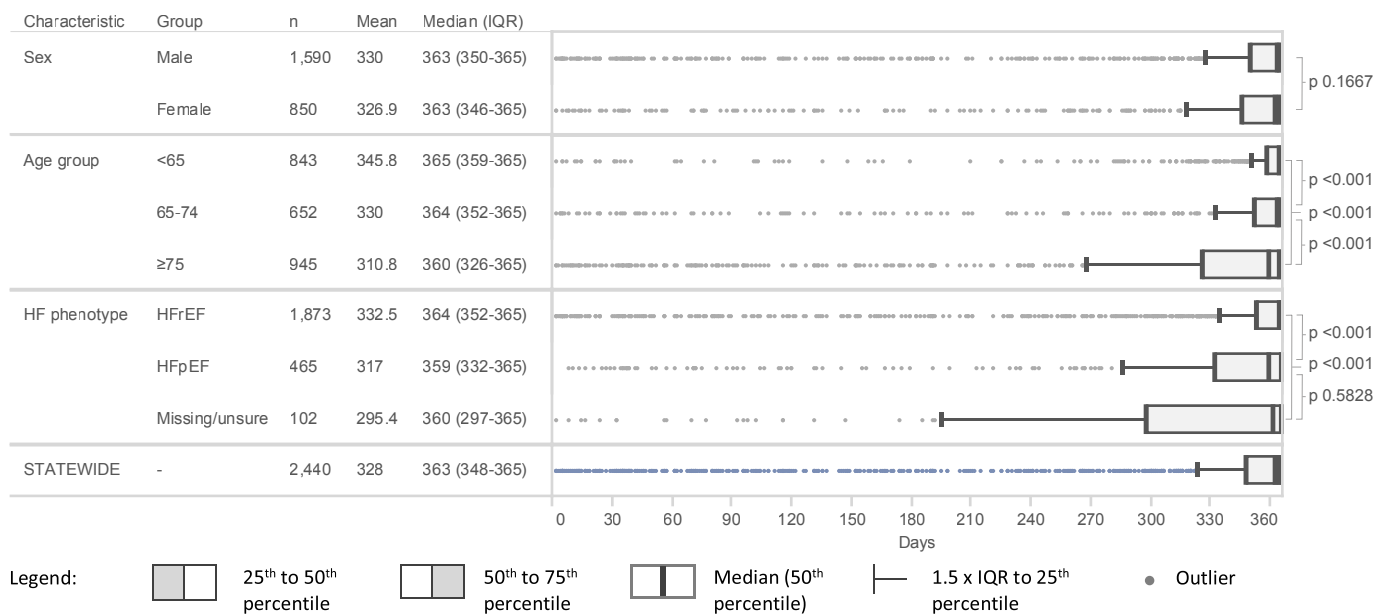


Figure 23: Days alive and out of hospital within one year after hospital discharge

Similar to mortality risk, we observed a lower DAOH among HFSS referrals with HFpEF phenotype compared to HFrEF (median 359.2 vs 364, $p < 0.001$). Elderly patients (aged >75 years) referred to HFSS were also associated with significantly lower DAOH compared to younger (aged <65 years) patients (median 359.7 vs 365, $p < 0.001$) (Figure 24).



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

Figure 24: Days alive and out of hospital within one year of discharge by patient characteristics

54.3 Discussion

Due to the limited variables collected, multivariate adjustment of clinical outcomes risks was not available for this analysis. This limits our ability to discern independent associations, hence unmeasured confounders may influence the associations observed in this analysis. For the same reason, comparisons of clinical outcomes across individual sites were intentionally avoided in this analysis.

This first report of clinical outcomes for patients referred to HFSS highlight the significant burden of morbidity and mortality among patients with HF after hospitalisation, and the impact this has on health care resources. With expanded future analyses, it is expected that improved insight and understanding can be gained.

Findings of this analysis also identify that the unadjusted outcomes for the HFpEF phenotype are significantly poorer compared to the HFrEF phenotype. Further investigation into the factors associated with increased risk for the HFpEF cohort is needed.

55 Conclusions

This second annual QCOR HFSS report captures information on patient referrals to 21 Queensland Heart Failure Support Services. While the statewide figures provide an overview of clinical performance, data from individual services should be treated with caution as underreporting or small patient numbers may not accurately reflect performance.

Pleasingly, performance on most clinical process indicators is at or above benchmarks except for review and titration of beta blockers. Measuring the review and titration of beta blocker therapy up to 6 months from referral provides unique information about chronic disease management. This supports the notion that continuity of treatment between acute and primary care sectors is rarely routinely measured and is a significant challenge encountered on a daily basis.

While performance on most clinical indicators is high, the variance between sites is considerable and this benchmarking provides valuable information needed for quality improvement initiatives. This vital information is integral to addressing local challenges and barriers to providing contiguous care.

Patient outcomes of mortality, readmission, and days alive and out of hospital are measured for the previous cohort for up to 12 months. This provides valuable information about the true impact of heart failure and extends the analytic capacity of this report. Future work that utilises this platform for analysis promises to deliver greater awareness and understanding of the true overarching burden of disease.

56 Recommendations

The first report in 2016 made many recommendations that have been implemented or are in development as follows:

- Patient outcomes of mortality, readmissions, days alive and out of hospital rates are now reported
- The benchmarking information for clinical process indicators has been reviewed at each site and has resulted in changes in work practices to improve efficiencies as well as submissions for increased staffing (for example: closer review and monitoring of potentially missed referrals may explain the 13% increase in referrals)

Plans are currently underway to:

- Provide incentives for data completion by introducing elements that assist with patient management such as production of referrals, assessment and management information to aid in communication
- Introduce new indicators to reflect changes in prescribing, e.g. mineralocorticoid receptor antagonists (MRAs) and monitor the pattern of Angiotensin Receptor Neprilysin Inhibitor (ARNI) prescription
- Collect covariates to allow risk-adjustment of outcomes measures (e.g. eGFR, serum sodium, serum potassium, haemoglobin, iron studies, and comorbidities)

New recommendations:

- Support HFSS to improve beta blocker titration by: promoting nurse and pharmacist facilitation of titration (when managed by GP); advocating for more pharmacy and nurse practitioner involvement in care; and providing systems to track patients under titration and for generating titration plans
- Introduce targeted non-pharmacological interventions known to improve quality of life and relieve symptoms; for example, exercise therapy and psycho-social support
- Measure outcomes for all patients regardless of referral source (i.e. for outpatient as well as inpatient referrals)

57 Appendix: List of ICD10-AM Codes

ICD10-AM Code	Description
E87.7	Fluid overload
I13.0	Hypertensive heart and kidney disease with (congestive) heart failure
I13.2	Hypertensive heart and kidney disease with both (congestive) heart failure and kidney failure
I25.5	Ischaemic cardiomyopathy
I42.0	Dilated cardiomyopathy
I42.1	Obstructive hypertrophic cardiomyopathy
I42.2	Other hypertrophic cardiomyopathy
I42.5	Other restrictive cardiomyopathy
I42.6	Alcoholic cardiomyopathy
I42.7	Cardiomyopathy due to drugs and other external agents
I42.8	Other cardiomyopathies
I42.9	Cardiomyopathy, unspecified
I46.0	Cardiac arrest with successful resuscitation
I46.1	Sudden cardiac death so described
I46.9	Cardiac arrest unspecified
I50	Heart failure (includes: congestive heart failure; left ventricular failure; and, heart failure, unspecified)
J81	Pulmonary oedema
J90	Pleural effusion, not elsewhere classified
R18	Ascites
R57.0	Cardiogenic shock
R60.1	Generalised oedema

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59 Glossary

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

60 Upcoming initiatives

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

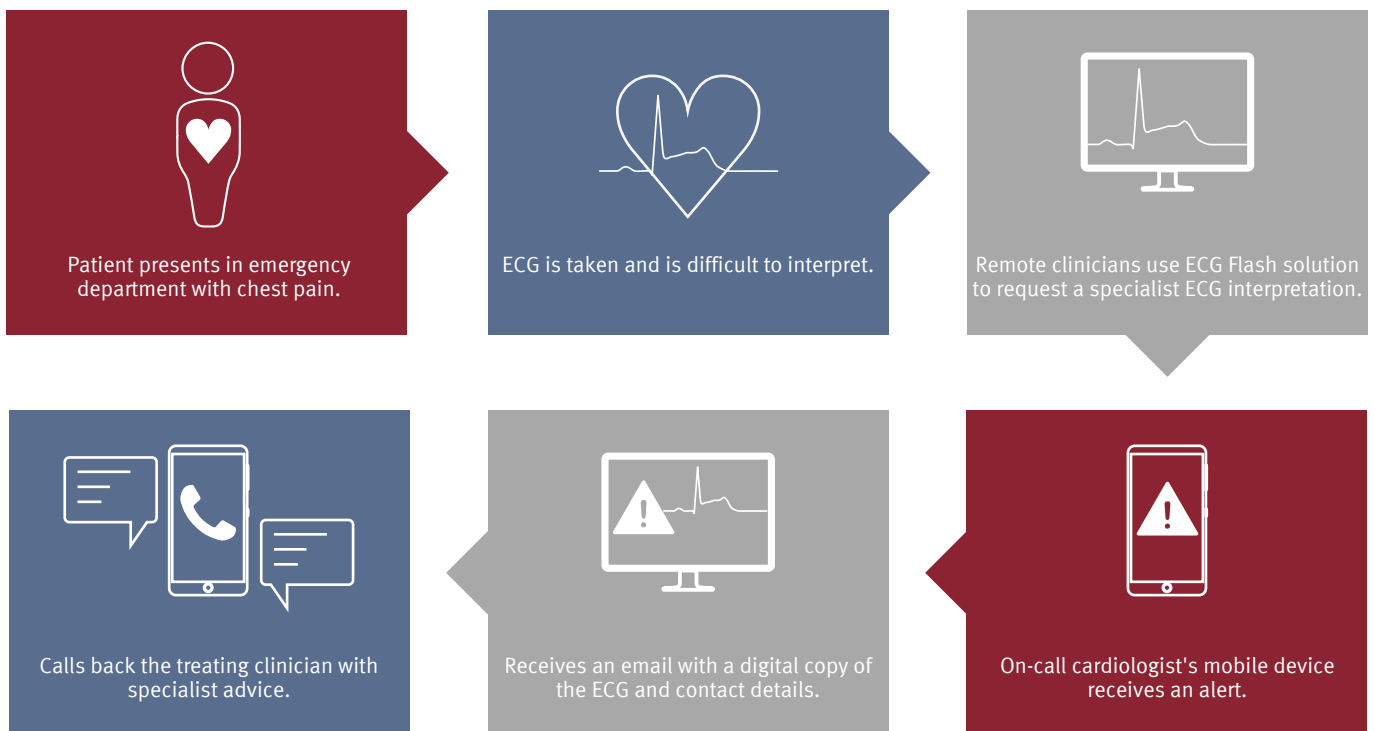


Figure C: Concept model for rapid inter-hospital clinical interpretation of 12-lead ECGs (CISP ECG Flash Project)

