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Statewide Cardiac Clinical Network

Queensland Cardiac Outcomes Registry
2017 Annual Report

Electrophysiology and Pacing Audit

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

Queensland Government

Contents

This report is available online at:

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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.

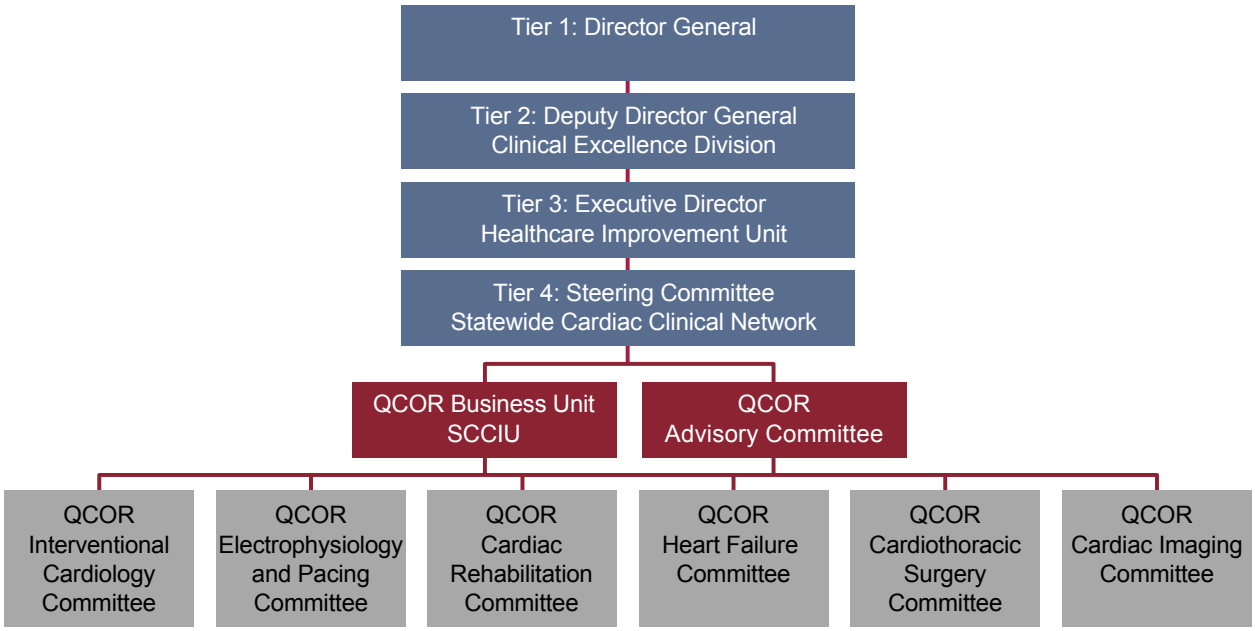

Figure A: Operational structure

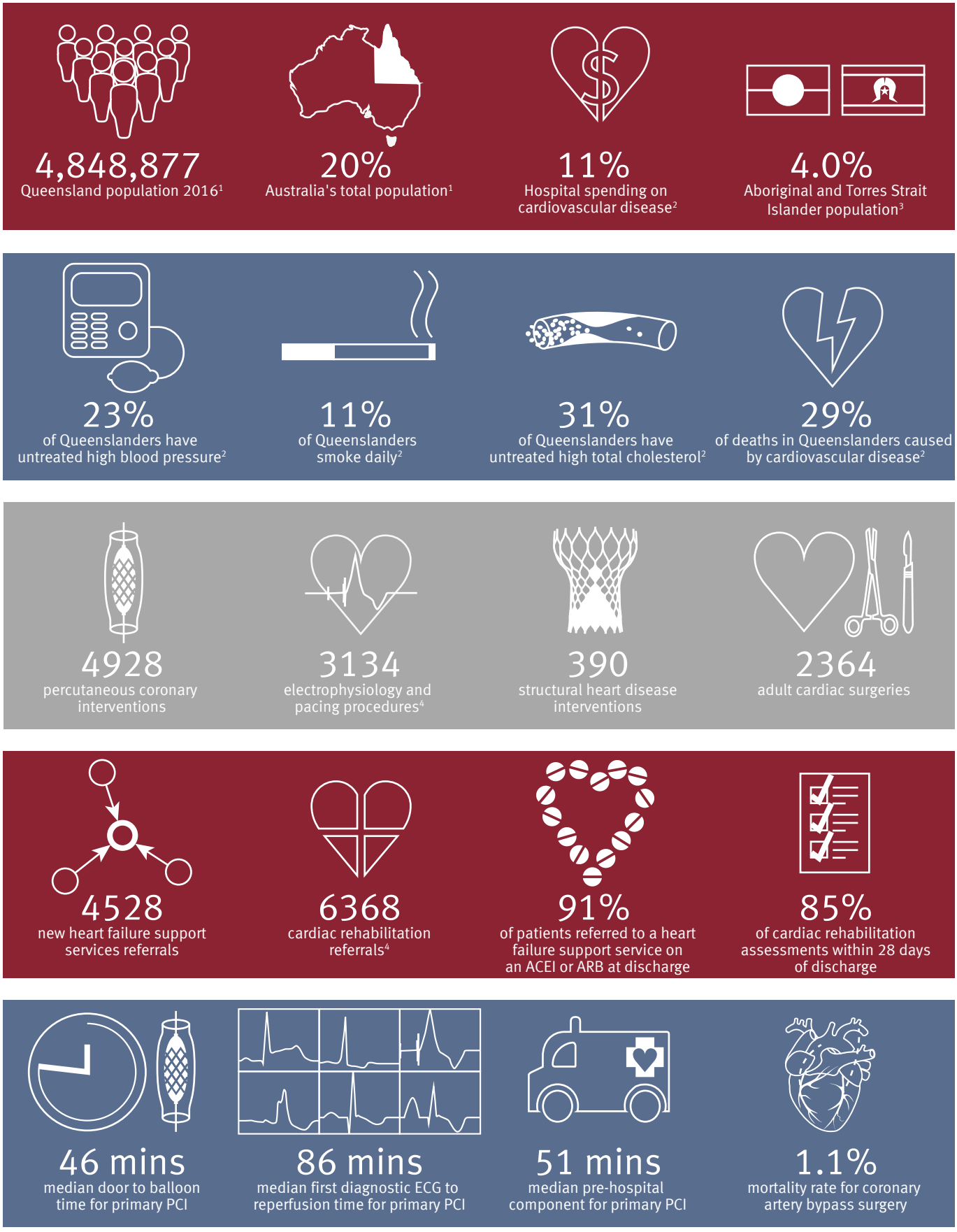

Figure B: QCOR 2017 infographic

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.

Electrophysiology and Pacing Audit

28 Message from the QCOR Electrophysiology and Pacing Committee Chair

The 2017 QCOR report expands to include for the first time data profiling demographics, activity and quality related to cardiac electrophysiology and pacing procedures in Queensland Health (QH) patients. This branch of cardiology practice has evolved to be responsible for, *inter alia*, significant and increasing rates of cardioverter/defibrillator (ICD) implants for prevention of sudden cardiac death, more complex time-consuming bi-ventricular pacing (otherwise known as cardiac resynchronisation therapy, CRT) procedures for heart failure patients, complex and increasingly numerous ablation procedures for atrial fibrillation (AF) and ventricular tachycardia (VT), an increasing demand for sophisticated pacemaker and ICD lead extraction techniques and deployment of technologies for remote monitoring of pacemaker and ICD patients. The advent of implantable loop recorders (ILRs) two decades ago provided the most valuable tool for diagnosis of the arrhythmic mechanism of unexplained syncope. Recently the introduction of an additional medical benefit schedule item number for ILR implant in the investigation of cryptogenic stroke has resulted in a very large increase in demand for these devices. In the background, increasing numbers of *curative* ablation interventions for (non-AF) supraventricular tachycardias continue to remove patients from QH care and increasing numbers of pacemaker interventions continue to enhance the lives of QH patients.

Increases in demand for and numbers of device and electrophysiological procedures will continue to be driven by an increasing, aging population with improved survival of other cardiovascular procedures, by adverse lifestyle trends and by technological advances. Authoritative activity and quality mapping is therefore mandatory for guidance of planning to address adequately these inescapable facts.

This initial data represents a snapshot of procedures in 2017; future reports will enable analysis of procedural success over time. The snapshot itself contains incomplete data by reason of logistics and some variation by site in completeness of data, but these issues will resolve as future reports are compiled.

The scope of this report builds substantially on activity data published previously by the Electrophysiology Working Group[21], which is developing clinical indicators for benchmarking of many aspects of procedures. Future analysis guided by these indicators will yield very important learnings about the journeys of QH patients who undergo procedures for heart rhythm disorders. Quality and performance metrics will naturally include assessment of waiting periods for procedures.

In the generation of this report, I wish to acknowledge the hard work of QCOR administrative staff, the indefatigable cardiac scientists who formulated the database, and the fortitude, confidence and cooperation of my clinical colleagues. Those qualities are traditional hallmarks of those who work in heart rhythm management.

Associate Professor John Hill
Chair
QCOR Electrophysiology and Pacing Committee

29 Key findings

This 2017 inaugural Queensland Electrophysiology and Pacing audit describes baseline demographics, risk factors, procedures performed and outcomes for an incomplete year of data collection.

Key findings include:

- Across Queensland, 7 public sites contributed data with staggered commencement dates for these data collections.
- 3,134 electrophysiology and pacing cases were performed across the 7 participating public Queensland sites including 2,131 device procedures and 889 electrophysiology procedures.
- The majority of all patients were aged over 60 years (57%) with a median age of 68 years.
- The overall proportion of Aboriginal and Torres Strait Islander patients was 3.9%.
- The vast majority of patients (70%) were classed as having an unhealthy body mass index (BMI) of greater than 30kg/m^2.
- The majority of procedures (52%) were classified as high urgency procedures that are clinically indicated within 30 days.
- Outpatient procedures accounted for 54% of all cases.
- 519 standard electrophysiology procedures were performed with a further 370 complex procedures undertaken utilising three-dimensional mapping technology and/or involving pulmonary vein isolation.
- Radiofrequency ablation was employed in the vast majority of ablation cases (91%).
- Cavo-tricuspid isthmus (atrial flutter), pulmonary veins (atrial fibrillation) and atrioventricular node slow pathway ablations accounted for 80% of all ablation cases.
- The most frequently ablated supraventricular arrhythmia was atrial fibrillation accounting for 28% of all cases with ventricular tachycardia making up 54% of all ventricular arrhythmia ablations.
- The statewide aggregate for all device procedure complications was 4.6%, while all electrophysiology procedures had a 2.6% complication rate overall.

30 Participating sites

In 2017, there were eight public electrophysiology and pacing units spread across metropolitan and regional Queensland. Seven of these entered data directly into the Queensland Cardiac Outcomes Registry (QCOR) electrophysiology and pacing application. The eighth site, Gold Coast University Hospital began direct entry in 2018.

Patients came from a wide geographical area, with the majority of patients residing on the Eastern Seaboard.

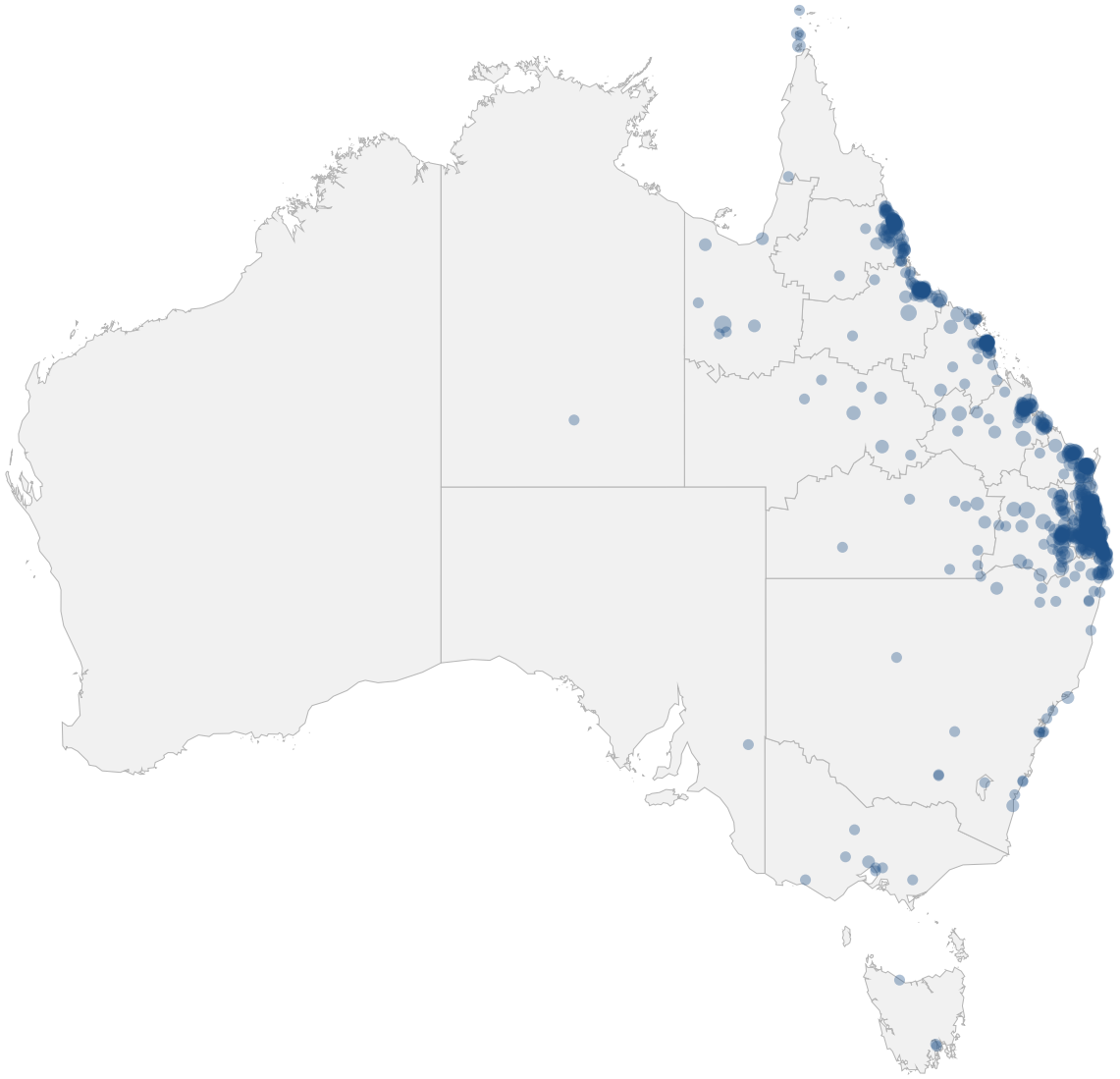


Figure 1: Electrophysiology and pacing cases by residential postcode

Table 1: Participating sites

Site number	Site name	Date commenced	Location	Acronym
1	Cairns Hospital	5 April 2017	Regional	CH
2	The Townsville Hospital	3 April 2017	Regional	TTH
3	Mackay Base Hospital	26 April 2017	Regional	MBH
4	Sunshine Coast University Hospital	6 July 2017	Regional	SCUH
5	The Prince Charles Hospital	11 January 2017	Metropolitan	TPCH
6	Royal Brisbane and Women's Hospital	3 April 2017	Metropolitan	RBWH
7	Princess Alexandra Hospital	9 January 2017	Metropolitan	PAH

Gold Coast University Hospital commenced direct data entry 29 January 2018

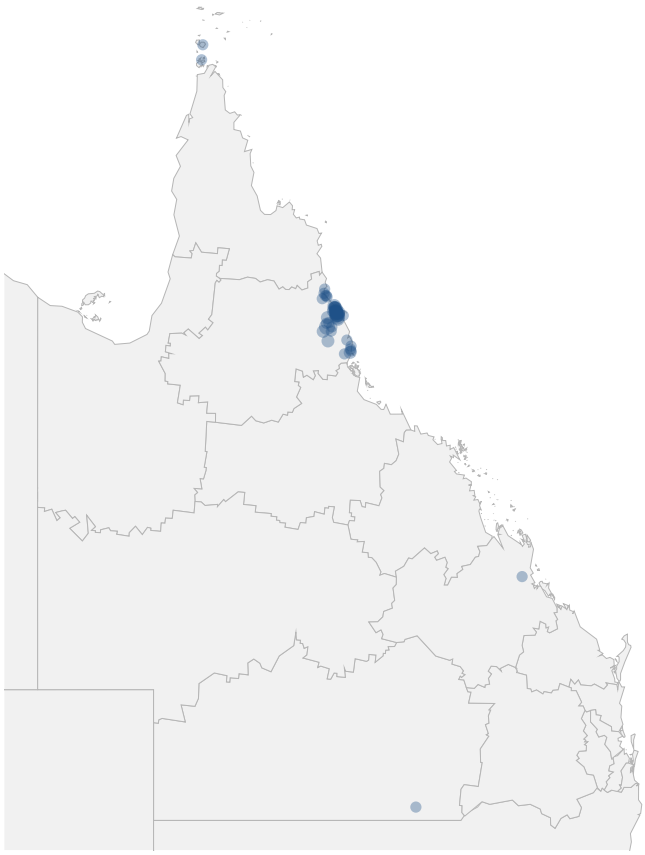


Figure 2: Cairns Hospital

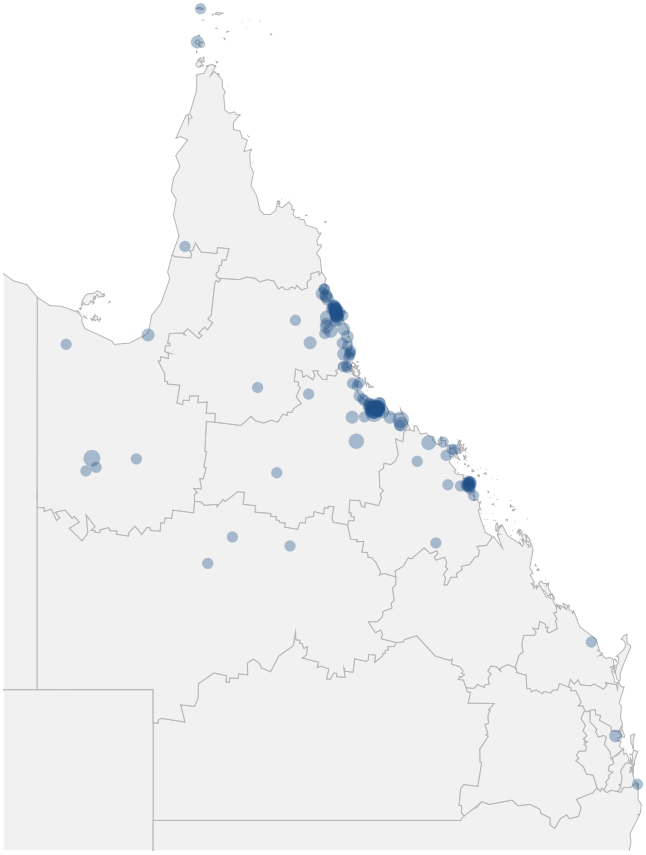


Figure 3: The Townsville Hospital

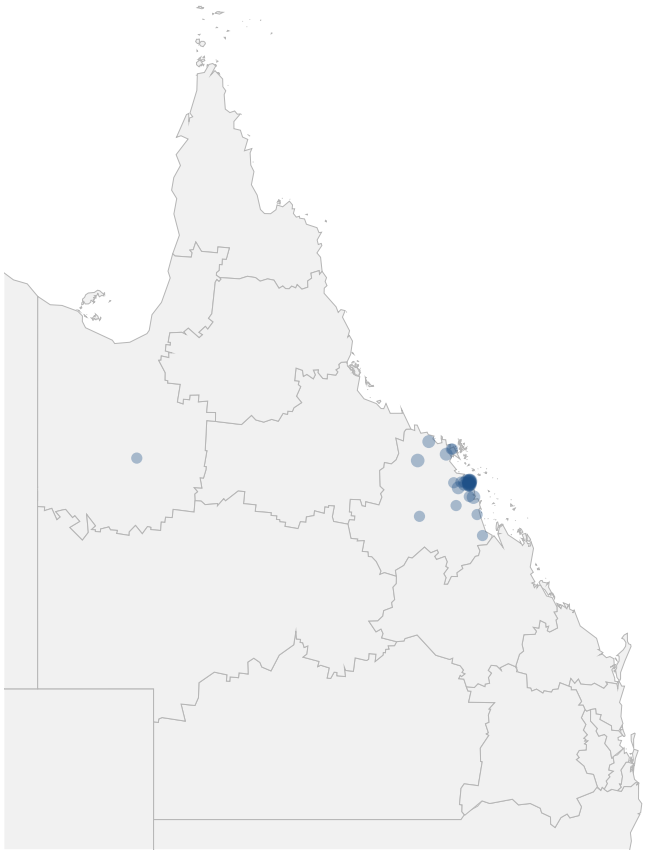


Figure 4: Mackay Base Hospital

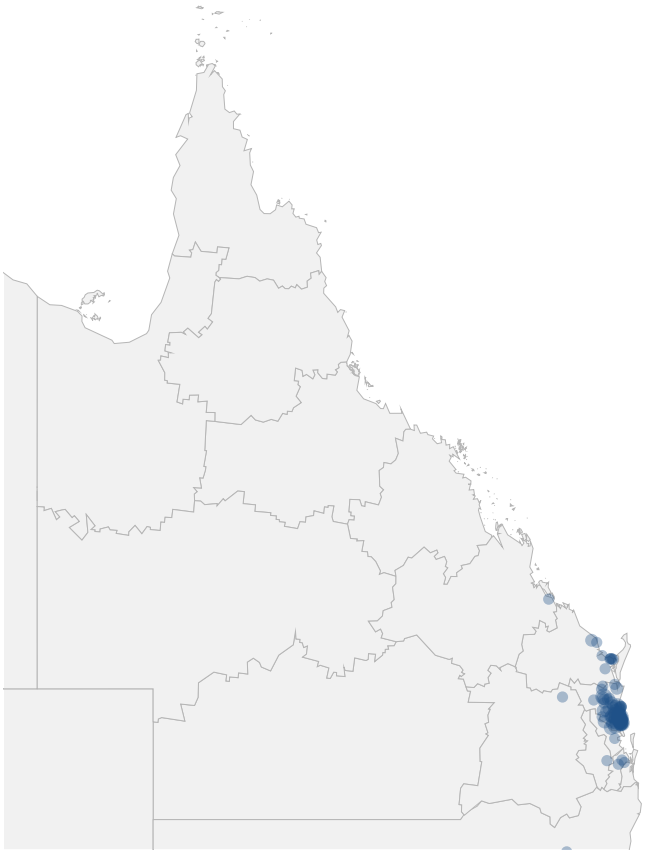


Figure 5: Sunshine Coast University Hospital

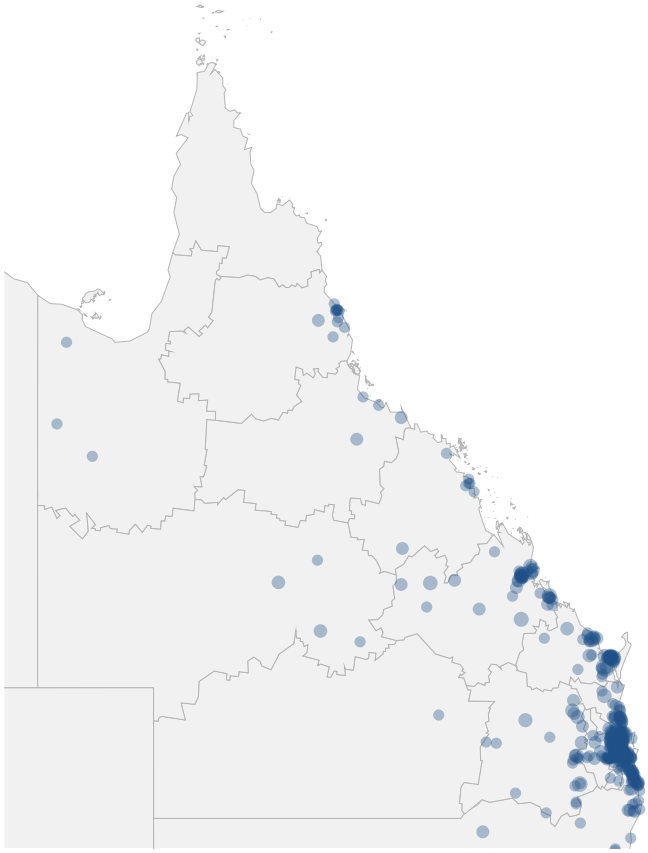


Figure 6: The Prince Charles Hospital

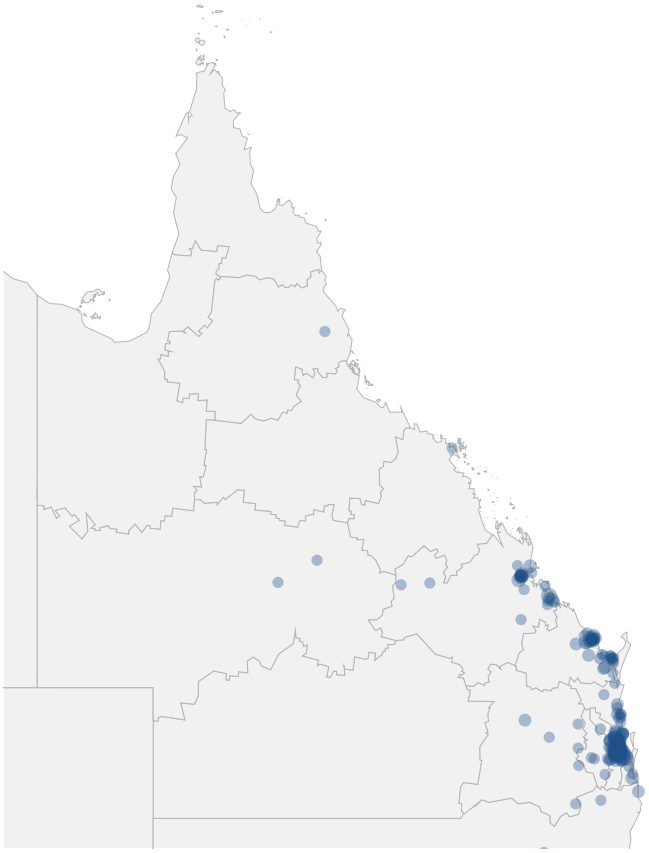


Figure 7: Royal Brisbane & Women's Hospital

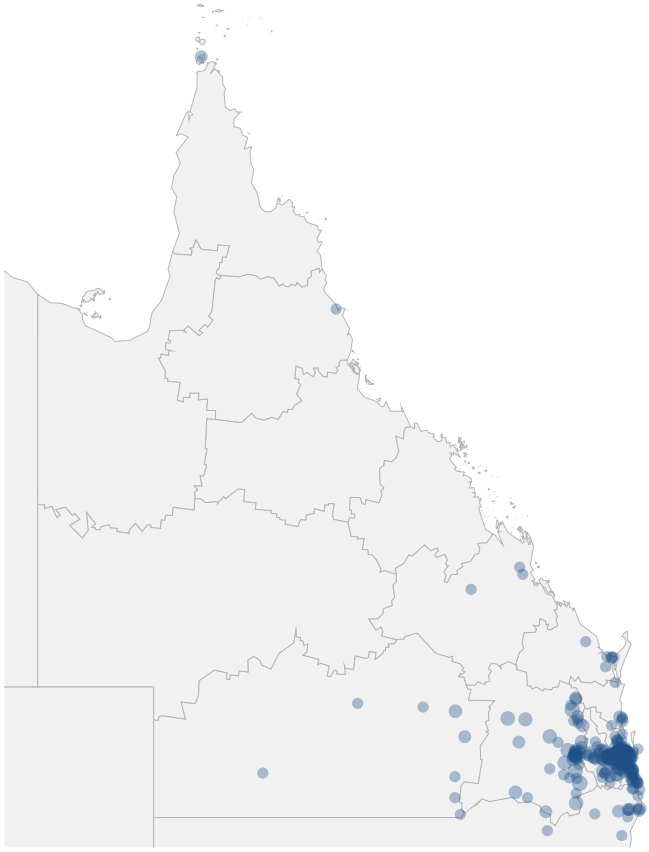


Figure 8: Princess Alexandra Hospital

31 Case totals

31.1 Total cases

In 2017, 3,134 electrophysiology and pacing procedures were documented using the Queensland Cardiac Outcomes Registry Electrophysiology and Pacing application. This number does not reflect the overall case totals as uptake of this new application was staggered across 2017.

Table 2: Total cases by category

Procedure combination	Total cases n (%)	Category
Cardiac device procedure	2,112 (67.4)	Device
Cardiac device procedure + EP study	16 (0.5)	
Cardiac device procedure + drug challenge	2 (0.1)	
Cardiac device procedure + EP study + ablation	1 (<0.1)	
EP study + ablation	554 (17.7)	EP
EP study	236 (7.5)	
Ablation	70 (2.2)	
EP study + ablation + cardioversion	20 (0.6)	
EP study + drug challenge	5 (0.2)	
EP study + cardioversion	4 (0.1)	
Cardioversion	73 (2.3)	Other
Drug challenge	29 (0.9)	
Other procedure	11 (0.4)	
Cardioversion + other procedure	1 (<0.1)	
ALL	**3,134 (100.0)**	

Case totals do not reflect all activity due to incomplete year of data acquisition

31.2 Cases by category

The majority of cases performed were cardiac device procedures accounting for approximately two-thirds (68%) of documented procedures. The remainder of cases were electrophysiology and ablation procedures (28%) with the remainder categorised as other procedures (4%).

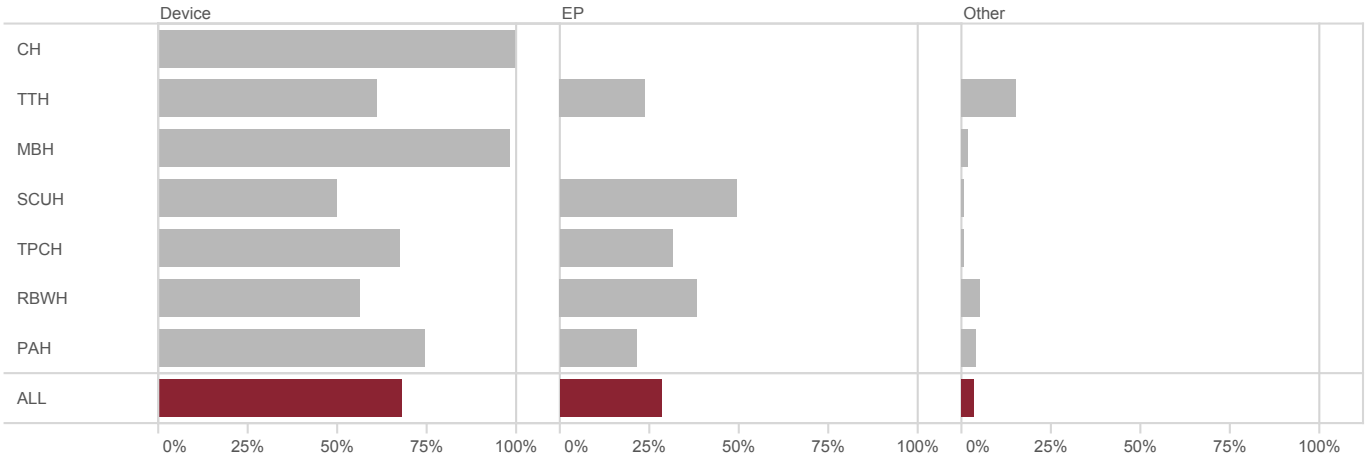


Figure 9: Proportion of cases by site and category

Table 3: Proportion of cases by case category

SITE	Cardiac Device Procedure n (%)	EP n (%)	Other n (%)	Total n (%)
CH	112 (100.0)	-	-	112 (3.6)
TTH	208 (61.2)	81 (23.8)	51 (15.0)	340 (10.8)
MBH	60 (98.4)	-	1 (1.6)	61 (1.9)
SCUH	103 (50.2)	101 (49.3)	1 (0.5)	205 (6.5)
TPCH	781 (67.8)	363 (31.5)	8 (0.7)	1,152 (36.8)
RBWH	238 (56.7)	161 (38.3)	21 (5.0)	420 (13.4)
PAH	629 (74.5)	183 (21.7)	32 (3.8)	844 (26.9)
ALL	**2,131 (68.0)**	**889 (28.4)**	**114 (3.6)**	**3,134 (100.0)**

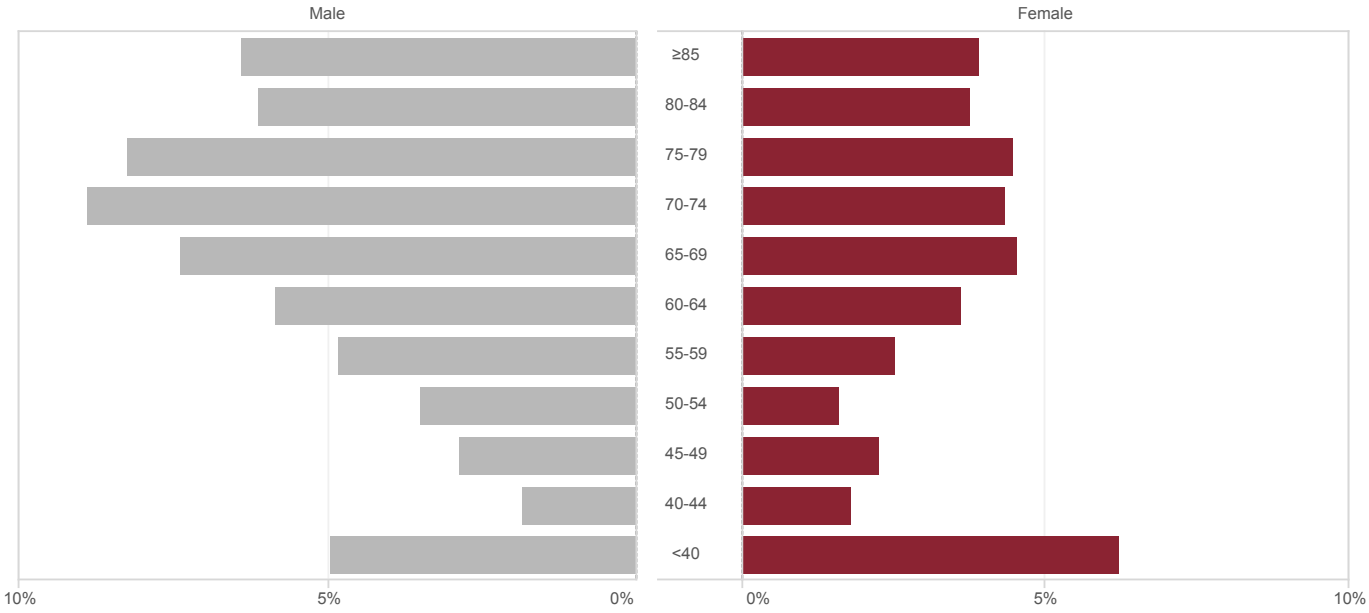
Case totals do not reflect all activity due to incomplete year of data acquisition

32 Patient characteristics

32.1 Age and gender

Age is an important risk factor for developing cardiovascular disease. The majority of patients were aged 60 years and above (57%). The median age of the overall electrophysiology and pacing patient cohort was 68 years of age.

Males had a higher median age of 69 years of age compared to females with a median age of 66 years. The median age of patients undergoing electrophysiology procedures was 57 years compared to 72 years for the cardiac device procedure category.



% of total (n=3,134)

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

The median age of the overall electrophysiology and pacing patient cohort was 68 years of age. Males had a higher median age of 69 years of age compared to females with a median age of 66 years. The median age of patients undergoing electrophysiology procedures was 57 years compared to 72 years for the cardiac device procedure category.

Table 4: Median age by gender and case category

	Total cases (n)	Female (years)	Male (years)	ALL (years)
Device	2,131	72	72	72
EP	889	50	59	57
Other	114	60	59	60
ALL	**3,134**	**66**	**69**	**68**

Case totals do not reflect all activity due to incomplete year of data acquisition

Overall, 61% of patients were male with all procedure categories demonstrating this trend also. The largest proportion of females was represented in the electrophysiology category (45%).

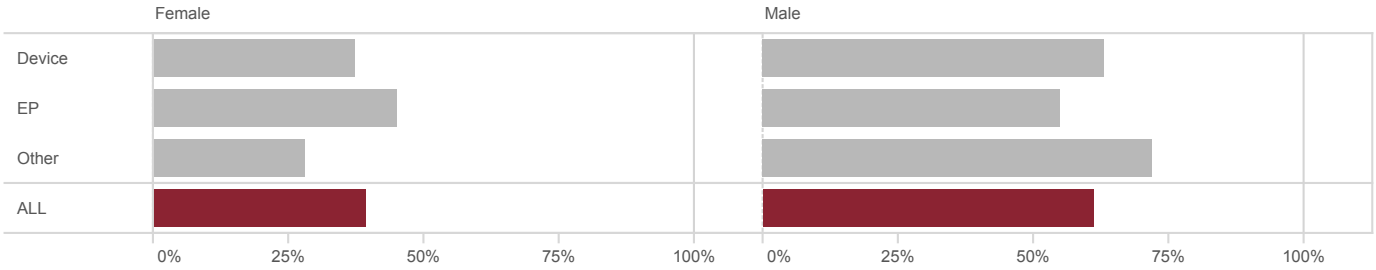


Figure 11: Proportion of cases by gender and category

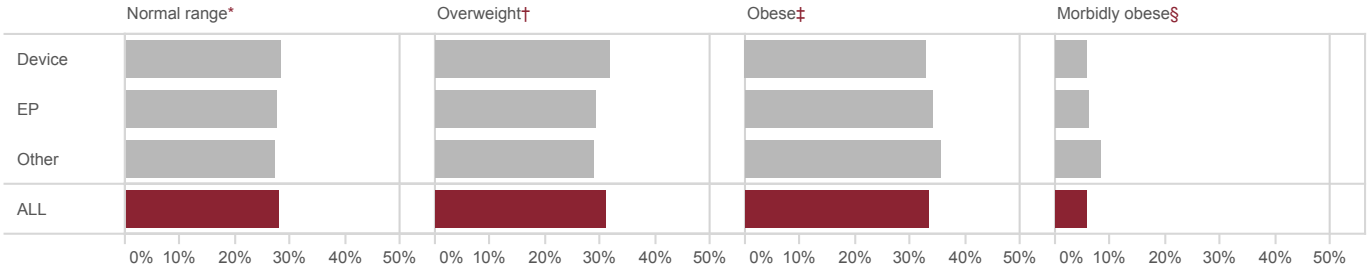
Table 5: Proportion of cases by gender and category

	Total cases (n)	Female n (%)	Male n (%)
Device	2,131	790 (37.1)	1,341 (62.9)
EP	889	400 (45.0)	489 (55.0)
Other	114	32 (28.3)	82 (71.7)
ALL	**3,134**	**1,222 (39.0)**	**1,912 (61.0)**

Case totals do not reflect all activity due to incomplete year of data acquisition

32.2 Body mass index

Patients classed as having a body mass index (BMI) category of overweight (31%), obese (33%) or morbidly obese (6%) represented slightly less than three quarters of electrophysiology and pacing patients. Patients classed as underweight represented 2% of all cases.



* BMI 18.5–24.9 kg/m^2

† BMI 25–29.9 kg/m^2

‡ BMI 30–39.9 kg/m^2

§ BMI ≥40 kg/m^2

Figure 12: Proportion of cases by BMI and case category

32.3 Aboriginal and Torres Strait Islander status

Overall, the proportion of identified Aboriginal and Torres Strait Islander patients undergoing electrophysiology and pacing procedures was 3.9%. This correlates closely to the estimated proportion of Aboriginal and Torres Strait Islander persons within Queensland (4.0%)[3]. There was large variation between units, with the North Queensland sites seeing a larger proportion of Aboriginal and Torres Strait Islander patients (Figure 13).

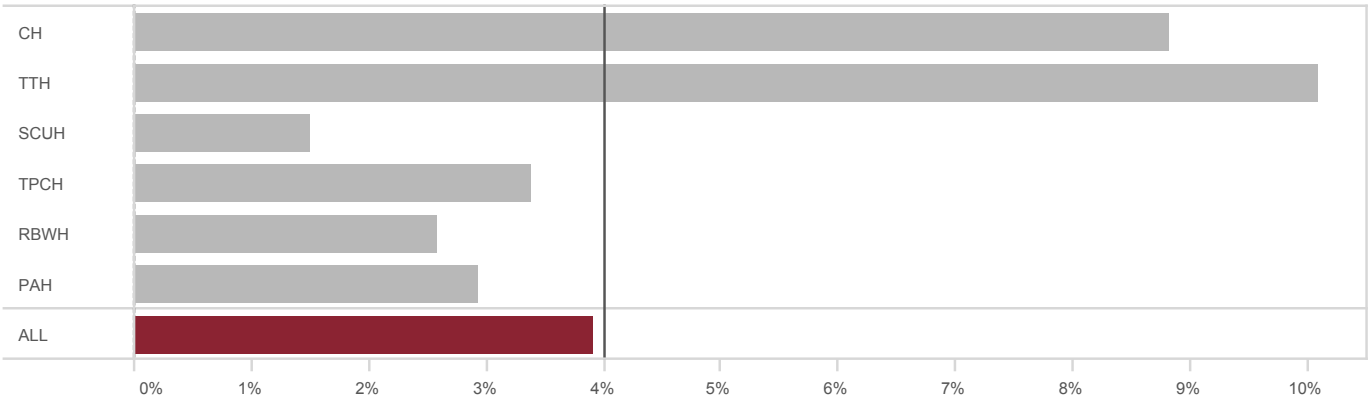
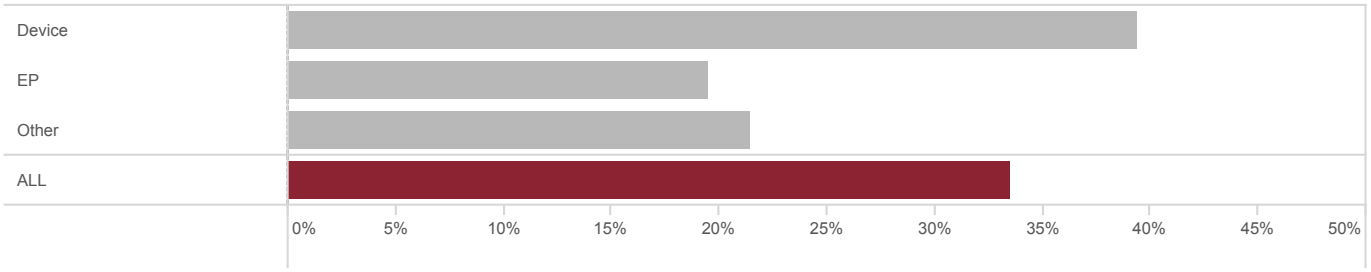


Figure 13: Proportion of cases by identified Aboriginal and Torres Strait Islander status and site

33 Risk factors and comorbidities

33.1 Coronary artery disease

Close to 40% of device patients have reported previous coronary artery disease with that figure almost halving among the electrophysiology patients.

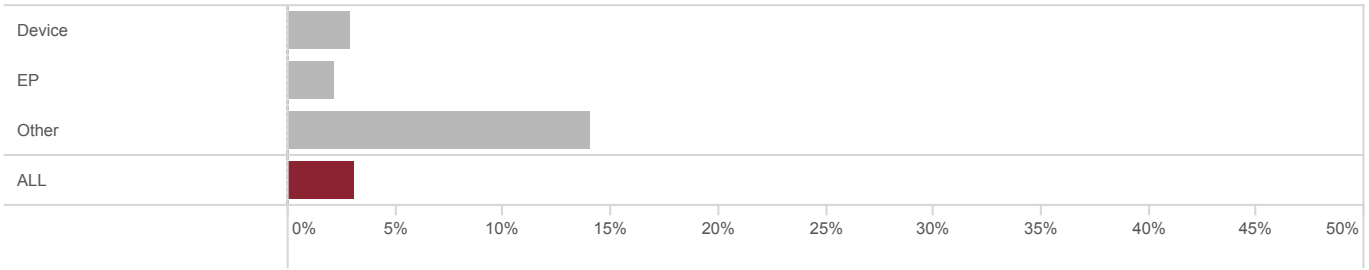


Excludes missing data (17%)

Figure 14: Proportion of cases by coronary artery disease history and case category

33.2 Family history of sudden cardiac death

During the surveyed period, 14% of patients with a family history of sudden cardiac death underwent other procedures. Overall, 75% of these patients had a drug challenge investigation performed.

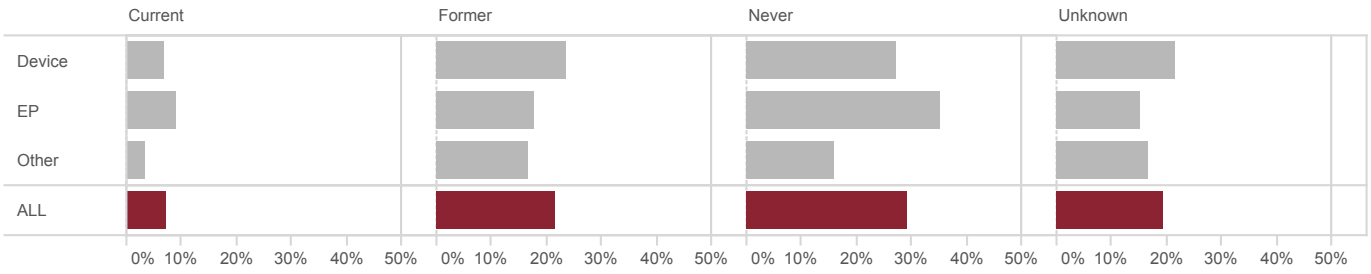


Excludes missing data (22%)

Figure 15: Proportion of cases by sudden cardiac death history and case category

33.3 Smoking history

Overall, 29% of patients had a history of tobacco use, including 7% being current smokers and 22% former smokers. 29% reported never having smoked and 19% had an unknown smoking history.

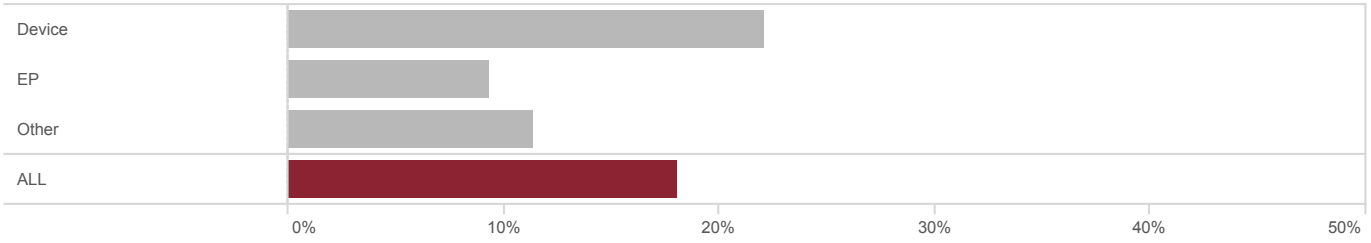


Excludes missing data (23%)

Figure 16: Proportion of cases by smoking status and case category

33.4 Diabetes

The prevalence of diabetes was highest in the cardiac device procedure group, with 22% of patients known to be diabetic. 18% of the overall cohort had some form of diabetes under treatment.

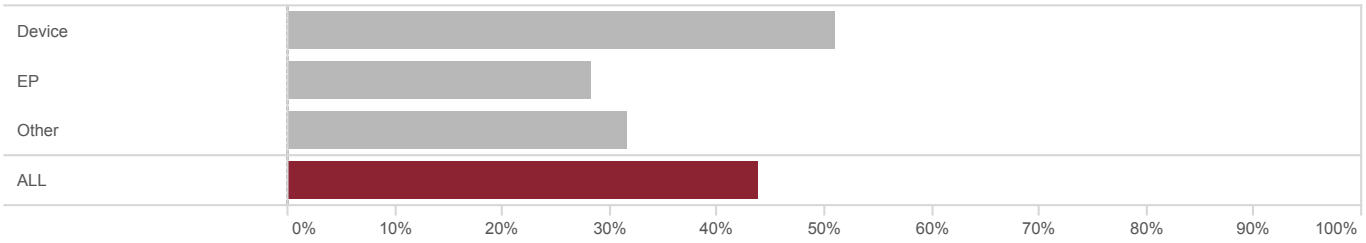


Excludes missing data (21%)

Figure 17: Proportion of cases by diabetes status and case category

33.5 Hypertension

Hypertension, defined as receiving antihypertensive medications at the time of case, was present in over 44% of patients irrespective of case type. Patients in the cardiac device procedure category had a greater incidence of hypertension (51%).

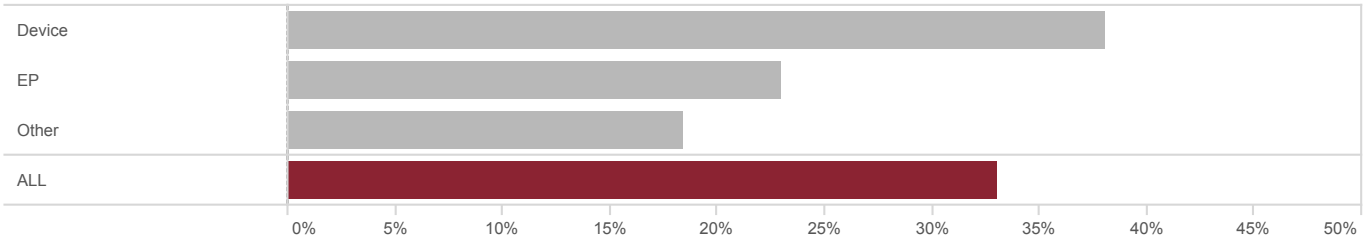


Excludes missing data (19%)

Figure 18: Proportion of cases by hypertension status and case category

33.6 Dyslipidaemia

Overall, 33% of patients were treated with statins for dyslipidaemia at the time of case, ranging from 38% for device procedures to 23% in the electrophysiology category.

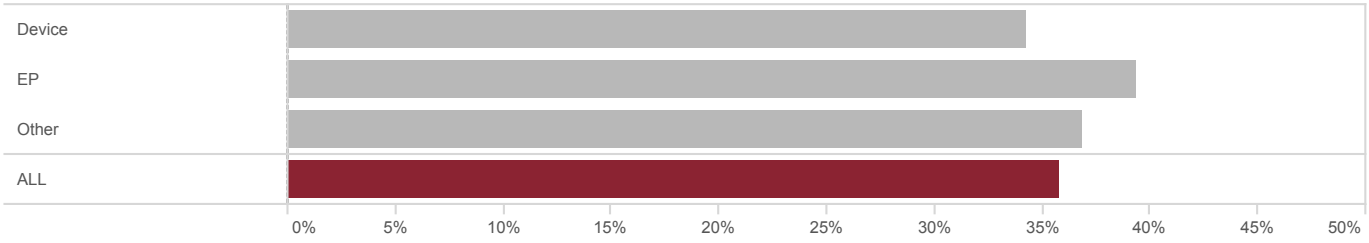


Excludes missing data (21%)

Figure 19: Proportion of cases by dyslipidaemia history status and case category

33.7 Atrial arrhythmia history

Overall, 36% of patients had a history of an atrial arrhythmia (atrial fibrillation, flutter or other atrial arrhythmia) at the time of case, ranging from 34% for device procedures to 39% in the electrophysiology category.

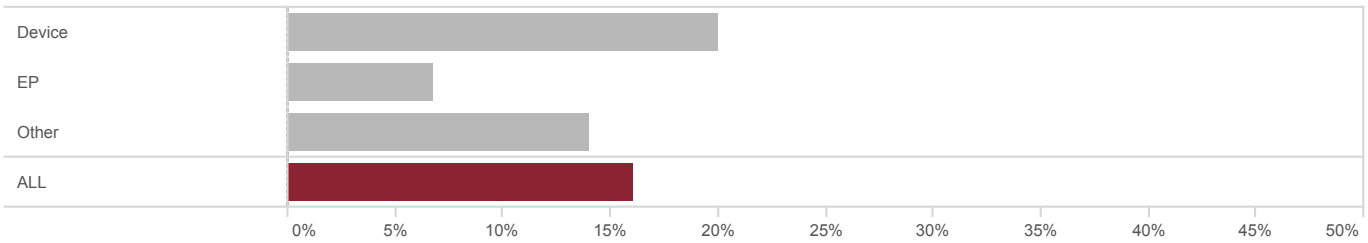


Excludes missing data (20%)

Figure 20: Proportion of cases by atrial arrhythmia history status and case category

33.8 Heart failure

Overall, 16% of patients had a classification of heart failure at the time of case, ranging from 20% for device procedures to 7% in the electrophysiology category.

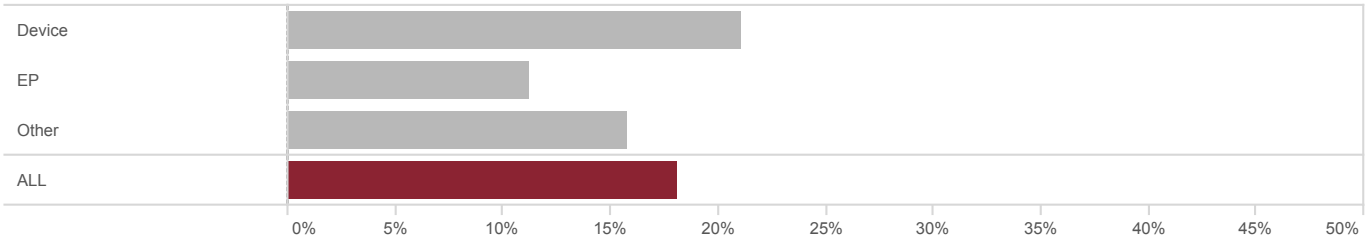


Excludes missing data (24%)

Figure 21: Proportion of cases by heart failure history status and case category

33.9 Valvular heart disease

18% of patients had a history of valvular heart disease at the time of case, ranging from 21% for device procedures to 11% in the electrophysiology category.

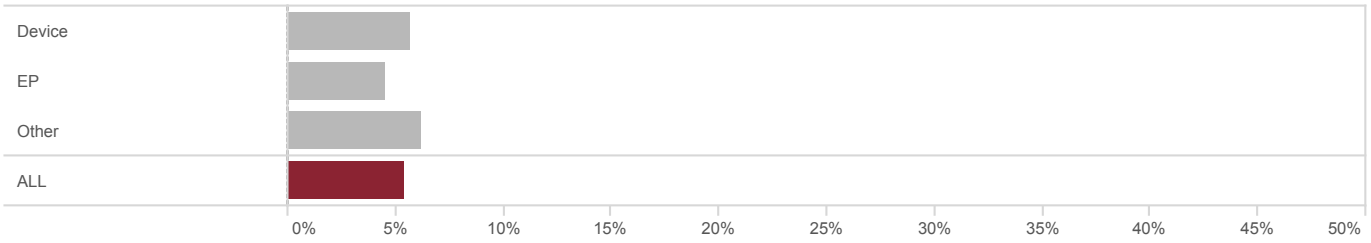


Excludes missing data (23%)

Figure 22: Proportion of cases by valvular heart disease history and case category

33.10 Other cardiovascular disease and co-morbidities

Overall, 5% of patients had a form of other cardiovascular (CV) disease or co-morbidity at the time of case, ranging from 6% for device procedures to 5% in the electrophysiology category.



Excludes missing data (28%)

Figure 23: Proportion of cases by CV disease history/co-morbidity and case category

33.11 Renal impairment

Across the state, 15% of all patients were identified as having impaired renal function (eGFR ≤89 mL/min/1.73 m^2) at the time of their case. Of these patients, the device procedure group had the highest incidence of renal impairment.

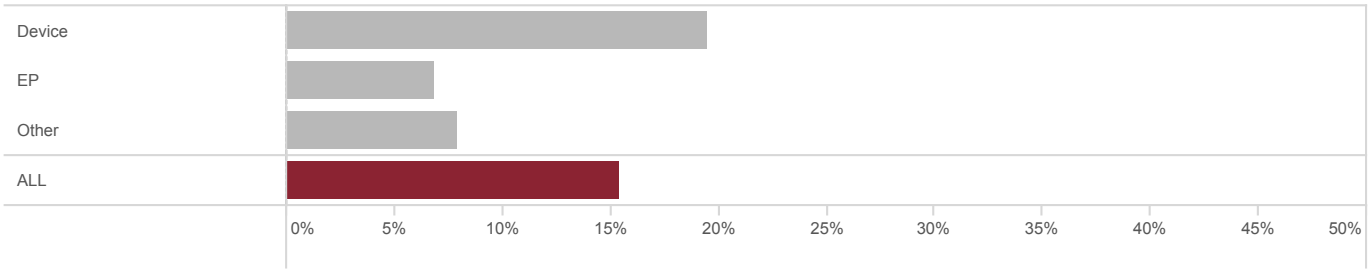


Figure 24: Proportion of cases by renal impairment status and case category

33.12 Anticoagulation

Patients identified as being anticoagulated using either warfarin or non-vitamin K antagonist oral anticoagulants (NOAC) at the time of case made up 29% of the total cohort. Of these, patients in the other procedure category had the highest use of anticoagulants followed by those in the electrophysiology category.

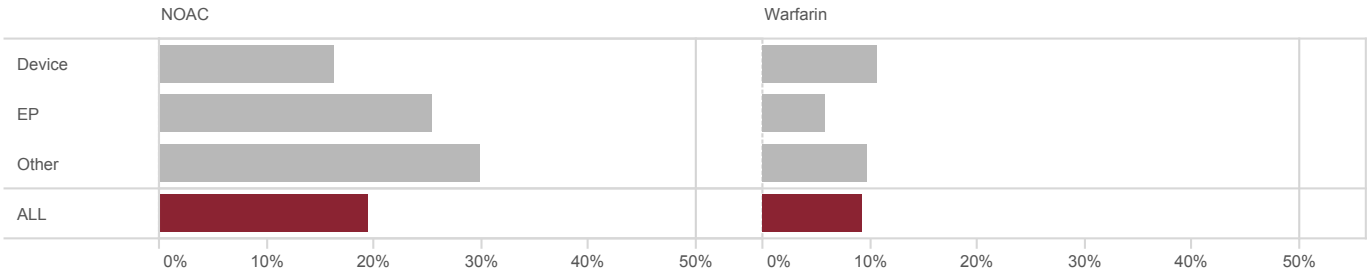
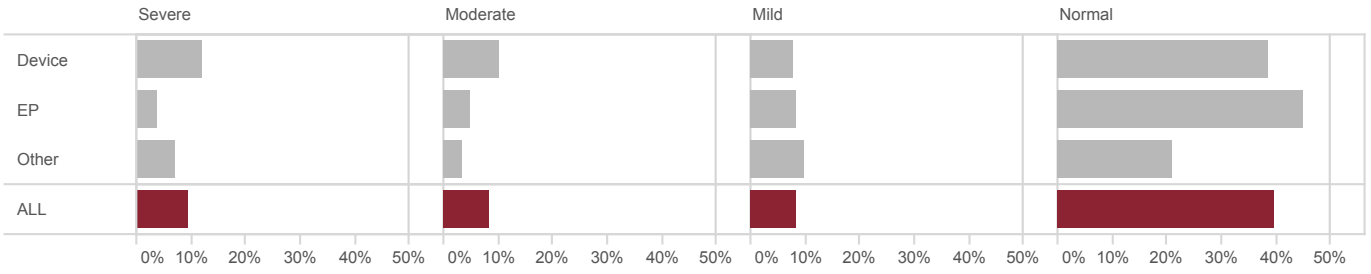


Figure 25: Proportion of cases by anticoagulation status and case category

33.13 LV function

Overall, 39% of patients were classed as having an impaired left ventricular ejection fraction (LVEF), including 12% with mild LV dysfunction (LVEF between 40%–50%), 13% with moderate LV dysfunction (LVEF between 30%–39%) and 14% with severe LV dysfunction (LVEF less than 30%).



Excludes missing data (34%)

Figure 26: Proportion of cases by LV function category and case category

34 Care and treatment of patients

34.1 Urgency category

Urgency categories are based on the time frame which the procedure is clinically indicated. Categorisation is judged by the individual treating clinician.

Across the state, category one cases formed the majority of procedures undertaken. Urgency category ranged widely between sites with category one cases varying from 27% to 65%. Further disparity was noted within category three, with statewide variation noted from as little as 5% of case volume through to 48%.

Table 6: Proportion of all cases by urgency category and site

	Total cases (n)	Category 1* n (%)	Category 2† n (%)	Category 3‡ n (%)
CH	112	49 (43.8)	50 (44.6)	8 (7.1)
TTH	340	133 (39.1)	33 (9.7)	4 (1.2)
MBH	61	39 (63.9)	13 (21.3)	2 (3.3)
SCUH	211	57 (27.8)	36 (17.6)	90 (43.9)
TPCH	1154	749 (65.0)	258 (22.4)	112 (9.7)
RBWH	420	145 (34.5)	68 (16.2)	202 (48.1)
PAH	844	466 (55.2)	172 (20.4)	138 (16.4)
ALL	**3,134**	**1,638 (52.3)**	**630 (20.1)**	**556 (17.7)**

Includes missing data 9.9%

Case totals do not reflect all activity due to incomplete year of data acquisition

* Procedures that are clinically indicated within 30 days

† Procedures that are clinically indicated within 90 days

‡ Procedures that are clinically indicated within 365 days

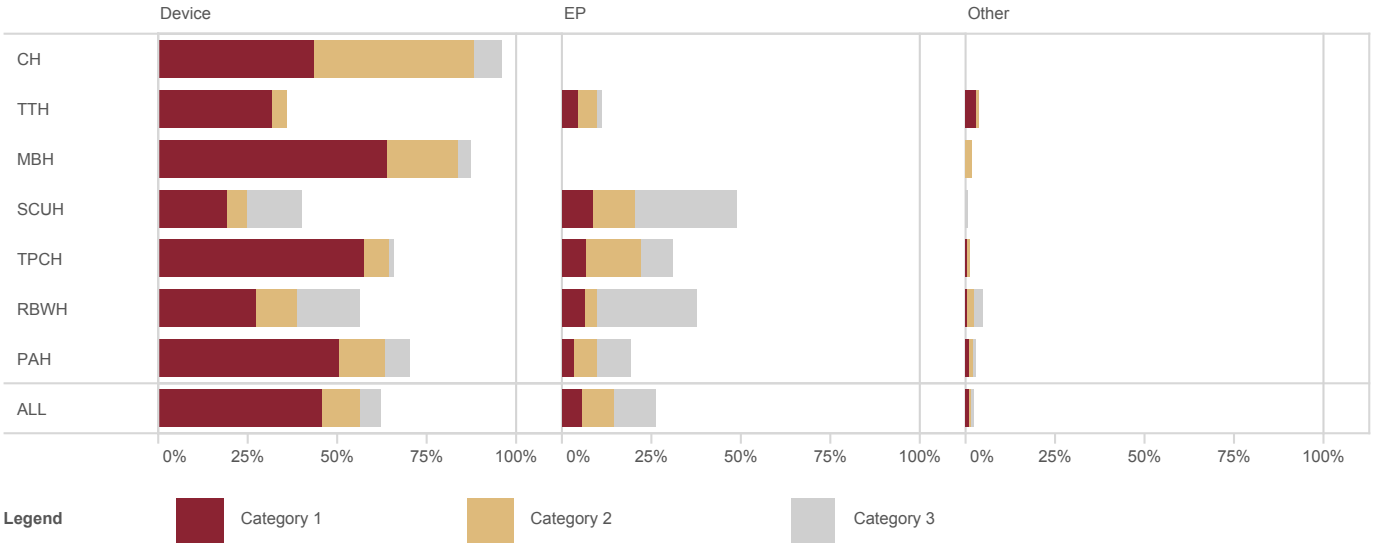


Figure 27: Proportion of all cases by urgency category, procedure category and site

34.2 Admission source

The majority of all cases were performed on patients classed as outpatients. CH and TTH were the only sites to perform more inpatient procedures than outpatient. Non-admitted inter-hospital transfers accounted for less than 1.0% of all case volume.

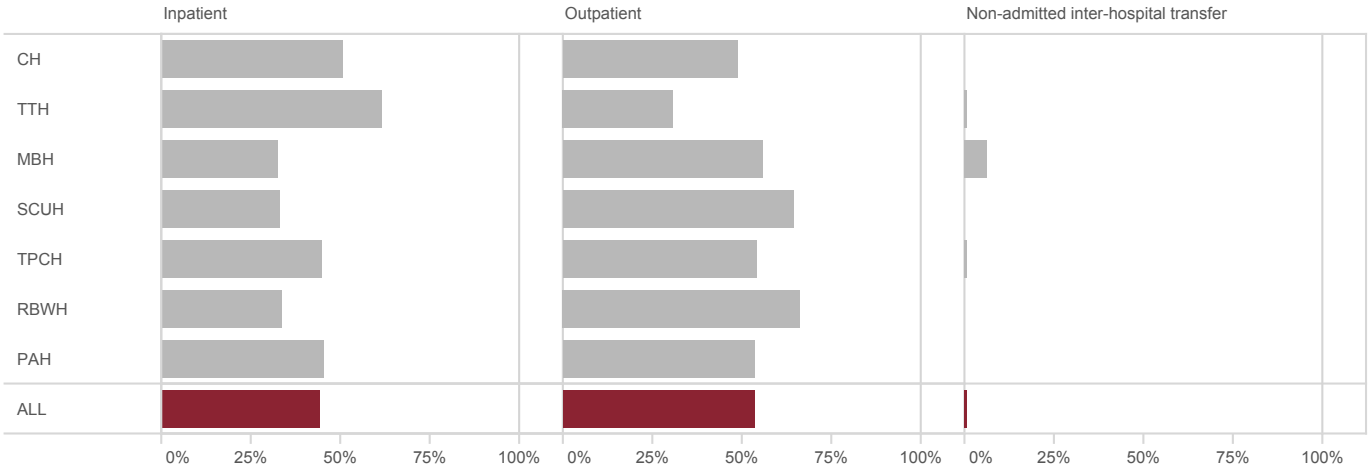


Figure 28: Admission source by site

Table 7: Admission source by site

	Total cases (n)*	Outpatient n (%)	Inpatient n (%)	Non-admitted inter-hospital transfer n (%)
CH	112	55 (49.1)	57 (50.9)	-
TTH	340	106 (31.2)	210 (61.8)	1 (0.3)
MBH	61	34 (55.7)	20 (32.8)	4 (6.6)
SCUH	205	133 (64.9)	68 (32.2)	-
TPCH	1152	626 (54.3)	515 (44.7)	10 (0.9)
RBWH	420	278 (66.2)	142 (33.8)	-
PAH	844	454 (53.8)	384 (45.4)	-
ALL	**3,134**	**1,686 (53.8)**	**1,396 (44.5)**	**15 (0.5)**

* Includes missing data 1.2%

Case totals do not reflect all activity due to incomplete year of data acquisition

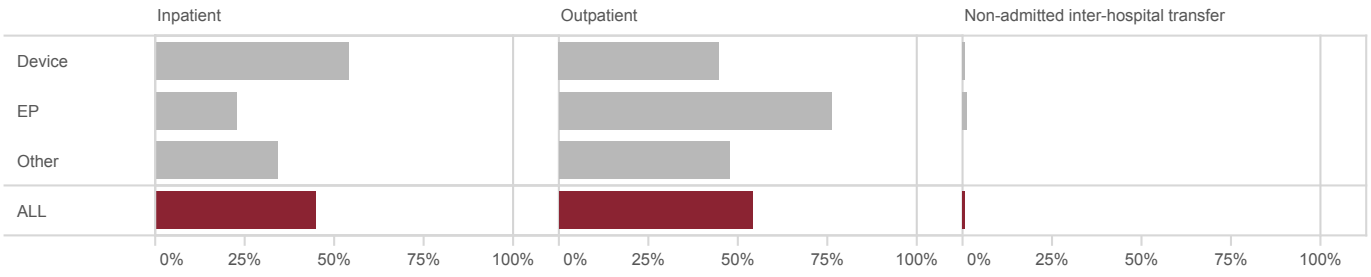


Figure 29: Admission source by case category

34.3 Admission source and urgency category

Category one procedures accounted for the majority of both inpatient and outpatient cases. There was a marked increase in proportions for inpatient procedures with category one cases accounting for over three-quarters of cases. Outpatient procedures demonstrated almost even distribution across the three categories.

Table 8: Outpatient cases by urgency category

Outpatient site	Total cases (n)*	Category 1 n (%)	Category 2 n (%)	Category 3 n (%)
CH	55	11 (20.0)	34 (61.8)	8 (14.5)
TTH	106	46 (43.4)	24 (22.6)	3 (2.8)
MBH	34	17 (50.0)	12 (35.3)	1 (2.9)
SCUH	139	1 (0.7)	35 (25.2)	95 (68.3)
TPCH	627	291 (46.4)	217 (34.6)	99 (15.8)
RBWH	278	22 (7.9)	58 (20.9)	193 (69.4)
PAH	454	158 (34.8)	143 (31.4)	109 (24.0)
ALL	**1,686**	**546 (32.3)**	**523 (30.9)**	**508 (30.0)**

* Includes 6.9% missing data

Case totals do not reflect all activity due to incomplete year of data acquisition

Table 9: Inpatient cases by urgency category

Inpatient site	Total cases (n)*	Category 1 n (%)	Category 2 n (%)	Category 3 n (%)
CH	57	38 (66.7)	16 (28.1)	-
TTH	210	85 (40.5)	9 (4.3)	1 (0.5)
MBH	20	17 (85.0)	1 (5.0)	-
SCUH	68	55 (80.9)	1 (1.5)	1 (1.5)
TPCH	515	456 (88.5)	35 (6.8)	11 (2.1)
RBWH	142	123 (86.6)	10 (7.0)	9 (6.3)
PAH	384	307 (79.9)	29 (7.6)	29 (7.6)
ALL	**1,396**	**1,081 (77.4)**	**101 (7.2)**	**51 (3.7)**

* Includes 11.7% missing data

Case totals do not reflect all activity due to incomplete year of data acquisition

34.4 Device procedures

Case types and procedure combinations varied across the state and relates primarily to services provided by individual sites. Single and dual chamber pacemaker implants/generator changes accounted for the majority of cases across the state. In 2018, 5 sites across the state offered biventricular pacemaker (BiV)/ implantable cardioverter defibrillator (ICD) implants with three sites providing leadless pacemaker implants.

Table 10: Cardiac device case types by site

Site	Procedure type	Case n (%)
CH	Pacemaker implant/generator change	75 (67.0)
	Loop recorder implant/explant	32 (28.6)
	Device explant	3 (2.7)
	Lead revision/replacement/pocket revision	2 (1.8)
TTH	Pacemaker implant/generator change	87 (41.8)
	ICD implant/generator change/upgrade	78 (37.5)
	BiV ICD implant/generator change/upgrade	15 (7.2)
	Loop recorder implant/explant	13 (6.3)
	Lead revision/replacement/pocket revision	7 (3.4)
	Device explant	3 (1.4)
	BiV pacemaker implant/generator change/upgrade	3 (1.4)
	Leadless pacemaker implant	2 (1.0)
MBH	Pacemaker implant/generator change	38 (63.3)
	Loop recorder implant/explant	17 (28.3)
	Lead revision/replacement/pocket revision	3 (5.0)
	ICD implant/generator change/upgrade	1 (1.7)
	Device explant	1 (1.7)
SCUH	Pacemaker implant/generator change	85 (82.5)
	ICD implant/generator change/upgrade	11 (10.7)
	BiV ICD implant/generator change/upgrade	3 (2.9)
	BiV pacemaker implant/generator change/upgrade BiV	2 (1.9)
	Device explant	1 (1.0)
	Lead revision/replacement/pocket revision	1 (1.0)
TPCH	Pacemaker implant/generator change	365 (46.7)
	ICD implant/generator change/upgrade	161 (20.6)
	Device explant	68 (8.7)
	Loop recorder implant/explant	52 (6.7)
	ICD implant/generator change/upgrade BiV	52 (6.7)
	BiV pacemaker implant/generator change/upgrade BiV	31 (4.0)
	Leadless pacemaker implant	28 (3.6)
	Lead revision/replacement/pocket revision	23 (2.9)
	Temporary pacing system	1 (0.1)
RBWH	Pacemaker implant/generator change	85 (35.7)
	Loop recorder implant/explant	62 (26.1)
	ICD implant/generator change/upgrade	46 (19.3)
	BiV ICD implant/generator change/upgrade	20 (8.4)
	BiV pacemaker implant/generator change/upgrade	11 (4.6)
	Lead revision/replacement/pocket revision	7 (2.9)
	Device explant	6 (2.5)
	Temporary pacing system	1 (0.4)
PAH	Pacemaker implant/generator change	397 (63.1)
	ICD implant/generator change/upgrade	115 (18.3)
	Loop recorder implant/explant	48 (7.6)
	BiV ICD implant/generator change/upgrade	41 (6.5)
	Lead revision/replacement/pocket revision	13 (2.1)
	BiV pacemaker implant/generator change/upgrade	4 (0.6)
	Device explant	7 (1.1)
	Leadless pacemaker implant	3 (0.5)
	Insertion of epicardial lead	1 (0.2)
ALL		**2,131**

Case totals do not reflect all activity due to incomplete year of data acquisition

34.5 Electrophysiology studies/ablations

Electrophysiology studies including radiofrequency ablation were the most common individual procedure performed across all sites, ranging from 46% at TTH to 64% at RBWH.

Table 11: Electrophysiology study/ablation types by site

Site	Procedure type	Case n (%)
TTH	Electrophysiology study and radiofrequency ablation	37 (45.7)
	Electrophysiology study	20 (24.7)
	Radiofrequency ablation	13 (16.0)
	Cryotherapy ablation	9 (11.1)
	Electrophysiology study and cryotherapy ablation	2 (2.5)
SCUH	Electrophysiology study and radiofrequency ablation	62 (61.4)
	Electrophysiology study	23 (22.8)
	Electrophysiology study and cryotherapy ablation	11 (10.9)
	Cryotherapy ablation	2 (2.0)
	Radiofrequency ablation	1 (1.0)
	Electrophysiology study with radiofrequency and cryotherapy ablation	1 (1.0)
	Electrophysiology study with drug challenge	1 (1.0)
TPCH	Electrophysiology study and radiofrequency ablation	191 (52.6)
	Radiofrequency ablation	73 (20.1)
	Electrophysiology study	71 (19.6)
	Electrophysiology study and cryotherapy ablation	12 (3.3)
	Cryotherapy ablation	7 (1.9)
	Electrophysiology study with drug challenge	5 (1.4)
	Electrophysiology study with radiofrequency and cryotherapy ablation	4 (1.1)
RBWH	Electrophysiology study and radiofrequency ablation	103 (64.0)
	Electrophysiology study	40 (24.8)
	Electrophysiology study and cryotherapy ablation	10 (6.2)
	Radiofrequency ablation	3 (1.9)
	Electrophysiology study with radiofrequency and cryotherapy ablation	3 (1.9)
	Electrophysiology study and drug challenge	2 (1.2)
PAH	Electrophysiology study and radiofrequency ablation	95 (51.9)
	Radiofrequency ablation	49 (26.8)
	Electrophysiology study	36 (19.7)
	Electrophysiology study and cryotherapy ablation	3 (1.6)
ALL		**889**

Case totals do not reflect all activity due to incomplete year of data acquisition

34.5.1 Standard vs complex electrophysiology

Complex electrophysiology cases using three-dimensional mapping technology or involving pulmonary vein isolation accounted for 42% of the total electrophysiology cases performed in 2017 across five sites.

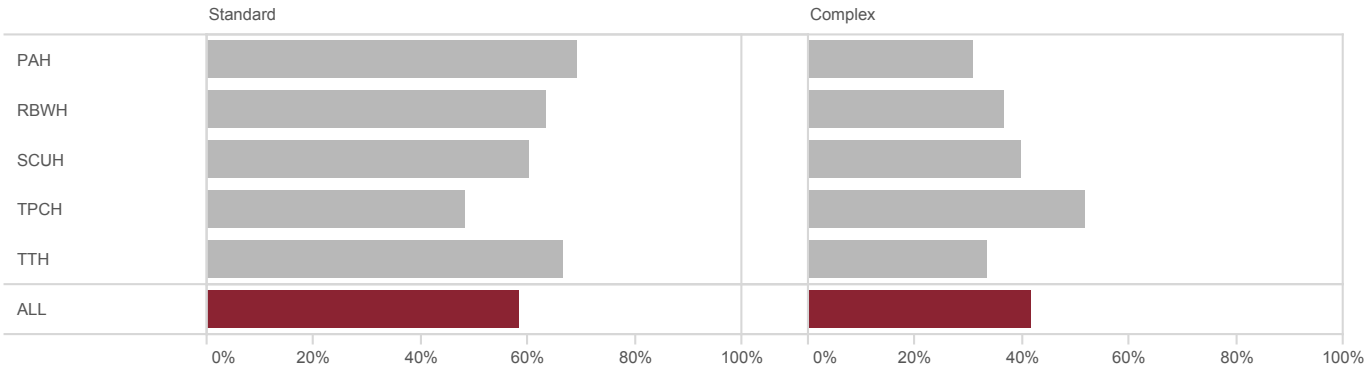


Figure 30: Complexity of electrophysiology procedures by site

Table 12: Proportion of standard and complex electrophysiology procedures by site

Site	Case type	Total (n)	Complex EP (n)	Standard EP (n)
TTH	Radiofrequency ablation	50	16	34
	Cryotherapy ablation	11	9	2
	Electrophysiology study	20	2	18
SCUH	Radiofrequency ablation	63	24	39
	Electrophysiology study	23	3	20
	Cryotherapy ablation	13	12	1
	Electrophysiology study with drug challenge	1	-	1
	Radiofrequency and cryotherapy ablation	1	1	-
TPCH	Radiofrequency ablation	264	144	120
	Electrophysiology study	71	21	50
	Cryotherapy ablation	19	18	1
	Electrophysiology study with drug challenge	5	1	4
	Radiofrequency and cryotherapy ablation	4	4	-
RBWH	Radiofrequency ablation	106	44	62
	Electrophysiology study	40	7	33
	Cryotherapy ablation	10	7	3
	Electrophysiology study with drug challenge	2	-	2
	Radiofrequency and cryotherapy ablation	3	1	2
PAH	Radiofrequency ablation	144	52	92
	Electrophysiology study	36	4	32
	Cryotherapy ablation	3	-	3
ALL		**889**	**370**	**519**

Case totals do not reflect all activity due to incomplete year of data acquisition

34.5.2 Three-dimensional mapping system

The total proportion of electrophysiology cases utilising three-dimensional mapping systems across sites, and distribution across vendors is shown in Table 13. Two vendors account for 91% of all three-dimensional mapping systems used.

Table 13: Three dimensional mapping system type by site

	Total cases (n)	CARTO n (%)	ESI n (%)	Rhythmia n (%)	ESI + Rhythmia n (%)
TTH	18	8 (44.4)	10 (55.6)	-	-
SCUH	27	-	15 (55.6)	12 (44.4)	-
TPCH	171	93 (54.4)	60 (35.1)	17 (9.9)	1 (0.6)
RBWH	57	5 (8.8)	52 (91.2)	-	-
PAH	56	34 (60.7)	22 (39.3)	-	-
ALL	**329**	**140 (42.6)**	**159 (48.3)**	**29 (8.8)**	**1 (0.3)**

Case totals do not reflect all activity due to incomplete year of data acquisition

34.5.3 Ablation type

Radiofrequency ablation is the principal method across all sites, with 91% of all cases utilising this energy.

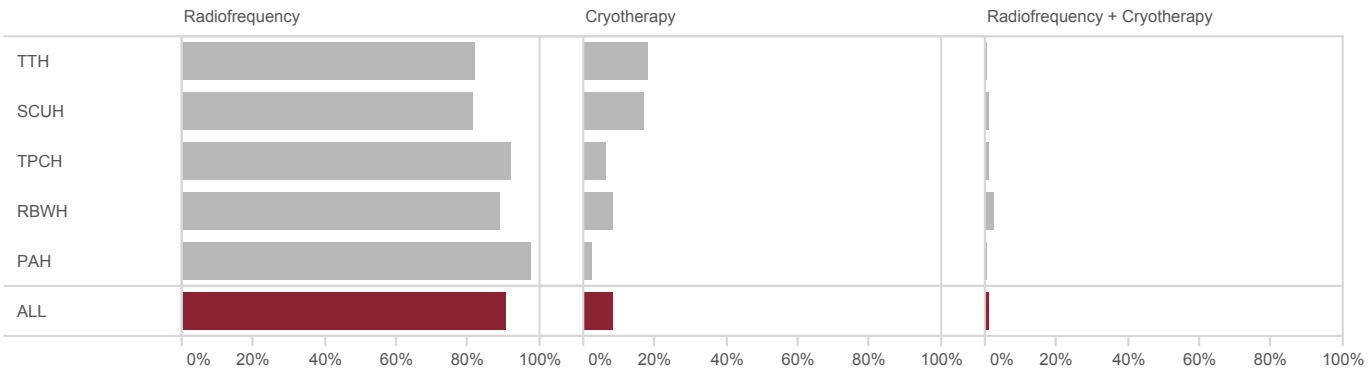


Figure 31: Ablation type by site

Table 14: Ablation type by site

	Total cases (n)	Radiofrequency n (%)	Cryotherapy n (%)	Radiofrequency + Cryotherapy n (%)
TTH	61	50 (82.0)	11 (18.0)	-
SCUH	77	63 (81.8)	13 (16.9)	1 (1.3)
TPCH	287	264 (92.0)	19 (6.6)	4 (1.4)
RBWH	119	106 (89.1)	10 (8.4)	3 (2.5)
PAH	147	144 (98.0)	3 (2.0)	-
ALL	**691**	**627 (90.7)**	**56 (8.1)**	**8 (1.2)**

Case totals do not reflect all activity due to incomplete year of data acquisition

34.5.4 Ablation chamber

The most common site for ablation is within the atria, with ventricular ablation being the second most common.

Table 15: Ablation chamber by site

	Atrial (n)	Ventricular (n)	Bypass Tract (n)	Bypass tract and atrial (n)	Epicardium (n)	Atrial and Ventricular (n)
TTH	43	1	7	-	-	-
SCUH	63	3	-	-	-	-
TPCH	207	64	13	1	1	1
RBWH	106	6	7	-	-	-
PAH	126	8	6	1	-	-
ALL	**545**	**82**	**33**	**2**	**1**	**1**

Includes 3.9% missing data

Case totals do not reflect all activity due to incomplete year of data acquisition

34.5.5 Ablation location – supraventricular

The anatomical location of supra ventricular ablation differs slightly across sites. Cavo-tricuspid isthmus (atrial flutter), pulmonary veins (atrial fibrillation) and slow pathway (atrial tachycardia) ablations accounting for 80% of all cases. The remainder of procedures were for accessory pathway ablation.

Table 16: Supraventricular ablation according to anatomical location

Site	Ablation category	Count (n)
TTH	Slow pathway	14
	Pulmonary veins	12
	Cavo-tricuspid isthmus	9
	Tricuspid annulus	6
	Mitral annulus	4
	Coronary sinus ostium	1
	Right septum	1
SCUH	Pulmonary veins	21
	Slow pathway	17
	Cavo-tricuspid isthmus	15
	Atrioventricular node	4
	Coronary sinus ostium	2
	Mitral annulus	2
	Crista terminalis mid	1
	Tricuspid annulus	1
	Other	4
TPCH	Pulmonary veins	62
	Cavo-tricuspid isthmus	56
	Slow pathway	48
	Mitral annulus	13
	Tricuspid annulus	10
	Atrioventricular node	7
	Coronary sinus ostium	3
	Crista terminalis	2
	Posteroseptal	2
	Right septum	2
	Anteroseptal	1
	Crista terminalis mid and Right atrial appendage	1
	Coronary sinus ostium and Other and Slow pathway and Mitral annulus	1
	Slow pathway and Crista terminalis	1
	Slow pathway and Coronary sinus body and Other	1
	Slow pathway and Coronary sinus ostium	1
	Superior vena cava	1
	Other	10
RBWH	Slow pathway	43
	Pulmonary veins	27
	Cavo-tricuspid isthmus	25
	Atrioventricular node	5
	Tricuspid annulus	5
	Mitral annulus	2
	Posteroseptal	2
	Cavo-tricuspid isthmus and Slow pathway	1
	Crista terminalis	1
	Coronary sinus ostium	1
	Slow pathway and left septum	1
	Left septum and right septum	1
	Other	1
PAH	Slow pathway	45
	Cavo-tricuspid isthmus	36
	Pulmonary veins	36
	Atrioventricular node	6
	Mitral annulus	6
	Tricuspid annulus	6
	Right septum	1
	Other	3

34.5.6 Ablation location – ventricular

The anatomical location of ventricular ablation is variable according to site with right ventricular outflow tract ablation making up a quarter of all ventricular ablation cases.

Table 17: Ventricular ablation according to anatomical location

Site	Anatomical location	Count (n)
TTH	Right ventricular outflow tract	1
SCUH	Right ventricular outflow tract	1
TPCH	Right ventricular outflow tract	10
	Left ventricular endocardium	8
	Pulmonary artery	5
	Aorta-mitral continuity	4
	Parahisian	4
	Mitral annulus	1
	Right/left coronary cusp	4
	Tricuspid annulus	3
	Papillary muscle	2
	Aortico-mitral continuity and Right coronary cusp	1
	Left posterior fascicle	1
	Left ventricular summit	1
	Mitral annulus and Slow pathway	1
	Parahisian and Tricuspid annulus	1
	Postero-medial papillary muscle and Right/left coronary cusp	1
	Other	11
RBWH	Right ventricular outflow tract	5
	Other	1
PAH	Right ventricular outflow tract	3
	Mitral annulus	2
	Right/left coronary cusp	1
	Other	2

34.5.7 Ablation category – supraventricular

The most frequently ablated clinical arrhythmia was atrial fibrillation accounting for 28% of all supraventricular ablations across all sites, followed by atrial flutter (24%).

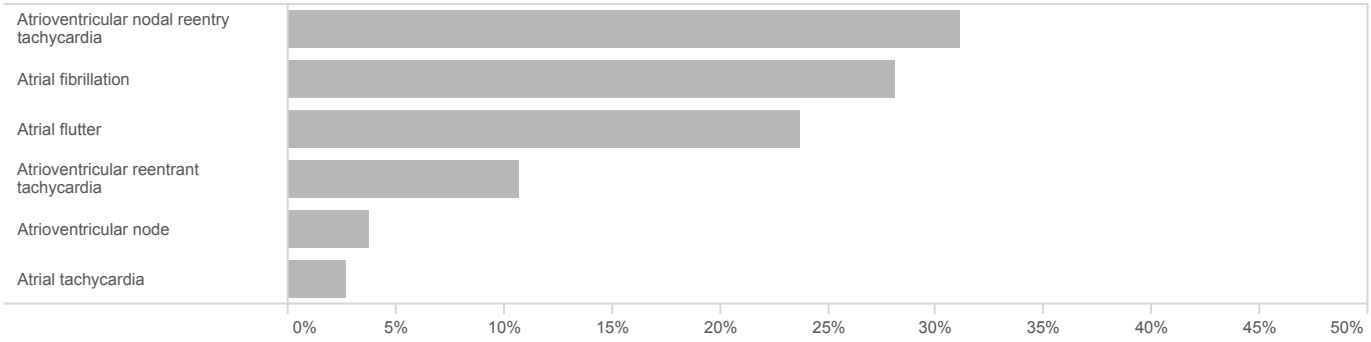


Figure 32: Proportion of supraventricular arrhythmia requiring ablation

Table 18: Supraventricular ablation according to arrhythmia

Site	Ablation category	Count (n)
TTH	Atrial fibrillation	12
	Atrial flutter	10
	Atrioventricular reentrant tachycardia	10
	Atrioventricular nodal reentry tachycardia	15
SCUH	Atrial fibrillation	21
	Atrial flutter	16
	Atrioventricular reentrant tachycardia	3
	Atrioventricular nodal reentry tachycardia	17
	Atrial tachycardia	1
	Atrioventricular node	4
TPCH	Atrial fibrillation	62
	Atrial flutter	51
	Atrioventricular reentrant tachycardia	28
	Atrioventricular nodal reentry tachycardia	50
	Atrial tachycardia	12
	Atrioventricular node	7
RBWH	Atrial fibrillation	27
	Atrial flutter	27
	Atrioventricular reentrant tachycardia	7
	Atrioventricular nodal reentry tachycardia	45
	Atrial tachycardia	2
	Atrioventricular node	4
PAH	Atrial fibrillation	36
	Atrial flutter	29
	Atrioventricular reentrant tachycardia	12
	Atrioventricular nodal reentry tachycardia	48
	Atrioventricular node	6
ALL		**562**

Includes 3.4% missing data

Case totals do not reflect all activity due to incomplete year of data acquisition

34.5.8 Ablation category – ventricular

Ventricular tachycardia ablation accounted for 54% of all ventricular ablations, with 35% of procedures indicated for ventricular ectopy.

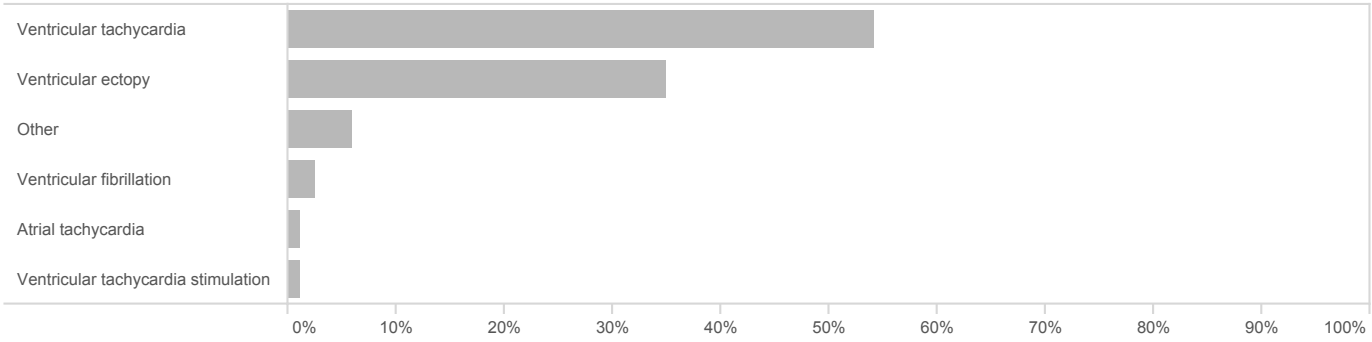


Figure 33: Proportion of ventricular arrhythmia requiring ablation

Table 19: Ventricular ablation according to arrhythmia

Site	Ablation category	Count (n)
TTH	Ventricular ectopy	1
SCUH	Ventricular ectopy	1
	Ventricular tachycardia	1
TPCH	Ventricular tachycardia	37
	Ventricular ectopy	24
	Other	5
	Ventricular fibrillation	2
RBWH	Ventricular tachycardia	3
	Ventricular ectopy	2
	Atrial tachycardia	1
PAH	Ventricular tachycardia	4
	Ventricular tachycardia stimulation	1
	Ventricular ectopy	1
ALL		**83**

Includes 11.9% missing data

Case totals do not reflect all activity due to incomplete year of data acquisition

34.6 Other procedures

The most common forms of other procedure were cardioversions (65%). Variations in clinical practice across sites can be observed here, with not all cardioversions performed being carried out in the electrophysiology laboratory environment.

Table 20: Other procedures

	Total (n)	Cardioversion n (%)	Drug challenge n (%)	Other n (%)
TTH	51	40 (78.4)	11 (21.6)	-
MBH	1	1 (100.0)	-	-
SCUH	1	-	1 (100.0)	-
TPCH	8	-	1 (12.5)	7 (87.5)
RBWH	21	5 (23.8)	14 (66.7)	2 (9.5)
PAH	32	28 (87.5)	2 (6.3)	2 (6.3)
ALL	**114**	**74 (64.9)**	**29 (25.4)**	**11 (9.6)**

Case totals do not reflect all activity due to incomplete year of data acquisition

35 Procedural complications

Lead complications were the most frequently encountered complication for device procedures and pericardial effusions were the most commonly observed complication across electrophysiology procedures. The summary of complications below denotes complications observed intraprocedurally as well as post procedure. Notation of complications within the QCOR electrophysiology application is the responsibility of site practitioners.

The complication rates for procedures in Tables 21 and 22 are reflected as the proportion of the total number of device and electrophysiology procedures respectively. Rarely, the development of an intraprocedural complication such as coronary sinus dissection necessitated a switch of procedure type from BiV implant/ upgrade to a non-BiV device procedure. These are categorised as the final procedure type.

The aggregate for all device procedure complications was 4.6%, while all electrophysiology procedures had a 2.6% complication rate.

Table 21: Cardiac device procedure complications

Procedure type	Complication	Total n (%)
Pacemaker implant/generator change	Lead complication	17 (0.8)
	Pericardial effusion with or without tamponade	6 (0.3)
	Haematoma	5 (0.2)
	Cardiac arrest	4 (0.2)
	Infection	3 (0.1)
	Pneumothorax	3 (0.1)
	Venous access complication	3 (0.1)
	Coronary sinus dissection	2 (0.1)
	Other	9 (0.4)
Loop recorder implant/explant	Device erosion	1 (<0.1)
	Drug reaction	1 (<0.1)
ICD implant/generator change/ upgrade	Infection	4 (0.2)
	Cardiac arrest	3 (0.1)
	Lead complication	3 (0.1)
	Drug reaction	3 (0.1)
	Haematoma	1 (<0.1)
	Pericardial effusion with or without tamponade	1 (<0.1)
BiV ICD implant/generator change/ upgrade	Coronary sinus dissection	3 (0.1)
	Lead dislodgement	3 (0.1)
	Haematoma	2 (0.1)
	Cardiac arrest	1 (<0.1)
	Infection	1 (<0.1)
	Other	5 (0.2)
BiV pacemaker implant/ generator change/upgrade	Coronary sinus dissection	3 (0.1)
	Cerebrovascular accident	1 (<0.1)
	Lead complication	1 (<0.1)
Device explant	Lead complication	2 (0.1)
	Conduction block	1 (<0.1)
	Coronary sinus dissection	1 (<0.1)
	Infection	1 (<0.1)
Lead revision/replacement/ pocket revision	Lead complication	2 (0.1)
	Pericardial effusion with or without tamponade	1 (<0.1)
ALL		**97 (4.6)**

% as proportion of device procedures

Case totals do not reflect all activity due to incomplete year of data acquisition

Table 22: Electrophysiology procedure complications

Procedure Type	Complexity	Complication	Total n (%)
Ablation – cryotherapy	Complex EP	Resolved phrenic nerve injury	1 (0.1)
Ablation – radiofrequency	Complex EP	Pericardial effusion with tamponade	3 (0.3)
		Readmission for return of arrhythmia	1 (0.1)
		Infection	1 (0.1)
		Transient ischaemic attack	1 (0.1)
	Standard EP	Conduction block	4 (0.4)
		Atrial arrhythmia requiring cardioversion	2 (0.2)
		Pericardial effusion with tamponade	2 (0.2)
		Vasovagal and chest pain	2 (0.2)
		Readmission for return of arrhythmia	1 (0.1)
		Sustained atrial fibrillation	1 (0.1)
EP study	Complex EP	Pericardial effusion with tamponade	1 (0.1)
	Standard EP	Pericardial effusion with tamponade	1 (0.1)
		Atrial arrhythmia requiring cardioversion	1 (0.1)
		Venous access complication	1 (4.3)
ALL			**23 (2.6)**

% as proportion of electrophysiology procedures

Case totals do not reflect all activity due to incomplete year of data acquisition

36 Conclusions

This first QCOR electrophysiology and pacing report details the mix of patients and clinical workloads encountered at seven of the eight public cardiac electrophysiology services. It demonstrates the first levels of analysis of robust Queensland Health data. With increasing sophistication and in unprecedented detail, future reports will be capable of informing processes of benchmarking, service review, audit and research.

Opportunities for improvement have been identified in some areas of data collection. One of these is the documentation of catheter ablation outcomes at intervals after the procedures, to evaluate the key metric of endurance of procedural success. This refinement could assist predictive and risk adjustment modelling for these procedures.

Subsequent QCOR electrophysiology and pacing reports, containing more comprehensive data from all sites, will highlight data regarding booking-to-procedure waiting times, for example as they apply to ablation procedures for atrial fibrillation. This should focus attention on longstanding deficiencies in workforce and laboratory access for cardiac ablation procedures in general. The current report details demographics and outcomes for patients who have undergone procedures, but makes no comment on the increasing and potentially unhealthy waiting times for cardiac ablation.

International clinical guidelines regarding management of heart rhythm disorders continue to evolve as rapidly as the evidence-based applications of new technologies in the most dynamic sub-specialty in cardiology. Future QCOR electrophysiology and pacing reports will frame data analysis around clinical indicators agreed by the Electrophysiology Working Group of the Statewide Cardiac Clinical Network, so as to assess the quality of care uniformly, meticulously, continuously and authoritatively for the first time on a Queensland Health statewide basis. Reporting on the QCOR platform should reinforce the continuing international standard of care for public patients with heart rhythm disorders.

37 Recommendations

With ongoing improvement and greater detail of electrophysiology and pacing data contained in QCOR, clinicians are now able to access quality reports and information. Collection and analysis of this information will continue to be moulded by the experience and requirements of clinicians as well as by changes in international guidelines and evidence-based practice.

The QCOR electrophysiology committee embraces these changes; the development of clinical indicators will build continuously on previously defined areas of interest. Through the work of the steering committee and associated departmental staff, contributions to and outputs from QCOR will continue to evolve and to play a pivotal role in guiding everyday practice and decision support for public patients with heart rhythm disorders.

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59 Glossary

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

60 Upcoming initiatives

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

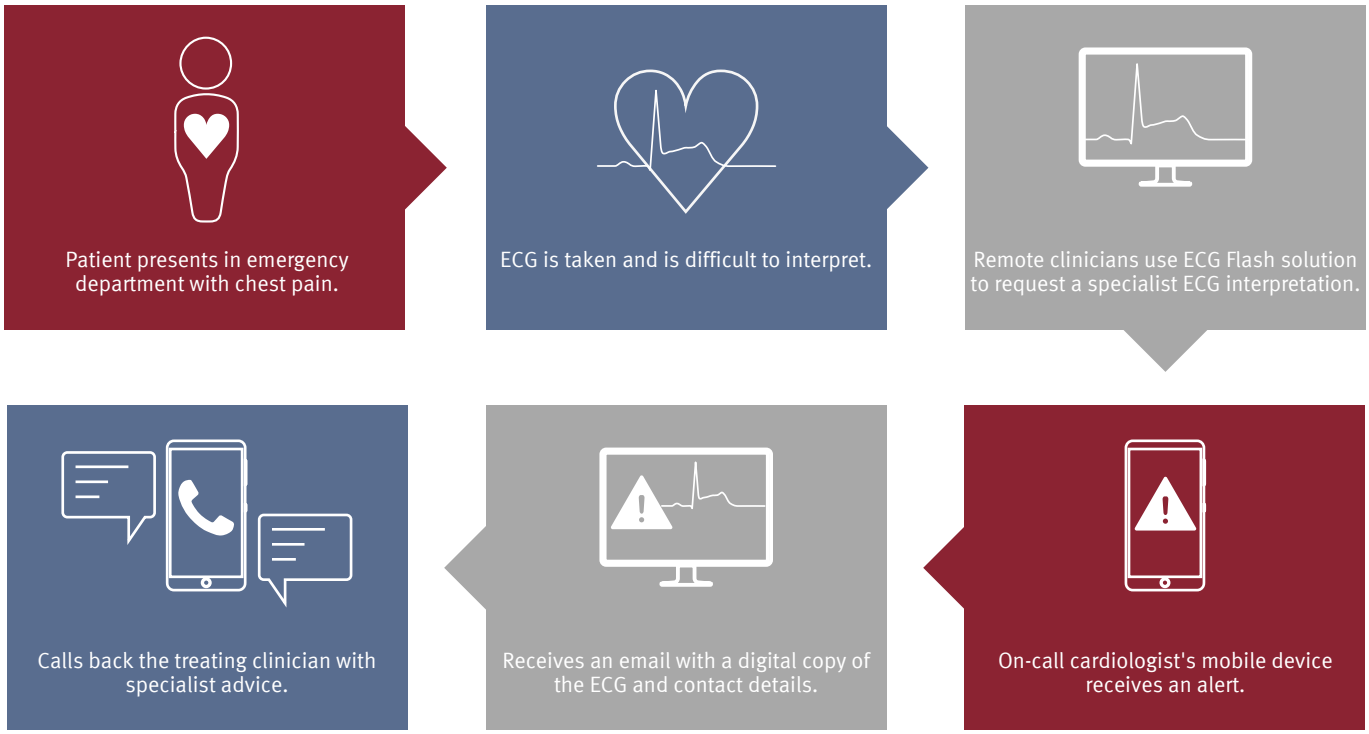

Figure C: Concept model for rapid inter-hospital clinical interpretation of 12-lead ECGs (CISP ECG Flash Project)