NATIONAL CARDIAC REGISTRY

ANNUAL STATUS REPORT 2024

NATIONAL CARDIAC REGISTRY

Data period: 1 January 2023 - 31 December 2023

Report No 4, pages 84

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National Cardiac Registry Annual Status Report 2024, December 2024
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NATIONAL CARDIAC REGISTRY

The National Cardiac Registry is supported by funding from the Commonwealth Department of Health and Aged Care as part of the National Clinical Quality Registry Program.

Australian Government
Department of Health and Aged Care

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Glossary

ACS	Acute coronary syndrome
ACTCOR	The Australian Capital Territory Cardiac Outcomes Registry
ACSQHC	Australian Commission on Safety and Quality in Health Care
AIHW	The Australian Institute of Health and Welfare
ANZSCTS	The Australian & New Zealand Society of Cardiac and Thoracic Surgeons
CABG	Coronary Artery Bypass Graft
CADOSA	The Coronary Angiogram Database of South Australia
CAD	Coronary Artery Disease
CIED	Cardiac Implantable Electronic Device
CQR	Clinical Quality Registry
CSANZ	The Cardiac Society of Australia and New Zealand
CVD	Cardiovascular Disease
DAPT	Dual Antiplatelet Therapy
ECG	Electrocardiogram
HREC	Human Research Ethics Committee
IQR	Interquartile range
LLT	Lipid Lowering Therapy
LVEF	Left Ventricular Ejection Fraction
MACCE	Major Adverse Cardiac and Cerebrovascular Events
MACE	Major Adverse Cardiac Events
NCR	National Cardiac Registry
NCR Ltd.	National Cardiac Registry Limited
NSTEMI	Non-ST Elevation Myocardial Infarction
NSWCOR	New South Wales Cardiac Outcomes Registry
NTTCD	Northern Territory Top End Coronary Database
OHCA	Out of Hospital Cardiac Arrest
PCI	Percutaneous Coronary Intervention
PHN	Pre-hospital notification
PVD	Peripheral Vascular Disease
QCOR	Queensland Cardiac Outcomes Registry
STEMI	ST-Elevation Myocardial Infarction
TVR	Target Vessel Revascularisation
VCOR	Victorian Cardiac Outcomes Registry

Message from the Chair of the Board

Dr Jim Leitch - Chair of the National Cardiac Registry Limited Board

It brings me great pleasure to introduce the 2024 Annual Report from the National Cardiac Registry (NCR) which includes 2023 data. The report details the results of more than 25,000 procedures in 55 hospitals across Australia and it is a testament to the hard work of all our stakeholders. I thank our dedicated Executive Officer, Megan Schoder and the team at Monash who have once again produced an outstanding summary of the NCR for 2023. I also thank the health workers and the State and Territory health departments who collect and collate the data and the team from the Clinical Quality Registry Program in the Australian Government Department of Health and Aged Care, who support and fund the NCR. Ultimately the Program serves the needs of our patients, and I thank each individual who has allowed their data to contribute to this report.

I am often asked how the NCR provides value to our patients. My own view is that the process of submitting your results and agreeing to be part of a national quality program in itself provides an assurance of achieving an acceptable standard of care. There are also a myriad of ways that clinical quality registries can improve outcomes other than by identification of statistical outliers on a funnel plot. These broader aims (like identifying low value care) can only be reliably achieved when all sites and clinicians embrace the NCR. Our challenge is then *'How can we bring on board those sites that currently elect not to participate?'*

From the organisations point of view, we must provide a product that is fit for purpose. That means utilisation of data linkage and integration with the Electronic Medical Record (EMR) thereby reducing human resource costs, the most important constraint to participation. Reporting needs to become more frequent and easier for clinicians and sites to access, proving better value to our stakeholders. We also need to work together with our partners and other registries to harmonise rather than duplicate our resources. This is a particular focus of the board in the coming year.

If we provide the right product (and I'm sure we can) then all that remains is for the hospitals and clinicians to embrace a culture that automatically includes an obligation to provide their results for national audit. This cultural shift is the key in my view to a successful registry and one that requires our cardiovascular community to work together. There are plenty of challenges ahead but the NCR has progressed year on year, and I am optimistic that the NCR will become the standard of care and an essential quality tool for our dedicated clinicians and hospitals.

Message from the Chair of the Steering Committee

A/Prof Jeff Lefkovits & Dr Rohan Poulter
- Chair and Deputy Chair

The National Cardiac Registry Steering Committee is pleased to report a year of meaningful progress and collaboration in advancing cardiac care. Throughout the year, we worked closely with hospitals, healthcare professionals, and stakeholders to expand the Registry's reach and improve data quality, building a robust resource for cardiovascular health insights.

Key achievements include increased hospital participation, enhanced data collection methods, and valuable findings on treatment outcomes that will support evidence-based practices and quality improvements in cardiac care. Our commitment to fostering partnerships, integrating innovative technologies, and advancing the Registry's impact remains strong. We look forward to furthering these efforts to ensure the highest standards of cardiovascular care for all Australians.

Message from the Heart Foundation

Mr David Lloyd - CEO, Heart Foundation

The Heart Foundation has passionately championed the fight against heart disease since 1959. Our vision to reach 2050 with better heart health a lived reality for all Australians, is bold; but our commitment to achieving this long-term goal through innovative research, comprehensive support, and targeted care initiatives is unwavering. It is an endeavour that welcomes allies like the National Cardiac Registry (NCR).

NCR data is gathered from a pool of 93,000 patients, capturing 50% of all Percutaneous Coronary Intervention (PCI) procedures performed nationally. This rich source of information includes a demographic breakdown that helps make targeted research and funding decisions more efficient.

The Heart Foundation is pleased to collaborate with the NCR to ensure that the information collected is fully utilised to help inform advocacy efforts for communities at greater risk of cardiovascular disease (CVD). We look forward to using the NCR's data to drive healthcare programs, targeted support for at-risk communities and broad advocacy initiatives. Such a collaboration will enable us to monitor progress, pinpoint areas needing improvement, and, ultimately, save countless lives.

The NCR 2024 Annual Status Report provides a dynamic view of cardiac healthcare across Australia, with support from a collegiate band of hospitals, and will only improve year on year. The future of Australia's heart health depends on it.

Heart Foundation

Message from the NCR Steering Committee Consumer Representative

Ms Karen Carey - NCR Steering Committee Consumer Representative

In 2024 Karen Carey joined the NCR Steering Committee as Consumer Representative.

Karen has an extensive lived experience of cardiac conditions having undergone 5 open-heart surgeries, including a heart transplant. Karen is one of Australia's leading consumer representatives having been past Chair of Consumers Health Forum and Health Consumers Counsel in WA. She is a former member of NHMRC and was the inaugural Chair of the NHMRC's Community and Consumer Advisory Group.

Karen is delighted to be appointed to the position and says:

Health consumers need PCIs to be high quality, safe, accessible, effective and cost effective. The capture and analysis of unbiased data relating to a large cohort of patients undergoing PCI provides a continuous quality loop that should reduce unwanted variation in clinical practice.

Although PCI in Australia is extremely safe, unwanted variation associated with poorer patient health outcomes means lives shortened or made more difficult. Our most powerful tool in reducing unwanted variation is data identified, collected and analysed to rapidly recognise clinical practice outliers or trends and minimise potential harm.

The NCR Fact Sheet targeted to consumers provides up to date information about the context, safety and complication rates of PCI so that patients can engage in genuinely informed shared decision-making.

In the future I look forward to participating in the Steering Group and working towards increasing the number of health services reporting data, refining the data set and expanding the reporting of findings.

Ms Karen Carey

Message from the School of Public Health and Preventive Medicine, Monash University

Professor Sophia Zoungas - Head of School, Public Health and Preventive Medicine

The School of Public Health and Preventive Medicine (SPHPM), Monash University is committed to our vision of Health and wellbeing for all people and communities. Through supporting and strengthening our health systems and informing and transforming policy and practice, we can help overcome the health challenges being faced across Australia and more broadly.

The School's clinical registries are a significant asset to the health sector, providing valuable insights into trends in healthcare interventions and outcomes, as well as being an increasingly important tool and infrastructure for high quality clinical research. Maximising the use of clinical registry data is critical to improve the safety and efficacy of clinical care and outcomes for individuals and the community.

The National Cardiac Registry (NCR) is an important part of the Registry Portfolio at Monash. The Portfolio consists of thirty seven clinical registries, and NCR operations are aptly based within a School which undertakes a broad range of clinical and health services research projects in cardiovascular and related diseases.

On behalf of Monash, I am delighted to be a part of the NCR and look forward to a continued partnership with NCR Ltd. and the Department of Health and Aged Care as we progress towards the next phase of the Registry.

I would like to thank the registry staff for their ongoing work to drive and garner new insights from NCR data.

I would also like to thank all the clinicians, multidisciplinary teams and consumers who contribute their time and information and recognise the importance of the NCR in improving cardiac care and outcomes.

Executive Summary

The National Cardiac Registry (NCR), currently in its fifth year of operation, has further established itself as a pivotal national cardiac clinical quality registry. Its current focus is monitoring and reporting on performance and outcomes in PCI. To date, there are over 90,000 case records in the register, with 55 hospitals in both the public and private sectors providing a full minimum dataset and a further 33 hospitals actively engaged but not yet contributing the full minimum dataset. Eleven PCI-specific quality indicators are measured at a hospital level, with performance and benchmarking assessed nationally.

Our ongoing activities have only been possible through the support of the Australian Government, which is committed to high-quality, patient-centred health care for optimal health outcomes. *The National Clinical Quality Registry and Virtual Registry Strategy* 2020-2030[1] provides the foundation for national registry design and operation. It is the result of a broad partnership of key stakeholders, including state and territory governments, the Australian Commission of for Safety and Quality in Healthcare and the Australian Institute of Health and Welfare (AIHW). While the NCR's key priorities are to optimise patient outcomes and promote equitable and appropriate high value care, it draws on the Australian Government's strategy to pursue quality, efficiency and cost effectiveness, and adoption of its data into Australian healthcare systems. NCR also has an eye to the future with its potential integration into hospital electronic medical record systems, automation of data extraction and data linkages so that data only need to be captured once but used multiple times.

This year's report follows the format of presenting nationally derived, patient-level data on the performance and outcomes of PCI from both the public and private sectors. These data allow state and territory jurisdictions to benchmark their outcomes against agreed performance indicators and is coupled with a feedback loop to empower jurisdictions to utilise the data for safety and quality improvement. The high acuity clinical presentation of ST elevation myocardial infarction (STEMI) and special sub-groups such as non-metropolitan hospitals, centres without on-site cardiac surgery facilities and low-volume institutions are examined in detail to identify and address unwanted variation in clinical care processes and outcomes.

Whether your interest stems from a patient, clinical, hospital, provider, government or other perspective, we hope you will find this year's report a useful tool to systematically drive delivery of patient-centred, high-quality and high value cardiac health care to all Australians.

1 Department of Health (2020) National Clinical Quality Registry and Virtual Registry Strategy, accessed 1 October 2024. https://www.health.gov.au/sites/default/files/2023-04/a-national-strategy-for-clinical-quality-registries-and-virtual-registries-2020-2030_0.pdf

1. Key Findings

50%

The NCR is currently capturing **50%** of all PCIs performed annually, across Australia[2]

25,223 procedures were performed on **22,665 patients**

74.4%

of cases were performed on males, whose **average age** was **65.7 years**

19.6%

of PCI procedures were performed **out-of-hours**

The **in-hospital major bleeding rate**, a potential complication, was 0.5% and was lower among radial access cases - 0.3%

PCI for **acute coronary syndromes** (ACS) accounted for **54.6% of the caseload**

Radial access is the predominant arterial approach for PCI, and is performed in **80.7% of procedures**. This rate has been increasing gradually since 2019

The **in-hospital mortality rate** was 1.8%

The overall rate of **referral to cardiac rehabilitation was 78.1%**.

This was lower amongst low volume centres - **74.3%**

30-day unplanned cardiac readmission rate was 3.2%

Major adverse cardiac event rate including; death, new myocardial infarction, stent thrombosis, unplanned revascularisation or stroke was highest among STEMI patients - 7.6% compared to the overall cohort at 2.6%

2 Australian Institute of Health and Welfare (2024) Heart, stroke and vascular disease: Australian facts, AIHW, accessed 1 August 2024.

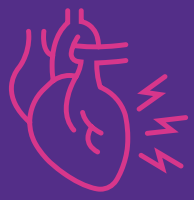
2. A National Approach

As a clinician led registry, the NCR is able to collect, collate and report nationally consistent outcome measures for Percutaneous Coronary Intervention (PCI). This reporting provides meaningful feedback to jurisdictions and offers the opportunity for collaboration and knowledge exchange amongst numerous cardiac registry experts across Australia.

In 2023, the NCR collected data from 50% of all PCIs completed across Australia[3]. The NCR will continue to work with jurisdictions, health services, public and private hospitals so that all eligible PCIs across Australia are captured. Through this report, and other reporting mechanisms, the NCR will continue to provide benchmarking at a national level, along with an opportunity to identify variation and promote best practice.

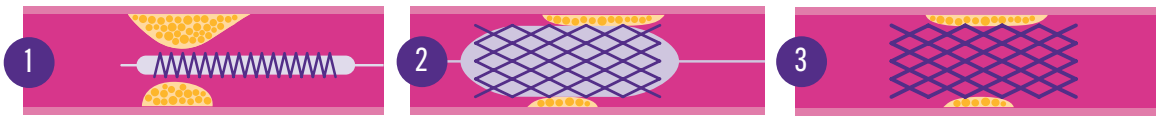
2.1 Percutaneous Coronary Intervention

PCI is a key treatment addressing the narrowing's in coronary arteries, usually due to thickening or hardening of the arteries caused by a build-up of plaque in the inner lining of an artery. PCI involves directly treating these narrowing's. These narrowing's obstruct blood flow to the heart muscle itself – triggering symptoms of angina, increasing the risk of heart attack and the development of heart muscle damage and heart failure.



Percutaneous coronany intervention (PCI)
is a non-surgical procedure to relieve the narrowing or blockage of the coronary arteries and improve blood supply to the heart

The most common method to repair the narrowing is to stretch the wall of the arteries with a small balloon or insert a metal coil called a stent to the narrowed area as shown in images 1-3



3. The Next Steps

In late 2024, NCR will introduce an option for hospitals that are not currently participating in a state-based registry to submit their data directly to the NCR data platform via a direct entry method. This will be particularly helpful for private hospitals, as a number of state and territory registries do not currently extend to the private sector. Looking to the future, NCR will continue to grow its hospital participation rate, aiming for complete national coverage by 2027. It plans to expand to other modules beyond PCI, foster links with other registries and promote an active research profile through the development of a registry research plan.

3 Australian Institute of Health and Welfare (2024) *Procedures and healthcare interventions (ACHI 12th edition), Australia, 2022-23* [data cubes], accessed 6 August 2024. https://www.aihw.gov.au/reports/hospitals/procedures-data-cubes/contents/summary

November
2016

Ischaemic Heart Disease named as the #1 priority area in The Australian Commission on Safety and Quality in Health Care's Prioritised list of clinical domains for clinical quality registry development final report.

March
2018

The department and existing State registries agree to form a clinician National Cardiac Registry

April
2019

NCR project team employed through Monash University

November
2019

Inaugural Steering Committee meeting held with clinical and jurisdictional representatives from all eight States & Territories

May
2020

NCR Ltd incorporated by the Australian Securities and Investments Commission

NCR Platform goes live

July
2021

May
2022

Launch of first public facing Annual Status Report

All eight jurisdictions contributing data elements into the NCR platform

July
2022

June
2023

Private hospitals commence participation

Reached over 70,000 cumulative PCI cases

Reached over 93,000 cumulative PCI cases

60 hospitals have contributed data

June
2024

4. Participating Hospitals 2019-2023

ACT

The Canberra Hospital

NSW

Concord Repatriation General Hospital

Gosford Hospital

Nepean Hospital

Orange Hospital

Wollongong Hospital

NT

Royal Darwin Hospital

QLD

Cairns Hospital

Gold Coast University Hospital

Ipswich Hospital

Mackay Base Hospital

Princess Alexandra Hospital

Royal Brisbane and Women's Hospital

Sunshine Coast University Hospital

The Prince Charles Hospital

Townsville University Hospital

SA

Ashford Hospital

Calvary Adelaide Hospital

Lyell McEwin Hospital

Royal Adelaide Hospital

The Queen Elizabeth Hospital

TAS

Hobart Private Hospital

Launceston General Hospital

Royal Hobart Hospital

VIC

Albury Hospital

Austin Hospital

Ballarat Hospital

Bendigo Health

Box Hill Hospital

Cabrini Health

Epworth Healthcare (Eastern)

Epworth Healthcare (Geelong)

Epworth Healthcare (Richmond)

Footscray Hospital

Frankston Hospital

Holmesglen Private Hospital

Jessie McPherson Private Hospital

Knox Private Hospital

Latrobe Regional Hospital

Melbourne Private Hospital

Mulgrave Private Hospital

Northern Hospital

Peninsula Private Hospital

The Alfred

The Royal Melbourne Hospital

St John of God Ballarat

St John of God Bendigo

St John of God Berwick

St John of God Geelong

St Vincent's Hospital Melbourne

St Vincent's Private Hospital Melbourne

St Vincent's Private Hospital Werribee

Sunshine Hospital

Victorian Heart Hospital

University Hospital Geelong

Warringal Private Hospital

Western Private Hospital

WA

Fiona Stanley Hospital

Royal Perth Hospital

Sir Charles Gairdner Hospital

5. Dynamic Reporting

The NCR has built a state-of-the-art digital reporting platform which hosts national level data from all States and Territories. Dynamic and interactive reports are produced within the platform based on the 11 Quality Indicators (QIs) providing valuable feedback and insights, Figure 3 (Page 23). Supplementary reports are provided to jurisdictions, giving each state and territory the ability to identify their own hospitals in the annual status report.

5.1 NCR Platform Design

The platform has been developed to support the specific needs and requirements of the NCR, including supporting anytime Comma Separated Value (CSV) data uploads and in-built reporting. These reports are customisable by a series of filters, and adaptable to allow for enhancements as the registry matures. The platform includes a range of features to ensure security and data safety as shown in Figure 1.

Significant improvements have been made to the platform within the last year. These include improvements to the platform's Power BI reporting, data import functionality, streamlined navigation and enhanced filtering options. These adjustments have resulted in significantly improved response times, the ability to produce national or jurisdiction reports at any time point and additional features to create an intuitive and informative experience for the end user.

Figure 1: The NCR Platform Key Attributes

Browser based	Dynamic reporting
User credentialing	Cloud hosting
Upload via CSV template	Multi-factor authentication
Anytime download of data	De-identified

5.2 REDCap Data Entry Tool

Over the last year, the NCR has built a bespoke REDCap data entry tool to facilitate the independent collection of information compliant with NCR's data dictionary for hospitals wishing to contribute data directly to the NCR.

The data entry tool is a secure, web-based application developed to collect and manage sensitive data effectively. In addition, it provides automated exports, downloads and reporting. REDCap at Monash University is hosted on infrastructure located in Australia and managed by Helix, Monash University.

The key features and benefits of this tool include web-based access, access for multi-site collaboration, a flexible design to ensure data consistency and accuracy at point of entry, data import functionality and custom data extracts[4].

4 Monash University (2024) Monash REDCap, accessed 18 October 2024. https://www.monash.edu/researchinfrastructure/helix/capabilities/redcap

5.3 Data Management and Security

The NCR works closely with each state and territory to ensure that data are provided in accordance with appropriate frameworks, timeframes and policies, in line with the NCR Data Management Plan and the National Statement on Ethical Conduct in Human Research[5]. The NCR Data Governance Framework outlines how data are managed and is based on the five safes framework[6]. All data in the NCR Platform and REDCap Data Entry Tool is securely hosted within Australia, and the NCR adopts multiple layers of security and rigorous testing to ensure appropriate levels of protection are in place. Figure 2 provides a comprehensive overview of the NCR Data Flow.

5.4 Ethics

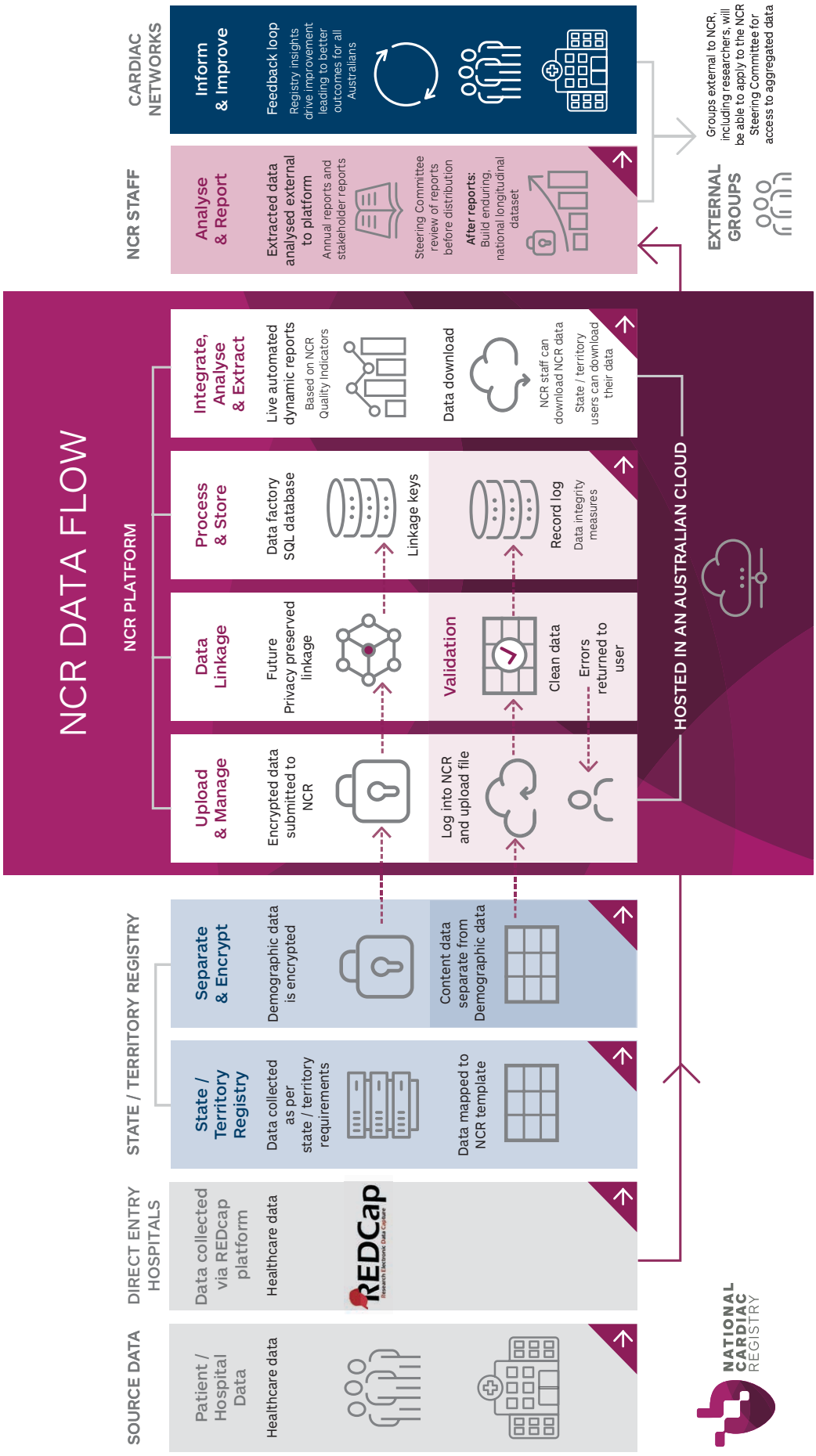
The NCR continues to maintain Human Research Ethics Committee (HREC) approval under the National Mutual Acceptance (NMA) scheme. A waiver of consent has been approved, with each state and territory registry operating under differing models of ethics and governance approvals based on their own structure and relevant legislation.

In 2024 the registry obtained HREC approval to accept data from eligible hospitals who are unable to participate via a state or territory based registry. An opt-off approach to consent has been approved for patients having a PCI at these hospitals. Local Governance (or equivalent) approvals will be obtained for new hospitals that contribute data directly to the NCR.

5 National Health and Medical Research Council (2023) National Statement on Ethical Conduct in Human Research 2023, accessed 18 October 2024. https://www.nhmrc.gov.au/about-us/publications/national-statement-ethical-conduct-human-research-2023

6 Australian Institute of Health and Welfare (2023) The Five Safes framework, accessed 18 October 2024. https://www.aihw.gov.au/about-our-data/data-governance/the-five-safes-framework

Figure 2: The NCR Data Flow



6. The role of Clinical Quality Registries

Clinical Quality Registries (CQRs), such as the NCR, aim to improve population health outcomes via monitoring the safety and quality of care in relation to high burden and high cost diseases and procedures. Ischaemic cardiac diseases continue to contribute to significant national mortality and morbidity, despite specific clinical guidelines and the availability of safe and effective treatments. It is essential therefore that the health system is able to continuously monitor quality of care in relation to high volume cardiac procedures, to maximise adherence to evidence-based medicine and strive for optimal clinical outcomes.

CQRs collect a standardised set of data at the point of clinical care, from both public and private hospitals across Australia. This includes patient demographic information, clinical assessment, treatment and outcome data following cardiac procedures. This data is then transferred to the central registry database, where it is reviewed, cleaned, extracted and analysed for the primary purpose of reporting to healthcare providers, and for secondary purposes including for research. Data within registries such as the NCR is also available in real-time for users to access and explore for additional quality or research purposes.

Registry data provides insights into the characteristics of the cohort associated with the particular disease or condition. This includes information regarding the most commonly affected age, gender, and co-morbidities, as well as how access to or timeliness of care may vary depending on location of residence of the population. CQRs also provide information regarding whether registry participants received appropriate and evidence-based care based on the clinical guidelines, as well as their discharge destination (e.g. whether they utilised cardiac rehabilitation) and their post-discharge clinical and wellbeing outcomes. These measures provide an overall assessment of the effectiveness of the system of care, and identification of issues in the system that may require attention.

As the NCR matures, it has the potential to increase the scope of cardiac conditions and procedures that are monitored in this way. Importantly, clinical registries can contribute to furthering knowledge of factors associated with variation in outcomes, whether related to patient or treatment factors. This information can be used to provide local data to support patient-clinician decision-making.

Increasingly, CQRs are being considered as critical infrastructure for a broad range of activities. Registry data can provide information to support growth and planning of clinical services at a jurisdictional or regional level. Registry data can also be used to evaluate the outcomes of specific interventions, whether they be new clinical interventions or models of care. Clinical researchers are also increasingly seeing the potential of clinical registries as infrastructure for clinical trials; these frequently compare the effectiveness of alternate existing interventions, to determine whether they have clinical or health economic advantages. Clinical registries, therefore, provide a valuable resource that has the potential to lead to significant ongoing improvements in clinical care and outcomes for Australians.

7. Measuring Quality and Performance

Quality indicators (QIs) are used to measure how effective procedures and treatments are at delivering good quality health care (Figure 3). The eleven NCR QIs reflect the care continuum for patients who undergo PCI. They include performance measures pertaining to guideline recommended care including referral to cardiac rehabilitation and outcome measures such as in-hospital stroke during or after a PCI.

Figure 3: The Registry Quality Indicators for PCI

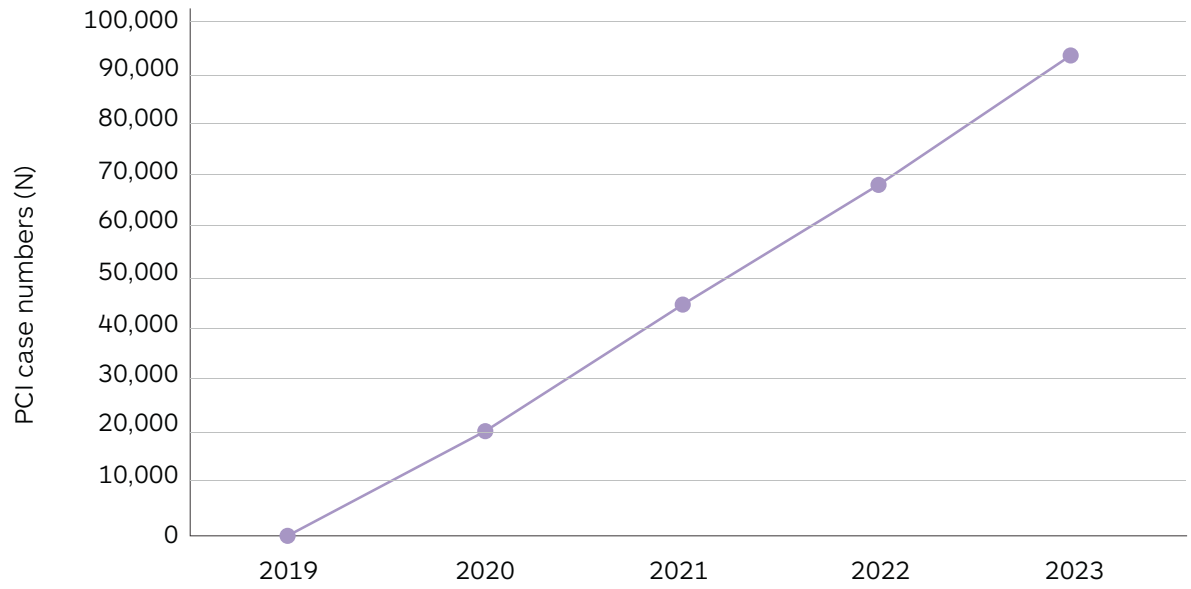
Indicator Type: Performance, Outcome

1. Time from diagnostic electrocardiogram to PCI mediated reperfusion
2. Time from door to PCI mediated reperfusion
3. In-hospital Stroke
4. In-hospital major bleeding
5. In-hospital mortality
6. 30-day unplanned cardiac readmission rate after PCI
7. Unplanned revascularisation within 30 days
8. 30-day mortality after PCI
9. Patients without contraindication discharged on lipid-lowering therapy
10. Patients referred to cardiac rehabilitation or other secondary prevention program
11. Proportion of patients, without a clear and documented contraindication for Aspirin and/or P2Y12 inhibitor, discharged on DAPT

8. Coverage

Between January to December 2023, the NCR collected data from 25,000 PCI procedures, equal to 50%[7] of PCI procedures conducted annually across Australia. Of the eligible 129 hospitals, this included data from 36 public and 19 private hospitals. The total number of procedures collected in the registry as at December 2023 now exceeds 93,500 (Figure 4).

Figure 4: Growth in PCI procedures captured by the Registry, January 2019 to December 2023



7 Australian Institute of Health and Welfare (2024) *Procedures and healthcare interventions (ACHI 12th edition), Australia, 2022-23* [data cubes], accessed 6 August 2024. https://www.aihw.gov.au/reports/hospitals/procedures-data-cubes/contents/summary

8.1 Data Completeness

This report includes analyses and reporting pertaining to all eleven indicators. Table 1 shows the number of state and territory registries that have contributed to each quality indicator, and how many hospitals make up the total figures.

Table 1: Registry Quality Indicators (QIs) and data completeness 2023*

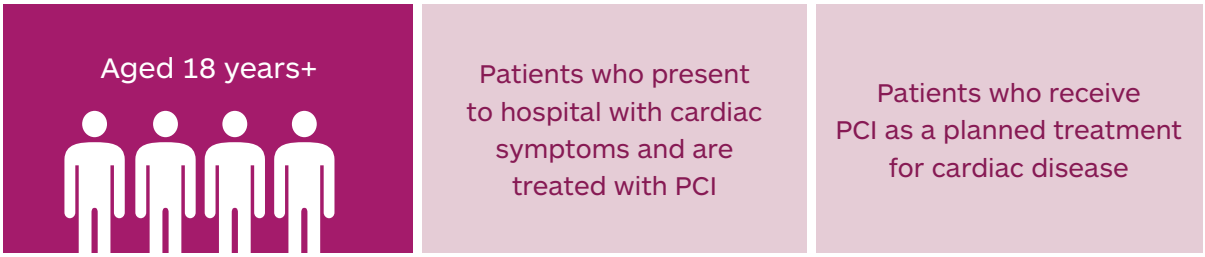
	Indicator Type	Quality Indicator	Data completeness (%)	Hospitals contributing to QI	State/ Territories included in 2023 QI reports
1	Performance	Time from diagnostic electrocardiogram to PCI mediated reperfusion	98	42*	6
2	Performance	Time from door to PCI mediated reperfusion	98	42*	6
3	Outcome	In-hospital stroke	96	53	6
4	Outcome	In-hospital major bleeding	91	50	5
5	Outcome	In-hospital mortality	96	53	6
6	Outcome	30-day unplanned cardiac readmission rate after PCI	69	38	4
7	Outcome	Unplanned revascularisation within 30 days	69	38	4
8	Outcome	30-day mortality after PCI	85	47	5
9	Performance	Patients without contra indication discharged on lipid-lowering therapy	80	44	5
10	Performance	Patients referred to cardiac rehabilitation or other secondary prevention program	96	53	6
11	Performance	Proportion of patients without a clear and documented contraindication for Aspirin and/or a P2Y12 inhibitor, discharged on DAPT	80	44	5

* 43 hospitals in this report undertake Primary PCI with 42 hospitals providing data for QIs 1 and 2.

As shown in Table 1, data completeness and the number of hospitals contributing data for QI's 6-11 (30 day outcomes) is less that hospitals contributing to In-hospital related QI's, as some of this data is not collected at the state and territory registry level.

Six of the eight state and territory registries submitted data between January 2023 - December 2023, however data from all eight state and territory registries have been included in the overall cohort and trend analysis (2019-2023).

Figure 5: Eligible participants



9. Clinical Findings

This report includes data on PCIs undertaken in public and private (N=55) hospitals across Australia for the calendar year 1 January to 31 December 2023. Overall, 25,223 PCI cases performed on 22,665 patients were submitted to the NCR. The majority of analyses for this report primarily represent N=53 hospitals (N=23,359 cases).

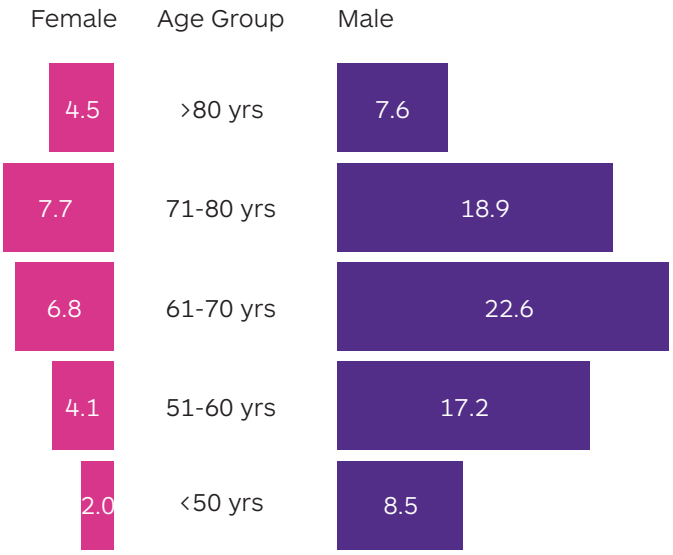
We include in this report outcomes and performance trends across a five year period, from 2019 - 2023. The overall cohort for these analyses includes over 93,000 cases.

9.1 Patient Characteristics and Clinical Features

Within the PCI patient cohort between 2020 - 2023, 12% of patients underwent multiple procedures. The majority of cases (77%) were performed in public hospitals. Men accounted for 75% of cases, and their median age was 66 years (IQR: 57, 74). Women were on average four years older than men: 70 years (IQR: 61, 78).

The peak frequency of PCI procedures occurred in the sixth decade for men and the seventh decade for women (Figure 6A).

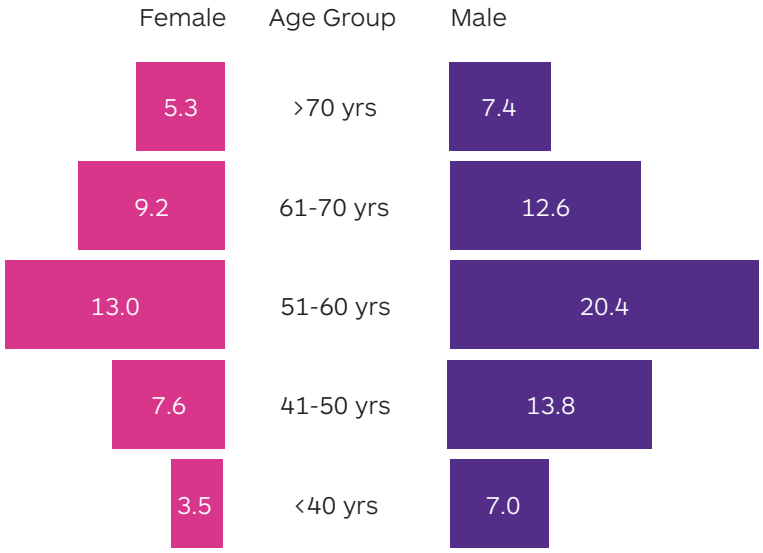
Figure 6A: Distribution of PCI patients by age group and sex 2020-2023



Within the PCI patient cohort between 2020 - 2023, 2.6% of all PCI patients identified as Aboriginal and/or Torres Strait Islander (N=2,463). Men accounted for 61% of cases, and the median age difference between men and women was two years (men: 55 years (IQR: 48,63) and women: 57 years (IQR: 48, 65). The peak frequency of PCI procedures within this cohort occurred in the fifth decade for both women and men (Figure 6B).

Women who identified as Aboriginal and/or Torres Strait Islander had higher rate of diabetes (59% vs 41%), but lower rates of previous PCI (26% vs 31%) and previous CABG (6.9% vs 7.9%) when compared to men in the same cohort.

Figure 6B: Aboriginal and/or Torres Strait Islander status distribution of PCI by age group and sex, 2020-2023



Selected patient demographic information presented by clinical presentation are shown in Table 2A. The cohort is divided into those patients with ST-elevation myocardial infarction (STEMI), non-ST-elevation acute coronary syndromes (NSTEACS) and non-acute coronary syndromes (non-ACS).

Table 2A: Patient characteristics by clinical presentation 2023

Patient characteristics	STEMI (N=5,825)	NSTEACS (N=6,930)	Non-ACS (N=10,604)	All (N=23,359)
Age - years (mean +/- SD)	63.8 +/- 12.7	65.8 +/- 12.5	68.5 +/- 10.9	66.5 +/- 12.0
Women (%)	23.9	28.2	24.9	25.6
Men (%)	76.1	71.8	75.1	74.4
Diabetes (%)	21.8	28.3	29.1	27.0
Peripheral vascular disease (%)	2.3	4.8	4.2	3.9
Severe obesity (BMI≥35kg/m^2) (%)	12.1	14.4	13.1	13.3
Previous PCI (%)	12.2	23.7	40.8	28.6
Previous CABG (%)	2.3	7.5	7.2	6.0
Moderate or severe LV dysfunction (LVEF<45%) (%)	32.5	15.5	14.8	20.4
Cardiogenic shock (%)	6.5	0.9	0.6	2.2
Out-of-hospital cardiac arrest (%)	7.0	0.6	0.7	2.2
Estimated glomerular filtration rate ≤30mls/min (%)	3.3	4.2	2.8	3.4

Patients presenting with STEMI differed from the remainder of the PCI cohort in that they were younger, and had fewer traditional cardiac risk factors such as diabetes, PVD and severe obesity. STEMI patients also had lower rates of previous revascularisation procedures (previous coronary artery bypass grafting (CABG) and/or PCI). Consistent with the acuity of STEMI patients, the rate of moderate to severe left ventricular impairment was more than double that of the rest of the cohort (32% vs 15%). In keeping with the severity of STEMI, the rates of cardiogenic shock and out-of-hospital cardiac arrest (OHCA) were significantly greater than the rest of the cohort as shown in Figure 9 (page 31).

Patient demographic data by hospital characteristics (PCI volume, cardiac surgery capability, hospital location - metro/ non-metro and patient sex) are presented in Tables 2B to 2E.

Patients treated in low volume hospitals were older and had higher rates of previous PCI and CABG compared to medium and high-volume hospitals. Additionally, as might be expected, low volume hospitals treated fewer patients with moderately or severely reduced LVEF and cardiogenic shock (Table 2B).

Table 2B: Patient characteristics by hospital volume 2023

Patient characteristics	Low volume<250	Medium volume 250-500	High volume >500	All
	(N=4,026)	(N=7,564)	(N=11,769)	(N=23,359)
Age - years (mean +/- SD)	67.1 +/- 12.0	66.2 +/- 11.9	66.5 +/- 12.1	66.5 +/- 12.0
Women (%)	25.9	25.0	25.9	25.6
Men (%)	74.1	75.0	74.1	74.4
Diabetes (%)	27.4	25.2	28.1	27.0
Peripheral vascular disease (%)	4.8	3.1	4.1	3.9
Severe obesity (BMI≥35kg/m^2) (%)	13.3	13.6	13.0	13.3
Previous PCI (%)	29.8	28.1	28.5	28.6
Previous CABG (%)	7.0	5.7	5.9	6.0
Moderate or severe LV dysfunction (LVEF<45%) (%)	17.5	19.8	21.9	20.4
Cardiogenic shock (%)	1.5	2.3	2.3	2.2
Out-of-hospital cardiac arrest (%)	2.2	2.2	2.3	2.2
Estimated glomerular filtration rate ≤30mls/min (%)	3.8	3.4	3.2	3.4

Patients treated in hospitals with on-site cardiac surgery facilities were older and had higher rates of PVD, previous PCI and CABG. Conversely, they had lower rates of severe obesity and moderately or severely reduced LVEF (Table 2C).

Table 2C: Patient characteristics by on-site CABG vs off-site CABG hospitals 2023

Patient characteristics	On-site CABG	Off-site CABG	All
	(N=12,472)	(N=10,887)	(N=23,359)
Age - years (mean +/- SD)	67.1 +/- 11.9	65.9 +/- 12.1	66.5 +/- 12.0
Women (%)	25.1	26.2	25.6
Men (%)	74.9	73.8	74.4
Diabetes (%)	27.2	26.9	27.0
Peripheral vascular disease (%)	4.1	3.8	3.9
Severe obesity (BMI≥35kg/m^2) (%)	12.5	14.1	13.3
Previous PCI (%)	29.4	27.7	28.6
Previous CABG (%)	6.6	5.4	6.0
Moderate or severe LV dysfunction (LVEF<45%) (%)	19.8	21.1	20.4
Cardiogenic shock (%)	2.0	2.4	2.2
Out-of-hospital cardiac arrest (%)	2.1	2.4	2.2
Estimated glomerular filtration rate ≤30mls/min (%)	3.4	3.3	3.4

Patient characteristics by the location of treatment is presented in Table 2D. Metropolitan hospitals (n=40) are those located in an Australian capital city. Those treated in non-metropolitan hospitals (n=13) were younger, had fewer previous PCIs and a higher rate of moderately or severely reduced LVEF and were more often severely obese.

Table 2D: Patient characteristics by metro vs non-metro hospitals 2023

Patient characteristics	Metro	Non-metro	All
	(N=19,182)	(N=4,177)	(N=23,359)
Age - years (mean +/- SD)	66.7 +/- 12.0	65.6 +/- 12.0	66.5 +/- 12.0
Women (%)	25.3	26.9	25.6
Men (%)	74.7	73.1	74.4
Diabetes (%)	27.2	26.6	27.0
Peripheral vascular disease (%)	3.9	4.1	3.9
Severe obesity (BMI≥35kg/m²) (%)	12.9	14.8	13.3
Previous PCI (%)	29.4	24.7	28.6
Previous CABG (%)	6.1	5.7	6.0
Moderate or severe LV dysfunction (LVEF<45%) (%)	19.8	22.8	20.4
Cardiogenic shock (%)	2.1	2.6	2.2
Out-of-hospital cardiac arrest (%)	2.2	2.6	2.2
Estimated glomerular filtration rate ≤30mls/min (%)	3.4	3.0	3.4

Patient characteristics divided by sex are presented in table 2E. As in previous reporting, women were on average three years older than men. Women had more comorbidities including diabetes, peripheral vascular disease and higher rates of severe obesity. Conversely, men had more previous revascularisation procedures, worse LVEF dysfunction and worse renal function.

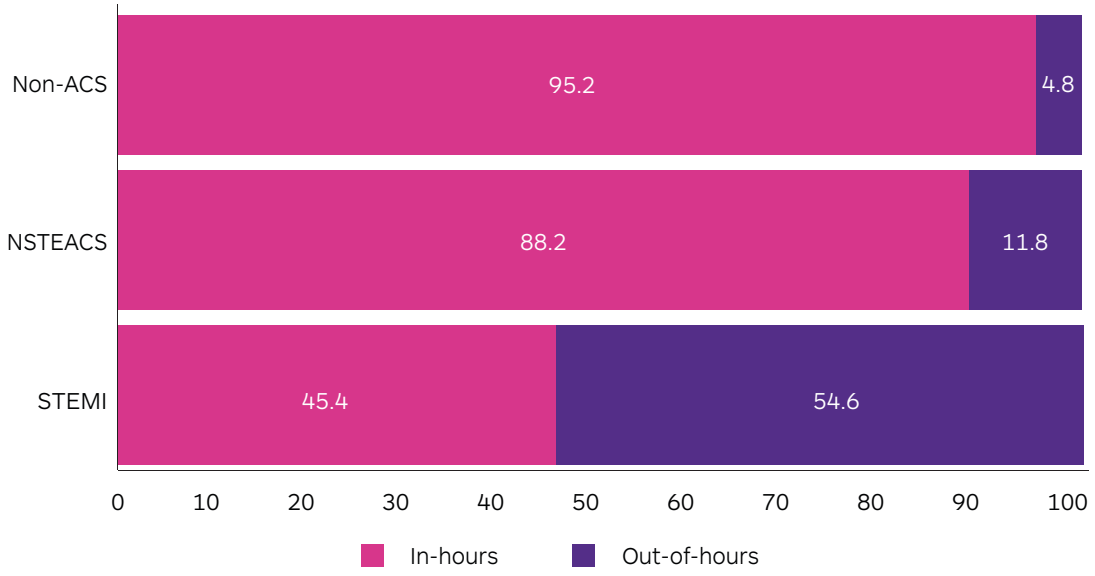
Table 2E: Patient characteristics by sex 2023

Patient characteristics	Male	Female	All
	(N=17,377)	(N=5,982)	(N=23,359)
Age - years (mean +/- SD)	65.7 +/- 11.9	68.9 +/- 12.0	66.5 +/- 12.0
Diabetes (%)	26.2	29.6	27.0
Peripheral vascular disease (%)	3.8	4.3	3.9
Previous PCI (%)	30.2	24.0	28.6
Previous CABG (%)	6.7	4.1	6.0
Severe obesity (BMI≥35kg/m²) (%)	11.7	17.7	13.3
Moderate or severe LV dysfunction (LVEF<45%) (%)	21.0	18.5	20.4
Cardiogenic shock (%)	2.1	2.2	2.2
Out-of-hospital cardiac arrest (%)	2.5	1.5	2.2
Estimated glomerular filtration rate ≤30mls/min (%)	2.7	5.2	3.4

9.2 Clinical Presentation and Access

Consistent with previous reporting, 19.3% (N=4,502) of all procedures (N=23,359) were performed out-of-hours. 54.6% of STEMI cases were performed out-of-hours. As expected, the majority of elective cases (Non-ACS) were performed in-hours (Figure 7).

Figure 7: Proportion of cases in-hours and out-of-hours by clinical presentation 2023*

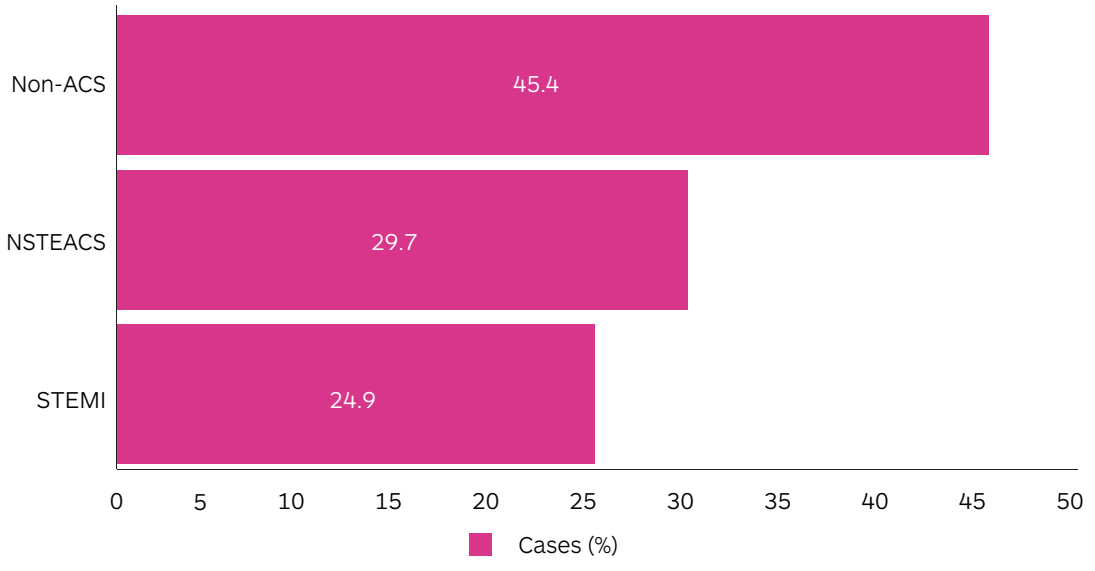


* In-hours: 8:00am - 6:00pm (Mon - Fri). Out-of-hours: 6:00pm - 8:00am (Mon - Fri, national public holidays and weekends)

The proportion of PCI undertaken for ACS and non-ACS indications was similar to the previous year, with ACS cases representing over half of the overall cohort (Figure 8). The majority of public hospital activity was ACS-related (64%) compared to the private sector where ACS accounted for 22% of procedures.

Over two thirds (67%) of ACS case workload was performed in high volume (>500 cases per year) hospitals, with just 5% undertaken in low volume (<250 cases per year) hospitals. Some hospitals did not treat any ACS cases with the overall range being 0 - 81%.

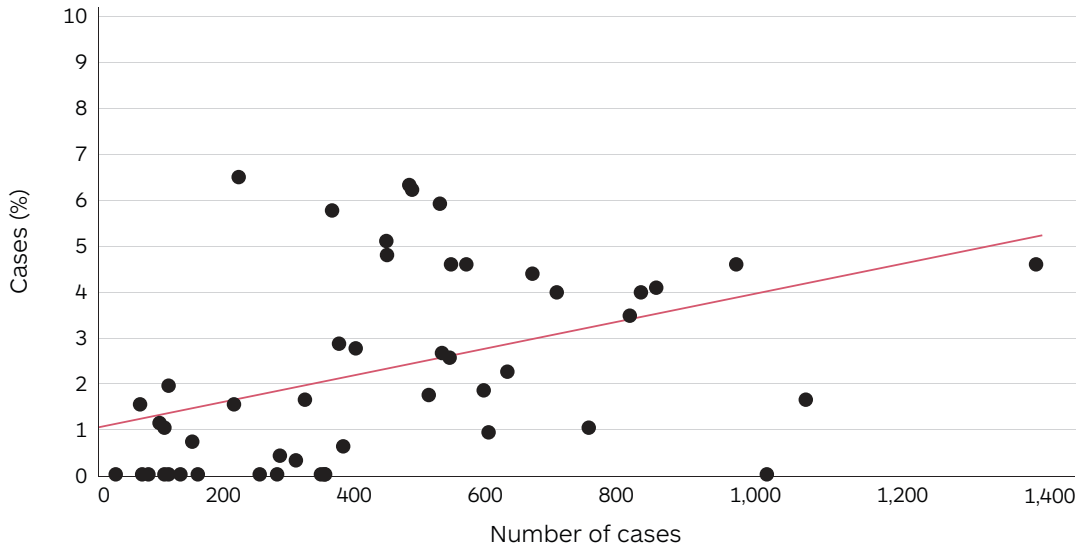
Figure 8: PCI cases by clinical presentation 2023



9.3 Clinical Presentation with Cardiogenic Shock and/or Intubated OHCA

Patients undergoing PCI who present with shock and/or intubated OHCA are an extremely high acuity cohort, with a higher risk of peri and post procedural mortality and morbidity. The proportion of shock and/or intubated OHCA patients undergoing PCI by hospital volume is presented in Figure 9. Overall, the rate of patients with these conditions accounted for 2.8% of hospitals' caseload (range 0-6.5%) with the majority of cases (96%) managed in public hospitals. Overall, PCI for shock and/or intubated OHCA represented 3.6% of public hospital workload compared to 0.4% in the private sector.

Figure 9: Shock and/or intubated OHCA cases by hospital volume 2023*

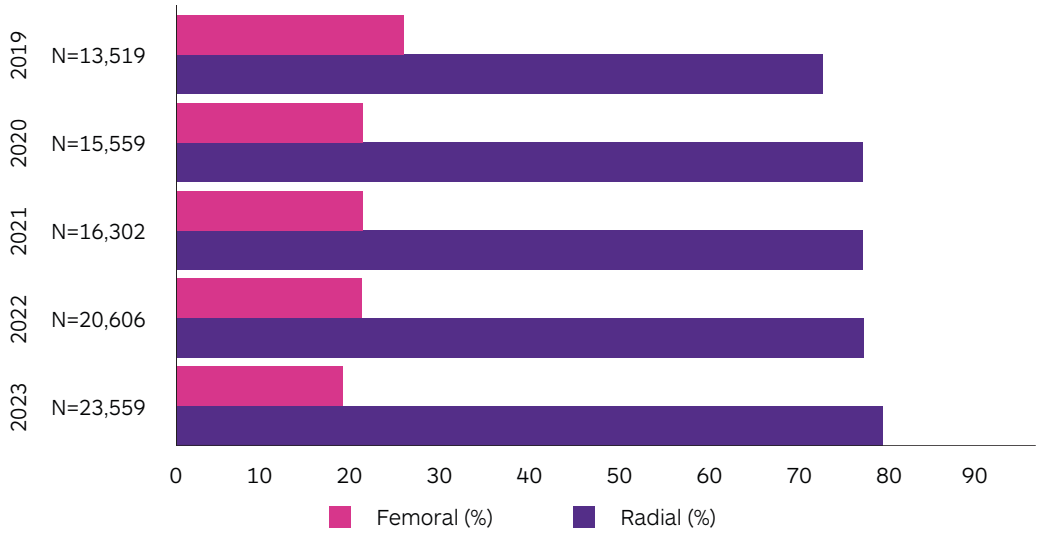


* 4 Hospitals excluded due to missing intubation data.

9.4 Access Site

In keeping with guideline recommendations, the radial artery is the predominant arterial access route[8]. The overall rate of radial artery use for vascular access in patients undergoing PCI in 2023 was 80.8% (an increase from 78.5% in 2022). Figure 10 presents arterial access rates over the last five years.

Figure 10: Arterial access route 2019-2023



8 Chew DP, Scott IA, Cullen L, French JK, Briffa TG, Tideman PA, Woodruffe S, Kerr A, Branagan M and Aylward PE (2016) 'National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand: Australian clinical guidelines for the management of acute coronary syndromes 2016', The Medical Journal of Australia, 205(3):128-33, doi: 10.5694/mja16.00368.

The rate of radial access across hospitals ranged from 55% to 96.3% (Figure 11). Radial access in men was 82.2% compared to 76.8% in women. Overall the radial access rates for all patients increased compared to the previous report. Radial access was utilised in 84.4% of PCI for STEMI, 82.5% of PCI for NSTEACS and 77.5% of PCI for non-ACS. The rate of femoral artery access has declined further in 2023 by 2.2%.

Figure 11: Arterial access route by hospital 2023

9.5 Procedural Access

In 2023, the overall procedural success rate, defined as successful treatment of all lesions and no major adverse cardiac events (MACE), was 92.8%. Across hospitals, the range was 86.4% to 98.1%. Information related to procedural success across a range of patient and procedural factors are presented in Tables 3A to 3E. The overall rate of PCI for in-stent restenosis was 5.0%, but differed when divided by hospital volume, onsite CABG capability and hospital location (metro and non-metro), see Tables 3A-3E.

The procedural success rate was lower in patients undergoing PCI for STEMI. As expected, STEMI patients required the highest use of mechanical ventricular support devices (Table 3A). Procedural success rates have remained consistent over the past three years.

Table 3A: Procedural data by clinical presentation 2023

Procedural data	STEMI	NSTEACS	Non-ACS	All
	(N=5,825)	(N=6,930)	(N=10,604)	(N=23,359)
Radial access (%)	84.4	82.5	77.5	80.7
Femoral access (%)	15.4	17.3	22.1	19.0
Drug-eluting stent(s) (%)	91.5	92.0	92.1	91.9
In-stent restenosis (%)	3.3	5.8	5.4	5.0
Mechanical ventricular support required (%)	2.1	0.5	0.4	0.9
Lesion success (%)	95.3	95.7	95.4	95.4
Procedural success (%)	89.0	94.2	94.0	92.8

Low volume hospitals had the highest use of mechanical ventricular support devices. The treatment of in-stent restenosis lesions did not vary greatly by hospital volume (Table 3B).

Table 3B: Procedural data by hospital volume 2023

Procedural data	Low volume <250	Medium volume 2 50-500	High volume >500	All
	(N=4,026)	(N=7,564)	(N=11,769)	(N=23,359)
Radial access (%)	83.7	79.1	80.8	80.7
Femoral access (%)	15.8	20.7	19.0	19.0
Drug-eluting stent(s) (%)	92.4	92.1	91.6	91.9
In-stent restenosis (%)	4.9	4.7	5.2	5.0
Mechanical ventricular support required (%)	1.1	0.6	0.9	0.9
Lesion success (%)	94.7	95.3	95.8	95.4
Procedural success (%)	92.7	92.5	93.0	92.8

Hospitals without CABG capability treated less in-stent restenosis cases and had a slightly lower procedural success rate (Table 3C).

Table 3C: Procedural data by on-site CABG vs off-site CABG hospitals 2023

Procedural data	On-site CABG (N=12,472)	Off-site CABG (N=10,887)	All (N=23,359)
Radial access (%)	75.9	86.2	80.7
Femoral access (%)	23.7	13.5	19.0
Drug-eluting stent(s) (%)	91.8	92.0	91.9
In-stent restenosis (%)	5.4	4.5	5.0
Mechanical ventricular support required (%)	0.9	0.8	0.9
Lesion success (%)	96.1	94.7	95.4
Procedural success (%)	93.7	91.7	92.8

The treatment of in-stent restenosis was lower in patients treated at non-metropolitan hospitals (Table 3D).

Table 3D: Procedural data by metro vs non-metro hospitals 2023

Procedural data	Metro (N=19,182)	Non-metro (N=4,177)	All (N=23,359)
Radial access (%)	80.3	82.9	80.7
Femoral access (%)	19.4	16.9	19.0
Drug-eluting stent(s) (%)	92.0	91.5	91.9
In-stent restenosis (%)	5.1	4.4	5.0
Mechanical ventricular support required (%)	0.9	0.6	0.9
Lesion success (%)	95.2	96.5	95.4
Procedural success (%)	92.6	93.8	92.8

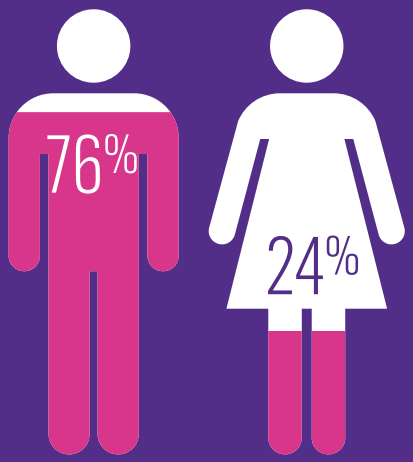
Procedural data by sex are presented in Table 3E. The overall lesion and procedural success rates were similar.

Table 3E: Procedural data by sex 2023

Procedural data	Male (N=17,377)	Female (N=5,982)	All (N=23,359)
Radial access (%)	82.3	76.3	80.7
Femoral access (%)	17.5	23.3	19.0
Drug-eluting stent(s) (%)	91.6	92.7	91.9
In-stent restenosis (%)	5.1	4.5	5.0
Mechanical ventricular support required (%)	0.9	0.8	0.9
Lesion success (%)	95.4	95.6	95.4
Procedural success (%)	92.9	92.4	92.8
Left main lesion (%)	1.6	1.1	1.5

10. STEMI Key Findings

The **STEMI cohort was younger** than the overall PCI cohort by an **average of 3 years** (64 years vs 67 years)



Males accounted for 76% of the STEMI cohort

In **79.6%** of STEMI cases, a door to PCI mediated reperfusion time of **≤90 minutes was achieved**

EMERGENCY

A median door to PCI mediated reperfusion time of **46 minutes** was achieved, when the ambulance service notified the hospital of the imminent arrival of an acute STEMI patient

The median door to PCI mediated reperfusion time for STEMI was **56 minutes**

Prehospital notification utilisation increased to **72.1%**

11. Percutaneous Coronary Intervention for Acute STEMI

In 2023, a total of 3,913 patients underwent a PCI for ST-elevation myocardial infarction (STEMI). Of these, 3,258 (83.3%) were primary PCIs - a PCI performed as a primary reperfusion therapy within 12 hours of symptom onset of STEMI. PCI for STEMI accounted for 16.8% of the overall PCI cohort and these cases were performed across 42 hospitals contributing to the NCR.

The majority of PCI for STEMI cases (95.3%) were performed in the public sector. Low volume centres and private hospitals undertook low numbers of these cases. Women accounted for 23.4% of PCI for STEMI cases. High volume hospitals performed the majority of these PCI cases (69.1%), and the majority (80.1%) were undertaken in metropolitan hospitals as outlined in Table 4.

Table 4: PCI for STEMI by hospital characteristics 2023*

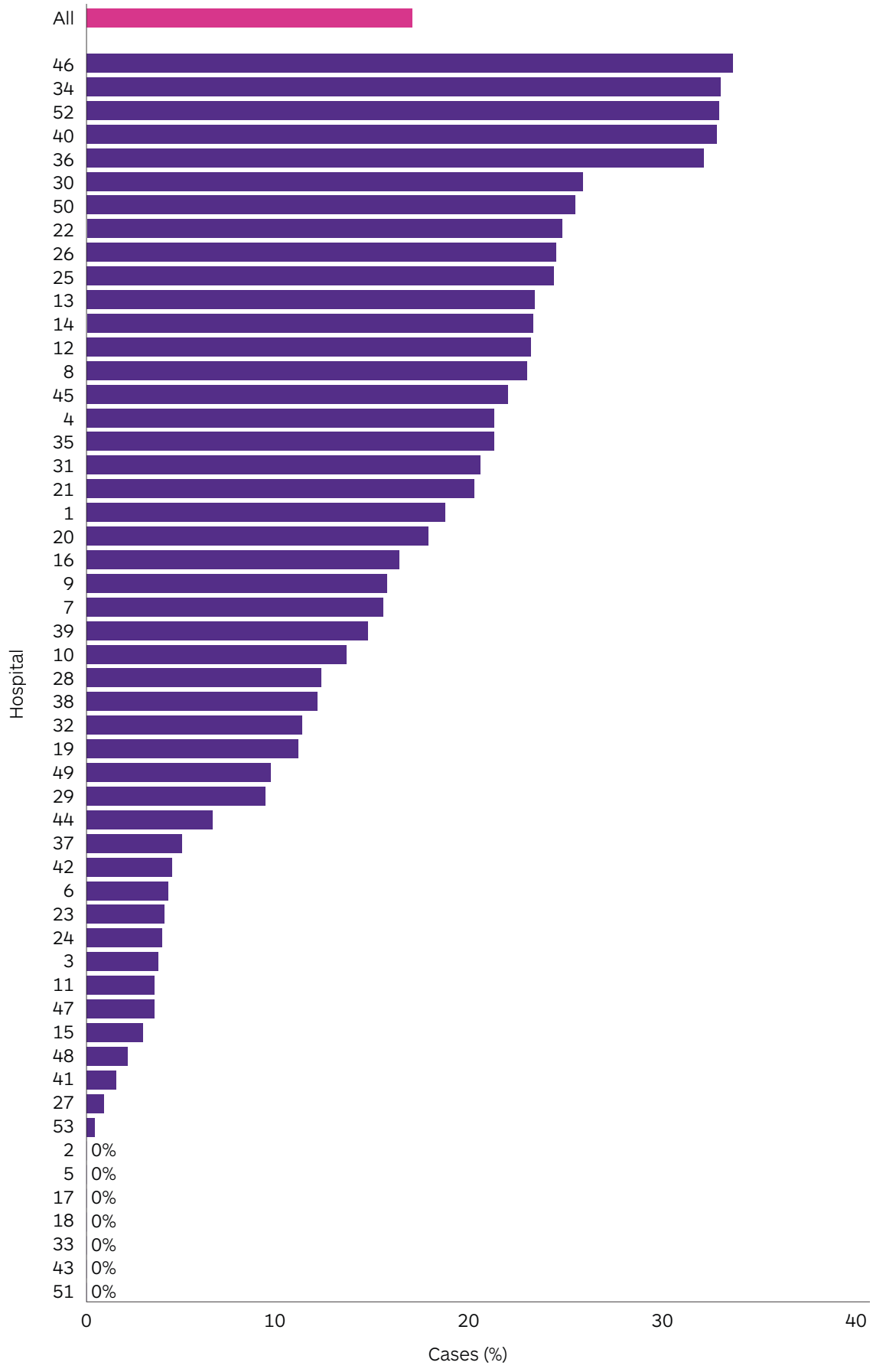
	Primary PCI rate
Hospital types	**N (%)**
Low volume <250	112 (2.9)
Medium volume 250-500	1,095 (28.0)
High volume >500	2,706 (69.1)
On-site CABG	1,878(48.0)
Off-site CABG	2,035 (52.0)
Metro	3,134 (80.1)
Non-metro	779 (19.9)
Public	3,728 (95.3)
Private	185 (4.7)
All	**3,913 (100)**

* Note: PCI for STEMI (n=3,913) includes STEMI patients presenting within 12 hours of symptom onset and includes inter-hospital transfers and patients with STEMI onset whilst a current in-patient.

Primary PCI is defined as a PCI performed within 12 hours of symptom onset of STEMI in patients presenting acutely to a health service or via ambulance.

Primary PCI for STEMI by hospital is shown in Figure 12. Excluding hospitals who did not do any primary PCIs, the range by hospital was 0.4% to 75%, with 61.6% of primary PCI cases being performed out-of-hours.

Figure 12: Primary PCI cases as a proportion of overall case numbers by hospital 2023*

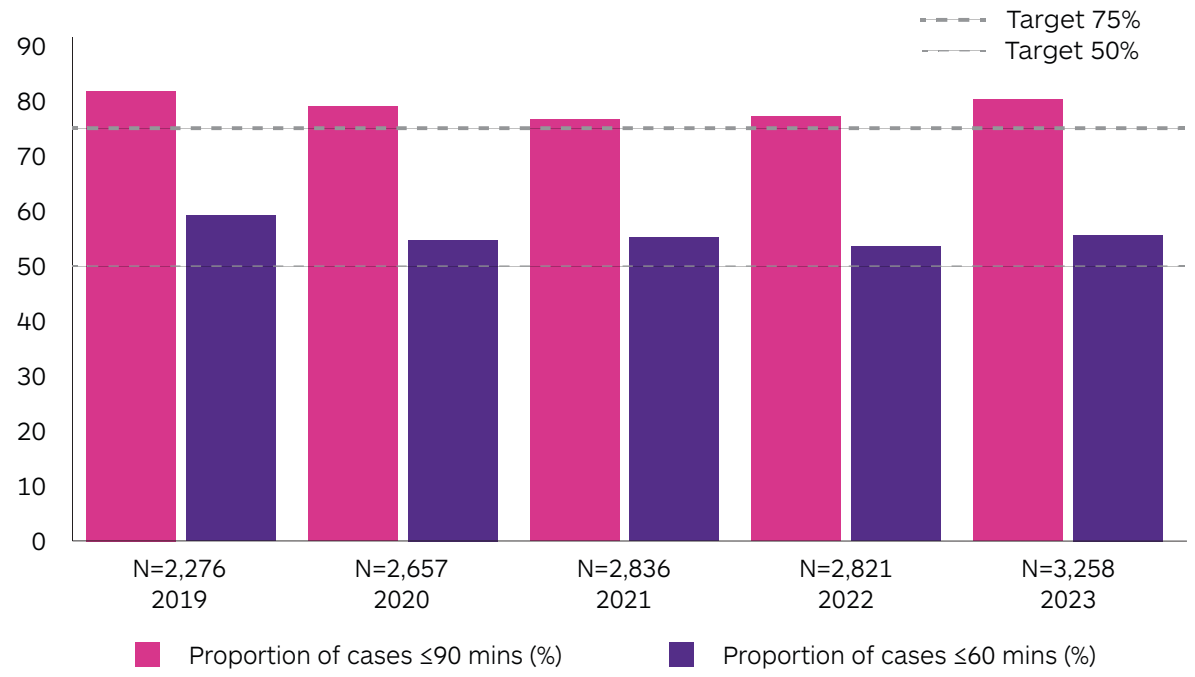


* Hospitals 2, 5, 17, 18, 33, 43, 51 had no Primary PCI cases.

11.1 Reperfusion Times In Primary PCI

The door to PCI-mediated reperfusion time is an important metric to enable assessment of the timely management of STEMI by the healthcare system. This metric encompasses the door time (defined as the time a patient arrives at a hospital) until coronary reperfusion (balloon time). Historically the time to coronary reperfusion has been defined as ≤90 minutes, however, updated guidelines now recommend the time to coronary reperfusion as ≤60 minutes[9].

Figure 13: Time from door to PCI mediated reperfusion for primary PCI cases 2019-2023



Trends in the door to Primary PCI-mediated reperfusion time over five years (2019-2023), divided by the proportion of cases treated ≤90 minutes and ≤60 minutes are presented in Figure 13. The percentage of cases treated in ≤90 minutes and ≤60 minutes has increased over the past two years.

QI 2. Time from door to PCI mediated reperfusion

9 Chew et al. National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand: Australian clinical guidelines for the management of acute coronary syndromes 2016. Med J Aust, 2016.

The overall median door to PCI mediated reperfusion time in patients undergoing primary PCI in 2023 was 56 minutes (Table 5A). The proportion of primary PCI patients treated in ≤90 minutes was 79.6%, with a subset of these (55.2%) being treated in ≤60 minutes.

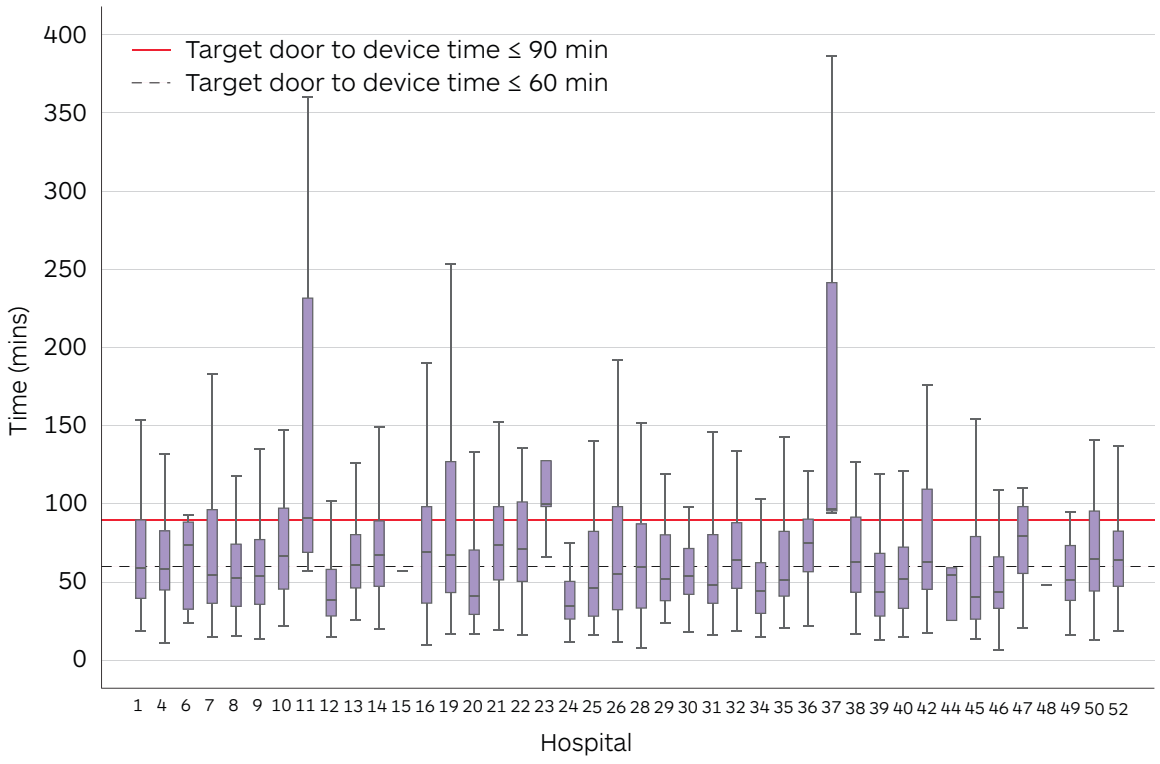
Table 5A: Time from door to PCI mediated reperfusion for primary PCI cases 2023*

Door to PCI mediated reperfusion time	All Primary PCI cases (N=3,258)
Median - mins (IQR)	56 (37, 83)
Proportion of cases ≤90mins (%)	79.6
Proportion of cases ≤60mins (%)	55.2

* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

The door to PCI-mediated reperfusion time by hospital is shown in Figure 14. The majority of hospitals (39/42) achieved a median door to PCI-mediated reperfusion time ≤90 minutes. When the ≤60 minutes median time was applied this dropped to almost two thirds of hospitals (24/42). Several hospitals treated a low volume of primary PCI (n<5).

Figure 14: Time from door to PCI mediated reperfusion for primary PCI by hospital 2023*

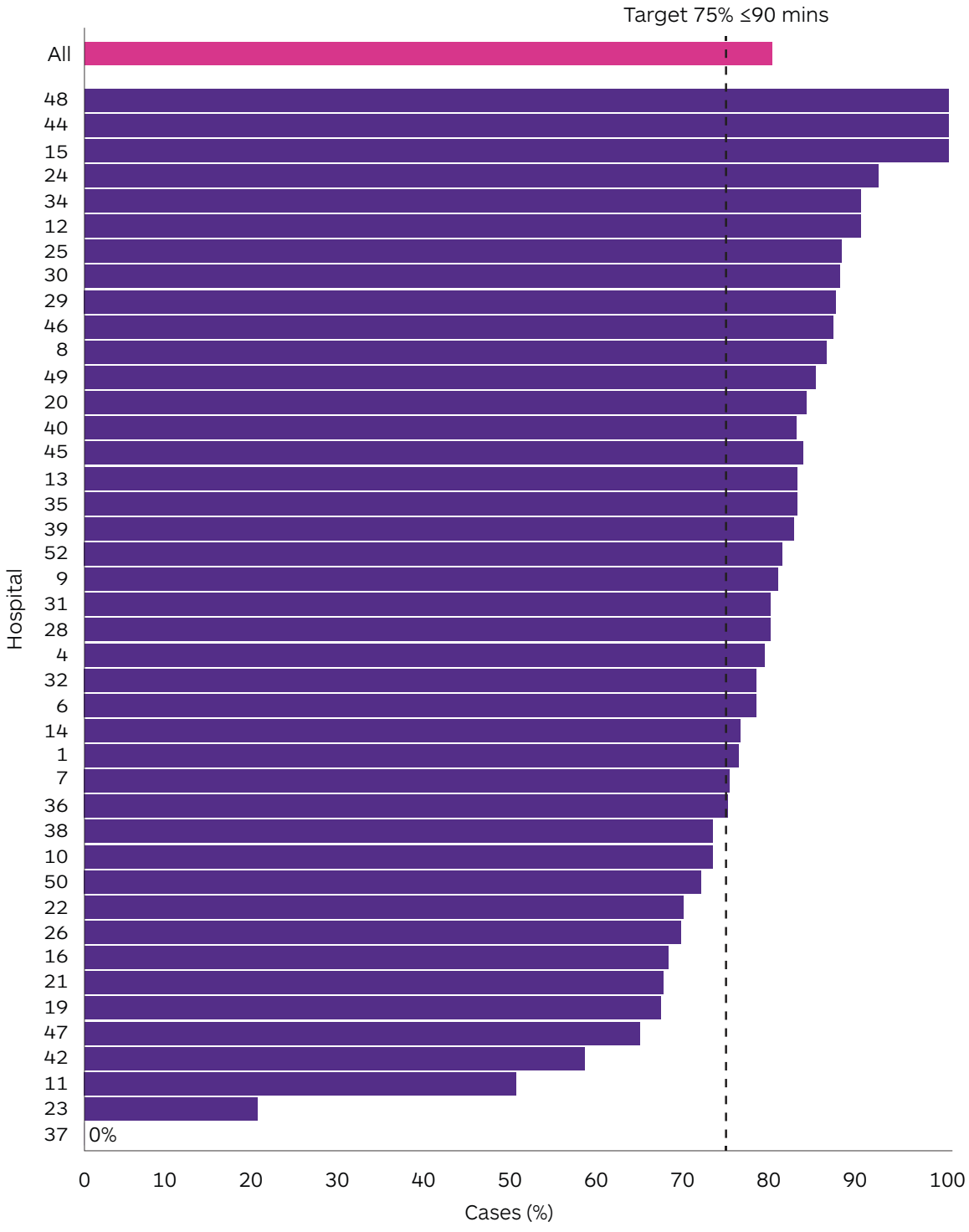


* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

QI 2. Time from door to PCI mediated reperfusion

Most hospitals treated at least 75% of their primary PCI patients in ≤90 minutes, with the average for this metric across all hospitals being 80% (Figure 15).

Figure 15: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital 2023*

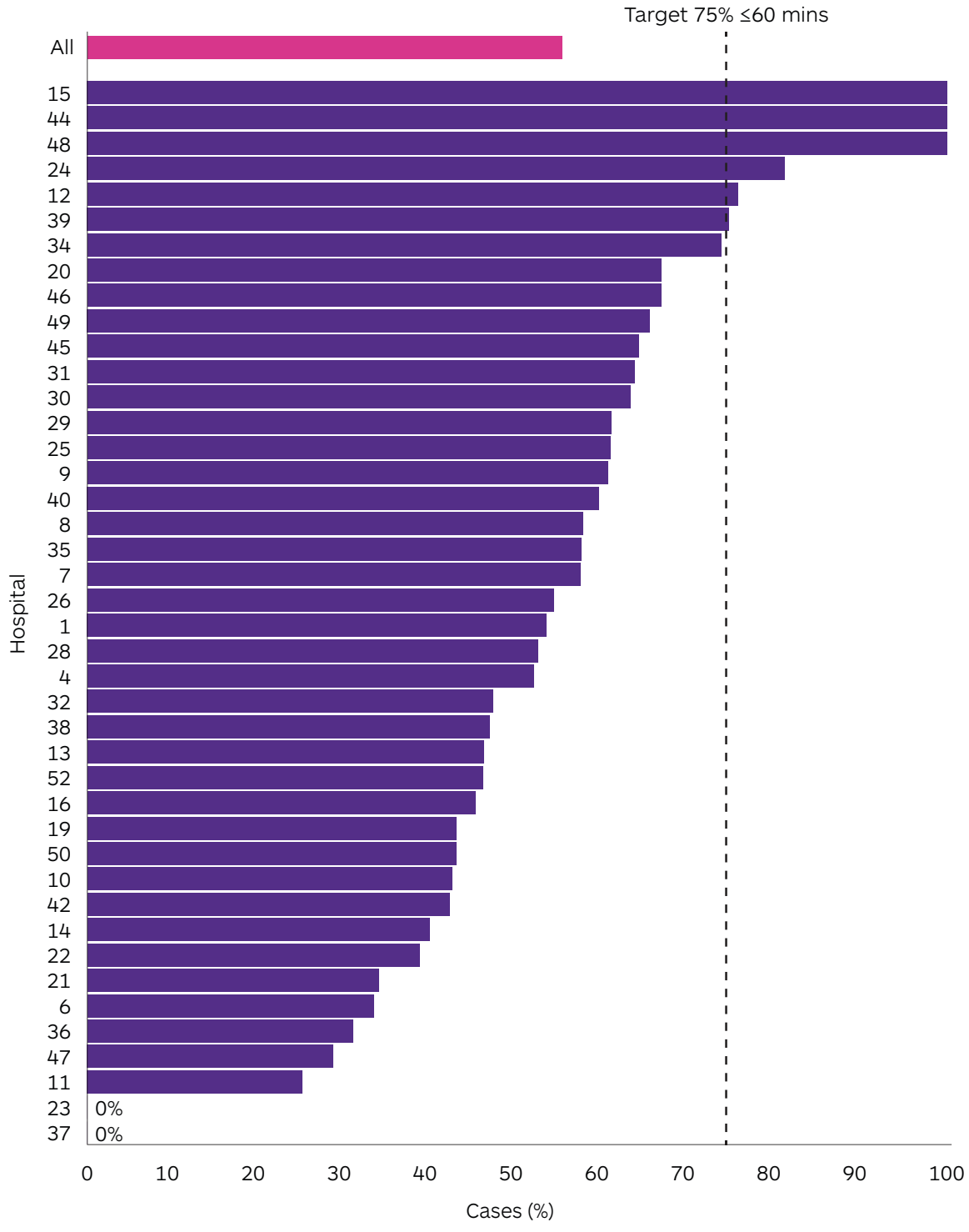


* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

QI 2. Time from door to PCI mediated reperfusion

Six hospitals treated at least 75% of their primary PCI patients in ≤60 minutes, with the average for this metric across all hospitals being 55% (Figure 16).

Figure 16: Proportion of primary PCI cases with door to device time ≤60 minutes by hospital 2023*



* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

QI 2. Time from door to PCI mediated reperfusion

11.2 Prehospital Notification

Pre-hospital notification (PHN) describes a hospital being notified of the imminent arrival of an acute STEMI patient. This may result in the opportunity to bypass the emergency department with direct admission to the cardiac catheter laboratory (CCL). The intention is to reduce treatment delay to allow for timely intervention.

PHN resulted in a significant improvement with overall reduced median door-to-device time (46 minutes vs 86 minutes) as well as increasing the proportion of patients treated in a timely manner by hospitals (Table 5B).

Table 5B: Door-to-device time for primary PCI cases by prehospital notification status 2023*

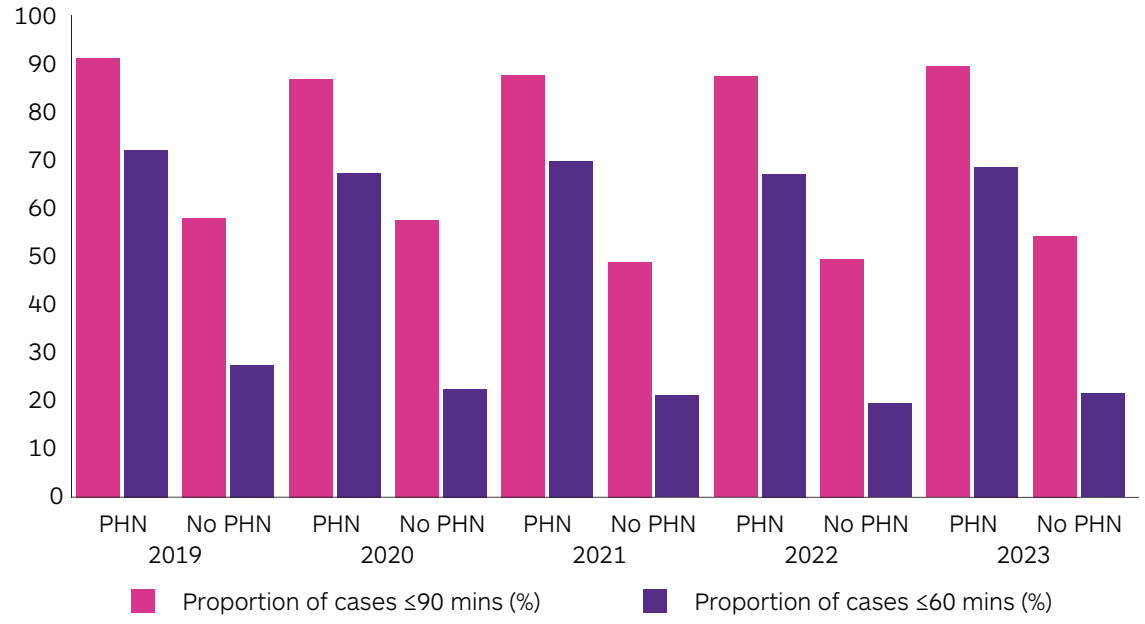
Door to PCI mediated reperfusion time	Primary PCI with PHN (N=2,303) †	Primary PCI no PHN (N=907) †	All Primary PCI cases (N=3,258)
Median - mins (IQR)	46 (33, 66)	86 (64, 117)	56 (37, 83)
Proportion of cases ≤90mins (%)	90.1	54.6	79.6
Proportion of cases ≤60mins (%)	69.1	21.7	55.2

* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient

† PHN data not supplied in 48 cases

Door-to-device times with and without PHN year on year are shown in Figure 17. In 2023, PHN occurred in 71.7% of primary PCI cases, a small increase from the previous year.

Figure 17: Door-to-device time for primary PCI cases by prehospital notification status 2019-2023*

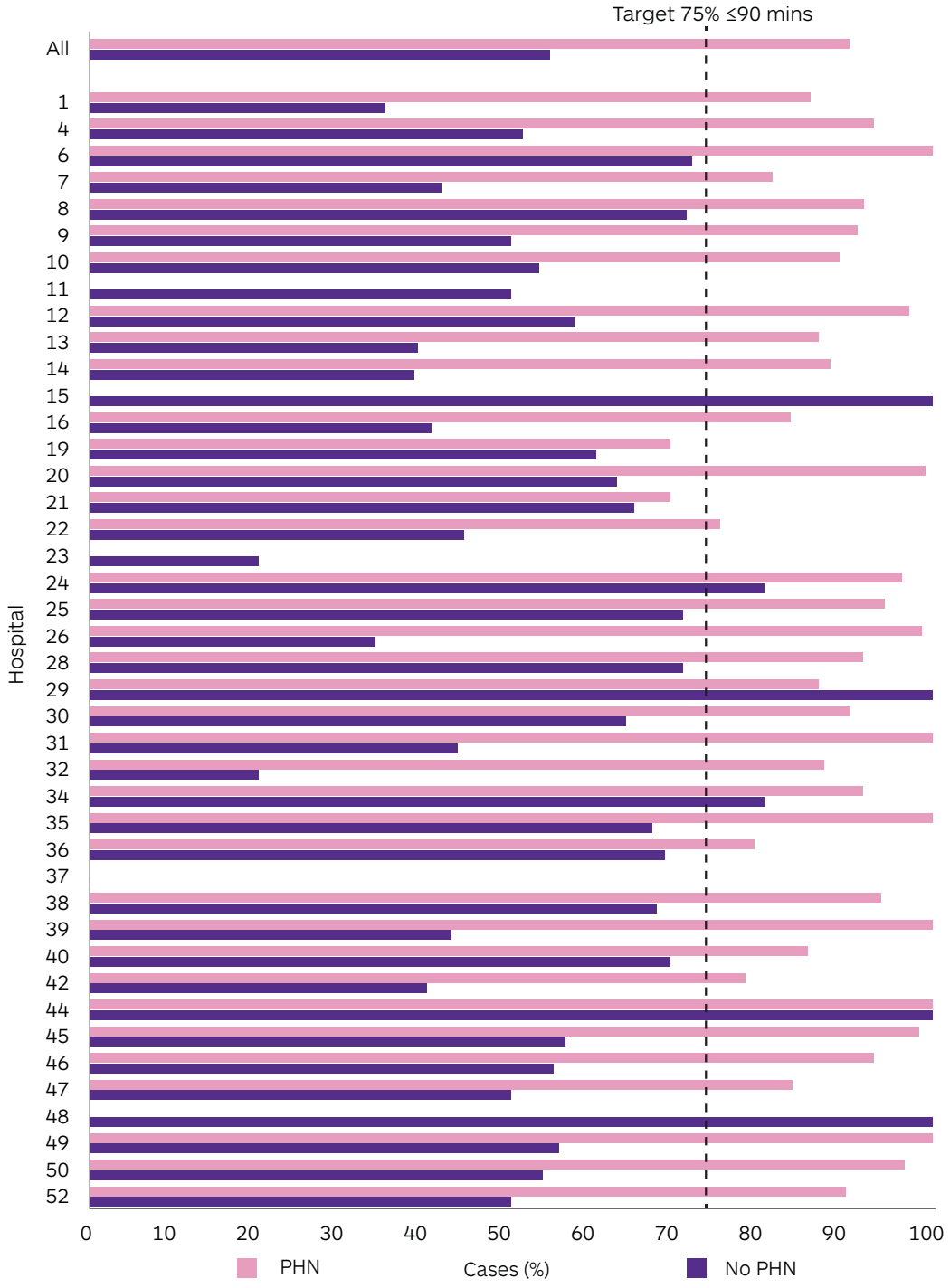


* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

QI 2. Time from door to PCI mediated reperfusion

A comparison of hospitals' door to PCI-mediated reperfusion results with and without PHN is shown in Figure 18. Only one hospital failed to achieve the target of at least 75% cases with a door to PCI-mediated reperfusion time ≤90 min with PHN. In 2023, 90.1% of primary PCI cases triaged with PHN achieved a door to PCI-mediated reperfusion time ≤90min, an increase from previous year (88% in 2022).

Figure 18: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital prehospital notification vs no prehospital notification 2023*

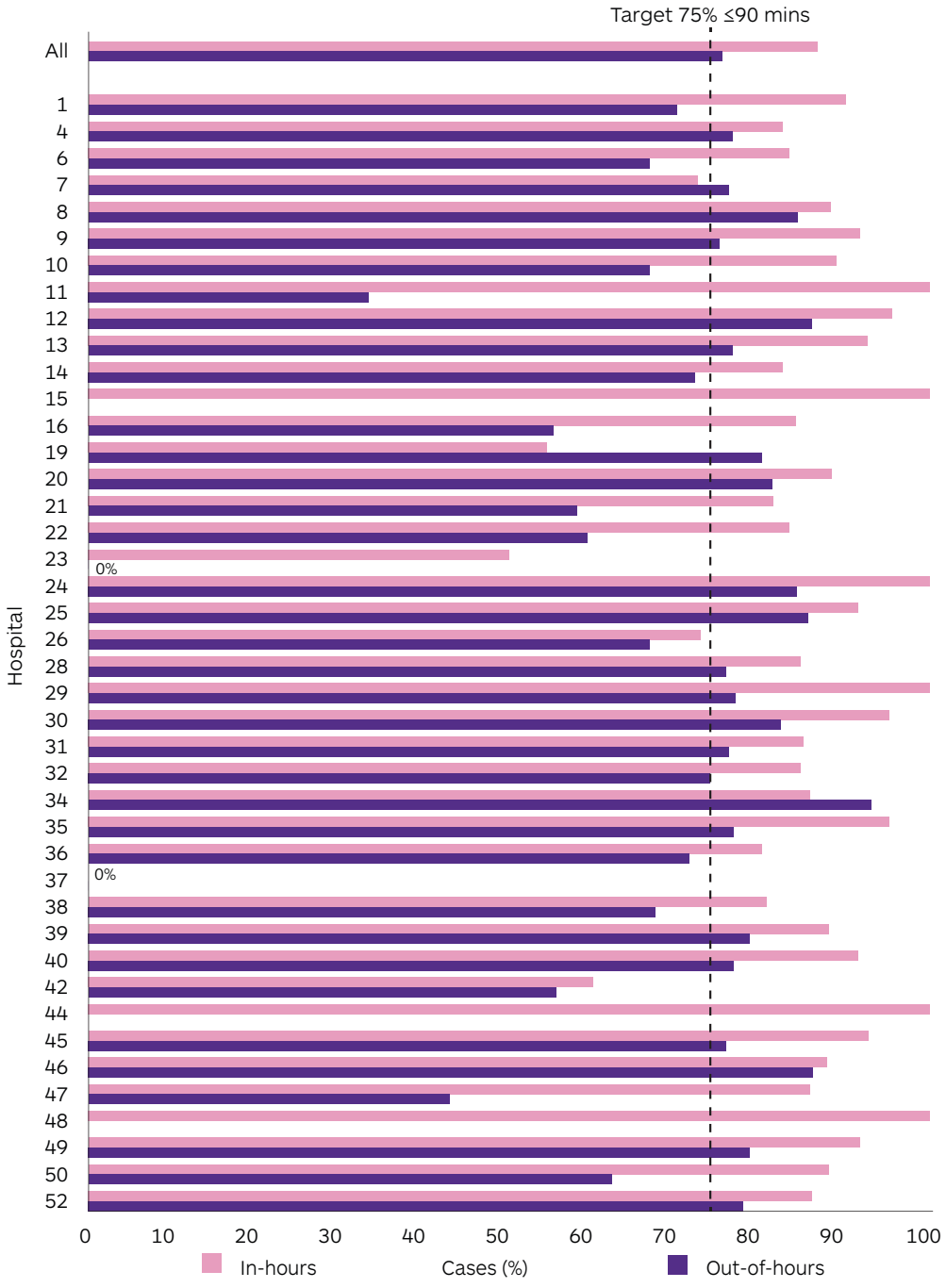


* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.
Hospitals 11, 15, 23 and 48 had no PHN cases.

11.3 In-Hours Versus Out-Of-Hours Presentation

The rate of primary PCI performed out-of-hours was 61.6% with the proportion of out-of-hours cases varying widely among hospitals (range: 0 to 75%). Door to PCI-mediated reperfusion ≤90 minutes was achieved in 75.3% of cases out-of-hours and 86.6% of cases in-hours, an improvement compared to previous reporting. Of note, three hospitals performed better out-of-hours (Figure 19).

Figure 19: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital: in-hours vs out-of-hours by hospital 2023*

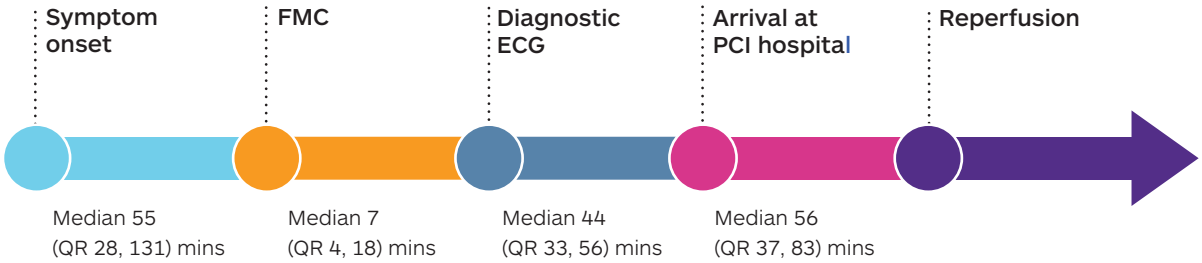


* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient. In-hours: 8:00am - 6:00pm (Mon-Fri). Out-of-hours: 6:00pm - 8:00pm (Mon - Fri, national public holidays, weekends).

11.4 Patient, Healthcare System and Procedural Timings

The various components of the time taken to treat STEMI patients encompass the patient, the health care system and the treating cardiac catheter laboratory. Figure 20 presents the median times throughout the patient journey, from symptom onset to reperfusion. The total ischaemic time represents the time from symptom onset to reperfusion. The effect of PHN on the various components of total ischaemic time are shown in Table 5C. The overall median time from patient symptom onset to first medical contact (FMC) was 55 minutes (IQR: 28, 131) an improvement compared to the previous year (58 mins in 2022).

Figure 20: Median times from symptom onset to PCI mediated reperfusion 2023*



* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

Table 5C: Median times from symptom onset to reperfusion by prehospital notification status 2023

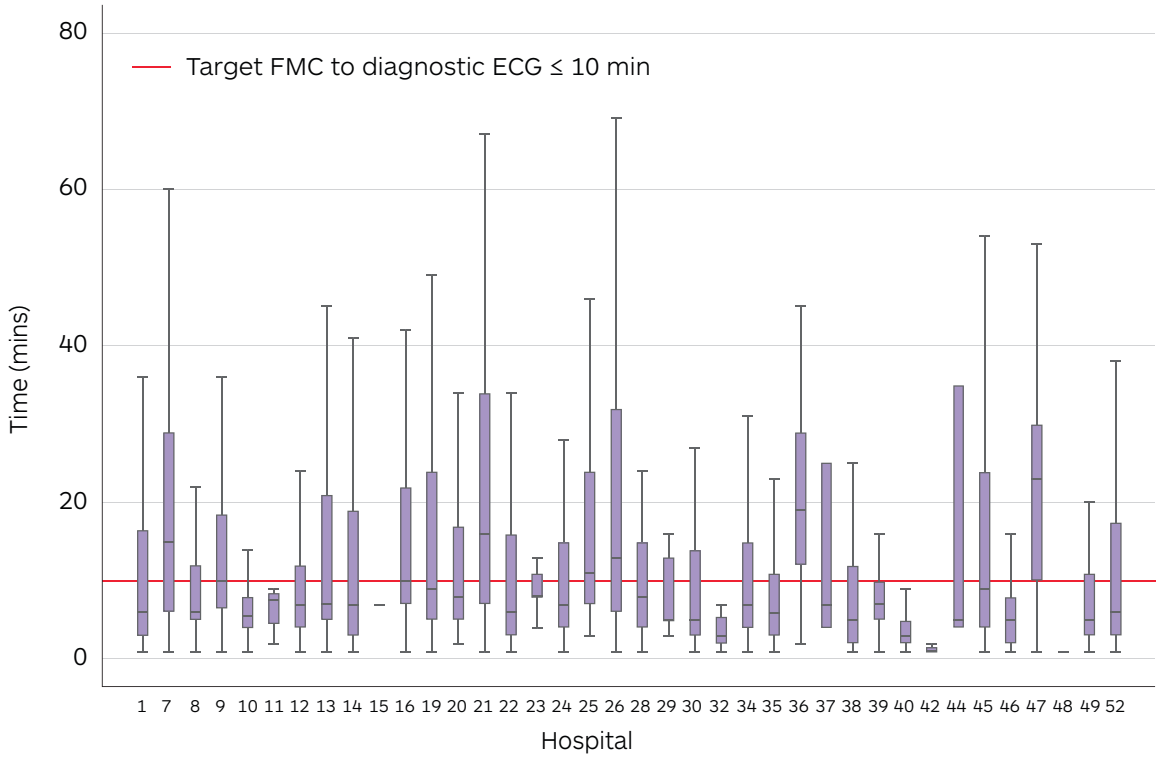
Symptom onset to reperfusion time	Primary PCI with PHN (N=2,303) †	Primary PCI no PHN (N=907) †	All Primary PCI cases* (N=3,258)
Median Symptom onset to FMC - mins (IQR)	50 (26, 109)	76 (37, 175)	55 (28, 131)
Median FMC to Diagnostic ECG - mins (IQR)	6 (4, 14)	12 (6, 34)	7 (4, 18)
Median Diagnostic ECG to door - mins (IQR)	44 (34, 56)	40 (27, 53)	44 (33, 56)
Median Diagnostic ECG to reperfusion time - mins (IQR)	90 (75, 115)	86 (68, 119)	90 (73, 116)
Median FMC to reperfusion time - mins (IQR)	100 (83, 126)	109 (81, 149)	102 (83, 133)
Median Symptom onset to reperfusion time - mins (IQR)	162 (126, 229)	212 (146, 321)	173 (130, 264)

* Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient

† PHN data not supplied in 48 cases

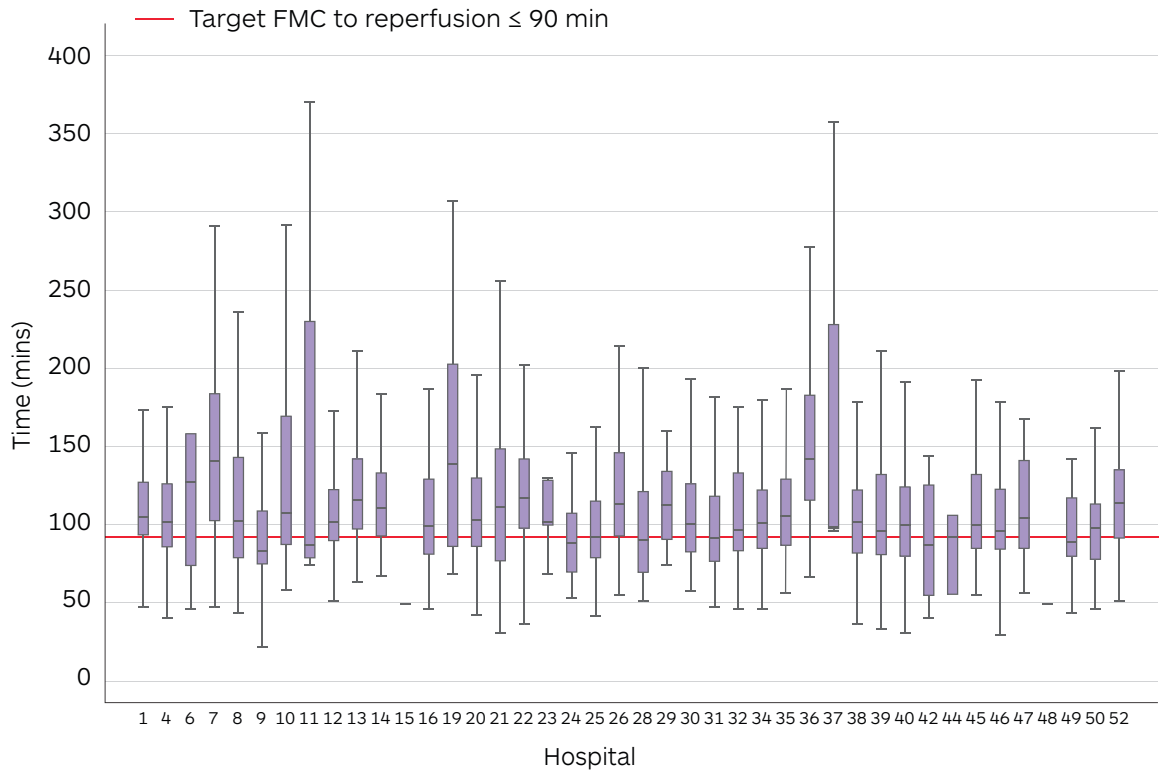
The median FMC to diagnostic electrocardiogram (ECG) time was 7 minutes (IQR: 4, 18) with 80% of hospitals meeting the recommended benchmark of 10 minutes (Figure 21). FMC to diagnostic ECG with PHN was 6 minutes, and was 50% shorter than without PHN, underscoring the importance of PHN.

Figure 21: First medical contact to diagnostic ECG time for primary PCI cases by hospital 2023



Australian guidelines[10] recommend FMC to reperfusion time of ≤90 min. The median FMC to reperfusion time was 102 minutes (IQR: 83, 133) (Table 5C). Eleven hospitals met the ≤90 minute target (Figure 22) representing an improvement compared to the previous year (9 hospitals met this target in 2022).

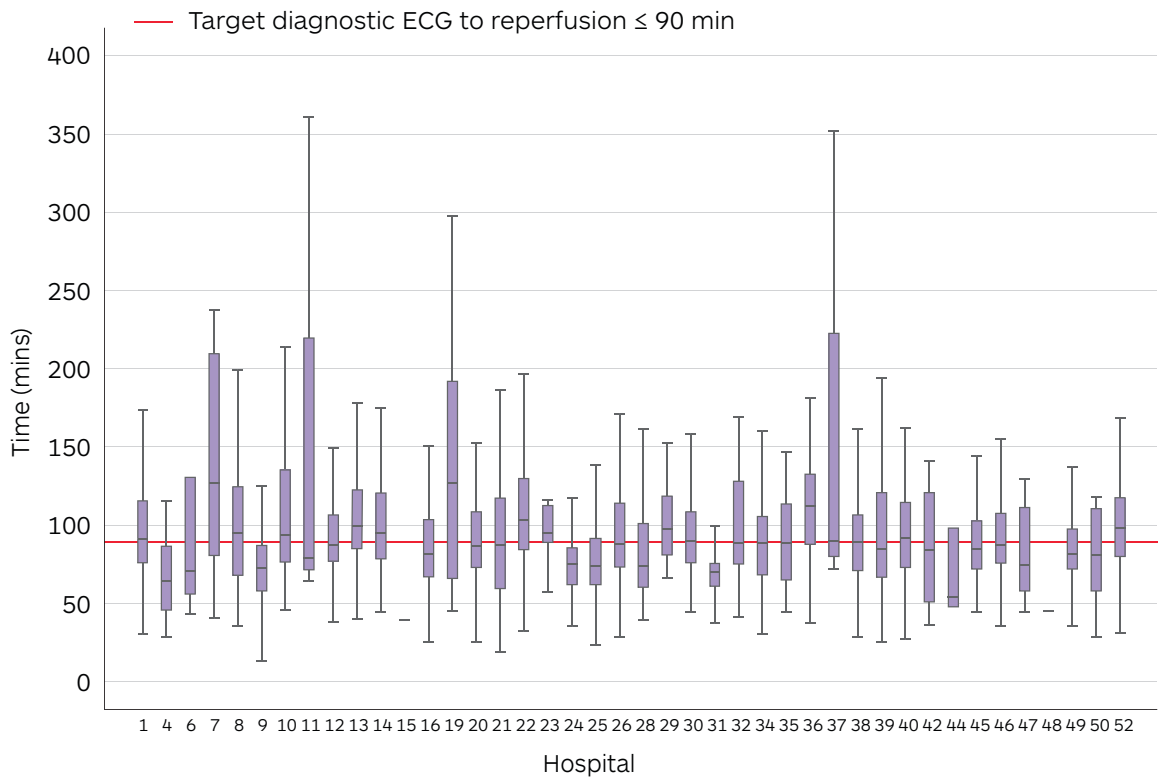
Figure 22: First medical contact to PCI-mediated reperfusion time for primary PCI cases by hospital 2023



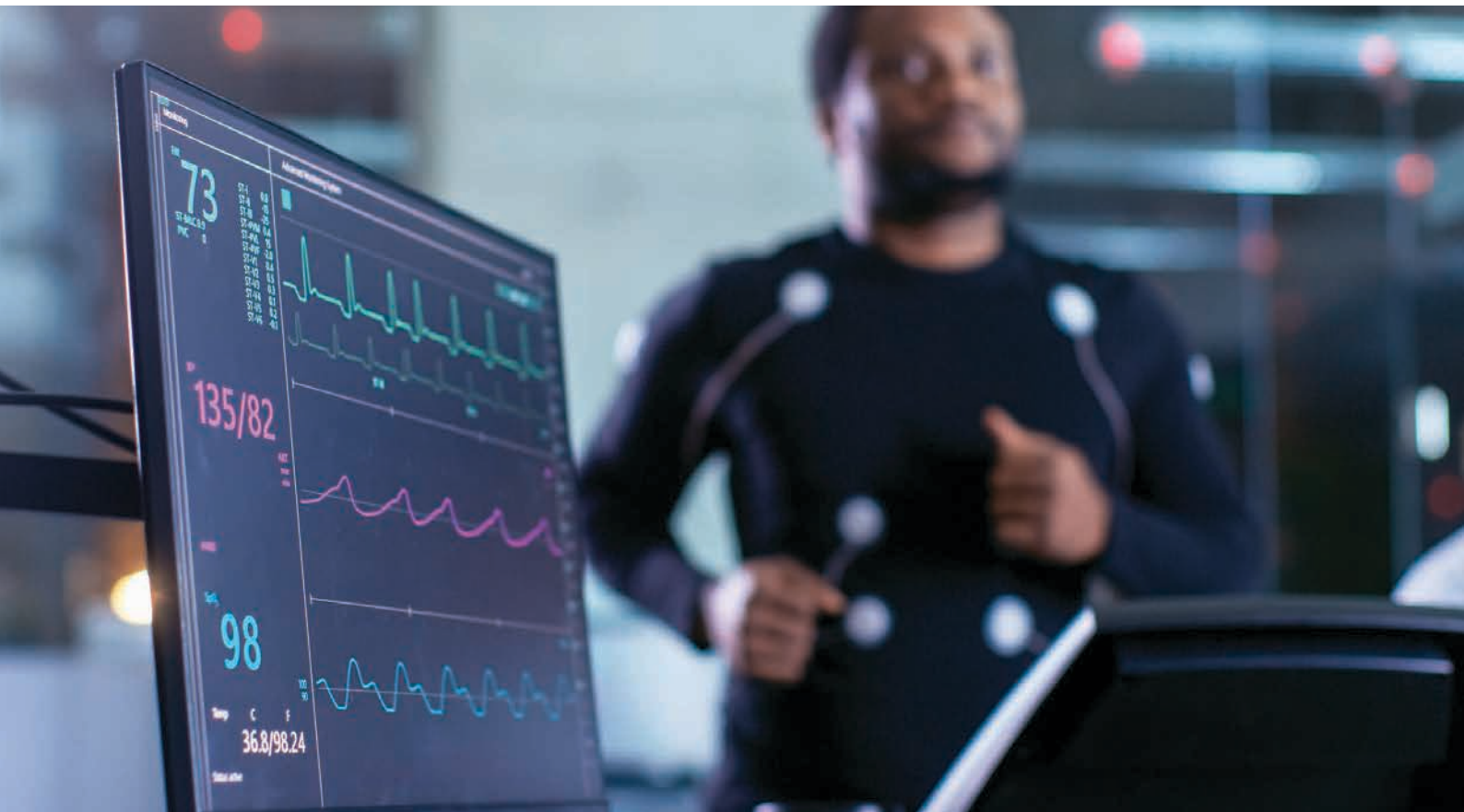
Further assessment of the time delays from diagnostic ECG to PCI-mediated reperfusion as an additional metric of system performance was performed. The median diagnostic ECG to reperfusion time for the 2023 cohort was 90 min (IQR: 73, 116). Wide variation among hospitals was observed (range 40-128 min), see Figure 23 (Page 50).

10 Chew DP, Scott IA, Cullen L, French JK, Briffa TG, Tideman PA, Woodruffe S, Kerr A, Branagan M and Aylward PE (2016) 'National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand: Australian clinical guidelines for the management of acute coronary syndromes 2016', The Medical Journal of Australia, 205(3):128-33, doi: 10.5694/mja16.00368.

Figure 23: Diagnostic ECG to reperfusion by hospital 2023



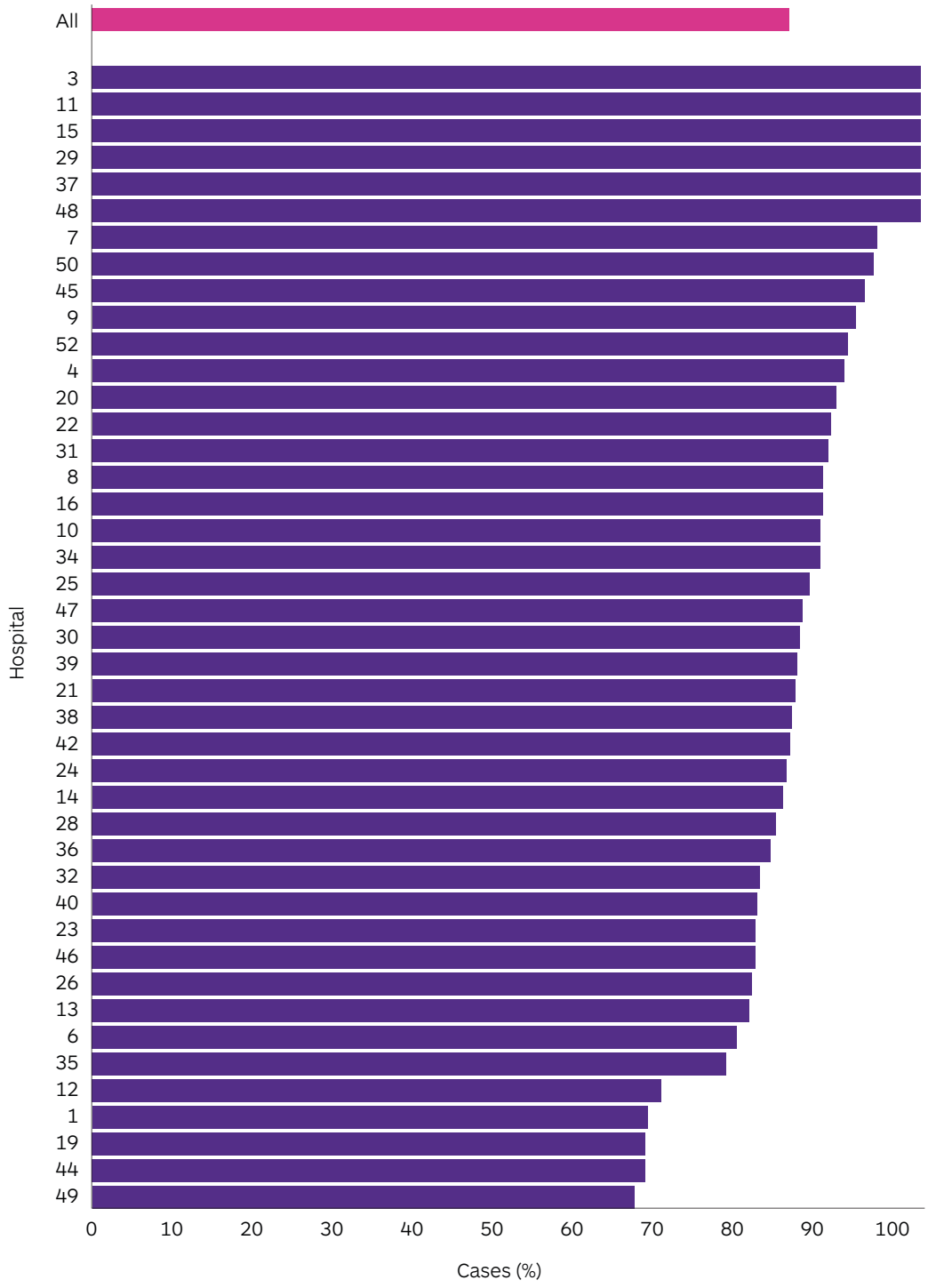
QI 1. Time from diagnostic electrocardiogram to PCI mediated reperfusion



11.5 Radial Access In Primary PCI

The radial artery is associated with lower bleeding and vascular complications than femoral artery access in primary PCI for STEMI[11]. However, not all patients are clinically suitable for radial vascular access. Rationale for femoral vascular access include prior harvesting of the radial artery for CABG and very low weight patients. In 2023, the overall radial vascular access rate in primary PCI was 80.7%. However, there was variation among hospitals, with the range being 66% - 100% (Figure 24). The overall procedural success rate in primary PCI patients was 92.8%.

Figure 24: Radial Access Rates in Primary PCI by hospital 2023



11 Chew DP, Scott IA, Cullen L, French JK, Briffa TG, Tideman PA, Woodruffe S, Kerr A, Branagan M and Aylward PE (2016) 'National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand: Australian clinical guidelines for the management of acute coronary syndromes 2016', The Medical Journal of Australia, 205(3):128-33, doi: 10.5694/mja16.00368.

12. Message from the Chair of the Indigenous Committee

Mr David Follent - Chair of the Indigenous Committee

The National Cardiac Registry is pleased to present data on Aboriginal and/or Torres Strait Islander peoples collected over a four-year period, from 2020-2023. During this timeframe 2,463 PCI patients identified as Aboriginal and/or Torres Strait Islander, equating to 2.6% of the total cohort.

The average age of Indigenous people receiving a PCI is in their fifties, a decade younger than the national average outlined in this report. These figures draw attention to the health concerns facing Aboriginal and Torres Strait communities, presenting with cardiovascular complications far younger in life.

Alongside cardiovascular disease, the NCR Board support the strategic direction of the NCR Indigenous Committee of adding a new module for collecting data on Rheumatic Heart Disease (RHD) for inclusion in the National Cardiac Registry. It is essential that thorough mechanisms are implemented for reporting on a condition which has serious health implications for communities and younger generations in Australia.

Reporting on these data is crucial to leading conversations about how policymakers and healthcare providers can be better equipped to provide equitable care, with Indigenous people in mind. It is my hope that RHD becomes an area of focus for reporting and continuous improvement, to drive better outcomes for all Aboriginal and Torres Strait Islander peoples.

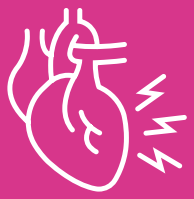
We recognise the importance of developing an NCR Indigenous Data Governance Policy to clarify ownership and safeguard the application of data regarding Indigenous peoples, which will incorporate the principles of Indigenous Data Governance and Data Sovereignty into NCR operations. This important piece of work will also be led by the NCR Indigenous Committee, and I'd like to thank members of this committee for their ongoing support. Together we can make a difference.

Thank you.

David Follent

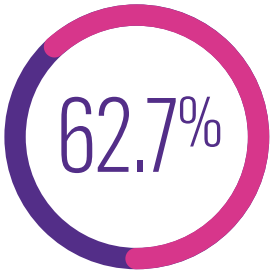
12.1 Aboriginal and Torres Strait Islander peoples - 2020-2023

The **mean age** of **Aboriginal** and **Torres Strait Islander** people was **56 years**

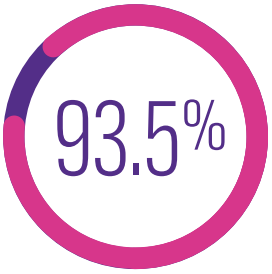


From 2020-2023 two thirds of Aboriginal and Torres Strait Islander people **who underwent a PCI** presented with Acute Coronary Syndrome (ACS)

The rate of **pre-hospital notification (PHN) among Aboriginal and Torres Strait Islander** people with an acute STEMI was



The overall rate of procedural success for **Aboriginal and Torres Strait Islander peoples** was



13. Message from Her Heart

Professor Linda Worrall-Carter - Her Heart, Founder and CEO

One in three women die from heart disease in Australia, equating to one every hour. Her Heart was established to drive change through awareness, education, research, and advocacy. By empowering women with knowledge and tools, Her Heart aims to equip them to take control of their heart health and initiate meaningful change.

It is with great pleasure that I introduce this new section of the NCR Annual Report, dedicated to women's heart health. For the first time, it includes year-on-year data that collects sex differences as well as analysis that highlights key disparities in patients receiving a PCI. This is vital for understanding and addressing inequities in cardiac care and for identifying differences in access and treatment between women and men. Over time, these insights can reveal different trajectories in outcomes, offering significant implications for achieving more equitable cardiac care.

In addition to uncovering disparities, the NCR's data plays a critical role in supporting further research and can also amplify the voices of women who share their experiences. Integrating these stories with robust evidence strengthens advocacy efforts and informs the development of personalised, gender-inclusive approaches to healthcare. Furthermore, this data creates opportunities to track the effectiveness of interventions, shaping future strategies and driving long-term improvements in care delivery.

Her Heart is proud to partner with the National Cardiac Registry to amplify these important findings through our networks and channels. By sharing this data publicly, we aim to foster greater awareness and inspire critical conversations that lead to change. Together, we hope to contribute to a future where equitable cardiac care is not just a goal but a reality for all women across Australia.

Thank you.

Professor Linda Worrall-Carter

13.1 Women and PCI findings 2020-2023

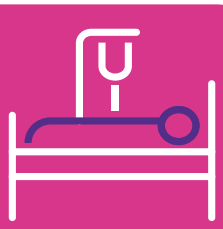
Major bleeding occurred more frequently in women compared to **men**

1.1% vs 0.4%

Procedural timings in women undergoing primary PCI (PPCI) for acute STEMI were longer compared to men, with the median symptom onset to hospital door time being **20 minutes longer** than men

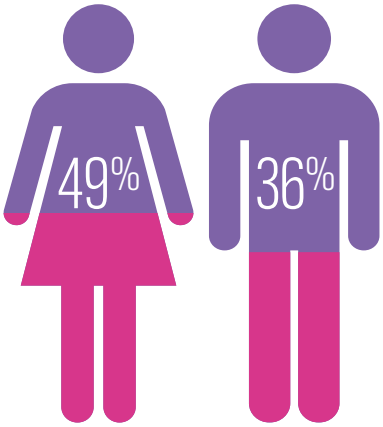
Women had higher **in-hospital mortality** compared to **men**

2.0% vs 1.5%



Radial vascular access was lower in women compared to **men**

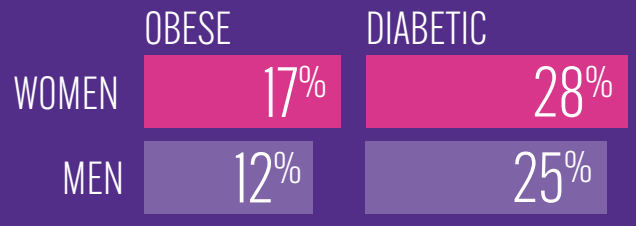
73% vs 79%



The **rate of PCI in women over 70** years of age was **higher** compared to men

Women were on average 4 years older than **men** with their **median age being 70** years

Women had **higher rates** of **severe obesity*** and **diabetes** compared to **men**



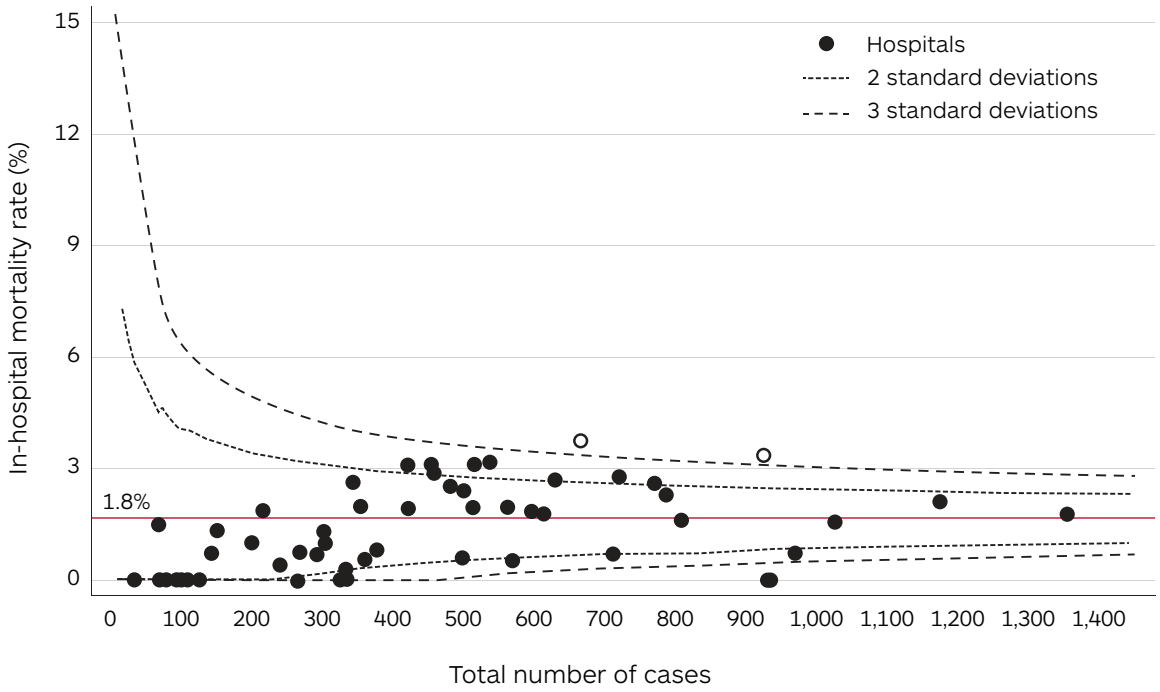
* Severe obesity (BMI≥35kg/m²)

14. In-Hospital Outcomes following PCI

14.1 In-Hospital Mortality

In 2023, the overall in-hospital mortality rate was 1.8%. Two hospitals were outside 3 standard deviations of the mean (Figure 25A). After high-acuity cases of shock and/or intubated OHCA were excluded, the overall rate declined to 0.9% and all hospitals were within expected limits (Figure 25B).

Figure 25A: In-hospital mortality rate by hospital 2023*

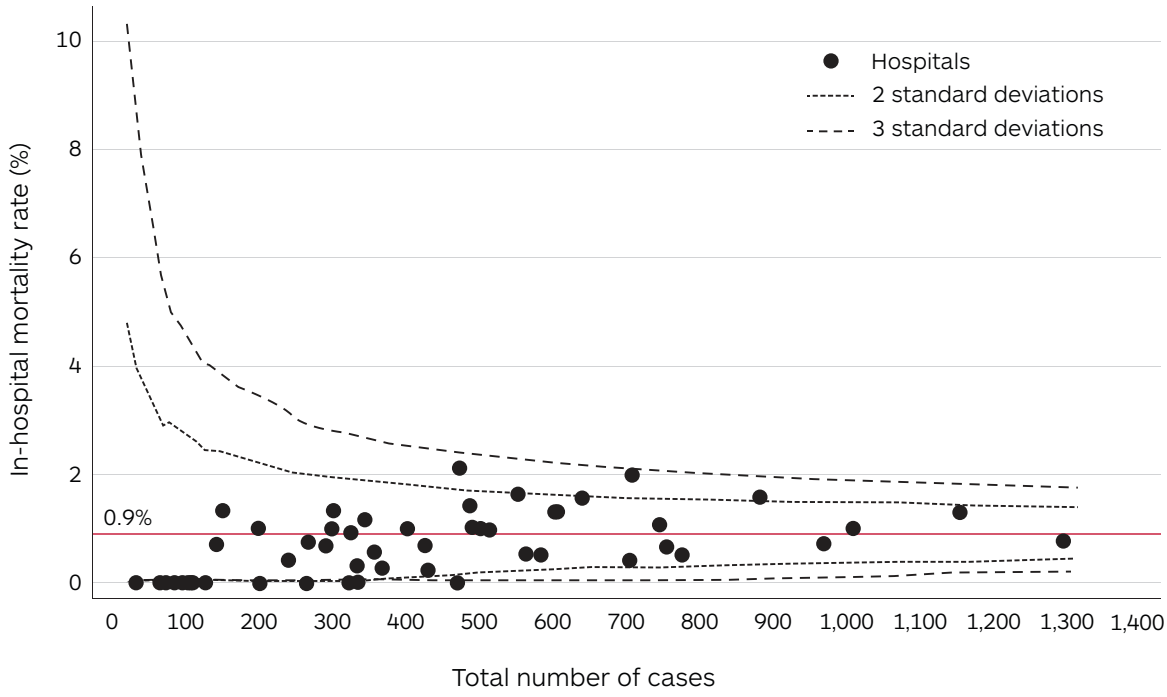


* 30 cases with multiple procedures were excluded to avoid mortality being counted more than once.

QI 5. **In-hospital mortality**

Within the STEMI cohort, the in-hospital mortality rate was 5.1% and was higher compared to the previous year (4.7%). When STEMI and shock and/or intubated OHCA cases were excluded, the mortality rate for the remainder of the PCI cohort was low at 0.4% (similar to the previous year).

Figure 25B: In-hospital mortality rate excluding shock/OHCA by hospital 2023*



* 30 cases with multiple procedures were excluded to avoid mortality being counted more than once.

The in-hospital mortality rates across various sub-groups are presented in table 6A. The in-hospital mortality for the subgroups of PCI for NSTEACS and non-ACS have remained stable over time.

Table 6A: In-hospital mortality rates for selected patient sub-groups 2023

Patient category	In-hospital mortality rate	Total
	N (%)	N
All PCI patients	419 (1.8)	23,329
STEMI patients	295 (5.1)	5,820
Cardiogenic shock and/or OHCA patients	216 (35.8)	603
NSTEACS	61 (0.9)	6,927
Non-ACS	63 (0.6)	10,582
Female	132 (2.2)	5,973
Male	287 (1.7)	17,356

The volume of patients undergoing PCI at a hospital may be a factor in procedural outcomes. Overall 1,832 cases were performed in low volume centres out of the total cohort of 23,329 cases. Table 6B provides unadjusted in-hospital mortality data for hospitals divided by hospital PCI volume. The overall mortality rate was the lowest in the low volume hospitals and trended upwards in the medium volume hospitals with the highest mortality observed in high volume hospitals. The highest mortality occurred in patients presenting with cardiogenic shock and/or OHCA, with two thirds of these patients being treated in high volume hospitals. Similarly, the mortality rate for STEMI patients was highest in high volume hospitals with the majority (65%) of STEMI patients being treated in these hospitals.

Table 6B: In-hospital mortality rates by hospital volume 2023

Patient category	Low volume <250	Medium volume 250-500	High volume >500	Total
	n/N (%)	n/N (%)	n/N (%)	N
All PCI patients	11/1,832 (0.6)	96/6,576 (1.5)	312/14,921 (2.1)	23,329
STEMI patients	7/155 (4.5)	69/1,624 (4.2)	219/4,041 (5.4)	5,820
Cardiogenic shock and/or OHCA patients	5/21 (23.8)	52/179 (29.1)	159/403 (39.5)	603
NSTEACS	4/474 (0.8)	10/1,909 (0.5)	47/4,544 (1.0)	6,927
Non-ACS	0/1,203 (0.0)	17/3,043 (0.6)	46/6,336 (0.7)	10,582

Hospitals with CABG capability had an overall slightly lower in-hospital mortality rate than hospitals without.The mortality rate for cardiogenic shock and/or OHCA patients was highest in hospitals with CABG capability (Table 6C).

Table 6C: In-hospital mortality rates by on-site CABG vs off-site CABG centres 2023

Patient category	On-site CABG	Off-site CABG	Total
	n/N (%)	n/N (%)	N
All PCI patients	204/12,458 (1.6)	215/10,871 (2.0)	23,329
STEMI patients	133/2,758 (4.8)	162/3,062 (5.3)	5,820
Cardiogenic shock and/or OHCA patients	108/292 (37.0)	108/311 (34.7)	603
NSTEACS	30/3,483 (0.9)	31/3,444 (0.9)	6,927
Non-ACS	41/6,217 (0.7)	22/4,365 (0.5)	10,582

Metropolitan hospitals had the highest mortality rate for cardiogenic shock and/or OHCA and STEMI patients (Table 6D). The majority of these high-acuity cases were treated in metropolitan hospitals (78% and 77% respectively). However, the overall rate (1.8%) of in-hospital mortality was the same for metropolitan and non-metro hospitals (Table 6D).

Table 6D: In-hospital mortality rates by metro vs non-metro hospitals 2023

Patient category	Metro	Non-metro	Total
	n/N (%)	n/N (%)	N
All PCI patients	345/19,157 (1.8)	74/4,172 (1.8)	23,329
STEMI patients	244/4,475 (5.5)	51/1,345 (3.8)	5,820
Cardiogenic shock and/or OHCA patients	179/472 (37.9)	37/131 (28.2)	603
NSTEACS	51/5,667 (0.9)	10/1,260 (0.8)	6,927
Non-ACS	50/9,015 (0.6)	13/1,567 (0.8)	10,582

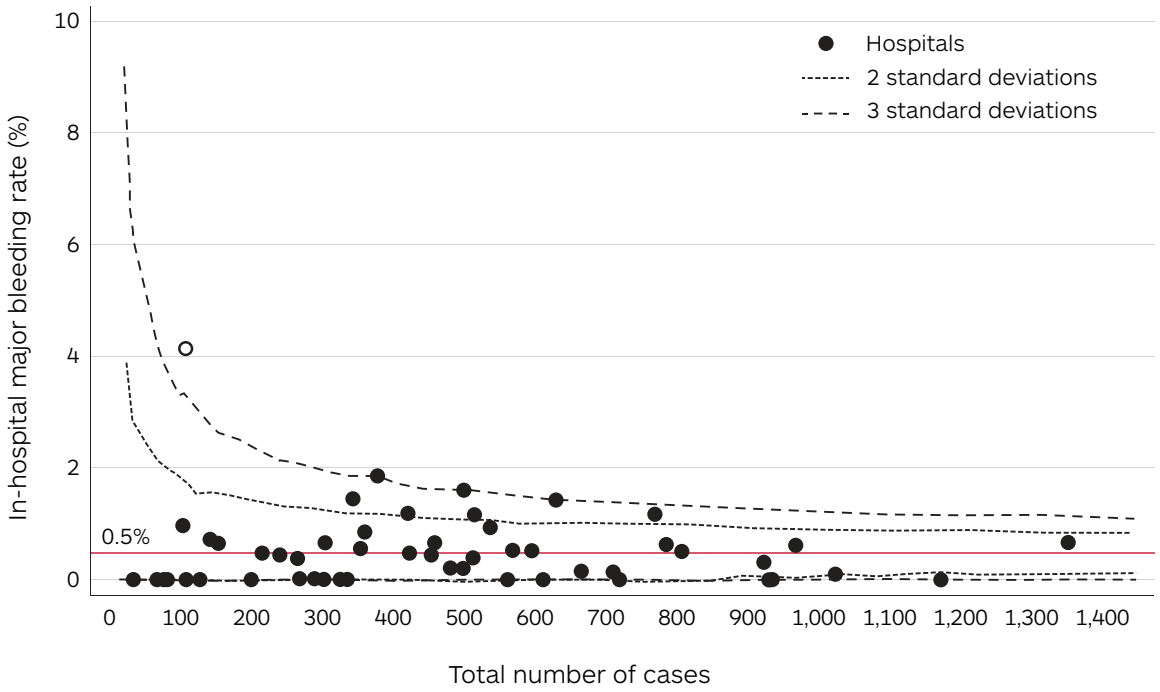
14.2 In-Hospital Major Bleeding

Major bleeding is a serious adverse outcome following PCI. It is defined as overt bleeding that may require surgical intervention, result in a significant haemoglobin decrease, involves the brain and may be fatal. The in-hospital major bleeding rate was 0.5% (Figure 26). A downward trend has been observed since 2020 when the rate of major bleeding was 0.8%. The rate of major bleeding across hospitals was 0 - 4.2%. One hospital was outside 3 standard deviations of the mean.

Major bleeding rates for selected patient subgroups are presented in Table 7A (page 64). Bleeding in patients undergoing femoral vascular access was five times (1.5%) the bleeding rate associated with radial vascular access (0.3%). Patients with STEMI had the highest bleeding rate compared to other presentations. The major bleeding rate for women decreased compared to the previous year (0.8% in 2023 vs 1.2% in 2022).

Patients undergoing PCI require medication that increases the risk of bleeding. Bleeding rates were lower among patients who received revascularisation via the radial artery.

Figure 26: In-hospital major bleeding rate by hospital 2023

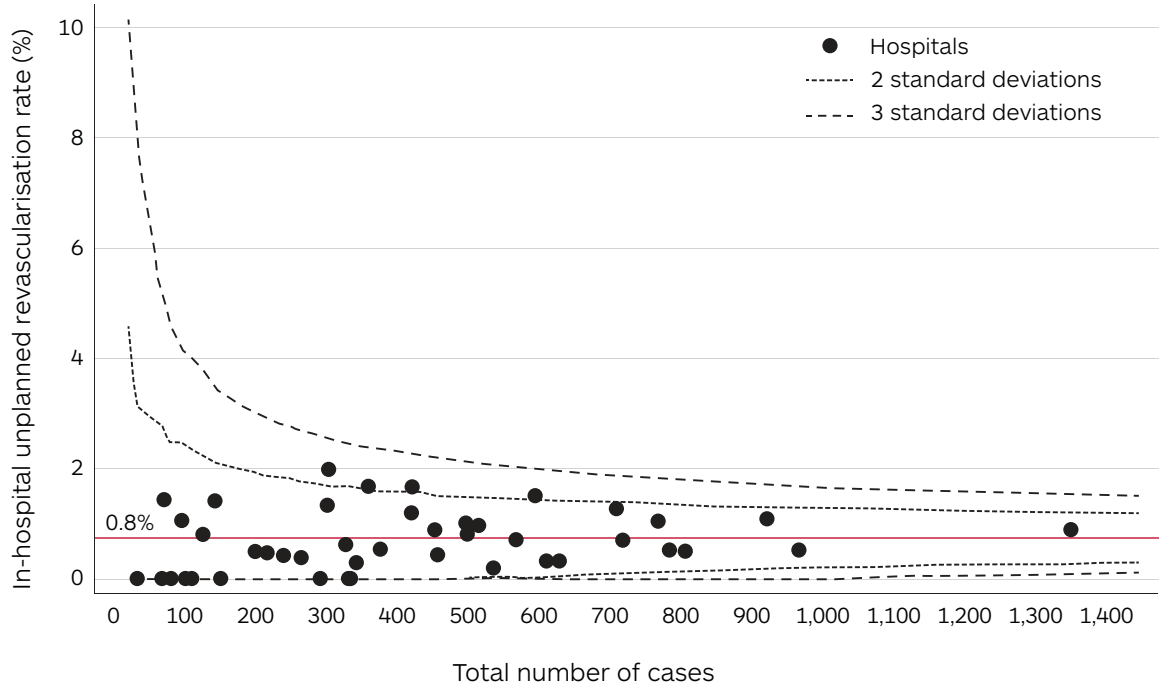


QI 4. In-hospital major bleeding

14.3 In-Hospital Unplanned Revascularisation

Unplanned revascularisation is defined as an unexpected revascularisation procedure (PCI or CABG surgery), following a PCI and occurring during the same admission. The rate of unplanned revascularisation was 0.8%, with all hospitals performing within control limits (Figure 27).

Figure 27: In-hospital unplanned revascularisation rate by hospital 2023

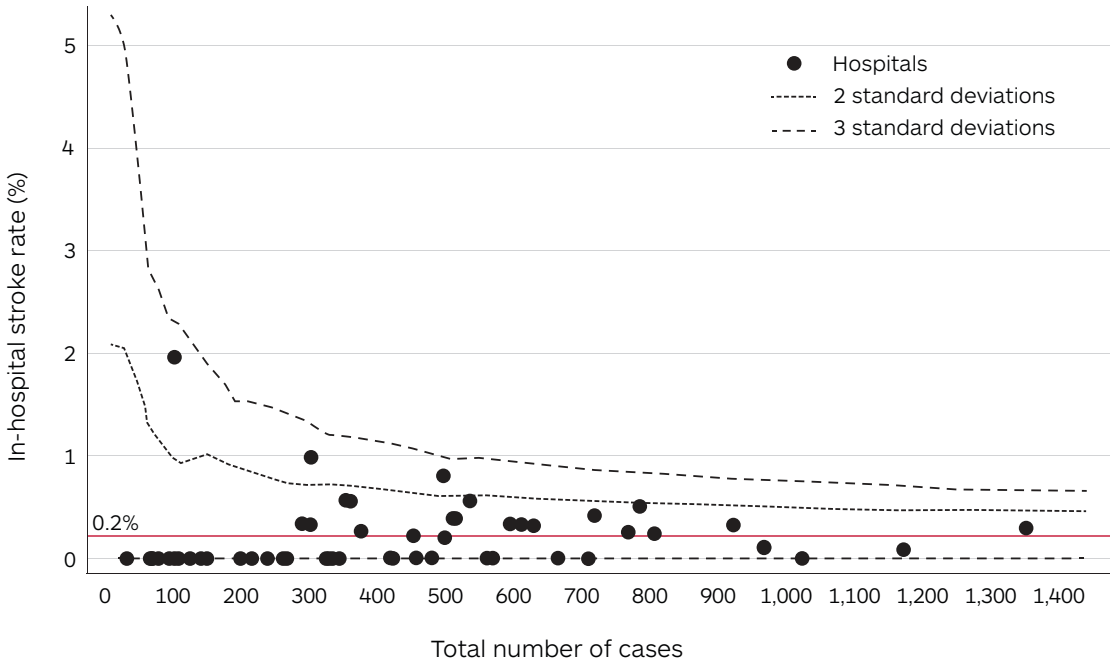


QI 7. Unplanned revascularisation within 30 days

14.4 In-Hospital Stroke

The overall rate of in-hospital stroke post PCI was 0.2% (range 0 – 2.0%), with all hospitals being within control limits (Figure 28).

Figure 28: In-hospital stroke rate by hospital 2023



QI 3. **In-hospital stroke**

14.5 Outcomes by Clinical Presentation and Hospital Characteristics

In-hospital adverse events occur during or after the patient's PCI. Tables 7A-7D present adverse event rates across a range of various initial clinical presentations (Table 7A), by hospital volume (table 7B), by hospital CABG capability (Table 7C) and by metropolitan or non-metropolitan hospital location (Table 7D).

Patients presenting with STEMI had higher rates of major bleeding, MACE (defined as death, new myocardial infarction, stent thrombosis and unplanned revascularisation) and MACCE (MACE plus stroke) compared to non-STEMI indications (Table 7A).

Table 7A: In-hospital outcomes by clinical presentation 2023

In hospital outcomes	STEMI	NSTEACS	Non-ACS	Total
	(N=5,820)	(N=6,927)	(N=10,582)	(N=23,329)
Mortality (%)	5.1	0.9	0.6	1.8
Myocardial infarction (%)	0.8	0.3	0.3	0.4
Stent thrombosis (%)	0.8	0.2	0.2	0.3
Unplanned revascularisation (%)	1.7	0.6	0.4	0.8
MACE (%)	7.6	1.7	1.0	2.6
Stroke (%)	0.4	0.2	0.1	0.2
MACCE (%)	7.9	1.9	1.1	2.8
Major bleeding (%)	1.0	0.3	0.5	0.5
Median length of stay (Days)	3.0	3.0	1.0	2.0

MACE and MACCE rates were higher in high volume centres, and those without CABG capability (Table 7B-7C).

Table 7B: In-hospital outcomes by hospital volume 2023

In hospital outcomes	Low volume <250	Medium volume 250-500	High volume >500	Total
	(N=1,832)	(N=6,576)	(N=14,921)	(N=23,329)
Mortality (%)	0.6	1.5	2.1	1.8
Myocardial infarction (%)	0.2	0.5	0.4	0.4
Stent thrombosis (%)	0.1	0.4	0.3	0.3
Unplanned revascularisation (%)	0.5	0.8	0.8	0.8
MACE (%)	1.2	2.4	3.0	2.6
Stroke (%)	0.1	0.2	0.2	0.2
MACCE (%)	1.3	2.6	3.2	2.8
Major bleeding (%)	0.5	0.5	0.6	0.5
Median length of stay (Days)	1.0	2.0	3.0	2.0

Table 7C: In-hospital outcomes by on-site CABG vs off-site CABG hospitals 2023

In hospital outcomes	On-site CABG (N=12,458)	Off-site CABG (N=10,871)	Total (N=23,329)
Mortality (%)	1.6	2.0	1.8
Myocardial infarction (%)	0.4	0.5	0.4
Stent thrombosis (%)	0.2	0.4	0.3
Unplanned revascularisation (%)	0.7	0.8	0.8
MACE (%)	2.2	3.0	2.6
Stroke (%)	0.2	0.3	0.2
MACCE (%)	2.4	3.3	2.8
Major bleeding (%)	0.5	0.6	0.5
Median length of stay (Days)	2.0	2.0	2.0

The rate of stent thrombosis in non-metropolitan hospitals was double that of metropolitan hospitals. Overall, the MACE and MACCE rates were similar (Table 7D).

Table 7D: In-hospital outcomes by metro vs non-metro hospitals 2023

In hospital outcomes	Metro (N=19,157)	Non-metro (N=4,172)	Total (N=23,329)
Mortality (%)	1.8	1.8	1.8
Myocardial infarction (%)	0.4	0.6	0.4
Stent thrombosis (%)	0.3	0.7	0.3
Unplanned revascularisation (%)	0.7	1.0	0.8
MACE (%)	2.6	2.6	2.6
Stroke (%)	0.2	0.3	0.2
MACCE (%)	2.8	3.1	2.8
Major bleeding (%)	0.6	0.3	0.5
Median length of stay (Days)	2.0	3.0	2.0

15. Discharge Medications and Secondary Prevention Programs

The NCR collects data on selected medications that are administered post-procedure. These include aspirin, antiplatelets, statins and other lipid-lowering therapies.

Australian guidelines recommend that ACS patients undergoing PCI are treated with up to 12 months of dual antiplatelet therapy (DAPT) alongside lipid lowering therapy (LLT) in order to reach a low-density lipoprotein level <1.8mmol/L, and preferably <1.4mmol/L[12].

Referral to cardiac rehabilitation or other secondary prevention programs can assist patients to better manage their medications and make lifestyle modifications post PCI procedure. The Cardiac Society of Australia & New Zealand (CSANZ) have published *A Clinical Guide for Assessment and Prescription of Exercise and Physical Activity in Cardiac Rehabilitation. A CSANZ Position Statement*[13]. This document provides guidance and assists clinicians and health care teams to optimally manage people with cardiac conditions, including those who have undergone PCI.

15.1 Compliance with Discharge Medication Prescribing

Compliance with prescribing discharge medication is high, with the prescription of DAPT (94.7%) and LLT (96.2%), consistent among the various clinical presentations and hospital characteristics (Table 8).

Minimal variation is observed with DAPT and LLT prescribing between the sexes (Table 8).

Table 8: Rates of prescription of DAPT and LLT by clinical presentation and hospital type 2023

	Discharged on DAPT	Discharged on LLT	Cases with data available
Clinical presentation	**%**	**%**	**N**
STEMI	95.4	98.3	3,926
NSTEACS	95.4	97.5	5,256
Non-ACS	93.9	94.5	8,663
Hospital types	**%**	**%**	**N**
Low volume <250	96.1	94.7	1,713
Medium volume 250-500	94.7	96.6	5,389
High volume >500	94.4	96.3	10,743
On-site CABG	93.8	95.7	9,107
Off-site CABG	95.6	96.8	8,738
Metro	94.5	96.2	16,048
Non-metro	96.4	96.5	1,797
Public	95.6	97.7	12,564
Private	92.3	92.9	5,281
All	94.7	96.2	17,845

QI 9. **Patients without contraindication discharged on lipid-lowering therapy**

QI 11. **Proportion of patients, without a clear and documented contraindication for Aspirin and/or P2Y12 inhibitor, discharged on DAPT**

12 Chew DP, Scott IA, Cullen L, French JK, Briffa TG, Tideman PA, Woodruffe S, Kerr A, Branagan M and Aylward PE (2016) 'National Heart Foundation of Australia & Cardiac Society of Australia and New Zealand: Australian Clinical Guidelines for the Management of Acute Coronary Syndromes 2016,' Heart Lung Circulation, 25(9):895-951. doi: 10.1016/j.hlc.2016.06.789.

13 Verdicchio C, Freene N, Hollings M, Maiorana A, Briffa T, Gallagher R, Hendriks JM, Abell B, Brown A, Colquhoun D, Howden E, Hansen D, Reading S and Redfern J (2023) 'A Clinical Guide for Assessment and Prescription of Exercise and Physical Activity in Cardiac Rehabilitation. A CSANZ Position Statement.' Heart Lung Circulation. 32(9):1035-1048. doi: 10.1016/j.hlc.2023.06.854.

15.2 Referral to Cardiac Rehabilitation

The overall rate for cardiac rehabilitation referral was 78.1%, a slight increase compared to the previous reporting period. Cardiac rehabilitation referral across various subgroups, including ACS type and clinical characteristics are presented in Table 9.

Table 9: Rates of referral to cardiac rehabilitation by clinical presentation and hospital type 2023

	Rehabilitation referral rate	Referral status 'unknown'	Cases with data available
Clinical presentation	%	%	N
STEMI	82.8	3.3	5,526
NSTEACS	80.3	2.5	6,868
Non-ACS	74.1	3.6	10,528
Hospital types	%	%	N
Low volume <250	74.3	5.7	1,822
Medium volume 250-500	77.4	1.2	6,486
High volume >500	78.9	3.7	14,614
On-site CABG	80.9	1.2	12,260
Off-site CABG	74.8	5.5	10,662
Metro	77.1	3.9	18,821
Non-metro	82.5	0.1	4,101
Public	78.3	3.0	17,637
Private	77.4	3.7	5,285
All	78.1	3.2	22,922

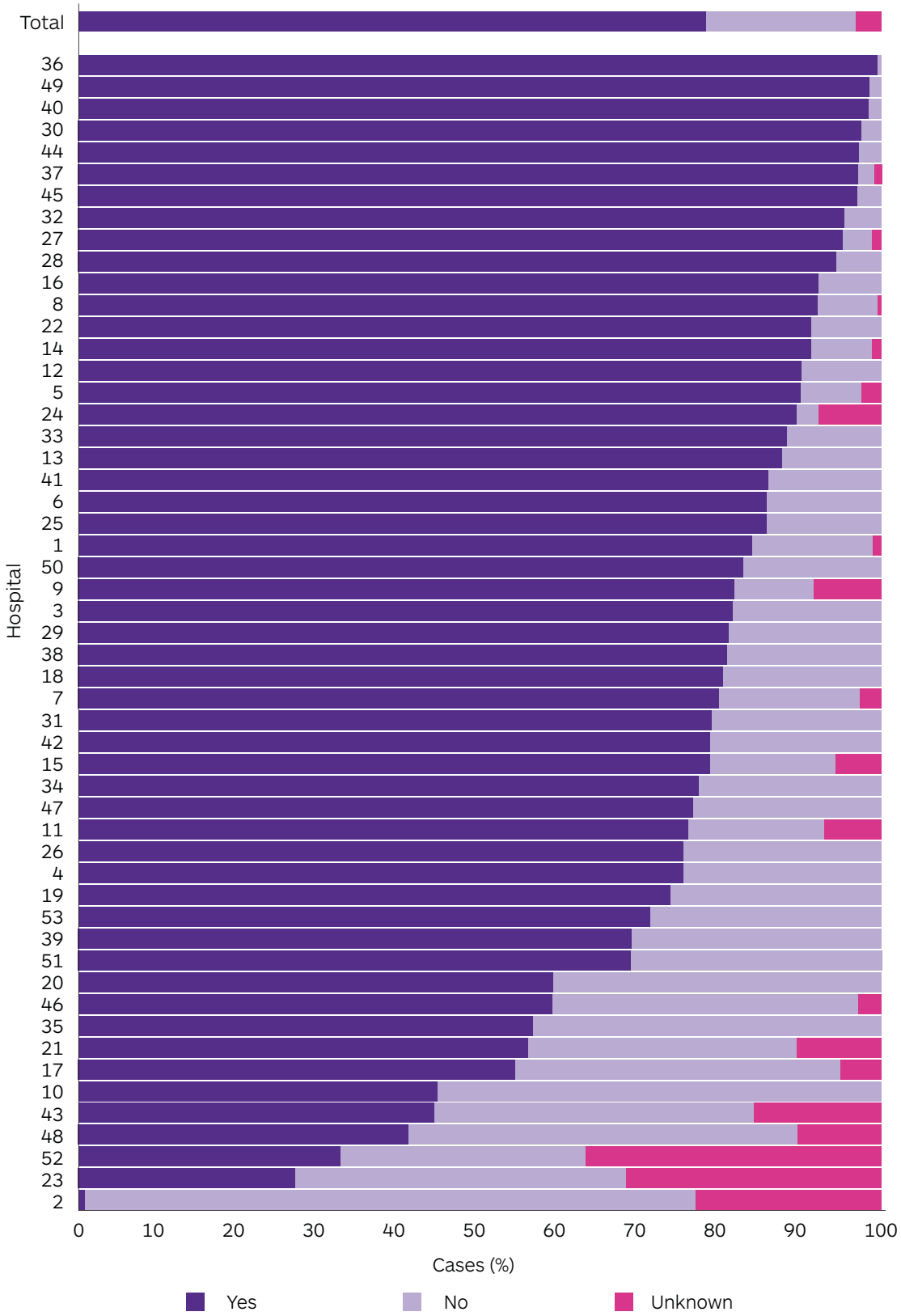
Referral to and compliance with cardiac rehabilitation by patients is linked to better long-term health outcomes following a cardiac event, intervention or procedure and has been assessed as a cost effective service for patients[14].

QI 10. Patients referred to cardiac rehabilitation or other secondary prevention program

14 Driscoll A, Hinde S, Harrison A, Bojke L and Doherty P (2020) 'Estimating the health loss due to poor engagement with cardiac rehabilitation in Australia,' International Journal of Cardiology, 317:7-12. doi: 10.1016/j.ijcard.2020.04.088.

Referral to cardiac rehabilitation post-procedure by hospital is presented in Figure 29, with wide variation observed among hospitals who reported this indicator.

Figure 29: Cardiac rehabilitation referral by hospital 2023



QI 10. Patients referred to cardiac rehabilitation or other secondary prevention program

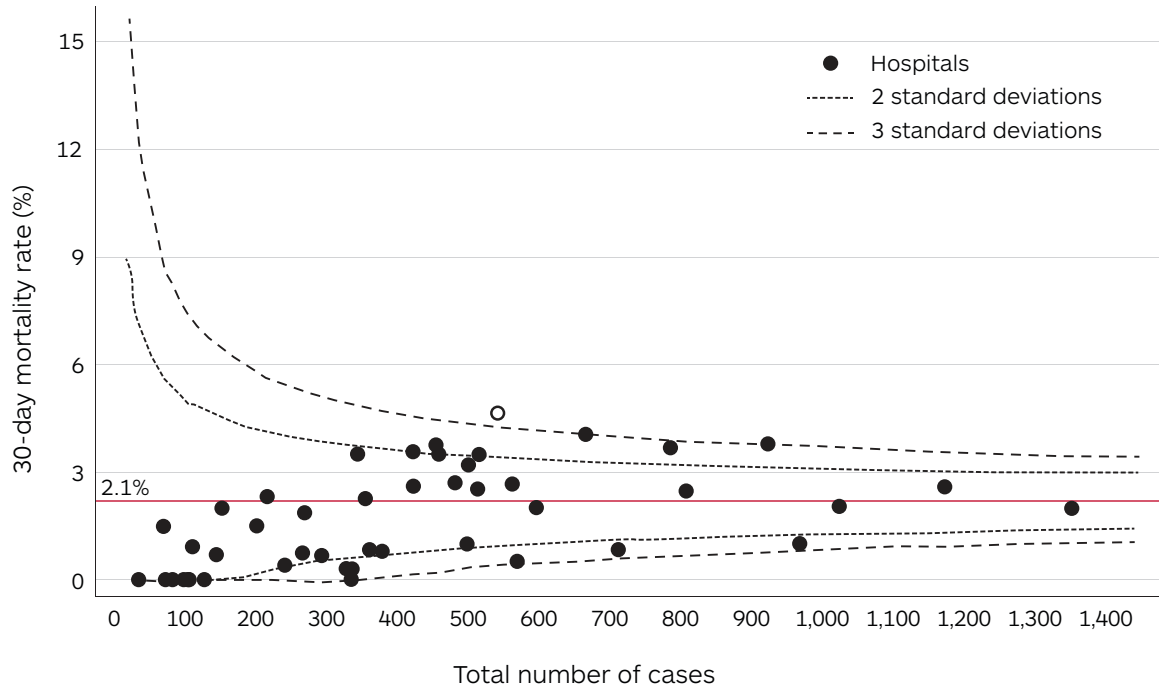
16. 30-Day Outcomes

In order to track the safety and success of a PCI procedure, the NCR adopts a thirty-day outcome measure. Five of the eight health jurisdictions provided data on 30-day mortality and four jurisdictions provided data on 30-day unplanned revascularisation and unplanned cardiac readmissions. The number of contributing hospitals ranged from 38 to 47, out of a possible total of 55 hospitals.

16.1 30-Day Mortality

The overall unadjusted 30-day mortality rate was 2.1% (similar to the 2022 rate of 2.2%). All participating hospitals (except one) were within expected limits (Figure 30). When cardiogenic shock and/or intubated OHCA cases were excluded, the mortality rate was 1.2%, with this one hospital returning within expected limits. The highest 30-day mortality rate was observed for STEMI patients (6.5%). The second highest mortality in patients aged 80 years and over (4.1%). Further exploratory work will be undertaken over the next two years in order to implement a risk-adjustment model to support these outcomes.

Figure 30: 30-day mortality rate by hospital 2023

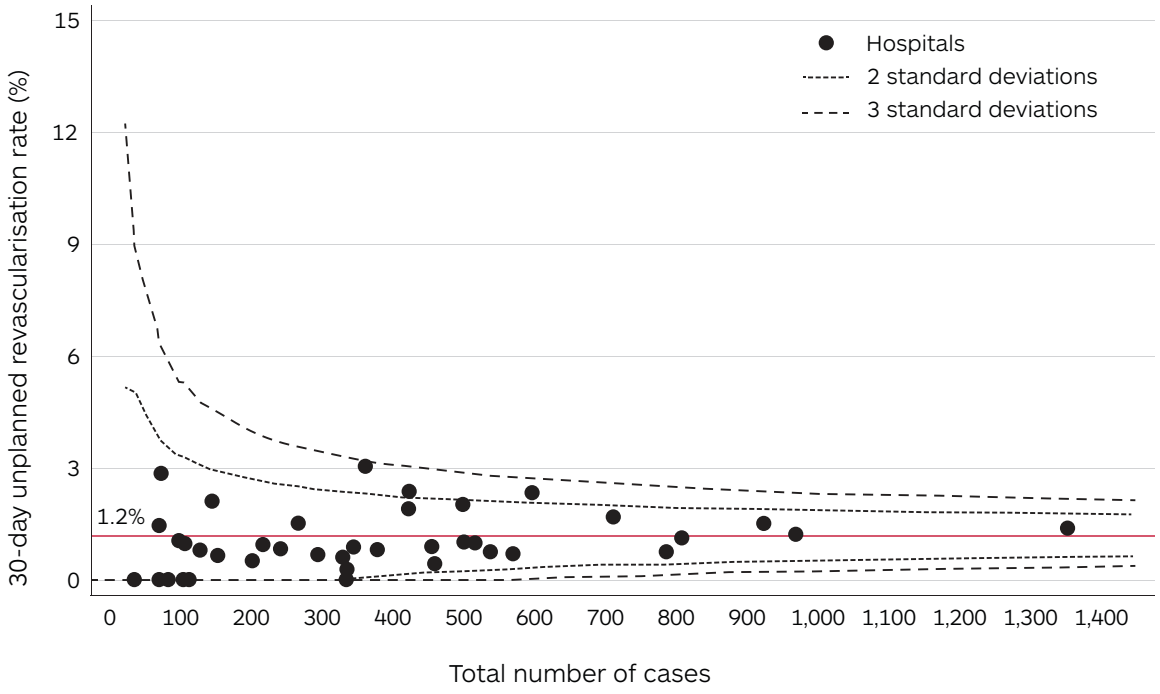


QI 8. **30-day mortality after PCI**

16.2 30-Day Unplanned Revascularisation

The overall rate of unplanned revascularisation within 30 days following PCI was 1.2% with all participating hospitals within expected limits (Figure 31) (range by hospital 0-3.1%).

Figure 31: 30-day unplanned revascularisation rate by hospital 2023

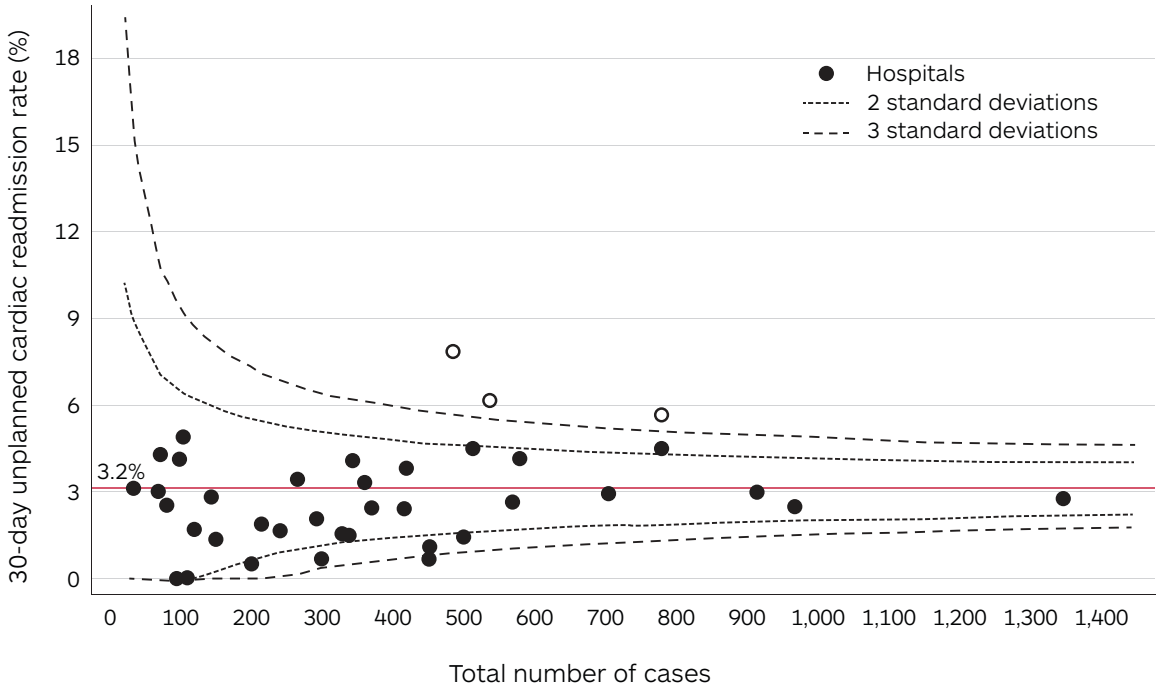


QI 7. **Unplanned revascularisation within 30 days**

16.3 30-Day Unplanned Cardiac Readmissions

Of the 38 hospitals contributing data for this outcome measure, three hospitals had rates of 30-day unplanned cardiac readmission that were >3 standard deviations beyond the mean.

Figure 32: 30-day unplanned cardiac readmission rate by hospital 2023



All of these hospitals had a medium to high case volume. The rate of unplanned cardiac readmission was 3.2%, ranging from 0% to 7.9% between hospitals (Figure 32).

QI 6. 30-day unplanned cardiac readmission rate after PCI

17. Acknowledgements

We would like to thank all State and Territory Registries for contributing to the NCR. We would also like to thank the NCR Steering Committee, the Monash Project Management Team at Monash University, School of Public Health and Preventive Medicine, NCR Ltd. Board Chairs Dr Leo Mahar (until October 2023) and Dr Jim Leitch (from October 2023), supported by the Company's Executive Officer Megan Schoder.

The Registry would not be possible without the participation of clinicians, allied health staff and all the Australian patients and their families who have contributed to the registries and shared their data to improve health outcomes for all Australians.

The Registry is a quality improvement initiative funded by the Commonwealth Department of Health and Aged Care.

Back row from left to right: A/Prof Jeff Lefkovits, Dr Rohan Poulter, Mr William Vollbon, A/Prof Catherine McDougall, Dr Jim Leitch, Prof Andrew Wilson, Ms Karen Carey, Mr David Follent, Mr Ben Weber, Mr Frank Gigliuto, Mr Ray Stewart

Front row from left to right: Dr Diem Dinh, Ms Megan Schoder, Ms Jasmine Pyyvaara, Dr Emily Granger, Dr Mayanna Lund, Mr Antony Kerslake, Prof Susannah Ahern, Ms Mel Tinsley

Taken at the NCR Workshop, October 2024

18. The Registry Project Management Team

Clinical Lead	Associate Professor Jeff Lefkovits
Program Manager, Cardiac Registries	Angela Brennan
Professor, Clinical Registries	Professor Susannah Ahern
Senior Research Fellow	Dr Diem Dinh
Program Manager, National Cardiac Registry	Jasmine Pyyvaara
Team Lead, Health Data Services	Mark Lucas
Senior Project Officer	Harriet Carruthers
Senior Project Officer	Ray Stewart
Project Officer	Tharini Sivakumaran
Communications Manager	Claudia Lassetter
Data Visualisation Analyst	Milinda Abayawardana

19. Governance Structure

19.1 The NCR Board

The NCR Board comprises the Chair, representation from each state and territory and representation from the Cardiac Society of Australia and New Zealand (CSANZ) and the Australian and New Zealand Society of Cardiac and Thoracic Surgeons (ANZSCTS).

From left to right: President of ANZSCTS Dr Emily Granger, Chair of the NCR Board Dr Jim Leitch, President of CSANZ Dr Mayanna Lund.
Taken at the NCR Workshop, October 2024.

Table 10: National Cardiac Registry Limited Board

Member	Role within Board	Substantive Role
Dr Leo Mahar	Chair	Cardiologist (until October 2023)
Dr James Leitch	Chair	Cardiologist (from October 2023)
Professor John Atherton	CSANZ representative	Director of Cardiology, Royal Brisbane and Women's Hospital, Professor, School of Clinical Medicine, Royal Brisbane Clinical Unit, Faculty of Medicine, University of Queensland, Adjunct Professor, School of Biomedical Sciences, Faculty of Health, Queensland University of Technology
Associate Professor Andrew Cochrane	ANZSCTS representative	Cardiothoracic Surgeon, Monash Heart, Monash Medical Centre Clayton and Chair of ANZSCTS Science and Education Committee (until March 2024)
Associate Professor Jayme Bennetts	ANZSCTS representative	Director of Cardiothoracic Surgery, Monash Health, Professor, Monash University (from April 2024)
Dr Dinesh Arya	Treasurer and ACT Board Director	Chief Medical Officer, ACT Health (until December 2023)
Dr Jean-Frederic Levesque	NSW Board Director	Chief Executive NSW Agency for Clinical Innovation; Deputy Secretary, Clinical Innovation and Research, NSW Ministry of Health
Dr Sara Watson	NT Board Director	Director of Medical Services, Royal Darwin and Palmerston Hospitals, NT Health (until March 2024)
Dr Angus Baumann	NT Board Director	Cardiologist, Alice Springs Hospital (from August 2024)
Kirstine Sketcher-Baker	QLD Board Director	Executive Director at Patient Safety and Quality Improvement Service, Clinical Excellence Division, QLD Health (until July 2023)
Associate Professor Catherine McDougall	QLD Board Director	Chief Medical Officer, QLD Health (from July 2023)
Dr Michael Cusack	SA Board Director	Chief Medical Officer, SA Health
Ms Hannah Paal	TAS Board Director	Statewide Manager, Acute Service Development and Enhancement Unit, Tasmania Health (until February 2024)
Dr Paul MacIntyre	TAS Board Director	Clinical Director of Acute Medical Services, Royal Hobart Hospital (from April 2024)
Professor Andrew Wilson	VIC Board Director	Chief Medical Officer, Safer Care Victoria
Dr Audrey Koay	WA Board Director	Executive Director, Patient Safety and Clinical Quality Department of Health Western Australia

19.2 National Cardiac Registry Audit and Risk Committee

The Audit and Risk Committee has been established to provide technical advice and support to the NCR Board in relation financial management, risk and auditing.

Table 11: National Cardiac Registry Audit and Risk Committee

Member	Role within Committee	Substantive Role
Hannah Paal	Acting Chair	Director Health Planning, Department of Health Tasmania (until February 2024)
Dr Audrey Koay	Member	Executive Director, Patient Safety and Clinical Quality Department of Health Western Australia
Dr Dinesh Arya	Member	Chief Medical Officer ACT Health (until December 2023)
Dr Michael Cusack	Member	Chief Medical Officer SA Health
Dr Angus Baumann	Member	Cardiologist, Alice Springs Hospital (from October 2024)
Ms Megan Schoder	Secretary	Executive Officer, NCR Limited

19.3 National Cardiac Registry Indigenous Committee

The NCR Indigenous Committee has been established to provide expert advice and input to help shape the Registry for the benefit of Aboriginal and Torres Strait Islander people with member representation from across Australia.

Table 12: National Cardiac Registry Indigenous Committee

Member	Role within Committee	Substantive Role
Mr David Follent	Chair and NSW Representative	Senior Project Officer, CCAP, NSW Agency for Clinical Innovation
Miss Wendy Ah Chin	Deputy Chair and QLD Representative	Executive Director of Aboriginal and Torres Strait Islander Health (until February 2023)
Mr Bob Buffington	ACT Representative	Aboriginal Health Clinician
Tanya Schramm	TAS Representative	Senior Lecturer, Aboriginal & Torres Strait Islander Health Education, University of Tasmania
Mrs Christine Ingram	VIC Representative	Team Leader & Outreach Worker Integrated Team Care Program
Ms Nola Naylor	WA Representative	South Metropolitan Health Service Director of Aboriginal Health Strategy, WA Health (Until May 2023)
Ms Megan Schoder	Secretary	Executive Officer, NCR Limited

19.4 National Cardiac Registry Variation Oversight Committee

The Variation Oversight Committee has been established to provide a mechanism for the reporting of variation in collaboration with participating registries. A core function of established clinical quality registries is to ensure that unwanted variation is addressed in a timely manner and communicated to relevant stakeholders.

Table 13: National Cardiac Registry Variation Oversight Committee

Member	Role within Committee	Substantive Role
Dr Leo Mahar	Chair	Cardiologist (Until October 2023)
Professor Andrew Wilson	Chair	Chief Medical Officer, Safer Care Victoria (from October 2023)
Associate Professor Andrew Cochrane	Member	Cardiothoracic Surgeon, Monash Heart Monash Medical Centre Clayton and Chair of ANZSCTS Science and Education Committee (until March 2024)
Associate Professor Rosanna Tavella	Member	CADOSA Registry Manager, Clinical Data Manager, Central Adelaide Local Health Network Affiliate A/Professor, Adelaide Medical School, University of Adelaide (from October 2023)
Dr Rohan Poulter	Member	Interventional Cardiologist, Sunshine Coast University Hospital and Chair of the QCOR Interventional Steering Committee (from October 2023)
Dr James Leitch	Member	Cardiologist (from August 2024)

19.5 National Cardiac Registry Steering Committee

The steering committee has been established to implement the strategic direction of the NCR, oversee the management of registry operations, report program operations and outcomes, review performance, and establish governance arrangements for collection, use and disclosure of data held within the Registry.

The core functions are:

(a) Report progress against deliverables to the Board;
(b) Engage with States and Territories to promote participation;
(c) Design registry outputs and oversee data analysis and reporting;
(d) Oversee the operational aspects of the registry - from its design, policy development, output and reporting;
(e) Fulfil all specific obligations as outlined within NCR policy documents
(f) Provide advice on annual status reports, project plans including stakeholder analysis, communication strategy and risk management plan;
(g) Monitor the infrastructure model including technical and data hosting services and processes for the organisation of data;
(h) Define the minimum dataset and clinical quality indicators;
(i) Steer the ongoing development of the design of the National Cardiac Registry including; patient case selection, data collection processes, data management, analytics and methods to facilitate reporting to a range of stakeholders for ongoing quality improvement; and
(j) Provide advice on a business model and assess the options for supporting the National Cardiac Registry, including cost-recovery options;
(k) Review requests for NCR data with recommendations to the Board.

The NCR steering committee is comprised of Australian state and territory representatives, clinicians, government representatives, subject matter experts, Australian government nominees, a consumer representative, an Aboriginal and Torres Strait Islander Peoples representative, and a cardiac surgeon.

Table 14: National Cardiac Registry Steering Committee

Member	Role within Committee	Substantive Role
Associate Professor Jeff Lefkovits	Chair	Interventional Cardiologist at Royal Melbourne Hospital; Clinical Lead for the Victorian Cardiac Outcomes Registry
Dr Rohan Poulter	Deputy Chair	Interventional Cardiologist at Sunshine Coast University Hospital; Chair of the Queensland Cardiac Outcome Registry Interventional Steering Committee
Dr Ren Tan	ACT Clinical Expert	Senior Cardiologist, Division of Cardiology, Canberra Health Services (until August 2023)
Dr Peter Scott	ACT Principal Investigator	Director of Cardiology, Cardiology of Division, Canberra Health Division of Canberra Health Services (from August 2023)
Mrs Sue Morberger	ACT Jurisdictional Representative	Project Officer, Cardiac Registry, Cardiology, Division of Medicine, Canberra Health Services
Professor David Brieger	NSW Clinical Expert	Interventional Cardiologist and Head of Cardiology, Concord Hospital; Board Chair of the Australasian Cardiac Outcomes Registry; Member, NSW Cardiac Clinical Network
Ms Mel Tinsley	NSW Jurisdictional Representative	Associate Director, Integrated Digital Enablement Accelerator (IDEA), Agency for Clinical Innovation
Dr Catherine Francis	NSW Registry Representative	Senior Cardiologist, Division of Cardiology, Canberra Health Services (until August 2023)
Dr Marcus Ilton	NT Clinician Expert	Cardiologist and Director of Cardiology, Royal Darwin Hospital
Ms Justine Williams	NT Gov. Representative	Cardiology Research Coordinator and Cardiac Quality Nurse, Cardiac Expansion Unit, Royal Darwin Hospital
Mr William Vollbon	QLD Gov. Representative	Queensland Cardiac Outcomes Registry Manager, Statewide Cardiac Clinical Informatics Unit, Queensland Health
Professor Chris Zeitz	SA Gov. Representative	Coronary Angiogram Database of South Australia, Head of Cardiology at Queen Elizabeth Hospital
Professor John Beltrame	SA Clinical Expert	Professor of Medicine, Michell Chair, Adelaide Medical School, University of Adelaide; Senior Cardiologist, Director of Research, Central Adelaide Local Health Network; CADOSA Data Custodian
Associate Professor Rosanna Tavella	SA Registry Representative	CADOSA Registry Manager, Clinical Manager, Central Adelaide Local Health Network Affiliate; A/Professor, Adelaide Medical School, University of Adelaide
Ms Jennifer Garden	TAS Gov. Representative	RN BTeach MN, Assistant Director of Nursing - Clinical Quality, Clinical Quality, Regulation and Accreditation (CQRA), Tasmanian Department of Health (until September 2023)
Dr Elizabeth Webber	TAS Gov. Representative	Medical Advisor Clinical Quality, Clinical Governance Medical Director, GP and Primary Care, Clinical Quality, Regulation and Accreditation (CQRA) Group, DoH Tasmania (from September 2023)

Member	Role within Committee	Substantive Role
Dr Andrew Black	TAS Clinical Expert	Cardiologist and Staff Specialist in Cardiology at Royal Hobart Hospital
Ms Angela Brennan	VIC Registry Expert	Program Manager, Cardiac Registries at CCRET, School of Public Health and Preventive Medicine, Monash University
Ms Felicity Loxton	Vic Gov. Representative	Director, Centre of Clinical Excellence, Safer Care Victoria (until February 2023)
Ms Michelle Wolthuizen	VIC Gov Representative	Director, Safety Insights, Safer Care Victoria (from February 2023 to September 2024)
Ms Nina Mulvey	VIC Gov. Representative	Assistant Director, Safety Insights, Safer Care Victoria (from February 2024 to September 2024)
Professor Tom Briffa	WA Clinical Expert	Cardiovascular Epidemiology Research Centre, School of Population and Global Health, University of Western Australia (until August 2024)
Dr Jamie Rankin	WA Clinical Expert	Head of Cardiology, Fiona Stanley Hospital, Western Australia (until August 2024)
Dr Jon Spiro	WA Clinical Expert	Interventional Cardiologist at Royal Perth Hospital; Senior Clinical Lecturer, University of Western Australia
Professor Girish Dwivedi	WA Clinical Expert	Consultant Cardiologist, Fiona Stanley Hospital; Professor of Cardiology, University of Western Australia
Mr Ben Weber	WA Gov. Representative	Senior Analyst, Patient Safety and Clinical Quality Directorate, Department of Health Western Australia (until October 2024)
Mr David Gist	Consumer Representative	Cardiovascular Service Consumer (until October 2023)
Ms Karen Carey	Consumer Representative	Consumer Representative (from February 2024)
Dr. Benjamin Michael Robinson	ANZSCTS Representative	Consultant Cardiothoracic Surgeon, Royal Prince Alfred Hospital (from August 2024)
Professor Susannah Ahern	Invited Guest	Head, Clinical Outcomes Reporting and Research, School of Public Health and Preventive Medicine, Monash University
Mr David Follent	NCR Chair of the Indigenous Committee	Senior Project Officer, CCAP Representative
Ms Sally Rayner	Department of Health and Aged Care Representative	Director - Clinical Quality Registries
Mr Antony Kerslake	Department of Health and Aged Care Representative	Assistant Director - Clinical Quality Registries

19.6 NCR Partners

Australian Government
Department of Health and Aged Care

CSANZ
Cardiac Society of Australia and New Zealand

Australian & New Zealand Society of Cardiac & Thoracic Surgeons

Heart Foundation

HER HEART

MONASH University

PlaytimeSolutions

ACTCOR
ACT Cardiac Outcomes Registry

CADOSA
Coronary Angiogram Database of South Australia

NSWCOR
New South Wales Cardiac Outcomes Registry

NTTCD
Northern Territory Top End Coronary Database

QCOR
Queensland Cardiac Outcomes Registry

VCOR
VICTORIAN CARDIAC OUTCOMES REGISTRY

WA CARDIOBASE EXTRACT

ACT Government | ACT Health

NSW GOVERNMENT Agency for Clinical Innovation

NORTHERN TERRITORY GOVERNMENT | NT Health

Queensland Government
Clinical Excellence Queensland | Queensland Health

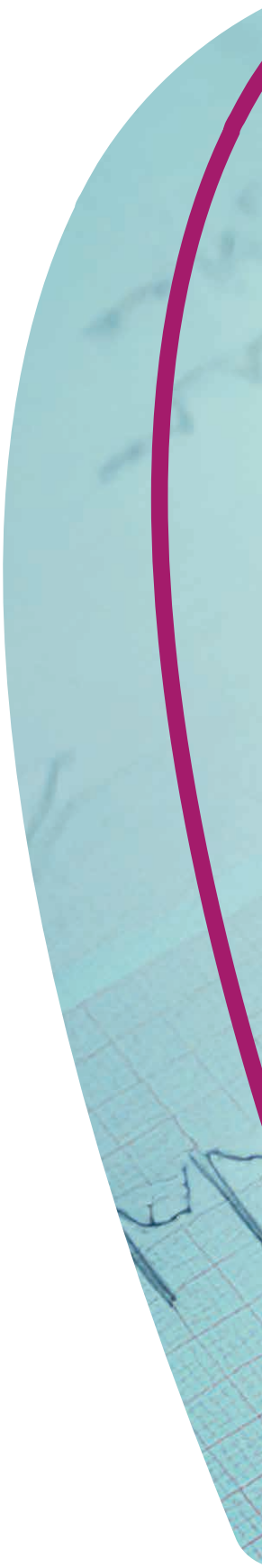
Government of South Australia
SA Health

Tasmanian Government | Department of Health

VICTORIA | Department of Health

Government of Western Australia
Department of Health

SCV Safer Care Victoria



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