NATIONAL CARDIAC REGISTRY

ANNUAL STATUS REPORT 2023

NATIONAL CARDIAC REGISTRY

A/Prof Jeffrey Lefkovits, Dr Rohan Poulter, Ms Jasmine Pyyvaara, Ms Angela Brennan,
Ms Harriet Carruthers, Ms Mathilda Wise, Mr Mark Lucas, Prof Susannah Ahern, Ms Claudia Lassetter,
Mr Milinda Abayawardana and Dr Diem Dinh on behalf of the Registry Steering Committee.

National Cardiac Registry Annual Report 2023. January 2024.

Report No 3, pages 80

Any enquiries about, or comments regarding this publication should be directed to:

The Registry Project Team
C/- School of Public Health and Preventative Medicine
Monash University
553 St Kilda Road
Melbourne VIC 3004
Phone: +61 3 9903 8646
Email: info@nationalcardiacregistry.org.au
Website: https://nationalcardiacregistry.org.au/

The National Cardiac Registry is supported by funding from the
Commonwealth Department of Health and Aged Care.

Data period: 1 January 2022 - 31 December 2022

Contents

List of Figures 5
List of Tables 5
Message from the Representative of the Indigenous Committee 8
Message from the Heart Foundation 9
Message from the Chair of the Board 10
Message from the Steering Committee 11
Executive Summary 12
1. Cardiovascular Health and Outcomes 13
2. Key Findings 14
3. A National Approach 15
4. The Next Steps 15
Timeline Page 16
5. Towards a National Target 18
5.1. Participating Hospitals 19
6. Pathway to Dynamic Reporting 21
6.1 Platform Design 21
6.2 Data Management and Security 22
6.3 Ethics approvals 22
7. Importance of CQRs 25
8. Measuring Quality and Performance 26
9. Coverage 27
10. Clinical Findings 30
10.1 Patient characteristics 30
10.2 Clinical Presentation 34
10.3 Clinical presentation with cardiogenic shock and/or OHCA 35
10.4 Access site 36
10.5 Procedural Success 39
11. STEMI Key Findings 41
12. Percutaneous Coronary Intervention for Acute STEMI 42
12.1 Prehospital notification 49
12.2 In-Hours Versus Out-Of-Hours Presentation 52
12.3 Times from symptom onset to first medical contact and diagnostic ECG to reperfusion 53
12.4 Radial Access In Primary PCI 55

13. In-Hospital Outcomes following PCI	58
13.1 In-hospital Mortality	58
13.2 In-Hospital Major Bleeding	61
13.3 Outcomes by Clinical Presentation and Hospital Characteristics	63
14. Discharge Medications and Secondary Prevention Programs	65
14.1 Compliance With Discharge Medication Prescribing	65
14.2 Referral to Cardiac Rehabilitation	66
15. 30-Day Outcomes	68
15.1 30-Day Mortality	68
15.2 30-day Unplanned Revascularisation	69
15.3 30-day Unplanned Cardiac Readmissions	70
16. Conclusions and Future Plans	71
17. Acknowledgements	71
18. The Registry Project Management Team	71
19. Acronyms	72
20. Glossary	73
21. Governance Structure	74
21.1 The NCR Board	74
21.2 National Cardiac Registry Audit and Risk Committee	75
21.3 National Cardiac Registry Indigenous Committee	75
21.4 National Cardiac Registry Variation Oversight Committee	76
21.5 National Cardiac Registry Steering Committee	76

List of Figures

Figure 1: 2022 Hospital Participation Rates 18
Figure 2: The Registry Digital Platform Key Attributes 21
Figure 3: The Registry Data Flow 23
Figure 4: The Registry Quality Indicators for PCI 26
Figure 5: Growth in PCI case numbers captured by the Registry, January 2019 to December 2022 27
Figure 6: PCI case numbers captured by the Registry, January 2019 to December 2022 27
Figure 7: Eligible participants 28
Figure 8A: Distribution of PCI patients by age group and sex 30
Figure 8B: Distribution of PCI by age group, sex, and Aboriginal and/or Torres Strait Islander status 31
Figure 9: Proportion of cases in-hours and out-of-hours by clinical presentation 34
Figure 10: PCI cases by clinical presentation 35
Figure 11: Shock and/or intubated OHCA cases by hospital volume 35
Figure 12: Arterial access route 2019-2022 36
Figure 13: Arterial access route by hospital 37
Figure 14: Primary PCI cases as a proportion of overall case numbers by hospital 43
Figure 15: Time from door to PCI-mediated reperfusion for primary PCI cases 2019-2022 44
Figure 16: Door-to-reperfusion time for primary PCI cases by hospital* 46
Figure 17: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital 47
Figure 18: Proportion of primary PCI cases with door to device time ≤60 minutes by hospital 48
Figure 19: Door-to-device time for primary PCI cases by prehospital notification status 2019-2022 49
Figure 20: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital - prehospital notification vs no prehospital notification* 51
Figure 21: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital -in-hours vs out-of-hours presentation 52
Figure 22: Median times from symptom onset to PCI mediated reperfusion 53
Figure 23: First medical contact to diagnostic ECG time for primary PCI cases by hospital 54
Figure 24: First medical contact to PCI-mediated reperfusion time for primary PCI cases by hospital 54
Figure 25: Diagnostic ECG to reperfusion by hospital 55
Figure 26: Radial access rates in primary PCIs by hospital 56
Figure 27: In-hospital mortality rate by hospital 58
Figure 28: In-hospital major bleeding rate by hospital 61
Figure 29: In-hospital unplanned revascularisation rate by hospital 62
Figure 30: In-hospital stroke rate by hospital 62
Figure 31: Referral to cardiac rehabilitation rate by hospital 67
Figure 32: 30-day mortality rate by hospital 68
Figure 33: 30-day unplanned revascularisation rate by hospital 69
Figure 34: 30-day unplanned cardiac readmission rate by hospital 70

List of Tables

Table 1: The Registry quality indicators (QIs) and data completeness 28
Table 2A: Patient characteristics by clinical presentation 32
Table 2B: Patient characteristics by hospital volume 32
Table 2C: Patient characteristics by on-site CABG vs off-site CABG hospitals 33
Table 2D: Patient characteristics by metro vs non-metro hospitals 33
Table 2E: Patient characteristics by sex 34
Table 3A: Procedural data by clinical presentation 39
Table 3B: Procedural data by hospital volume 39
Table 3C: Procedural data by on-site CABG vs off-site CABG hospitals 40
Table 3D: Procedural data by metro vs non-metro hospitals 40
Table 3E: Procedural data by sex 40
Table 4: Primary PCI cases as a proportion of overall case numbers by hospital types 42
Table 5A: Time from door to PCI mediated reperfusion for primary PCI cases 44
Table 5B: Door-to-device time for primary PCI cases by prehospital notification status 50
Table 5C: Median times from symptom onset to reperfusion by prehospital notification status 53
Table 6A: In-hospital mortality rates for selected patient group 59
Table 6B: In-hospital mortality rates by hospital volume 59
Table 6C: In-hospital mortality rates by on-site CABG vs off-site CABG centres 60
Table 6D: In-hospital mortality rates by metro vs non-metro hospitals 60
Table 7A: In-hospital outcomes by clinical presentation 63
Table 7B: In-hospital outcomes by hospital volume 63
Table 7C: In-hospital outcomes by on-site CABG vs off-site CABG hospitals 64
Table 7D: In-hospital outcomes by metro vs non-metro hospitals 64
Table 8: Rates of prescription of DAPT and LLT by clinical presentation and hospital type 65
Table 9: Rates of referral to cardiac rehabilitation by clinical presentation and hospital type 66
Table 10: National Cardiac Registry Limited Board 74
Table 11: National Cardiac Registry Audit and Risk Committee 75
Table 12: National Cardiac Registry Indigenous Committee 75
Table 13: National Cardiac Registry Variation Oversight Committee 76
Table 14: National Cardiac Registry Steering Committee 77

Message from the Representative of the Indigenous Committee

Mr David Follent – Chair of the Indigenous Committee

In 2022, the National Cardiac Registry (NCR) reported a familiar statistic that Aboriginal and Torres Strait Cardiovascular disease tends to strike at younger ages among Indigenous populations, leading to more severe health consequences. This statistic highlights the vital role of NCR in supporting the health system in responding to ensure equitable outcomes for Aboriginal and Torres Strait Islander people. Here's how it can benefit Indigenous cardiovascular health:

Identifying Disparities: The registry can help identify disparities in cardiovascular health outcomes between Indigenous and non-Indigenous populations. This knowledge is essential for understanding the unique challenges Indigenous communities face and developing targeted interventions to reduce these disparities.

Tailored Interventions: With the insights gained from the registry, healthcare organisations and policymakers can develop and implement culturally sensitive interventions specific to the needs of Indigenous populations. These interventions can include community-based programs, health education initiatives, and improved access to healthcare services.

Monitoring Progress: The registry provides a means to track progress over time. By regularly updating and analysing the data, stakeholders can assess the impact of interventions and policies to improve Indigenous cardiovascular health. This feedback loop is essential for refining strategies and ensuring they are effective.

Equitable Access to Care: The registry can help highlight disparities in access to cardiovascular care among Indigenous populations. This information can be used to advocate for improved healthcare infrastructure and resources in areas with significant Indigenous populations, ensuring equitable access to high-quality care.

In summary, the National Cardiac Registry addresses cardiovascular health disparities among Indigenous populations. By analysing this information specifically for Indigenous populations, policymakers and healthcare providers can identify trends, disparities, and areas needing improvement. Collecting, analysing, and utilising comprehensive data can guide evidence-based policies and interventions, ultimately working towards improved health outcomes and health equity for Aboriginal and Torres Strait Islander peoples.

Message from the Heart Foundation

Mr David Lloyd – CEO, Heart Foundation

For over 60 years, the Heart Foundation has been working towards a future free of heart disease. We acknowledge this is an ambitious vision, and we are dedicated to saving and improving lives through our work across research, support and care, and risk reduction. Since 1959, we have invested more than $720 million (in today's dollars) in life-saving cardiovascular research.

The National Cardiac Registry is an important resource to guide our research objectives, healthcare initiatives and advocacy efforts. National collaboration is imperative to ensure that clinical quality outcomes data available through the Registry is meaningful and relevant to all Australians, particularly those individuals who disproportionately bear the burden of heart disease in this country. The Heart Foundation is again delighted to see all states and territories represented this year, as well as private hospitals for the first time.

As the Registry continues to expand it will yield more comprehensive insights into the provision of cardiac health services throughout Australia. We eagerly anticipate the forthcoming efforts to incorporate data related to Cardiac Implantable Electronic Devices, a pivotal component of treatment for heart rhythm disorders.

We congratulate the National Cardiac Registry on this valuable report which now represents an accumulative body of over 70,000 cases, further enhancing our understanding of cardiac care in Australia.

Message from the Chair of the Board

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

This is my first report as the chair of the National Cardiac Registry, having been in this role only since October. I would like to take this opportunity to thank the inaugural chair, Dr Leo Mahar, for his vision and tireless work to lead the NCR from an idea to a company with a detailed governance structure and a registry collecting data on almost half the PCI procedures in Australia. On behalf of all the NCR staff, thank you Leo and all the best in your retirement.

The NCR is more than just a database – it represents the collective work of a group of dedicated individuals. I would like to thank our Executive Officer, Megan Schoder, all the members of the various committees (many of whom donate their time) and the entire Monash team who together are responsible for the outstanding results detailed in this report. I also thank the health care workers who have entered the individual data in addition to all their other duties, and the patients who have allowed their data to be employed to improve health outcomes. The NCR is funded by the Commonwealth Department of Health and Aged Care, and I thank them for their support which has allowed the Registry to grow and develop.

This year the number of hospitals contributing data has increased to 57 and data on 23,622 procedures have been included in the report - an increase of 5,154 on last year. Private hospitals are seeing the value of the Registry with 21 sites joining the Registry. All states and territories contributed to this report. We expect to see increased participation in the coming 12 months, as individual sites are now able to participate in the NCR by contributing data directly, without the need to go through the local participating State or Territory registry. The plan to extend the NCR to cardiac rhythm device implantation is progressing with the potential to extract data from the existing device databases.

No one in health care could dispute the need to monitor and report outcomes. Without a tool to evaluate individual, hospital and jurisdictional outcomes, continuous improvement is impossible. However, the Registry can be more than a mechanism to audit results, it can also help to highlight centres of excellence and disseminate their expertise. The NCR could also be used to evaluate novel changes to procedures and to measure efficiency, curtailing low value and wasteful interventions. All this requires active engagement from the cardiovascular community across Australia. That is our challenge for the future, one that I am confident the NCR team can meet.

Message from the Steering Committee

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

On behalf of the Steering Committee we are pleased to be able to present the third Annual Status Report from the National Cardiac Registry. As we reflect on another year of dedicated efforts to advance cardiac care, the Steering Committee acknowledges the engagement of all participants and stakeholders whose unwavering commitment has been instrumental in fostering progress of the Registry and driving positive outcomes with the delivery of high-quality and safe care.

In the past year, our collaborative initiatives have not only expanded the scope of the Registry but have also yielded valuable insights into cardiovascular health trends and treatment outcomes. Through expanding engagement and participation of hospitals in both public and private settings, the Registry continues to build a comprehensive database that will serve as a cornerstone for developing evidence-based practices, quality improvement and informed decision-making for cardiovascular care in Australia.

The challenges we face in establishing the NCR as a clinical quality registry that is embedded in the day-to-day practice of hospitals has only strengthened our resolve to enhance the Registry's role, outreach and impact. We remain committed to fostering collaboration, embracing technological advancements and exploring innovative avenues for data collection and analysis. As we look ahead, the Steering Committee is optimistic that our mutually cooperative linkages with the NCR Management Team, the NCR Board, the Department of Health and Aged Care and other key stakeholders will progress the Registry's vision to promote and ensure that best quality cardiovascular care is provided to all Australians.

Executive Summary

This third Annual Status Report from the National Cardiac Registry proudly represents a collaborative effort by 8 states and territories. Through their combined contribution to this clinical quality registry, PCI performance and outcomes can be measured and benchmarked on a national scale. Since the commencement of data collection in 2019, there are now over 72,000 cases of PCI in the registry with this year's contribution of 23,622 cases reflecting the activity of 57 contributing hospitals from both the public and private sectors. As in the previous reports, quality assessment is reflected in the measurement and reporting of 11 quality indicators, specific to PCI. Results are reported at a hospital level and benchmarked with a national rather than jurisdictional perspective.

The Registry itself has arisen as a result of the priorities set by the Australian Government, in its National Clinical Quality Registry and Virtual Registry Strategy 2020-2030. It has been supported by several important national initiatives including the National Digital Health Strategy and the Australian Institute of Health and Welfare's Australian Health Performance Framework. The Registry's principles of best practice are modelled on the Australian Commission on Safety and Quality in Health Care's Framework for Australian Clinical Quality Registries.

The National Cardiac Registry recognises that we are in a climate of continuous quality improvement, with the goals of providing best practice care in a patient-centred manner and minimising unwanted variation in the quality and safety of cardiovascular care across the country – in all states and territories, in metropolitan and rural/regional centres and across all socioeconomic strata. For example, the NCR is aware of the increasing attention at payer, provider and consumer levels of the need to reduce the amount of low value care within certain categories of PCI. Other examples include ensuring that the right care is delivered to all people, irrespective of their location and demographics and avoiding both overuse and underuse of cardiac therapies such as coronary stents.

This year's report presents data on the performance and outcomes of PCI across the country, and for the first time, includes patient-level clinical data from both the public and private hospital sectors. Hospitals' performances are benchmarked at a national level, and the information obtained feeds back to jurisdictions and participating hospitals to support them in their ongoing quality assurance activities. The report highlights outcome and performance measures for PCI for ST elevation myocardial infarction (STEMI), as this condition particularly requires well-developed systems of care to ensure the best outcomes.

A summary of the key findings in this year's report follows. We hope you find the report informative and interesting.

1. Cardiovascular Health and Outcomes

Cardiovascular disease describes health conditions including heart disease and stroke

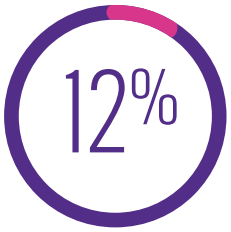
The annual estimated health system expenditure on CVD is

$12.7 **Billion**

CVD was the underlying cause of death for one quarter of all deaths in Australia in 2022[1]

90% of all **CVD related hospitalisations** in 2020-21 required acute hospital care

84% of all CVD hospitalisations were in those aged **55+**



of the **total burden of disease** in 2022 was attributed to CVD

At all ages, there was a **higher burden of CVD for males** than females

The burden of disease from CVD was **1.8 times higher** in the lowest socioeconomic areas in Australia versus the highest

Five major risk factors for CVD include tobacco use, being overweight (including obesity), poor diet, high blood pressure, and alcohol use

Aboriginal and Torres Strait Islander people, men, lower socioeconomic groups, those living in rural and remote areas are **disproportionately represented in hospitalisations for CVD**

Women are less likely to receive radial access for revascularisation than men[2]

1. Australian Bureau of Statistics. Causes of Death, Australia [Internet]. Canberra: ABS; 2022 [cited 2023 November 2]. Available from: https://www.abs.gov.au/statistics/health/causes-death/causes-death-australia/latest-release.
2. Murphy AC, Dinh D, Koshy AN, et al. Comparison of Long-Term Outcomes in Men versus Women Undergoing Percutaneous Coronary Intervention. Am J Cardiol. 2021;153:1-8. doi:10.1016/j.amjcard.2021.05.013

2. Key Findings

49%

The NCR is currently capturing **49%** of all PCIs performed annually, across Australia[3]

23,622 procedures were performed on **21,368 patients**

75.4%

of cases were performed on males, whose **average age** was **66.4 years**

19.6%

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

The **in-hospital major bleeding rate**, a potential complication, was 0.6% and was lower among radial access cases - 0.3%

PCI for **acute coronary syndromes** (ACS) accounted for **55.1% of the caseload**

Radial access is the predominant arterial approach for PCI, and is performed in **78.5% of procedures**. This rate has been increasing gradually since 2019

The **in-hospital mortality rate** was 1.6%

The overall rate of **referral to cardiac rehabilitation was 77.7%**. This was lower in private sites (72.3% vs 79.8% in the public sector) and lower amongst low volume centres - 66%

Primary PCIs make up 16.1% of all PCIs

30-day unplanned cardiac readmission rate was 4.3%

Major adverse cardiac event rate including; death, new myocardial infarction, stent thrombosis, unplanned revascularisation or stroke was highest among STEMI patients - 6.6% compared to the overall cohort at 2.5%

3. Australian Institute of Health and Welfare (2023) Heart, stroke and vascular disease: Australian facts, AIHW, Australian Government, accessed 01 November 2023.

3. A National Approach

A national approach to the prevention, management and treatment of cardiovascular disease within Australia has been established in line with *The National Strategy for Clinical Quality Registries 2020 to 2030* 10-year vision. The collection of a common dataset for the PCI procedure is ongoing. These data are analysed and reported, including within participating state and territory registries. These registries use the data to assess their outcomes compared to the overall cohort. The capacity for jurisdictions to compare their health services to the national average and share this information with hospitals and their clinical teams is a key aspect of clinical quality registries. The Registry is leading the way on core activities outlined within *The National Strategic Action Plan for heart disease and stroke 2020*[4] by bringing together each State and Territory to collect nationally consistent outcome measures for PCI and collaboratively track progress. Discussion and dissemination of information related to evidence-based decision making and addressing variation continues.

4. The Next Steps

The Registry is working towards nationally consistent data collection. There are a number of data elements that contribute to the key performance and quality measures which are not uniformly collected by all contributing state and territory registries. In 2023, a review of the national dataset was undertaken to ensure all data elements collected for the Registry are valid and relevant. Results from the consultative review will be implemented throughout 2024, with a small number of new and amended elements being incorporated into the dataset for collection in 2025.

The Registry is actively preparing to increase hospital participation in an effort to produce reports based on a more complete and robust dataset. Whilst the Registry has seen an increase of 21 private hospitals, several hospitals are yet to contribute to the Registry which impacts the ability to harness insights to drive better outcomes for all Australians. In 2023, the Registry will open up for direct hospital data collection, utilising an interim data collection tool, while the bespoke online platform infrastructure is reconfigured to support direct data entry. The current data journey of jurisdictional data contribution via existing State and Territory Registries will be maintained, in conjunction with direct hospital entry to increase hospital and case numbers.

As hospital and case numbers grow, there is opportunity for data linkage with other key datasets and registries, as well as embedding quality data into clinical practice through electronic medical records. The Registry hopes to expand the modules of data collected to widen its scope and incorporate other therapeutic areas beyond PCI.

4 National Strategic Action Plan for Heart Disease and Stroke September 2020 – Australian Government Department of Health - https://www.health.gov.au/resources/publications/national-strategic-action-plan-for-heart-disease-and-stroke 12

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 National Cardiac Registry

October
2018

Engagement of clinicians from States & Territories and development of strategy

April
2019

NCR project team employed through Monash University

August
2019

Funding approved for States and Territories to help facilitate in participation in NCR

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

July
2020
NCR Ltd. inaugural board meeting

October
2020
NCR inaugural status report

July
2021
NCR Platform goes live

April
2022
Funding secured within federal budget to support registry operations

May
2022
Launch of first public facing Annual Status Report

July
2022
All eight jurisdictions contributing data elements into the NCR platform

January
2023
Private hospitals commence participation

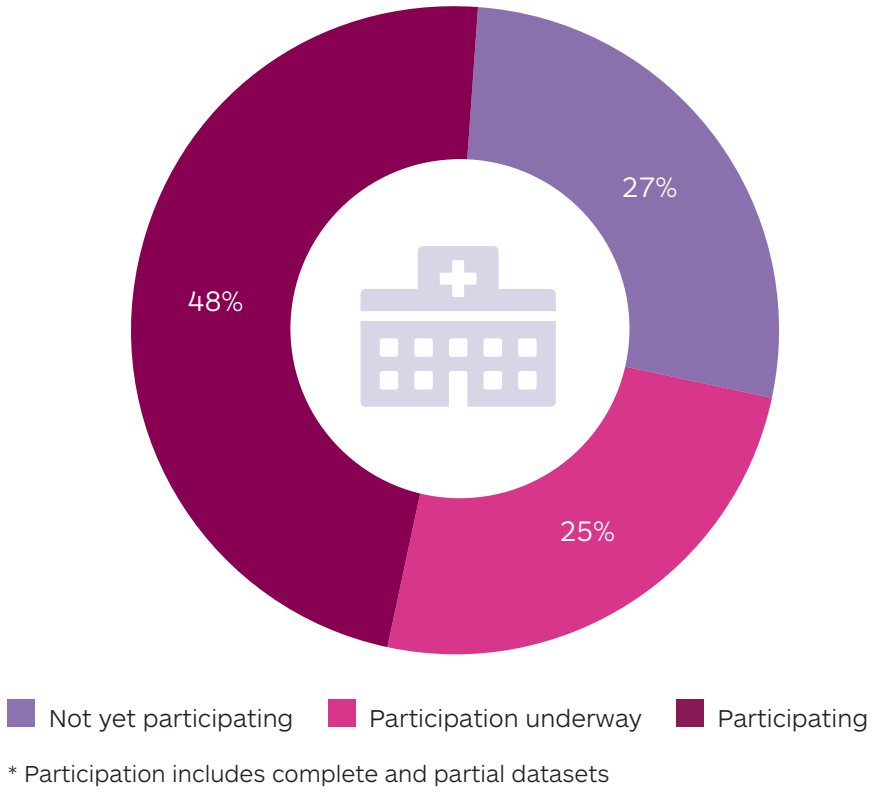
June
2023
Reached over 70,000 cumulative PCI cases

57 hospitals contributing data

5. Towards a National Target

Over the next 12 months the national participation goal is 45% of all eligible hospitals contributing the complete dataset. This includes 46% of public and 44% of private hospitals performing PCI. Over the next 12 months, a focus of the Registry will be to increase the number of private hospitals participating. The previous focus of the Registry pertained to public hospital participation. However, over the previous year private hospital data has been included in the Registry. The 2022 hospital participation rates are shown in Figure 1.

Figure 1: 2022 Hospital Participation Rates*



* Participation includes complete and partial datasets

As we further progress towards the national participation goal, additional activities will be explored including the development of risk adjustment models for key outcome measures such as 30-day mortality. To achieve this, the Registry needs to:

- Ensure that data collected is robust, complete and with high rates of jurisdictional hospital participation
- Ensure the use of well-organised and effective methods of data cleaning and analysis

Participating jurisdictional registries will need to:

- Continue to develop and implement processes for receiving and disseminating NCR data
- Engage in NCR-based committees that will manage data and oversee variation management.

5.1. Participating Hospitals

ACT

The Canberra Hospital

NSW

Concord Repatriation General Hospital
Wollongong Hospital
Orange Hospital
Nepean Hospital
Gosford Hospital

NT

Royal Darwin Hospital

QLD

Cairns Hospital
Gold Coast University 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
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
Monash Health
Mulgrave Private Hospital
Northern Hospital
Peninsula Private Hospital
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
The Alfred
University Hospital Geelong
Warringal Private Hospital
Western Private Hospital

WA

Fiona Stanley Hospital
Royal Perth Hospital
Sir Charles Gairdner Hospital

6. Pathway to Dynamic Reporting

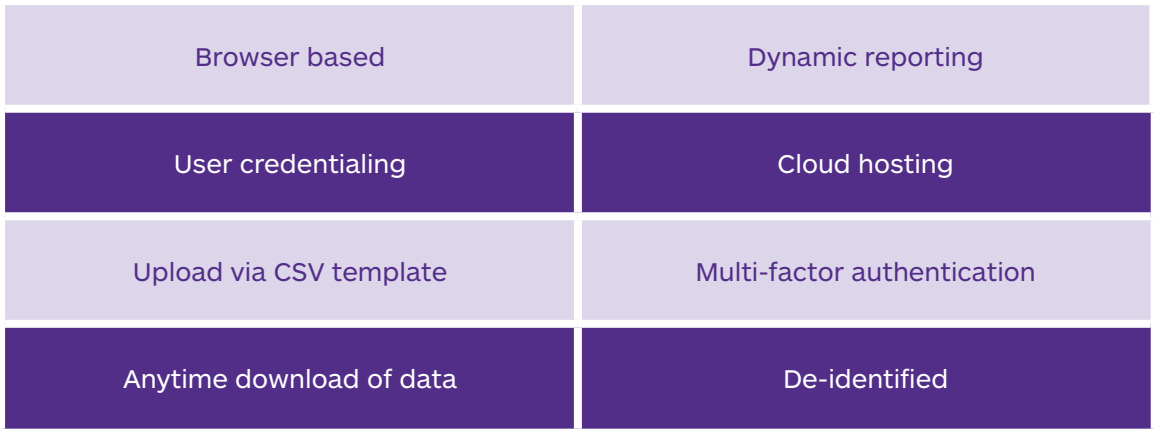
Dynamic Reporting describes the ability to view live data based on parameters chosen by the user, customising the view based on what is important to that user (as opposed to data cuts). The Registry has purpose built a state-of-the-art digital platform which hosts national level data enabling contributing state and territory registries to upload data on PCIs. Through this mechanism, dynamic and interactive reports are produced, aligning to the eleven key quality indicators (QIs), and in addition, annual supplementary reports are provided to participating registries. This provides an opportunity for states and territories to identify their own hospitals in the results published each year in the public annual report.

This model of dynamic reporting continues to allow for individual hospitals results to be compared to the national cohort, which will assist with improvement in clinical care for Australians with cardiovascular disease, and complement the reporting that is currently being undertaken at a State and Territory level.

6.1 Platform Design

The Registry platform was developed through extensive consultation with stakeholders to support the specific needs and requirements. The key features of the Platform are shown in Figure 2, with a key capability being the ability to adapt and modify the Platform as the Registry matures. Of utmost importance, features to ensure security and data safety such as secure user credentialing, multi-factor authentication, and cloud hosting in a secure browser-based environment underpin the Platform.

Figure 2: The Registry Digital Platform Key Attributes



6.2 Data Management and Security

The Registry works with state and territory registries to ensure that data are provided in-line with agreed time frames and policies. A comprehensive Data Management plan has been developed to ensure that all parties are aware of their obligations in line with the National Statement on Ethical Conduct in Human Research[5].

Regular meetings are held with state and territory registries to ensure that the data collected and submitted to the Registry are accurate, complete and meet the requirements for upload to the platform. Once data submission is finalised by all state and territory registries, an extensive statistical analysis is undertaken to identify trends, patterns and outcomes forming the content of this report.

The Registry also adheres to its Data Governance Framework which outlines how data are handled and is based around the five safes framework[6].

As shown in Figure 3, de-identified data in the NCR platform are securely hosted within Australia. The Registry continues to have multiple layers of security in place, and rigorous testing has been conducted to ensure appropriate levels of protection are applied to the platform.

The Registry routinely reviews all policies relating to the management and access to registry data.

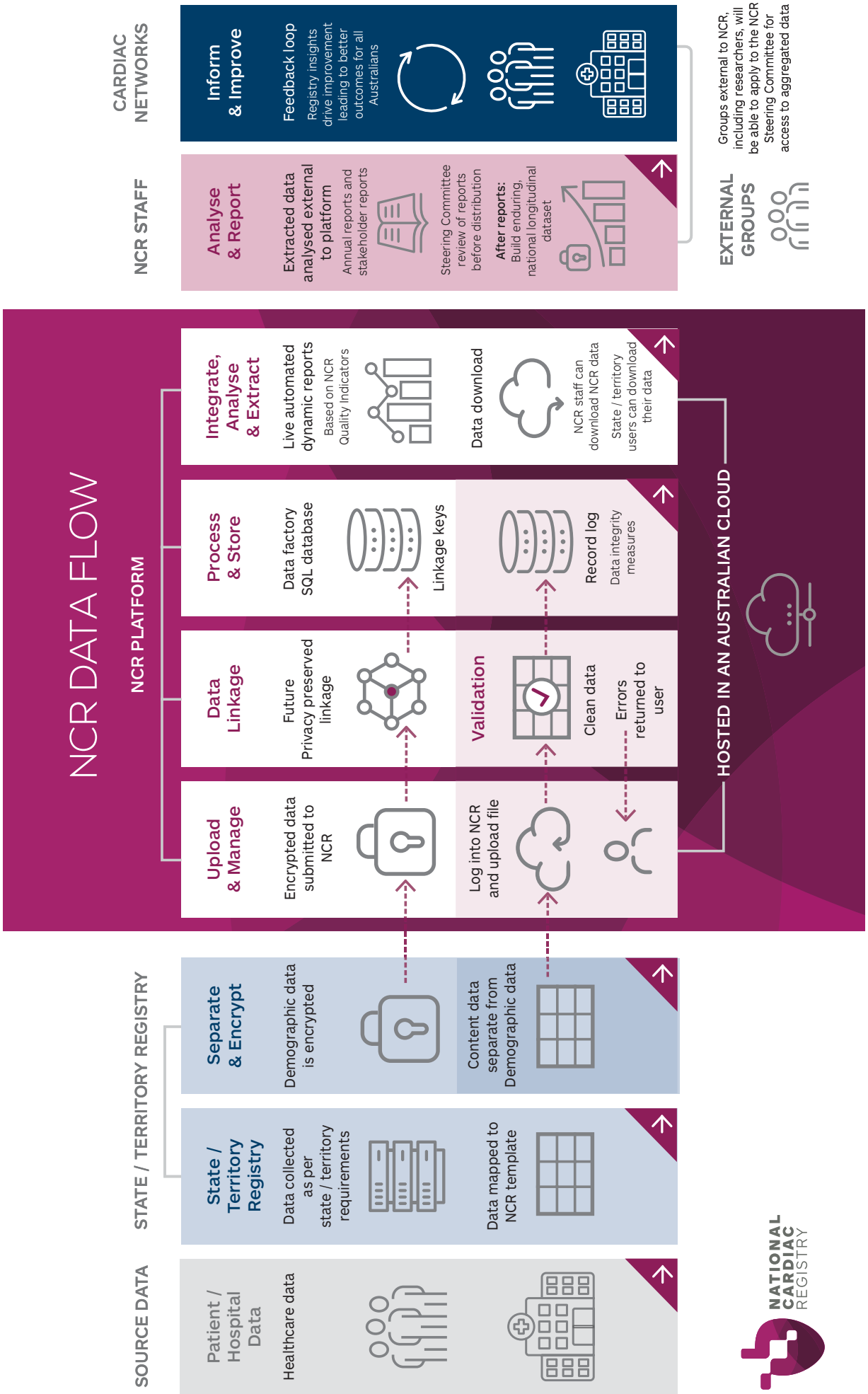
6.3 Ethics approvals

The Registry 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. Each state and territory registry has appropriate approvals in place in order to contribute data.

5 https://www.nhmrc.gov.au/sites/default/files/documents/attachments/publications/National-Statement-Ethical-Conduct-Human-Research-2023.pdf

6 https://www.abs.gov.au/about/data-services/data-confidentiality-guide/five-safes-framework

Figure 3: The Registry Data Flow



7. Importance of CQRs

Hospitals capture patient data for funding, reporting purposes and to track the care provided to patients; we refer to this as hospital administrative data. However, they do not routinely collect information about the quality or effectiveness of the care provided and its impact on the patient.

Clinical quality registries (CQRs) are databases that collect data about health outcomes – the quality and effectiveness of the experiences and care provided to patients (and sometimes their carers), who have been treated with a particular surgical procedure, or drug, diagnosed with a particular illness, e.g. stroke; or managed via a specific healthcare resource, e.g. treated in an intensive care unit.

They are long term observational studies, where the effect of a treatment or intervention is observed and captured without interfering in it. Registries collect a comprehensive set of critical data, including patient demographics, along with programs of care provided over several years. The more data is collected, the more reliable is the analysis of outcomes. CQRs for instance can identify potential risks and identify if certain cohorts of patients have better outcomes than others.

The data are analysed and provided to doctors, hospitals as well as state and federal health departments to help improve the overall standard of care, and to make sure that the health care system is continuously evaluating itself and improving.

Early phase registries such as the NCR add value as soon as they begin recruitment. The NCR has representation from highly experienced clinicians which then encourages clinician participation across multiple specialties.

The collaboration that arises in the establishment and ongoing activities of the Registry supports harmonisation of clinical practice across the specialties. The aim of registries, including the NCR, is to minimise undesirable variation. Evidence-based guidelines are reviewed to inform the development of the Registry datasets and to align with clinician expectations regarding what effective contemporary clinical practice looks like. Registry data and clinical quality indicators in particular are based on the agreed best standards of care, and are reviewed regularly. By requesting for this data to be captured, registries influence the standards of care provided in the health system.

These data sets are also informed by international data collections, to allow future international harmonisation where possible. Registries create standardised datasets that allow comparison of practice and outcomes within and across specialties, across public and private settings, metropolitan and rural settings, and across states and territories. The regular comparison of clinical practice amongst peers is an important part of the quality improvement cycle and an essential part of the health learning system. Patients can be reassured when their hospitals participate in registries as it shows a commitment to providing high quality care.

Data comparison can be reassuring especially for new specialists and those working in smaller communities that may not handle large volumes of patients presenting with specific clinical issues.

There are 111 Clinical Quality Registries in Australia, details of which can be found on the Australian Register of Clinical Registries[7]. The NCR is one of ten national registries that has been funded under the Federal Government's Clinical Quality Registries Program.

7 Australian Register of Clinical Registries | Australian Commission on Safety and Quality in Health Care

8. Measuring Quality and Performance

As shown in Figure 4, the Registry reports on 11 indicators for PCI which include five performance indicators and six outcome indicators.

Figure 4: 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. Peri-PCI 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

These indicators were selected via a consultative process guided by the Steering Committee and reflect the care continuum for patients who undergo PCI. They include performance measure indicators including referral to cardiac rehabilitation and outcome measures such as stroke after PCI.

This report includes analyses of data pertaining to all 11 indicators. As in previous reporting, some state and territory registries are still working towards the capture of the complete minimum dataset, thus data completeness varies, requiring the exclusion of cases across various indicators (see Table 1 - page 28).

9. Coverage

Coverage relates to the proportion of hospital data that are collected nationwide. Of the 125 hospitals that perform PCI in Australia, 36 public hospitals and 21 private hospitals provided data in the 2022 reporting period. In this year's report, private hospital data are reported for the first time. The total number of cases in the Registry as at December 2022 exceeds 72,000 (Figure 5, 6).

Figure 5: Growth in PCI case numbers captured by the Registry, January 2019 to December 2022

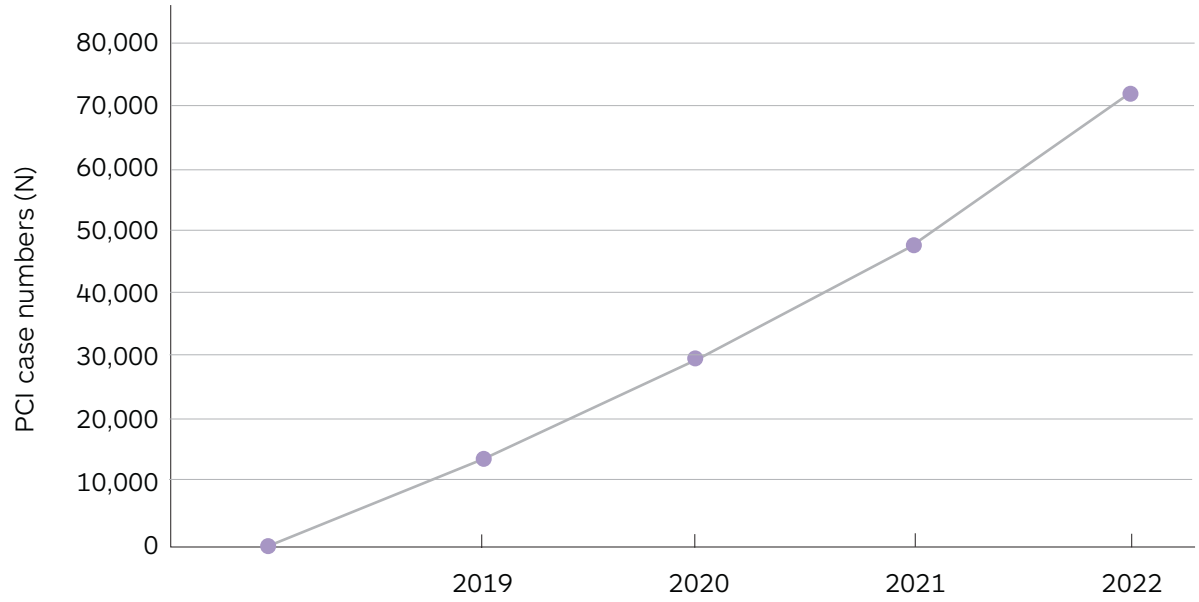


Figure 6: PCI case numbers captured by the Registry, January 2019 to December 2022

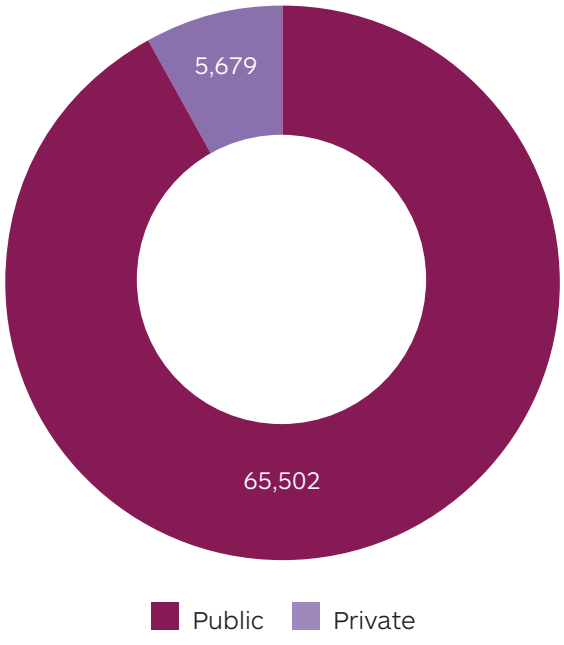


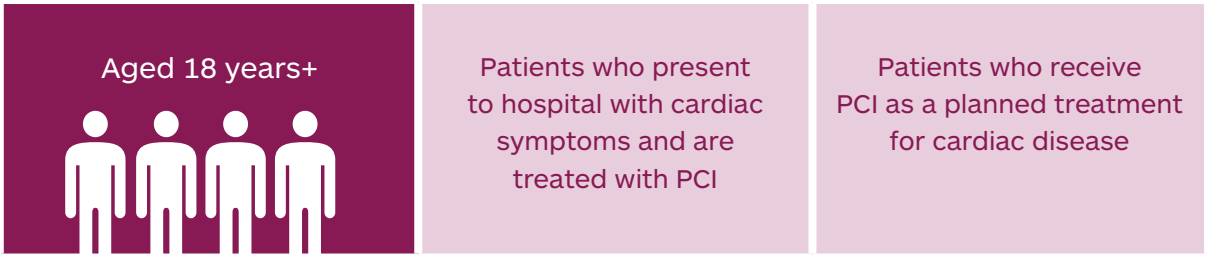
Table 1 presents the percentage of hospital participation of the 57 contributing hospitals across each of the eleven Registry quality indicators (QIs). With the current model of data collection, state and territory registries are responsible for the management of their own jurisdictional data. The data elements collected at a state and territory level impact the percentage of data provided to the Registry.

Table 1: The Registry quality indicators (QIs) and data completeness

	Indicator Type	Quality Indicator	Data completeness (%)	Sites contributing to QI	State/ Territories included in 2022 QI reports
1	Performance	Time from diagnostic electrocardiogram to PCI mediated reperfusion	84	37*	6
2	Performance	Time from door to PCI mediated reperfusion	91	40*	6
3	Outcome	Peri-PCI stroke	93	53	7
4	Outcome	In hospital major bleeding	93	53	7
5	Outcome	In hospital mortality	93	53	7
6	Outcome	30-day unplanned cardiac readmission rate after PCI	82	47	6
7	Outcome	Unplanned revascularisation within 30 days	68	39	5
8	Outcome	30-day mortality after PCI	82	47	6
9	Performance	Patients without contraindication discharged on lipid-lowering therapy	79	44	5
10	Performance	Patients referred to cardiac rehabilitation or other secondary prevention program	91	51	6
11	Performance	Proportion of patients without a clear and documented contraindication for Aspirin and/or a P2Y12 inhibitor, discharged on DAPT	79	44	5

*44 sites in this report undertake Primary PCI as reported in QIs 1 & 2.

Figure 7: Eligible participants



10. Clinical Findings

This report contains data on PCIs undertaken in public and private hospitals across Australia for the calendar year 1 January to 31 December 2022. A total of 23,622 new PCI cases were included in this report. Seven state and territory Registries contributed to QI data as outlined in Table 1. One registry did not contribute any data for QI reporting, and some state and territory registries did not provide the full minimum dataset. This is mainly related to 30-day outcomes, with each state and territory working towards complete data collection into the future. While there were 23,622 new cases, only 20,606 (87%) had sufficient information to be included in QI reporting due to the completeness of the data submitted.

10.1 Patient characteristics and clinical features

In contributing hospitals, a total of 23,622 new PCI cases were performed on 21,368 patients in 2022. Of those, 2,254 (9.5%) underwent more than one procedure. A total of 17,943 cases (76%) were treated in public hospitals. Overall, 75% of cases were performed on male patients. The median age for males was 66 years (IQR: 57, 74) and for females 70 years (IQR: 61, 78). The peak frequency of PCI procedures occurred in the sixth decade for males and the seventh decade for females (Figure 8a).

Three percent of all PCI patients in 2022 identified as Aboriginal and/or Torres Strait Islander peoples. Males accounted for 59% of this cohort. The median age of this cohort was similar between males and females (males: 56 years (IQR: 49, 64) and females: 57 years (IQR: 48, 65)) and younger for the overall cohort. The peak frequency of PCI procedures for this cohort occurred in the fifth decade for both males and females (Figure 8b).

Females in the Aboriginal and/or Torres Strait Islander peoples cohort had lower rates of diabetes (42% vs 58%), peripheral vascular disease (PVD) (2.3% vs 4.3%) and previous PCI (23% vs 31%) compared to males in the same cohort.

Figure 8A: Distribution of PCI patients by age group and sex

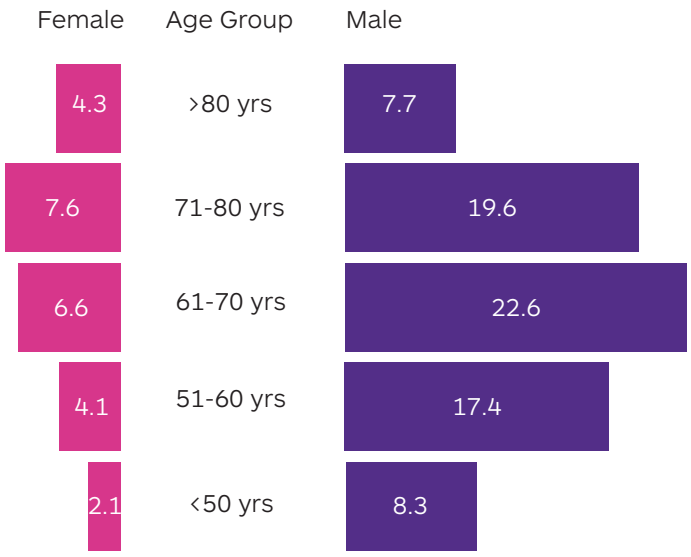


Figure 8B: Distribution of PCI by age group, sex, and Aboriginal and/or Torres Strait Islander status

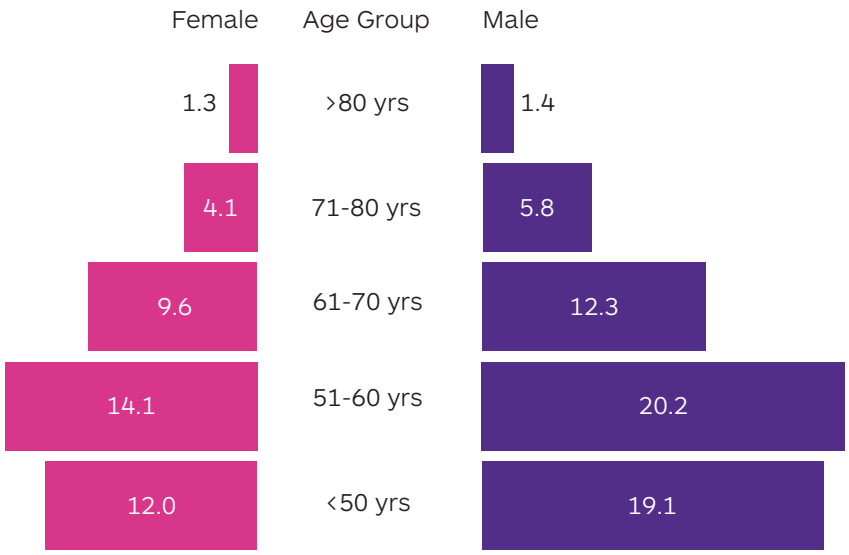


Table 2A (page 32) compares selected patient demographic information by clinical presentation, comprising ST-elevation myocardial infarction (STEMI), non-ST-elevation acute coronary syndromes (NSTEACS) and non-acute coronary syndromes (non-ACS). The STEMI cohort was younger, had fewer risk factors such as diabetes, PVD or severe obesity. This cohort had lower rates of revascularisation procedures (previous coronary artery bypass grafting (CABG) and PCI). There were higher rates of cardiogenic shock and out-of hospital cardiac arrest (OHCA) in STEMI patients, compared with NSTEACS and Non-ACS patients.

There were also differences in the demographic profiles among patients treated in selected hospital characteristics (Tables 2B to 2D - pages 32, 33). Those treated in the medium to high volume hospitals were younger, had more diabetes and moderately or severely reduced LVEF (Table 2B). Patients treated in non-metropolitan hospitals had fewer previous PCIs and a higher rate of moderately or severely reduced LVEF (Table 2C).

Patients treated in private hospitals were older - 71 years vs 65 years, with a similar distribution between the sexes as seen in the public sector.

Table 2A: Patient characteristics by clinical presentation

Patient characteristics	STEMI	NSTEACS	Non-ACS	All
	(N=4,956)	(N=6,096)	(N=9,554)	(N=20,606)
Age - years (mean+/-SD)	63.5+/-12.7	65.7+/-12.4	68.4+/-10.8	66.4+/-11.9
Female (%)	24.8	26.3	23.3	24.6
Male (%)	75.2	73.7	76.7	75.4
Diabetes (%)	21.6	28.1	27.2	26.1
Peripheral vascular disease (%)	2.2	4.1	3.9	3.5
Previous PCI (%)	12.0	23.2	39.6	28.1
Previous CABG (%)	2.0	7.2	7.0	5.9
Severe obesity (BMI≥35kg/m^2) (%)	11.2	15.2	13.0	13.2
Moderate or severe LV dysfunction (LVEF<45%) (%)	33.8	15.7	13.4	20.0
Cardiogenic shock (%)	7.4	1.0	0.4	2.3
Out-of-hospital cardiac arrest (%)	7.1	0.6	0.7	2.2
Estimated glomerular filtration rate ≤30mls/min (%)	3.5	3.5	2.9	3.2

Table 2B: Patient characteristics by hospital volume

Patient characteristics	Low volume <250	Medium volume 250-500	High volume >500
	(N=2,027)	(N=7,816)	(N=10,763)
Age -years (mean+/-SD)	68.3+/-11.5	66.3+/-11.9	66.2+/-12.0
Female (%)	24.3	24.5	24.7
Male (%)	75.7	75.5	75.3
Diabetes (%)	22.0	24.9	27.8
Peripheral vascular disease (%)	3.7	3.2	3.8
Previous PCI (%)	29.6	28.1	27.9
Previous CABG (%)	6.2	5.4	6.1
Severe obesity (BMI≥35kg/m^2) (%)	10.6	13.1	13.8
Moderate or severe LV dysfunction (LVEF<45%) (%)	11.5	20.7	21.1
Cardiogenic shock (%)	1.9	2.2	2.4
Out-of-hospital cardiac arrest (%)	1.0	2.3	2.4
Estimated glomerular filtration rate ≤30mls/min (%)	2.5	2.9	3.6

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

Patient characteristics	On-site CABG (N=11,683)	Off-site CABG (N=8,923)
Age -years (mean+/-SD)	67.0+/-11.8	65.7+/-12.1
Female (%)	23.7	25.7
Male (%)	76.3	74.3
Diabetes (%)	26.3	25.9
Peripheral vascular disease (%)	3.5	3.6
Previous PCI (%)	29.3	26.6
Previous CABG (%)	6.4	5.1
Severe obesity (BMI≥35kg/m²) (%)	12.7	13.9
Moderate or severe LV dysfunction (LVEF<45%) (%)	19.2	21.1
Cardiogenic shock (%)	2.1	2.5
Out-of-hospital cardiac arrest (%)	2.0	2.4
Estimated glomerular filtration rate ≤30mls/min (%)	3.0	3.5

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

Patient characteristics	Metro (N=16,603)	Non-metro (N=4,003)
Age -years (mean+/-SD)	66.7+/-11.9	65.5+/-12.1
Female (%)	24.2	26.4
Male (%)	75.8	73.6
Diabetes (%)	26.4	25.0
Peripheral vascular disease (%)	3.6	3.3
Previous PCI (%)	29.0	24.6
Previous CABG (%)	5.9	5.9
Severe obesity (BMI≥35kg/m²) (%)	12.9	14.4
Moderate or severe LV dysfunction (LVEF<45%) (%)	18.7	25.2
Cardiogenic shock (%)	2.3	2.4
Out-of-hospital cardiac arrest (%)	2.1	2.7
Estimated glomerular filtration rate ≤30mls/min (%)	3.2	3.3

Table 2E presents patient characteristics by sex. Males undergoing PCI were younger, had lower rates of diabetes and severe obesity (BMI ≥35kg/m²) and more previous PCIs. With respect to the type of clinical presentation in 2022, the proportion of females presenting with ACS was slightly higher than males (56% vs 53%).

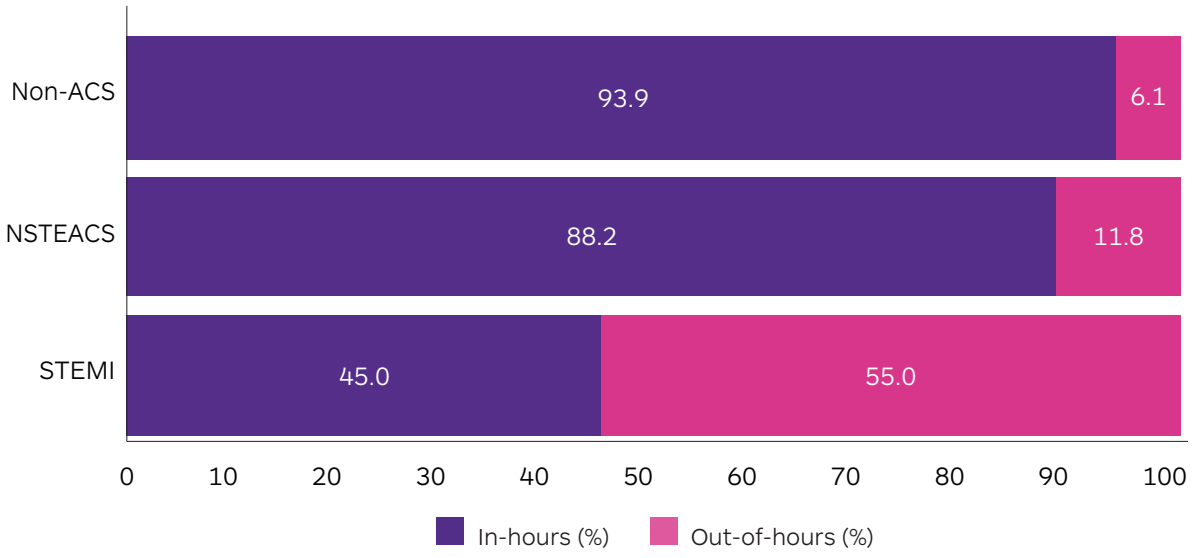
Table 2E: Patient characteristics by sex

Patient characteristics	Male (N=15,541)	Female (N=5,065)	All (N=20,606)
Age - years (mean+/-SD)	65.6 +/- 11.8	69.0 +/-12.0	66.4 +/- 12.9
Diabetes (%)	25.3	28.7	26.1
Peripheral vascular disease (%)	3.4	4.0	3.5
Previous PCI (%)	29.7	23.3	28.1
Previous CABG (%)	6.3	4.6	5.9
Severe obesity (BMI≥35kg/m²) (%)	11.9	17.2	13.2
Moderate or severe LV dysfunction (LVEF<45%) (%)	20.7	18.0	20
Cardiogenic shock (%)	2.2	2.6	2.3
Out-of-hospital cardiac arrest (%)	2.5	1.4	2.2
Estimated glomerular filtration rate ≤30mls/min (%)	2.5	5.4	3.2

10.2 Clinical Presentation and Access

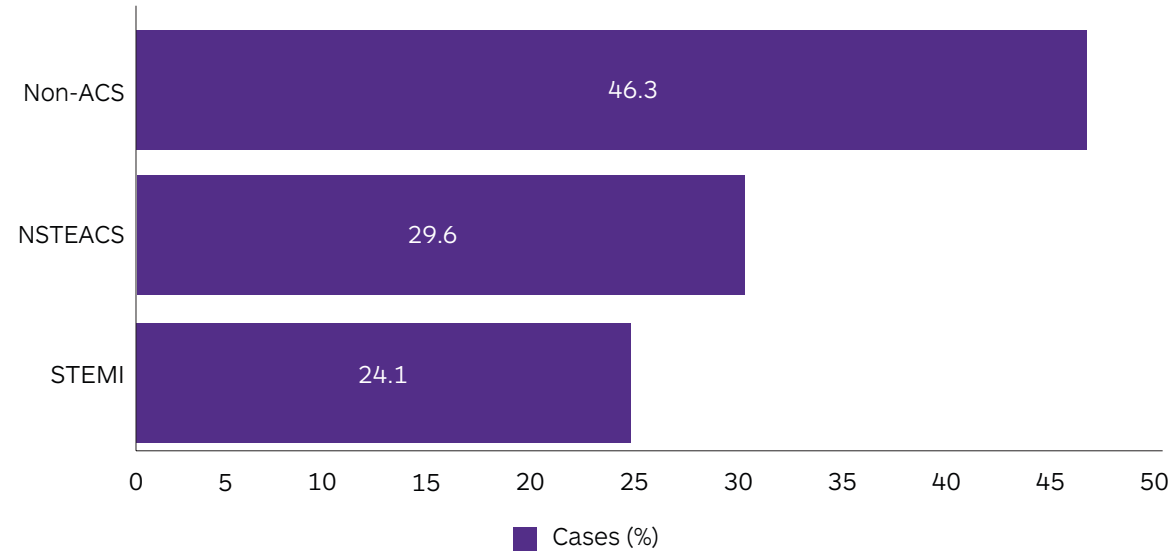
One fifth of the caseload (n=4,032, 19.6% of the total cases) were performed out-of-hours, the majority of which were for STEMI (67.7% of out-of-hours cases) (Figure 9). These results in this report vary slightly from the previous year, which may be due to the inclusion of data from twenty-one private hospitals.

Figure 9: Proportion of cases in-hours and out-of-hours by clinical presentation*



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

Figure 10: PCI cases by clinical presentation

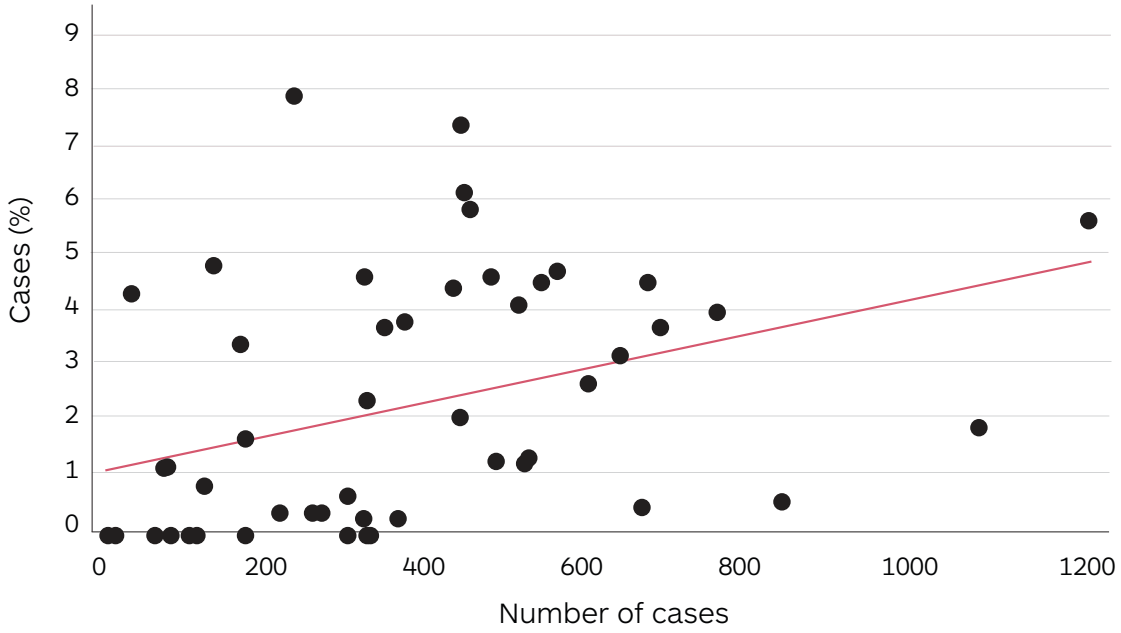


Over half of the PCI cases were for treatment of an ACS (STEMI or NSTEACS). The majority of public sector activity was ACS-related (65%), whereas the private sector mostly dealt with non-ACS cases (76%). Over half of the ACS case workload (54%) was performed in the high-volume centres, 39% in medium volume hospitals and only 7% in low volume hospitals.

10.3 Clinical presentation with cardiogenic shock and/or OHCA

Figure 11 presents the proportion of shock and/or intubated OHCA by hospital volume. These conditions accounted for 3% of hospitals' caseload on average (range 0-7.9%). The majority (96%) of these high acuity cases were managed in public hospitals. In 2022, this clinical subset made up 3.9% of public sector activity compared to 0.4% of private sector workload.

Figure 11: Shock and/or intubated OHCA cases by hospital volume

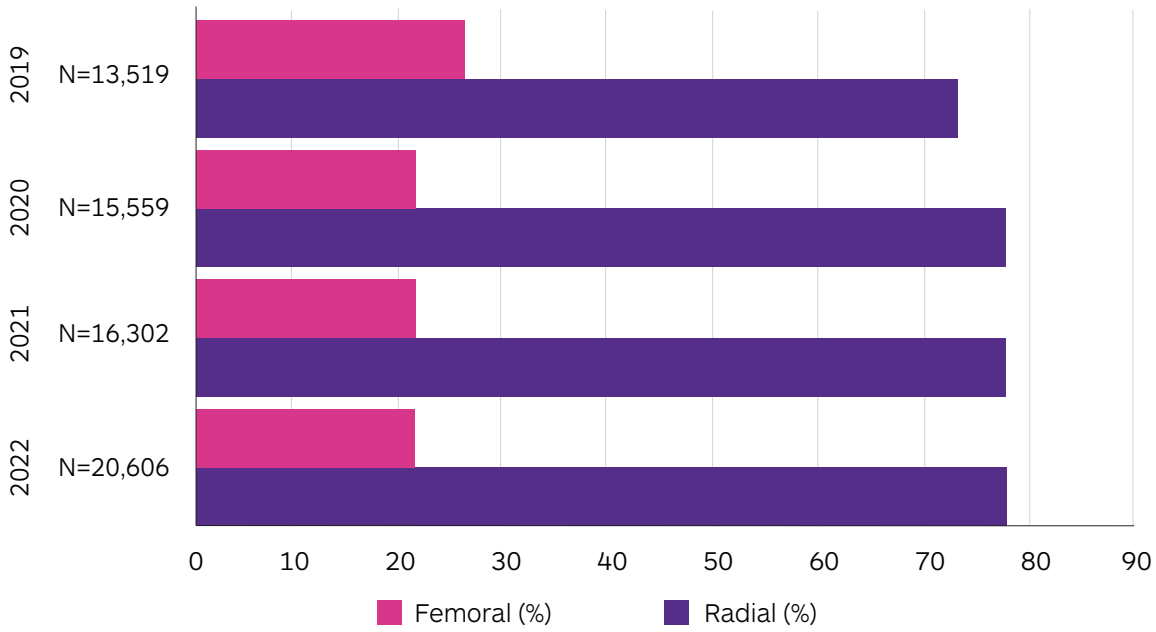


Note: Four hospitals excluded due to missing data elements used to calculate this indicator.

10.4 Access site

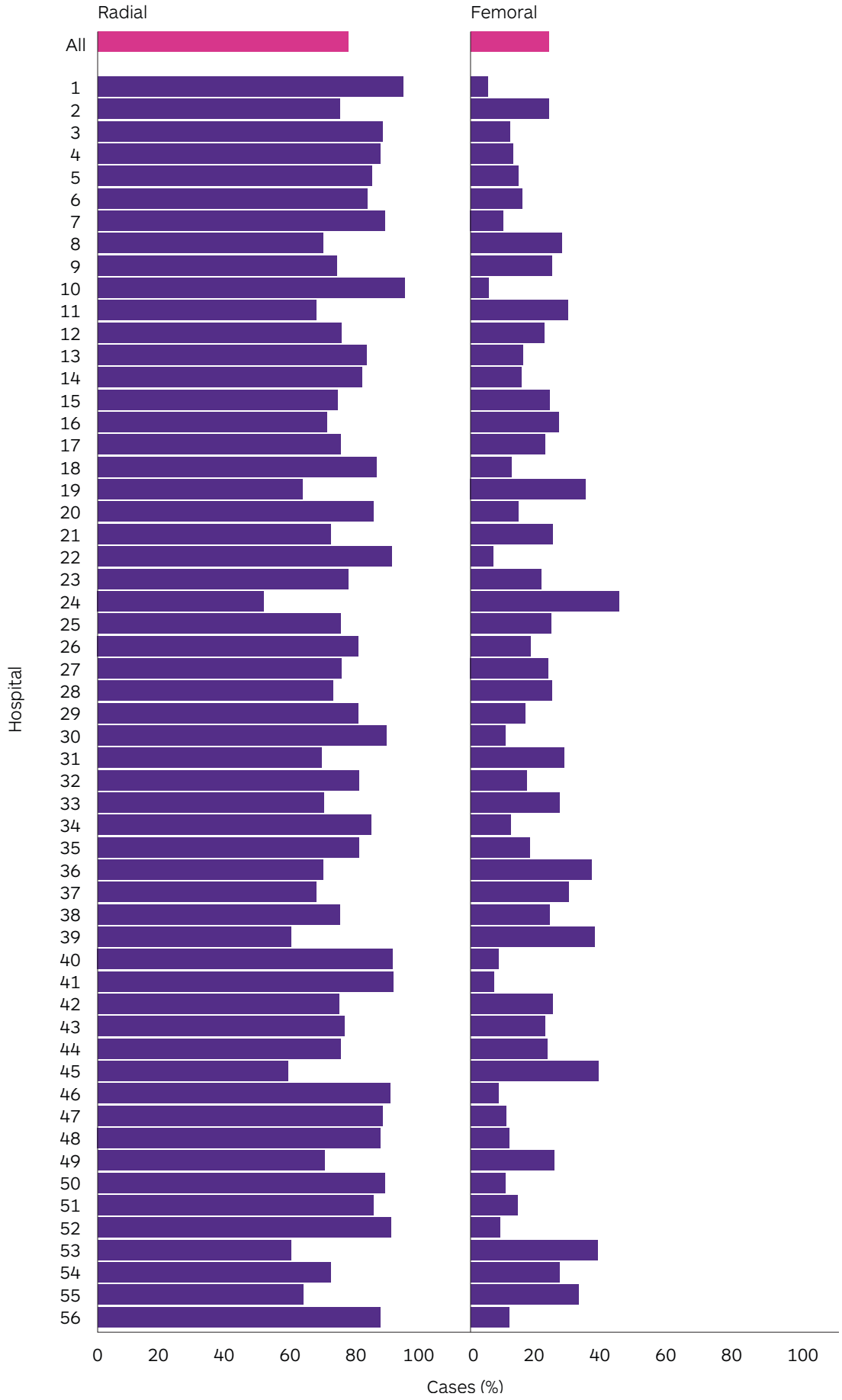
The overall rate of radial artery use for vascular access was 78.5% with rates across hospitals ranging from 50.2% to 95.2%. The radial access rate was higher in the public sector (79.7%) compared to the private sector (75.5%) and was higher in males (80.2% in males vs 73.2% in females). Rates of radial access were highest in STEMIs (81.6% in STEMI vs 80.2% in NSTEACS vs 75.8% in non-ACS). The radial artery is the predominant arterial access route, with rates of femoral artery access declining since 2019 in accordance with clinical guidelines[8].

Figure 12: Arterial access route 2019-2022



8 National Heart Foundation of Australia & Cardiac Society of Australia and New Zealand: Australian Clinical Guidelines for the Management of Acute Coronary Syndromes 2016

Figure 13: Arterial access route by hospital



10.5 Procedural Success

The overall procedural success rate, defined as successful treatment of all lesions and no major adverse cardiac events (MACE), was 93% with a range among hospitals from 83.9% to 100%. The rate of procedural success was lowest in the STEMI cohort.

Rates of in-stent restenosis were similar for non-ACS and NSTEACS patient groups and lower in STEMIs (5.8% vs 5.7% vs 3.6% respectively) with an overall rate of 5.2% across the cohort (Table 3A).

Table 3A: Procedural data by clinical presentation

Procedural data	STEMI	NSTEACS	Non-ACS	All
	(N=4,956)	(N=6,096)	(N=9,554)	(N=20,606)
Radial access (%)	81.6	80.2	75.8	78.5
Femoral access (%)	18.2	19.4	23.9	21.2
Drug-eluting stent(s) (%)	92.0	93.2	93.4	93.0
In-stent restenosis (%)	3.6	5.7	5.8	5.2
Mechanical ventricular support required (%)	1.6	0.4	0.2	0.6
Lesion success (%)	95.4	95.5	95.8	95.6
Procedural success (%)	89.1	93.5	94.6	93.0
Left main lesion (%)	1.7	1.8	1.6	1.7

Procedural data by hospital volume are presented in Table 3B. Low volume hospitals treated the lowest proportion of left main lesions and had the lowest use of mechanical ventricular support devices. Lesion and procedural success were higher in medium to high volume hospitals.

Table 3B: Procedural data by hospital volume

Procedural data	Low volume <250	Medium volume 250-500	High volume >500
	(N=2,027)	(N=7,816)	(N=10,763)
Radial access (%)	81.5	75.9	79.8
Femoral access (%)	18.4	23.7	19.9
Drug-eluting stent(s) (%)	94.4	93.0	92.8
In-stent restenosis (%)	4.9	5.1	5.4
Mechanical ventricular support required (%)	0.2	0.6	0.6
Lesion success (%)	93.1	95.4	96.2
Procedural success (%)	91.1	92.8	93.4
Left main lesion (%)	0.8	1.8	1.8

When examining hospitals with and without CABG capability and between metropolitan and non-metropolitan hospitals, there were no major differences seen among selected procedural characteristics (Table 3C and 3D).

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

Procedural data	On-site CABG (N=11,683)	Off-site CABG (N=8,923)
Radial access (%)	74.5	83.8
Femoral access (%)	25.2	16.0
Drug-eluting stent(s) (%)	92.9	93.1
In-stent restenosis (%)	5.5	4.9
Mechanical ventricular support required (%)	0.5	0.7
Lesion success (%)	96.4	94.6
Procedural success (%)	93.9	91.7
Left main lesion (%)	1.6	1.8

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

Procedural data	Metro (N=16,603)	Non-metro (N=4,003)
Radial access (%)	77.6	82.1
Femoral access (%)	22.1	17.5
Drug-eluting stent(s) (%)	93.1	92.5
In-stent restenosis (%)	5.4	4.4
Mechanical ventricular support required (%)	0.6	0.3
Lesion success (%)	95.5	96.2
Procedural success (%)	92.9	93.3
Left main lesion (%)	1.6	2.2

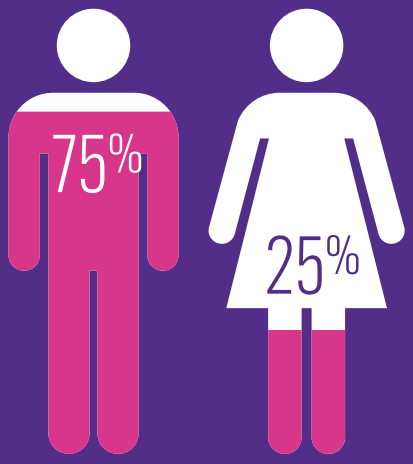
Procedural data by sex are presented in Table 3E. Procedural success rate was higher in males than females (93.3% vs 91.9% respectively), and lesion success rate was the same between sexes (95.6%).

Table 3E: Procedural data by sex

Procedural data	Male (N=15,541)	Female) (N=5,065	All (N=20,606)
Radial access (%)	80.2	73.2	78.5
Femoral access (%)	19.5	26.5	21.2
Drug-eluting stent(s) (%)	92.9	93.2	93.0
In-stent restenosis (%)	5.5	4.3	5.2
Mechanical ventricular support required (%)	0.5	0.7	0.6
Lesion success (%)	95.6	95.6	95.6
Procedural success (%)	93.3	91.9	93.0
Left main lesion (%)	1.8	1.3	1.7

11. STEMI Key Findings

The **STEMI cohort was younger** than the overall PCI cohort by an **average of 4 years** (63 years vs 67 years)



Males accounted for 75% of the STEMI cohort

In **76.6%** of STEMI cases, a door to PCI mediated reperfusion time of **≤90 minutes was achieved**

The median door to PCI mediated reperfusion time for STEMI was **57 minutes**

EMERGENCY

A median door to **PCI mediated reperfusion time of 47 minutes** was achieved, when the ambulance service notified the hospital of the imminent arrival of an acute STEMI patient

The majority of hospitals (90%) achieved a median door to PCI **mediated reperfusion time ≤90 minutes**

12. Percutaneous Coronary Intervention for Acute STEMI

Primary PCI is defined as a PCI performed as primary reperfusion therapy within 12 hours of symptom onset of STEMI. In 2022, there were 3,371 cases of primary PCI included from six of the eight jurisdictions. Two jurisdictions did not yet have the appropriate systems in place to provide data for this quality indicator in 2022, however will be working towards providing this in the future.

The two principal process measures used to assess performance in primary PCI were:

- Time from door to PCI-mediated reperfusion;
- Time from diagnostic ECG to PCI-mediated reperfusion.

These are timeframes from when a patient enters the emergency department or receives a diagnostic ECG until the blood flow is restored. These are accepted measures for assessing the quality of hospital systems and processes which correlate with patient outcomes, with longer delays associated with increased 30-day and 12-month mortality[9].

The cohort of 3,371 patients that underwent primary PCI represented 16% of the total PCI caseload of the 49 hospitals providing data. The proportion of primary PCI cases by hospital is shown in Figure 14. Excluding hospitals who did not do any primary PCI, the range was 0.3% to 38.3%. Overall, 62% of primary PCI cases were performed out-of-hours.

The majority of primary PCI cases were performed in the public sector. Low volume centres and private hospitals treated the lowest proportion of primary PCI patients (Table 4). The primary PCI rate was similar between males and females (16.0% and 16.3% respectively).

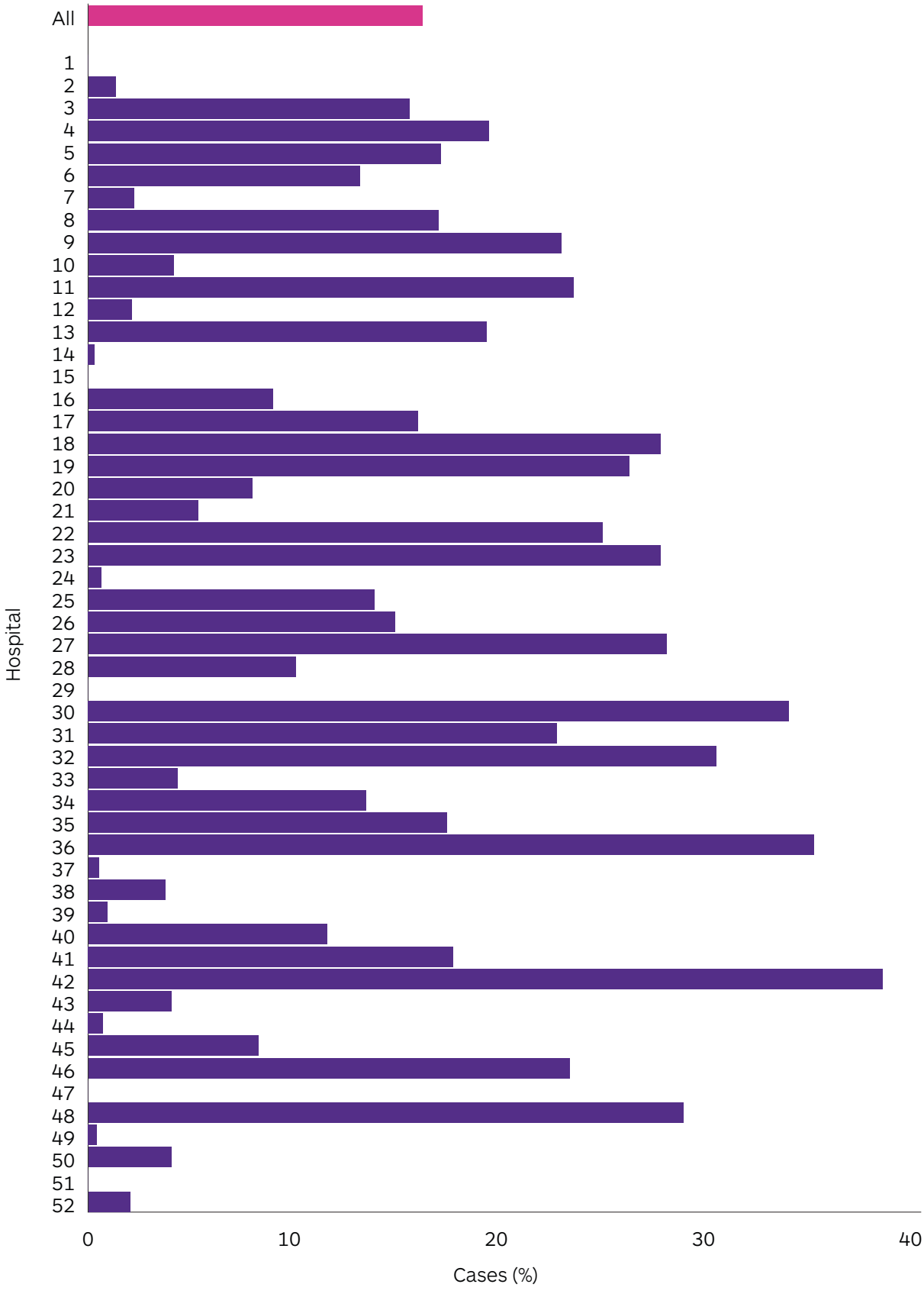
Table 4: Primary PCI cases as a proportion of overall case numbers by hospital types

	Cases with data available	Primary PCI rate
Hospital types	N	N (%)
Low volume <250	2,027	118 (5.8)
Medium volume 250-500	7,816	1,351 (17.3
High volume >500	10,763	1,841 (17.1)
On-site CABG	11,683	1,645 (14.1)
Off-site CABG	8,923	1,665 (18.7)
Metro	16,603	2,539 (15.3)
Non-metro	4,003	771 (19.3)
Public	14,927	3,105 (20.8)
Private	5,679	205 (3.6)
All	**20,606**	**3,310 (16.1)**

Note: Primary PCI (n=3,310) includes STEMI patients presenting within 12 hours of symptom onset and includes inter-hospital transfers and those who are already in-patients.

9 Foo CY, Bonsu KO, Nallamothu BK, Reid CM, Dhippayom T, Reidpath DD, Chaiyakunapruk N. Coronary intervention door-to-balloon time and outcomes in ST-elevation myocardial infarction: a meta-analysis. Heart. 2018 Aug;104(16):1362-1369. doi: 10.1136/heartjnl-2017-312517. Epub 2018 Feb 5. PMID: 29437704.

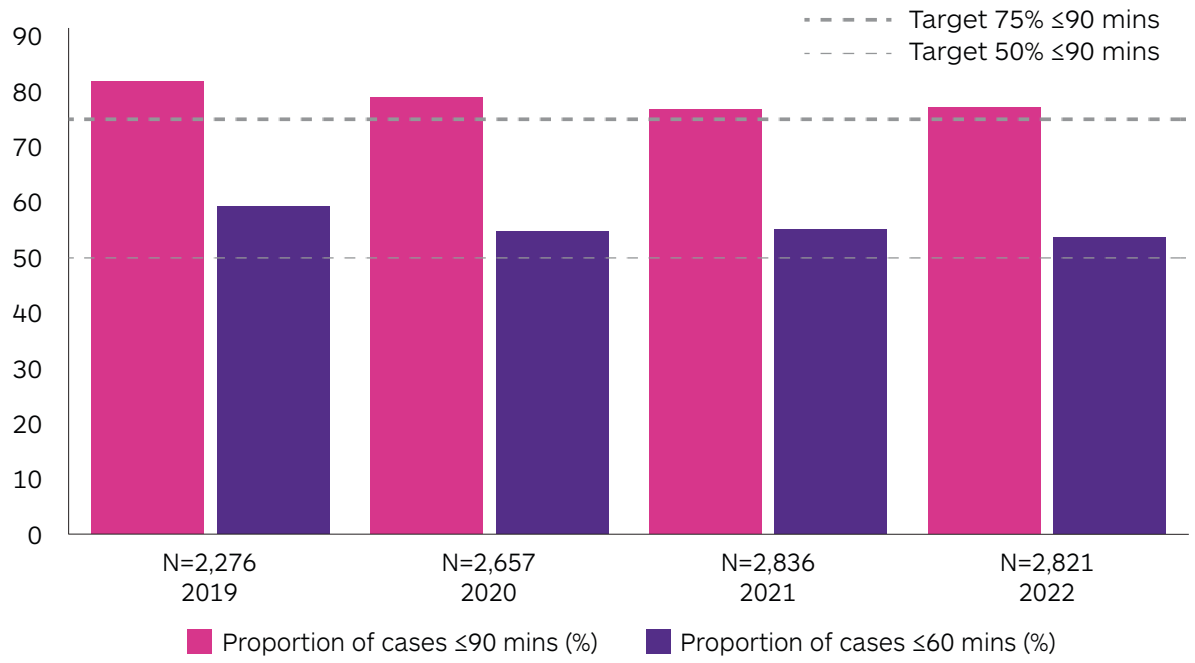
Figure 14: Primary PCI cases as a proportion of overall case numbers by hospital*



*Hospitals 1, 15, 29, 47, 51 had no Primary PCI cases.

For patients undergoing primary PCI, the door to PCI-mediated reperfusion is a standard process measure used to assess hospitals' ability to deliver timely treatment. Hospitals were assessed on their compliance in achieving a door to PCI-mediated reperfusion time ≤90 minutes, in at least 75% of cases. Figure 15 displays door-to-PCI mediated reperfusion from 2019-2022.

Figure 15: Time from door to PCI-mediated reperfusion for primary PCI cases 2019-2022



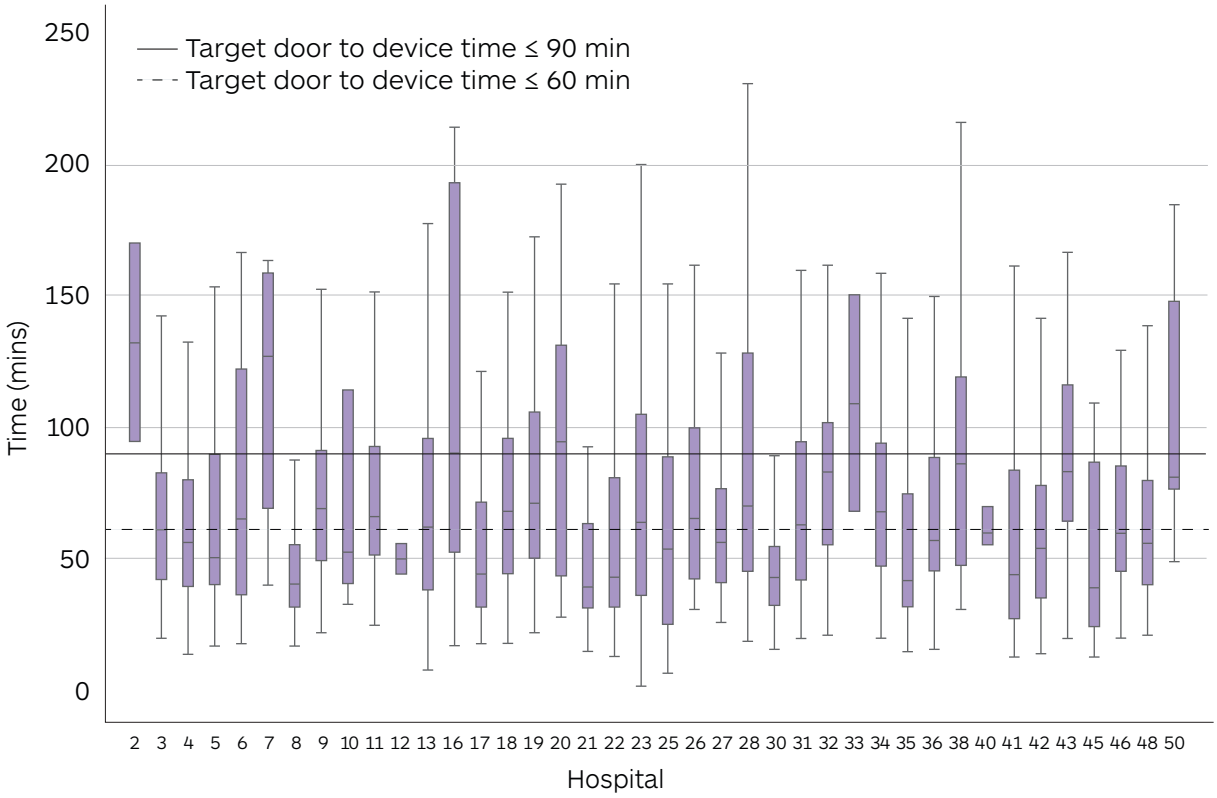
In 2022, the median door to PCI-mediated reperfusion time was 57 min (Table 5A). More than half the cases reported on achieved door to PCI-mediated reperfusion time ≤60 min, and more than three-quarters in ≤90 min (Table 5A below, Figure 16 - page 46).

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

Door to PCI mediated reperfusion time	Primary PCI (all cases)
	N=2,821
Median - mins (IQR)	57 (38, 88)
Proportion of cases ≤90mins (%)	76.6
Proportion of cases ≤60mins (%)	53.2

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

Figure 16: Door-to-reperfusion time for primary PCI cases by hospital*

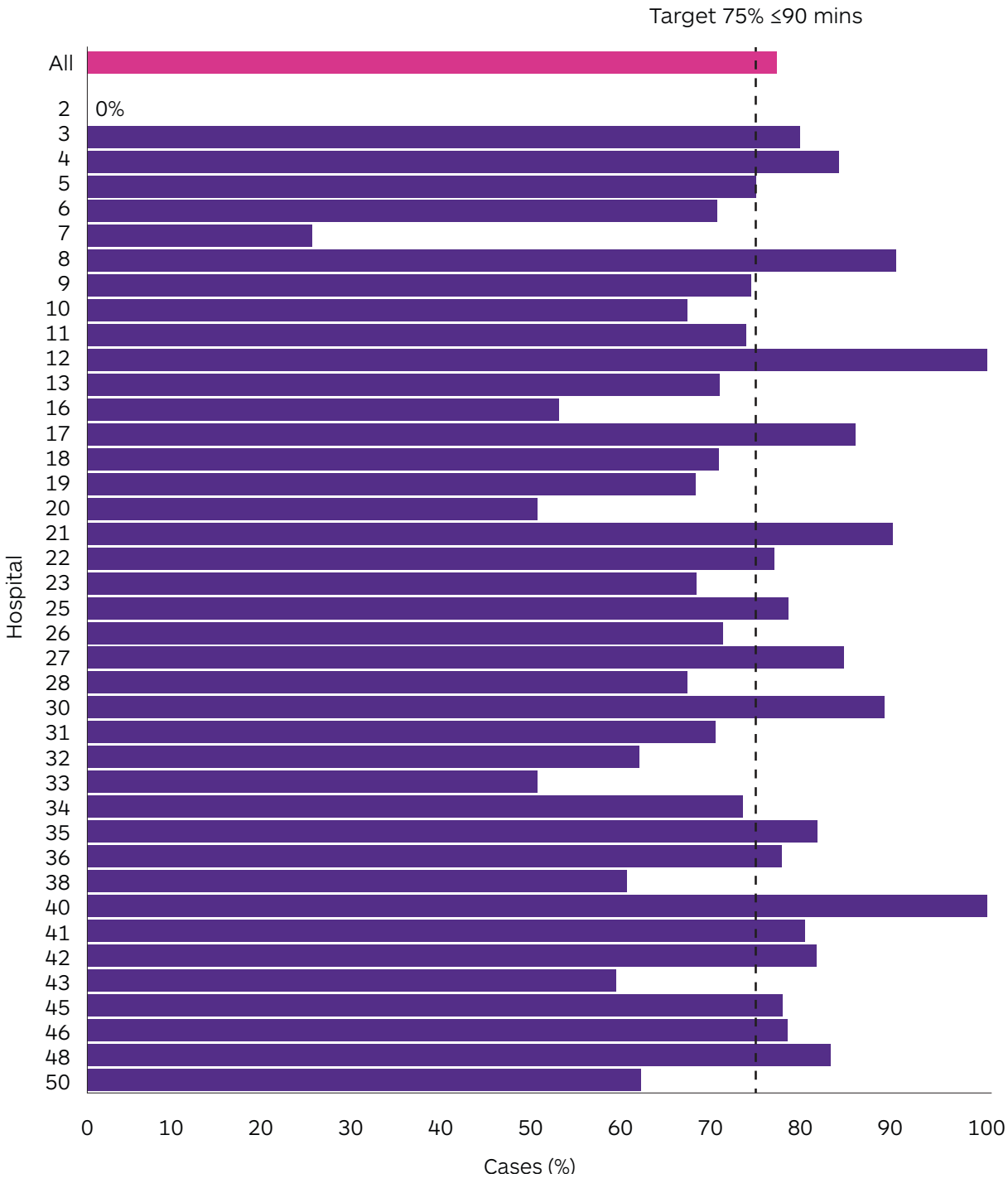


*Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

20 out of 40 hospitals were compliant with achieving median door to PCI-mediated reperfusion time ≤90 min in at least 75% of their primary PCI cases when benchmarked against other hospitals (Figure 16). When the best-practice treatment time frame was set to ≤60 min, just three hospitals managed to achieve a >75% compliance rate.

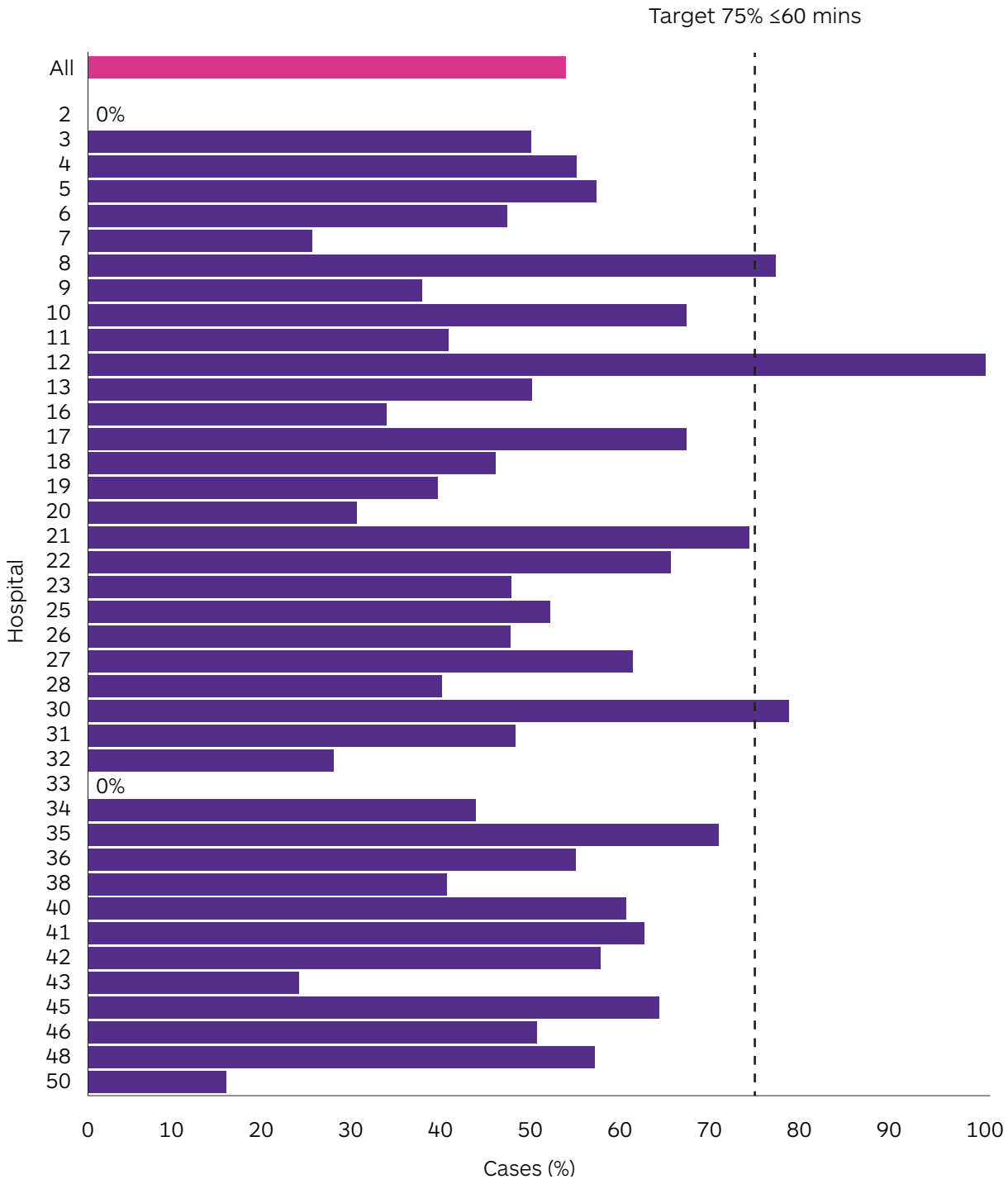
All but four hospitals achieved a median door to PCI-mediated reperfusion time ≤90min and just under half of the hospitals achieved median PCI-mediated reperfusion time ≤60min (Figures 17 and 18).

Figure 17: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital



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

Figure 18: Proportion of primary PCI cases with door to device time ≤60 minutes by hospital*



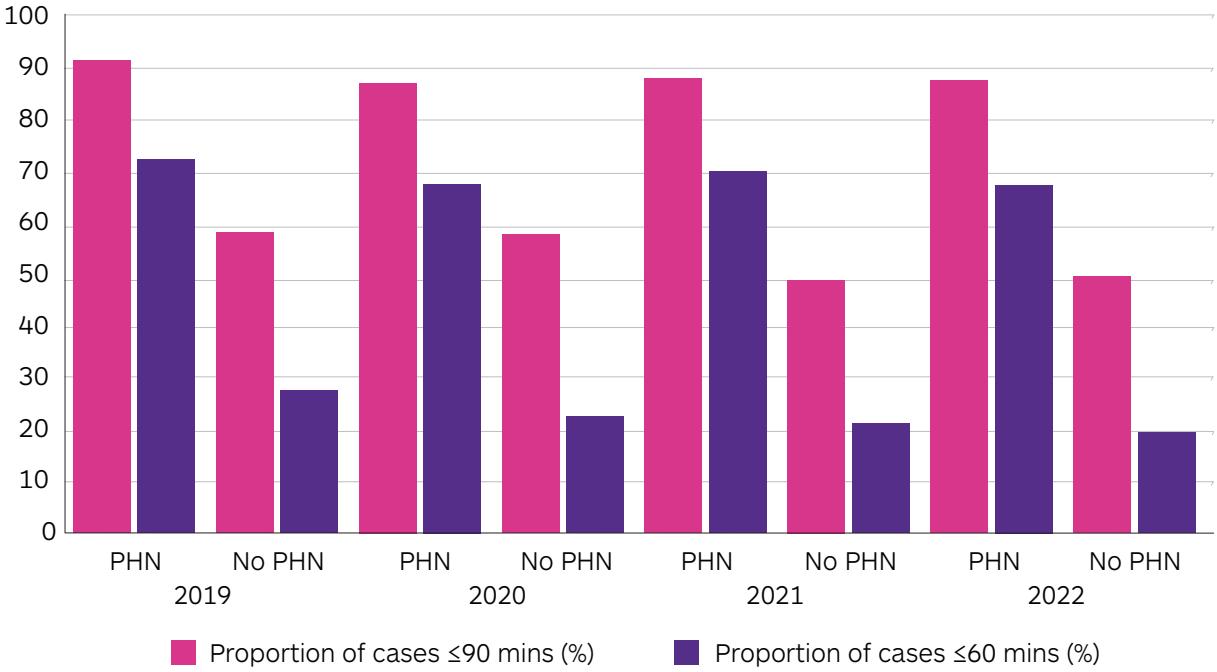
*Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

12.1 Prehospital notification

Prehospital notification (PHN) describes notification by ambulance service or general practitioner to a PCI hospital of the imminent arrival of an acute STEMI patient, bypassing the emergency department[10]. PHN allows cardiology staff to activate the cardiac catheter laboratory (CCL), and is essential for patient survival by alleviating treatment delay[11,12].

PHN was utilised in 70% of primary PCI cases and resulted in significant reductions in the door to PCI-mediated reperfusion times (Table 5B - page 50, Figure 20 - page 51). As in previous years, PHN clearly resulted in shorter door to PCI-mediated reperfusion times and greater compliance in achieving at least 75% target with door to PCI-mediated reperfusion time ≤90 min (Figure 19).

Figure 19: Door-to-device time for primary PCI cases by prehospital notification status* 2019-2022



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

10 Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017 Aug 26;39(2):119–77.

11 Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017 Aug 26;39(2):119–77.

12 The management of STEMI patients identified by the Queensland Ambulance Service: 11-year findings (2008-2018). Brisbane: Queensland Ambulance Service; 2019.

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

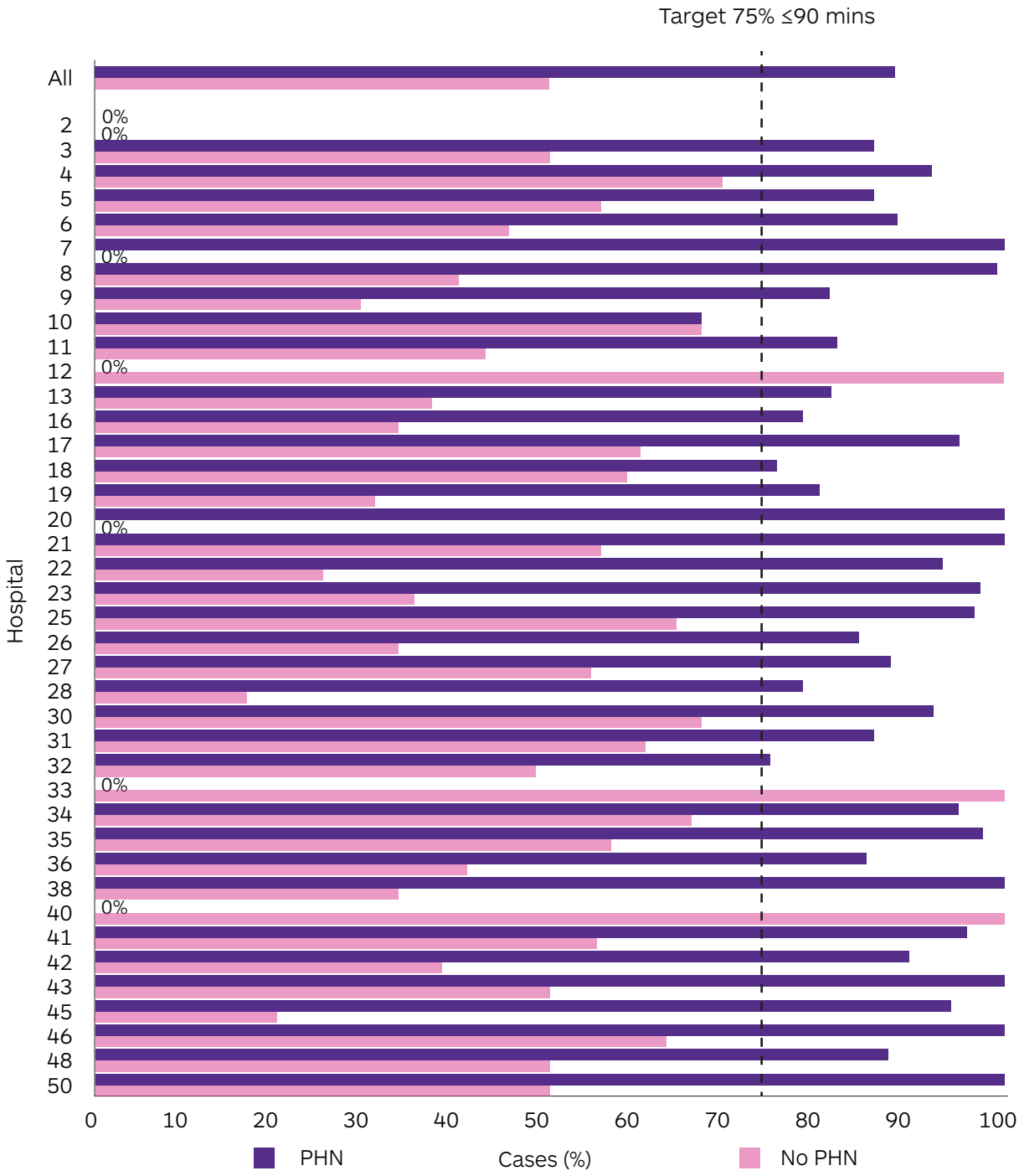
Door to PCI mediated reperfusion time	Primary PCI (all cases)	Primary PCI (PHN only†)	Primary PCI (no-PHN†)
	N=2,821	N=1,964	N=767
Median -mins (IQR)	57 (38, 88)	47 (33, 68)	91 (67, 132)
Proportion of cases ≤90mins (%)	76.6	88.0	49.9
Proportion of cases ≤60mins (%)	53.2	67.7	19.6

*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 90 cases

In 2022, 88% of cases triaged with PHN achieved door to PCI-mediated reperfusion ≤90 minutes, whereas only 49.9% of cases achieved this target without PHN (Figure 20).

Figure 20: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital - prehospital notification vs no prehospital notification*

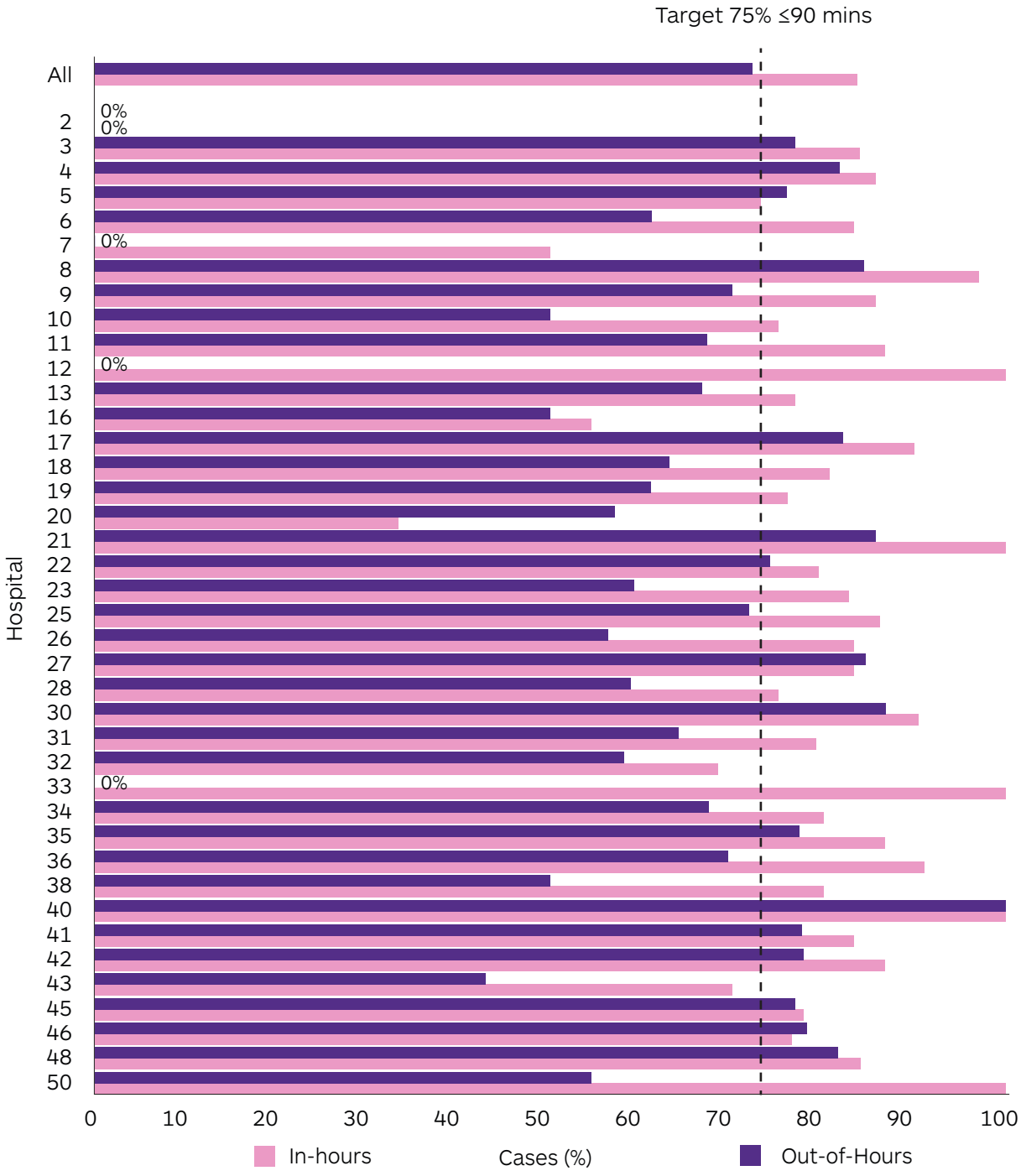


*Primary PCI for STEMI presentations excluding all inter-hospital arrivals and patients with STEMI onset whilst a current in-patient.

12.2 In-Hours Versus Out-Of-Hours Presentation

In 2022, 62% of STEMI cases were treated out-of-hours (range by hospital 33-85%). The compliance with a door to PCI-mediated reperfusion time ≤90 min was achieved in 72.7% of cases out-of-hours vs 83.7% of cases in-hours. Only four hospitals performed better out-of-hours (Figure 21).

Figure 21: Proportion of primary PCI cases with door to device time ≤90 minutes by hospital -in-hours vs out-of-hours presentation



*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 - 8:00am (Mon - Fri, national public holidays, weekends).

12.3 Times from symptom onset to first medical contact and diagnostic ECG to reperfusion

The total ischaemic time from symptom onset to reperfusion is presented in Table 5C. The median time from symptom onset to first medical contact (FMC) was 58 minutes (IQR: 29, 125). PHN shortened the symptom onset to FMC time by 27 minutes.

In 2022, the overall median FMC to diagnostic ECG time was 8 minutes (IQR: 4, 18) - two thirds of hospitals met the recommended benchmark of 10 minutes (Figure 23, page 54). FMC to diagnostic ECG time improved with PHN (7 min with PHN vs 13 min without PHN).

Australian guidelines[13] recommend the benchmark of FMC to reperfusion time ≤90 min. The median FMC to reperfusion time for the cohort was 105 minutes (IQR: 85, 139) (Table 5C). Only nine hospitals met this target (Figure 24, page 54).

Figure 22: Median times from symptom onset to PCI mediated reperfusion

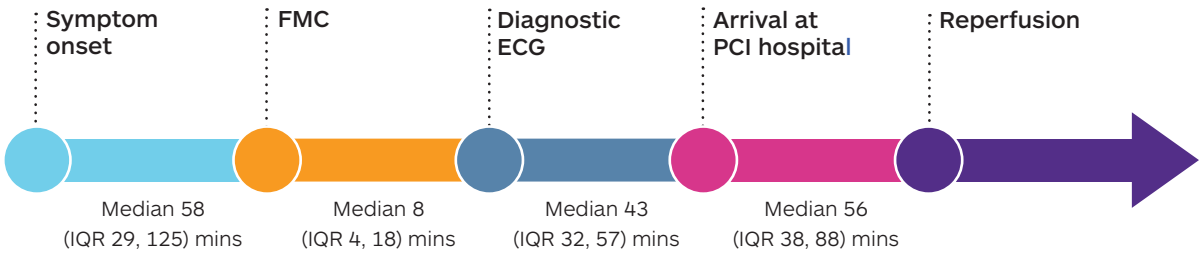


Table 5C: Median times from symptom onset to reperfusion by prehospital notification status*

Symptom onset to reperfusion time	All Primary PCI*	Primary PCI (PHN only†)	Primary PCI (no-PHN†)
	(N=2,774)	(n=1,946)	(n=740)
Median Symptom onset to FMC - mins (IQR)	58 (29, 125)	51 (27, 107)	78 (38, 175)
Median FMC to Diagnostic ECG - mins (IQR)	8 (4, 18)	7 (4, 13)	13 (6, 39)
Median Diagnostic ECG to door - mins (IQR)	43 (32, 57)	44 (33, 57)	37 (23, 54)
Median Diagnostic ECG to reperfusion time - mins (IQR)	92 (74, 121)	92 (75, 118)	88 (69, 122)
Median FMC to reperfusion time - mins (IQR)	105 (85, 139)	103 (85, 131)	113 (84, 164)
Median Symptom onset to reperfusion time - mins (IQR)	179 (135, 263)	167 (130, 231)	219 (154, 351)

*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 90 cases

13 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.

Figure 23: First medical contact to diagnostic ECG time for primary PCI cases by hospital

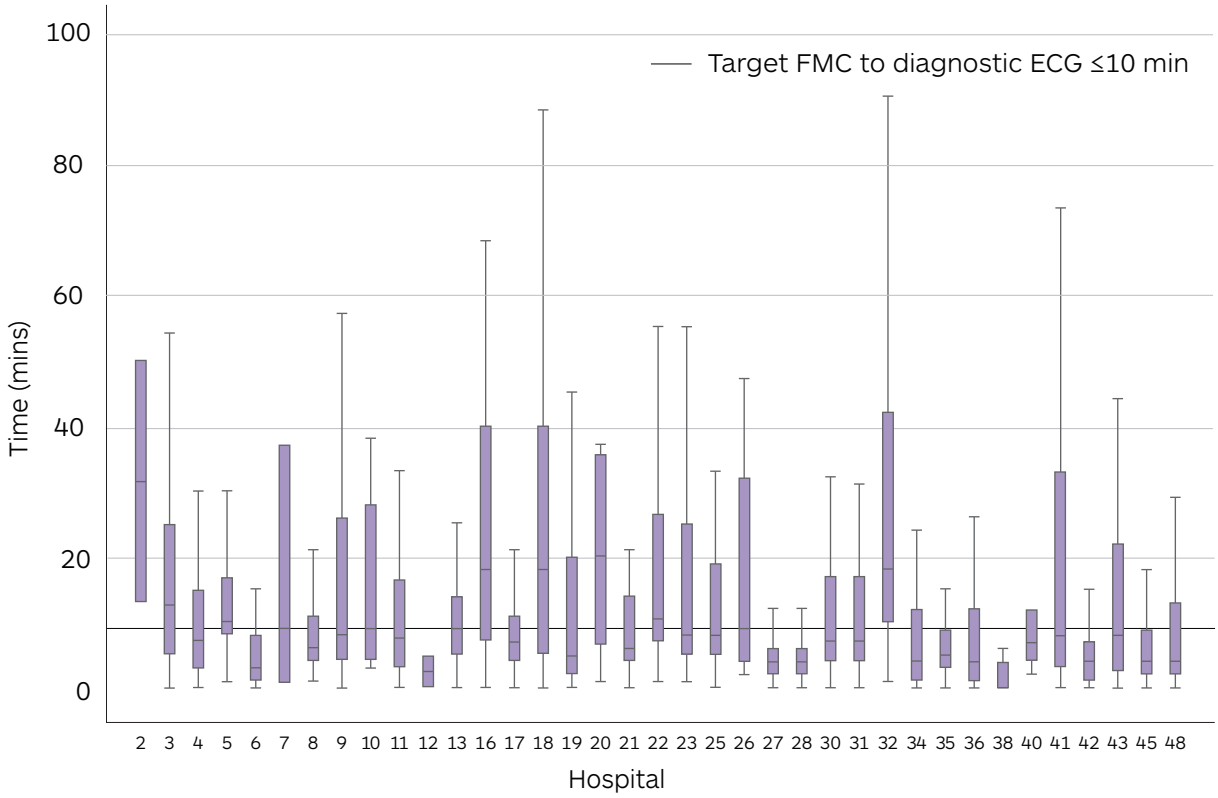
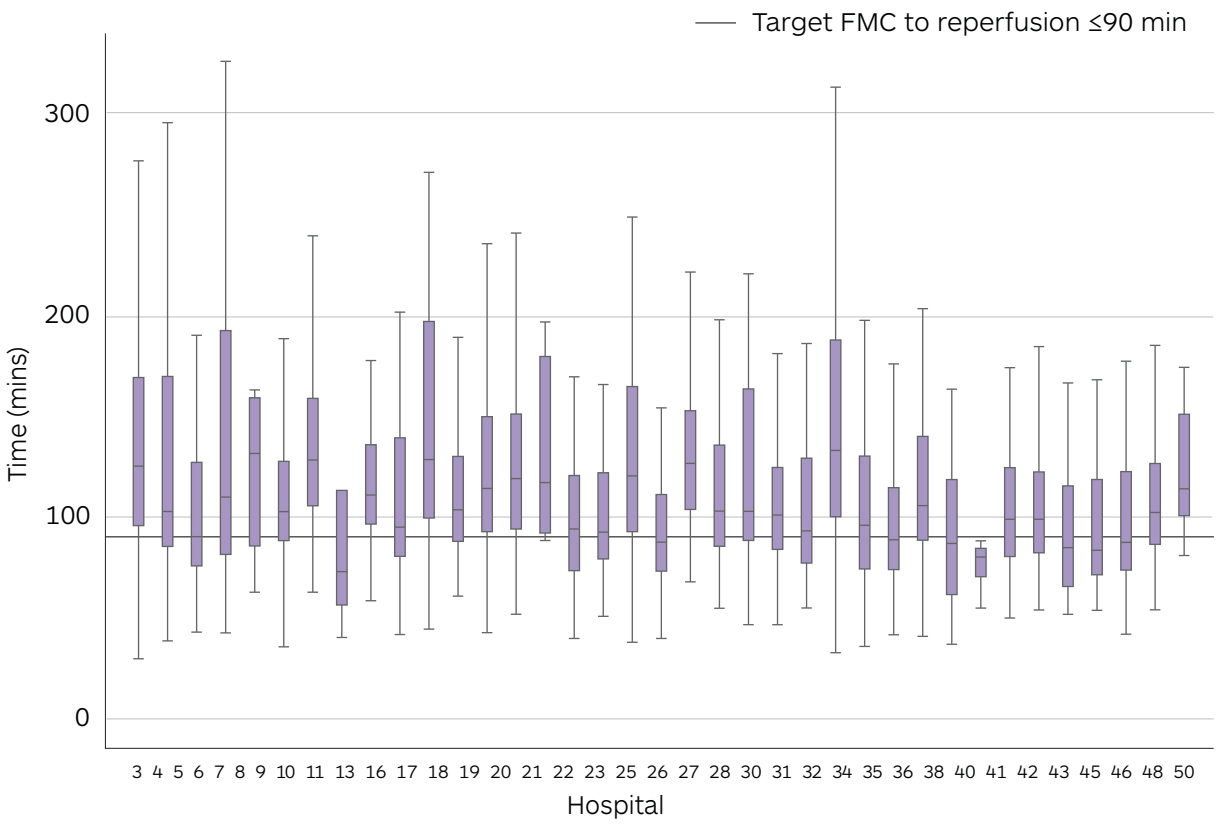
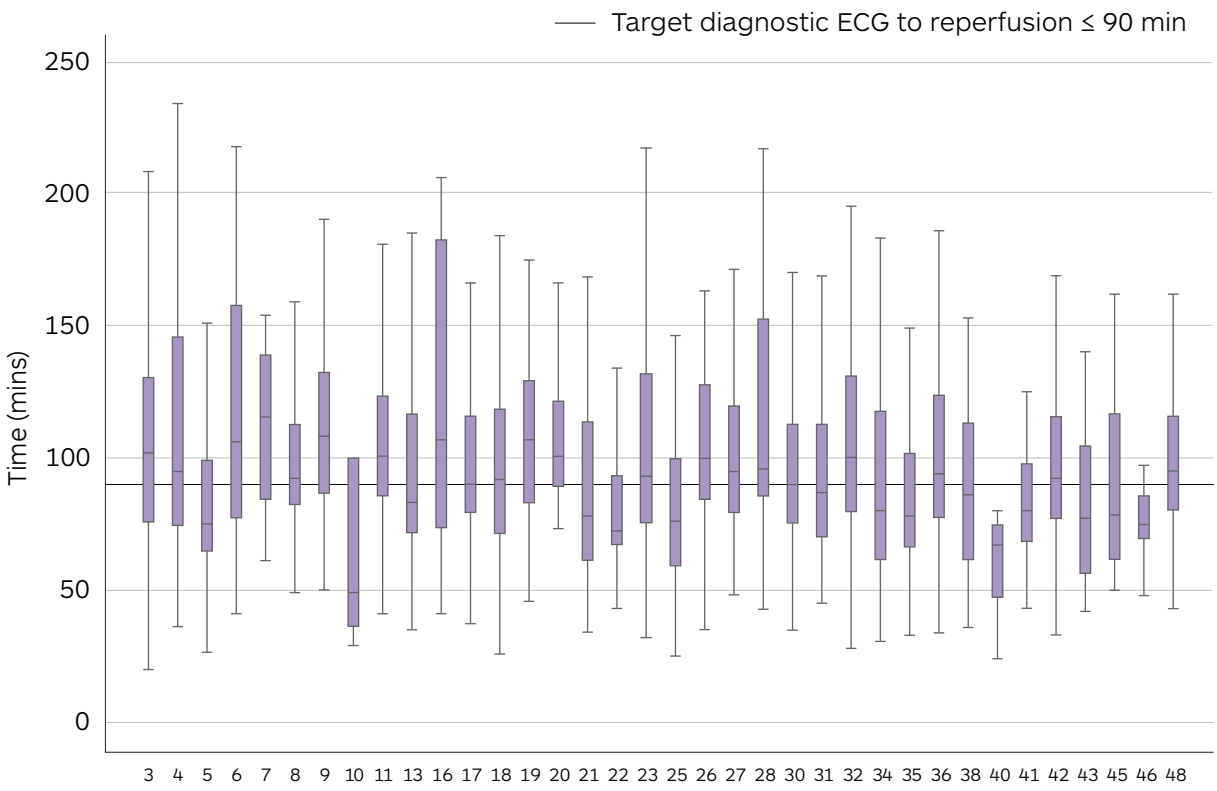


Figure 24: First medical contact to PCI-mediated reperfusion time for primary PCI cases by hospital



We further assessed the time delays from diagnostic ECG to PCI-mediated reperfusion as an additional metric of system performance. The median ECG to reperfusion time for the 2022 cohort was 92 min (IQR: 74, 121) with variation among hospitals (Figure 25).

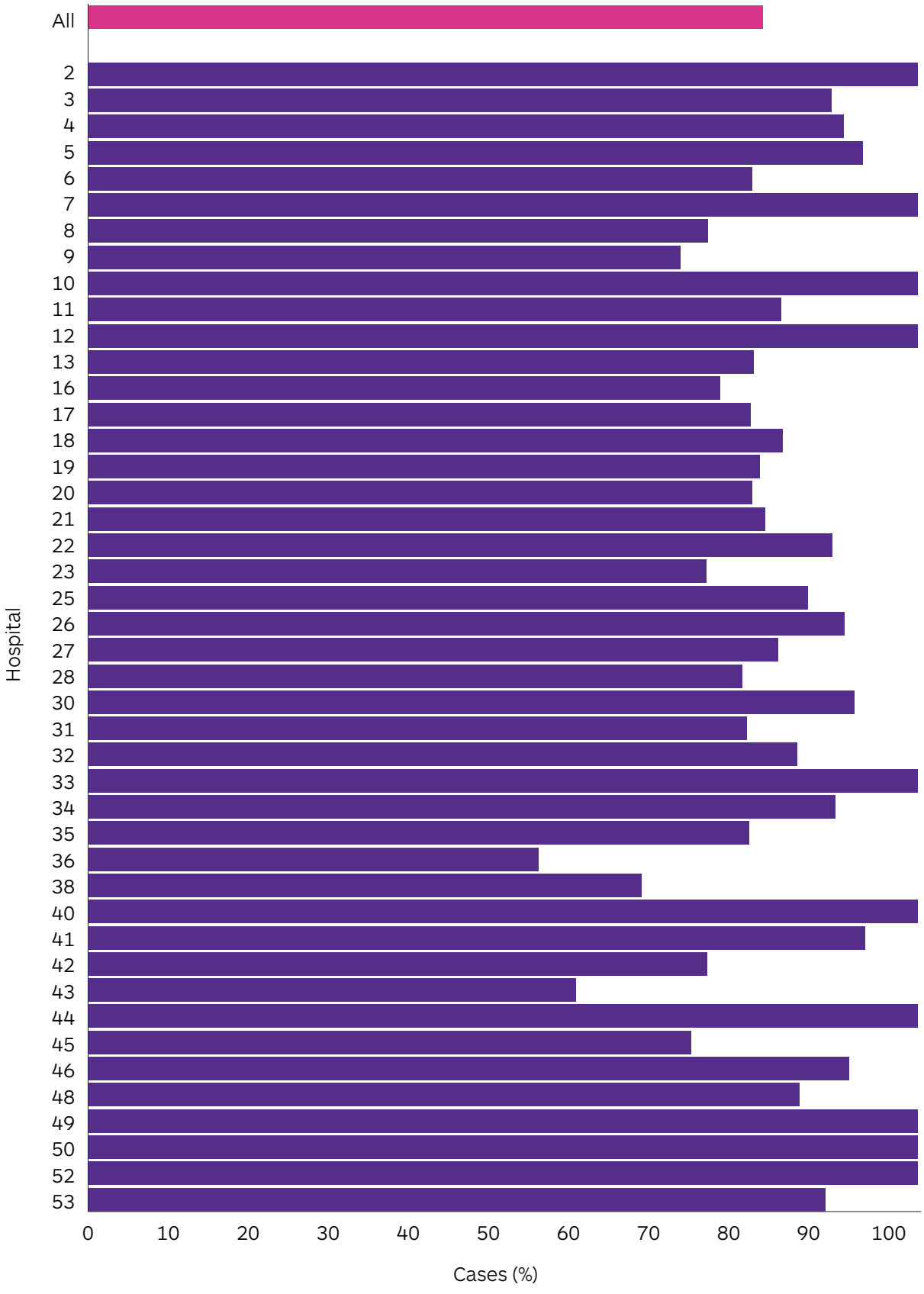
Figure 25: Diagnostic ECG to reperfusion by hospital



12.4 Radial Access In Primary PCI

The overall rate of radial vascular access was used in 81.3% of patients undergoing primary PCI for STEMI (Figure 26). While the radial access rates among hospitals varied from 54-100%, its use was similar between public and private sectors (81.3% and 82.1% respectively).

Figure 26: Radial access rates in primary PCIs by hospital

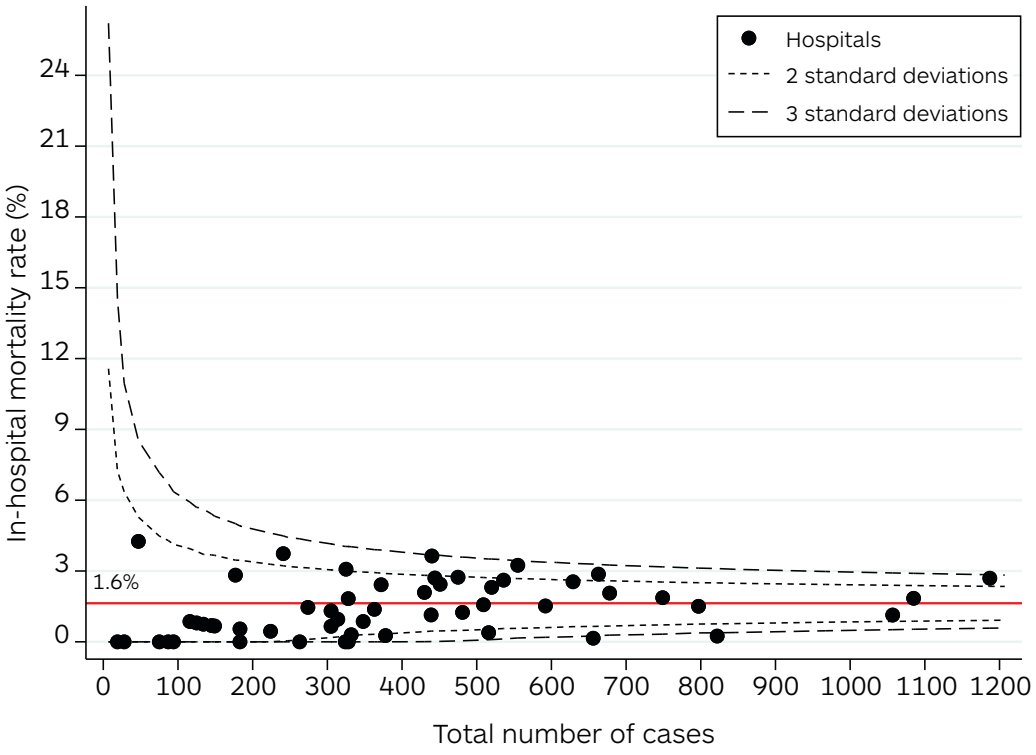


13. In-Hospital Outcomes following PCI

13.1 In-hospital Mortality

The overall in-hospital mortality rate in 2022 was 1.6%, this was slightly lower than the rate in 2021 (2.0%). All hospitals had rates of in-hospital mortality within control limits (Figure 27). When high-acuity cases of shock and/or intubated OHCA were excluded, the overall rate declined to 0.7%. When STEMI and shock and/or intubated OHCA cases were excluded, the mortality rate for the rest of the PCI cohort was also low at 0.4%.

Figure 27: In-hospital mortality rate by hospital*



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

Table 6A provides in-hospital mortality data for selected clinical groups. The in-hospital mortality rate was slightly lower in males, low volume and metropolitan hospitals.

The in-hospital mortality rate in private hospitals was 0.4% for all PCI patients. When looking at other sub-groups the in-hospital mortality rates were lower, however private data only made up one quarter of the cases analysed in this report. As more private data is contributed to the Registry we will be able to gain insights into the case mix and in-hospital mortality rates in the private sector in Australia.

Table 6A: In-hospital mortality rates for selected patient group

Patient category	Total	In-hospital mortality rate
	N	N (%)
All PCI patients	20,500	336 (1.6)
STEMI patients	4,937	234 (4.7)
Cardiogenic shock and/or OHCA patients	532	184 (34.6)
NSTEACS	6,073	61 (1.0)
Non-ACS	9,490	41 (0.4)
Female	5,032	103 (2.0)
Male	15,468	233 (1.5)

The volume of patients undergoing PCI may be a factor in procedural outcomes, however it is noteworthy that only 2,027 cases were performed in low volume centres out of the total cohort of 20,500.

Table 6B provides unadjusted in-hospital mortality data for hospitals performing different volumes of PCI. In-hospital mortality rates were highest for patients presenting with cardiogenic shock and/or OHCA treated in low volume hospitals. Death rates for STEMI patients were also highest in low volume hospitals, when compared with medium and high volume centres.

The in-hospital mortality rate for cardiogenic shock and/or OHCA patients and STEMI patients was highest in hospitals without CABG capability (Table 6C - page 60). Metropolitan hospitals had highest mortality rates for cardiogenic shock and/or OHCA patients, however the in-hospital mortality rates for the overall PCI cohort were lower than non-metro hospitals (1.6% vs 2.0%).

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

Patient category	Total	Low volume <250	Medium volume 250-500	High volume >500
	N	n/N (%)	n/N (%)	n/N (%)
All PCI patients	20,500	23/2,027 (1.1)	120/7,719 (1.6)	193/10,754 (1.8)
STEMI patients	4,937	13/228 (5.7)	87/1,955 (4.5)	134/2,754 (4.9)
Cardiogenic shock and/or OHCA patients	532	15/40 (37.5)	67/195 (34.4)	102/297 (34.3)
NSTEACS	6,073	5/576 (0.9)	23/2,353 (1.0)	33/3,144 (1.0)
Non-ACS	9,490	5/1,223 (0.4)	10/3,411 (0.3)	26/4,856 (0.5)

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

Patient category	Total	On-site CABG	Off-site CABG
	N	n/N (%)	n/N (%)
All PCI patients	20,500	168/11,671 (1.4)	168/8,829 (1.9)
STEMI patients	4,937	108/2,456 (4.4)	126/2,481 (5.1)
Cardiogenic shock and/or OHCA patients	532	84/269 (31.2)	100/263 (38.0)
NSTEACS	6,073	34/3,249 (1.0)	27/2,824 (1.0)
Non-ACS	9,490	26/5,966 (0.4)	15/3,524 (0.4)

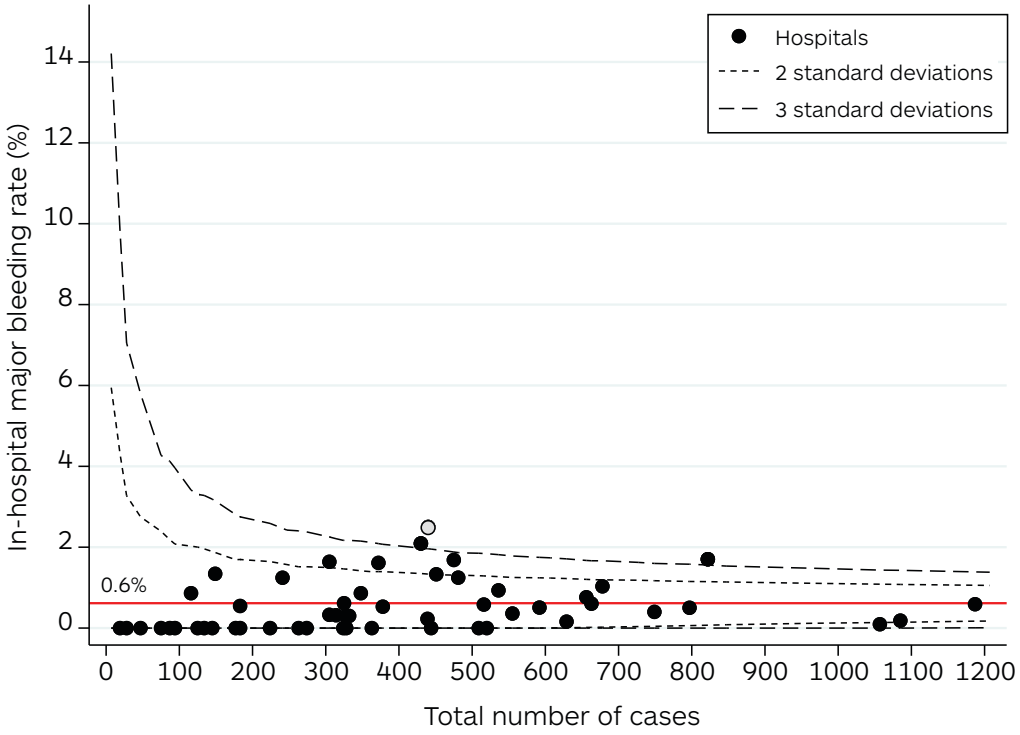
Table 6D: In-hospital mortality rates by metro vs non-metro hospitals

Patient category	Total	Metro	Non-metro
	N	n/N (%)	n/N (%)
All PCI patients	20,500	256/16,501 (1.6)	80/3,999 (2.0)
STEMI patients	4,937	172/3,628 (4.7)	62/1,309 (4.7)
Cardiogenic shock and/or OHCA patients	532	147/423 (34.8)	37/109 (33.9)
NSTEACS	6,073	49/4,833 (1.0)	12/1,240 (1.0)
Non-ACS	9,490	35/8,040 (0.4)	6/1,450 (0.4)

13.2 In-Hospital Major Bleeding

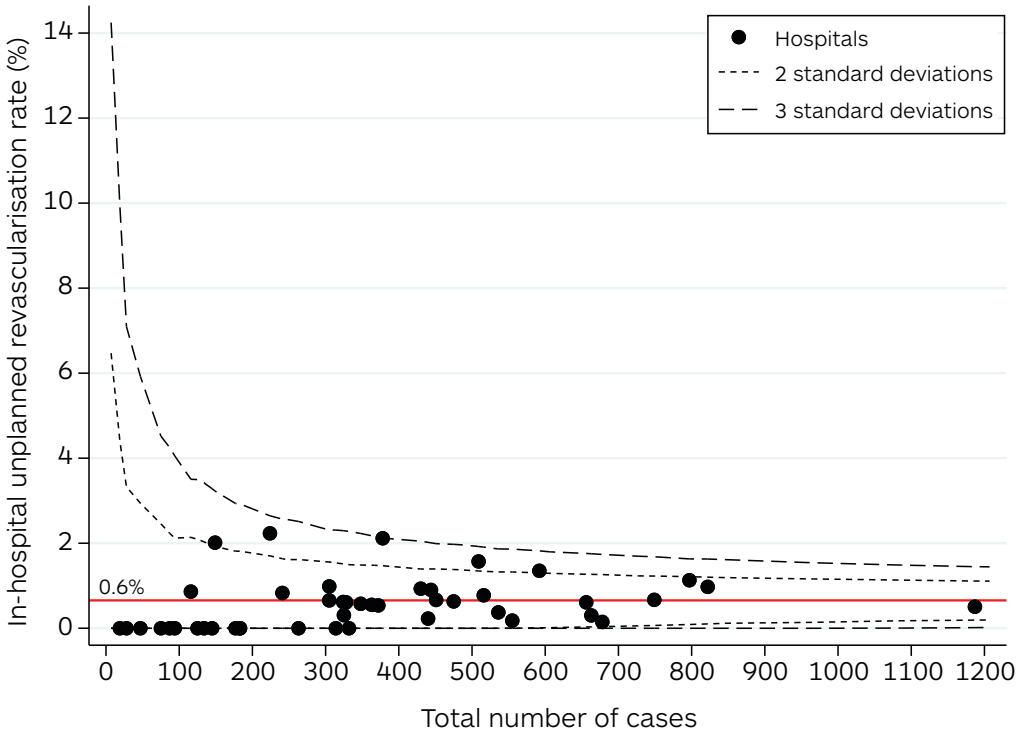
The overall in-hospital major bleeding rate was 0.6% (Figure 28). All but one hospital was within 3 standard deviations of the mean. Major bleeding rates for selected patient subgroups are presented in Table 7A (page 63). Major bleeding was more common in females, STEMIs and in patients who underwent femoral arterial access. Patients presenting with STEMI require blood thinning medications which increase the risk of bleeding following PCI. Bleeding rates were lower among patients who received revascularisation via the radial artery – the recommended approach for PCI. The Registry is working towards consolidating different jurisdictions' definitions of bleeding.

Figure 28: In-hospital major bleeding rate by hospital



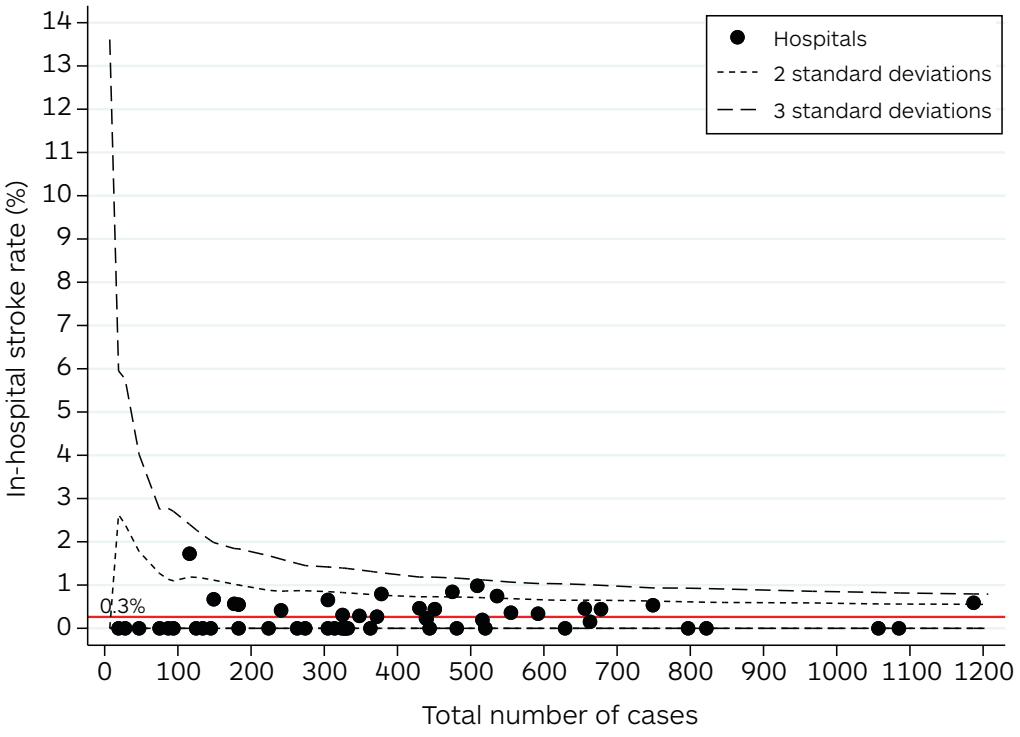
In-hospital unplanned revascularisation is defined as an unexpected revascularisation procedure, following the index PCI which occurs during the same admission. This may include PCI or CABG, and occurs when there are complications from the initial PCI such as coronary dissection or acute stent thrombosis. The rate of unplanned revascularisation was 0.6%, with all hospitals performing within expected limits (Figure 29).

Figure 29: In-hospital unplanned revascularisation rate by hospital



The overall rate of the complication of in-hospital stroke after PCI was 0.3% and all hospitals were within control limits (Figure 30).

Figure 30: In-hospital stroke rate by hospital



13.3 Outcomes by Clinical Presentation and Hospital Characteristics

Rates of in-hospital adverse events are presented in tables 7A-7D (pages 63-64). Patients presenting with STEMI had higher rates of major bleeding, MACE (defined as death, new myocardial infarction, stent thrombosis and unplanned revascularisation) and MACCE (defined as MACE plus stroke) compared to NSTEACS and non-ACS presentations (Table 7A). Post-procedure MI was more common in low volume hospitals, and MACCE rates were higher in non-metropolitan hospitals, and those without CABG capability (Table 7C-7D).

Table 7A: In-hospital outcomes by clinical presentation

In hospital outcomes	Total	STEMI	NSTEACS	Non-ACS
	(N=20,500)	(N=4,937)	(N=6,073)	(N=9,490)
Major bleeding (%)	0.6	1.2	0.5	0.4
Myocardial infarction (%)	0.4	0.5	0.5	0.2
Stroke (%)	0.3	0.7	0.1	0.1
Stent thrombosis (%)	0.3	0.7	0.2	0.2
Unplanned revascularisation (%)	0.6	1.1	0.4	0.5
MACE (%)	2.5	6.6	1.9	0.9
MACCE (%)	2.7	7.2	2.1	1.1
Median length of stay (Days)	2.0	3.0	3.0	1.0

Note: MACE = Major adverse cardiac event
MACCE = Major adverse cardiac and/or cerebrovascular events

Table 7B: In-hospital outcomes by hospital volume

In hospital outcomes	Low volume <250	Medium volume 250-500	High volume >500
	(N=2,027)	(N=7,719)	(N=10,754)
Major bleeding (%)	0.3	0.8	0.5
Myocardial infarction (%)	0.7	0.4	0.4
Stroke (%)	0.3	0.2	0.3
Stent thrombosis (%)	0.2	0.2	0.4
Unplanned revascularisation (%)	0.5	0.6	0.7
MACE (%)	2.1	2.4	2.7
MACCE (%)	2.2	2.5	3.0
Median length of stay (Days)	1.0	2.0	2.0

Note: MACE = Major adverse cardiac event
MACCE = Major adverse cardiac and/or cerebrovascular events

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

In hospital outcomes	On-site CABG (N=11,671)	Off-site CABG (N=8,829)
Major bleeding (%)	0.6	0.7
Myocardial infarction (%)	0.3	0.5
Stroke (%)	0.2	0.4
Stent thrombosis (%)	0.2	0.3
Unplanned revascularisation (%)	0.7	0.5
MACE (%)	2.2	2.8
MACCE (%)	2.3	3.1
Median length of stay (Days)	2.0	2.0

Note: MACE = Major adverse cardiac event
MACCE = Major adverse cardiac and/or cerebrovascular events

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

In hospital outcomes	Metro (N=16,501)	Non-metro (N=3,999)
Major bleeding (%)	0.6	0.6
Myocardial infarction (%)	0.4	0.5
Stroke (%)	0.3	0.3
Stent thrombosis (%)	0.2	0.6
Unplanned revascularisation (%)	0.6	0.9
MACE (%)	2.4	3.4
MACCE (%)	2.6	4.0
Median length of stay (Days)	2.0	3.0

Note: MACE = Major adverse cardiac event
MACCE = Major adverse cardiac and/or cerebrovascular events

14. Discharge Medications and Secondary Prevention Programs

Australian guidelines recommend that patients undergoing PCI for ACS are treated with up to 12 months of dual antiplatelet therapy (DAPT) and receive lipid lowering therapy (LLT) to achieve a low-density lipoprotein level <1.8mmol/L, and preferable <1.4mmol/L[14]. Patients should receive a personalised care plan to identify medications and lifestyle modifications for managing their risk profile, psychosocial needs and referral to appropriate cardiac rehabilitation or other secondary prevention programs. Cardiac rehabilitation is a key factor in preventing mortality and recurrent cardiac events[15, 16].

14.1 Compliance With Discharge Medication Prescribing

Compliance with the prescription of DAPT (94.5%) and lipid lowering therapy (95.4%) remain high in 2022 and consistent among the various clinical presentations and hospital characteristics (Table 8). Prescription rates for females vs males were consistent for both DAPT and LLT.

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

	Discharged on DAPT (%)	Discharged on LLT (%)
STEMI (N=3,232)	95.2	97.5
NSTEACS (N=4,425)	95.1	96.8
Non-ACS (N=7,740)	94.0	93.8
Low volume <250 (N=1,997)	94.3	94.3
Medium volume 250-500 (N=6,084)	94.8	97.1
High volume >500 (N=7,316)	94.4	94.4
On-site CABG (N=8,450)	93.3	95.7
Off-site CABG (N=6,947)	96.1	95.2
Metro (N=13,668)	94.3	95.4
Non-metro (N=1,729)	96.7	95.9
Public (N=9,754)	96.1	96.4
Private (N=5,643)	91.9	93.8
All cases (N=15,397)	**94.5**	**95.4**

14 National Heart Foundation of Australia & Cardiac Society of Australia and New Zealand (2016) Australian Clinical Guidelines for the Management of Acute Coronary Syndromes. Heart, Lung and Circulation, 25, 895–951. https://doi.org/10.1016/j.hlc.2016.06.789

15 Mitchell, Matthew D et al. "Systematic review and cost-benefit analysis of radial artery access for coronary angiography and intervention." Circulation. Cardiovascular quality and outcomes vol. 5,4 (2012): 454-62. doi:10.1161/CIRCOUTCOMES.112.96526

16 Zhang Y, Cao H, Jiang P, Tang H. Cardiac rehabilitation in acute myocardial infarction patients after percutaneous coronary intervention: A community-based study. Medicine (Baltimore). 2018;97(8):e9785. doi:10.1097/MD.0000000000009785

14.2 Referral to Cardiac Rehabilitation

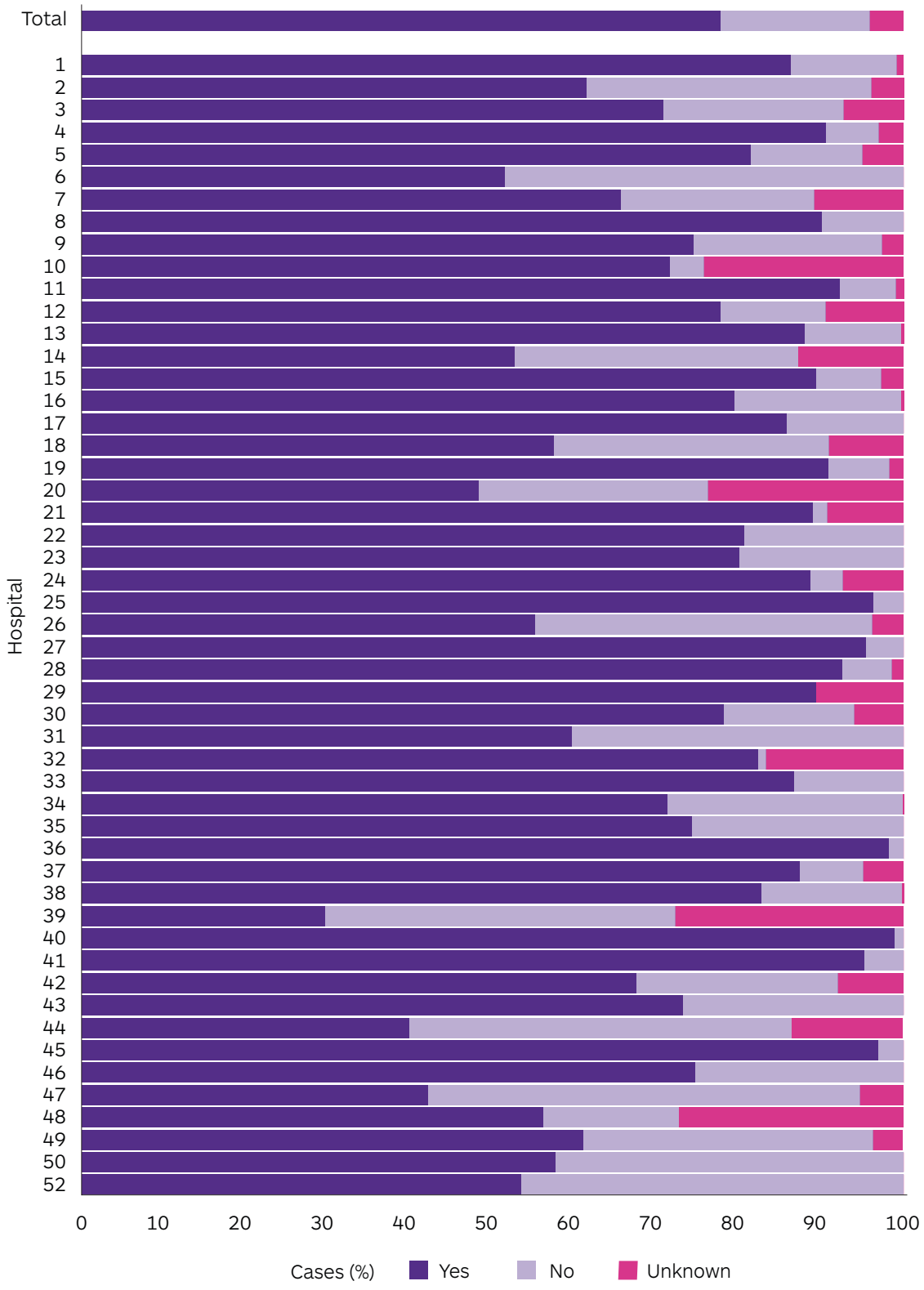
The overall rate for referral to cardiac rehabilitation following PCI was 77.7% (Table 9). There was no significant difference in the rate of referral to cardiac rehabilitation observed based on sex - (77.9% for females vs 77.2% for males).

The percentage of patients referred ranged by hospital from 29.6% to 96.3%. (Figure 31). Hospitals with low rates of referral had a high rate of cases where it was 'unknown' if the patient was referred to rehab. This suggests that hospitals with low rates are likely to be related to how the data is collected/ documented at the individual hospital and not representative of the true referral rate.

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

	Cases with data available	Rehabilitation referral rate	Referral status 'unknown'
Clinical presentation	N	%	%
STEMI	4,704	83.9	4.0
NSTEACS	6,001	79.8	4.1
Non-ACS	9,350	73.3	4.1
Hospital types	N	%	%
Low volume <250	1,889	66.6	12.7
Medium volume 250-500	7,601	78.7	2.4
High volume >500	10,565	79.0	3.8
On-site CABG	11,508	78.6	2.5
Off-site CABG	8,547	76.5	6.2
Metro	16,134	76.6	4.7
Non-metro	3,921	82.5	1.5
Public	14,513	79.8	3.6
Private	5,542	72.3	5.4
All	**20,055**	**77.7**	**4.1**

Figure 31: Referral to cardiac rehabilitation rate by hospital



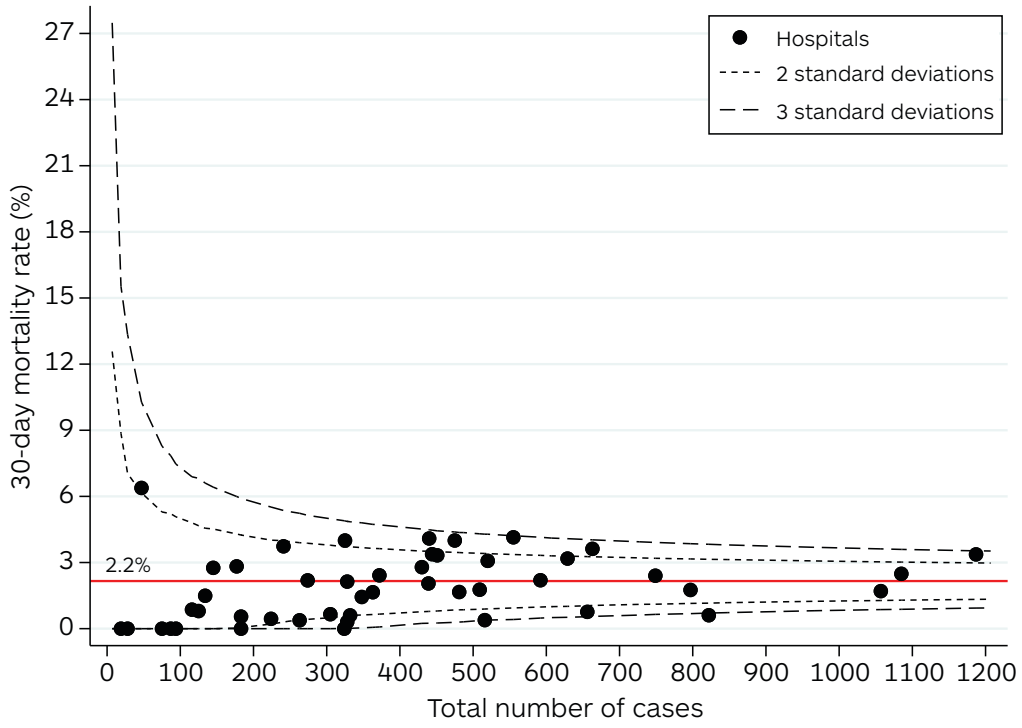
15. 30-Day Outcomes

The measurement of outcomes at 30 days (post discharge) continues to be a standard approach in clinical quality assessment and provides important information regarding performance and quality of care for PCI patients. Collection of these data varies within contributing registries, therefore not all jurisdictions were able to provide complete data sets of all 30-day endpoints utilised in this report. Six of the eight jurisdictions provided data on 30-day mortality and 30-day unplanned cardiac readmissions and five registries provided data on 30-day unplanned revascularisation. For the set of 30-day outcomes being assessed, the number of contributing hospitals ranged from 39 to 47, out of a possible total of 57 hospitals.

15.1 30-Day Mortality

The overall unadjusted 30-day mortality rate following PCI was 2.2% and all participating hospitals were within control limits (Figure 32). When cardiogenic shock and/or intubated OHCA cases were excluded, the mortality rate was 1.1%. The 30-day mortality rate for STEMI patients was 5.8%, with the highest mortality observed in patients aged 80 years and over (13.3%).

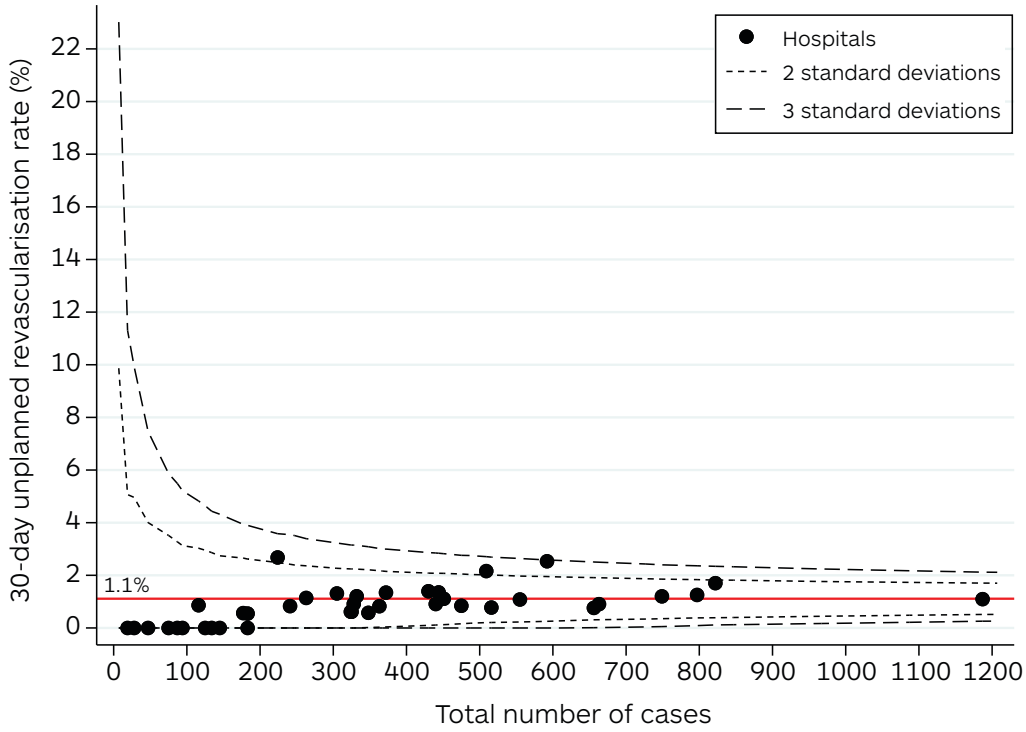
Figure 32: 30-day mortality rate by hospital



15.2 30-day Unplanned Revascularisation

The overall rate of unplanned revascularisation within 30 days post-PCI was 1.1% with all participating hospitals within control limits (Figure 33) (range by hospital 0-2.7%).

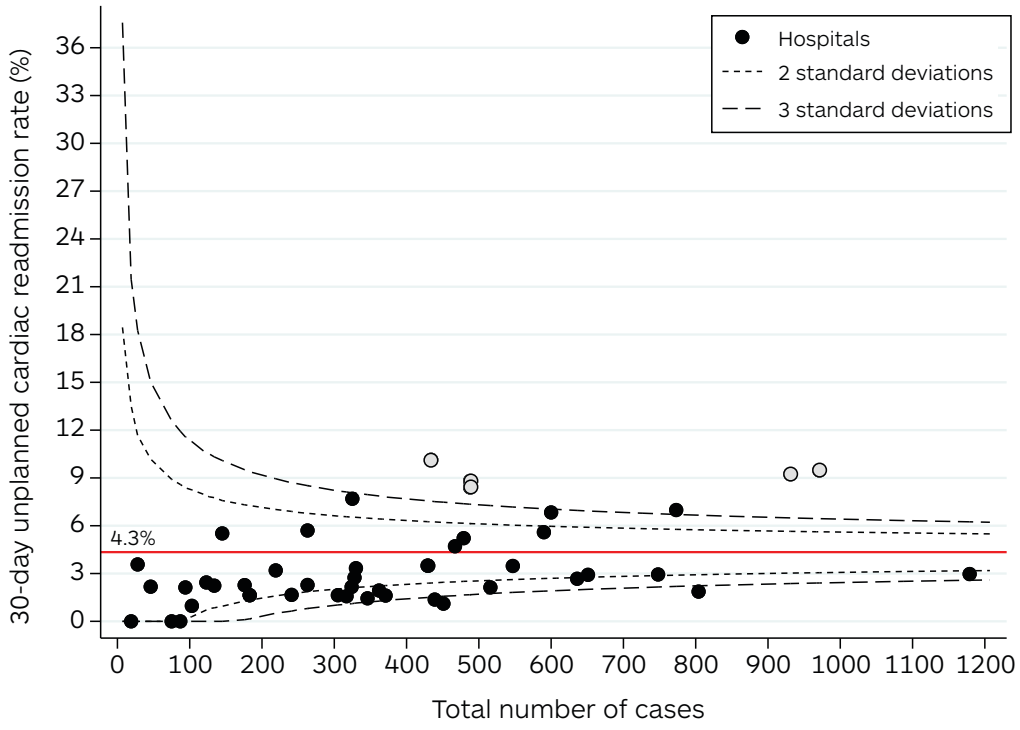
Figure 33: 30-day unplanned revascularisation rate by hospital



15.3 30-day Unplanned Cardiac Readmissions

Of the 46 hospitals contributing data for this outcome measure, five hospitals had rates of 30-day unplanned cardiac readmission that were >3 standard deviations beyond the mean. All of these hospitals had a medium to high case volume. The rate of unplanned cardiac readmission ranged by hospital from 0% to 10.3%.

Figure 34: 30-day unplanned cardiac readmission rate by hospital



16. Conclusions and Future Plans

In 2023, the National Cardiac Registry reported on over 70,000 procedures, received data from 57 hospitals, and included private hospital data for the first time. As the Registry matures, the number of contributing hospitals will increase. This will strengthen the ability to undertake additional data analyses, thus identify emerging trends over time.

As the Registry actively prepares for increased hospital participation, complex work is underway to enable multiple methods of data collection, providing an opportunity for hospitals to contribute data directly. This project includes building a database for direct entry, whilst also increasing the platform infrastructure to ingest data and enhance reporting capability. Ongoing engagement through collaboration with states and territories is a vital step in ensuring its future success.

The Registry provides meaningful, relevant and transparent feedback to state and territory based registries, hospitals, clinicians and health services, and is well placed to achieve success in harnessing insights in national cardiac data to drive better outcomes in cardiac care. A five-year strategic plan and roadmap is in place and work is underway to prepare for the future. This includes the exploration of opportunities for data linkage, and expansion into other modules of data collection, including therapeutic areas in addition to PCI.

17. Acknowledgements

The Registry and the information provided in this report would not be possible without the support of the State and Territory Registries whose data make up this report. We also thank our dedicated Committee members, Project Management Team at Monash University, School of Public Health and Preventive Medicine along with the NCR Ltd Board, chaired by Dr Leo Mahar (until Oct 2023) / Dr Jim Leitch (from October 2023) and supported by Megan Schoder the Company's Executive Officer.

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.

18. The Registry Project Management Team

Clinical Lead	Associate Professor Jeff Lefkovits
Program Manager	Angela Brennan
Professor, Clinical Registries	Professor Susannah Ahern
Senior Research Fellow	Dr Diem Dinh
Project Manager	Jasmine Pyyvaara
Team Lead – Health Data Services	Mark Lucas
Senior Research Officer	Harriet Carruthers
Research Officer	Mathilda Wise
Communications Manager	Claudia Lassetter
Data Visualisation Analyst	Milinda Abayawardana

19. Acronyms

ACS	Acute coronary syndrome
ACTCOR	The ACT Cardiac Outcomes Registry
AIHW	The Australian Institute of Health and Welfare
ANZSCTS	The Australian & New Zealand Society of Cardiac & Thoracic Surgeons
CABG	Coronary artery bypass graft
CADOSA	The Coronary Angiogram Database of South Australia
CHD	Coronary heart disease
CIED	Cardiac Implantable Electronic Devices
CQR	Clinical Quality Registry
CSANZ	The Cardiac Society of Australia and New Zealand
CSV	Comma-separated values file: a common form of spreadsheet
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 – The Registry
NCR Ltd.	National Cardiac Registry Limited; the company established to oversee the Registry
NHMRC	National Health and Medical Research Council
NMA	National mutual acceptance: a national scheme for the mutual acceptance of Human Research Ethics Committee review for multi-centre studies conducted in publicly funded health service.
NSTEMI	Non-ST Elevation Myocardial Infarction
NTTCD	Northern Territory Top End Coronary Database
OHCA	Out of Hospital Cardiac Arrest
PCI	Percutaneous Coronary Intervention
PHN	Pre-hospital notification: Ambulance services notify the hospital of the imminent arrival of an acute STEMI patient. This allows the hospital to 'activate' the cath lab for procedure.
PVD	Peripheral Vascular Disease
QCOR	Queensland Cardiac Outcomes Registry
SD	Standard Deviation
STEMI	ST-Elevation Myocardial Infarction
The Commission	Australian Commission on Safety and Quality in Health Care
TVR	Target Vessel Revascularisation
VCOR	Victorian Cardiac Outcomes Registry

20. Glossary

Burden of Disease	The Australian Institute of Health defines burden of disease as years of healthy life lost due to injury, illness or premature deaths
CABG Hospital	Defined as a hospital that performs Coronary artery bypass graft surgery on-site
Caseload	The total number of procedures captured in the registry, for the relevant data collection period
Clinical Quality Registry	A registry that monitors the quality of health care in a clinical domain by collecting, analysing and reporting health-related information for the purpose of quality improvement
Collecting Only	The hospital has started collecting Data for submission to the National Cardiac Registry
Contributing	The hospital is contributing Data to the National Cardiac Registry platform
Coronary Revascularisation	Coronary revascularisation is when blood flow is restored to coronary arteries/vessels after it has been reduced or blocked
Interquartile range	Quartiles divide a rank-ordered dataset into four equal parts. The values that divide each part are called the first, second and third quartiles. First, second and third quartiles correspond to the observation at the 25th, 50th and 75th percentiles, respectively. The period between the 25th percentile to the 75th percentile is referred to as the interquartile range
Metro hospital	A hospital within an Australian capital city
Non-Metro hospital	A hospital outside an Australian capital city
Percutaneous Coronary Intervention	A minimally invasive procedure to open narrowed or blocked arteries
Pre-hospital notification	When ambulance or emergency clinicians notify a hospital in advance that a patient is enroute for treatment
Hospital	A public or private hospital within Australia that offers a Percutaneous Coronary Intervention (PCI) service

21. Governance Structure

21.1 The NCR Board

The NCR Limited Board is made up of representatives from each jurisdiction, the Cardiac Society of Australia and New Zealand (CSANZ), Australian and New Zealand Society of Cardiac and Thoracic Surgeons (ANZSCTS), and an independent Chair.

Table 10: National Cardiac Registry Limited Board

Member	Role with 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
Dr Dinesh Arya	Treasurer and ACT Board Director	Chief Medical Officer ACT Health
Dr Nigel Lyons	NSW Board Director	Deputy Secretary, Health System Strategy and Planning NSW Health (until November 2022)
Dr Jean-Frédéric Levesque	NSW Board Director	Chief Executive NSW Agency for Clinical Innovation; Deputy Secretary, Clinical Innovation and Research, NSW Ministry of Health (from January 2023)
Dr Sara Watson	NT Board Director	Director of Medical Services, Royal Darwin and Palmerston Hospitals, NT Health
Kirstine Sketcher-Baker	QLD Board Director	Executive Director at Patient Safety and Quality Improvement Service, Clinical Excellence Division, Queensland Health (until July 2023)
Associate Professor Catherine McDougall	QLD Board Director	Chief Medical Officer, QLD Health (from July 2023)
Michele McKinnon	SA Board Director	Executive Director, Quality, Information and Performance, SA Health (until March 2022)
Dr Michael Cusack	SA Board Director	Chief Medical Officer, SA Health (from October 2022)
Hannah Paal	TAS Board Director	Statewide Manager, Acute Service Development and Enhancement Unit Tasmania Health
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

(L to R) Prof John Atherton CSANZ Nominated NCR Director, Prof Stephen Nicholls CSANZ President, Dr James Leitch Chair NCR Board, Dr Emily Granger President ANZSCTS and A/Prof Andrew Cochrane ANZSCTS Nominated NCR Director

21.2 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
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
Dr Michael Cusack	Member	Chief Medical Officer SA Health

21.3 National Cardiac Registry Indigenous Committee

The Indigenous Advisory 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)

21.4 National Cardiac Registry Variation Oversight Committee

The Variation Oversight Committee is currently being established and will 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
Dr Nigel Lyons	Member	Deputy Secretary, Health System Strategy and Planning NSW Health (Until November 2022)
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	Director of Cardiology, Sunshine Coast University Hospital and Chair of the Queensland Cardiac Outcome Registry Interventional Steering Committee (from October 2023)

21.5 National Cardiac Registry Steering Committee

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

Its core functions are to:

- Engage with states and territories to promote participation
- Design registry outputs and oversee data analysis and reporting
- Oversee the operational aspects of the registry
- Report progress against deliverables into the Registry Board

The Registry steering committee is comprised of Australian state and territory, clinicians, government representatives, subject matter experts, an Australian government nominee, 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 and Clinical Lead for the Victorian Cardiac Outcomes Registry and Interventional Cardiologist
Dr Rohan Poulter	Deputy Chair	Director of Cardiology, Sunshine Coast University Hospital and 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 Clinical Expert	Director of Cardiology, Canberra Health Services (from August 2023)
Mrs Sue Morberger	ACT Gov. Representative	Assistant Director, ACT Cardiac Outcomes Registry, Clinical System Governance Unit, ACT Health Directorate
Professor David Brieger	NSW Clinical Expert	Chair, NSW Cardiac Clinical Network; Interventional Cardiologist and head of Cardiology, Concord Hospital
Ms Melissa Tinsley	NSW Gov. Representative	Associate Director, Integrated Digital Enablement Accelerator (IDEA), NSW Agency for Clinical Innovation
Dr Catherine Francis	NSW Registry Representative	Senior Medical Advisor, Centre for Epidemiology and Evidence, NSW Health
Mr William Vollbon	QLD Gov. Representative	Queensland Cardiac Outcomes Registry Manager, Statewide Cardiac Clinical Informatics Unit, Queensland Health
Associate Professor Chris Zeitz	SA Gov. Representative	CADOSA Steering Committee Member, A/Prof of Rural & Indigenous Cardiovascular Health, Adelaide Medical School, University of Adelaide Director of Cardiology, The Queen Elizabeth Hospital, Central Adelaide Local Health Network
Professor John Beltrame	SA Clinical Expert	CADOSA Data Custodian, Michell Professor, Adelaide Medical School, University of Adelaide, Senior Cardiologist, Central Adelaide Local Health Network, Director of Research, Central Adelaide Local Health Network
Associate Professor Rosanna Tavella	SA Registry Representative	CADOSA Registry Manager, Clinical Data Manager, Central Adelaide Local Health Network Affiliate A/Professor, Adelaide Medical School, University of Adelaide

Member	Role within Committee	Substantive role
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	MBBS, DRANZCOG, FRACGP, M Leadership (Health), AFRACMA Medical Advisor Clinical Quality, Clinical Governance Medical Director, GP and Primary Care Clinical Quality, Regulation and Accreditation (CQRA) Group, DoH Tasmania (from September 2023)
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)
Professor Tom Briffa	WA Clinical Expert	Cardiovascular Epidemiology Research Centre, School of Population and Global Health, University of Western Australia
Dr Jamie Rankin	WA Clinical Expert	Head of Cardiology, Fiona Stanley Hospital, Western Australia
Dr Christina Bertilone	WA Gov. Representative	Patient Safety and Clinical Quality Directorate, Department of Health Western Australia (until April 2022)
Dr Ben Hartmann	WA Gov. Representative	Patient Safety and Clinical Quality Directorate, Department of Health Western Australia (until August 2022)
Mr Ben Weber	WA Gov. Representative	Patient Safety and Clinical Quality Directorate, Department of Health Western Australia (from August 2022)
Mr David Gist	Consumer Representative	Cardiovascular Service Consumer (until October 2023)
Dr Dorothy Morrison	National Aboriginal and Torres Strait Islander Representative	National Cardiac Registry Aboriginal and Torres Strait Islander Peoples Committee Chair (until August 2022)
Mr David Follent	National Aboriginal and Torres Strait Islander Representative	Senior Project Officer, CCAP (from Sept 2022)
Ms Sally Rayner	Department of Health Representative	Director – Clinical Quality Registries

National Cardiac Registry Limited
ABN 75 640 959 226
PO Box 3161, North Adelaide SA 5006

https://nationalcardiacregistry.org.au