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Medication use for secondary prevention after coronary heart disease hospitalisations

Patient pathways
using linked data



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Summary

An estimated 580,000 Australian adults have coronary heart disease (CHD). CHD is the leading single cause of disease burden and death in Australia and has substantial costs for both the individual and the health system.

Acute coronary syndrome (ACS) is a subset of CHD, which includes heart attacks and unstable angina, which are sudden, severe and life threatening events. CHD is the most common form of cardiovascular disease (CVD).

People who have been hospitalised for CHD are at higher risk of having another cardiovascular event in the future. However, they can take steps to reduce this risk, including by taking cardiovascular medicines. Australian Clinical Guidelines for the Management of Acute Coronary Syndromes recommend that people who survive a CHD event be prescribed a multi-drug regime. Despite evidence that this substantially reduces the risk of future cardiovascular events, research indicates that not all patients are being prescribed and/or are taking these medicines.

This project explores some of the factors that affect medication use by CHD patients discharged from hospital. It found that younger patients and women were among those people less likely to be dispensed cardiovascular medicines and/or to still be taking them 1 year after leaving hospital. This information may help policy-makers and health practitioners to develop strategies to improve medication use among these groups.

The project uses the National Integrated Health Services Information Analysis Asset (NIHSI AA), which links data from the Medicare Benefits Schedule, Pharmaceutical Benefits Scheme, hospitals, residential aged care and the National Death Index. Use of this linked data set allows a better understanding of how people use and interact with the health system.

The NIHSI AA includes data from New South Wales, Victoria, Queensland, South Australia, Tasmania and the Australian Capital Territory.

The project analysed data for 67,800 people who had been admitted to hospital with CHD between 1 July 2016 and 30 June 2017. About half (35,200, or 52%) of these people had acute coronary syndrome (ACS), which covers heart attacks and unstable angina.

The analysis found that:

- 3 in 5 (61%) people with ACS were dispensed 3 or more of the recommended cardiovascular medicines within 40 days of leaving hospital. Women, and people aged under 65 with less severe CHD subtypes, were less likely to be dispensed the recommended medicines within this time frame
- around 3 in 4 (74%) of all CHD patients were still taking their medicines 1 year after leaving hospital. People in older age groups and those who regularly saw their general practitioner (GP) were more likely to be doing so
- people who had been dispensed the medicines in the year before going to hospital were significantly more likely to be dispensed medicines after being discharged from hospital and to be still taking them 1 year later
- 1 in 5 (21%) CHD patients had an emergency CVD-related readmission and 1 in 15 (6.6%) died within 2 years after the hospital admission.

Further work is required to identify why some population subgroups were less likely to initiate, or continue to access, preventive medications after hospitalisation for ACS.

1

Introduction





Coronary heart disease (CHD) is the leading single cause of disease burden and death in Australia and has substantial costs for both the individual and the health system (AIHW 2021a, 2021b).

People hospitalised for CHD are at substantially greater risk of having recurrent cardiovascular events (for example, an acute myocardial infarction, or AMI) (Briffa et al. 2011). Health care that aims to prevent a recurrence of cardiovascular events or complications in patients with diagnosed CHD is referred to as secondary prevention. Secondary prevention involves medical treatment (including use of medications), modification of risk factors, psychosocial care, education, and support for self-management.

The Australian Clinical Guidelines for the Management of Acute Coronary Syndromes (Chew et al. 2016) – hereafter referred to as the Guidelines – outlines a multi-drug regime for people who survive a CHD event that aims to prevent future cardiovascular events. This regimen specifies use of a statin, beta blocking agent, angiotensin-converting enzyme inhibitor or angiotensin receptor blocker (ACEI/ARB), and an antiplatelet agent. Despite evidence that this drug combination substantially reduces the risk of major health outcomes, existing research reveals suboptimal prescription of medicines after CVD hospitalisations and poor adherence to medications over time (Naderi et al. 2012; Packard and Hillman 2016).

Identifying subgroups of the population who do not access Guideline-indicated medicines after a hospital separation – or who fail to adhere to prescribed medications over the long term – may allow targeted strategies to be developed to improve patterns of medication use for secondary prevention among people hospitalised for CHD. This approach aligns closely with key objectives of the National Strategic Action Plan for Heart Disease and Stroke, which focus on:

- improving the transition from hospital into the community
- improving post-discharge support services to ensure ongoing preventive medication use and treatment and rehabilitation
- supporting priority populations with heart disease and stroke (Department of Health 2020).

Analysing linked administrative health services data allows examination of medication use among a cohort of people discharged from hospital after a CHD-related admission. This project, which uses data held in the National Integrated Health Services Information Analysis Asset (NIHSI AA), examined initiation, persistence and adherence to Guideline-indicated medications among people with CHD, and among a subset of the cohort diagnosed with acute coronary syndrome (ACS). It examined demographic, clinical and community-based health care service use factors associated with patterns of medication use.

The Australian Institute of Health and Welfare's (AIHW's) National Centre for Monitoring Chronic Conditions undertook this project, and the Department of Health and Aged Care funded it.



Aims

The research questions this project explored are listed here:

- What proportion of people discharged after an acute CHD-related hospitalisation were dispensed the Guideline-indicated medications for secondary prevention within 40 days? Did the supply of medication after hospitalisation vary by demographic, clinical or other factors?
- What proportion of people discharged from hospital after an acute CHD-related hospitalisation continued to access Guideline-indicated medications at selected time points after hospitalisation? Did medication persistence at 1 year after discharge vary by demographic, clinical or other factors?
- What proportion of people discharged from hospital after an acute CHD-related hospitalisation adhered to the Guideline-indicated medications? Did adherence vary by demographic, clinical or other factors?

2

About the project





This project uses data from the NIHSI AA (version 1.0) – a linked administrative data set held by the AIHW. It includes:

- admitted patient care data from the National Hospital Morbidity Database
- deaths data from the National Death Index
- prescription medications data from the Pharmaceutical Benefits Scheme (PBS) and the Repatriation Pharmaceutical Benefits Scheme
- data on use of Medicare subsidised health services from the Medicare Benefits Schedule (MBS).

The NIHSI AA holds data from New South Wales, Victoria, Queensland, South Australia, Tasmania and the Australian Capital Territory.

The accompanying technical report presents detailed information on the data sources, cohort selection, analysis variables, measures and statistical methods.

Key definitions and measures used in this report are presented in boxes 1–3.

Cohort

The cohort included 67,800 people, aged between 25 and 84, who had a CHD hospitalisation with an acute care type between 1 July 2016 and 30 June 2017 and were alive at the point of discharge.

In this project, we examined outcomes for the whole cohort (the ‘all CHD’ cohort) as well as for a subgroup of people diagnosed with ACS. See Box 1 for CHD definitions.

Box 1: Coronary heart disease definitions

Coronary heart disease (CHD): a disease due to a blockage in the blood vessels that supply blood to the heart muscle. There are 2 major clinical forms – heart attack (also known as acute myocardial infarction, or AMI) and angina.

Heart attack (or acute myocardial infarction): a life-threatening event where a blocked blood vessel threatens to damage the heart muscle. Clinically, AMI is often categorised based on the pattern that appears on an electrocardiogram (ECG) (a diagnostic tool that measures and records the heart’s electrical activity):

- STEMI, or ST segment elevation myocardial infarction, is so named because the ‘ST segment’ on the ECG appears elevated. STEMI is a type of heart attack almost always caused by a complete blockage to a major coronary artery.
- NSTEMI, or non-ST segment elevation myocardial infarction, is a type of heart attack in which an artery is frequently partially blocked. This severely reduces blood flow. Unlike STEMI, the ‘ST segment’ on the ECG is not elevated.

continued

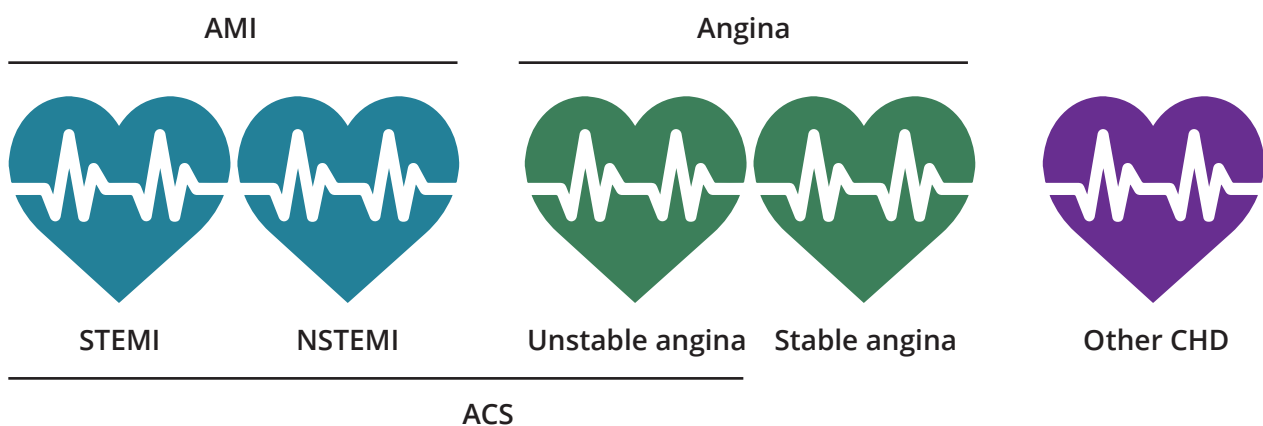


Box 1 (continued): Coronary heart disease definitions

Angina: a chronic condition in which intermittent episodes of chest pain can occur when the heart has a temporary deficiency in blood supply. Unstable angina can be dangerous due to the changing severity in partial coronary blockages. Stable angina is generally not life threatening.

Acute coronary syndrome (ACS): a term used to describe a continuum of acute coronary artery diseases (including heart attacks and unstable angina). These conditions are sudden, severe and life-threatening events.

Other CHD: a category that includes complications following AMI, and chronic coronary heart diseases. In this project, almost all (99%) of people classified as having 'other CHD' had a diagnosis of chronic CHD.



Coronary artery bypass grafting (CABG): a surgical procedure that uses blood vessel grafts to bypass blockages in the coronary arteries and restore adequate blood flow to the heart muscle.

Percutaneous coronary interventions (PCIs): procedures used to restore blood flow to the myocardium by removing blockages in the coronary arteries. Two types of procedure are used: coronary angioplasty without stent, and coronary stenting.

Reference period

The pre-hospitalisation period was from the start of the data set (1 July 2010) to the index hospital admission date. This period was used to identify comorbidities, including existing CHD, use of community health services, and prior use of in-scope CVD medicines for each patient.

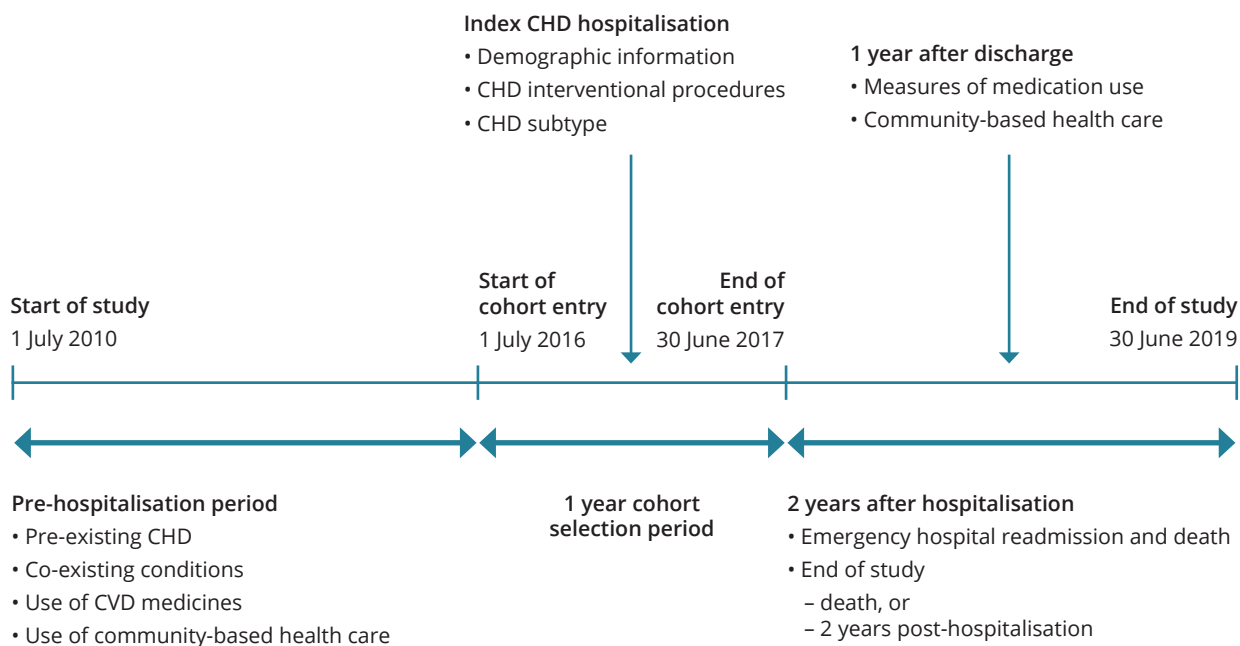
The cohort selection period, during which the index hospitalisation was identified, was from 1 July 2016 to 30 June 2017. Demographic information, CHD subtype (see Box 1) and interventional CVD procedures performed were identified from the index hospitalisation.

The post-hospitalisation period began at the date of hospital discharge and ended at death or 2 years after hospitalisation (whichever occurred first). This period was used to examine patterns of CVD medication use (see Box 2), community-based health service use and health outcomes (hospital readmission and/or death).

See Figure 1 for the study timeline.



Figure 1: Study timeline



Box 2: Cardiovascular disease medicines

Guideline-indicated medications: The Australian Clinical Guidelines for the Management of Acute Coronary Syndromes (Chew et al. 2016) outlines a multi-drug regime to prevent secondary events. This comprises 4 drug classes, which were examined in this project:

1. **statins:** lipid modifying medicines that help control blood lipid levels
2. **beta blocking agents:** agents that treat high blood pressure by suppressing signals that cause the heart to beat hard and fast
3. **agents acting on the renin-angiotensin system (ACEI/ARB):** agents that treat high blood pressure by blocking effects of the renin-angiotensin system, a hormone system that regulates blood pressure and the volume of fluids in the body
4. **antiplatelet agents:** agents that prevent or dissolve blood clots, reducing the risk of heart attack or stroke.

Measures of medication use

Initiation: the first PBS dispensing record for the relevant medication, after discharge from the index hospitalisation.

Persistence: the continuation of prescribed treatments for the recommended period. In this project, a person was classified as being no longer persistent (discontinued) when there was a gap in medication supply of 60 days or more. Persistence estimates include only those people who initiated the relevant medication class.

continued



Box 2 (continued): Cardiovascular disease medicines

Adherence: the compliance by an individual with the intended timing, dosage and frequency of a medication. There are several ways to measure adherence in administrative data. In this project, it is measured using the proportion of days covered (PDC) method and the daily polypharmacy possession ratio.

Combined measures of medication use (for example, initiation to 3 or more medication classes) were also derived to try to capture the multi-drug regime provided in the Guidelines.

These measures are explained in more detail in the associated technical report.

Box 3: Community-based health care

Community-based health care includes a range of health care services provided outside of a hospital – for example, by GPs, allied health professionals, specialists seen in the community and Aboriginal and Torres Strait Islander health workers.

This project includes only MBS-subsidised community health care services (see Table S30 for MBS classifications). Supplementary tables can be accessed at <https://www.aihw.gov.au/reports/heart-stroke-vascular-diseases/use-of-medications-for-secondary-prevention-follow/contents/summary>.

GP services: Services that include general attendances, GP out-of-hours care, and GP Enhanced Primary Care items (described below). GP care is typically the first point of contact with health care professionals in the community.

Allied health services: Services provided by allied health care professionals, including physiotherapists, exercise physiologists and dieticians. Allied health services that are not government subsidised are not captured in the MBS data set and, as a result, their use is likely to be underestimated in this population.

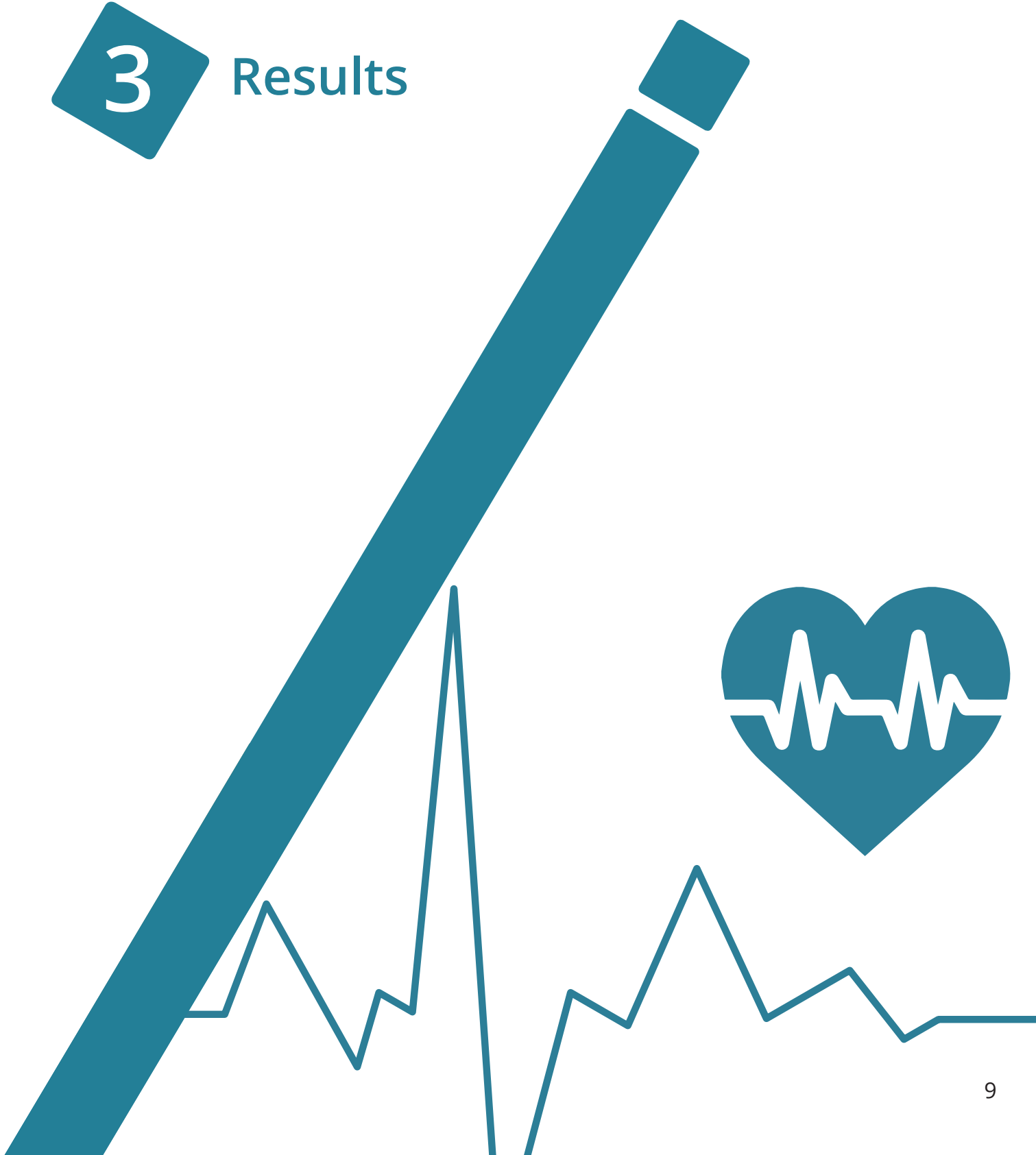
Enhanced Primary Care services: Services provided by a GP, which include MBS items that allow GPs to plan and coordinate the health care of patients with chronic conditions such as CHD. In this project, enhanced primary care services included chronic disease management plans, medication reviews, completed diabetes cycle of care, and health assessments.

Regularity of GP care: This was measured by a regularity score that calculates the variation in time intervals between GP visits. More regular GP visits are thought to represent planned preventive care; irregular visits may indicate sporadic care or a response to declining health.

Continuity of GP care: This was assessed based on the proportion of GP visits that are with a regular provider. If 75% or more services were with the same provider, the patient was considered to have high continuity of care. Higher continuity of care is associated with improved patient–provider relationships.

3

Results





Box 4: Statistical terms used in this report

Logistic regression: A statistical modelling technique used to estimate the probability of a binary outcome's occurring, based on individual characteristics (for example, the probability of a patient's being adherent to statins at 1 year after hospital separation – as opposed to not being adherent). Logistic regression outputs presented in this report are multivariate adjusted.

Odds: The ratio of the probability that an outcome will occur to the probability that it will not.

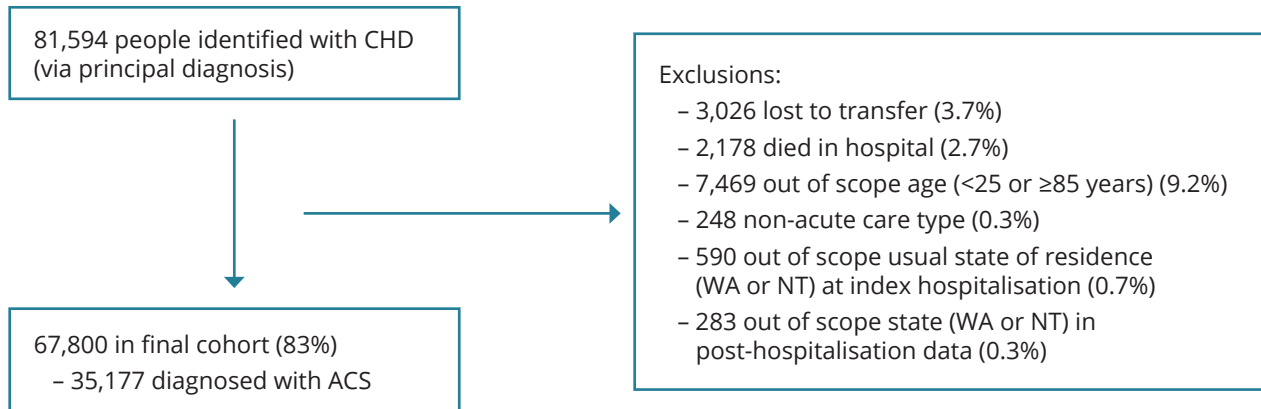
Odds ratio: The ratio of 2 odds. An odds ratio (or OR) measures the odds of an event's occurring (for example, being adherent to medications), given a characteristic relative to the reference category (for example, women compared with men). An odds ratio greater than 1 means that the characteristic is associated with a higher odds of the outcome's occurring; an odds ratio of less than 1 means that the characteristic is associated with a lower odds of the event's occurring.

Confidence interval: An interval of the likely range of values in which the odds ratio (a point estimate) falls. In this report, the confidence level of all intervals is set at 95%.

Cohort selection

The final cohort comprised 67,800 people hospitalised for CHD. Around half the cohort had a diagnosis of ACS (52%). The cohort selection is illustrated in Figure 2. See the associated technical report for additional information about cohort selection and exclusions.

Figure 2: Cohort selection





What were the cohort characteristics?

Acute coronary syndrome

Around 80% of people hospitalised for ACS were aged 55 and older (Figure 3), and more than 2 in 3 (68%) were men. The majority lived in *Major cities* (61%); less than 2% lived in *Remote and very remote* areas. Eighty-six per cent of people were discharged from a public hospital.

Almost 4% (n = 1,326) of the cohort identified as Indigenous – with a slightly higher proportion of women doing so (5.2%) than men (3.1%). For information on how Indigenous status was derived, see the technical report.

The most common CHD subtypes for people with ACS were NSTEMI (48%) followed by unstable angina (28%). Twenty three percent of the cohort had a diagnosis of STEMI (23%) and one percent had a diagnosis of unspecified myocardial infarction (MI).

Around 4 in 5 patients (79%) diagnosed with STEMI had a percutaneous coronary intervention (PCI) procedure during the index hospitalisation. PCI procedures were less common among people with other CHD subtypes (Figure 4).

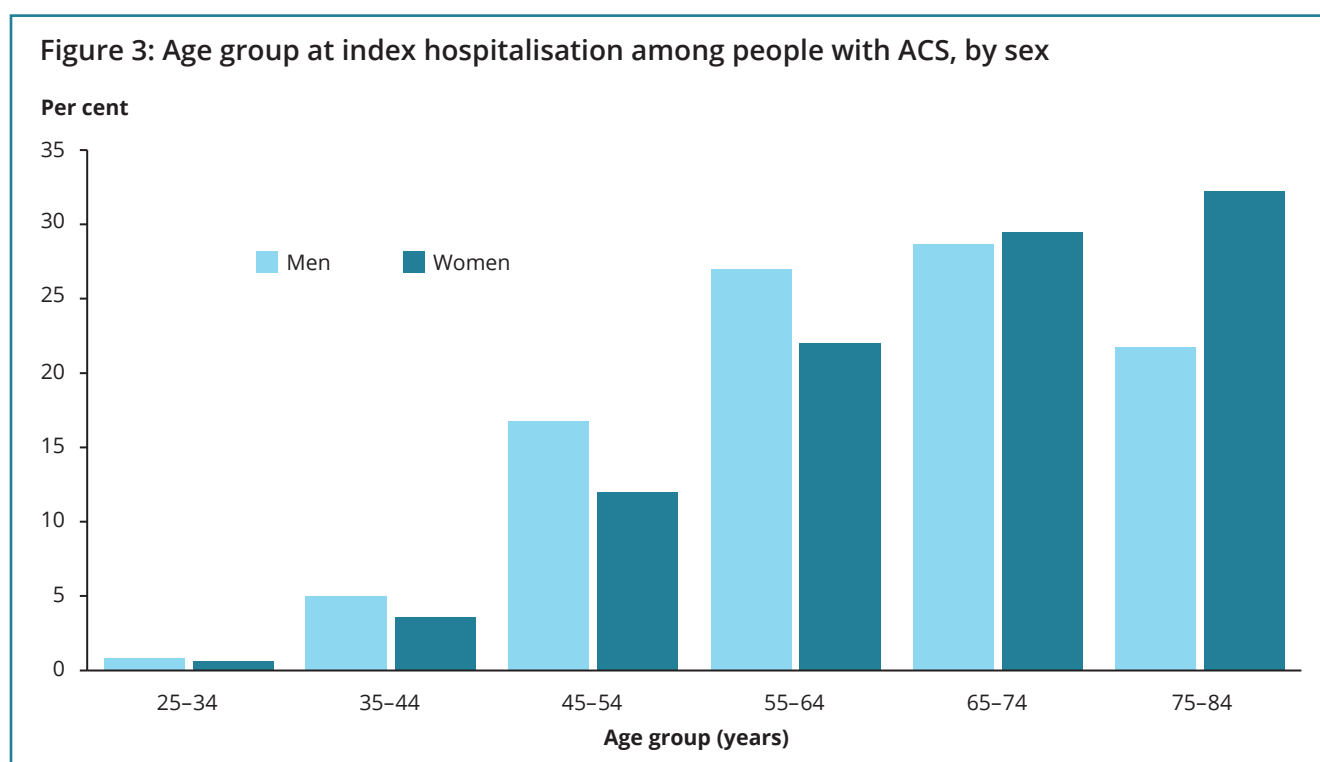
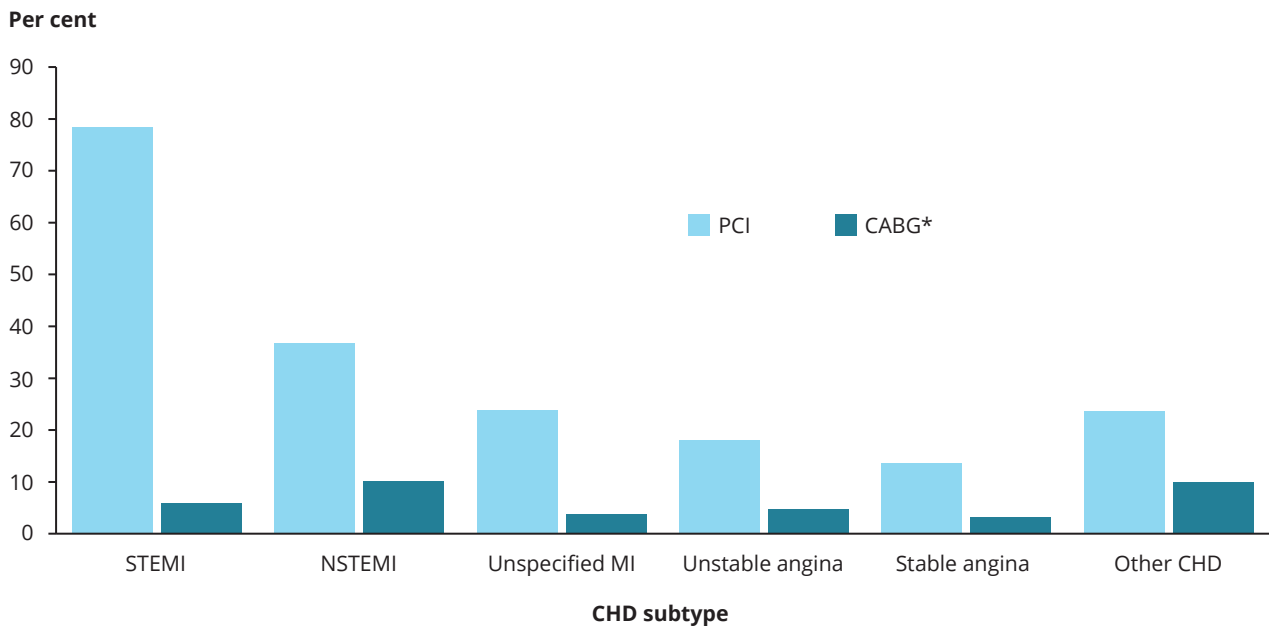




Figure 4: Procedures performed during the index hospitalisation, by CHD subtype



* coronary artery bypass grafting

All coronary heart disease

The characteristics of the CHD and ACS cohorts were similar; however, the CHD cohort was slightly older, with 83% aged 55 or over.

Around 3% of the cohort ($n = 2,092$) identified as Indigenous, with the proportion of women who did so being higher than the proportion of men (4.3% and 2.6%, respectively).

Around 1 in 4 (26%) lived in the most socioeconomically disadvantaged areas and 13% in the least disadvantaged areas.

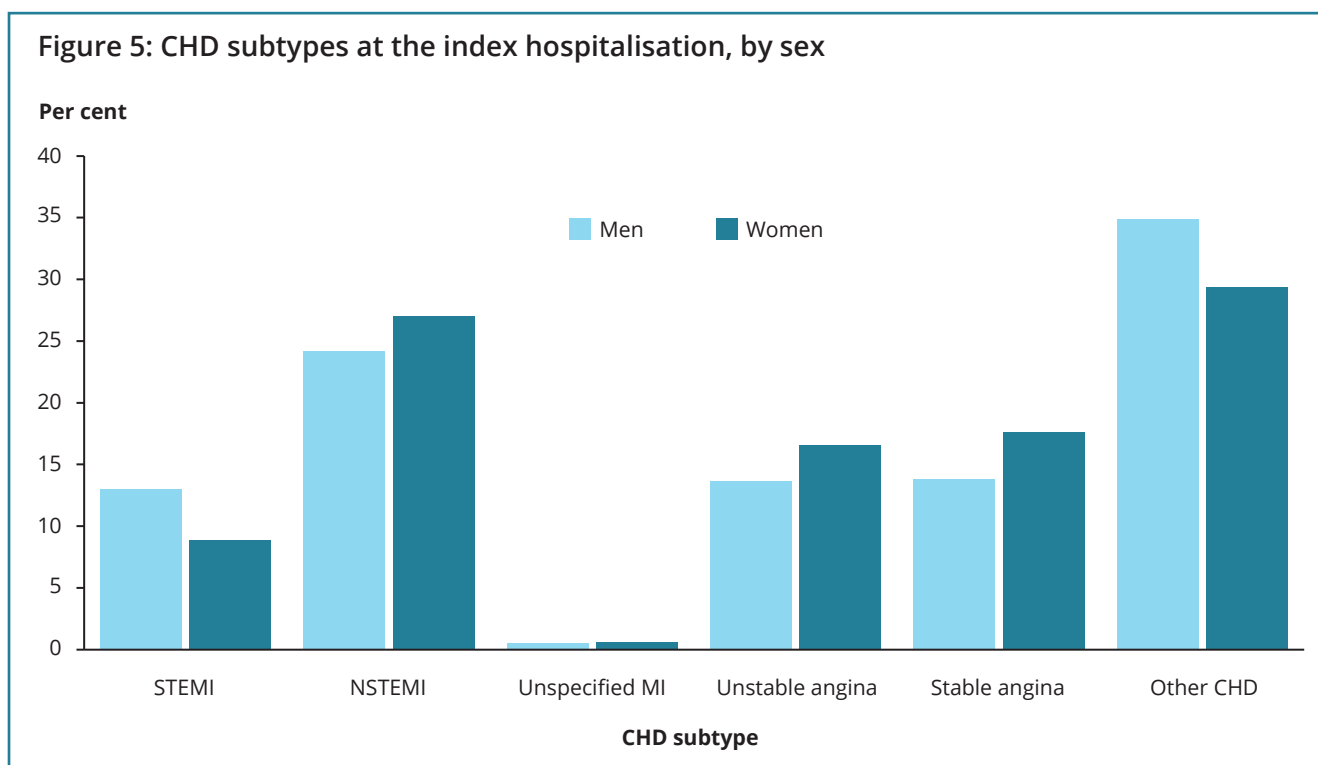
The most common CHD subtype was 'other CHD' (Figure 5). Other CHD covers diagnoses related to complications due to AMI and chronic CHD. Almost all people classified as having other CHD (ICD-10-AM: I25; 99%) had a diagnosis of chronic CHD (International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification).

Around 1 in 4 people (24%) diagnosed with 'other CHD' underwent a PCI procedure during the index hospitalisation, and 1 in 10 underwent a coronary artery bypass grafting (CABG) procedure (Figure 4).

See Supplementary Table S1 for data relating to the demographic and clinical characteristics of the cohort, and Supplementary Table S2 for procedures performed during the index stay and in the year after the index hospitalisation.



Figure 5: CHD subtypes at the index hospitalisation, by sex



How did the cohort's comorbidity profiles differ?

Comorbidity information was obtained during the pre-hospitalisation period (for example, a hospitalisation with a diagnosis of cerebrovascular disease or diabetes) and at the time of the index hospitalisation. Prior CHD diagnoses were obtained from the pre-hospitalisation period only.

It is important to note that, as comorbidities were obtained only from the hospitalisation data, the estimate of comorbidities in this population is an underestimate.

See Supplementary Table S3 for comorbidity data.

Acute coronary syndrome

Around 1 in 4 (27%) people in the cohort had a prior CHD diagnosis, 38% had a diagnosis of hypertension and around 1 in 3 (32%) had a diagnosis of diabetes. One in 5 women (21%) had a diagnosis of congestive heart failure compared with 15% of men (Figure 6).

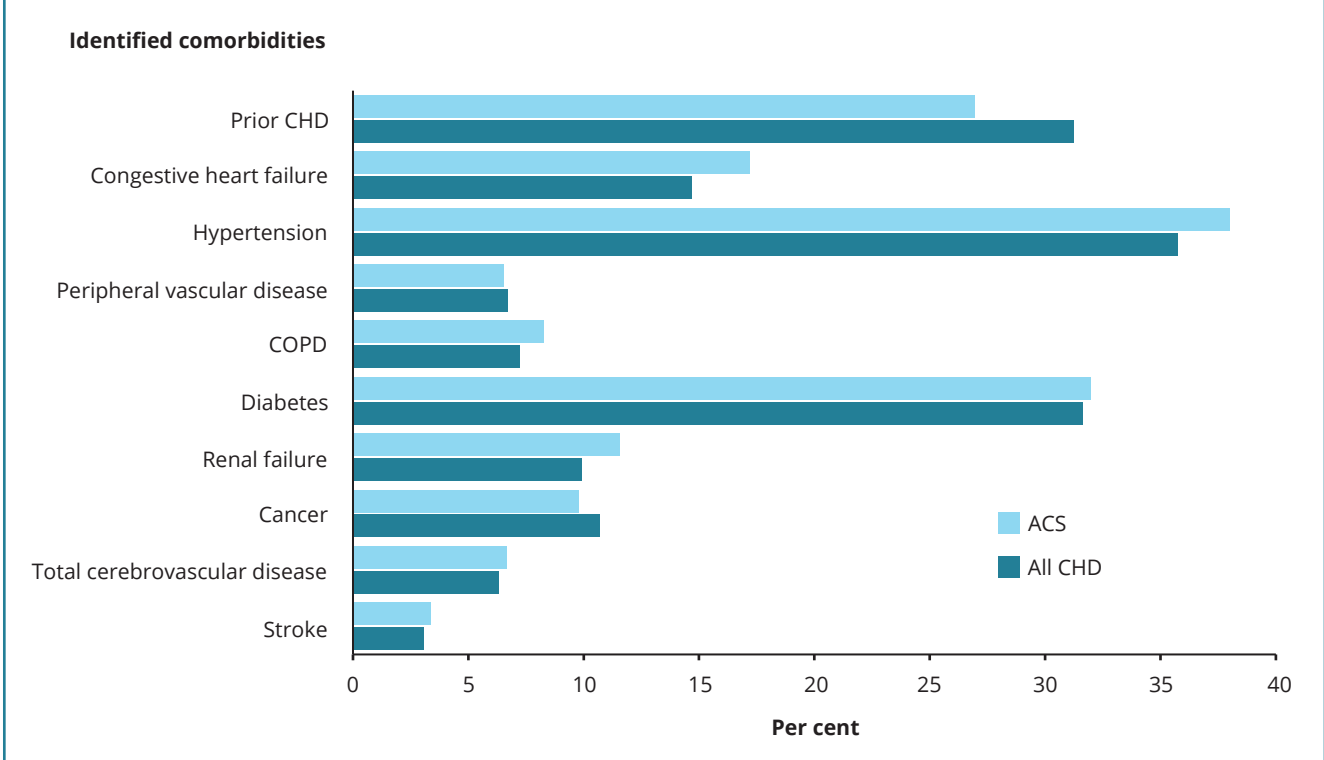
All coronary heart disease

Thirty-one per cent of the cohort had a diagnosis of CHD identified before the index hospitalisation, which suggests that 69% were incident cases of CHD. However, it is important to note that this estimate is based on a limited number of years of hospitalisation data (6 to 7 years) and may be an underestimate of pre-existing disease in this population.

As seen in Figure 6, the prevalence of comorbidities among the whole CHD cohort was similar to that for the ACS cohort.



Figure 6: Comorbidities identified before or during the index hospitalisation among people with ACS and all CHD



Were CVD medications used before the index hospitalisation?

Acute coronary syndrome

Seventy per cent of people with a diagnosis of ACS had been dispensed an in-scope CVD medicine in the year before the index hospitalisation (Figure 7), and 1 in 4 (26%) had been dispensed 3 or more of the 4 in-scope medication classes.

The most commonly dispensed classes of medicine were ACEIs/ARBs (53%) and lipid modifying agents (52%). Antiplatelet agents were the least commonly dispensed. However, it is important to note that aspirin – a common antiplatelet agent – is available over the counter. As over-the-counter medicines are not captured on the PBS, aspirin was not included in this analysis; hence, the percentage identified for use of antiplatelet agents is an underestimate. Combination drugs that included aspirin and another in-scope antiplatelet were retained in the analysis. Detailed information about in-scope medications is included in the technical report.

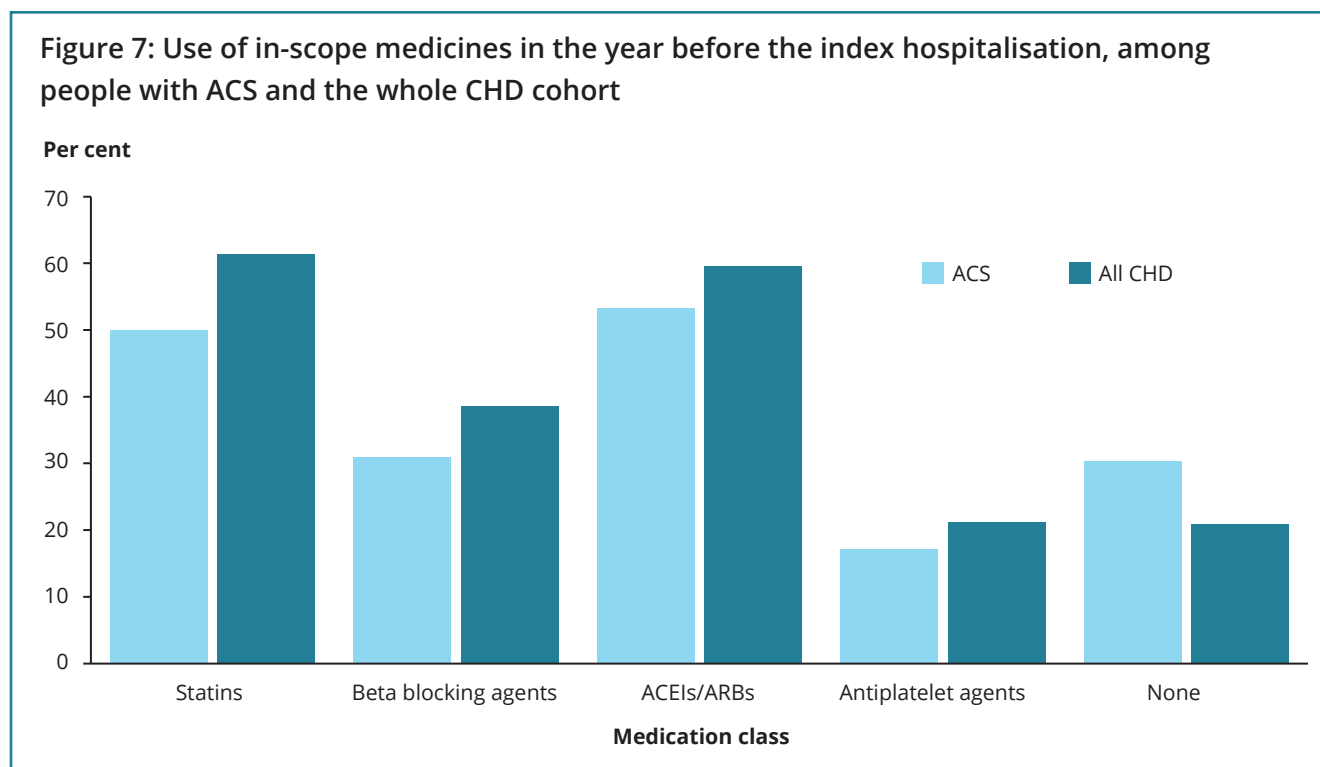
Access to individual classes of CVD medicines were similar among men and women. However, a slightly higher proportion of men than women had no dispensing record for in-scope medicines in the year before the index hospitalisation (32% and 26%, respectively).



All coronary heart disease

The most commonly dispensed classes of medicine in the CHD cohort were lipid modifying agents (64%) and ACEIs/ARBs (60%). One in 3 people in the cohort (33%) had been prescribed 3 or more in-scope medication classes in the year before the index hospitalisation. Around 1 in 5 people in the cohort were not dispensed an in-scope CVD medicine in the year before the index hospitalisation.

See Supplementary Table S4 for data related to use of CVD medicines before the index hospitalisation.



Cohort use of community-based health services before the index hospitalisation

Information on the use of community-based health care was obtained from MBS data and includes only government subsidised health services. See Box 3 for more information on in scope services and Supplementary Table S30 for MBS codes associated with each service type.

Acute coronary syndrome

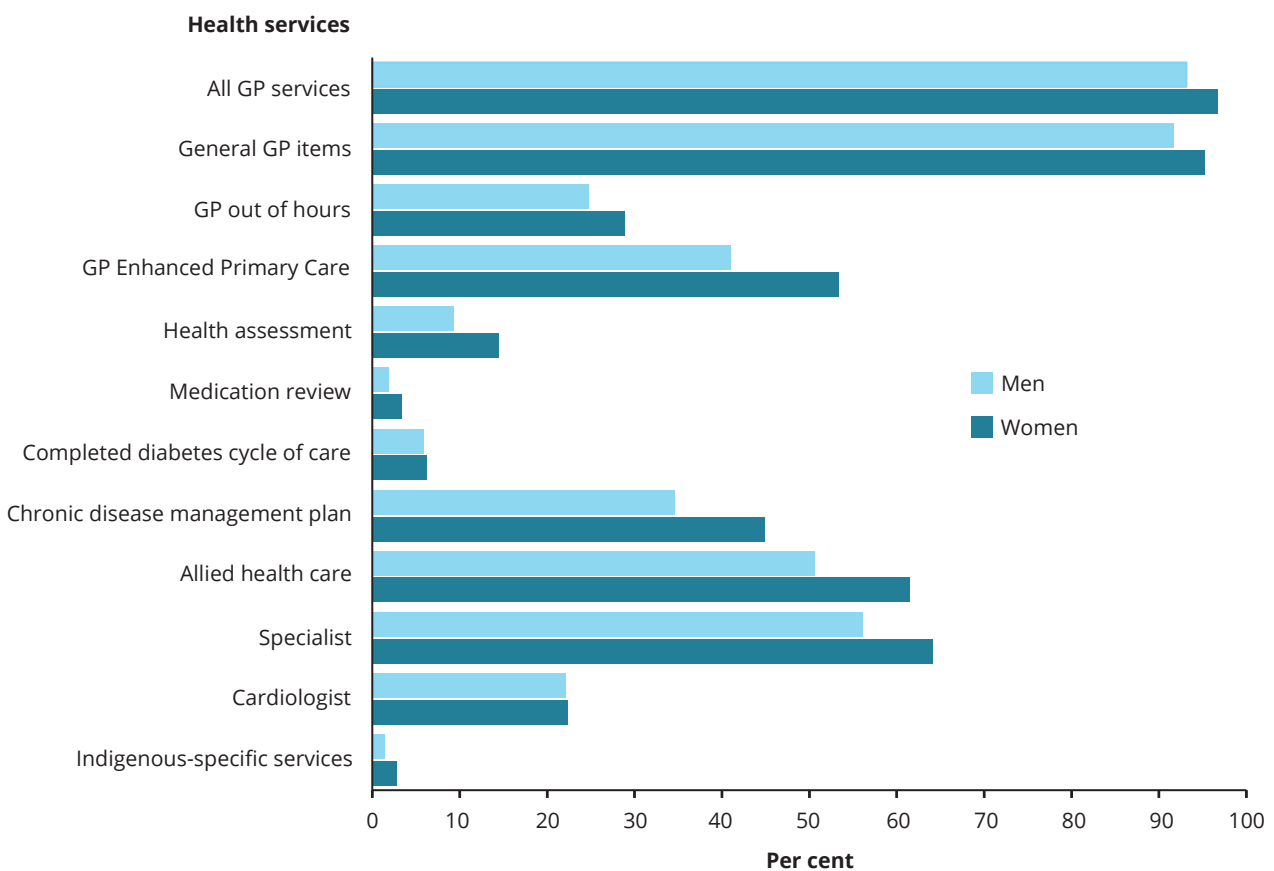
Almost all (94%) people with a diagnosis of ACS had a GP service in the year before the index hospitalisation. Forty-one per cent of men and 53% of women had a GP Enhanced Primary Care service (Figure 8), the most common item of which was a chronic disease management plan; a greater proportion of women than men accessed this service (45% and 35%, respectively). Around 1 in 5 (22%) saw a cardiologist in the year before the index hospitalisation.



Around 2% of the cohort accessed Indigenous-specific health services before the index hospitalisation. Indigenous health services captured in the analysis included MBS items relating to health assessments and allied health services (for example, diabetes education and exercise physiology) for people of Indigenous descent.

A greater proportion of women than men not only accessed all types of health services but also had a higher number of GP visits and greater continuity of GP care. Higher health service use by women than men aligns with patterns observed in the Australian population (ABS 2021).

Figure 8: Use of health services in the year before the index hospitalisation among people with ACS, by sex



All coronary heart disease

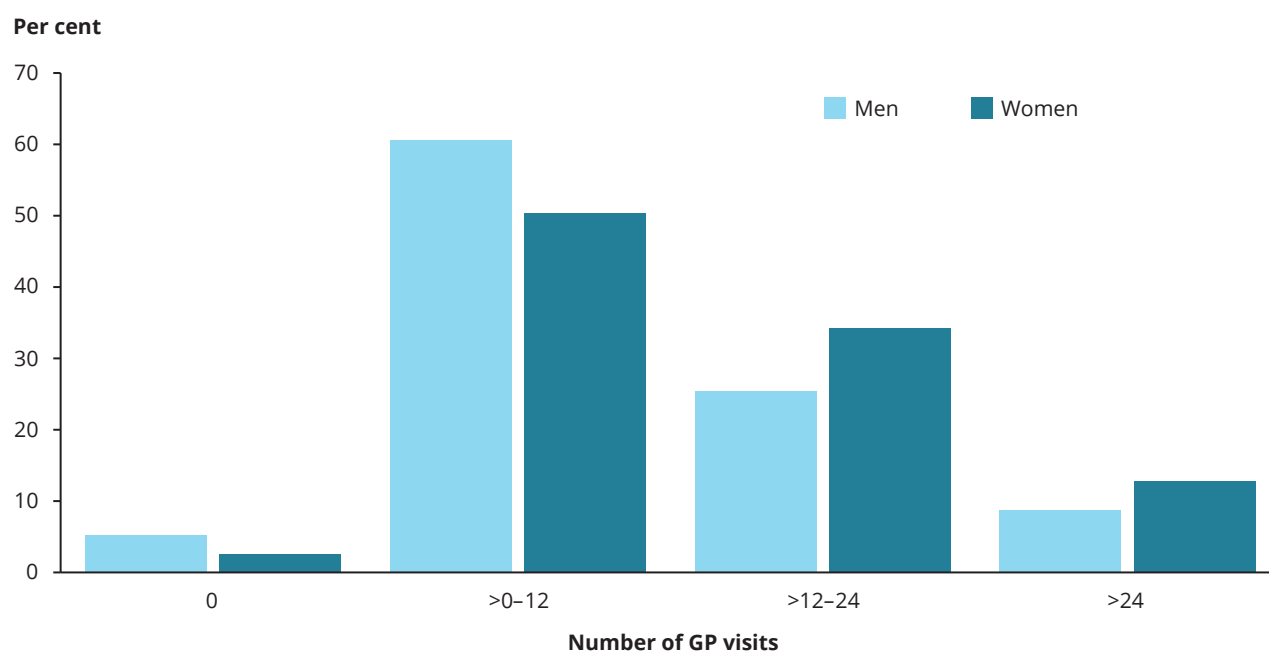
Almost half (47%) of the CHD cohort accessed GP Enhanced Primary Care services. The most commonly accessed item was chronic disease management plan (41%) followed by health assessment (11%).

As in the ACS cohort, health service use tended to be higher among women. This included a higher number of GP visits in the year before the index hospitalisation and higher levels of continuity of GP care than for men (Figure 9).

Pre-hospitalisation use of community health care data is included in Supplementary tables S5a–S5b.



Figure 9: Number of GP services in the year before the index hospitalisation, by sex



What were the major health outcomes?

Acute coronary syndrome

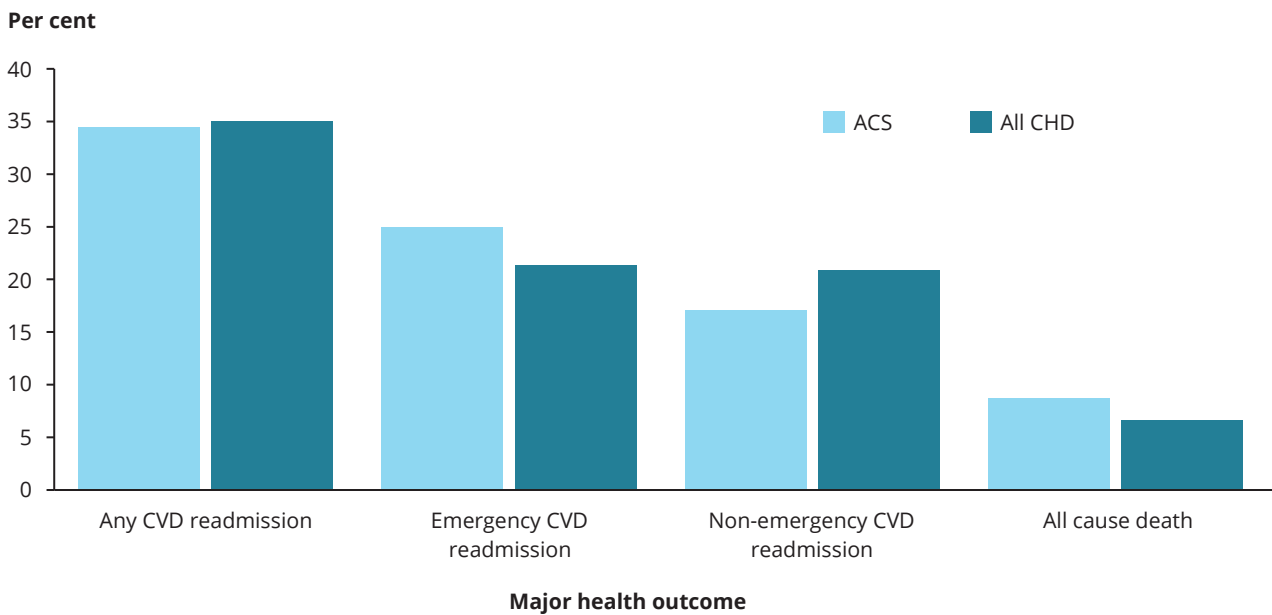
One in 4 people had an emergency CVD-related readmission within the 2 years after the index hospitalisation (Figure 10).

The most common reason for readmission (the principal diagnosis) was CHD (56%).

Seventeen per cent had a non-emergency CVD readmission within 2 years of the index hospitalisation. The rate of non-emergency readmissions was slightly higher among men than women (18% and 14%, respectively). Nine per cent of the cohort died.



Figure 10: Major health outcomes experienced in the 2 years after the index hospitalisation among people with ACS and the whole CHD cohort



All coronary heart disease

Twenty-one per cent had an emergency CVD readmission and around half of these readmissions (53%) were due to CHD. Twenty-one per cent had a non-emergency CVD readmission (Figure 10). Again, the rate of non-emergency readmissions was higher among men than women (23% and 16%, respectively). Seven per cent of patients in the cohort died within 2 years.

See Supplementary tables S6a–S6e for major health outcomes data.

Did the cohort use community-based health services after the index hospitalisation?

Acute coronary syndrome

Ninety-seven per cent of people visited a GP in the year after the index hospitalisation.

Sixty-two per cent of women and 53% of men accessed GP Enhanced Primary Care services, the most commonly item of which was a chronic disease management plan (47% of men and 53% of women), followed by health assessments (12%). Four per cent had a medication review (Figure 11).

Around 2% (2.3%) of the cohort accessed Indigenous-specific health services in the year after the index hospitalisation. A higher proportion of women than men did so (3.3% and 1.8%, respectively), which reflects, in part, the higher proportion of women who identified as Indigenous.

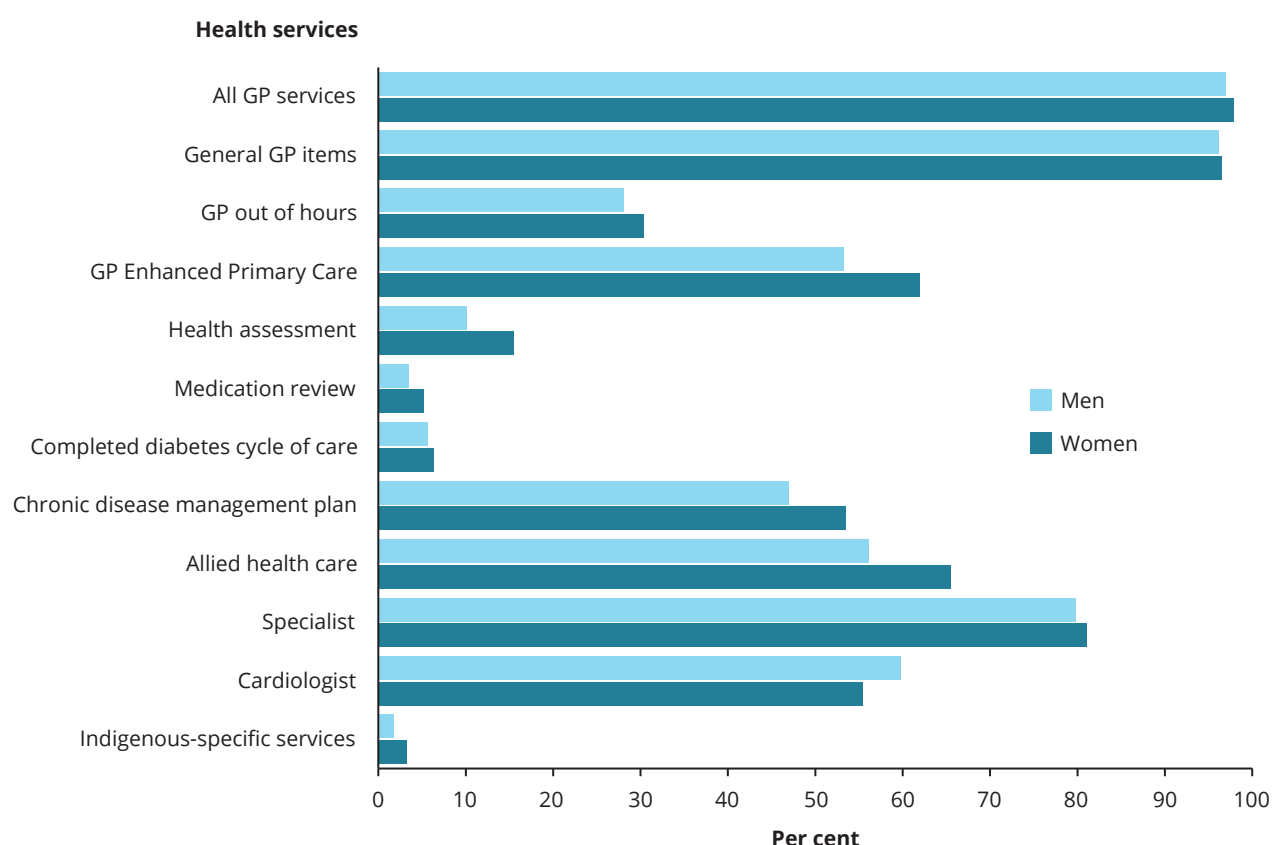
Fifty-eight per cent had a cardiologist service, and a similar proportion accessed allied health services (59%). Allied health service use was higher among women than men (66% and 56%, respectively).



Sixty one percent of people visited a GP within 1 week of hospitalisation. Around half of the men (50%) and women (48%) were classified as having high continuity of GP care. However, a greater proportion of women than men had a higher number of GP visits in the year after hospitalisation.

A small number of people had no MBS record of visiting a GP in the year after the index hospitalisation. Compared with the cohort as a whole, a slightly higher proportion of both people aged 65–74 and people with NSTEMI did not visit a GP in this time frame. Characteristics of people who did not visit a GP in the year after the index hospitalisation are included in Supplementary Table S8.

Figure 11: Use of health services in the year after the index hospitalisation among people with ACS, by sex



All coronary heart disease

The patterns of post-hospitalisation service use in the CHD and ACS cohorts were similar. However, a slightly lower proportion of the CHD cohort than of the ACS cohort visited a GP within 1 week of discharge (54% and 61%, respectively).

See Supplementary tables S7a–S7b for data on post-hospitalisation community-based health care.



How did people use Guideline-indicated CVD medications after the index hospitalisation?

Initiation

How was initiation calculated?

In this analysis, the length of time till medication initiation was identified by the first dispensing record after hospital discharge.

This project examines initiation within 40 days of discharge. Selecting a 40-day period aimed to account for any existing medication supplies (as PBS prescriptions typically provide 1 month of medication) and any small amounts of medication supplied by the hospital pharmacy at the time of discharge (as in hospital dispensing in public hospitals is not captured on the PBS in New South Wales and the Australian Capital Territory).

As well as examining initiation to individual medication classes, people who initiated 3 or more of the 4 Guideline-indicated classes of medication were identified. This measure attempts to capture the proportion of people who are dispensed the majority of recommended medication classes, while allowing for incomplete capture of the antiplatelet agent drug class (due to the absence of aspirin in the analysis).

People who died within 40 days were excluded from the initiation analysis (ACS: $n = 410$; All CHD: $n = 503$).

See Supplementary tables S9a–S9f for initiation data.

Acute coronary syndrome

Sixty-one per cent of patients with ACS were dispensed 3 or more of the 4 medication classes indicated in the Guidelines within 40 days of hospital separation. Initiation within 40 days of hospitalisation varied by medication: it was highest for statins (81%) and lowest for beta blocking agents (57%). Sixty-five per cent of the cohort were dispensed an ACEI/ARB and 61% an antiplatelet agent.

Based on univariate analyses, medication initiation was significantly lower among the younger age groups than among people aged 45 and older (Figure 12). Slightly more than half (56%) of those aged 25–34 initiated statins within 40 days, compared with 83% of those aged 65–74. The variation by age group was smaller for beta blocking agents, with an 8% difference between the youngest and oldest age groups. However, this is in the context of relatively lower initiation for this medication class overall.

Women were significantly less likely than men to be dispensed Guideline-indicated medications at 40 days. This was consistent across medication classes and for the combined measure (≥ 3 classes).

The disparity in initiation rates between men and women varied across age groups. As shown in Figure 13, the difference in initiation to 3 or more medication classes was greatest among men and women aged 45–54 (68% for men and 48% for women). Lower rates of initiation among women were observed across most age groups for each individual medication class, with the largest disparity among people aged 35–64 (see Supplementary Table S9c for data disaggregated by age group, sex and medication class).



Figure 12: Proportion of people with ACS dispensed in-scope medications within 40 days of hospital separation, by medication class and age group

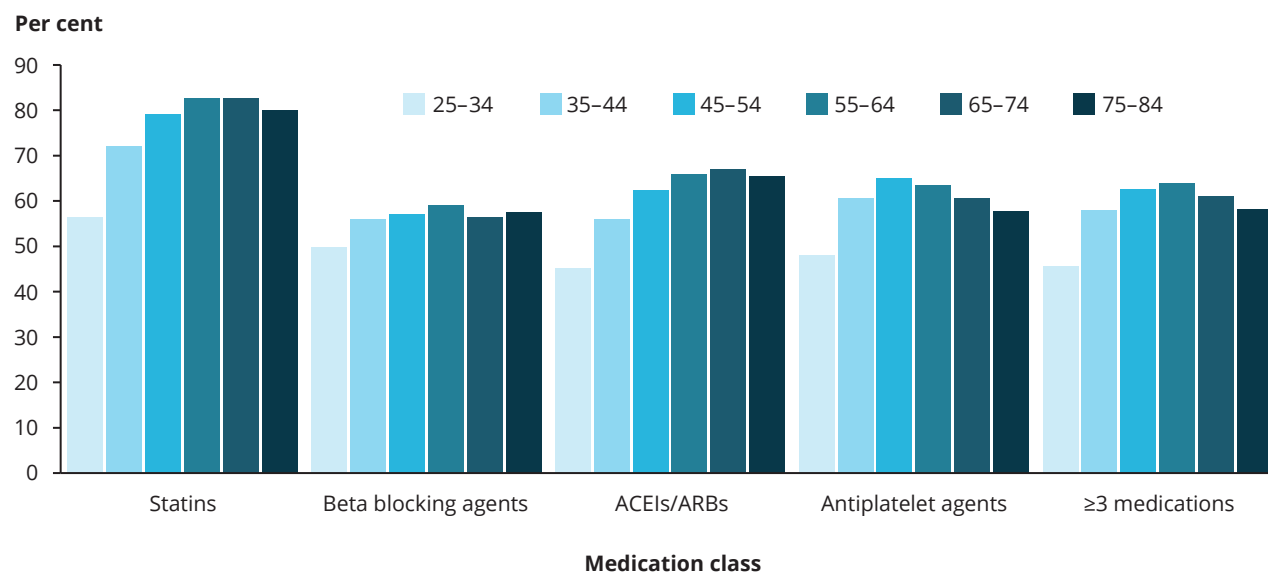
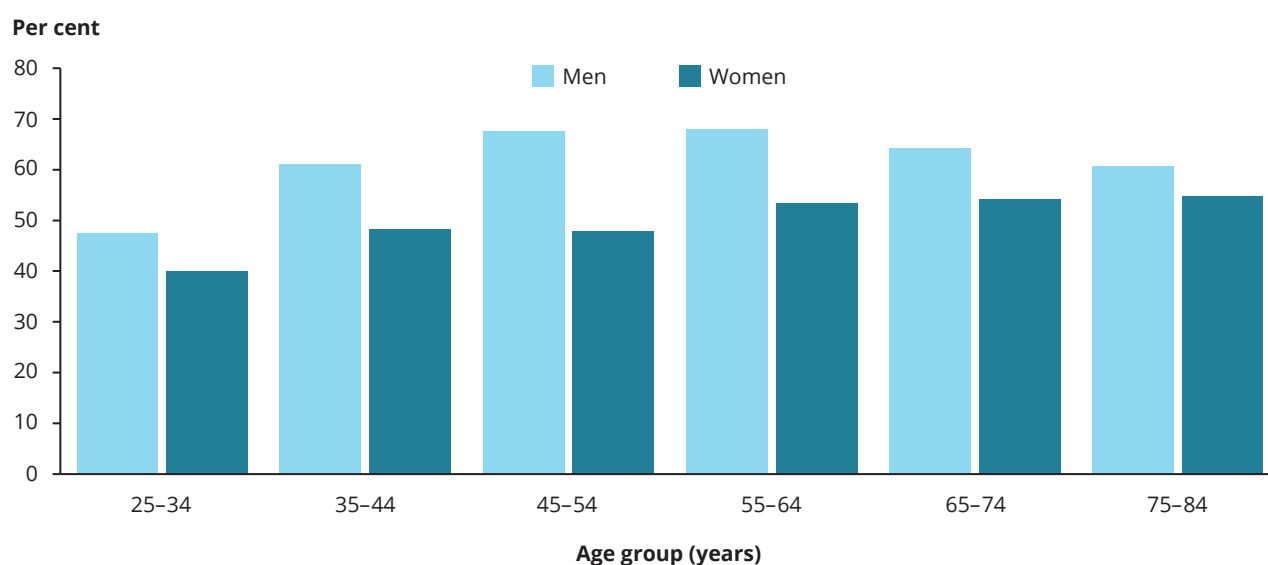


Figure 13: Proportion of people with ACS dispensed ≥3 in-scope medications within 40 days of hospital separation, by age group and sex



There were no consistent differences in initiation by remoteness area or socioeconomic group. Indigenous Australians were significantly less likely than non-Indigenous Australians to be dispensed statins (75% and 81%, respectively) and antiplatelet agents (61% and 55%, respectively). However, there was no significant difference in the proportion of people dispensed 3 or more in-scope medications by Indigenous status.

The proportion of people who initiated medications within 40 days increased with increasing CHD severity. This was consistent across all medication classes and for the combined measure (≥3 medication classes).

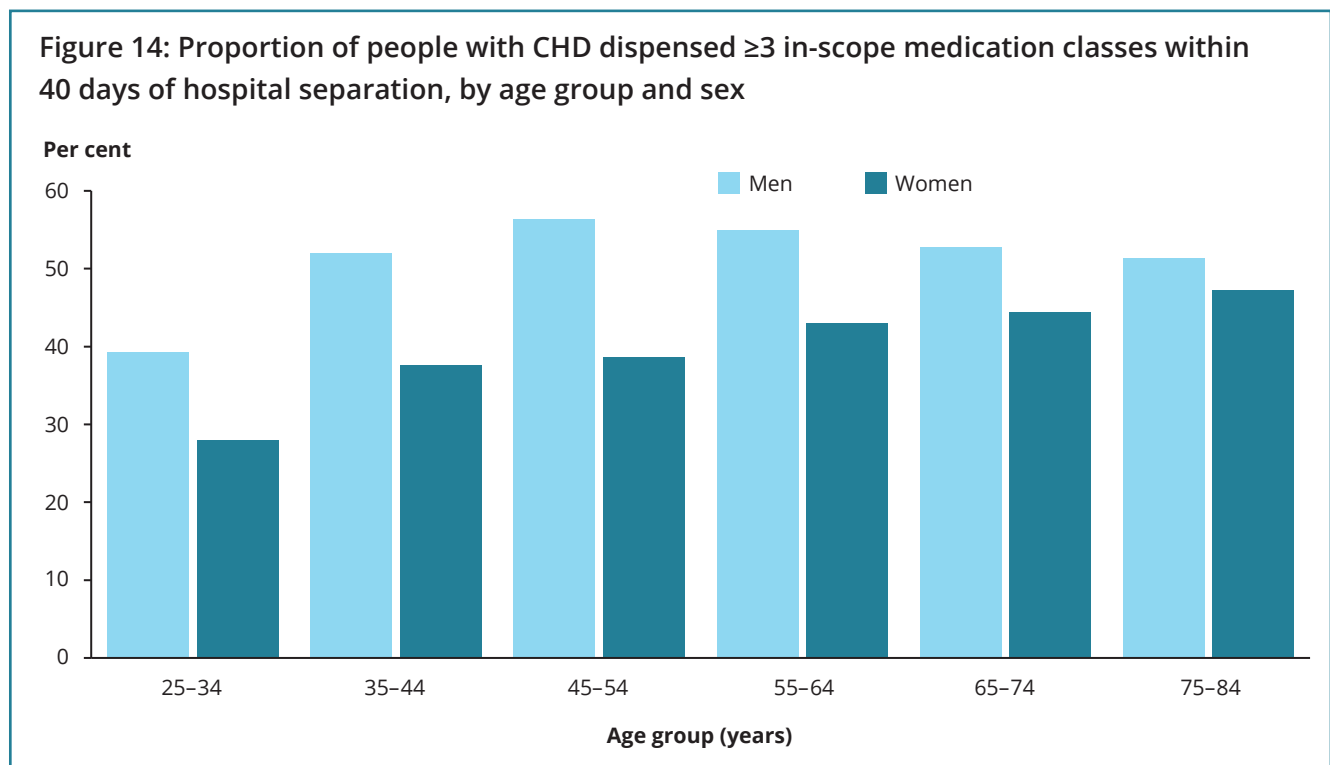


All coronary heart disease

Initiation at 40 days varied between 78% for statins and 48% for beta blocking agents. Sixty two per cent of the cohort were dispensed an ACEI/ARB, and 50% an antiplatelet agent, within 40 days of hospitalisation. Again, it is important to note that antiplatelet agent use is underestimated in this analysis and results should be interpreted with caution.

The patterns in the CHD cohort were similar to those described for ACS, with higher initiation among older patients. The variation by age group was most evident for statins and ACEI/ARB; the differences between age groups was less pronounced for beta blocking agent initiation.

Initiation to 3 or more recommended medication classes was significantly lower among women than men. This was consistent across all age groups. However, as evident in the ACS cohort, the discrepancy was larger among people aged under 55 and greatest among men and women aged 45–54 (Figure 14). This finding was consistent across medication classes (Supplementary Table S9e).

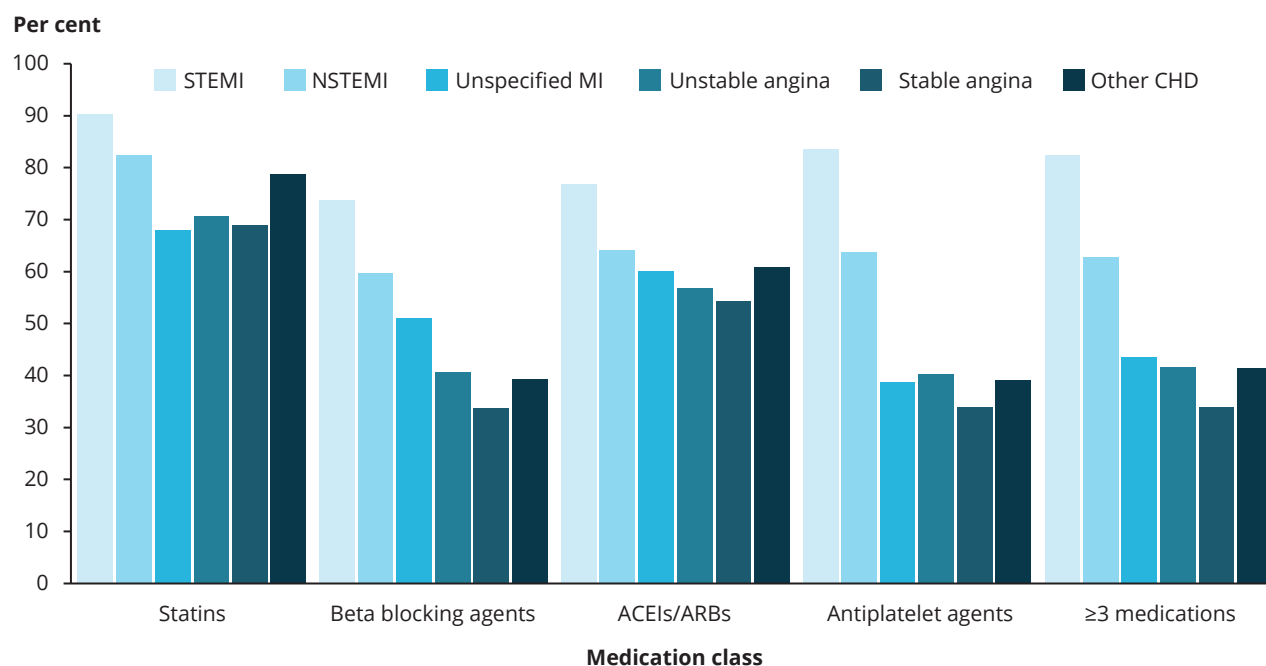


Indigenous Australians were significantly more likely to be dispensed beta blocking agents than non-Indigenous Australians (52% and 48%, respectively) and more likely to be dispensed 3 or more in-scope medication classes within 40 days of discharge (53% and 50%, respectively).

More severe CHD subtypes were associated with higher rates of initiation (Figure 15). However, it is important to note that the Guidelines applied in this analysis are specific to ACS; they do not necessarily apply to people with stable angina or chronic CHD – which is the overwhelming majority of those in the ‘other CHD’ category.



Figure 15: Proportion of people with CHD dispensed in-scope medications within 40 days of hospital separation, by medication class and CHD subtype



What factors are associated with initiation?

Multivariate (multiple variables) logistic regression was used to investigate factors associated with the probability of initiation within 40 days of discharge. (See the technical report for additional information on the statistical methods.) Data tables for this combined measure, and for individual medication classes, are included in the Supplementary tables S10a–S14b.

Acute coronary syndrome

After adjusting for other variables in the model, the odds of being dispensed ≥ 3 medication classes within 40 days of hospitalisation were higher among those people:

- with more severe CHD subtypes (STEMI versus unstable angina: OR = 4.04, 95% CI = 3.70–4.40)
- who underwent a PCI procedure during the index hospitalisation (OR = 4.46, 95% CI = 4.19–4.75)
- aged 65–74 (65–74 versus 25–34: OR = 1.57, 95% CI = 1.18–2.08)
- with a prior diagnosis of CHD (OR = 1.20, 95% CI = 1.12–1.28), diabetes (OR = 1.27, 95% CI = 1.20–1.34), hypertension (OR = 1.25, 95% CI = 1.18–1.33) or congestive heart failure (OR = 1.23, 95% CI = 1.15–1.32)
- who visited a cardiologist within 40 days (OR = 1.21, 95% CI = 1.14–1.28)
- who were dispensed CVD medications in the year before the index hospitalisation (OR = 1.75, 95% CI = 1.64–1.88).



In contrast, lower odds of initiation to ≥ 3 medication classes were associated with:

- women (OR = 0.70, 95% CI = 0.66–0.74)
- those people undergoing a CABG procedure during the index hospitalisation (OR = 0.44, 95% CI = 0.40–0.48)
- a diagnosis of chronic obstructive pulmonary disease (COPD) (OR = 0.87, 95% CI = 0.80–0.96) or renal failure (OR = 0.83, 95% CI = 0.76–0.90)
- a higher number of GP visits in the year before the index hospitalisation (>24 services versus >0–12 services (OR = 0.83, 95% CI = 0.76–0.91).

Interpreting logistic regression output

Logistic regression was used to estimate the probability of initiation, persistence and adherence to medications at 1 year after hospitalisation.

The adjusted OR is a point estimate, represented by the black circle in the following figures: it is an estimate of the odds of an event's occurring (for example, the odds of initiating statins).

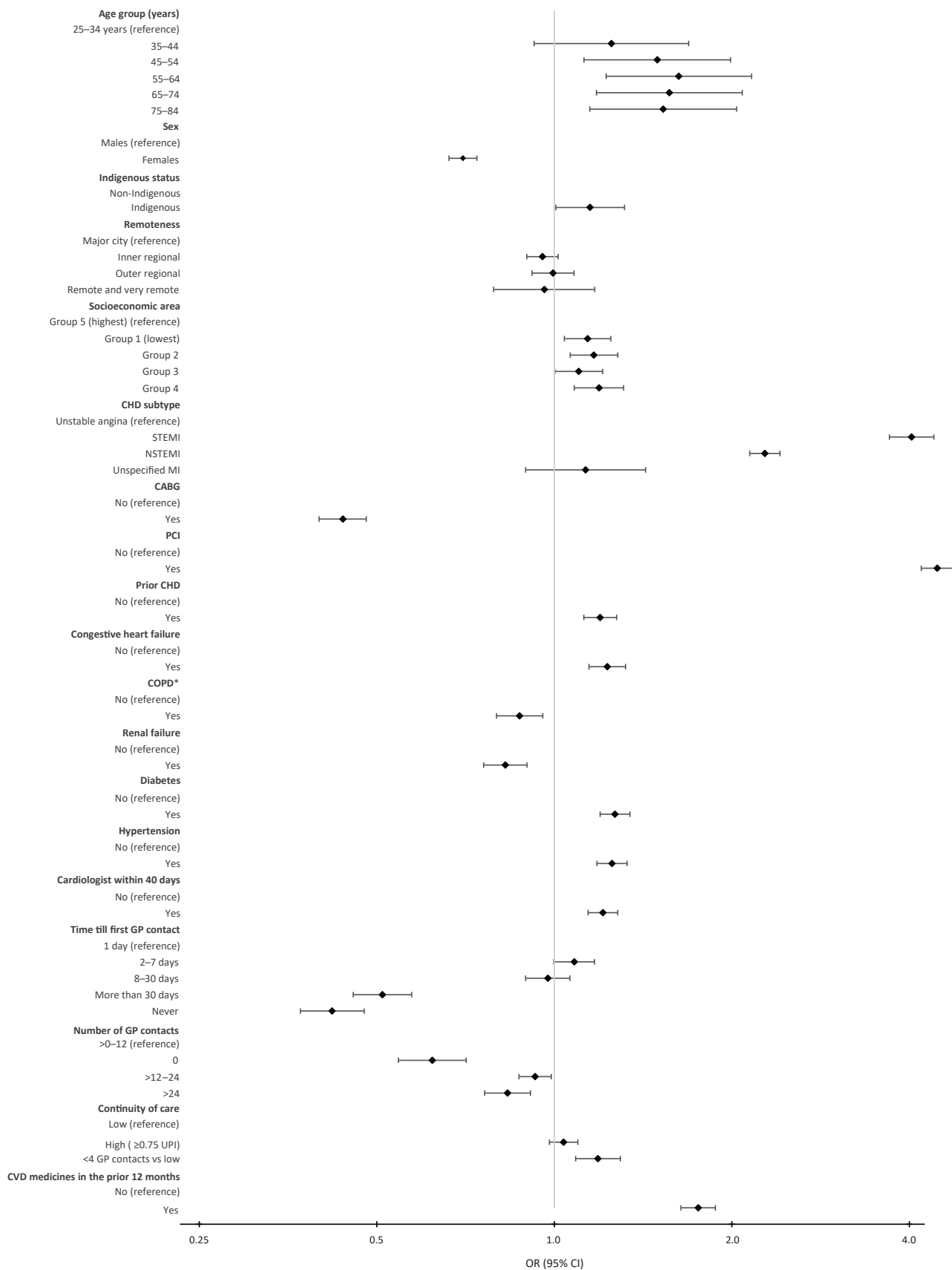
- An OR of 1, or close to 1, indicates that the characteristic or subcategory has no effect on the odds of the outcome's occurring relative to the reference category.
- An OR of greater than 1 indicates that the characteristic is associated with higher odds of the outcome's occurring relative to the reference category.
- An OR of less than 1 indicates that the characteristic is associated with lower odds of the event's occurring relative to the reference category.

The confidence interval indicates the likely range of values in which the OR falls. This is represented by the horizontal line in the figures that follow. Where a confidence interval crosses 1, the relationship between the characteristic or subcategory and outcome is not statistically significant.

Logistic regression results are displayed in Figure 16.



Figure 16: Factors associated with initiation to ≥ 3 Guideline-indicated medication classes within 40 days of hospital separation, among people with ACS



* COPD = chronic obstructive pulmonary disease



All coronary heart disease

Findings for the whole cohort were comparable with those for the ACS subset (Figure 17). However, in the whole CHD cohort, the odds of initiation to ≥ 3 medication classes were slightly higher among:

- Indigenous Australians compared with non-Indigenous Australians (OR = 1.15, 95% CI = 1.04–1.28).

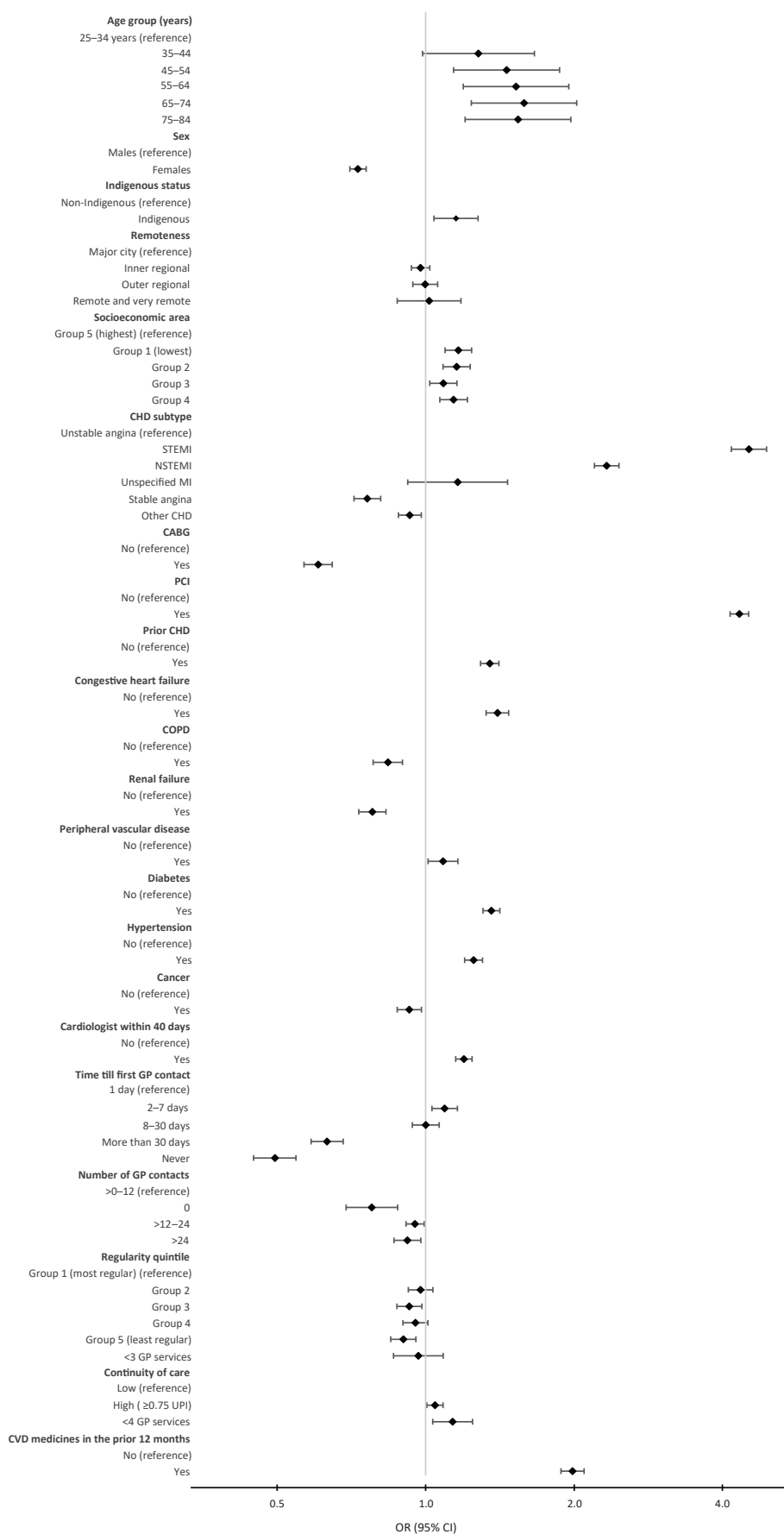
In contrast, the odds of initiation were lower among those people who had:

- a higher number of GP visits in the year before the index hospitalisation (>24 services versus >0–12 services: OR = 0.92, 95% CI = 0.86–0.98)
- less regular GP contact in the year before the index hospital admission, when compared with those with the most regular GP contact (least regular quintile versus most regular quintile: OR = 0.90, 95% CI = 0.85–0.96).

Data are displayed in Figure 17. See Supplementary tables S10a–S14b for data on initiation both to ≥ 3 medication classes and to individual medication classes.



Figure 17: Factors associated with initiation to ≥ 3 Guideline-indicated medication classes within 40 days of hospital separation, among people with CHD





Persistence

How was persistence calculated?

In this analysis, persistence was defined as the continuation of initiated medications for 1 year after the index hospitalisation.

A patient was considered to have discontinued a medication class when there was a gap of more than 60 days with no medication available. This included accounting for any estimated medication oversupplies (that is, where a new dispensing occurred before the current medication supply was finished). People who died within 1 year of hospital separation were excluded from the persistence analysis (ACS: n = 1,848; all CHD: n = 2,605).

See Supplementary tables S15a–S15e for persistence data.

Acute coronary syndrome

Fifty-five per cent of people were persistent with all initiated medication classes at 1 year after hospitalisation. However, persistence varied by medication class. It was highest among people who initiated statins and ACEIs/ARBs (81% and 79%, respectively) and lowest among those who initiated beta blocking agents (73%). Seventy-seven per cent were persistent with antiplatelet agents.

Persistence was higher among people in older age groups. Less than half (43%) of patients aged 25–44 were persistent with all initiated medication classes, compared with 58% of those aged 65–84 (Figure 18). Persistence was comparable by remoteness area and socioeconomic group.

There was little difference in the proportion of men and women who were persistent to all initiated medications. However, women aged 35–44 had significantly lower levels of persistence than men in the same age group (40% and 47%, respectively). There were no significant differences in persistence among men and women in other age groups. (See Supplementary Table S15b for persistence data disaggregated by age group, sex and medication class.)

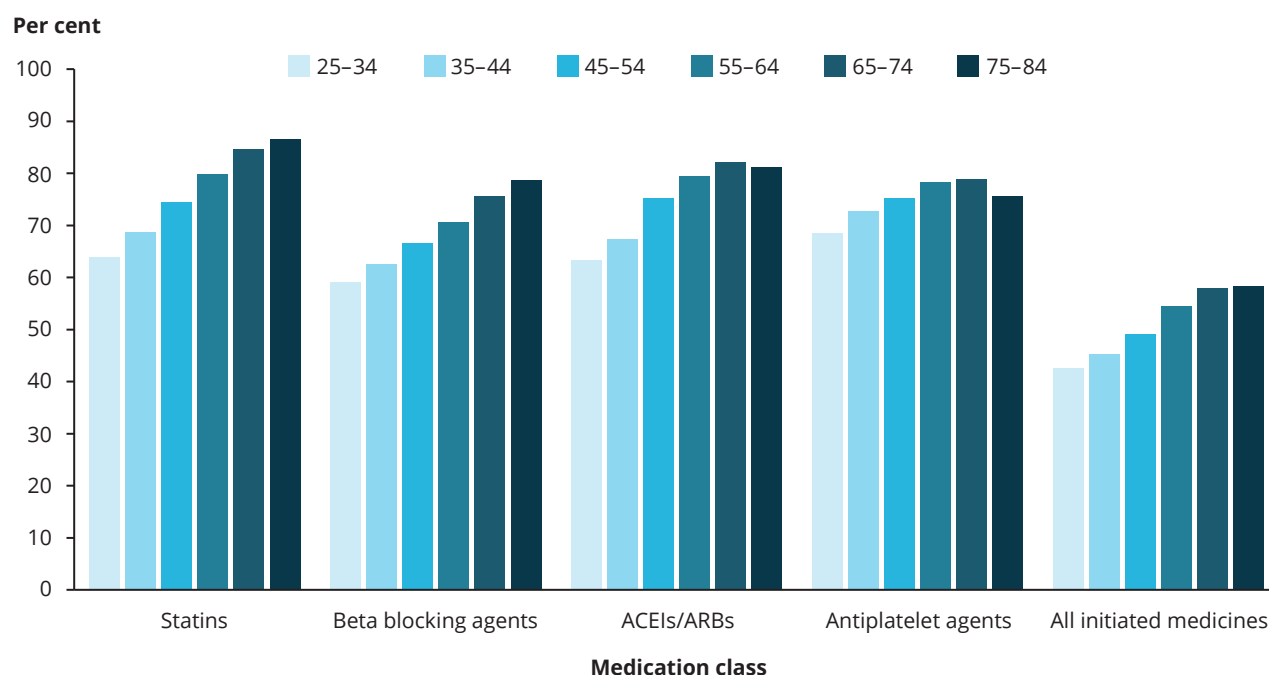
Based on the univariate analysis, there was no significant difference in the proportion of people persistent to all initiated medications by Indigenous status. However, persistence to beta blocking agents was higher among Indigenous Australians than among non-Indigenous Australians (77% and 73%, respectively). In contrast, persistence to statins and antiplatelet agents were lower among Indigenous Australians than among non-Indigenous Australians (statins: 75% and 82%, respectively; antiplatelet agents: 70% and 77%, respectively).

Persistence was slightly higher among people with unstable angina compared with people with more severe diagnoses. This relationship appeared to be driven by higher persistence to ACEIs/ARBs and beta blocking agents among those with unstable angina, despite having significantly lower initiation to these medications (Supplementary Table S15c).

Of note, 13% of people who initiated in-scope medications received only one dispensing for any in-scope medication class. This was classified as primary non-adherence. Primary non-adherence varied by medication class: it was highest among those dispensed beta blocking agents (11%) and lowest among those dispensed statins (3.8%). Those classified as primary non-adherers remained in the persistence analysis; however, they were excluded from the adherence estimates that follow. This exclusion should be considered when comparing persistence and adherence results. Primary non-adherence counts by medication class are included in Supplementary Table S21h.



Figure 18: Persistence at 1 year after hospital separation among people with ACS, by age group and medication class



All coronary heart disease

Persistence in the whole cohort was similar to that in the ACS sub-cohort, with 58% persistent to all initiated medications at 1 year after hospital separation. Among the whole CHD cohort, persistence was higher among people in older age groups.

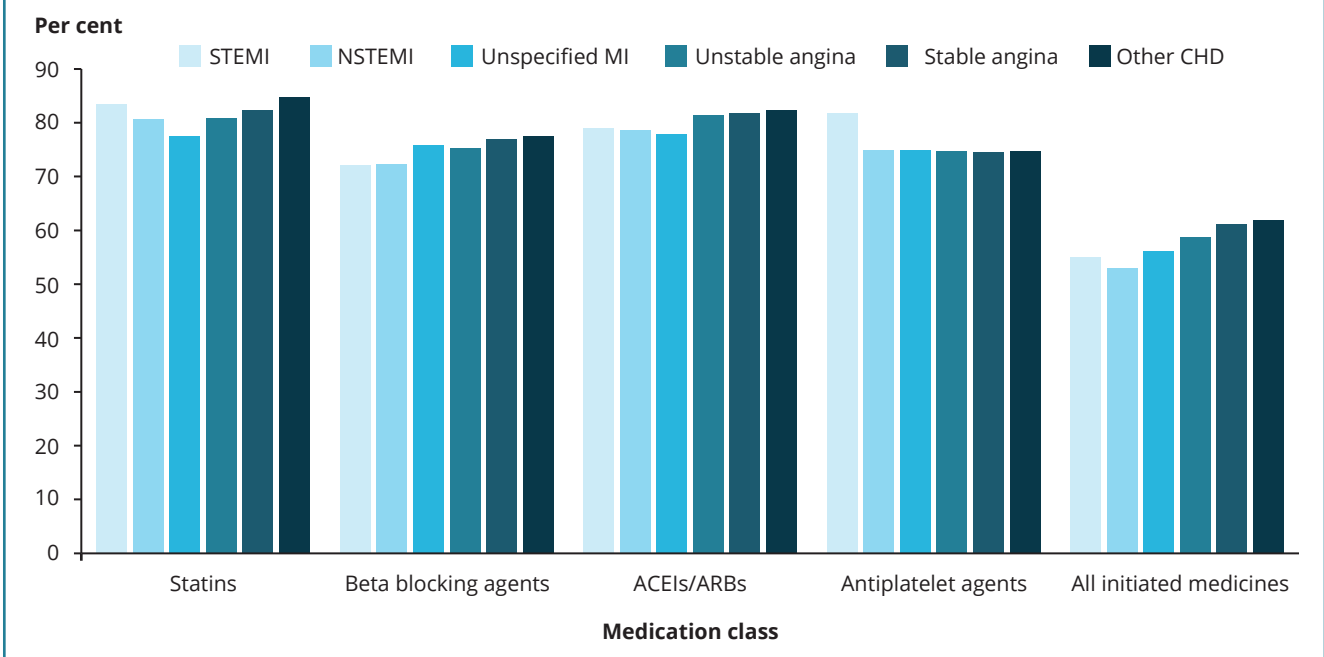
There was little difference in persistence to all initiated medications by sex. However, as in the ACS cohort, persistence was lower among women aged 35–44 than among men in the same age group (39% and 48%, respectively).

Indigenous Australians were less likely to persist with statins, ACEIs/ARBs and antiplatelet agents than non-Indigenous Australians and, while the difference was relatively small, had significantly lower persistence to all initiated classes than non-Indigenous Australians (56% and 58%, respectively).

There was greater persistence among those people classified as having 'other CHD' compared with more severe CHD subtypes. The relationship between severity of CHD subtype and persistence varied by medication class (Figure 19).



Figure 19: Persistence with medications at 1 year after hospital separation, by CHD subtype



What factors are associated with persistence?

Multivariate logistic regression was used to examine demographic, clinical and community based health service use factors associated with persistence with all initiated medications at 1 year after separation (Figure 20).

Results for persistence to individual medication classes are included in the Supplementary tables S16a–S20b.

Acute coronary syndrome

After adjusting for other variables in the model, the odds of persistence were higher among:

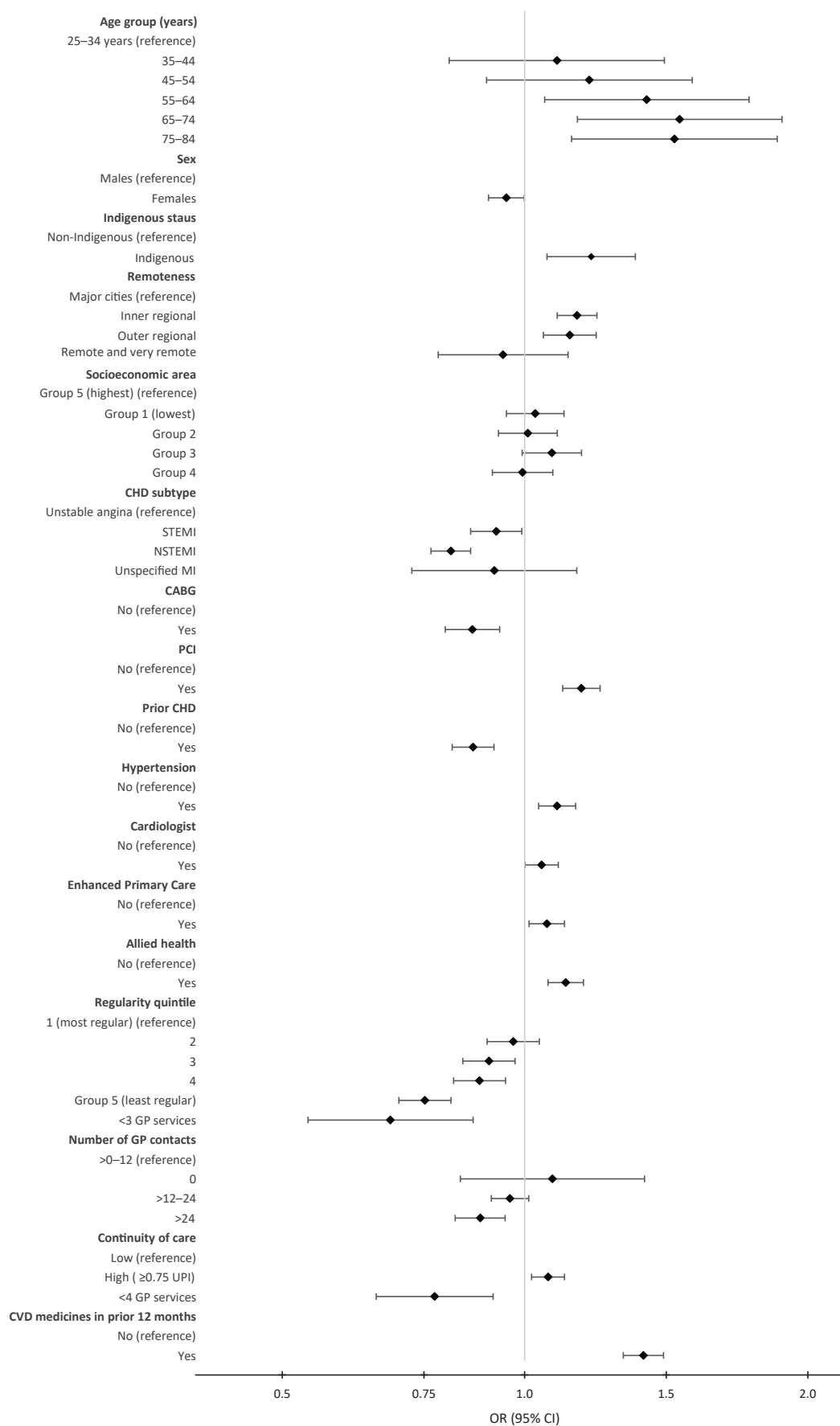
- people aged 65–74 (65–74 versus 25–34: OR = 1.56 95% CI = 1.16–2.09)
- people who underwent a PCI procedure during, or in the year after, the index hospitalisation (OR = 1.18, 95% CI = 1.12–1.24)
- Indigenous Australians (OR = 1.21, 95% CI = 1.07–1.37)
- people who accessed MBS funded allied health services (OR = 1.13, 95% CI = 1.07–1.18)
- people who had been dispensed CVD medicines in the year before the index hospitalisation (OR = 1.41, 95% CI = 1.33–1.49).

The odds of persistence were lower among:

- people with NSTEMI than among people with unstable angina (OR = 0.81, 95% CI = 0.77–0.86)
- people with a prior CHD diagnosis (OR = 0.86, 95% CI = 0.81–0.92)
- people who underwent a CABG procedure (OR = 0.86, 95% CI = 0.80–0.93)
- people who had less regular, more sporadic GP care during the year after hospitalisation (lowest versus highest regularity quintile – OR = 0.75, 95% CI = 0.70–0.81).



Figure 20: Factors associated with persistence with all initiated medications at 1 year after hospital separation, among people with ACS





All coronary heart disease

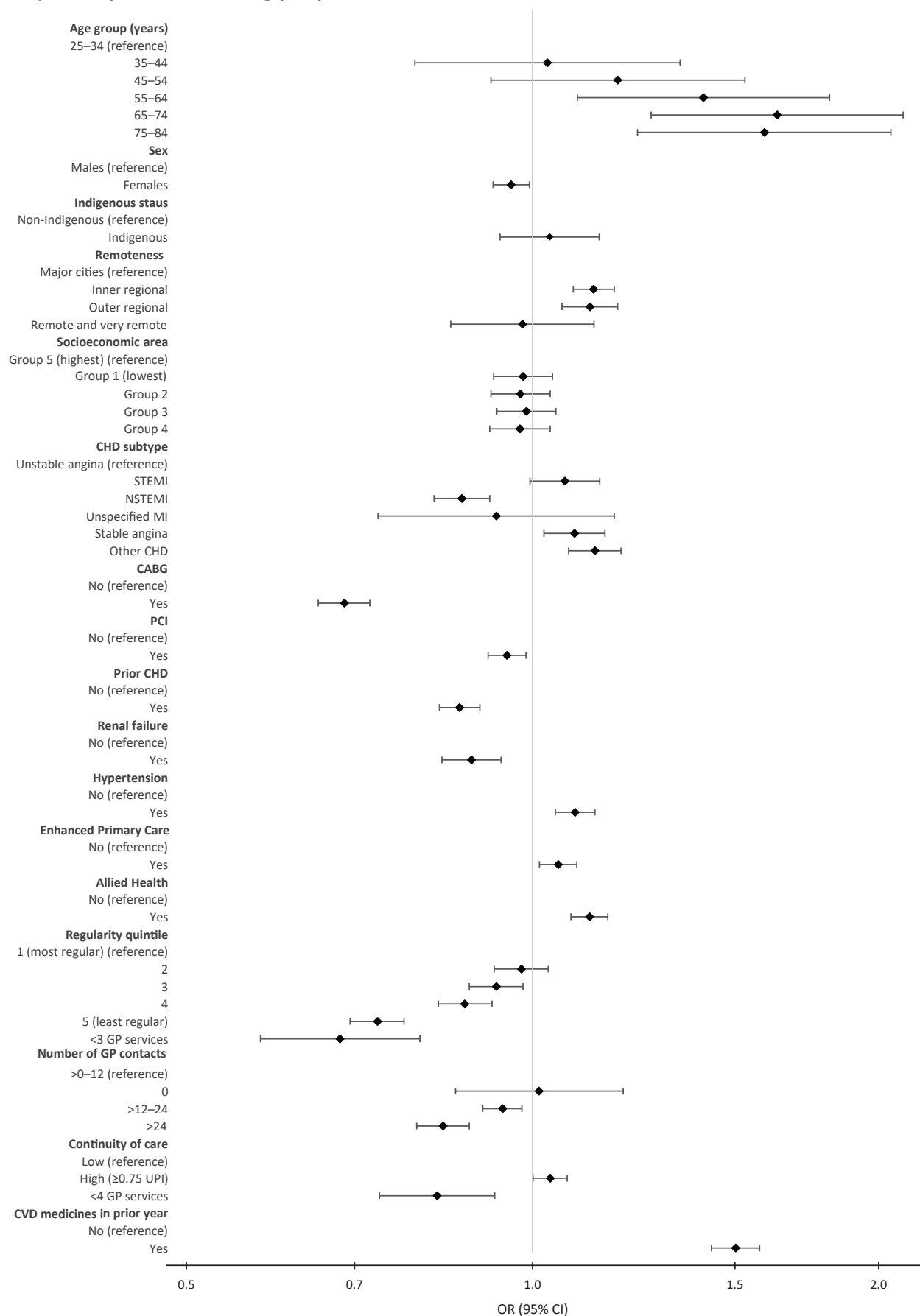
After adjusting for other variables in the model, higher odds of being classified as persistent were associated with:

- CHD subtypes of stable angina and 'other CHD' when compared with unstable angina (stable angina: OR = 1.09, 95% CI = 1.02–1.16; other CHD: OR = 1.13, 95% CI = 1.08–1.19).

While there was a significant difference in the odds of persistence by Indigenous status in the ACS cohort, this was not evident in the whole CHD cohort in the adjusted model (Figure 21).



Figure 21: Factors associated with persistence with all initiated medications at 1 year after hospital separation, among people with CHD





Adherence

How was adherence calculated ?

Adherence refers to whether an individual complies with the intended timing, dosage and frequency of a medication. As the PBS does not contain information about the intended medication protocol, and dispensing data alone do not capture whether the patient took the drug as indicated, adherence measures are an estimate only.

There are several ways to measure adherence in administrative data. In this project, we used the proportion of days covered (PDC) for individual medication classes, and the daily polypharmacy possession ratio (DPPR) when examining multiple medication classes.

The PDC is obtained by dividing the number of days where medication was available by the total number of days in the observation period. A PDC of 80% (that is, medication available on 80% of the days in the observation period) was used as a cut point to define good medication adherence.

The DPPR is an index of adherence to polypharmacy, or multiple medication classes. It is an estimate of the proportion of time a patient has all medications available by considering the presence of multiple medications on each day of the relevant period (Arnet et al. 2018).

Those people who died during the 1-year period were excluded from the adherence analyses (ACS: n = 1,848; all CHD: n = 2,605). As well, those who received only one dispensing of a drug class were excluded to reduce the impact of primary non-adherence on estimates.

See Supplementary Table S21h for primary non-adherence by drug class and Supplementary tables S21a–S21i for adherence data.

Acute coronary syndrome

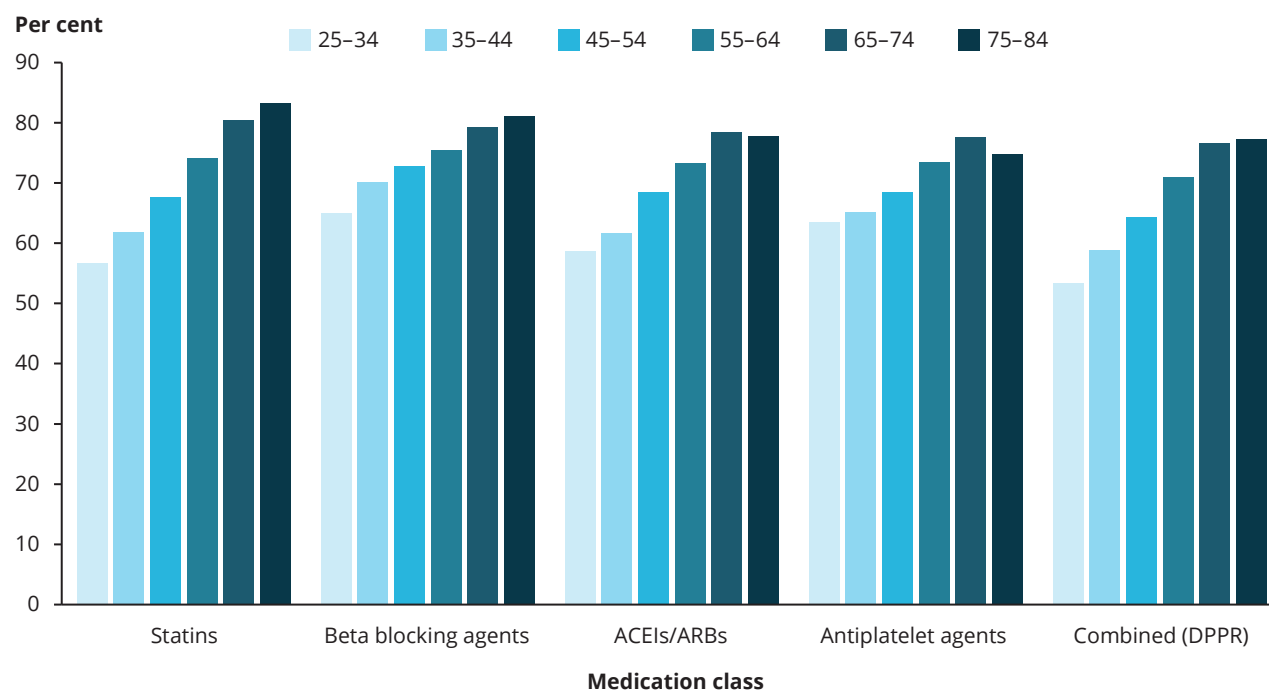
Around 3 in 4 people (73%) were adherent to all initiated medications at 1 year after hospitalisation. Adherence was similar across all medication classes, ranging between 74% for antiplatelet agents to 77% for statins and beta blocking agents (Figure 22).

Adherence increased across age groups. The largest variation by age group was observed for statins (57% of people aged 25–34 versus 83% of those aged 75–84) and for the combined measure (DPPR), which estimates adherence to all initiated medication classes (53% of those aged 25–34 versus 77% of people aged 75–84 were adherent to all initiated medications).

The proportion of people classified as adherent to all initiated medications at 1 year after hospitalisation was similar for men and women across age groups. However, there was a small but significant difference between men and women aged 45–54 (65% for men and 61% for women). Adherence data disaggregated by age group, sex and medication class are provided in Supplementary Table S21d.



Figure 22: Adherence at 1 year after hospital separation among people with ACS, by age group and medication class



There was little difference in adherence by remoteness area or socioeconomic group. Adherence to all initiated medications was lower among Indigenous Australians than among non-Indigenous Australians (68% and 73%, respectively).

Adherence varied by severity of CHD subtype. However, this relationship varied by medication class. While people with more severe subtypes were more likely to be classified as adherent to statins and antiplatelet agents, those with unstable angina (a less severe subtype) were more likely to be adherent to ACEIs/ARBs and beta blocking agents. Adherence to the combined measure (DPPR) was highest among those with STEMI.

All coronary heart disease

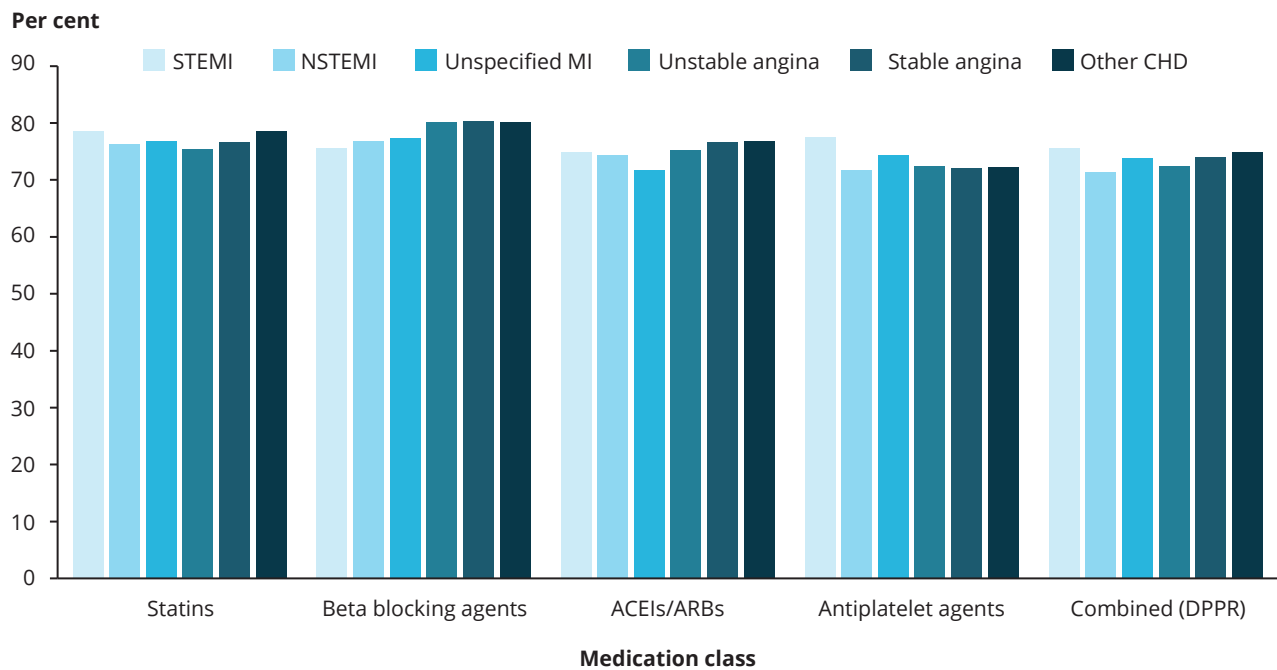
Seventy-four per cent of the cohort were adherent to all initiated medications at 1 year after hospitalisation. Adherence ranged between 79% for beta blocking agents and 73% for antiplatelet agents. Adherence was higher among older age groups than among those aged under 45.

There was little difference in adherence by sex, remoteness area or socioeconomic group. Indigenous Australians had lower adherence to all initiated medications than non-Indigenous Australians (68% and 74%, respectively). This was consistent among individual medication classes except for beta blocking agents.

Again, there was some variation in adherence by CHD severity and medication class (Figure 23).



Figure 23: Adherence at 1 year after hospital separation among people with CHD, by CHD subtype



What factors are associated with adherence?

Multivariate logistic regression was used to examine the relationship between demographic, clinical and community-based health care use and adherence at 1 year after discharge (Figure 24).

See Supplementary tables S22a–S26b for logistic regression output for the combined measure of adherence (DPPR) and adherence to individual medication classes.

Acute coronary syndrome

After adjusting for other variables in the model, the odds of being adherent at one year after hospitalisation were higher among:

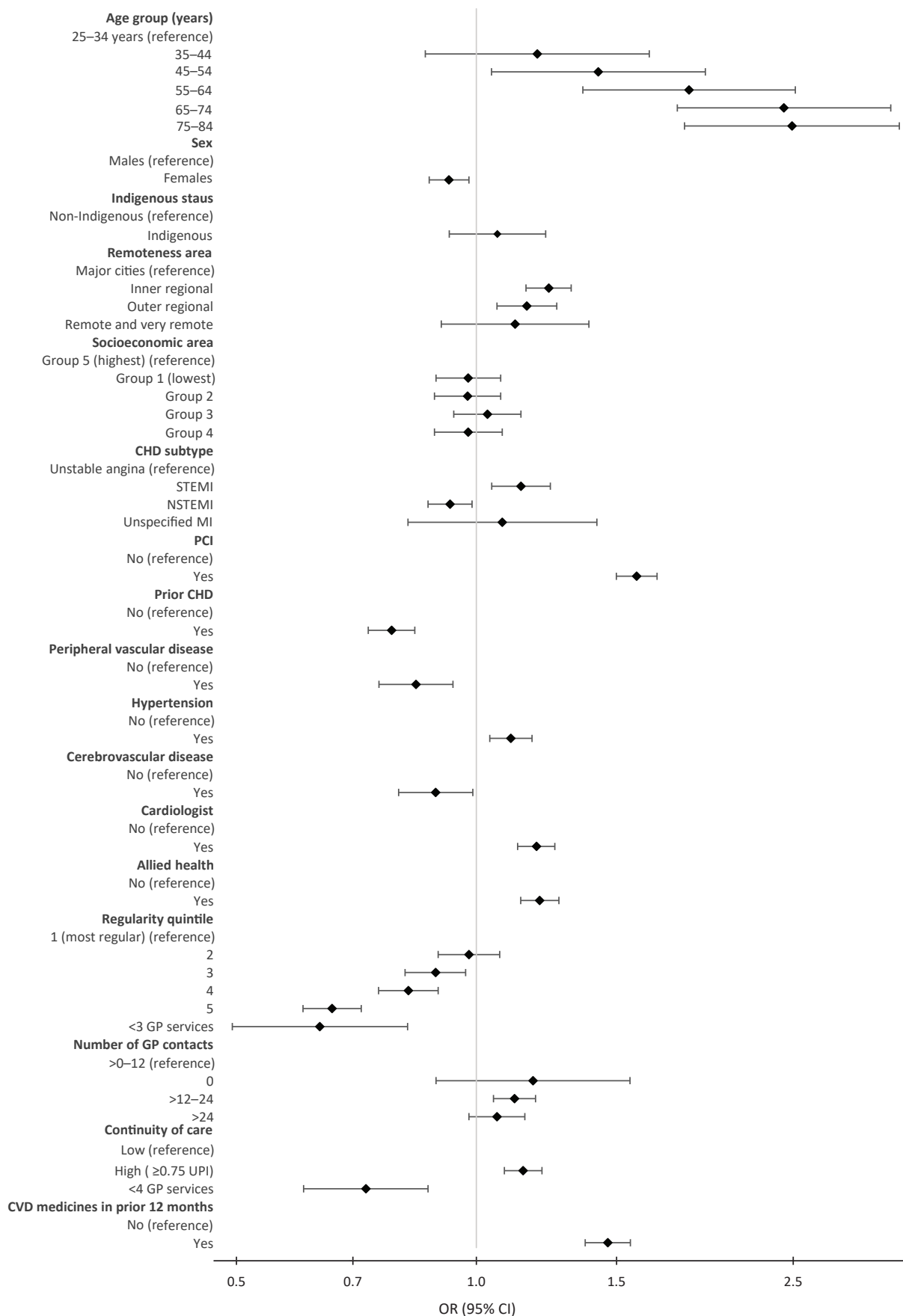
- older age groups (75–84 versus 25–34: OR = 2.49, 95% CI = 1.83–3.40)
- people diagnosed with STEMI than among those with unstable angina (OR = 1.14, 95% CI = 1.05–1.24)
- people who underwent a PCI procedure (OR = 1.59, 95% CI = 1.50–1.69)
- people who visited a cardiologist or accessed MBS funded allied health services in the year after hospitalisation (cardiologist: OR = 1.19, 95% CI = 1.13–1.26; allied health: OR = 1.20, 95% CI = 1.14–1.27)
- people dispensed CVD medicines in the year before the index hospitalisation (OR = 1.46, 95% CI = 1.37–1.56).

People with lower odds of being classified as adherent included:

- women (OR = 0.92, 95% CI = 0.87–0.98)
- people with a prior diagnosis of CHD (OR = 0.78, 95% CI = 0.73–0.84)
- people with irregular GP contact (least regular quintile versus most regular quintile: (OR = 0.66, 95% CI = 0.61–0.72).



Figure 24: Factors associated with adherence to all initiated medications at 1 year after hospital separation, among people with ACS



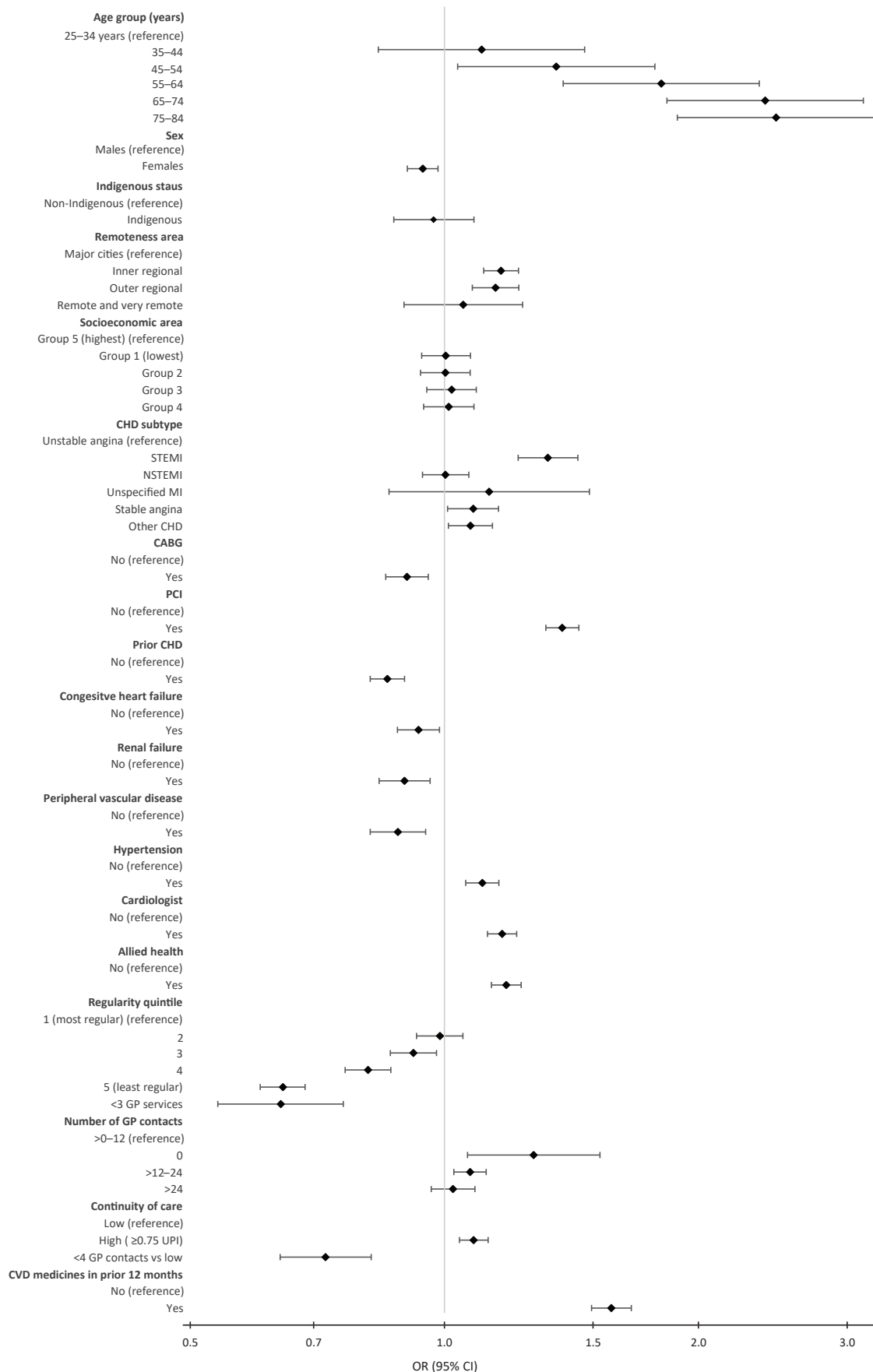


All coronary heart disease

Again, the findings for the whole CHD cohort were similar to those for the ACS subgroup (see Figure 25). However, in the CHD cohort, undergoing a CABG procedure was significantly associated with lower odds of being classified as adherent at 1 year after hospitalisation (OR = 0.90, 95% CI = 0.85–0.96).



Figure 25: Factors associated with adherence to all initiated medications at 1 year after hospital separation, among people with CHD



4

Discussion





This project sought to examine the use of Guideline-indicated cardiovascular medicines among a cohort of people who were discharged after an acute hospitalisation with a CHD diagnosis.

Use of cardiovascular disease medicines

Initiation

Sixty-one per cent of people with a diagnosis of ACS were dispensed 3 or more of the 4 Guideline-indicated medication classes within 40 days of hospitalisation. Among the broader CHD cohort, around half were dispensed 3 or more classes of medications. However, it is important to note that the recommendations applied in this analysis are specific to ACS, not CHD. While many people with chronic CHD are prescribed these 4 classes of drugs, the recommendations may not be appropriate for the broader cohort.

This analysis identified higher rates of initiation among men, people with more severe CHD subtypes and people who underwent a PCI procedure during the index hospitalisation. Conversely, people who underwent a CABG at the index hospitalisation were less likely to be prescribed 3 or more medication classes. This is due to lower dispensing of ACEI/ARB and antiplatelet agents in this group. This finding suggests that post-hospitalisation medication review and follow-up should be emphasised among those who undergo CABG procedures.

These findings are comparable with those of Redfern et al. (2014) who reported, based on the Australian SNAPSHOT ACS study, that 65% of people were discharged with at least 4 of 5 classes of preventive medications (lipid lowering, aspirin, other antiplatelet, beta blocking agent, and ACEI/ARB) following admission for ACS. Of note, the SNAPSHOT ACS study was based on prescription information before discharge. As a result, their analysis captured the use of aspirin, and study estimates were not affected by those people who do not fill their prescription.

Persistence

More than half of the cohort were persistent with all initiated medication classes at 1 year after hospitalisation. The proportion of people who were persistent with all initiated drug classes was higher among older age groups and those people with stable angina and other CHD. This may reflect a lower medication burden in those with less severe subtypes (for example, stable angina), as persistence is estimated only for initiated medication classes. Further, those with chronic CHD – who make up almost all the ‘other CHD’ subtype – may have established patterns of medication use before the index hospitalisation.

In the multivariate analysis, use of in-scope CVD medicines before the index hospitalisation was associated with increased odds of persistence. This was consistent across individual medication classes and for the combined measure (persistent with all initiated drug classes). Again, this may indicate a demonstrated tolerance to medications or existing patterns of medication use among prior users.

Of note, while initiation to individual drug classes tended to be higher among people with more severe CHD subtypes (that is, STEMI and NSTEMI) and lower among those people with unstable and stable angina, once initiated, persistence was relatively high across all CHD subtypes.



Adherence

Around 3 in 4 people in the cohort were classified as adherent to all initiated medication classes at 1 year after hospitalisation. The odds of being adherent increased with increasing age and was higher among people with STEMI than among those with unstable angina. People who underwent PCI procedures during the index stay, or within 1 year after hospitalisation, had significantly higher odds of being adherent to all initiated medicines, whereas those who underwent CABG procedures had lower odds of being classified as adherent. Again, prior use of in-scope medications in the year before the index hospital admission was associated with higher odds of adherence at 1 year. Of note, there was no significant association between socioeconomic area and medication adherence in this analysis.

These adherence estimates are comparable with those in published literature (Naderi et al. 2012; Packard and Hilleman 2016). The association between medication adherence and prior use of CVD medicines aligns with the findings of Campaign and colleagues, who examined medication adherence at 1 year among an Australian cohort who experienced their first AMI (Campaign et al. 2022). Their analysis examined adherence to 2 classes of recommended medications (lipid lowering medications and ACEI/ARB). The authors reported that people who had been dispensed the 2 in-scope medication classes in the 6 months before were more than 9 times more likely to be adherent after the index admission than those people who had no dispensing before the AMI event. The authors concluded that prior treatment was the strongest predictor of adherence, even after adjusting for age, sex, education and income.

Previous Australian literature has demonstrated an inverse association between CVD medication adherence and relative socioeconomic disadvantage (Paige et al. 2022). This has been attributed to the subsidisation of lower income households, concession cardholders, and those people taking multiple medications within the Australian health system. The lack of association between socioeconomic area and adherence in this study may reflect the use of an area-based measure rather than individual-level socioeconomic information.

Community health care and medication use

This analysis identified that high continuity and regularity of GP care was associated with higher odds of persistence and adherence to Guideline-indicated medications at 1 year after hospitalisation.

Contact with a cardiologist and allied health services was associated with initiation and ongoing medication use. It is possible that people who accessed these community-based health care services were prompted to continue Guideline-based therapies – or it may indicate that this group of people were more motivated, or more able, to invest in their health.

These findings align with those of existing literature, which notes that higher continuity of care is associated with a better patient–GP therapeutic alliance, improved information continuity, higher levels of patient satisfaction and greater adherence to medical advice (Chen et al. 2013; Pereira Gray et al. 2018).

Further, higher levels of GP regularity are thought to indicate planned preventive care rather than increasing (or sporadic) GP contact due to declining health (Chen et al. 2013; Warren et al. 2015; Youens et al. 2021).



Limitations

It is important to note that there are several limitations to the results presented in this report. A key assumption of the analysis is that PBS dispensing records accurately represent medication use. However, it is possible that a person may be dispensed a medicine but does not take the full course, or fails to take it as prescribed by their health professional.

Aspirin, an antiplatelet agent, is available over the counter and is therefore not comprehensively captured in the PBS data set. It was therefore excluded from the analysis (except in combination with other in-scope medications). While the Guidelines recommend dual antiplatelet therapy (aspirin and another antiplatelet), people who took only aspirin will not be identified in the analysis. As a result, estimates relating to antiplatelet agents are an underestimate of true usage and should be interpreted with caution.

PBS data do not include any information about the intended dosage; as a result, this information was estimated for the cohort. This may affect the validity of conclusions drawn in the persistence and adherence analyses. Additional information on the methodology, including dosage estimates, is included in the associated technical report.

The reasons for discontinuing a medication class are not known and cannot be obtained from administrative data. For example, it may be due to a patient's being unable, or choosing not, to follow the advice of their doctor; it may also be done in consultation with a medical professional due to adverse side effects, a new therapeutic approach or agreed discontinuation of one or more medications.

Comorbidity information is drawn from the admitted patient care data only. The identification of comorbidities is likely to be an underestimate of disease burden in the population. Further, multimorbidity, which may be an indicator of more complex health conditions and service needs, is not captured in the analysis. Additional work is needed to explore the impact of multimorbidity on treatment patterns and service use in the community.

In this analysis, Indigenous status was derived from the admitted patient care data recorded at the index hospital stay only. This may be an underestimate of the Indigenous population in the cohort, which may be inconsistently captured across hospital admissions for the same individual. Additional work is needed to validate Indigenous identification in the NIHSI AA data set; thus results relating to Indigenous Australians should be interpreted with caution. As well, as the NIHSI AA does not include data from Western Australia and the Northern Territory, results may not be generalisable to the Indigenous population in Australia.

Public Hospital Pharmaceutical Reforms, introduced from 2001, allow participating public hospitals to provide PBS medicines to patients at discharge. These medicines will be captured in the data set. However, as New South Wales and the Australian Capital Territory did not participate in these reforms, patients discharged from hospitals in these jurisdictions are supplied a small amount of medicine at discharge, which is not captured. However, as these supplies are small (usually lasting a week or less) it is unlikely to substantially affect estimates of initiation within 40 days. Existing supplies of relevant medicines an individual may have before the index hospitalisation are not well adjusted for in this analysis. This may affect initiation estimates but is unlikely to substantially affect persistence or adherence estimates.



Private hospital data were available only for Victoria (to June 2017), Queensland and the Australian Capital Territory. As a result, readmissions may be underestimated.

NISHI AA (version 1.0) includes data from 6 of the 8 jurisdictions and results may not be generalisable to Western Australia and the Northern Territory.

Conclusions

The project examined patterns of medication use in a large cohort of people following a CHD hospitalisation. This project is unique in Australia due to its significant population coverage, with the inclusion of data from 6 jurisdictions.

The results suggest that patterns of medication use after an acute event were suboptimal, with fewer than 2 in 3 patients with ACS initiating Guideline-indicated medications within 40 days of hospital separation.

These results align with those in previous literature published on this topic; they indicate that women and people in younger age groups have lower rates of initiation. Further, the need for improvements in the transition from hospital care into the community, and support services for those people with heart disease after discharge, are key actions outlined in the National Strategic Action Plan for Heart Disease and Stroke (Department of Health 2020). Additional work is needed to identify why these groups are less likely to initiate preventive medications.

Seventy-three per cent of people with ACS, who initiated Guideline-indicated medications, were adherent at 1 year after hospitalisation. Adherence was associated with more severe CHD subtypes, older age groups, and use of community-based health care services. People who had taken in-scope CVD medicines before their index hospitalisation were significantly more likely to be adherent at 1 year. This may reflect their tolerance to medications, or an established pattern of medication use. While we are unable to determine the reasons for non-adherence, additional work is needed to determine whether subgroups of the population with lower levels of medication adherence would benefit from additional ongoing support after their transition from hospital to the community.

The AIHW is working to release further analysis that examines the relationship between medication adherence at 1 year after hospitalisation and risk of subsequent health outcomes, including readmission to hospital, and death.



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Abbreviations

ACS	acute coronary syndrome
ACEI	angiotensin converting enzyme inhibitor
AIHW	Australian Institute of Health and Welfare
ARB	angiotensin II receptor blocker
CABG	coronary artery bypass grafting
CHD	coronary heart disease
COPD	chronic obstructive pulmonary disease
CVD	cardiovascular disease
DPPR	daily polypharmacy possession ratio
ECG	electrocardiogram
GP	general practitioner
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification
MBS	Medicare Benefits Schedule
MI	myocardial infarction
NIHSI AA	National Integrated Health Services Information Analysis Asset
NSTEMI	non-ST-elevation myocardial infarction
OR	odds ratio
PBS	Pharmaceutical Benefits Scheme
PCI	percutaneous coronary intervention
PDC	proportion of days covered
STEMI	ST-elevation myocardial infarction



Glossary

acute myocardial infarction (AMI): A term commonly used for a heart attack, but more correctly refers only to those heart attacks that have caused some death of heart muscle.

admission: An admission to hospital. In this report the term 'hospitalisation' describes an episode of hospital care that starts with the formal admission process and ends with the formal separation process.

allied health professional: A professional working in audiology, dietetics and nutrition, hospital pharmacy, occupational therapy, orthoptics, orthotics and prosthetics, physiotherapy, podiatry, psychology, radiography and speech pathology.

angina: Temporary chest pain or discomfort when the heart's own blood supply is inadequate to meet extra needs, as in exercise. See also **unstable angina** and **cardiovascular disease**.

Australian Statistical Geography Standard (ASGS): A common framework defined by the Australian Bureau of Statistics for collection and dissemination of geographically classified statistics. The ASGS replaced the Australian Standard Geographical Classification (ASGC) in July 2011.

cancer: A large range of diseases whose common feature is that some of the body's cells become defective, begin to multiply out of control, can invade and damage the area around them, and can also spread to other parts of the body to cause further damage.

cardiovascular disease: Any disease of the circulatory system, namely the heart (cardio) or blood vessels (vascular). Includes heart attack, **angina**, stroke, **heart failure** and **peripheral vascular disease**. Also known as circulatory disease.

cerebrovascular disease: Any disorder of the blood vessels supplying the brain or its covering membranes. A notable and major form of cerebrovascular disease is stroke.

chronic obstructive pulmonary disease (COPD): Serious, progressive and disabling long term lung disease where damage to the lungs, usually because of both emphysema and chronic bronchitis, obstructs oxygen intake and causes increasing shortness of breath. By far the greatest cause of COPD is cigarette smoking.

continuity of care: A situation where patients experience an episode of care as complete, or consistent, or seamless even if it is provided in several different consultations by different providers. It also refers to the continuing relationship between patients and their doctors, known as relational continuity.

coronary artery bypass graft (CABG): A surgical procedure using blood vessel grafts to bypass blockages in the coronary arteries and restore adequate blood flow to the heart muscle.

coronary heart disease: The most common form of cardiovascular disease. There are 2 major clinical forms – heart attack and **angina**. Heart attack is a life-threatening event that occurs when a blood vessel supplying the heart itself is suddenly blocked, causing damage to the heart muscle and its functions. Angina is a chronic condition in which short episodes of chest pain can occur periodically when the heart has a temporary deficiency in its blood supply.



diabetes (diabetes mellitus): A chronic condition in which the body cannot properly use its main energy source, the sugar glucose. This is due to a relative or absolute deficiency in insulin, a hormone produced by the pancreas, which helps glucose enter the body's cells from the bloodstream and be processed by them. Diabetes is marked by an abnormal build up of glucose in the blood, and can have serious short- and long-term effects. There are 3 main types of diabetes: type 1 diabetes, type 2 diabetes and gestational diabetes.

heart failure: A situation that occurs when the heart functions less effectively in pumping blood around the body. It can result from a wide variety of diseases and conditions that can impair or overload the heart, such as heart attack, other conditions that damage the heart muscle directly, **high blood pressure** or a damaged heart valve.

high blood pressure/hypertension: A well-accepted definition (as definitions vary) is from the World Health Organization: a systolic blood pressure of 140 mmHg or more or a diastolic blood pressure of 90 mmHg or more, or [the person is] receiving medication for high blood pressure.

hospitalisation: An episode of hospital care that starts with the formal admission process and ends with the formal separation process. An episode of care can be completed by the patient's being discharged, transferred to another hospital or care facility, or dying, or by a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute to rehabilitation). Synonymous with **admission** and **separation**.

socioeconomic groups: Is an indication of how 'well off' a person or group is. Socioeconomic groups are reported using the Australian Bureau of Statistics' Socio-Economic Indexes for Areas (SEIFA), whereby areas are classified based on social and economic information (such as low income, low educational attainment, high levels of public sector housing, high unemployment, and jobs in relatively unskilled occupations) collected in the Census of Population and Housing. Socio-Economic Indexes for Areas are divided into 5 groups, from the most disadvantaged (worst off) to the least disadvantaged (best off). Note, that this index refers to the average disadvantage of all people living in an area, not to the level of disadvantage of a specific individual.

International Classification of Diseases (ICD): The World Health Organization's internationally accepted statistical classification of disease and injury.

Medicare: A national, government-funded scheme that subsidises the cost of personal medical services for all Australians and aims to help them afford medical care. **The Medicare Benefits Schedule**, which is part of this scheme, lists the Medicare services subsidised by the Australian Government.

Medicare Benefits Schedule (MBS) data collection: The MBS data collection contains information on services that qualify for a benefit under the *Health Insurance Act 1973* and for which a claim has been processed. The database comprises information about MBS claims (including benefits paid), patients and service providers. MBS claims data are an administrative by-product of the Services Australia administration of the Medicare fee-for-service payment system.

peripheral vascular disease: A disease of the arteries outside the heart and brain. It occurs when fatty deposits build up in the inner walls of these arteries and affect blood circulation to arteries that supply blood to the body's peripheries, such as the legs and feet.



Pharmaceutical Benefits Scheme (PBS): A national, government-funded scheme that subsidises the cost of a wide range of pharmaceutical drugs for all Australians to help them afford standard medications. The Pharmaceutical Benefits Schedule lists all the medicinal products available under the PBS and explains the uses for which they can be subsidised.

Pharmaceutical Benefits Scheme (PBS) data collection: The PBS data collection contains information on prescription medicines that qualify for a benefit under the *National Health Act 1953* and for which a claim has been processed. The database comprises information about PBS scripts and payments, patients, prescribers and dispensing pharmacies. PBS data are an administrative by-product of the Services Australia administration of the PBS online system.

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care, an episode of residential care or an attendance at the health-care establishment, as represented by a code.

private hospital: A privately owned and operated institution, catering for patients who are treated by a doctor of their own choice. Patients are charged fees for accommodation and other services provided by the hospital and relevant medical and allied health practitioners. The term includes private free-standing day hospital facilities.

procedure: A clinical intervention that is surgical in nature, carries a procedural risk, carries an anaesthetic risk, and requires specialist training and/or special facilities or equipment available only in the acute-care setting.

quintile: A group derived by ranking the population of people or elements according to specified criteria and dividing it into 5 equal parts. The term can also mean the cut-points that make these divisions – that is, the 20th, 40th, 60th and 80th percentiles – but the first use is the more common one.

separation: The formal process where a hospital records the completion of an episode of treatment and/or care for an admitted patient. In this report, this is described by the term **hospitalisation**.

statistical significance: A data characteristic determined by a statistical procedure that measures the probability that, under the model specified, a statistical summary of data would be equal to or more extreme than the value observed. If the probability falls below a predetermined value (for example, $p < 0.05$ in this analysis), the observation is said to be statistically significant.

unstable angina: A form of **angina** that is more dangerous than normal angina but less so than a **heart attack**. It is a form of **acute coronary syndrome**. It can feature chest pain that occurs at rest; in someone who already has **angina** it can be marked by new patterns of onset with exertion or by pain that comes on more easily, more often or for longer than previously.



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Related publications

[Medication use for secondary prevention after coronary heart disease hospitalisations: patient pathways using linked data—Technical report.](#)

[Estimating the incidence of stroke and acute coronary syndrome using the National Integrated Health Services Information Analysis Asset.](#)

[Heart, stroke and vascular disease—Australian facts.](#)



This project used the National Integrated Health Services Information Analysis Asset to explore factors that affect medication use among 67,800 people who were hospitalised for coronary heart disease. It found that younger patients and women were among those people less likely to be dispensed cardiovascular medicines and to still be taking them 1 year after leaving hospital. This information may inform strategies to improve medication use among these groups.

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