Aboriginal and Torres Strait Islander Better Cardiac Care Data Linkage Project

Final Report

4 November, 2021

Acknowledgements

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to Elders past and present.

We would also like to acknowledge the contributions of the Project Advisory Group, the Aboriginal and Torres Strait Islander Health Branch of the Queensland Health Department, the Queensland Data Linkage group, the Health Innovation, Investment and Research Officer and data custodians, our collaborators, and past members of the Menzies School of Health Research team, including the Menzies Global and Tropical Health business manager.

This report was prepared by Dr Abbey Diaz, Professor John Condon and Associate Professor Lisa Whop.

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Investigators

Coordinating Principal Investigator	
Daniel Williamson	Manager Performance, Aboriginal and Torres Strait Islander Health Branch
Menzies Team	
Abbey Diaz	Senior Research Officer, Menzies School of Health Research
Lisa Whop	Senior Research Fellow, Menzies School of Health Research
John Condon	Senior Principal Research Fellow, Menzies School of Health Research
Therese Kearns	Research Fellow, Menzies School of Health Research
Suzanne Moore	Senior Research Fellow, Menzies School of Health Research
Boyd Potts	Data Analyst, Menzies School of Health Research
Ross Andrews	Senior Principal Research Fellow, Menzies School of Health Research
Gail Garvey	Senior Principal Research Fellow, Menzies School of Health Research
Queensland Health Team	
Abdulla Suleman	Principal Policy & Planning Officer, Aboriginal and Torres Strait Islander Health Branch
Alex Kathage	Principal Policy & Planning Officer, Aboriginal and Torres Strait Islander Health Branch
Lucy Stanley	Principal Policy & Planning Officer, Aboriginal and Torres Strait Islander Health Branch
Louise Mitchell	Principal Policy & Planning Officer, Aboriginal and Torres Strait Islander Health Branch

ABBREVIATIONS

Acronym	Term
ABS	Australian Bureau of Statistics
ACHI	Australian classification of health interventions
ACS	Acute coronary syndrome
ARF	Acute rheumatic fever
AHMAC	Australian Health Ministers' Advisory Council
AIHW	Australian Institute of health and Welfare
ARIA+	Accessibility/Remoteness Index of Australia
CABG	Coronary artery bypass graft
CHF	Congestive heart failure
CVD	Cardiovascular disease
DLQ	Data Linkage Queensland
ERP	Estimated resident population
ICD	International classification of disease
IHD	Ischaemic heart disease
MI	Myocardial infarction
NSTEACS	Non-ST-segment elevation acute coronary syndrome (NSTEMI + UA)
NSTEMI	Non-ST-segment elevation myocardial infarction
PCI	Percutaneous coronary intervention
QHAPDC	Queensland Hospital Admitted Patients Data Collection
RHD	Rheumatic heart disease
SA	Statistical Area
SEIFA	Socioeconomic Indexes for Areas
SLA	Statistical Local Area
STEMI	ST-segment elevation myocardial infarction
UA	Unstable angina

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Executive summary

This study includes Queenslanders admitted to hospital with Ischaemic heart disease (IHD), congestive heart failure (CHF), stroke, rheumatic heart disease (RHD) and/or acute rheumatic fever (ARF) during 2010-2016. Key findings include:

Survival
Compared to other Queenslanders, Aboriginal and Torres Strait Islander people were:

- 2.0 times as likely to die from IHD during their first IHD admission
- 2.2 times as likely to die from IHD after discharge from their first IHD admission
- 2.1 times as likely to die from CHF during their first CHF admission
- 1.1 times as likely to die from stroke during their first stroke admission
- 1.2 times as likely to die from other cause during their first stroke admission
- 1.4 times as likely to die from stroke after discharge from their first stroke admission
- 3.5 times as likely to die from RHD during their first RHD admission

Procedures

- 68% of Queenslanders aged 25-84 years admitted with a principal diagnosis of ACS received at least one therapeutic procedure for ACS during this admission, diagnostic angiography (63%), percutaneous coronary intervention (32%) and coronary artery bypass graft (8%).
- A lower proportion of Aboriginal and Torres Strait Islander people received ACS procedures during their first ACS admission. People who did not receive a therapeutic procedure for ACS during their first ACS admission had a higher ACS re-admission rate and ACS fatality rate than those who did receive a procedure.

Length of stay

- Generally, Aboriginal and Torres Strait Islander people spent one day longer in hospital than other Queenslanders at their index admission. For CHF, however, Aboriginal and Torres Strait Islander people spend one day less in hospital.
- For stroke, the difference in length of stay between Aboriginal and Torres Strait Islander people and other Queenslanders was larger (relatively) for those living in the most advantaged areas
- For RHD, the difference in length of stay between Aboriginal and Torres Strait Islander people and other Queenslanders was seen for those living in major cities, but not elsewhere

Re-admission rate

- Aboriginal and Torres Strait Islander people had a higher 30-month rate of re-admission than other Queenslanders for IHD, CHF, stroke, and ARF, but it was similar for RHD
- Most re-admissions occurred within the first month after discharge from the first index admission and then declined to plateau
- Generally, Aboriginal and Torres Strait Islander people had a higher one-month re-admission rate than other Queenslanders

Differences across age groups

- The average age at time of index admission was lower for Aboriginal and Torres Strait Islander people than other Queenslanders in all study cohorts.
- The risk of dying from the index condition during the index hospital admission moderately increased with increasing age for the IHD, CHF, stroke, and RHD cohorts.
- The risk of dying from index condition in the three years post discharge from the index admission increased with increasing age for the IHD, stroke, and RHD cohorts.

- Generally, age was not associated with length of stay or 30-month re-admission rate

Differences between men and women

- Generally, there were more men than women hospitalised for CVD during the study period, except for RHD and, for Aboriginal and Torres Strait Islander people, CHF and Stroke.
- Women had lower cause-specific death rates in the 36-months after discharge from their index admission, for IHD and RHD, and, for Aboriginal and Torres Strait Islander people, stroke.
- For the IHD cohort, women had a shorter length of stay, on average, compared to men. For other cohorts, sex was not associated with length of stay.
- For the IHD, CHF and stroke cohorts, women had significant lower 30-month re-admission rates compared to men.

Differences across residential and service areas

- Aboriginal and Torres Strait Islander people were more likely to live in poorer and non-urban areas and be admitted to health services in northern Queensland and less likely to be admitted to private hospitals.
- Socioeconomic advantage was associated with:
  - Less deaths due to IHD during the index admission and the three years after discharge from the index admission for the IHD cohort, although the latter was only observed in other Queenslanders.
  - Less deaths due to other causes during the index admission and the three years post discharge for the CHF cohort.
  - Less deaths due to other causes during the index admission for the RHD cohort
- Residential remoteness was associated with:
  - Increased cause-specific deaths during the index admission for the IHD and RHD cohorts
  - Longer length of stay during the index admission, in general.
  - Increased 30-month re-admission rate for the IHD and Stroke cohorts.
- Compared to Metro North HHS, private hospital patients were:
  - Less likely to die during the index admission, from any cause, an the 36-months after discharge for the IHD cohort
  - Less likely to die during the index admission, for any cause, for the Stroke cohort
  - Had shorter length of stay, on average, during their index IHD and stroke admissions
  - Had a reduced 30-month re-admission rate for the Stroke cohort.

Differences by co-morbidity level

- The most common non-cardiac comorbidities were diabetes, renal disease, pulmonary disease, and cancer. Except for cancer, these comorbidities were more common in Aboriginal and Torres Strait Islander people.
- As comorbidity score increased the proportion of the IHD, stroke and RHD cohorts who died during their index admissions increased, more so for other causes of death.
- The 36-month cause-specific death rate after discharge from the index admission increased for IHD, stroke and RHD cohorts, as did the cause-specific death rate for the CHF cohort.
- As comorbidity increased, the average length of stay increased for the IHD and RHD cohorts.
- Generally, those with comorbidity compared to those without, had an increased re-admission over the 30-month follow-up.

1 BACKGROUND

1.1 Policy Context

In 2009, the Council of Australian Governments signed the National Indigenous Reform Agreement, which committed all Australian State governments to close the gap in life expectancy within a generation and to halve the gap in mortality rates for Indigenous children under five years of age within a decade. The Australian Health Ministers' Advisory Council (AHMAC) recognised the importance of improving the quality of cardiac care and cardiovascular disease outcomes for Aboriginal and Torres Strait Islander Australians in closing the gap in life expectancy.

In 2014, a set of priority actions to improve primary prevention, diagnosis and management, and secondary care of cardiovascular disease for Aboriginal and Torres Strait Islander Australians were developed. In response, the Queensland Government Health Department developed the *Queensland Aboriginal and Torres Strait Islander Cardiac Health Strategy 2014-2017* with key partners to provide clear direction on areas in which health services could improve their responsiveness to Aboriginal and Torres Strait Islander Queenslanders with cardiovascular disease, we well as commission the Menzies School of Health Research to work in partnership with the Aboriginal and Torres Strait Islander Health Branch of Queensland Health to undertake this project.

1.2 Cardiovascular care and outcomes for Aboriginal and Torres Strait Islander people

Nationally, more than one in four Aboriginal and Torres Strait Islander people live with cardiovascular disease (CVD).[1] The mortality rate from CVD is 1.5 times higher for Aboriginal and Torres Strait Islander people compared to other Australians, despite it falling by 49% during 1998 and 2017 for this population.[2,3] Aboriginal and Torres Strait Islander people, particularly women and those from remote areas, are more likely to be hospitalised for CVD than other Australians.[1,4]

There have been improvements in the level of access to cardiac care for Aboriginal and Torres Strait Islander people, although disparities are persistent.[5] Nationally, almost one-third of Aboriginal and Torres Strait Islander people had an annual health assessment during 2017-2018, which was more than double the 2010-2011 proportion.[5] Aboriginal and Torres Strait Islander people and other Australians have similar uptake of cardiovascular diagnostic services.[5] In New South Wales (NSW), 33% of Aboriginal and Torres Strait Islander people received revascularisation after hospitalisation for acute myocardial infarction (MI) compared to 40% of other NSW people.[6] Available data suggest that this disparity in in-hospital therapeutic procedures for patients with MI may be explained by differences in the age and geographical distribution of Aboriginal and Torres Strait Islander people and other NSW people.[7] In NSW, one-year mortality for MI is higher for Aboriginal and Torres Strait Islander people compared to the rest of the population, and this was at least in part explained by the higher burden of co-morbidity among the Aboriginal and Torres Strait Islander population.[8]

In Queensland, CVD accounts for one-quarter of all deaths in Aboriginal and Torres Strait Islander people.[9] Aboriginal and Torres Strait Islander people are more likely to die from CVD before the age of 50 years than other Queenslanders (25% compared to 3%, respectively).[10] There is little known about the level of cardiovascular care and outcomes for Aboriginal and Torres Strait Islander people in Queensland and the disparity in care and outcomes compared to other Queenslanders.

1.3 Project aims

This study aimed to:

1. Investigate variation in, and factors associated with, three-year survival for Aboriginal and Torres Strait Islander people and other Queenslanders diagnosed with ischaemic heart disease, congestive heart failure, stroke, acute rheumatic fever, and rheumatic heart disease
2. Describe and identify factors associated with length of stay and time to re-admission in Aboriginal and Torres Strait Islander people and other Queenslanders diagnosed with ischaemic heart disease, congestive heart failure, stroke, acute rheumatic fever, and rheumatic heart disease
3. Describe and identify factors associated with receipt of in-hospital therapeutic procedures for acute coronary syndrome for Aboriginal and Torres Strait Islander people and other Queenslanders

2 METHODS

2.1 Study setting

This study is set in Queensland, Australia. Aboriginal and Torres Strait Islander people constitute 4.6% of the Queensland population (3.3% of the national population).[11] The Queensland Aboriginal and Torres Strait Islander population represents 28.7% of the total national Aboriginal and Torres Strait Islander population.[11] In Queensland, 33% of the Aboriginal and Torres Strait Islander population live in major cities, 51% in regional areas, seven percent in remote areas and nine percent in very remote areas.[12]

2.2 Study design

A retrospective cohort study design has been employed to address the research aims.

2.3 Study cohorts and principal data source

All Queensland residents who were admitted to a Queensland public or private hospital with a principal or other international disease classification (ICD) diagnosis code for ischaemic heart disease (IHD; ICD code: I20-I25), congestive heart failure (CHF; I50), stroke (I61, I63, I64), acute rheumatic fever (ARF; I00-I02), and/or rheumatic heart disease (RHD; I05-I09) during the cohort period of 1 July 2010 to 30 June 2016 were initially included.

An overall cardiovascular (CV) cohort was established, with Queenslanders entering the study at the first hospitalisation with a principal or other diagnosis code for IHD, CHF, stroke, ARF, or RHD (index date) and excluding those who had a hospitalisation for any of these conditions in the five-year period prior to the index date (lookback period). Four disease-specific cohorts were established for each of the five index conditions: IHD, CHF, stroke, and RHD (Table 1). Individuals entered the respective cohorts at the date of their first hospital admission with a principal or other diagnosis code for the index conditions, referred to as the index admission, and were excluded if they had a hospital admission record with a principal or other diagnosis code for the index condition in the five-year lookback period. Throughout the report, the first eligible admission in the cohort period is referred to as the first index admission. The index date is assumed to approximate when a person first developed the index condition. Four sub-group cohorts were established which identified individuals at their first hospital admissions with a principal diagnosis for the index admission (i.e. the first hospitalisation *for* that condition), excluding those with a hospital record (based on principal and other diagnosis code) in the lookback period. As ACS and ARF are acute conditions, the cohorts established for these conditions were based only on the principal diagnosis code.

Due to the small numbers of people in the younger age groups, the IHD, ACS, CHF and Stroke cohorts excluded those aged younger than 2 years. For some analyses, people aged 85 years or older were also excluded. In the data provided for this study, age was coded as '85' for all persons aged 85 years and over. This prevented adjusting for confounding of death rates by age for those aged 85+ years. Aboriginal and Torres Strait Islander people had a younger age distribution than other Queenslanders overall and this was likely reflected in the 85+ age group. As age was associated with most outcomes, comparing unadjusted estimates for those aged 85+ years may underestimate differences between Aboriginal and Torres Strait Islander people and other Queenslanders. There was also a small proportion of the cohort in this age group (e.g., 1.6% of the Aboriginal and Torres Strait Islander IHD cohort were aged 85 years and older).

For the ARF cohort, individuals with an eligible index admission before the age of 30 were included. ARF is almost exclusively a disease of children and young adults, which is reflected in the age distribution of the Aboriginal and Torres Strait Islander cohort. However, almost half of the other Queenslander cohort

were aged over 30 years. The reasons for this are not known and may be a coding issue, repeat ARF episode in adults who developed RHD in younger years, or people who are experiencing their first ARF episode after 30 years of age. The latter is unlikely given the natural history of the disease. The aim of the Better Cardiac Care project is to investigate cardiac care for Aboriginal and Torres Strait Islander people, therefore the analysis has been restricted to those aged under 30 years.

Further restrictions were placed on some analyses and are described in the relevant Chapters.

Table 1 Terminology guide relevant for cohort eligibility criteria

Terminology	Definition
Index condition	The cardiovascular condition (IHD, ACS, CHF, stroke, ARF, RHD) that determines individuals' eligibility into the cohort.
Index admission	The first admission in the study period (1 July 2010 – 30 June 2016) which contains the international disease classification (ICD) code(s) of the index condition.
Index admission date	The earliest date of the index admission.
Index end date	During an admission, individuals may be admitted and discharged multiple times, creating multiple episodes for a single admission. The index end date is the separate date of the final episode of the index admission.
Cohort period	Individuals were eligible for inclusion in the analysis if they had a QHAPDC hospital record related to an index condition during 1 July 2010 – 30 June 2016.
Lookback period	The five years preceding the index admission date.
Follow-up period	The three years subsequent to the index admission date (for those who enter the study during 1 January – 30 June 2016 only 2.5 years follow-up time was available).
First admission	Index admissions which are not preceded by admissions for the index condition in the lookback period.

The QHAPDC contains information for each admission episode. For each hospital admission, patients may have multiple episode records. A new episode record is created when a person presents to the hospital for admission, or is transferred from emergency or another health facility, or changes their care. Likewise, patients may be discharged to home or their usual care, to other facilities, for changing care type, for not returning from leave, or for leaving the hospital against medical advice (self-discharge). Discharges that do not result in the patient leaving hospital are referred to as statistical discharges. For each episode, the associated principal diagnosis is recorded along with up to 40 other diagnoses that are deemed clinically relevant for the care of the patient and any procedures administered to the patient during the episode. Principal and other diagnoses are coded using the International Classification of Disease (ICD) and procedures are coded using the Australian Classification of Health Interventions (ACHI).

All public and private hospital admissions that occur in Queensland are recorded in the Queensland Hospital Admitted Patient Data Collection (QHAPDC) and is therefore considered to be a complete data source for all Queenslanders who have been hospitalised. However, as some individuals may experience or be diagnosed with one of the index CVD conditions without hospitalisation (e.g., people who experience a heart attack and die before being able to be admitted to hospital) it is not a complete dataset of all individuals with CVD in Queensland. In an effort to identify all Queenslanders with CVD onset/diagnosis during the cohort period, QHAPDC records with ischaemic heart disease, congestive heart failure, stroke, acute rheumatic fever, and rheumatic heart disease recorded in the 'other diagnoses' field were also included. Exclusion of individuals with a QHAPDC record of hospitalisation with the index condition records (based on principal and other diagnosis codes) in the five-year lookback period helps ensure that individuals in the cohort had the onset/diagnosis of their CVD condition during the cohort period.

2.4 Data sources and data linkage

For all individuals in the cohort, all QHAPDC records for the lookback, cohort and follow-up periods (1 July 2005 and 30 December 2018) were extracted and linked to the national death index (NDI; 1 July 2010-31 December 2018) and the National Health Costings Data Collection (NHDCD; 1 July 2010-31 December 2018).[FN 1] Once ethics, public health governance, and data custodian approvals were obtained, these datasets were linked by Data Linkage Queensland (DLQ) and data were extracted. As per our ethics approvals, key identifiers were removed from the analysis dataset provided to the research team, who were able to access the individual level data through the Secure Unified Research Environment (SURE), managed by the Sax Institute.

2.5 Variables

2.5.1 Admission and cohort characteristics

Each QHAPDC record contains information about the episode, including the episode admission date, episode separation date, separation mode (reason for hospital separation), type of episode (acute, palliative, rehabilitation, maintenance, and other care types), the principal and other ICD diagnoses codes associated with the admission, procedures codes for any procedures undergone during the episode, and the hospital and health service (HHS) area of the admitting hospital. The records also contain information about the patient at the time of admission, including patient age (in full years, from age zero, capped at age 85+ years), sex (male, female), Indigenous status (Aboriginal only, Torres Strait Islander only, Both Aboriginal and Torres Strait Islander, Neither Aboriginal or Torres Strait Islander), insurance status (hospital insurance, no hospital insurance, not stated/unknown), residential remoteness, and area-level socioeconomic disadvantage.

The QHAPDC dataset provided to the research team contained a measure of residential remoteness for each person at each hospital admission. Residential remoteness was measured using the Accessibility and Remoteness Index of Australia (ARIA) measure and based on residential address provided at hospital admission.[13] The ARIA measure, developed by the Australian Bureau of Statistics, indicates distance from nearest service centre and access to goods and services, and is classified as Major City (relatively unrestricted accessibility to a wide range of goods and service and opportunities for social interaction), inner regional (some restrictions to accessibility), Outer Regional (significant restrictions to accessibility), Remote (very restricted accessibility), and Very Remote (very little accessibility).

The Index of Socioeconomic Advantage and Disadvantage (IRSAD)[14] was also provided in the QHAPDC dataset. IRSAD is a measure of area-level socioeconomic status, which is calculated using individual's home address provided at hospital admission. The variable provided in the analysis dataset was quintiles of IRSAD, with quintile one (Q1) indicating the most disadvantaged 20% of the population, and quintile five (Q5) indicating the most advantaged 20% of the population.

Co-morbidity was measured using the Charlson co-morbidity index (CCI).[15,16] Indicator variables for each CCI condition (Table 2) were created to indicate the presence of principal or other diagnosis codes for these conditions in hospital admission records during the lookback period (five years prior to the index admission date). To calculate the CCI score, a weighting was given to the variables (Table 2).

[FN1] As part of the Aboriginal and Torres Strait Islander Better Cardiac Care Data Linkage (Queensland) project we have also collected data from the Emergency Department dataset, Rheumatic Heart Disease Register and Enhanced Surveillance Database, Ferret and Best Practice primary care databases for Far North Queensland, and the Queensland Death Register. Further data is currently being linked and extracted from the Medicare Benefits Schedule (MBS) and the Pharmaceutical Benefits Scheme (PBS) housed by the Australian Institute of Health and Welfare and under custodianship of the Commonwealth Health Department. While outside of this current report, it is envisaged that these additional datasets will be used to measure and investigate primary and secondary care for individuals in the five cohorts.

Separation mode was provided for each episode of care record. Using this variable, we created a variable to indicate whether someone has discharged against medical advice or not returned from hospital leave; here referred to as 'self-discharge'. Those whose separation mode was coded as 'died in hospital' where cross checked against the National Death Index. Individuals not coded as 'died in hospital' but who died during their first index admission or on the day of discharge were re-coded as 'died in hospital'.

Table 2 Charlson co-morbidity score, included conditions and weightings

Condition	Weighting
Myocardial infarction	1
Congestive heart failure	1
Peripheral heart disease	1
Cerebrovascular disease	1
Dementia	1
Rheumatoid arthritis	1
Peptic ulcer	1
Liver disease – mild	1
Diabetes – without complications	1
Diabetes – with complications	2
Paraplegia	2
Renal disease – moderate to severe	2
Cancer	2
Liver disease – moderate to severe	3
Metastatic cancer	6
HIV/AIDS	6

2.5.2 Vital status and survival time

ICD codes for the underlying cause of death were obtained from the National Death Index and was coded as 'died from the index condition', 'died from any cause', and 'alive'.

Survival time was calculated as the time (in days) from the first (index) admission date to death, end of study (31 December 2018), or end of thirty-six month follow-up, which ever occurred first.

2.5.3 Length of stay

Information on the admission date, separation date, and total leave days (days patient has taken leave from the hospital without discharge) for each admission episode was contained in the QHAPDC. The first episode of the first index admission was initially identified for each member of the cohort. Any episode which overlapped by date with the first episode was considered part of the first index admission. Using all of the episodes in the first index admission, the admission date of the first episode and the separation date of the last episode was identified as the admission start and end date, respectively. Using these dates, any further episodes that fell inside the first index admission were identified. This process continued until no new episodes were added to the first index admission.

Length of stay was calculated as the time from first admission start date to first admission end date, minus the total days of leave taken during this time.

2.5.4 Re-admission

Patients who had been admitted to hospital with a principal diagnosis of the index condition in 30 months after discharge from their first index admission were considered to have had a re-admission. The time to re-admission was calculated as the time from discharge from the first index admission to

the first re-admission for the index admission, censored by end of study (31 December 2018) or 30 months, which ever occurred first.

2.5.5 In-hospital therapeutic procedures for acute coronary syndrome

Procedure codes that occurred during the first index admission (i.e., any episode record that was part of the index admission) were used to create indicator variables of procedures received during first admission with a principal diagnosis of acute coronary syndrome. These procedures were: diagnostic angiography, percutaneous coronary intervention and coronary artery bypass graft. Another variable was made to indicate if a person received any (one or more) of these procedures during their index admission. The Australian Classification of Health Intervention codes used to identify whether a person had received a relevant procedure is listed in Table 3 below.

Table 3 Procedure codes from the Australian Classification of Health Interventions (ACHI) used in the analysis, edition 8 and earlier equivalents.

Procedure Type	8th Edition ACHI		Equivalent earlier edition ACHI codes			
	Description	Code	7th	6th	5th	4th
PCI	Percutaneous transluminal balloon angioplasty of 1 coronary artery	**38300-00**	38300-00	38300-00	35304-00	35304-00
	Percutaneous transluminal balloon angioplasty of >=2 coronary arteries	**38303-00**	38303-00	38303-00	35305-00	35305-00
	Percutaneous insertion of 1 transluminal stent into single coronary artery	**38306-00**	38306-00	38306-00	35310-00	35310-00
	Percutaneous insertion of >=2 transluminal stents into a single coronary artery	**38306-01**	38306-01	38306-01	35310-01	35310-01
	Percutaneous insertion of >=2 transluminal stents into multiple coronary arteries	**38306-02**	38306-02	38306-02	35310-02	35310-02
	Percutaneous transluminal coronary rotational atherectomy, 1 artery	**38309-00**	38309-00	38309-00	35335-00	35304-00
	Percutaneous transluminal coronary rotational atherectomy, 1 artery with insertion of 1 stent	**38312-00**	38312-00	38312-00	35338-00	35310-00
	Percutaneous transluminal coronary rotation atherectomy, 1 artery with insertion of >=2 stents	**38312-01**	38312-01	38312-01	35338-01	35310-01
	Percutaneous transluminal coronary rotation atherectomy, multiple arteries	**38315-00**	38315-00	38315-00	35341-00	35305-00
	Percutaneous transluminal coronary rotation atherectomy, multiple arteries with insertion of 1 stent	**38318-00**	38318-00	38318-00	35344-00	35305-00
	Percutaneous transluminal coronary rotation atherectomy, multiple arteries with insertion of >=2 stents	**38318-01**	38318-01	38318-01	35344-01	35310-02
	Percutaneous transluminal coronary angioplasty with aspiration thrombectomy, 1 artery	**90218-00**	-	-	-	-
	Percutaneous transluminal coronary angioplasty with aspiration thrombectomy, multiple arteries	**90218-01**	-	-	-	-
	Percutaneous transluminal coronary angioplasty with embolic protection device, 1 artery	**90218-02**	-	-	-	-
	Percutaneous transluminal coronary angioplasty with embolic protection device, multiple arteries	**90218-03**	-	-	-	-
Diagnostic angiography	Coronary angiography	**38215-00**	38215-00	38215-00	38215-00	38215-00
	Coronary angiography with left heart catheterisation	**38218-00**	38218-00	38218-00	38218-00	38218-00
	Coronary angiography with right heart catheterisation	**38218-01**	38218-01	38218-01	38218-01	38218-01

	Coronary angiography with left and right heart catheterisation	**38218-02**	38218-02	38218-02	38218-02	38218-02
Coronary artery bypass graft	Open transluminal balloon angioplasty of 1 coronary artery	**38300-01**	38300-01	38300-01	35304-01	35304-01
	Open transluminal balloon angioplasty of 2+ coronary arteries	**38303-01**	38303-01	38303-01	35305-01	35305-01
	Open insertion of 1 transluminal stent into single coronary artery	**38306-03**	38306-03	38306-03	35310-03	35310-03
	Open insertion of 2+ transluminal stents into multiple coronary arteries	**38306-04**	38306-04	38306-04	35310-04	35310-04
	Coronary artery bypass, using 1 saphenous vein graft	**38306-05**	38306-05	38306-05	35310-05	35310-05
	Coronary artery bypass, using 2 saphenous vein grafts	**38497-00**	38497-00	38497-00	38497-00	38497-00
	Coronary artery bypass, using 3 saphenous vein grafts	**38497-01**	38497-01	38497-01	38497-01	38497-01
	Coronary artery bypass, using 4+ saphenous vein grafts	**38497-02**	38497-02	38497-02	38497-02	38497-02
	Coronary artery bypass using 1 other venous graft	**38497-03**	38497-03	38497-03	38497-03	38497-03
	Coronary artery bypass using 2 other venous grafts	**38497-04**	38497-04	38497-04	38497-04	38497-04
	Coronary artery bypass using 3 other venous grafts	**38497-05**	38497-05	38497-05	38497-05	38497-05
	Coronary artery bypass using 4+ other venous grafts	**38497-06**	38497-06	38497-06	38497-06	38497-06
	Coronary artery bypass using 1 other venous graft	**38497-07**	38497-07	38497-07	38497-07	38497-07
	Coronary artery bypass using 1 left international mammary artery graft	**38500-00**	38500-00	38500-00	38500-00	38500-00
	Coronary artery bypass using 1 right intern mammary artery graft	**38500-01**	38500-01	38500-01	38500-01	38500-01
	Coronary artery bypass, using 1 radial artery graft	**38500-02**	38500-02	38500-02	38500-02	38500-02
	Coronary artery bypass, using 1 epigastric artery graft	**38500-03**	38500-03	38500-03	38500-03	38500-03
	Coronary artery bypass, using 1 other arterial graft	**38500-04**	38500-04	38500-04	38500-04	38500-04
	Coronary artery bypass, using 1 composite graft	**38500-05**	38500-05	-	-	-
	Coronary artery bypass, using >=2 left internal mammary artery grafts	**38503-00**	38503-00	38503-00	38503-00	38503-00
	Coronary artery bypass, using >=2 right internal mammary artery grafts	**38503-01**	38503-01	38503-01	38503-01	38503-01
	Coronary artery bypass, using >=2 radial artery grafts	**38503-02**	38503-02	38503-02	38503-02	38503-02
	Coronary artery bypass, using >=2 epigastric artery grafts	**38503-03**	38503-03	38503-03	38503-03	38503-03
	Coronary artery bypass, using >=2 other arterial grafts	**38503-04**	38503-04	38503-04	38503-04	38503-04
	Coronary artery bypass, using >=2 composite grafts	**38503-05**	38503-05	-	-	-
	Coronary artery bypass, using 1 other graft, not elsewhere classified	**90201-00**	90201-00	90201-00	90201-00	90201-00
	Coronary artery bypass, using 2 other grafts, not elsewhere classified	**90201-01**	90201-01	90201-01	90201-01	90201-01
	Coronary artery bypass, using 3 other grafts, not elsewhere classified	**90201-02**	90201-02	90201-02	90201-02	90201-02
	Coronary artery bypass, using >=4 other grafts, not elsewhere classified	**90201-03**	90201-03	90201-03	90201-03	90201-03

2.6 Analysis

2.6.1 Cohort description

For each study cohort, cohort characteristics (socio-demographics, cardiovascular diagnosis characteristics, and admission characteristics) were described using frequency and proportion for categorical variables and mean and standard deviation (SD) for normally distributed continuous variables, such as age at first admission. Characteristics were described overall and by Indigenous status (Aboriginal and Torres Strait Islander Queenslanders vs. other Queenslanders).

For each cohort, the characteristics of those who died during the index admission compared to those who didn't were also described and those who self-discharged compared to those who were discharged for other reasons were described.

2.6.2 Fatality

Fatality is the proportion of people who died of their condition within a certain amount of time after the condition was diagnosed. Fatality was measured in two ways:

In hospital fatality: the proportion of people who died from their condition, and separately the proportion who died from any other cause, during their first hospital admission

After discharge fatality: the proportion of people discharged alive from their first hospital admission who died from their condition after discharge, measured at one month, six months and thirty-six months (three years).

This study focuses on 'cause-specific' deaths rather than 'all-cause' deaths. The all-cause death rate measures total deaths in the population. The cause-specific death rate measures the death rate from a specific cause (e.g., deaths from IHD). Aboriginal and Torres Strait Islander people have a much higher all-cause death rate than other Queenslanders, so the all-cause death rate is higher for Aboriginal and Torres Strait Islander people than other Queenslanders in each cardiovascular disease cohort; this does not tell us anything about their risk of death from each specific cardiovascular disease. Therefore, survival analysis focused on deaths from each specific cardiovascular disease rather than deaths from any cause.

In-hospital cause-specific fatality was calculated as the proportion of people with their first hospital admission who died from that condition during that admission. In-hospital other-cause fatality was calculated as the proportion of people with their first hospital admission who died from any other condition during that admission. Some cohort members did not have a full three-year follow-up period after their first hospital admission and some died from other causes during that time, so the Kaplan-Meier method was used to estimate cause-specific fatality at one, six and thirty-six months after first admission. Fatality was expressed as a percentage.

To assess whether the risk of death after discharge changed over time, the study investigated the rate of death from each condition (i.e., cause-specific death rate, not all-cause death rate) by time period after diagnosis. Cause-specific death rates were estimated by splitting follow-up time into periods after first hospital admission and calculating the cause-specific death rate as the number of deaths in each time period divided by the total person-time of people in each cohort still alive at the start of each period. Follow-up time was split at 1, 2, 3, 6, 12, 24 and 36 months because risk of death was found to be highest but decreasing in the months immediately after discharge. The Mantel-Haentzel method was used to calculate the death rate ratio of Aboriginal and Torres Strait Islander people compared to other Queenslanders, adjusted for age. Death rates were expressed as average number of deaths per 1,000 persons per year.

Multivariable regression analysis was used to investigate factors that were potentially associated with risk of in-hospital and after-hospital death. Modified Poisson regression was used to analyse the proportion of in-hospital deaths, separately for cause-specific and other-cause deaths. Cox regression was used to analyse the after-hospital cause-specific death rate.

Taking IHD as an example, In-hospital IHD fatality is the proportion of people who died from IHD during their first hospital admission for IHD. In-hospital other-cause fatality is the proportion of people who died from any cause other than IHD during their first IHD admission. After-hospital IHD one-month fatality is the proportion of people who died from IHD within one month of being discharged alive from their first IHD admission (and similarly for six-month and thirty-six month fatality).

2.6.3 Services use and costs

Length of stay: Length of stay is a count variable (i.e., number of days) with a skewed distribution (minimum number of zero, mostly low numbers with a small number of persons with very high numbers) that approximated the Poisson distribution but was found to be over-distributed (i.e., the variance was greater than the mean). It is described overall and by groups using median and inter-quartile range (IQR). It is modelled using negative binomial regression, which estimates an incidence rate ratio for length of stay for Aboriginal and Torres Strait Islander people compared to other Queenslanders, adjusting for potentially confounding variables.

Re-admission: The proportion of people who had a re-admission in the follow-up period is reported, stratified by Indigenous status and age group.

Time to re-admission: Time to re-admission was described using Kaplan Meier fatality functions (referred to here as the re-admission rate) at different time points after discharge from the first index admission and expressed as a percentage. This was described overall and by groups. Time to re-admission was modelled using Cox proportional hazard regression. To assess whether the relative risk of re-admission after discharge form the first index admission changed over time, follow-up time was split into time period and the re-admission rate in each time period was divided by the total person-time of people in each cohort non-admitted at the start of each period. The Mantel-Haentzel method was used to calculate the re-admission rate ratio of Aboriginal and Torres Strait Islander people compared to other Queenslanders, adjusted for age.

2.6.4 In-hospital therapeutic procedures

For the acute coronary syndrome (ACS) cohort, the proportion of people who receive a diagnostic angiography, percutaneous coronary intervention, a coronary artery bypass graft, or at least one of these is described, overall and by groups. Logistic regression models are used to model the difference in proportions for Aboriginal and Torres Strait Islander people and other Queenslanders, adjusted for age (Model A), sex and co-morbidity (Model B), and either remoteness and socioeconomic advantage of residential areas (Model C) or the hospital and health service area of the initial admitting hospital (Model D). A stratified model by Indigenous status was also run and findings presented, to identify variables associated with receiving ACS procedures during first index hospitalisation for Aboriginal and Torres Strait Islander people and other Queenslanders, separately.

3 FIRST CARDIOVASCULAR HOSPITAL ADMISSIONS

This chapter describes Queenslanders at the time of their first hospital admission for IHD, CHF, stroke, ARF or RHD. Due to significant heterogeneity in the structure of the sub-group cohorts, subsequent chapters will describe each disease-specific cohort and investigate the project aims for the individual disease cohorts.

3.1 Indigenous algorithms

The proportion of the cohort who were identified in the hospital records as Aboriginal and Torres Strait Islander ranged from 3.4% to 4.2%, depending on the algorithm used to determine Indigenous status (Table 4).

Compared to the cohort identified using the 'Ever Indigenous' cohort, the Aboriginal and Torres Strait Islander cohort identified using the 'Greater than 50% of records' cohort were three years younger at index admission, a lower proportion had hospital insurance, lived in major cities and inner regional areas, and were admitted to private hospitals, and a higher proportion lived in the least socioeconomic advantaged areas and were admitted to hospitals in the Cairns and Hinterland, Torres and the Cape, and Townsville hospital and health service areas. Throughout this report, the 'Greater than 50% of records' algorithm is used to establish the Aboriginal and Torres Strait Islander Queensland cohort using the QHAPDC data.

Table 4 Proportion of the Cardiovascular Cohort[1] identified as Aboriginal and Torres Strait Islander using QHAPDC data and three 'best-practice'[2] algorithms, 2010-2016 (n=184,459).

Algorithm	Definition	Indigenous N (%)
Ever Indigenous	If at least one of all available QHAPDC records identify the individual as an Aboriginal and/or Torres Strait Islander Queenslander, then the individual is classified as such and everyone else is classified as other Queenslanders	7,899 (4.24)
Most Recent Indigenous	If the most recent (and non-missing) available QHAPDC record identifies the individual as an Aboriginal and/or Torres Strait Islander Queenslander, then the individual is classified as such and everyone else is classified as other Queenslanders.	6,412 (3.47)
Greater than 50% records	If more than 50% of available and non-missing QHAPDC records identify an individual an Aboriginal and/or Torres Strait Islander Queenslander, then the individual is classified as such and everyone else is classified as other Queenslanders.	6,203 (3.36)

Abbreviation: QHAPDC: Queensland Hospital Admitted Patient Data Collection; N: number

1. the cohort includes all Queenslanders hospitalised in a Queensland hospital during 1 July 2010 and 30 June 2016, with a principal or other diagnosis code related to IHD, CHF, stroke, ARF, RHD.
2. Australian Institute of Health and Welfare (AIHW) & the Australian Bureau of Statistics (ABS), 2012. https://www.aihw.gov.au/getmedia/6d6b9365-9cc7-41ee-873f-13e69e038337/13627.pdf.aspx?inline=true

3.2 Index cardiovascular cohort

The cardiovascular disease (CVD) cohort consisted of Queenslanders who were admitted to a Queensland hospital with a principal or other diagnosis code of IHD, CHF, stroke, ARF or RHD between 1 July 2010 and 30 June 2016. People for whom their first CVD admission was for palliative care or with missing data on Indigenous status were excluded. The CVD cohort consisted of 178,256 people, 6,203 (3.4%) of whom were Aboriginal and Torres Strait Islander people.

A greater proportion of Aboriginal and Torres Strait Islander people were female, in younger age groups, and lived in outer regional, remote, and very remote and the least advantaged socioeconomic areas than other Queenslanders (Table 5). A higher proportion of Aboriginal and Torres Strait Islander people than other Queenslanders were admitted to hospitals in Northern Queensland Hospital and Health Service areas, while a much lower proportion were admitted to private hospitals. A much lower proportion of Aboriginal and Torres Strait Islander people had health insurance than other Queenslanders (5.6% compared to 46.1%).

Table 5 Cardiovascular cohort[1], demographic characteristics (%), Queensland 2010-2016

	Other Queenslander N=178,256	Aboriginal and Torres Strait Islander N=6,203
Sex		
Male	58.17	50.62
Female	41.83	49.38
Age-group		
0-24	0.66	8.33
25-44	4.13	20.26
45-64	28.21	48.65
65-84	50.74	20.67
85-99	16.26	2.08
Hospital and health service		
Cairns & Hinterland	3.33	21.41
Central Queensland	2.88	4.55
Central West	0.21	0.48
Children's health Queensland	0.10	0.42
Darling Downs	3.66	4.97
Gold Coast	5.91	1.90
Mackay	2.52	3.61
Mater public hospitals	1.52	1.69
Metro North	15.33	9.17
Metro South	11.74	8.54
North-west	0.33	7.87
South-west	0.44	1.69
Sunshine Coast	6.02	1.92
Torres and Cape	0.13	8.04
Townsville	3.82	14.04
West Moreton	3.29	2.79
Wide Bay	4.63	3.69
Private	34.15	3.21
Remoteness		
Major Cities	55.33	19.99
Inner Regional	27.76	16.98
Outer Regional	15.07	35.34
Remote	1.10	11.88
Very Remote	0.74	15.81
Socioeconomic advantage		
Least advantaged	25.18	51.48
Quintile 2	23.86	22.57
Quintile 3	19.99	14.33
Quintile 4	17.59	7.83
Most advantaged	13.38	3.79
Health insurance		
Insured	46.11	5.59
Not insured	52.14	90.15
Other	1.75	4.26
Self-discharge		
Yes	0.58	2.90

1. the cohort consists of all Queenslanders hospitalised with a principal or other diagnosis code related to IHD, CHF, stroke, ARF and/or RHD during 2010-2016

Common non-cardiovascular co-morbidities for Aboriginal and Torres Strait Islander people were diabetes, pulmonary disease and renal disease (Figure 1). A higher proportion of Aboriginal and Torres Strait Islander people than other Queenslanders had co-morbidity among those aged 25-44, 45-64, and 65-84 years (Table 6)

Figure 1 CVD cohort, most common co-morbidities (%), by Indigenous status, Queensland 2010-2016

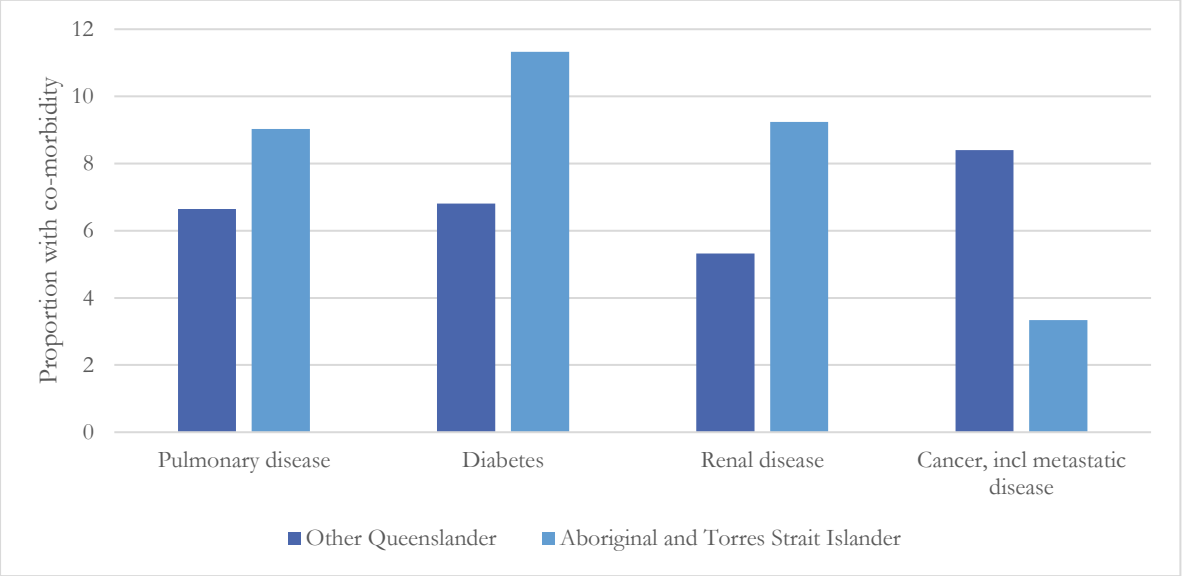


Table 6 Cardiovascular cohort, proportion (%) with co-morbid conditions within age group and by indigenous status, Queensland 2016-2010

	Other Queenslanders			Aboriginal and Torres Strait Islander			Total Queenslanders		
Age-group	zero	one or two	three or more	zero	one or two	three or more	zero	one or two	three or more
0-24	88.3	8.7	3.0	93.6	6.0	0.4	89.9	7.9	2,2
25-44	85.2	11.8	3.1	78.5	16.2	5.3	84.2	12.4	3.4
45-64	81.8	13.9	4.4	66.4	25.5	8.1	80.9	14.5	4.6
65-84	66.1	24.5	9.4	55.0	30.0	15.0	66.0	24.6	9.5
85+	59.7	29.2	11.1	58.1	31.8	10.1	59.7	29.2	11.1

1. Charlson co-morbidity score

Similar proportions of Aboriginal and Torres Strait Islander people and other Queenslanders died in hospital (3.2% vs. 4.2%), although the difference was wider for the 0-24 years age group (2.5% vs. 6.2%). The proportion of the cohort who died during their index admission was greatest for those aged 85 years and older and increased with increasing co-morbidity (Table 7).

Table 7 Cardiovascular cohort[1], proportion (%) who died in hospital at index admission by characteristics, Queensland 2016-2010

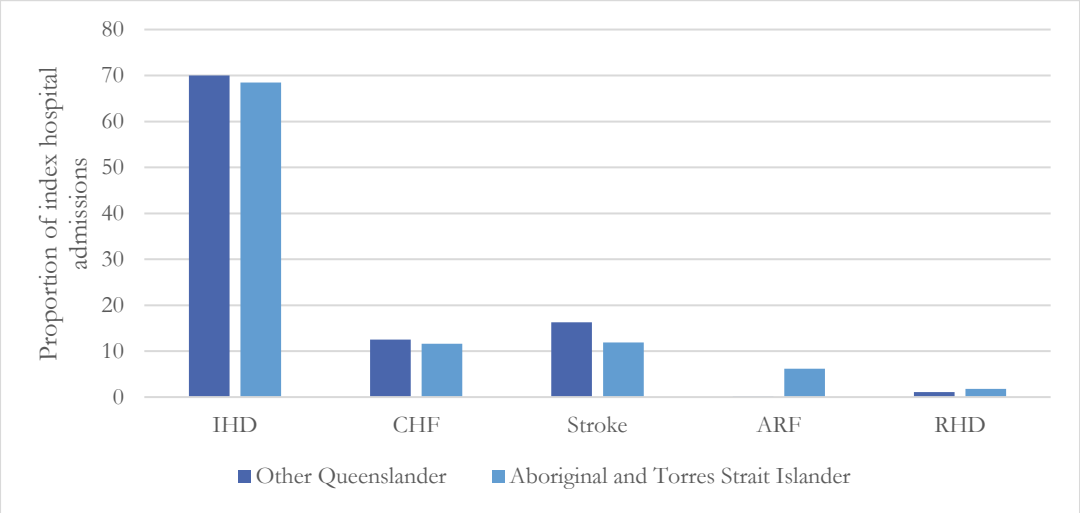
	Other Queenslanders	Aboriginal & Torres Strait Islander
Age group		
0-24	6.2	2.5
25-44	2.4	2.5
45-64	1.8	2.7
65-84	3.8	5.0
85+	10.0	10.1
Remoteness		
Major city	4.3	3.1
Inner regional	4.0	3.8
Outer regional	4.1	3.2
Remote	3.9	2.4
Very remote	4.1	3.5
Socioeconomic advantage		
Least advantaged	4.3	3.3
Quintile 2	4.1	3.3
Quintile 3	4.2	2.9
Quintile 4	4.3	2.9
Most advantaged	3.9	3.8
Co-morbidity score[2]		
None	3.0	2.3
One or two	6.1	4.5
Three or more	9.6	7.9

1. the cohort consists of all Queenslanders hospitalised with a principal or other diagnosis code related to IHD, CHF, stroke, ARF and/or RHD during 2010-2016
2. Charlson co-morbidity score

3.3 First principal cardiovascular cohort

In total, 124,878 Queenslanders were hospitalized with a principal diagnosis code of IHD, CHF, stroke, ARF or RHD between 1 July 2010 and 30 June 2016, excluding those admitted for one of these conditions in the five years prior to their index admission, admitted for palliative care or with missing data on Indigenous status. Of these, 4,416 (3.5%) were Aboriginal and Torres Strait Islander people. The majority were admitted for IHD (Figure 2).

Figure 2 Principal CVD cohort, principal diagnosis code for index admission (%), by Indigenous status, Queensland 2010-2016



Similar patterns in the distribution of socio-demographic characteristics were observed for the first principal CVD cohort compared to the first CVD cohort (based on principal and other diagnosis fields). Compared to other Queenslanders, a higher proportion of Aboriginal and Torres Strait Islander Queenslanders were female, in younger age groups, lived in regional, remote and very remote areas, lived in the least socioeconomic advantaged areas, were admitted to hospitals in the North Queensland hospital and health service areas, did not have private health insurance, and self-discharged against medical advice from their index admission (Table 8). While similar proportions of Aboriginal and Torres Strait Islander and other Queenslanders had a Charlson comorbidity score of at least one, a higher proportion of Aboriginal and Torres Strait Islander people had a previous hospital admission associated with pulmonary disease, diabetes and renal disease (Figure 3).

Figure 3 Principal CVD cohort, most common co-morbidities (%), by Indigenous status, Queensland 2010-2016

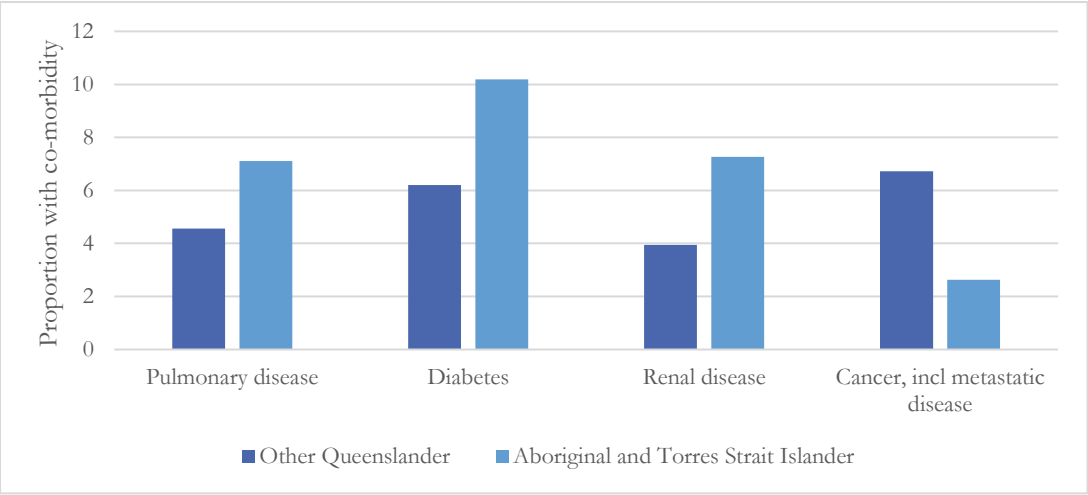


Table 8 Principal cardiovascular cohort[1], demographic characteristics (%), Queensland 2010-2016

	Other Queenslander N=120,462	Aboriginal and Torres Strait Islander N=4,416
Sex		
Male	61.04	53.78
Female	38.96	46.22
Age-group		
0-24	0.43	7.25
25-44	4.49	20.63
45-64	32.62	52.11
65-84	49.36	18.59
85-99	13.09	1.43
Co-morbidity score[2]		
None	75.72	73.55
One or two	18.49	20.06
Three or more	5.79	6.39
Hospital and health service		
Cairns & Hinterland	3.50	21.78
Central Queensland	3.20	4.94
Central West	0.24	0.61
Children's health Queensland	0.05	0.20
Darling Downs	3.96	5.37
Gold Coast	6.03	1.86
Mackay	2.61	3.89
Mater public hospitals	1.29	1.29
Metro North	14.90	8.15
Metro South	12.06	8.38
North-west	0.38	8.24
South-west	0.50	1.95
Sunshine Coast	6.35	1.83
Torres and Cape	0.15	7.63
Townsville	3.72	13.79
West Moreton	3.46	3.17
Wide Bay	5.20	3.99
Private	32.40	2.92
Remoteness		
Major Cities	54.43	19.07
Inner Regional	27.99	17.50
Outer Regional	15.62	36.28
Remote	1.17	11.93
Very Remote	0.78	15.22
Socioeconomic advantage		
Least advantaged	25.43	51.09
Quintile 2	23.97	22.55
Quintile 3	19.97	14.92
Quintile 4	17.56	7.88
Most advantaged	13.07	3.56
Health insurance		
Insured	46.10	5.77
Self-discharge		
Yes	0.63	2.60
Died in hospital		
Yes	2.51	1.88

1. The cohort consists of all Queenslanders hospitalised with a *principal* diagnosis code related to IHD, CHF, stroke, ARF and/or RHD during 2010-2016

A slightly lesser proportion of Aboriginal and Torres Strait Islander than other Queenslanders died during their index principal CVD hospital admission (Table 8), with the difference most prominent in the older age groups (Table 9). For both Aboriginal and Torres Strait Islander and other Queenslanders in the Principal CVD cohort, the proportion who died during index hospital admission increased with age and increasing Charlson co-morbidity score.

Table 9 Principal cardiovascular cohort[1], proportion (%) who died in hospital by characteristics, Queensland 2016-2010

	Other Queenslanders	Aboriginal & Torres Strait Islander
Age group		
0-24	1.9	0.3
25-44	0.7	1.0
45-64	0.9	1.6
65-84	2.3	3.7
85+	8.2	11.1
Remoteness		
Major city	2.6	1.4
Inner regional	2.3	1.9
Outer regional	2.4	1.8
Remote	2.5	1.1
Very remote	2.3	3.1
Socioeconomic advantage		
Least advantaged	2.6	2.2
Quintile 2	2.4	1.8
Quintile 3	2.4	1.1
Quintile 4	2.7	2.0
Most advantaged	2.4	0.6
Co-morbidity score[2]		
None	1.9	1.3
One or two	3.9	2.9
Three or more	6.3	5.3

1. the cohort consists of all Queenslanders hospitalised with a *principal* or other diagnosis code related to IHD, CHF, stroke, ARF and/or RHD during 2010-2016
2. Charlson co-morbidity score

4 ISCHAEMIC HEART DISEASE

4.1 Key findings

1. IHD-specific fatality was higher for Aboriginal and Torres Strait Islander than other Queenslanders in all age groups between 25 and 84 years of age

2. The IHD-specific death rate was highest in the first month after the index admission, then decreased to plateau after 12-18 months

3. On average, Aboriginal and Torres Strait Islander people had a 1 day longer length of stay for their first IHD admission than other Queenslanders

4. Aboriginal and Torres Strait Islander people had a greater 30-month IHD re-admission rate than other Queenslanders, with about one-third of Aboriginal and Torres Strait Islander people and one-quarter of other Queenslanders having a re-admission by 30 months after discharge from their first IHD admission

4.2 The IHD cohort

The ischemic heart disease (IHD) cohort consisted of Queenslanders aged 25 years and older who were admitted to a Queensland hospital with a diagnosis code of ischaemic heart disease between 1 July 2010 and 30 June 2016. People for whom their first IHD admission was for palliative care or with missing data on Indigenous status were excluded. The IHD cohort consisted of 129,804 people, 4,148 (3.2%) of whom were Aboriginal and/or Torres Strait Islander people.

The majority of cohort members were men, although the proportion of women was higher for Aboriginal and Torres Strait Islander than for other Queenslanders (Table 10). A higher proportion of Aboriginal and Torres Strait Islander than other Queenslanders were in younger age-groups, lived in northern and western Queensland and in areas that are more remote and had lower socioeconomic advantage. About half of other Queenslanders had private health insurance, compared to only seven percent of Aboriginal and Torres Strait Islander people. A higher proportion of Aboriginal and Torres Strait Islander people self-discharged from hospital. The proportion of people with co-morbid conditions increased with increasing age and was higher for Aboriginal and Torres Strait Islander than other Queenslanders in all age-groups (Table 11). Diabetes, renal disease, pulmonary disease and congestive heart failure were the most common co-morbid conditions among Aboriginal and Torres Strait Islander and other Queenslanders (Figure 4).

Analysis of IHD deaths was restricted to those aged 25-84 years at the time of their first IHD admission. Only 1.6% of Aboriginal and Torres Strait Islander members of the cohort were aged 85+ (Table 10).

Figure 4 IHD cohort, most common co-morbidities (%), by Indigenous status, Queensland 2010-2016

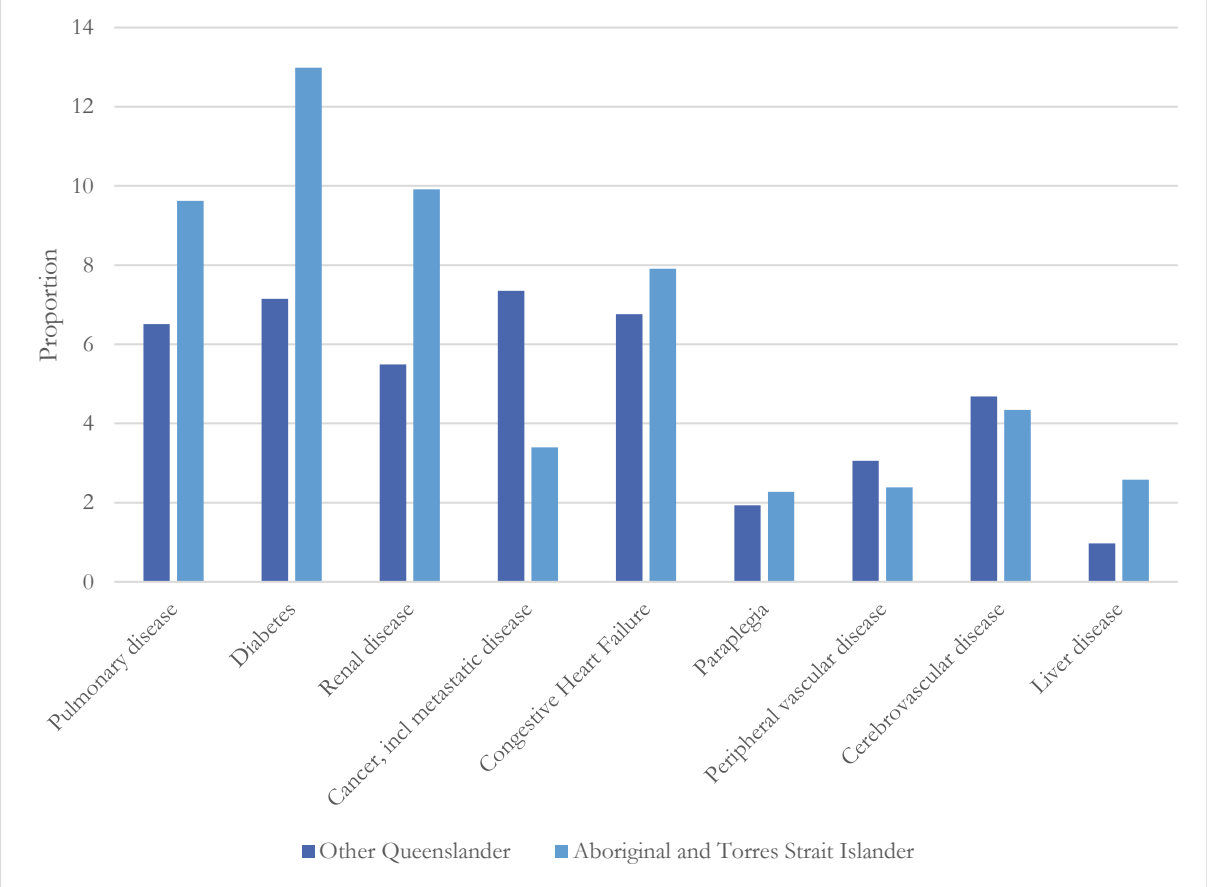


Table 10 IHD cohort, demographic characteristics (%), Queensland 2010-2016

	Other Queenslander N=125,656	Aboriginal and Torres Strait Islander N=4,148
Sex		
Male	62.5	53.8
Female	37.5	46.2
Age-group		
25-44	3.8	20.7
45-64	32.1	56.5
65-84	51.8	21.2
85-99	12.2	1.6
Hospital and health service		
Cairns & Hinterland	3.1	20.4
Central Queensland	2.8	4.8
Central West	0.2	0.6
Darling Downs	3.1	4.8
Gold Coast	5.1	2.0
Mackay	2.7	4.2
Mater public hospitals	1.2	1.4
Metro North	15.5	10.7
Metro South	10.8	8.8
North-west	0.3	6.4
South-west	0.4	1.8
Sunshine Coast	5.4	2.1
Torres and Cape	0.1	6.6
Townsville	3.7	14.0
West Moreton	3.1	2.9
Wide Bay	4.5	4.2
Private	38.2	4.1
Remoteness		
Major Cities	54.3	21.6
Inner Regional	28.2	18.3
Outer Regional	15.7	35.2
Remote	1.1	10.8
Very Remote	0.7	14.1
Socioeconomic advantage		
Least advantaged	25.1	49.6
Quintile 2	23.9	23.7
Quintile 3	20.0	14.3
Quintile 4	17.6	8.3
Most advantaged	13.4	4.1
Health insurance		
Insured	49.3	6.7
Not insured	49.1	89.3
Other	1.6	4.0
Self-discharge		
No	99.4	96.9
Self-discharged	0.6	3.1

Table 11 IHD cohort, proportion (%) with co-morbid conditions by age-group, Queensland 2016-2010

	One or two[1]		Three or more[1]	
Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander	Other Queenslanders	Aboriginal & Torres Strait Islander
25-44	9.8	15.2	2.3	4.9
45-64	13.1	24.0	4.1	10.4
65-84	24.1	30.5	10.8	17.7
85+	31.5	37.3	18.3	16.4

1. Charlson co-morbidity score

4.3 Fatality

4.3.1 Death in hospital

The proportion of people who died in hospital during their first IHD admission was higher for older than younger age-groups, for both deaths from IHD and from other causes (Table 12), and higher for Aboriginal and Torres Strait Islander people than other Queenslanders in all age-groups except 85+.

Table 12 IHD cohort, proportion (%) who died in hospital during first IHD admission, Queensland 2010-2016

	Died from IHD		Died from other cause	
Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander	Other Queenslanders	Aboriginal & Torres Strait Islander
25-44	0.4	0.5	0.5	1.2
45-64	0.5	1.0	0.7	1.5
65-84	1.7	2.4	2.5	3.6
85+	7.3	6.0	7.2	4.5

4.3.1.1 In-hospital deaths from IHD

In multivariable analysis, the proportion of people who died from IHD during their first hospital admission increased with increasing age, increasing number of co-morbid conditions and increasing remoteness while decreasing with increasing socioeconomic advantage (Table 13). When adjusted only for age (Model A), the proportion who died from IHD during their first hospital admission was 102% higher for Aboriginal and Torres Strait Islander people than other Queenslanders. This was reduced to 76% when also adjusted for co-morbidity (Model B) and further reduced to 55% higher when remoteness and socioeconomic disadvantage were included (Model C), indicating that their higher proportion of in-hospital deaths was partially explained by the higher proportion of Aboriginal and Torres Strait Islander people with higher levels of co-morbidity and living in remote and/or less advantaged areas.

Model D includes hospital and health service instead of remoteness and socioeconomic advantage (all three variables are based on the person's geographical place of residence). The proportion of in-hospital IHD deaths was much higher (relative to Metro North, the reference category) for some hospital and health services than others (Model D), with an overall pattern of those in northern and western parts of Queensland having a higher proportion of in-hospital IHD deaths than those in the south-eastern part of the state. A notable exception to this pattern was the Metro South service (88% higher).

Table 13 IHD cohort[1], multivariable analysis[2] of the proportion who died from IHD during their first IHD admission, Queensland 2010-2016

	Model A		Model B		Model C		Model D	
	Ratio		Ratio		Ratio		Ratio	
Indigenous status[3]	2.02	(1.52-2.68)	1.76	(1.32-2.34)	1.55	(1.16-2.08)	1.22	(0.91-1.64)
Age[4]	1.07	(1.07-1.08)	1.06	(1.06-1.07)	1.06	(1.06-1.07)	1.07	(1.06-1.08)
Sex[5]			0.94	(0.85-1.05)	0.94	(0.85-1.05)	0.92	(0.82-1.02)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One or two			1.57	(1.38-1.78)	1.55	(1.37-1.76)	1.53	(1.34-1.73)
Three or more			2.85	(2.49-3.26)	2.82	(2.47-3.23)	2.57	(2.24-2.94)
Remoteness[6]					1.07	(1.00-1.14)		
Socioeconomic advantage[7]					0.93	(0.89-0.97)		
Hospital & health service								
Cairns & Hinterland							2.03	(1.59-2.59)
Central Queensland							1.63	(1.21-2.19)
Central West							2.19	(1.01-4.74)
Darling Downs							1.75	(1.34-2.28)
Gold Coast							1.39	(1.09-1.77)
Mackay							1.18	(0.84-1.67)
Mater public hospitals							0.69	(0.38-1.25)
Metro North							1.00	reference
Metro South							1.88	(1.56-2.26)
North-west							2.68	(1.47-4.90)
South-west							2.39	(1.35-4.24)
Sunshine Coast							1.21	(0.94-1.56)
Torres and Cape							0.60	(0.15-2.45)
Townsville							1.71	(1.33-2.19)
West Moreton							1.42	(1.05-1.93)
Wide Bay							1.47	(1.14-1.88)
Private							0.43	(0.36-0.52)

1. aged 25-84 at their first IHD admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

4.3.1.2 In-hospital deaths from other causes

Like in-hospital IHD deaths, the proportion who died during their first IHD admission from causes other than IHD increased with increasing age and level of co-morbidity and decreased with increasing socioeconomic advantage but was slightly higher (rather than lower) for women than men, was not strongly associated with remoteness and there was much less variation between hospital and health services (Table 14).

Table 14 IHD cohort[1], multivariable analysis[2] of the proportion who died from other causes during their first IHD admission, Queensland 2010-2016

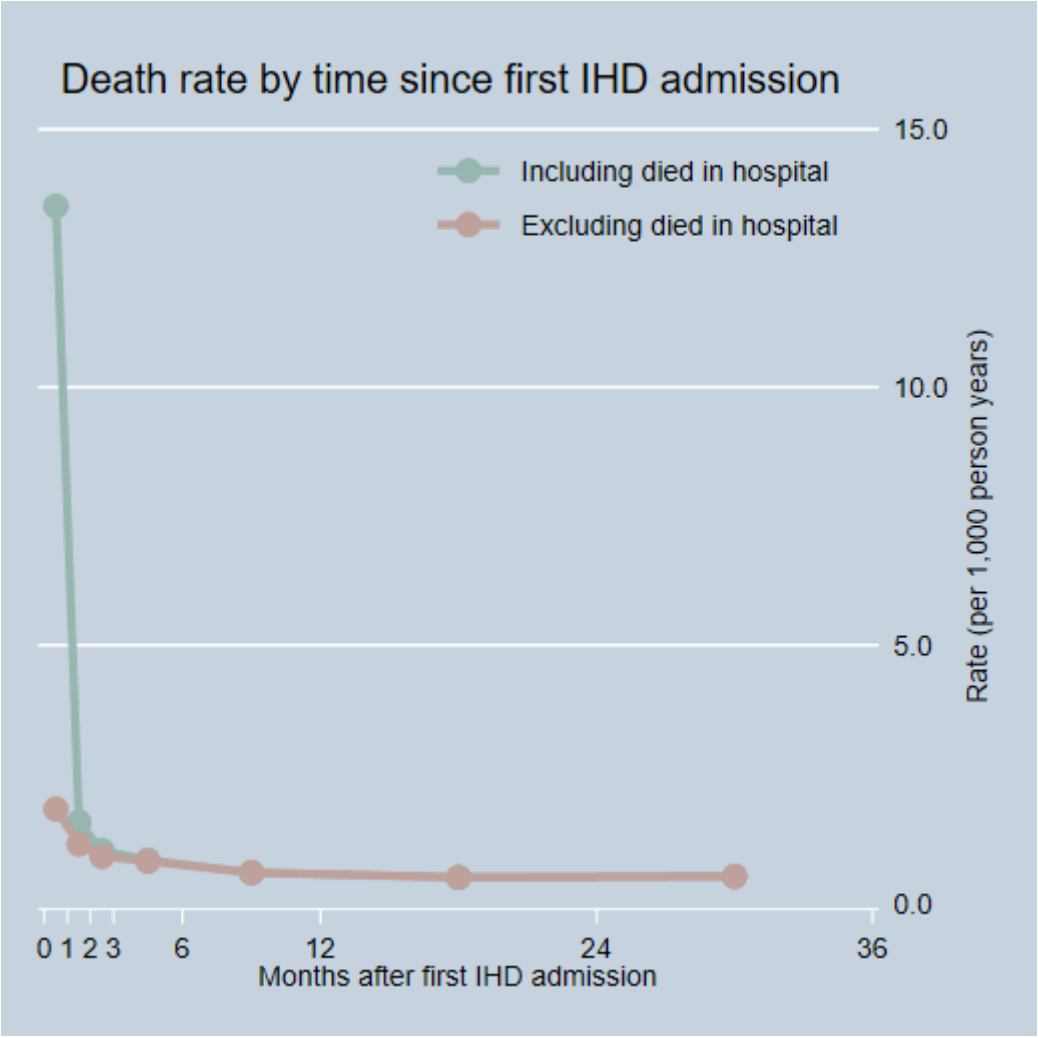
	Model A		Model B		Model C		Model D	
	Ratio		Ratio		Ratio		Ratio	
Indigenous status[3]	2.21	(1.77-2.77)	1.64	(1.31-2.06)	1.52	(1.20-1.92)	1.29	(1.03-1.63)
Age[4]	1.07	(1.07-1.08)	1.05	(1.05-1.06)	1.05	(1.05-1.06)	1.06	(1.05-1.06)
Sex[5]			1.10	(1.01-1.20)	1.10	(1.01-1.20)	1.06	(0.97-1.16)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One or two			2.62	(2.35-2.92)	2.60	(2.33-2.90)	2.56	(2.30-2.86)
Three or more			5.96	(5.32-6.66)	5.91	(5.28-6.61)	5.49	(4.90-6.15)
Remoteness[6]					1.03	(0.97-1.08)		
Socioeconomic advantage[7]					0.93	(0.90-0.97)		
Hospital & health service								
Cairns & Hinterland							1.34	(1.09-1.66)
Central Queensland							1.51	(1.21-1.88)
Central West							0.41	(0.10-1.64)
Darling Downs							1.16	(0.92-1.46)
Gold Coast							1.13	(0.93-1.37)
Mackay							1.21	(0.95-1.56)
Mater public hospitals							1.35	(0.98-1.87)
Metro North							1.00	reference
Metro South							1.09	(0.93-1.27)
North-west							1.04	(0.52-2.08)
South-west							1.44	(0.84-2.47)
Sunshine Coast							0.89	(0.72-1.10)
Torres and Cape							0.75	(0.31-1.79)
Townsville							1.17	(0.95-1.45)
West Moreton							1.38	(1.10-1.74)
Wide Bay							1.11	(0.90-1.37)
Private							0.45	(0.39-0.52)

1. aged 25-84 at their first IHD admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

4.3.2 Death after discharge from hospital

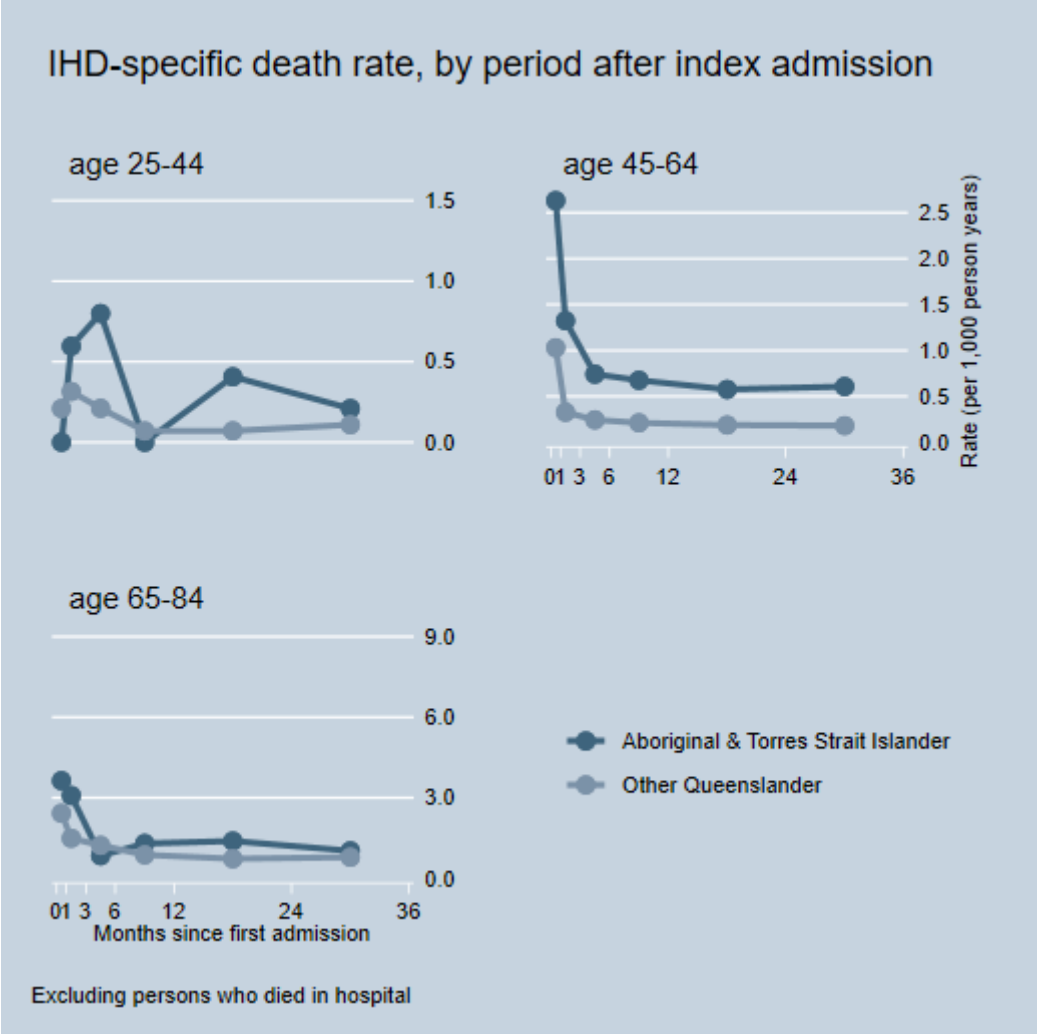
The IHD-specific death rate was much higher in the first month after first IHD admission than in subsequent months (Figure 5). Most deaths in the first month occurred in hospital. When deaths in hospital were excluded, the death rate in the first month remained higher than subsequent periods; the death rate decreased over several months and plateaued at a lower rate after 6 months. This pattern of higher but decreasing death rates in the first several months occurred for both Aboriginal and Torres Strait Islander and other Queenslanders and in all age-groups (Figure 6), with wide variation in the rate for Aboriginal and Torres Strait Islander people in the 25-44 age-groups because of the small number of persons and deaths in this category.

Figure 5 IHD cohort[1], cause-specific death rate by period after first IHD admission, Queensland 2010-2016



1. Aboriginal & Torres Strait Islander people and other Queenslanders combined, aged 25-84 years.

Figure 6 IHD cohort, IHD death rate by period after first IHD admission, Queensland 2010-2016



The proportion of people who died from IHD after discharge increased with increasing age and was higher for Aboriginal and Torres Strait Islander than other Queenslanders at each age (Table 15). The difference was greater (relatively) at age 35 than at age 75.

Table 15 IHD cohort[1], IHD cumulative fatality[2] (%) at 1, 6 and 36 months after first IHD admission by Indigenous status and selected ages, Queensland 2010-2016

	Other Queenslander			Aboriginal and Torres Strait Islander		
Time after first admission	Age (years)			Age (years)		
(months)	35	55	75	35	55	75
One	0.1	0.4	1.9	0.5	1.2	3.1
Six	0.1	0.5	2.7	0.7	1.7	4.3
Thirty-six	0.2	1.0	5.0	1.4	3.4	8.4

1. aged 25-84 years, excluding those who died during first IHD admission.
2. Aalen-Nelson estimate of cumulative fatality (expressed as a percentage) age-adjusted and estimated for selected ages

The death rate for Aboriginal and Torres Strait Islander members of the cohort was more than two times higher than for other Queenslanders in all time periods up to 36 months after the first IHD admission (Table 16). There was no strong evidence that the death rate ratio changed over time; the death rate ratio varied between time periods with mostly overlapping confidence intervals.

Table 16 IHD cohort[1], IHD death rate ratio[2] (Aboriginal and Torres Strait Islander compared to other Queenslanders) by time period after first IHD admission

Time period (months)	Ratio[2]	(95% CI)
0-2	2.54	(1.52-4.25)
3-6	2.11	(1.20-3.73)
7-12	2.52	(1.49-4.28)
13-24	3.11	(2.13-4.56)
25-36	2.50	(1.65-3.79)
0-36	2.61	(2.12-3.21)

1. excluding those aged 85 and over at the time of first IHD admission and those who died in hospital during first IHD admission
2. Mantel-Haenzel age-adjusted estimate of the death rate ratio, stratified by months after first admission, and for months 0-36 combined

When adjusted only for age (within each 20-year age-group), the death rate was between two and three times higher for Aboriginal and Torres Strait Islander than for other Queenslanders; when adjusted for other co-morbidity, remoteness, socioeconomic disadvantage and hospital and health service the relative excess decreased, particularly in the 45-64 and 65-84 age-groups. This indicates that higher prevalence of co-morbidity and the lower proportion of Aboriginal and Torres Strait Islander people than other Queenslanders living in more advantaged areas partially explains the higher IHD death rates of Aboriginal and Torres Strait Islander members of the IHD cohort. The proportion of women in the IHD cohort was higher for Aboriginal and Torres Strait Islander than other Queenslanders, but the IHD death rate was lower for women than men (Table 17) so the different proportion of women did not contribute to the higher IHD death rate for Aboriginal and Torres Strait Islander cohort members. There was little evidence that the IHD death rate varied between hospital and health services for Aboriginal and Torres Strait Islander people; although some death rate ratios were considerably higher or lower than one, the confidence intervals were wide and included one in all cases.

Table 17 IHD cohort[1], multivariable analysis[2] of IHD death rate in 36 months after discharge from first IHD admission[3], stratified by Indigenous status.

	Other Queenslanders		Aboriginal & Torres Strait Islanders	
	Ratio[2]		Ratio[2]	
Age at index admission[4]	1.09	(1.08-1.09)	1.05	(1.03-1.06)
Female (c/w male)	0.75	(0.68-0.81)	0.62	(0.41-0.93)
Co-morbidity score				
None	1.00	reference	1.00	reference
One or two	2.14	(1.94-2.35)	2.03	(1.29-3.20)
Three or more	3.27	(2.92-3.66)	3.18	(1.89-5.37)
Self-discharge	2.43	(1.65-3.58)	2.09	(0.83-5.24)
Socioeconomic advantage[5]	0.95	(0.92-0.98)	1.10	(0.93-1.30)
Hospital & health service				
Cairns & Hinterland	0.75	(0.56-0.99)	1.67	(0.82-3.40)
Central Queensland	1.32	(1.03-1.68)	0.46	(0.10-2.09)
Central West	1.46	(0.69-3.09)	0.00	(.-.)
Darling Downs	1.35	(1.09-1.68)	0.46	(0.10-2.09)
Gold Coast	1.33	(1.10-1.60)	0.90	(0.20-4.08)
Mackay	1.19	(0.92-1.54)	0.98	(0.31-3.09)
Mater public hospitals	0.90	(0.59-1.36)	1.18	(0.26-5.37)
Metro North	1.00	reference	1.00	reference
Metro South	1.39	(1.20-1.62)	1.79	(0.83-3.88)
North-west	0.43	(0.11-1.71)	1.66	(0.66-4.18)
South-west	1.21	(0.65-2.27)	1.34	(0.29-6.08)
Sunshine Coast	0.93	(0.76-1.13)	0.49	(0.06-3.77)
Torres and Cape	1.35	(0.43-4.21)	1.01	(0.37-2.80)
Townsville	1.21	(0.97-1.50)	0.84	(0.37-1.93)
West Moreton	1.33	(1.05-1.67)	0.89	(0.19-4.06)
Wide Bay	1.07	(0.86-1.32)	0.23	(0.03-1.82)
Private	0.52	(0.46-0.60)	0.00	(.-.)

1. aged 24-84 at first IHD admission
2. Cox proportional hazard regression
3. i.e., excluding those who died during first admission
4. per year of age
5. per quintile increase in socioeconomic advantage

4.4 Length of stay for first IHD admission

This analysis included members of the IHD cohort aged 25-84 years old who were admitted with a principal diagnosis of IHD and did not self-discharge at their first IHD admission (n=83,603). A higher proportion of Aboriginal and Torres Strait Islander people self-discharged and, for both Aboriginal and Torres Strait Islander and other Queenslanders, those who self-discharged had a shorter median length of stay shorter length of stay than those discharged for other reasons (Table 18).

Table 18 IHD cohort[1], length of stay during first IHD admission by Indigenous status and reason for discharge, Queensland 2010-2016

	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
Self-discharged	2.78	(6.83)	1	(0-2)	2.12	(3.34)	1	(0-3)
Other discharge reason	4.40	(12.86)	2	(1-5)	4.58	(6.82)	3	(1-6)

1. Queensland residents, aged 25-84, at their first admission with a principal diagnosis of IHD

The cohort included 3,071 (3.7%) Aboriginal and Torres Strait Islander people. In general, Aboriginal and Torres Strait Islander people had a longer median length of stay at their first IHD admission than other Queenslanders (3 vs. 2 days) However, Aboriginal and Torres Strait Islander people living in major cities and the most socioeconomic advantaged areas had a median length of stay equivalent to other Queenslanders. (Table 19). Other Queenslanders had a median length of stay of two days in all sub-groups, except for those with a co-morbidity score of three or more.

Table 19 IHD cohort[1], length of stay during first IHD admission by Indigenous status and select demographics, Queensland 2010-2016

	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
Age group								
25-44	3.05	(4.94)	2	(1-4)	3.88	(4.92)	3	(1-5)
45-64	3.52	(9.91)	2	(1-4)	4.38	(6.00)	3	(1-6)
65-84	4.69	(14.31)	2	(1-5)	5.98	(10.12)	3	(1-7)
Sex								
Male	4.21	(13.35)	2	(1-5)	4.80	(6.95)	3	(1-6)
Female	3.98	(10.14)	2	(1-5)	4.29	(6.58)	3	(1-5)
Remoteness								
Major cities	3.88	(14.80)	2	(1-4)	3.72	(6.73)	2	(1-4)
Inner regional	4.45	(8.65)	2	(1-5)	4.51	(7.33)	3	(1-5)
Outer regional	4.38	(9.51)	2	(1-5)	4.95	(7.17)	3	(1-6)
Remote	4.30	(6.35)	2	(1-5)	5.08	(5.81)	4	(1-7)
Very remote	4.02	(5.66)	2	(1-5)	4.47	(5.66)	3	(1-6)
Socioeconomic advantage								
Least advantaged	4.63	(19.29)	2	(1-5)	4.77	(7.69)	3	(1-6)
Quintile 2	4.30	(10.28)	2	(1-5)	4.29	(5.58)	3	(1-5)
Quintile 3	3.97	(7.70)	2	(1-5)	4.79	(5.88)	3	(1-7)
Quintile 4	3.79	(9.13)	2	(1-4)	4.09	(5.80)	3	(1-5)
Most advantaged	3.56	(7.00)	2	(1-4)	3.78	(6.61)	2	(1-4)
Co-morbidity score								
None	3.82	(11.99)	2	(1-4)	4.21	(5.68)	3	(1-5)
One	4.84	(15.03)	2	(1-5)	4.02	(5.67)	2	(1-5)
Two	4.66	(9.01)	2	(1-5)	6.60	(10.61)	3	(1-7)
Three of more	6.63	(14.83)	3	(1-7)	6.82	(11.26)	3	(1-8)
Hospital & health service								
Cairns & Hinterland	4.81	(7.07)	3	(1-5)	4.79	(8.38)	3	(1-5)
Central Queensland	5.70	(7.32)	3	(1-8)	5.88	(9.57)	4	(1-7)
Central West	4.54	(4.31)	4	(1-7.5)	4.52	(5.68)	3	(1-6)
Darling Downs	3.75	(5.14)	3	(1-5)	5.34	(13.80)	3	(1-6)
Gold Coast	3.60	(4.15)	2	(1-5)	4.15	(10.55)	3	(1-4)
Mackay	4.55	(5.61)	3	(1-6)	5.08	(7.24)	3	(1-6)
Mater public hospitals	2.65	(2.25)	2	(1-4)	4.46	(9.18)	3	(1-5)
Metro North	3.63	(5.92)	2	(0-4)	4.44	(12.07)	2	(1-5)
Metro South	4.58	(8.33)	3	(1-6)	4.39	(12.71)	3	(1-5)
North-west	4.84	(4.88)	3	(1-7.5)	4.84	(12.22)	3	(1-7)
South-west	3.17	(3.85)	2	(1-4)	4.41	(7.38)	2	(1-5)
Sunshine Coast	3.92	(4.70)	3	(1-4)	4.97	(8.52)	3	(2-5)
Torres and Cape	4.07	(5.71)	2	(0-5)	3.67	(5.30)	1	(0-5)
Townsville	5.50	(5.38)	4	2-7)	6.22	(12.85)	4	(2-7)
West Moreton	5.35	(11.85)	3	(1-6)	5.26	(42.88)	3	(1-5)
Wide Bay	5.74	(12.25)	2	(1-5)	5.39	(9.20)	3	(1-6)
Private	2.00	(9,22)	1	(0-3)	2.86	(5.72)	1	(0-3)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of IHD and excluding those who self-discharged from this admission

In multivariable analysis, length of stay for first IHD admission increased with increasing co-morbidity and, to a small degree, with increasing age, was lower for females than males, and was not strongly associated with remoteness or socioeconomic advantage (Table 20). When adjusted for only age (Model A) Aboriginal and Torres Strait Islander people had an average length of stay 32% higher than other Queenslanders; this reduced slightly to 29% when also adjusted for sex and co-morbidity (Model B), and to 21% when adjustment was made for remoteness and socioeconomic advantage (Model C). The differential fell to nine percent when adjusted for hospital and health service instead of remoteness

and socioeconomic advantage (Model D). The average length of stay was much higher (relative to Metro North, the reference category) for some hospital and health services than others, with a general pattern of longer stays in the northern and western parts of Queensland. Gold Coast and Private had a significantly shorter length of stay relative to Metro North.

Table 20 IHD cohort[1], multivariable analysis[2] of the length of stay during first IHD admission, Queensland 2010-2016

	Model A		Model B		Model C		Model D	
	Ratio	95% CI	Ratio	95% CI	Ratio	95%CI	Ratio	95%CI
Indigenous status[3]	1.32	(1.26-1.38)	1.29	(1.23-1.35)	1.21	(1.16-1.27)	1.09	(1.04-1.14)
Age[4]	1.02	(1.01-1.02)	1.01	(1.01-1.01)	1.01	(1.01-1.01)	1.02	(1.02-1.02)
Sex[5]			0.89	(0.88-0.91)	0.89	(0.87-0.91)	0.88	(0.86-0.89)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One			1.20	(1.16-1.23)	1.19	(1.15-1.22)	1.20	(1.17-1.23)
Two			1.13	(1.10-1.18)	1.13	(1.09-1.17)	1.13	(1.09-1.17)
Three or more			1.58	(1.52-1.64)	1.58	(1.52-1.64)	1.55	(1.50-1.61)
Remoteness								
Major cities					1.00	reference		
Inner regional					1.06	(1.03-1.08)		
Outer regional					1.09	(1.06-1.12)		
Remote					1.14	(1.06-1.22)		
Very remote					0.99	(0.92-0.08)		
Socioeconomic advantage[6]					0.95	(0.94-0.96)		
Hospital & health service								
Cairns & Hinterland							1.10	(1.05-1.15)
Central Queensland							1.34	(1.28-1.41)
Central West							1.01	(0.85-1.20)
Darling Downs							1.17	(1.11-1.23)
Gold Coast							0.93	(0.89-0.97)
Mackay							1.22	(1.16-1.29)
Mater public hospitals							1.00	(0.92-1.09)
Metro North							1.00	reference
Metro South							1.03	(0.99-1.06)
North-west							1.27	(1.14-1.42)
South-west							1.03	(0.91-1.16)
Sunshine Coast							1.08	(1.04-1.13)
Torres and Cape							0.93	(0.81-1.06)
Townsville							1.40	(1.34-1.47)
West Moreton							1.18	(1.12-1.24)
Wide Bay							1.18	(1.13-1.24)
Private							0.60	(0.58-0.62)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of IHD and excluding those who self-discharged from this admission
2. negative binomial regression
3. Aboriginal and Torres Strait Islander people compared to other Queenslanders
4. by year in age
5. females compared to males
6. per unit increase in socioeconomic advantage

In multivariable analysis stratified by Indigenous status, length of stay slightly increased with increasing age and was lower for females than males for both Aboriginal and Torres Strait Islander and other Queenslanders; the difference between females and males was greater for Aboriginal and Torres Strait Islander people than other Queenslanders (Table 21). Length of stay increased with increasing co-morbidity score for Aboriginal and Torres Strait Islander people, but the pattern was less clear for other Queenslanders. The association between hospital and health service and length of stay was similar for Aboriginal and Torres Strait Islander and other Queenslanders.

Table 21 IHD cohort[1] multivariable analysis[2] of length of stay during first IHD admission, stratified by Indigenous status, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islanders	
	Ratio[2]	95% CI	Ratio[2]	95% CI
Age at index admission[3]	1.02	(1.02-1.02)	1.01	(1.01-1.01)
Female[4]	0.88	(0.86-0.89)	0.85	(0.78-92)
Co-morbidity score				
None	1.00	reference	1.00	reference
One	1.21	(1.18-1.25)	0.93	(0.82-1.05)
Two	1.12	(1.08-1.16)	1.40	(1.20-1.64)
Three or more	1.56	(1.50-1.61)	1.49	(1.28-1.73)
Socioeconomic advantage[5]	0.99	(0.98-1.00)	0.99	(0.95-1.03)
Hospital & health service				
Cairns & Hinterland	1.07	(1.01-1.12)	1.29	(1.10-1.51)
Central Queensland	1.33	(1.27-1.41)	1.50	(1.21-1.86)
Central West	0.98	(0.82-1.18)	1.32	(0.83-2.11)
Darling Downs	1.16	(1.11-1.23)	1.06	(0.84-1.33)
Gold Coast	0.94	(0.90-0.98)	0.98	(0.71-1.34)
Mackay	1.22	(1.15-1.28)	1.32	(1.05-1.67)
Mater public hospitals	1.03	(0.94-1.12)	0.70	(0.47-1.09)
Metro North	1.00	reference	1.00	reference
Metro South	1.03	(0.99-1.06)	1.15	(0.95-1.39)
North-west	1.26	(1.10-1.45)	1.34	(1.10-1.64)
South-west	1.06	(0.93-1.20)	0.86	(0.63-1.18)
Sunshine Coast	1.07	(1.03-1.12)	1.03	(0.76-1.41)
Torres and Cape	0.76	(0.62-0.94)	1.09	(0.88-1.34)
Townsville	1.40	(1.33-1.47)	1.49	(1.26-1.77)
West Moreton	1.16	(1.11-1.23)	1.42	(1.10-1.84)
Wide Bay	1.16	(1.11-1.22)	1.35	(1.07-1.71)
Private	0.60	(0.58-0.62)	0.51	(0.39-0.66)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of IHD and excluding those who self-discharged from this admission
2. negative binomial regression
3. per year of age
4. female compared to male
5. per unit increase in socioeconomic advantage

4.5 Time to IHD re-admission

This analysis included members of the IHD cohort aged 25-84 years old who had been admitted with a principal diagnosis of IHD and had not died during their index admission (n=83,157). The cohort included 3,134 (3.8%) Aboriginal and Torres Strait Islander people.

Time to re-admission was calculated as the time from discharge from first IHD admission to the next admission with a principal diagnosis of IHD, death, end of follow-up (30 months), or end of the study (31 December 2018), which ever occurred first. The maximum follow-up time was 30 months, with a mean follow-up of 23 months.

Aboriginal and Torres Strait Islander people had a higher IHD re-admission rate than other Queenslanders (Figure 7). The rate of IHD re-admission increased most rapidly in the first month after discharge from the first IHD admission, for both Aboriginal and Torres Strait Islander and other Queenslanders and the began to slow (Table 22). By 30 months, 32.7% of Aboriginal and Torres Strait Islander people and 23.5% of other Queenslanders had an IHD re-admission. The re-admission rate for Aboriginal and Torres Strait Islander members of the cohort was higher than for other Queenslanders in all time periods in the first 30 months after discharge from the first IHD admission (Table 23). There was no strong evidence that the death rate ratio changed over time; the death rate ratio varied between time periods with overlapping confidence intervals.

Figure 7 IHD cohort, 30-month IHD re-admission rate by Indigenous status

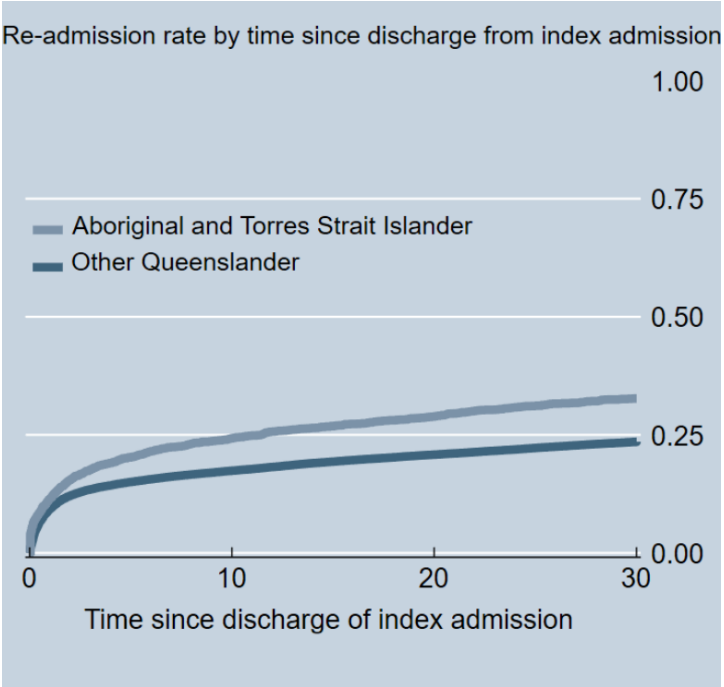


Table 22 IHD cohort[1], cumulative IHD re-admission rate[2] (%) at 1, 6 and 30 months after discharge from first IHD admission by Indigenous status, Queensland 2010-2016

Time (month)	Other Queenslanders	Aboriginal & Torres Strait Islander
One	9.28	11.48
Six	15.64	21.55
Thirty	23.53	32.69

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of IHD and excluding those who died during first IHD admission
2. Kaplan Meier estimate of cumulative fatality (expressed as a percentage), age adjusted.

Table 23 IHD cohort[1], IHD re-admission rate ratio[2] (Aboriginal and Torres Strait Islander people compared to other Queenslanders) by time period after discharge from first IHD admission

Time period (months)	Ratio[2]	(95% CI)
0-2	1.31	(1.19-1.43)
3-6	1.88	(1.62-2.18)
7-12	1.77	(1.47-2.13)
13-24	1.28	(1.00-1.63)
25-30	1.99	(1.58-2.51)
0-30	1.37	(1.04-1.80)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of IHD and excluding those who died during first IHD admission
2. Mantel-Haenzel age-adjusted estimate of the re-admission rate ratio, stratified by months after first admission, and for months 0-36 combined

The proportion of people re-admitted for IHD during the follow-up period increased with increasing age and was higher for Aboriginal and Torres Strait Islander than other Queenslanders at each age (Table 24). The difference between Aboriginal and Torres Strait Islander people and other Queenslanders was greatest (relatively) in the 25-44 age group and smallest in the 65-84 age group. The proportion of people re-admitted for IHD was lower for females than males and this difference was for Aboriginal and Torres Strait Islander relative to other Queenslanders. The proportion of people re-admitted for IHD increased with increasing remoteness and there was no strong association with socioeconomic advantage for both Aboriginal and Torres Strait Islander and other Queenslanders. The proportion of people re-admitted for IHD increased with increasing co-morbidity score for Aboriginal and Torres Strait Islander people, while for other Queenslanders the proportion of people re-admitted for IHD was higher for people with any level of co-morbidity compared to those without known co-morbidity. For both Aboriginal and Torres Strait Islander and other Queenslanders, the proportion of people re-admitted for IHD was greater for those who self-discharged from their first principal IHD admission compared to those who had been discharged for other reasons.

Table 24 IHD cohort[1], cumulative IHD re-admission rate[2] (%) at 30 months by Indigenous status and selected demographics, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islander	
	%	95% CI	%	95% CI
Age group				
25-44	18.80	(17.63-20.03)	28.85	(25.67-32.33)
45-64	24.32	(23.85-24.78)	34.32	(32.19-36.54)
65-84	27.87	(27.45-28.30)	32.76	(28.96-36.93)
Sex				
Male	28.16	(27.78-28.55)	34.12	(31.92-36.43)
Female	21.46	(20.97-21.96)	31.16	(28.79-33.68)
Remoteness				
Major cities	24.69	(24.28-25.11)	27.18	(23.88-30.82)
Inner regional	26.35	(25.78-26.94)	28.51	(25.03-32.37)
Outer regional	28.67	(27.90-29.45)	35.13	(32.38-38.04)
Remote	27.70	(25.03-30.59)	36.69	(31.81-42.05)
Very remote	31.30	(27.85-35.07)	37.83	(33.43-42.60)
Socioeconomic advantage				
Least advantaged	26.34	(25.74-26.96)	35.23	(32.88-37.70)
Quintile 2	26.65	(26.02-27.28)	29.25	(26.10-32.69)
Quintile 3	26.96	(26.28-27.66)	33.36	(29.28-37.84)
Quintile 4	25.45	(24.73-26.19)	27.44	(22.42-33.32)
Most advantaged	22.82	(22.03-23.64)	32.97	(25.09-42.55)
Co-morbidity score				
None	25.19	(24.85-25.53)	31.08	(29.20-33.04)
One	29.17	(28.19-30.18)	34.12	(29.75-38.94)
Two	27.88	(26.64-29.16)	37.04	(30.98-43.85)
Three or more	29.04	(27.61-30.54)	43.85	(37.54-50.72)
Self-discharged from first admission				
No	25.86	(25.55-26.17)	32.45	(30.80-34.17)
Yes	33.86	(30.25-37.77)	41.16	(32.89-50.59)
Hospital and Health service area				
Cairns & Hinterland	27.67	(25.97-29.46)	36.67	(32.97-40.64)
Central Queensland	26.21	(24.53-27.99)	29.94	(23.48-37.69)
Central West	34.91	(28.28-42.58)	39.13	(22.63-61.73)
Darling Downs	26.28	(24.61-28.04)	35.74	(28.73-43.88)
Gold Coast	26.37	(25.05-27.74)	15.93	(8.91-27.59)
Mackay	29.56	(27.68-31.53)	33.14	(25.82-41.87)
Mater public hospitals	21.61	(18.86-24.70)	32.10	(19.21-50.45)
Metro North	25.40	(24.63-26.20)	28.17	(23.42-33.65)
Metro South	25.99	(25.08-26.91)	31.22	(26.02-37.17)
North-west	33.79	(28.71-39.49)	38.63	(32.58-45.37)
South-west	28.55	(24.20-33.49)	27.27	(18.15-39.74)
Sunshine Coast	26.83	(25.52-28.18)	22.73	(14.38-34.84)
Torres and Cape	28.47	(21.68-36.82)	38.59	(32.26-45.69)
Townsville	30.95	(29.29-32.68)	36.77	(32.45-41.46)
West Moreton	22.75	(21.20-24.39)	26.27	(18.82-35.93)
Wide Bay	24.97	(23.65-26.36)	24.43	(18.11-32.46)
Private	25.30	(24.80-25.81)	23.34	(16.41-32.55)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of IHD and excluding those who died during first IHD admission

2. Kaplan Meier fatality function for ACS re-admission (expressed as a percentage)

In multivariable analysis, (Table 25) age and socioeconomic advantage were not associated with time to IHD re-admission. Those with co-morbidity had a slight excess of IHD re-admissions compared to those with without co-morbidity, but risk did not appear to increase with increasing co-morbidity score. There was a slight increase in time to IHD re-admissions with increasing residential remoteness. Compared to Metro North (reference category), hospital and health services in the north and west of the state generally had a higher rate of IHD re-admission. In stratified multivariable analysis, males had excess IHD re-admissions compared to females for both Aboriginal and Torres Strait Islander and other Queenslanders, though the differential was greatest for other Queenslanders (Table 26).

Table 25 IHD cohort[1], multivariable analysis[2], IHD re-admission rate in 30 months after discharge from first IHD admission, stratified by Indigenous status

	Model A		Model B		Model C		Model D	
	Ratio	95% CI	Ratio	95% CI	Ratio	95%CI	Ratio	95%CI
Indigenous status[3]	1.46	(1.36-1.55)	1.51	(1.42-1.61)	1.36	(1.28-1.46)	1.34	(1.25-1.44)
Age[4]	1.01	(1.01-1.01)	1.01	(1.01-1.01)	1.01	(1.01-1.01)	1.01	(1.01-1.01)
Sex[5]			0.72	(0.69-0.74)	0.71	(0.69-0.74)	0.71	(0.69-0.73)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One			1.14	(1.09-1.19)	1.13	(1.08-1.18)	1.14	(0.09-1.19)
Two			1.04	(0.99-1.10)	1.04	(0.98-1.10)	1.04	(0.98-1.10)
Three or more			1.09	(1.03-1.15)	1.08	(1.02-1.15)	1.08	(1.02-1.14)
Remoteness[6]					1.09	(1.07-1.11)		
Socioeconomic advantage[7]					0.99	(0.98-1.00)		
Hospital & health service								
Cairns & Hinterland							1.16	(1.08-1.25)
Central Queensland							1.11	(1.03-1.21)
Central West							1.58	(1.24-2.00)
Darling Downs							1.07	(0.99-1.16)
Gold Coast							1.02	(0.96-1.10)
Mackay							1.27	(1.17-1.38)
Mater public hospitals							0.89	(0.77-1.04)
Metro North							1.00	reference
Metro South							1.05	(0.99-1.10)
North-west							1.60	(1.37-1.86)
South-west							1.24	(1.04-1.49)
Sunshine Coast							1.05	(0.98-1.12)
Torres and Cape							1.47	(1.22-1.78)
Townsville							1.29	(1.20-1.39)
West Moreton							0.93	(0.86-1.02)
Wide Bay							1.01	(0.94-1.09)
Private							0.97	(0.93-1.01)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of IHD and excluding those who died during first IHD admission
2. Cox proportional hazard regression
3. Aboriginal and Torres Strait Islander people compared to other Queenslanders
4. per year of age
5. females compared to males
6. per unit increase in remoteness
7. per increase in socioeconomic advantage

Table 26 IHD cohort[1], multivariable analysis[2] of IHD re-admission rate, stratified by Indigenous status, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islanders	
	Ratio[2]	95% CI	Ratio[2]	95% CI
Age at index admission[3]	1.01	(1.01-1.01)	1.01	(1.00-1.01)
Female[4]	0.70	(0.68-0.73)	0.84	(0.74-0.95)
Co-morbidity score				
None	1.00	reference	1.00	reference
One	1.13	(1.08-1.18)	1.10	(0.92-1.32)
Two	1.03	(0.98-1.09)	1.11	(0.88-1.41)
Three or more	1.05	(0.99-1.12)	1.41	(1.14-1.76)
Socioeconomic advantage[5]	0.99	(0.98-0.99)	0.98	(0.96-1.01)
Hospital & health service				
Cairns & Hinterland	1.10	(1.01-1.19)	1.37	(1.06-1.76)
Central Queensland	1.10	(1.01-1.20)	1.12	(0.79-1.60)
Central West	1.56	(1.21-2.01)	1.61	(0.81-3.20)
Darling Downs	1.03	(0.95-1.12)	1.35	(0.96-1.90)
Gold Coast	1.04	(0.97-1.19)	0.54	(0.28-1.04)
Mackay	1.27	(1.16-1.38)	1.29	(0.89-7.86)
Mater public hospitals	0.90	(0.77-1.06)	1.24	(0.66-2.33)
Metro North	1.00	reference	1.00	reference
Metro South	1.05	(0.99-1.11)	1.13	(0.83-1.53)
North-west	1.57	(1.29-1.92)	1.62	(1.19-2.20)
South-west	1.28	(1.05-1.55)	1.04	(0.63-1.74)
Sunshine Coast	1.04	(0.97-1.12)	0.78	(0.45-1.35)
Torres and Cape	1.25	(0.91-1.72)	1.61	(1.18-2.21)
Townsville	1.27	(1.18-1.37)	1.38	(1.06-1.80)
West Moreton	0.91	(0.83-0.99)	0.95	(0.61-1.48)
Wide Bay	0.98	(0.91-1.05)	0.80	(0.53-1.20)
Private	0.98	(0.94-1.02)	0.77	(0.49-1.20)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of IHD and excluding those who died during first IHD admission
2. Cox proportional hazard regression
3. per year of age
4. females compared to males
5. per increase in socioeconomic advantage

5 ACUTE CORONARY SYNDROME (IN-HOSPITAL THERAPEUTIC PROCEDURES)

5.1 Key findings

1. There was a greater proportion of Aboriginal and Torres Strait Islander than other Queenslanders who self-discharged from their first ACS admission; younger age, being female, socioeconomic advantage, urban residence, having co-morbidity, and being admitted for a diagnosis of unstable angina were associated with self-discharge

2. Length of stay of first ACS admission was similar for Aboriginal and Torres Strait Islander and other Queenslanders; shorter length of stay was associated with being female, increasing co-morbidity, and a diagnosis of unstable angina

3. Aboriginal and Torres Strait Islander people were more likely to have an ACS re-admission within 30-months than other Queenslanders; being male, increasing remoteness, increasing co-morbidity score, and self-discharge at index admission were associated with increased re-admission rates

4. 62.9% of the cohort received a diagnostic angiography during their first ACS admission, 32.2% receive a percutaneous coronary intervention, and 7.6% received a coronary artery bypass graft

5. A lower proportion of Aboriginal and Torres Strait Islander than other Queenslanders received therapeutic procedures for ACS during their first ACS admission

6. The proportion of people who died from ACS during the follow-up period was small but was relatively larger for Aboriginal and Torres Strait Islander people than other Queenslanders; ACS-specific death during the follow-up was associated with self-discharge and not having an ACS procedure during first ACS admission

5.2 ACS cohort

Of the 124,878 Queenslanders admitted to hospital with a primary diagnosis of CVD (IHD, CHF, stroke, RHD, or ARF) 87,289 (69.9%) were for IHD. In turn, 57.3% of those admitted with a primary diagnosis of IHD were admitted for ACS (71.7% Aboriginal and Torres Strait Islander people).

The ACS cohort consisted of Queensland residents who had their first hospital admission with a principal diagnosis of acute coronary syndrome (ACS) in the period 1 July 2010 and 30 June 2016 and who had not been admitted for ACS (principal or other diagnosis code) in the five year prior to their first index ACS admission, and excluded those whose index admission was for palliative care, without Indigenous identification information, and aged younger than 25 years. There were 61,310 people in the initial ACS cohort. 2,640 (4.3%) were Aboriginal and Torres Strait Islander people.

There was a higher proportion of Aboriginal and Torres Strait Islander people than other Queenslanders who were in younger age groups, lived in northern and western Queensland and in more remote and socioeconomically disadvantaged areas (Table 27). While there was a higher proportion of males than females in both groups, proportionately more Aboriginal and Torres Strait Islander than other Queenslanders were female. The proportion of people with co-morbid conditions was similar for both groups.

At first ACS admission, 10,573 (17.25%) of the cohort had a principal diagnosis of ST-elevated myocardial infarction, 26,477 (43.19%) non-ST-elevated myocardial infarction, 2,095 (3.42%) unspecified myocardial infarction, and 22,165 (36.15%) had a principal diagnosis of unstable angina. The proportion of people admitted with a diagnosis of ST-elevated myocardial infarction decreased with increasing age, while the proportion of people admitted with a principal diagnosis of non-ST-elevated myocardial infarction increased with age (Table 28).

The proportion of people who self-discharged was higher for Aboriginal and Torres Strait Islander people than other Queenslanders (Table 29). Self-discharge was associated with younger age, being female, socioeconomic disadvantage, urban residence, having co-morbidity, and a diagnosis of unstable angina (Table 30).

For subsequent analyses related to service use and receipt of therapeutic procedures in hospital, the ACS cohort was restricted to those aged 25-84 years (n=54,387; 4.80% Aboriginal and Torres Strait Islander people), due to relatively few Aboriginal and Torres Strait Islander people in this age group and the coding of everyone aged 85 years and older into one group meant that confounding by age in this age group could not be adequately adjusted for. It is important to note, however, that a higher proportion of those aged 85 years and older than other age groups were admitted with a principal diagnosis of non-ST-elevated myocardial infarction and unspecified myocardial infarction and were more likely to die in hospital but less likely to self-discharge. For each analysis, further restrictions to the cohort that apply are described within each section below.

Table 27 Demographic characteristics (%), ACS cohort

	Other Queenslander N=58,670	Aboriginal and Torres Strait Islander N=2,640
Sex		
Male	63.0	55.0
Female	37.0	45.0
Age-group		
25-44	5.29	23.45
45-64	36.63	57.80
65-84	46.33	17.58
85-99	11.75	1.17
Hospital and health service		
Cairns & Hinterland	4.27	21.55
Central Queensland	4.42	5.83
Central West	0.32	0.98
Darling Downs	4.62	5.27
Gold Coast	6.09	1.33
Mackay	3.60	4.39
Mater public hospitals	1.25	1.02
Metro North	14.85	7.05
Metro South	14.21	9.13
North-west	0.45	7.58
South-west	0.63	2.16
Sunshine Coast	8.04	2.39
Torres and Cape	0.20	7.46
Townsville	4.69	13.71
West Moreton	5.12	3.86
Wide Bay	7.45	4.77
Private	19.78	1.52
Remoteness		
Major Cities	51.17	19.47
Inner Regional	30.41	18.26
Outer Regional	16.35	36.44
Remote	1.22	11.44
Very Remote	0.85	14.39
Socioeconomic advantage[1]		
Least advantaged	27.96	51.17
Quintile 2	25.23	23.86
Quintile 3	19.63	13.90
Quintile 4	16.26	7.54
Most advantaged	10.91	3.52
Co-morbidity score		
None	71.82	68.56
One	11.96	13.86
Two	8.52	8.11
Three or more	8.70	9.47

1.seven other Queenslanders were missing data on socioeconomic advantage

Table 28 ACS cohort[1], select demographics by type of acute coronary syndrome, Queensland 2012-2016

	Total	STEMI[2]	NSTEMI[3]	UMI[4]	UA[5]
	n	%	%	%	%
Indigenous status					
Other Queenslander	58,670	17.15	43.10	3.40	36.36
Aboriginal & Torres Strait Islander	2,640	19.43	45.11	3.83	31.63
Age group					
25-34	510	22.55	35.10	3.73	38.63
35-39	907	25.58	38.26	3.64	32.52
40-44	2,304	21.22	39.84	2.73	36.20
45-49	3,763	22.75	39.04	2.39	35.82
50-54	5,396	22.76	40.34	2.65	34.25
55-59	6,235	21.80	39.63	2.65	35.93
60-64	7,625	19.63	38.92	2.69	38.75
65-69	7,823	16.80	41.49	2.94	38.77
70-74	7,299	14.33	42.40	2.78	40.48
75-79	6,444	13.21	45.42	3.24	38.13
80-84	6,081	11.58	49.55	4.41	34.47
85+	6,923	12.74	52.97	6.75	27.55
Sex					
Male	38,422	19.82	42.81	3.45	33.92
Female	22,888	12.93	43.81	3.36	39.91
Remoteness					
Major Cities	30,536	19.00	41.26	3.17	36.57
Inner Regional	18,324	14.72	43.47	3.97	37.84
Outer Regional	10,554	16.69	47.18	2.84	33.30
Remote	1,015	15.76	50.64	3.74	29.85
Very Remote	881	17.37	47.79	6.81	28.04
Socioeconomic advantage[1]					
Least advantaged	17,758	15.35	44.74	3.78	36.12
Quintile 2	15,431	16.21	42.95	3.47	37.37
Quintile 3	11,882	17.40	43.09	3.82	35.68
Quintile 4	9,739	19.44	42.30	2.81	35.45
Most advantaged	6,493	21.32	40.98	2.45	35.25
Co-morbidity score					
None	43,949	19.45	41.44	3.05	36.06
One	7,380	12.09	44.73	3.96	39.23
Two	4,628	11.71	47.60	4.06	36.62
Three or more	5,353	11.04	51.56	5.12	32.28
Hospital and health service					
Cairns & Hinterland	3,075	19.77	48.75	3.22	28.26
Central Queensland	2,750	12.80	53.45	5.64	28.11
Central West	213	14.08	48.36	7.98	29.58
Darling Downs	2,848	13.52	54.92	4.00	27.56
Gold Coast	3,607	24.31	51.43	1.72	22.54
Mackay	2,226	15.09	46.00	2.65	36.25
Mater public hospitals	759	11.07	54.28	3.43	31.23
Metro North	8,901	20.21	45.43	3.37	30.99
Metro South	8,579	26.19	40.27	2.51	31.03
North-west	466	17.17	53.00	5.58	24.25
South-west	428	12.85	53.04	5.14	28.97
Sunshine Coast	4,783	17.02	40.60	6.15	36.23
Torres and Cape	315	17.14	41.90	6.03	34.92
Townsville	3,116	18.77	52.57	1.28	27.37
West Moreton	3,104	9.02	37.24	2.93	50.81
Wide Bay	4,497	10.32	44.52	4.07	41.09
Private	11,643	13.08	31.84	3.20	51.88

1. aged 25 years and older at first admission with a principal diagnosis of ACS
2. ST-elevated myocardial infarction
3. non-ST-elevated myocardial infarction
4. unspecified myocardial infarction
5. unstable angina

Table 29 ACS cohort[1], proportion who self-discharged[2] during first ACS admission (%)

	Other Queenslander	Aboriginal and Torres Strait Islander
25-44 years	2.93	7.27
45-64 years	1.39	4.33
65-84 years	0.70	1.29
85+ years	0.44	0.00
Total	1.04	4.43

1. aged 25 years and older at first admission with a principal diagnosis of ACS
2. self-discharge is defined as discharge against medical advice or non-return from hospital leave

Table 30 ACS cohort[1], multivariable analysis[2] [3] of the proportion who self-discharged from their first ACS admission, Queensland 2010-2016

Variable	Ratio	95%CI
Indigenous status		
Other Queenslander	1.00	reference
Aboriginal and Torres Strait Islander	2.77	(2.19-3.50)
Age[4]	0.96	(0.95-0.96)
Sex		
Male	1.00	reference
Female	0.65	(0.55-0.76)
Remoteness area		
Major Cities	1.00	reference
Inner Regional	0.80	(0.67-0.97)
Outer Regional	0.87	(0.71-1.07)
Remote	0.66	(0.40-1.07)
Very Remote	0.55	(0.32-0.94)
Socioeconomic advantage[5]	0.86	(0.81-0.92)
Co-morbidity score		
None	1.00	reference
One	1.41	(1.13-1.77)
Two	1.19	(0.87-1.62)
Three or more	1.42	(1.06-1.88)
ACS Type		
STEMI	1.00	reference
Non-STEMI	1.37	(1.09-1.72)
Unspecified MI	1.12	(0.68-1.84)
Unstable Angina	1.72	(1.37-2.16)

1. aged 25 years or older at their first admission with a principal diagnosis of ACS
2. logistic regression; estimate expressed as an Odds Ratio
3. adjusted for admission year
4. per year increase in age
5. per one unit increase in quintile of socioeconomic advantage

The proportion of people who died in hospital during their first ACS admission was higher for older than younger age-groups, and higher for Aboriginal and Torres Strait Islander people than other Queenslanders in all age-groups except 85+ (Table 31). In multivariable analysis, the proportion of people who died during their first hospital admission increased with increasing age and with increasing number of co-morbid conditions, was slightly lower for females than males and was not strongly association with remoteness or socioeconomic advantage (Table 32). After adjustment for age, sex, remoteness, socioeconomic advantage, co-morbidity, type of ACS and admission year, Aboriginal and Torres Strait Islander people had higher odds of dying during their index ACS admission that other Queenslanders.

Table 31 ACS cohort[1], proportion (%) who died in hospital during first ACS admission by Indigenous status and age group, Queensland 2010-2016

Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander
25-44	0.42	1.13
45-64	0.99	2.10
65-84	3.75	5.17
85+	11.87	9.68
Total	3.52	2.50

1.aged 25 years and older at their first admission with a principal diagnosis of ACS

Table 32 ACS cohort[1], multivariable analysis[2] of the proportion who died during their first ACS admission, Queensland 2010-2016[3]

Variable	Ratio	95%CI
Indigenous status		
Other Queenslander	1.00	reference
Aboriginal & Torres Strait Islander	1.68	(1.26-2.23)
Age[4]	1.09	(1.08-1.09)
Sex		
Male	1.00	reference
Female	1.08	(0.98-1.18)
Remoteness area		
Major Cities	1.00	reference
Inner Regional	0.94	(0.84-1.06)
Outer Regional	1.05	(0.92-1.21)
Remote	1.02	(0.67-1.54)
Very Remote	0.93	(0.61-1.41)
Socioeconomic advantage[5]	0.93	(0.89-0.97)
Co-morbidity score		
None	1.00	reference
One	1.59	(1.39-1.81)
Two	1.83	(1.58-2.12)
Three or more	2.55	(2.25-2.89)
ACS Type		
STEMI	1.00	reference
Non-STEMI	0.25	(0.22-0.28)
Unspecified MI	2.23	(1.94-2.56)
Unstable Angina	0.05	(0.04-0.06)

1.aged 25 years or older at their first admission with a principal diagnosis of ACS
2.logistic regression (estimate expressed as an Odds Ratio)
3.adjusted for admission year
4.per year increase in age
5.per one unit increase in quintile of socioeconomic advantage

5.3 Length of stay at first ACS admission

This analysis included members of the ACS cohort aged 25-84 years old who were admitted with a principal diagnosis of ACS and did not self-discharge at their first ACS admission (n=53,690). Those who self-discharged were excluded as their length of stay was considerably shorter, on average, than those who discharged for other reasons (Table 33).

The cohort included 2,492 (4.6%) Aboriginal and/or Torres Strait Islander people. The average length of stay was the similar for Aboriginal and Torres Strait Islander people and the median length of stay was similar across age groups; lowest for Aboriginal and Torres Strait Islander people aged 65-84 years (Table 34).

In multivariable analysis, being female, increasing socioeconomic advantage, and being admitted for unstable angina were associated with lower length of stay, while increasing co-morbidity was associated with increasing length of stay (Table 35). After adjustment for age, sex, remoteness, socioeconomic advantage, co-morbidity, type of ACS and admission year, Aboriginal and Torres Strait Islander people had a slightly increased length of stay compared to other Queenslanders.

Table 33 ACS Cohort[1], length of stay during first ACS admission by Indigenous status and reason for discharge[2], Queensland 2010-2016

	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
Self-discharged[1]	2.96	(7.12)	1	(0-3)	2.38	(3.38)	1	(1-3)
Other discharge reason	5.76	(15.10)	3	(2-6)	5.53	(8.00)	3	(2-7)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who self-discharged from their first ACS admission
2. self-discharge was defined as those whose separation from their first admission was coded as 'discharged against medical advice' or 'non return from hospital leave'.

Table 34 ACS cohort[1], length of stay during first ACS admission by Indigenous status and age group, Queensland 2010-2016

Age-group	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
25-44	3.5	(5.2)	3	(1-4)	4.3	(5.1)	3	(1-5)
45-64	4.7	(12.4)	3	(2-5)	5.4	(7.4)	4	(2-6)
65-84	6.8	(17.5)	4	(2-7)	7.6	(11.5)	4	(2-9)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who self-discharged from first ACS admission

Table 35 ACS cohort[1], multivariable analysis[2] length of stay during first ACS admission, Queensland 2010-2016[3]

Variable	Ratio	95%CI
Indigenous status		
Other Queenslander	1.00	reference
Aboriginal and Torres Strait Islander	1.10	(1.05-1.15)
Age[4]	1.02	(1.02-1.02)
Sex		
Male	1.00	reference
Female	0.88	(0.87-0.90)
Remoteness area		
Major Cities	1.00	reference
Inner Regional	1.05	(1.03-1.07)
Outer Regional	1.08	(1.05-1.11)
Remote	0.11	(1.04-1.18)
Very Remote	0.95	(0.88-1.02)
Socioeconomic advantage[5]	0.97	(0.97-0.98)
Co-morbidity score		
None	1.00	reference
One	1.13	(1.10-1.16)
Two	1.12	(1.08-1.16)
Three or more	1.34	(1.30-1.38)
ACS Type		
STEMI	1.00	reference
Non-STEMI	1.02	(1.00-1.05)
Unspecified MI	0.92	(0.87-0.97)
Unstable Angina	0.55	(0.53-0.56)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who self-discharged from their first ACS admission
2. negative binomial regression
3. adjusted for admission year
4. per year increase in age
5. per one unit increase in quintile of socioeconomic advantage

5.4 Time to ACS re-admission

This analysis included members of the ACS cohort aged 25-84 years who had been admitted with a principal diagnosis of ACS and did not self-discharge from their first admission (n=53,079).

Aboriginal and Torres Strait Islander people had a higher ACS re-admission rate than other Queenslanders (Figure 8). By 1 month after discharge from the first ACS admission, nine percent of the Aboriginal and Torres Strait Islander cohort and five percent of the other Queenslander cohort had been re-admitted for ACS. By 30 months, the cumulative re-admission rate increased to 25.2% for Aboriginal and Torres Strait Islander people and 14.1% for other Queenslanders (Table 36). The ACS re-admission rate was higher for Aboriginal and Torres Strait Islander then other Queenslanders at all time points over the follow-up period (Table 37). There was no strong evidence that the re-admission rate ratio changed over time.

Figure 8 ACS cohort, 30-month IHD re-admission rate by Indigenous status

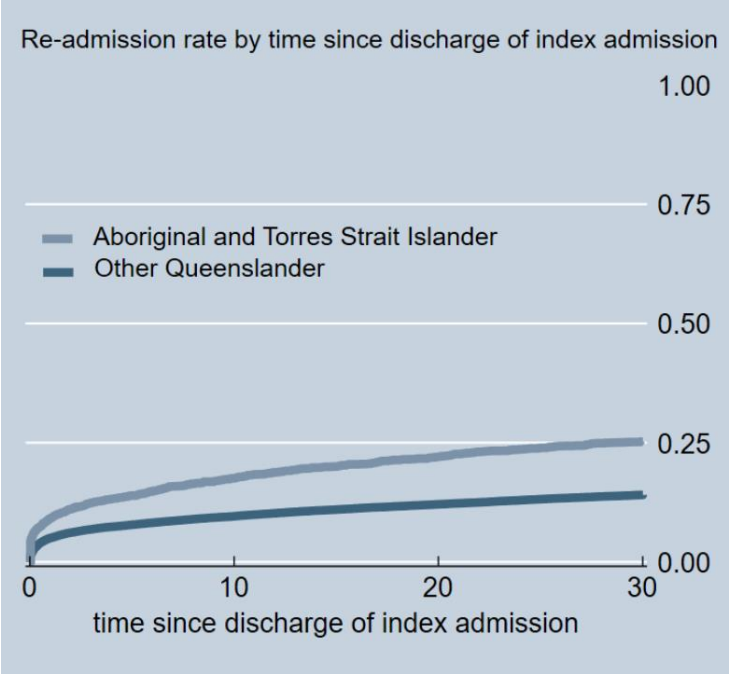


Table 36 ACS cohort[1], cumulative ACS re-admission rate[2] (%) by Indigenous status at select times after first ACS admission

Month	Other Queenslanders	Aboriginal & Torres Strait Islander
One	5.01	9.13
Six	8.23	14.84
Thirty	14.07	25.23

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who died during first ACS admission
2. Kaplan Meier failure function of the ACS re-admission rate, expressed as a proportion (%), presented for select months after first ACS admission.

Table 37 ACS cohort[1], ACS re-admission rate ratio[2] (Aboriginal and Torres Strait Islander compared to other Queenslanders) by time period after discharge from first ACS admission

Time period (months)	Ratio[2]	(95% CI)
0-2	1.72	(1.51-1.95)
3-6	1.97	(1.59-2.46)
7-12	2.24	(1.81-2.79)
13-24	2.03	(1.66-2.47)
25-30	1.62	(1.16-2.26)
0-30	1.87	(1.72-2.03)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who died during first ACS admission
2. Mantel-Haenzel age-adjusted estimate of the re-admission rate ratio, stratified by months after first admission, and for months 0-36 combined

The proportion of people re-admitted for ACS increased with increasing age and was higher for Aboriginal and Torres Strait Islander than other Queenslanders at each age group (Table 38). The difference between Aboriginal and Torres Strait Islander people and other Queenslanders was smallest (relatively) in the 65-84 age group. A greater proportion of males than females were re-admitted for ACS and this was observed for both Aboriginal and Torres Strait Islander and other Queenslanders. Generally, the proportion of the cohort re-admitted for ACS increased with increasing remoteness and was higher for Aboriginal and Torres Strait Islander than other Queenslanders at each level of remoteness. The difference was greatest (relatively) for those in outer regional and remote areas and smallest for those in very remote areas. For other Queenslanders, the proportion who had an ACS re-admission increased with increasing socioeconomic advantage, but for Aboriginal and Torres Strait Islander people the pattern was unclear. The greatest difference (relatively) between Aboriginal and Torres Strait Islander people and other Queenslanders was in those in the most advantaged quintile. The proportion of people re-admitted for ACS increased with increasing co-morbidity score and was higher for Aboriginal and Torres Strait Islander than other Queenslanders at each co-morbidity score. The proportion of people re-admitted for ACS was higher for those who self-discharged from their first ACS admission and was higher for Aboriginal and Torres Strait Islander people than other Queenslanders for both those who did and did not self-discharge.

Table 38 ACS cohort[1], ACS re-admission rate[2] (%) at 30 months by Indigenous status and selected demographics, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islander	
	%	95% CI	%	95% CI
Age group				
25-44	12.72	(11.59-13.95)	23.72	(20.56-27.34)
45-64	14.40	(13.94-14.89)	25.64	(23.48-27.96)
65-84	18.52	(18.05-19.01)	26.10	(22.16-30.60)
Sex				
Male	17.06	(16.65-17.47)	25.88	(23.64-28.28)
Female	15.12	(14.59-15.67)	24.51	(22.09-27.14)
Remoteness				
Major cities	14.47	(14.04-14.91)	18.63	(15.43-22.41)
Inner regional	17.99	(17.38-18.61)	21.01	(17.55-25.05)
Outer regional	18.44	(17.62-19.29)	27.27	(24.49-30.30)
Remote	18.17	(15.41-21.36)	26.82	(22.08-32.36)
Very remote	29.44	(25.40-33.96)	33.46	(28.81-38.64)
Socioeconomic advantage				
Least advantaged	18.06	(17.43-18.71)	27.12	(24.76-29.66)
Quintile 2	17.52	(16.86-18.19)	23.03	(19.85-26.62)
Quintile 3	16.63	(15.90-17.38)	26.24	(21.95-31.20)
Quintile 4	14.57	(13.82-15.37)	18.01	(13.22-24.27)
Most advantaged	11.74	(10.91-12.63)	25.30	(17.26-36.16)
Co-morbidity score				
None	14.88	(14.52-15.24)	22.45	(20.56-24.48)
One	20.43	(19.37-21.54)	29.67	(25.09-34.87)
Two	19.76	(18.43-21.19)	31.64	(25.65-38.64)
Three or more	24.60	(23.12-26.16)	36.24	(30.02-43.40)
Self-discharged from first admission				
No	16.28	(15.95-16.61)	24.54	(22.86-26.32)
Yes	26.19	(22.75-30.03)	40.51	(32.11-50.16)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who died during first ACS admission
2. Kaplan Meier fatality function for ACS re-admission (expressed as a percentage)

In multivariable analysis, excess re-admissions were associated with being male, self-discharge from first ACS admission, and with increasing remoteness and socioeconomic disadvantage (Table 39). Aboriginal and Torres Strait Islander people had an excess rate of ACS re-admission compared to other Queenslanders, when adjusting for age, sex, remoteness, socioeconomic advantage, co-morbidity, ACS type, self-discharge, and admission year.

Table 39 ACS cohort[1], multivariable analysis[2 3] of the time to ACS re-admission, Queensland 2010-2016

Variable	Ratio	95%CI
Indigenous status		
Non-Indigenous	1.00	reference
Indigenous	1.47	(1.35-1.61)
Age[4]	1.01	(1.01-1.01)
Sex		
Male	1.00	reference
Female	0.85	(0.81-0.89)
Remoteness area		
Major Cities	1.00	reference
Inner Regional	1.16	(1.10-1.23)
Outer Regional	1.26	(1.19-1.34)
Remote	1.34	(1.16-1.56)
Very Remote	2.00	(1.74-2.29)
Socioeconomic advantage[5]	0.94	(0.93-0.96)
Co-morbidity score		
None	1.00	reference
One	1.34	(1.26-1.43)
Two	1.25	(1.16-1.35)
Three or more	1.53	(1.42-1.64)
ACS Type		
STEMI	1.00	reference
Non-STEMI	1.05	(0.99-1.12)
Unspecified MI	1.13	(0.99-1.28)
Unstable Angina	0.85	(0.80-0.90)
Self-discharge of first admission		
Yes	1.89	(1.63-2.18)
No	1.00	reference

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who died during first ACS admission
2. Cox proportional hazards regression; estimate expressed as a hazards ratio
3. adjusted for admission year
4. per year increase in age
5. per one unit increase in quintile of socioeconomic advantage

5.5 Therapeutic procedures received during first ACS admission

This analysis included members of the ACS cohort aged 25-84 years who had been admitted for the first time with a principal diagnosis of ACS (n=54,387). 2,609 (4.8%) of the cohort members were Aboriginal and Torres Strait Islander people. Overall, 62.2% of people had a diagnostic angiography during their first ACS admission, 32.2% had a percutaneous coronary intervention, and only 7.6% received a coronary artery bypass graft (Table 40).

A lower proportion of Aboriginal and Torres Strait Islander than other Queenslanders, and females than males, received diagnostic angiography, percutaneous coronary intervention, and coronary artery bypass graft. The proportion of people who received percutaneous coronary interventions at first ACS admission decreased with increasing remoteness, however the relationship with remoteness was less clear for the other procedures. The proportion of people who received diagnostic angiography and percutaneous coronary intervention at first ACS admission increased with increasing advantage; the relationship with socioeconomic advantage was not clear for coronary artery bypass graft. The proportion of people receiving diagnostic angiography and percutaneous coronary intervention was highest among those without co-morbidity and lowest among those with co-morbidity scores of three or more. As expected, a higher proportion of those with a diagnosis of ST-elevated myocardial infarction (STEMI) than other ACS conditions at first ACS admission received diagnostic angiography and percutaneous coronary interventions. Coronary artery bypass grafts were slightly more common among those with non-ST-elevated myocardial infarction and unspecified myocardial infarction.

Table 40 ACS cohort[1], proportion (%) who received therapeutic ACS procedures[2] at first ACS admission, Queensland 2012-2016

	DA[3] %	PCI[4] %	CABG[5] %
Total	62.17	32.14	7.62
Indigenous status			
Other Queenslander	62.55	32.46	7.69
Aboriginal & Torres Strait Islander	54.62	25.72	6.21
Age group			
25-44	58.13	33.03	2.88
45-64	66.34	37.92	7.16
65-84	59.24	27.21	8.63
Sex			
Male	66.61	37.45	9.37
Female	53.90	22.23	4.35
Remoteness			
Major cities	64.41	36.25	7.62
Inner regional	59.95	27.87	7.76
Outer regional	61.41	29.64	7.59
Remote	58.60	24.51	8.03
Very remote	47.22	22.10	4.59
Socioeconomic advantage[6]			
Least advantaged	55.77	26.96	7.07
Quintile 2	60.08	30.25	7.64
Quintile 3	65.39	33.84	7.83
Quintile 4	66.35	36.69	7.78
Most advantaged	72.99	41.28	8.44
Co-morbidity score			
None	66.25	35.63	7.96
One	53.89	23.37	7.18
Two	54.21	25.05	7.19
Three or more	41.61	17.28	5.27
ACS type			
STEMI[7]	87.19	67.33	6.66
NSTEMI[8]	70.04	31.59	9.64
UMI[9]	58.85	30.04	7.74
UA[10]	41.60	32.14	5.79

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS
2. individuals could receive multiple procedures, so the proportions may total above 100%
3. diagnostic angiography
4. percutaneous coronary intervention
5. coronary artery bypass grafting
6. seven other Queenslanders were missing data on socioeconomic advantage
7. ST-elevated myocardial infarction
8. non-ST-elevated myocardial infarction
9. unspecified myocardial infarction
10. unstable angina

A lower proportion of females than males and people living in very remote than other areas received at least one therapeutic procedure for ACS during the first ACS admission. In general, the patterns in the proportion of people who received at least one ACS procedure during their first ACS admission were similar for Aboriginal and Torres Strait Islander and other Queenslanders (Table 41). In general, the proportion who had an ACS procedure decreased with increasing co-morbidity and residential remoteness and, for other Queenslanders, increased with increasing socioeconomic advantage. The hospital and health services of admitting hospitals associated with the highest proportion of people undergoing therapeutic hospital procedures during their index admission include Private, Townsville, Sunshine Coast and Metro North.

Individuals who received a procedure for ACS during their index admission had a longer mean length of stay than those who did not receive a procedure (Table 42). Those who received an ACS procedure during their index admission had a lower 30-month ACS re-admission rate. Aboriginal and Torres Strait Islander people compared to other Queenslanders who received a diagnostic angiography or a PCI during their index admission were more likely to have a re-admission in the next 30 months.

Table 41 ACS cohort,[1] proportion (%) who received at least one ACS procedure (diagnostic angiography or definitive revascularisation)[2] at first ACS admission, stratified by Indigenous status, Queensland 2012-2016

	Other Queenslander N=51,778	Aboriginal and Torres Strait Islander N=2,609
Total	63.93	55.77
Sex		
Male	68.57	60.72
Female	55.08	49.66
Age-group		
25-44	59.70	54.93
45-64	68.48	58.19
65-84	60.81	48.92
Hospital and health service		
Cairns & Hinterland	59.61	55.22
Central Queensland	58.24	53.95
Central West	48.48	48.00
Darling Downs	53.07	44.20
Gold Coast	69.08	63.64
Mackay	56.22	49.57
Mater public hospitals	51.36	40.74
Metro North	71.99	74.59
Metro South	55.52	52.94
North-west	50.58	49.75
South-west	44.81	50.00
Sunshine Coast	70.40	73.02
Torres and Cape	37.39	34.55
Townsville	75.73	75.62
West Moreton	31.11	28.43
Wide Bay	48.88	52.80
Private	81.02	82.35
Remoteness		
Major Cities	66.08	55.27
Inner Regional	60.95	55.35
Outer Regional	63.96	58.05
Remote	59.70	60.13
Very Remote	49.56	47.58
Socioeconomic advantage		
Least advantaged	57.15	53.07
Quintile 2	61.71	55.45
Quintile 3	67.07	63.11
Quintile 4	68.30	60.71
Most advantaged	74.66	57.30
Co-morbidity score		
None	67.95	59.87
One	55.74	50.84
Two	56.18	47.47
Three or more	42.88	40.41
ACS type (at index)		
STEMI	88.66	82.39
NSTEMI	71.32	64.47
UMI	60.47	42.00
UA	44.27	28.66

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS
2. at least one of: diagnostic angiography, percutaneous coronary intervention, or coronary artery bypass draft.

Table 42 ACS cohort[1], length of stay and 30-day re-admission rate, by Indigenous status and ACS procedure received

	DA[2]	PCI[3]	CABG[4]	Any ACS procedure[5]	No ACS procedure
Length of stay at index (mean, SD)[5]					
Other Queenslander	6.63 (12.21)	5.05 (9.75)	17.91 (21.37)	6.72 (12.20)	4.03 (19.15)
Aboriginal and Torres Strait Islander	7.18 (8.35)	5.51 (5.94)	18.59 (14.62)	7.27 (8.43)	3.20 (6.71)
ACS re-admission (rate, 95%CI)[6]					
Other Queenslander	14.1 (13.7-14.4)	15.0 (14.5-15.6)	7.1 (6.3-8.0)	13.9 (13.5-14.3)	21.0 (20.4-21.6)
Aboriginal and Torres Strait Islander	21.8 (19.7-24.1)	22.2 (19.2-25.6)	9.0 (5.5-14.8)	(19.6-24.0)	5.9 (27.2-32.7)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS
2. diagnostic angiography
3. percutaneous coronary intervention
4. coronary artery bypass grafting
5. at least one of: diagnostic angiography, percutaneous coronary intervention, or coronary artery bypass draft.
6. excluding those who self-discharged from their index admission
7. excluding those who died during their index hospital admission

In multivariable analysis (Table 43), the proportion of people who underwent a therapeutic procedure for ACS during their first ACS admission was lower for Aboriginal and Torres Strait Islander people than other Queenslanders when adjusted for age (OR 0.61; Model A). There was a slight reduction in the differential when sex, co-morbidity score, and ACS type were added to the model (OR 0.65; Model B), with a further reduction when also adjusted for remoteness and socioeconomic advantaged (OR 0.84; Model C). When health service area was included in the model instead of remoteness and socioeconomic advantage, there was a further reduction (OR 0.91; Model D). This suggest that differences in where Aboriginal and Torres Strait Islander people live and seek care compared to other Queenslanders live and seek care have an impact on whether they receive therapeutic procedures in hospital when admitted for ACS for the first time.

Model D shows that being female and having co-morbidities are associated with a lower proportion of people receiving in-hospital therapeutic procedures for ACS. People admitted to hospitals outside of Metro North hospital and health service area were less likely to receive in-hospital therapeutic procedures for ACS compared to those admitted to a Metro North facility, except for people who were admitted to a private facility or a facility in the Townsville hospital and health service area.

Table 43 ACS cohort[1], multivariable analysis[2] of the proportion who received a therapeutic procedure for ACS during their first ACS admission, Queensland 2010-2016

	Model A		Model B		Model C		Model D	
	Ratio	95% CI	Ratio	95% CI	Ratio	95%CI	Ratio	95%CI
Indigenous status[3]	0.61	(0.57-0.67)	0.65	(0.59-0.71)	0.85	(0.78-0.82)	0.95	(0.83-1.00)
Age[4]	0.99	(0.99-0.99)	1.00	(1.00-1.00)	1.00	(1.00-1.00)	0.99	(0.99-0.99)
Sex[5]			0.62	(0.60-0.65)	0.63	(0.61-0.66)	0.62	(0.55-0.59)
Co-morbidity score								
None			1.00	reference	1.00	Reference	1.00	reference
One or two			0.64	(0.61-0.68)	0.65	(0.62-0.69)	0.61	(1.34-1.73)
Three or more			0.33	(0.31-0.36)	0.34	(0.31-0.36)	0.31	(2.24-2.94)
ACS type (at index)								
STEMI			1.00	reference	1.00		1.00	
NSTEMI			0.36	(0.34-0.39)	0.37	(0.35-0.40)	0.36	(0.34-0.39)
UMI			0.21	(0.19-0.24)	0.22	(0.20-0.25)	0.20	(0.17-0.22)
UA			0.11	(0.10-0.12)	0.11	(0.10-0.12)	0.08	(0.07-0.08)
Remoteness[6]					0.97	(0.94-0.99))		
Socioeconomic advantage[7]					1.19	(1.17-1.20)		
Hospital & health service								
Cairns & Hinterland							0.45	(0.40-0.49)
Central Queensland							0.46	(0.41-0.51)
Central West							0.32	(0.23-0.44)
Darling Downs							0.36	(0.33-0.40)
Gold Coast							0.64	(0.58-0.71)
Mackay							0.45	(0.41-0.51)
Mater public hospitals							0.38	(0.32-0.45)
Metro North							1.00	Reference
Metro South							0.35	(0.33-0.38)
North-west							0.26	(0.21-0.32)
South-west							0.26	(0.21-0.33)
Sunshine Coast							1.08	(0.98-1.18)
Torres and Cape							0.15	(0.12-0.20)
Townsville							1.20	(1.08-1.34)
West Moreton							0.18	(0.16-0.20)
Wide Bay							0.40	(0.37-0.44)
Private							2.90	(2.68-3.13)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS
2. logistic regression
3. Aboriginal and Torres Strait Islander people compared to other Queenslanders
4. Per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

Of the 9,691 Queenslanders hospitalised for with a principal diagnosis of STEMI during the study period and did not have an ACS-related admission (ACS identified in either the principal or other diagnosis codes) in the previous five years (5.27% were Aboriginal and Torres Strait Islander people). Of these, 67.3% received PCI (Table 40). After mutual adjustment, the odds of STEMI patients receiving PCI during the index admission was reduced for Aboriginal and Torres Strait Islander people compared to other Queenslanders with an index admission of STEMI (OR 0.75, 95%CI 0.62-0.93), for females compared to males (0.72, 0.65-0.79), with each year or increasing age (0.98, 0.97-0.98), with increasing residential remoteness (0.72, 0.69-0.76) and with each increased unit in the Charlson co-morbidity score (0.83, 0.80-0.87). On average, the odds of receiving PCI during the index STEMI hospital admission increased by 8% with each increasing quintile of socioeconomic advantage (1.08, 1.05-1.13).

5.6 Fatality during first ACS admission

Of Queenslanders aged between 25 and 84 years old at time of index ACS hospital admission, 1,521 died in hospital. ACS was the primary cause (n=34, 54.8% for Aboriginal and Torres Strait Islander people) for 53.5% of these deaths. For Aboriginal and Torres Strait Islander people, 64.7% of those who receive an ACS procedure died from ACS during the index admission compared to 51.1% of those who did not receive a procedure. For other Queenslanders, 53.2% of those that received a procedure and 53.5% of those that did not receive a procedure died during their hospital admission. Due to small case numbers no further analysis of ACS death during the index admission were conducted.

5.7 Fatality after discharge from first ACS admission

This analysis included Queensland residents aged 25-84 years admitted to hospital with a principal diagnosis of ACS during 1 July 2010 and 30 June 2016, excluding those who died during their first admission. Survival time was calculated as the time from first ACS admission to death, 30 months, or end of the study (31 December 2018), which ever occurred first. The average follow-up time was 28.7 months.

In total, 8,602 (14.7%) people died during the follow-up period (15.5% of Aboriginal and Torres Strait Islander Queenslanders). Of these, 819 (1.5%) died from ACS, including 43 Aboriginal and Torres Strait Islander Queenslanders (1.7%) and 776 Other Queenslanders (1.5%). Aboriginal and Torres Strait Islander peoples' excess ACS mortality was greatest in those aged 25 years and decreased with increasing age (Table 44).

Table 44 ACS cohort[1], 30-month ACS fatality[2] by Indigenous status and selected ages

Age (years)	Ratio[2]	(95% CI)
25	6.56	(2.61-16.49)
35	5.16	(2.55-10.43)
45	4.06	(2.46-6.69)
55	3.19	(2.28-4.48)
65	2.51	(1.87-2.37)
75	2.00	(1.31-2.98)

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who died during first ACS admission Cox proportional hazards regression
2. Cox proportional hazard regressions, age-adjusted and estimated for selected ages

People who died from any cause during the follow-up had a higher median length of stay at their first ACS admission (both: 5 days, IQR 3-9) than those who did not die during follow-up (3 days, IQR 2-6). A lower proportion of people who received a therapeutic procedure for ACS during their first ACS admission died during follow-up than those who did not receive a procedure (death due to any cause: 12.0% vs. 23.7%; death due to ACS: 1.1% vs. 2.3%). A higher proportion of people who self-discharged during their first ACS admission died during follow-up than those who did not self-discharge (death due to any cause: 21.5% vs. 16.1%; death due to ACS: 2.9% vs. 1.5%).

In multivariable analysis, ACS-specific mortality was higher for Aboriginal and Torres Strait Islander people than other Queenslanders, those with comorbidity than those without, and increased by an average of 7% with year increase in age. ACS-specific mortality in the 30-month follow-up was lower for women than men and for those who received an ACS procedure during their index hospital admission compared to those who did not receive a procedure (Table 45). Due to small case numbers, remoteness and self-discharge were not included in the model. All other variables, except for age which was included as a continuous variable, were collapsed into dichotomous categories.

Table 45 ACS cohort[1], multivariable analysis[2] of 30-month ACS fatality, Queensland 2010-2016

Variable	Hazard Ratio[3]	95%CI
Indigenous status		
Non-Indigenous	1.00	reference
Indigenous	2.42	(1.63-3.59)
Age[4]	1.07	(1.06-1.09)
Sex		
Male	1.00	reference
Female	0.70	(0.58-0.85)
Socioeconomic advantage[5]		
Least advantaged	1.00	Reference
Other	0.98	(0.81-1.19)
Co-morbidity score		
None	1.00	reference
Any	2.10	(1.74-2.53)
ACS procedure at index admission		
At least one	0.53	(0.44-0.64)
None	1.00	reference

1. Queensland residents, aged 25-84 at their first admission with a principal diagnosis of ACS and excluding those who died during first ACS admission
2. Cox proportional hazards regression; estimate expressed as a hazards ratio
3. adjusted for admission year
4. per year increase in age

6 CONGESTIVE HEART FAILURE

6.1 Key findings

1. There were 2000 Aboriginal and Torres Strait Islander people in the CHF cohort. 1,203 died within three years of index admission, but only 18 of these died of CHF (as underlying cause of death). CHF is not a 'stand-alone' disease process; it occurs secondary to other diseases such as ischaemic heart disease, cardiomyopathy or valve damage. So, the underlying cause will rarely be CHF. This limits the analysis of CHF-specific fatality.

2. In-hospital CHF fatality was higher for Aboriginal and Torres Strait Islander people than other Queenslanders, but in-hospital deaths from other causes (the majority of deaths) was not higher for Aboriginal and Torres Strait Islander people.

3. For those people discharged after their first CHF admission, the all-cause death rate was 34% higher for Aboriginal and Torres Strait Islander than other Queenslanders.

4. Aboriginal and Torres Strait Islander people had a shorter median length of stay at first CHF admission than other Queenslanders; the differential was larger for the youngest age group (25-44 years) than older age groups and females than males.

5. Aboriginal and Torres Strait Islander people had a higher rate of CHF re-admission than other Queenslanders; more than one-quarter of re-admissions among Aboriginal and Torres Strait Islander people and almost one-fifth of those among other Queenslanders occurred within the first month after discharge from the first CHF admission.

6. CHF re-admission rates were lower for people living in very remote than other areas and for those in the most socioeconomic advantaged than less advantaged areas, higher for those who self-discharged from their first CHF admission and increased with increasing co-morbidity score.

6.2 The Congestive Heart Failure (CHF) cohort

The CHF cohort consisted of 65,424 Queensland residents who had their first hospital admission with a diagnosis of congestive heart failure in the period 1 July 2010 and 30 June 2016 and who were aged 25 years or older at the time of that admission. 2,000 (3.1%) of the cohort members were Aboriginal and/or Torres Strait Islander people. People whose first admission was for palliative care, and those with missing data on Indigenous status, were excluded.

The majority (54%) of Aboriginal and Torres Strait Islander cohort members were female, while for other Queenslanders there was a small excess of males (Table 46). A higher proportion of Aboriginal and Torres Strait Islander than other Queenslanders were in younger age-groups, lived in northern and western Queensland and in areas that are more remote and had lower socioeconomic advantage. Forty percent of other Queenslanders had private health insurance, compared to only four percent of Aboriginal and Torres Strait Islander people. A higher proportion of Aboriginal and Torres Strait Islander people self-discharged from hospital. The proportion of people with co-morbid conditions was higher for Aboriginal and Torres Strait Islander than other Queenslanders, except for the 85+ age-group (Table 47). The most common co-morbid conditions were renal disease, diabetes, pulmonary disease, myocardial infarction and cancer (Figure 9). A higher proportion of Aboriginal and Torres Strait Islander people than other Queenslanders had a prior hospital admission for these most common conditions, except for cancer.

Figure 9 Principal CHF cohort, most common co-morbidities (%), by Indigenous status, Queensland 2010-2016

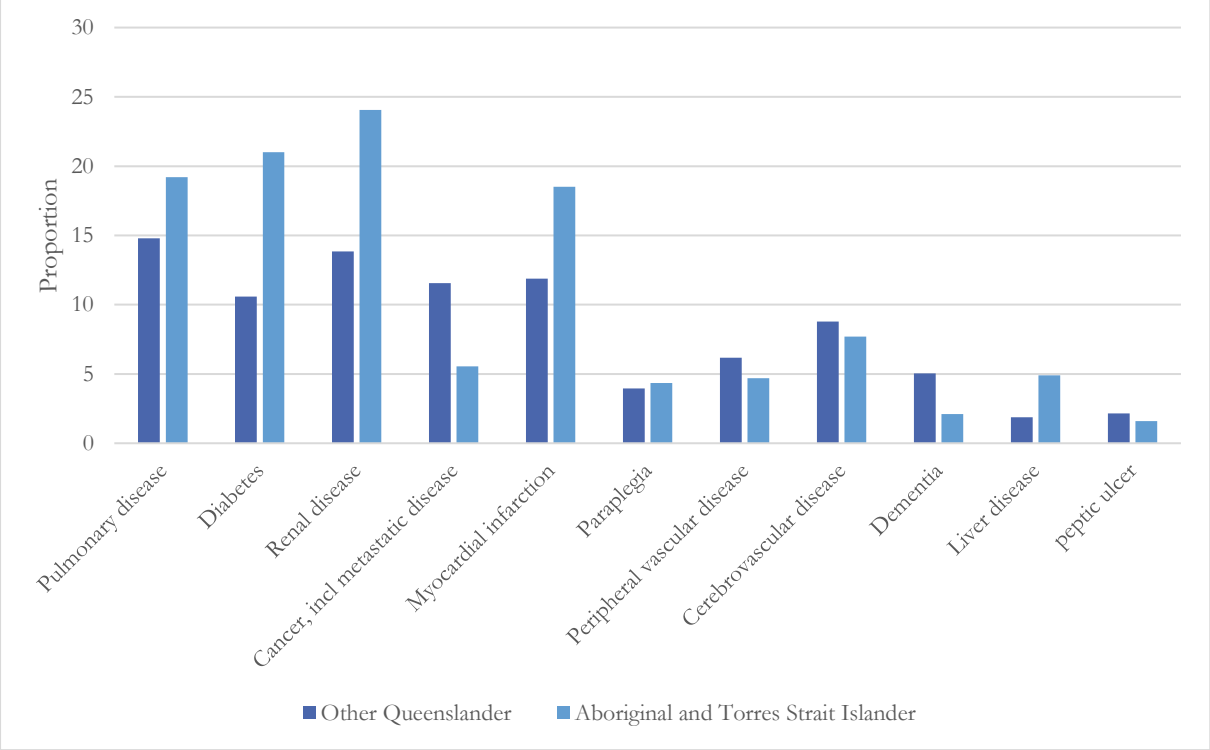


Table 46 CHF cohort, demographic characteristics (%), Queensland 2010-2016

	Other Queenslander N=63,424	Aboriginal and Torres Strait Islander N=2,000
Sex		
Male	51.3	45.7
Female	48.7	54.3
Age-group		
25-44	2.1	14.4
45-64	13.1	46.5
65-84	53.5	34.9
85-99	31.4	4.2
Hospital and health service		
Cairns & Hinterland	3.3	20.1
Central Queensland	2.9	5.1
Central West	0.2	0.2
Darling Downs	4.5	6.6
Gold Coast	6.5	1.5
Mackay	2.3	3.3
Mater public hospitals	1.9	1.5
Metro North	16.3	9.6
Metro South	13.1	10.4
North-west	0.3	7.6
South-west	0.5	1.5
Sunshine Coast	6.4	1.3
Torres and Cape	0.1	8.3
Townsville	4.3	15.6
West Moreton	3.8	2.9
Wide Bay	4.4	3.0
Private	29.1	2.0
Remoteness		
Major Cities	56.8	21.3
Inner Regional	27.7	16.5
Outer Regional	13.8	34.7
Remote	1.0	11.1
Very Remote	0.7	16.4
Socioeconomic advantage		
Least advantaged	26.9	54.5
Quintile 2	24.6	22.4
Quintile 3	19.5	12.0
Quintile 4	16.7	7.3
Most advantaged	12.3	3.8
Health insurance		
Insured	39.5	3.7
Not insured	58.8	92.5
Other	1.7	3.8
Self-discharge		
No	99.5	96.8
Self-discharged	0.5	3.2

Table 47 CHF cohort, proportion (%) with co-morbid conditions[1] by age-group, Queensland 2016-2010

	One or two		Three or more	
Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander	Other Queenslanders	Aboriginal & Torres Strait Islander
25-44	24.3	33.9	8.2	19.4
45-64	30.8	38.5	15.8	25.5
65-84	35.6	35.5	23.0	32.5
85+	33.8	38.1	19.7	15.5

1. Charlson co-morbidity score

6.3 Fatality

6.3.1 Death in hospital

Only a small proportion of deaths in the CHF cohort were attributed to CHF as the underlying cause of death; most were attributed to other causes. The proportion of people who died in hospital during their first CHF admission was higher for older than younger age-groups, for both deaths from CHF and from other causes (Table 48); there was no consistent difference between Aboriginal and Torres Strait Islander people and other Queenslanders.

Table 48 CHF cohort, proportion (%) who died in hospital during first CHF admission, Queensland 2010-2016

	Died from CHF		Died from other cause	
Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander	Other Queenslanders	Aboriginal & Torres Strait Islander
25-44	0.0	0.0	7.0	5.2
45-64	0.1	0.3	6.9	7.0
65-84	0.3	0.3	10.0	8.0
85+	1.0	1.2	14.3	9.5

6.3.1.1 In-hospital deaths from CHF

In multivariable analysis, the proportion of people who died from CHF during their first hospital admission increased with increasing age, was similar for females and males, and not strongly associated with remoteness or socioeconomic advantage (Table 49). When adjusted only for age (Model A), the proportion who died from CHF during their first hospital admission was 112% higher for Aboriginal and Torres Strait Islander than other Queenslanders; this reduced only slightly when also adjusted for co-morbidity (Model B) but was somewhat reduced when remoteness and socioeconomic disadvantage were included (Model C), although neither of these factors were strongly associated with in-hospital IHD death. Hospital and health service was not included in multivariable analysis because of the small number of CHF deaths for most services.

Table 49 CHF cohort[1], multivariable analysis[2] of the proportion who died from CHF during their first CHF admission, Queensland 2010-2016

	Model A		Model B		Model C	
	Ratio		Ratio		Ratio	
Indigenous status[3]	2.12	(0.87-5.18)	2.01	(0.82-4.93)	1.60	(0.61-4.22)
Age[4]	1.08	(1.05-1.10)	1.07	(1.05-1.10)	1.08	(1.05-1.11)
Sex[5]			1.10	(0.77-1.58)	1.12	(0.78-1.59)
Co-morbidity score						
None			1.00	reference	1.00	reference
One or two			1.11	(0.79-1.87)	1.21	(0.78-1.85)
Three or more			1.43	(0.90-2.27)	1.43	(0.90-2.26)
Remoteness[6]					1.13	(0.92-1.39)
Socioeconomic advantage[7]					0.88	(0.76-1.03)

1. Aged 25-84 at their first IHD admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. Per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

6.3.1.2 In-hospital deaths from other causes

The proportion who died during their first CHF admission from causes other than CHF increased with increasing age and level of co-morbidity and was not strongly associated with remoteness or socioeconomic advantage but was slightly lower for women than men (Table 50). There was no strong evidence of variation between hospital and health services.

Table 50 CHF cohort[1], multivariable analysis[2] of the proportion who died from other causes during their first CHF admission, Queensland 2010-2016

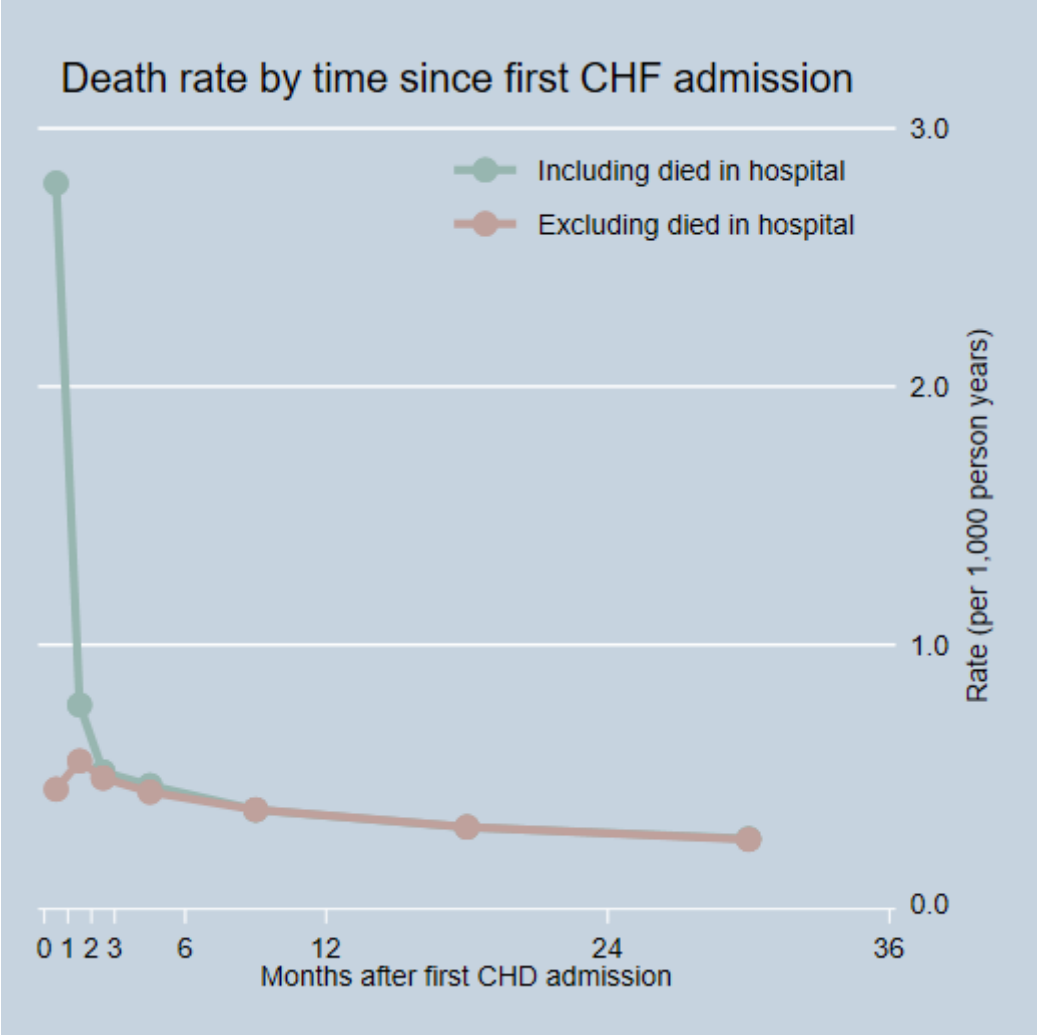
	Model A		Model B		Model C		Model D	
	Ratio		Ratio		Ratio		Ratio	
Indigenous status[3]	0.93	(0.79-1.10)	0.87	(0.73-1.03)	0.84	(0.70-1.00)	0.85	(0.71-1.01)
Age[4]	1.02	(1.01-1.02)	1.01	(1.01-1.02)	1.01	(1.01-1.02)	1.02	(1.01-1.02)
Sex[5]			0.91	(0.86-0.96)	0.91	(0.86-0.96)	0.91	(0.86-0.97)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One or two			1.33	(1.24-1.43)	1.33	(1.24-1.43)	1.33	(1.24-1.43)
Three or more			2.02	(1.88-2.17)	2.02	(1.88-2.17)	2.01	(1.87-2.16)
Remoteness[6]					1.01	(0.98-1.05)		
Socioeconomic advantage[7]					0.97	(0.95-1.00)		
Hospital & health service								
Cairns & Hinterland							1.01	(0.87-1.18)
Central Queensland							1.16	(0.99-1.36)
Central West							0.56	(0.26-1.21)
Darling Downs							0.95	(0.82-1.10)
Gold Coast							1.05	(0.93-1.19)
Mackay							0.91	(0.75-1.11)
Mater public hospitals							0.77	(0.61-0.98)
Metro North							1.00	reference
Metro South							0.93	(0.84-1.03)
North-west							0.64	(0.40-1.04)
South-west							0.85	(0.57-1.26)
Sunshine Coast							0.96	(0.84-1.09)
Torres and Cape							0.65	(0.34-1.21)
Townsville							1.15	(1.01-1.31)
West Moreton							0.80	(0.67-0.94)
Wide Bay							0.90	(0.78-1.05)
Private							0.73	(0.67-0.80)

1. Aged 25-84 at their first IHD admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. Per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

6.3.2 Deaths after discharge from hospital

For the entire CHF cohort, the CHF-specific death rate was highest in the first months after first CHF admission and decreased gradually thereafter (Figure 10). The death rate by time after first CHF admission was not calculated separately for Aboriginal and Torres Strait Islander people because of the small number of deaths with CHF as the underlying cause of death in that group.

Figure 10 CHF cohort[1], CHF-specific death rate by period after first CHF admission, including and excluding those who died in hospital, Queensland 2010-2016



1. Aboriginal & Torres Strait Islander and Other Queenslanders combined, aged 25-84 years

Analysis of deaths after discharge from hospital for the CHF cohort included deaths from all causes rather than only deaths from CHF because of the very low proportion of deaths attributed to CHF as the underlying cause. In multivariable analysis, the all-cause death rate increased with increasing age, number of co-morbid conditions and (for other Queenslanders only) increasing remoteness (Table 51). When adjusted only for age, the all-cause death rate was 34% higher (rate ratio 1.34) for Aboriginal and Torres Strait Islander than other Queenslanders. (Table 52, Model A). This reduced to 24% higher when also adjusted for number of co-morbid conditions (Model B). There was little further reduction when also adjusted for other factors (Model C).

Table 51 CHF cohort, multivariable analysis[1] of all-cause death rate in 36 months after index admission, stratified by Indigenous status, Queensland 2010-2016.

	Other Queenslanders		Aboriginal & Torres Strait Islanders	
	Ratio[2]		Ratio[2]	
Age at index admission[3]	1.04	(1.04-1.04)	1.03	(1.02-1.04)
Sex[4]	0.88	(0.84-0.91)	0.86	(0.71-1.01)
Co-morbidity score				
None	1.00	reference	1.00	reference
One or two	1.62	(1.56-1.69)	1.56	(1.24-1.96)
Three or more	2.57	(2.56-2.69)	2.43	(1.93-3.05)
Self-discharge	1.50	(1.24-1.81)	1.45	(0.93-2.27)
Remoteness[5]	1.00	(0.98-1.02)	0.97	(0.90-1.04)
Socioeconomic advantage[6]	0.99	(0.98-1.00)	1.01	(0.93-1.10)

1. Cox proportional hazard regression
2. Death rate ratio (95% confidence interval)
3. per year of age
4. female compared with male
5. per one unit increase in remoteness category
6. per one unit increase in advantage quintile

Table 52 CHF cohort, multivariable analysis[1] of all-cause death rate in 36 months after index admission, Queensland 2010-2016

	Model A		Model B		Model C	
	Ratio[2]		Ratio[2]		Ratio[2]	
Indigenous status[3]	1.34	(1.23-1.47)	1.22	(1.11-1.37)	1.21	(1.10-1.33)
Age at index admission[4]	1.04	(1.04-1.04)	1.04	(1.04-1.04)	1.04	(1.04-1.04)
Sex[5]			0.87	(0.84-0.90)	0.87	(0.84-0.91)
Co-morbidity score						
None			1.00	reference	1.00	reference
One or two			1.62	(1.56-1.69)	1.62	(1.56-1.69)
Three or more			2.57	(2.46-2.68)	2.56	(2.45-2.68)
Self-discharge					1.51	(1.26-1.79)
Remoteness[6]					0.99	(0.97-1.02)
Socioeconomic advantage[7]					0.99	(0.98-1.00)

1. Cox proportional hazard regression
2. Death rate ratio (95% confidence interval)
3. Aboriginal and Torres Strait Islander people compared with other Queenslanders
4. per year of age
5. female compared with male
6. per one unit increase in remoteness category
7. per one unit increase in socioeconomic advantage quintile

6.4 Length of stay for first CHF admission

This analysis included members of the CHF cohort aged 25-84 years old who had been admitted with a principal diagnosis of CHF, had not been admitted for CHF in the five-year period prior to the index CHF Admission, and not self-discharged from their first CHF hospital admission (n=14,724). Those who self-discharged were excluded as a higher proportion of Aboriginal and Torres Strait Islander people self-discharged and, for both Aboriginal and Torres Strait Islander and other Queenslanders, those who self-discharged had a shorter median length of stay than those discharged for other reasons (Table 53).

Table 53 CHF Cohort[1], length of stay during first CHF admission by Indigenous status and reason for discharge, Queensland 2010-2016

	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
Self-discharged	3.75	(6.29)	2	(1-4)	3.74	(4.21)	2	(0-6)
Other discharge reason	7.66	(13.67)	5	(2-9)	6.04	(8.61)	4	(2-7)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF

The cohort included 681 (4.6%) Aboriginal and Torres Strait Islander people. Overall, the median length of stay at first CHF admission was 5 days (IQR 2-9 days). Generally, Aboriginal and Torres Strait Islander people had a shorter length of stay at their first CHF admission than other Queenslanders (Table 54). The difference between Aboriginal and Torres Strait Islander people and other Queenslanders was greatest in the 25-44 age group than older age groups and for females than males.

Table 54 CHF cohort[1], length of stay during first CHF admission by Indigenous status and select demographics, Queensland 2010-2016

	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
Age group								
25-44	8.43	(18.61)	5	(2-9)	6.69	(7.88)	3	(2-8)
45-64	7.27	(21.09)	4	(2-8)	5.54	(7.41)	4	(2-7)
65-84	7.73	(11.03)	5	(3-9)	6.47	(10.26)	4	(2-7)
Sex								
Male	7.68	(15.38)	5	(2-8)	6.05	(8.52)	4	(2-7)
Female	7.63	(10.91)	5	(3-9)	6.02	(8.71)	3	(2-7)
Remoteness								
Major cities	7.64	(15.33)	5	(2-8)	5.31	(5.71)	4	(2-7)
Inner regional	7.98	(12.03)	5	(2-9)	6.11	(8.18)	4	(2-8)
Outer regional	7.37	(10.05)	5	(2-9)	6.28	(9.62)	4	(2-7)
Remote	5.43	(9.59)	3	(2-6)	4.01	(5.03)	3	(1-5)
Very remote	7.52	(14.50)	4	(2-8)	7.56	(10.81)	4	(2-8)
Socioeconomic advantage								
Least advantaged	7.72	(17.91)	5	(2-8)	6.23	(9.85)	3	(2-7)
Quintile 2	7.67	(12.08)	5	(2-9)	5.98	(6.87)	4	(2-7)
Quintile 3	7.17	(10.31)	5	(2-8)	5.29	(5.67)	3	(2-7)
Quintile 4	7.51	(10.26)	5	(3-9)	6.24	(7.73)	3.5	(2-7)
Most advantaged	8.62	(14.10)	5	(3-9)	5.05	(4.78)	3	(1-6)
Co-morbidity score								
None	7.75	(13.91)	5	(2-9)	6.05	(8.79)	4	(2-7)
One	6.46	(13.86)	4	(2-7)	4.92	(6.28)	3	(1-7)
Two	6.26	(9.46)	4	(2-7)	8.74	(10.03)	5	(3-11)
Three or more	7.80	(11.43)	4	(3-9)	5.45	(7.18)	4	(1-7)
Hospital & health service								
Cairns & Hinterland	6.42	(8.48)	4	(2-7)	5.92	(9.52)	3	(2-7)
Central Queensland	8.83	(19.00)	5	(2-10)	5.85	(7.56)	4	(1-8)
Central West	6.38	(5.39)	5	(3-8)	-	-	-	-
Darling Downs	7.07	(11.87)	4	(2-8)	6.65	(7.66)	5	(3-9)
Gold Coast	5.63	(7.64)	4	(2-6)	5.50	(5.34)	4,5	(1-7)
Mackay	7.10	(9.64)	4	(2-8)	4.16	(3.13)	4	(1-7)
Mater public hospitals	6.78	(9.84)	5	(2-9)	5.10	(2.33)	5.5	(3-7)
Metro North	8.20	(15.13)	5	(2-9)	6.26	(6.97)	4.5	(2-7)
Metro South	6.12	(10.68)	4	(2-7)	4.79	(4.60)	3	(2-7)
North-west	4.30	(6.06)	3	(2-5)	6.07	(9.19)	3	(1-7)
South-west	7.13	(12.58)	4	(2-8)	3.46	(3.20)	3	(1-5)
Sunshine Coast	7.65	(10.89)	5	(3-8)	-	-	-	-
Torres and Cape	3.88	(6.14)	1.5	(1-4)	7.00	(10.76)	4	(1-8)
Townsville	7.50	(11.74)	5	(2-9)	6.45	(10.61)	3	(2-7)
West Moreton	9.17	(38.43)	5	(2-9)	8.59	(8.03)	6	(3-11)
Wide Bay	7.55	(9.82)	5	(2-9)	7.10	(13,51)	3.5	(2-6)
Private	9.03	(10.59)	6	(4-10)	-	-	-	-

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF, excluding those who self-discharged from this admission

In multivariable analysis, age, sex and socioeconomic advantage were not associated with length of stay during first principal CHF admission and the association with remoteness was not clear (Table 55). The average length of stay may be shorter for those with co-morbidity than those without co-morbidity, although the association was not linear. Adjustment for age (Model A), sex, co-morbidity (Model B), and either remoteness and socioeconomic advantage (Model C) or hospital and health service (Model D) did not reduce the re-admission rate ratio of Aboriginal and Torre Strait Islander people and other Queenslanders. A number of hospital and health services had a shorter length of stay on average than Metro North (reference category), though there was no apparent geographical pattern.

In stratified multivariable analysis, age, sex, and socioeconomic status were not associated with length of stay for Aboriginal and Torres Strait Islander or other Queenslanders (Table 56). Co-morbidity may have an inverse effect, although the pattern was not consistent.

Table 55 CHF cohort[1], multivariable analysis[2] of the length of stay during first CHF admission, Queensland 2010-2016

	Model A		Model B		Model C		Model D	
	Ratio	95% CI	Ratio	95% CI	Ratio	95%CI	Ratio	95%CI
Indigenous status[3]	0.81	(0.75-0.88)	0.82	(0.75-0.89)	0.84	(0.77-0.91)	0.89	(0.82-0.98)
Age[4]	1.00	(1.00-1.00)	1.00	(1.00-1.00)	1.00	(1.00-1.00)	1.00	(1.00-1.00)
Sex[5]			0.98	(0.95-1.02)	0.98	(0.95-1.01)	0.98	(0.95-1.02)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One			0.83	(0.76-0.91)	0.84	(0.77-0.92)	0.86	(0.79-0.94)
Two			0.84	(0.76-0.93)	0.84	(0.76-0.93)	0.85	(0.77-0.94)
Three or more			0.99	(0.92-1.06)	0.98	(0.92-1.05)	0.98	(0.92-1.05)
Remoteness								
Major cities					1.00	reference		
Inner regional					1.06	(1.02-1.11)		
Outer regional					0.99	(0.94-1.04)		
Remote					0.71	(0.63-0.81)		
Very remote					1.13	(0.99-1.29)		
Socioeconomic advantage[6]					1.01	(1.00-1.03)		
Hospital & health service								
Cairns & Hinterland							0.79	(0.73-0.86)
Central Queensland							1.06	(0.96-1.17)
Central West							0.78	(0.59-1.03)
Darling Downs							0.86	(0.80-0.93)
Gold Coast							0.69	(0.63-0.74)
Mackay							0.84	(0.76-0.94)
Mater public hospitals							0.82	(0.72-0.93)
Metro North							1.00	reference
Metro South							0.75	(0.70-0.79)
North-west							0.68	(0.57-0.81)
South-west							0.83	(0.69-0.99)
Sunshine Coast							0.93	(0.86-1.01)
Torres and Cape							0.87	(0.69-1.11)
Townsville							0.91	(0.84-1.00)
West Moreton							1.12	(1.02-1.23)
Wide Bay							0.92	(0.85-1.00)
Private							1.09	(1.03-1.15)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF, excluding those who self-discharged
2. negative binomial regression
3. Aboriginal and Torres Strait Islander people compared to other Queenslanders
4. by year of age
5. females compared to males
6. per unit increase in socioeconomic advantage

Table 56 CHF cohort[1], multivariable analysis[2] of length of stay during first CHF admission stratified by Indigenous status, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islanders	
	Ratio[2]	95% CI	Ratio[2]	95% CI
Age at index admission[3]	1.00	(1.00-1.00)	1.00	(1.00-1.01)
Female (c/w male)	0.98	(0.95-1.02)	1.00	(0.85-1.19)
Co-morbidity score				
None	1.00	reference	1.00	reference
One	0.86	(0.78-0.94)	0.85	(0.55-1.31)
Two	0.81	(0.73-0.90)	1.47	(0.95-1.29)
Three or more	0.99	(0.92-1.06)	0.91	(0.70-1.20)
Socioeconomic advantage[4]	1.00	(0.99-1.02)	1.01	(0.92-1.09)
Hospital & health service				
Cairns & Hinterland	0.78	(0.71-0.86)	0.95	(0.66-1.36)
Central Queensland	1.08	(0.98-1.19)	0.96	(0.59-1.55)
Central West	0.77	(0.58-1.03)	1.20	(0.16-9.34)
Darling Downs	0.86	(0.79-0.94)	1.11	(0.72-1.70)
Gold Coast	0.68	(0.63-0.74)	0.90	(0.43-1.88)
Mackay	0.86	(0.77-0.96)	0.68	(0.40-1.16)
Mater public hospitals	0.82	(0.72-0.93)	0.84	(0.40-1.76)
Metro North	1.00	reference	1.00	reference
Metro South	0.75	(0.70-0.79)	0.80	(0.53-1.20)
North-west	0.52	(0.41-0.66)	1.05	(0.70-1.60)
South-west	0.87	(0.72-1.05)	0.56	(0.28-1.11)
Sunshine Coast	0.93	(0.86-1.01)	0.50	(0.13-1.85)
Torres and Cape	0.47	(0.28-0.80)	1.16	(0.77-1.77)
Townsville	0.92	(0.84-1.01)	1.09	(0.73-1.62)
West Moreton	1.12	(1.02-1.24)	1.39	(0.81-2.39)
Wide Bay	0.92	(0.85-1.01)	1.19	(0.68-2.10)
Private	1.09	(1.03-1.15)	0.97	(0.39-2.41)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF excluding those who self-discharged
2. negative binomial regression
3. per year of age
4. per quintile increase in socioeconomic advantage

Generally, the average length of stay was shorter for Aboriginal and Torres Strait Islander people compared to other Queenslanders in all co-morbidity categories, except for those with a Charlson co-morbidity score of two. (Table 57).

Table 57 CHF Cohort[1], length of stay for Aboriginal and Torres Strait Islander people (relative to other Queenslanders) by Charlson co-morbidity score, Queensland 2010-2016

	Other Queenslanders	
Co-morbidity score	Ratio[2]	95% CI
None	0.78	(0.72-0.85)
One	0.76	(0.50-1.17)
Two	1.40	(0.94-2.08)
Three or more	0.70	(0.54-0.90)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF excluding those who self-discharged
2. negative binomial regression

6.5 Time to CHF re-admission

This analysis included members of the CHF cohort aged 25-84 years old who had been admitted with a principal diagnosis of CHF and had not died during their first CHF admission (n=14,302).

Time to re-admission was calculated as the time from discharge from first CHF admission to the next admission with a principal diagnosis of CHF, death, end of follow-up (30 months), or end of the study (31 December 2018), whichever occurred first. The maximum follow-up time was 30 months, with a mean follow-up 20.5 months.

Aboriginal and Torres Strait Islander people had a higher CHF re-admission rate than other Queenslanders (Figure 11). Adjusted for age, 10% of Aboriginal and Torres Strait Islander members people had a CHF re-admission within 1 month after discharge from their first principal CHF admission (Table 58), double that of other Queenslanders. By 30-months, the CHF re-admission rate was 38.7% for Aboriginal and Torres Strait Islander people and 24.6% for other Queenslanders. This suggests that the greatest increase in re-admissions occur within the first few months after discharge from the first CHF admission and the rate then begins to slow down. The CHF re-admission rate for Aboriginal and Torres Strait Islander members of the cohort was higher than for other Queenslanders in all time periods in the first 30 months after discharge from the first principal CHF admission (Table 59). There was no strong evidence that the death rate ratio changed over time; the death rate ratio varied between time periods with overlapping confidence intervals.

Figure 11 CHF cohort, 30-month CHF re-admission rate by Indigenous status

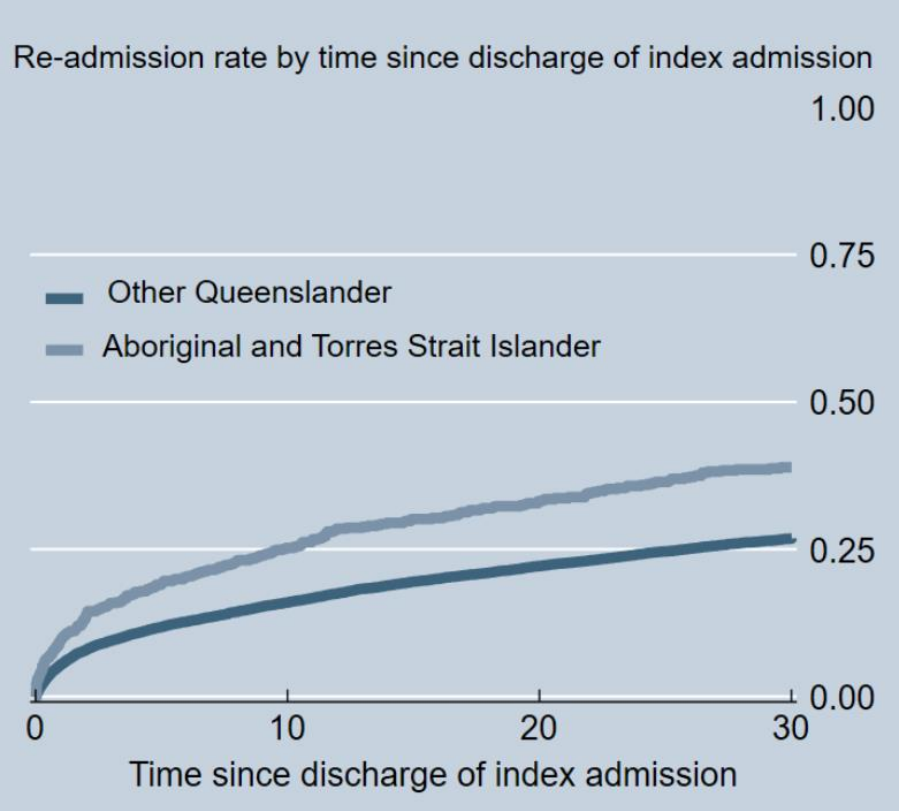


Table 58 CHF cohort[1], cumulative CHF re-admission rate[2] (%) by Indigenous status and time since discharge from first principal CHF admission, Queensland 2010-2016

Month	Other Queenslanders	Aboriginal and Torres Strait Islander
One	4.92	9.54
Six	11.58	20.30
Thirty	24.59	38.72

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF excluding those who died during first index admission
2. Kaplan Meier failure function of the CHF re-admission rate calculated for each follow-up time period, expressed as a proportion (%)

Table 59 CHF cohort[1], cumulative CHF re-admission rate ratio[2] (Aboriginal and Torres Strait Islander people compared to other Queenslanders) by time period after first CHF admission

Time period (months)	Ratio[2]	(95% CI)
0-2	1.57	(1.26-1.97)
3-6	1.31	(0.94-1.82)
7-12	1.93	(1.43-2.62)
13-24	1.18	(0.76-1.85)
25-30	1.56	(1.00-2.43)
0-30	1.78	(1.11-2.88)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF excluding those who died during first index admission
2. Mantel-Haenzel age-adjusted estimate of the re-admission rate ratio, stratified by months after first admission, and for months 0-36 combined

For both Aboriginal and Torres Strait Islander and other Queenslanders, the rate of CHF re-admission increased with increasing co-morbidity, was higher in those who self-discharged from the first CHF admission and lowest in those living in the most socioeconomically advantaged areas (Table 60). For other Queenslanders, the rate of re-admission also increased with increasing age.

In multivariable analysis, CHF re-admission was associated with being Aboriginal and/or Torres Strait Islander, being male and increasing co-morbidity (Table 61). The differential between Aboriginal and Torres Strait Islander and other Queenslanders was largest for females and for those with Charlson co-morbidity scores of one or two. Aboriginal and Torres Strait Islander people had a 56% increased rate of re-admission, adjusted for age (Model A). The Aboriginal and Torres Strait Islander to other Queenslander re-admission rate ratio did not reduce with adjustment for sex and co-morbidity (Model B) but did reduce to 46% with further adjustment for either remoteness and socioeconomic advantage (Model C) and to 41% with hospital and health service, instead of remoteness and socioeconomic advantage (Model D). In stratified multivariable analyses, the excess CHF re-admissions among males was only seen for other Queenslanders and not Aboriginal and Torres Strait Islander people (Table 62). The re-admission ratio for Aboriginal and Torres Strait Islander people to other Queenslanders was 1.18 (95%CI 0.98-1.42) in males and 1.42 (1.19-1.70) for females.

Table 60 CHF cohort[1], cumulative 30-month CHF re-admission rate[2] (%) by Indigenous status and selected demographics, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islander	
	%	95% CI	%	95% CI
Age group				
25-44	22.64	(18.64-27.36)	43.68	(34.52-54.08)
45-64	25.80	(24.12-27.58)	35.34	(30.37-40.86)
65-84	34.31	(33.36-35.28)	42.40	(35.92-49.53)
Sex				
Male	33.49	(32.41-34.61)	37.42	(32.20-43.19)
Female	30.54	(29.30-31.81)	40.21	(35.0-45.78)
Remoteness				
Major cities	31.78	(30.67-32.91)	35.78	(27.96-45.02)
Inner regional	32.70	(31.15-34.31)	28.10	(20.04-38.52)
Outer regional	32.38	(30.35-34.51)	40.95	(34.90-47.62)
Remote	39.00	(32.24-46.63)	46.81	(36.23-58.77)
Very remote	33.35	(25.55-42.75)	42.02	(33.22-52.10)
Socioeconomic advantage				
Least advantaged	32.29	(30.76-33.87)	39.93	(35.01-45.27)
Quintile 2	31.69	(30.08-33.37)	38.60	(31.04-47.28)
Quintile 3	34.38	(32.51-36.32)	39.21	(29.09-51.36)
Quintile 4	33.54	(31.52-35.65)	36.53	(24.16-52.63)
Most advantaged	27.63	(25.29-30.14)	24.24	(9.68-53.10)
Co-morbidity score				
None	31.57	(30.70-32.46)	35.61	(31.65-39.92)
One	30.57	(26.64-34.92)	46.87	(29.87-67.61)
Two	36.75	(31.91-42.06)	53.35	(33.88-75.48)
Three or more	42.07	(38.38-45.98)	58.63	(46.41-71.31)
Self-discharged from first admission				
No	32.18	(31.35-33.01)	38.64	(34.88-42.65)
Yes	40.75	(31.97-50.90)	48.40	(27.27-74.71)
Hospital and Health service area				
Cairns & Hinterland	35.81	(31.91-40.04)	39.71	(32.37-48.04)
Central Queensland	33.40	(29.04-38.25)	20.80	(9.89-40.69)
Central West	28.15	(16.99-44.38)	(-.-)	(-.-)
Darling Downs	35.13	(31.69-38.84)	50.13	(37.15-64.74)
Gold Coast	30.80	(27.74-34.11)	22.22	(6.07-63.52)
Mackay	32.01	(27.17-37.46)	26.43	(12.81-49.70)
Mater public hospitals	30.46	(24.99-36.80)	41.67	(17.93-77.02)
Metro North	31.95	(29.87-34.13)	38.57	(25.25-55.77)
Metro South	34.05	(31.92-36.29)	35.62	(25.42-48.39)
North-west	34.92	(25.57-46.46)	47.52	(36.17-60.38)
South-west	33.86	(25.40-44.18)	42.31	(19.92-74.38)
Sunshine Coast	31.62	(28.40-35.10)	33.33	(5.48-94.59)
Torres and Cape	20.00	(6.93-50.02)	43.48	(31.20-58.12)
Townsville	28.86	(25.05-33.12)	45.54	(35.15-57.38)
West Moreton	34.58	(30.45-39.10)	27.57	(12.36-54.57)
Wide Bay	30.49	(27.08-34.22)	16.49	(5.61-43.02)
Private	31.17	(29.57-32.85)	0.00	(-.-)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF excluding those who died during first index admission

2. Kaplan Meier fatality function for stroke re-admission (expressed as a percentage)

Table 61 CHF cohort[1], multivariable analysis[2], time to CHF re-admission, 2010-2016, Queensland

	Model A		Model B		Model C		Model D	
	Ratio	95% CI	Ratio	95% CI	Ratio	95%CI	Ratio	95%CI
Indigenous status[3]	1.56	(1.36-1.78)	1.56	(0.36-1.78)	1.46	(1.27-1.68)	1.41	(1.22-1.63)
Age[4]	1.02	(1.01-1.02)	1.02	(1.01-1.02)	1.02	(1.01-1.02)	1.02	(1.01-1.02)
Sex[5]			0.88	(0.83-0.94)	0.88	(0.83-0.94)	0.88	(0.83-0.94)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One			0.99	(0.84-1.16)	0.99	(0.84-1.16)	0.98	(0.83-1.15)
Two			1.21	(1.02-1.43)	1.20	(1.02-1.43)	1.21	(1.03-1.44)
Three or more			1.39	(1.24-1.56)	1.39	(1.24-1.56)	1.39	(1.02-.56)
Remoteness[6]					1.05	(1.01-1.09)		
Socioeconomic advantage[7]					0.99	(0.97-1.02)		
Hospital & health service								
Cairns & Hinterland							1.20	(1.03-1.39)
Central Queensland							1.05	(0.87-1.26)
Central West							0.81	(0.46-1.44)
Darling Downs							1.16	(1.01-1.34)
Gold Coast							0.93	(0.81-1.08)
Mackay							1.01	(0.82-1.23)
Mater public hospitals							0.96	(0.76-1.21)
Metro North							1.00	reference
Metro South							1.10	(0.98-1.23)
North-west							1.37	(1.04-1.80)
South-west							1.12	(0.81-1.56)
Sunshine Coast							0.95	(0.82-1.10)
Torres and Cape							1.26	(0.84-1.89)
Townsville							0.96	(0.81-1.13)
West Moreton							1.09	(0.92-1.30)
Wide Bay							0.93	(0.79-1.09)
Private							0.90	(0.81-1.00)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF, excluding those who died during their first index admission
2. Cox proportional hazards regression
3. Aboriginal and Torres Strait Islander people compared to other Queenslanders
4. by year of age
5. females compared to males
6. per unit increase in socioeconomic advantage

Table 62 CHF cohort[1], multivariable analysis[2] of time to CHF re-admission[3], stratified by Indigenous status, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islanders	
	Ratio[2]	95% CI	Ratio[2]	95% CI
Age at index admission[4]	1.02	(1.02-1.02)	1.00	(0.99-1.01)
Female (c/w male)	0.87	(0.81-0.92)	1.06	(0.82-1.37)
Co-morbidity score				
None	1.00	reference	1.00	reference
One	0.95	(0.80-1.12)	1.42	(0.78-2.57)
Two	1.19	(1.00-1.41)	1.63	(0.88-3.02)
Three or more	1.35	(1.20-1.53)	0.71	(1.19-2.46)
Socioeconomic advantage[5]	0.99	(0.98-1.01)	0.99	(0.93-1.06)
Hospital & health service[6]				
Cairns & Hinterland	1.20	(1.02-1.41)	1.01	(0.57-1.79)
Central Queensland	1.10	(0.92-1.33)	0.44	(0.17-1.14)
Central West	0.84	(0.48-1.79)	-.-	(-.-)
Darling Downs	1.12	(0.67-1.30)	1.34	(0.70-2.56)
Gold Coast	0.94	(0.82-1.09)	0.47	(0.11-2.09)
Mackay	1.04	(0.84-1.28)	0.65	(0.25-1.70)
Mater public hospitals	0.95	(0.74-1.21)	1.32	(0.43-4.09)
Metro North	1.00	reference	1.00	reference
Metro South	1.11	(0.99-1.24)	0.89	(0.47-1.70)
North-west	1.19	(0.82-1.74)	1.27	(0.67-2.39)
South-west	1.11	(0.78-1.57)	1.06	(0.38-2.93)
Sunshine Coast	0.94	(0.81-7.10)	1.04	(0.14-7.91)
Torres and Cape	0.65	(0.21-2.01)	1.28	(0.66-2.50)
Townsville	0.88	(0.73-1.06)	1.28	(0.69-2.35)
West Moreton	1.10	(0.93-1.32)	0.67	(0.24-1.88)
Wide Bay	0.93	(0.79-1.10)	0.40	(0.12-1.40)
Private	0.90	(0.81-1.00)	-.-	(-.-)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of CHF, excluding those who died during their first index admission
2. Cox proportional hazard regression
3. time from separation of index CHF admission to admission of next CHF admission
4. per year of age
5. per quintile increase in socioeconomic advantage
6. cell counts not reported where cases are <10

7 STROKE

7.1 Key findings

1. The stroke death rate for Aboriginal and Torres Strait Islander people was similar to that for other Queenslanders, both in-hospital and after discharge.

2. Length of stay was longer, on average, for Aboriginal and Torres Strait Islander people compared to other Queenslanders, especially for those living in the most socioeconomic advantaged areas.

3. The rate of re-admission for stroke was higher for Aboriginal and Torres Strait Islander people compared to other Queenslanders, and this was partially explained by where people live.

7.2 The Stroke cohort

The stroke cohort consisted of 31,614 Queenslanders aged 25 years and older who were admitted to a Queensland hospital between 1 July 2010 and 30 June 2016 with a diagnosis of stroke as the principal or a secondary diagnosis code. Of these, 882 (2.8%) were Aboriginal and/or Torres Strait Islander people. People for whom their first stroke admission was for palliative care or with missing data on Indigenous status were excluded.

The majority of cohort members were men, but for Aboriginal and Torres Strait Islander people the majority were women (Table 63). A higher proportion of Aboriginal and Torres Strait Islander than other Queenslanders were in younger age-groups, lived in northern and western Queensland and in areas there are more remote and less advantaged. Thirty-nine percent of other Queenslanders had private health insurance, compared to five percent of Aboriginal and Torres Strait Islander people. A higher proportion of Aboriginal and Torres Strait Islander people self-discharged from hospital, although this was uncommon in both groups.

The proportion of people with co-morbid conditions was higher for Aboriginal and Torres Strait Islander than other Queenslanders, except in the 85+ age-group (Table 64).The most common co-morbidities among Aboriginal and Torres Strait Islander people were renal disease, CHF, myocardial infarction, other cerebrovascular conditions, and pulmonary disease; Aboriginal and Torres Strait Islander people had a higher prevalence of each of these conditions compared to other Queenslanders (Figure 12). Other Queenslanders had a greater prevalence of cancer and dementia than Aboriginal and Torres Strait Islander people hospitalised for stroke.

Table 63 Demographic characteristics (%), Stroke cohort

	Other Queenslander N=30,732	Aboriginal and Torres Strait Islander N=882
Sex		
Male	53.3	46.5
Female	46.7	53.5
Age-group		
25-44	4.4	15.0
45-64	20.8	51.8
65-84	51.0	29.0
85-99	23.8	4.2
Hospital and health service		
Cairns & Hinterland	4.3	24.3
Central Queensland	3.2	5.4
Central West	0.2	0.2
Darling Downs	5.0	5.3
Gold Coast	8.0	1.8
Mackay	2.4	2.8
Mater public hospitals	1.4	1.6
Metro North	15.8	8.3
Metro South	14.2	9.6
North-west	0.3	7.8
South-west	0.5	2.2
Sunshine Coast	9.2	2.8
Torres and Cape	0.1	6.7
Townsville	4.3	13.5
West Moreton	3.5	2.8
Wide Bay	6.0	3.3
Private	21.5	1.5
Remoteness		
Major Cities	56.2	19.4
Inner Regional	28.3	17.6
Outer Regional	13.8	37.5
Remote	0.9	11.3
Very Remote	0.8	14.2
Socioeconomic advantage		
Least advantaged	26.0	50.3
Quintile 2	23.6	22.9
Quintile 3	19.9	15.4
Quintile 4	17.3	7.7
Most advantaged	13.3	3.6
Health insurance		
Insured	39.2	4.6
Not insured	58.5	90.9
Other	2.4	4.4
Self-discharge		
No	99.4	98.9
Self-discharged	0.6	1.1

Figure 12 Stroke cohort, most common co-morbidities (%), by Indigenous status, Queensland 2010-2016

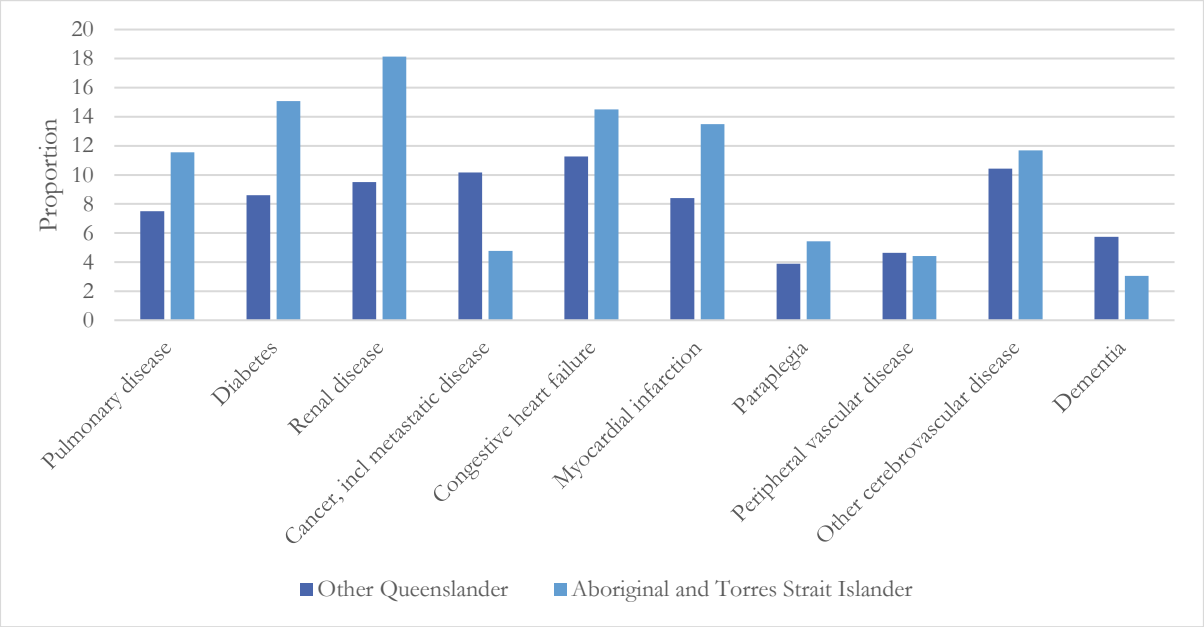


Table 64 Stroke cohort, proportion (%) with co-morbid conditions by age-group, Queensland 2016-2010

	One or two		Three or more	
Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander	Other Queenslanders	Aboriginal & Torres Strait Islander
25-44	14.1	25.0	7.3	12.1
45-64	20.4	30.9	11.6	24.3
65-84	28.4	26.6	19.7	34.0
85+	33.8	32.4	23.4	24.3

Footnotes

7.3 Death in hospital

The proportion of people who died in hospital during their first stroke admission was higher for older than younger age-groups, for both deaths from stroke and from other causes (Table 65); there was no consistent difference between Aboriginal and Torres Strait Islander people and other Queenslanders.

Table 65 Stroke cohort, proportion (%) who died in hospital during first IHD admission, Queensland 2010-2016

	Died from stroke		Died from other cause	
Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander	Other Queenslanders	Aboriginal & Torres Strait Islander
25-44	2.3	4.5	7.1	8.3
45-64	2.8	2.4	7.3	7.2
65-84	7.2	6.6	10.0	13.3
85+	16.7	10.8	14.7	16.2

7.3.1 In-hospital deaths from stroke

In multivariable analysis (Table 66), the proportion of people who died from stroke during their first hospital admission: was similar for females and males; similar for Aboriginal and Torres Strait Islander as other Queenslanders; increased with increasing age and with increasing number of co-morbid conditions; and was not strongly association with remoteness but decreased with increasing socioeconomic advantage (Model C). The proportion varied between hospital and health services, but this variation was consistent with random variation (wide confidence intervals that included 1.0) except for private hospitals and the Sunshine Coast, both of which had lower in-hospital stroke fatality than other hospital and health services (Model D).

Table 66 Stroke cohort[1], multivariable analysis[2] of the proportion who died from stroke during their first stroke admission, Queensland 2010-2016

	Model A		Model B		Model C		Model D	
	Ratio		Ratio		Ratio		Ratio	
Indigenous status[3]	1.11	(0.79-1.55)	1.04	(0.74-1.45)	0.96	(0.68-1.36)	0.97	(0.68-1.37)
Age[4]	1.05	(1.04-1.06)	1.05	(1.04-1.05)	1.05	(1.04-1.05)	1.05	(1.04-1.06)
Sex[5]			1.04	(0.94-1.16)	1.04	(0.94-1.16)	1.05	(0.95-1.17)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One or two			1.19	(1.06-1.34)	1.19	(1.05-1.34)	1.20	(1.06-1.35)
Three or more			1.43	(1.26-1.62)	1.42	(1.25-1.61)	1.43	(1.26-1.63)
Remoteness[6]					1.04	(0.98-1.11)		
Socioeconomic advantage[7]					0.96	(0.93-1.00)		
Hospital & health service								
Cairns & Hinterland							1.01	(0.78-1.30)
Central Queensland							0.79	(0.57-1.10)
Central West							0.64	(0.21-1.93)
Darling Downs							1.07	(0.85-1.36)
Gold Coast							1.12	(0.91-1.36)
Mackay							1.52	(1.15-2.01)
Mater public hospitals							0.72	(0.44-1.18)
Metro North							1.00	reference
Metro South							0.94	(0.78-1.12)
North-west							0.81	(0.37-1.77)
South-west							0.81	(0.40-1.66)
Sunshine Coast							0.71	(0.57-0.89)
Torres and Cape							0.91	(0.34-2.43)
Townsville							1.23	(0.97-1.56)
West Moreton							0.83	(0.61-1.14)
Wide Bay							0.91	(0.72-1.14)
Private							0.61	(0.51-0.73)

1. Aged 25-84 at their first IHD admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. Per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

7.3.2 In-hospital deaths from other causes

Like in-hospital stroke deaths, the proportion who died during their first stroke admission from causes other than stroke (Table 67) was: similar for Aboriginal and Torres Strait Islander as other Queenslanders; increased with increasing age and level of co-morbidity; and was not strongly associated with remoteness (Model C). The proportion who died of other causes was slightly higher for women but not associated with socioeconomic advantage (Model C). It was lower than the reference category (Metro North) for several hospital and health services (Darling Downs, Gold Coast, Mackay, Mater public hospitals, West Moreton, Wide Bay and private hospitals) (Model D).

Table 67 Stroke cohort[1], multivariable analysis[2] of the proportion who died from other causes during their first stroke admission, Queensland 2010-2016

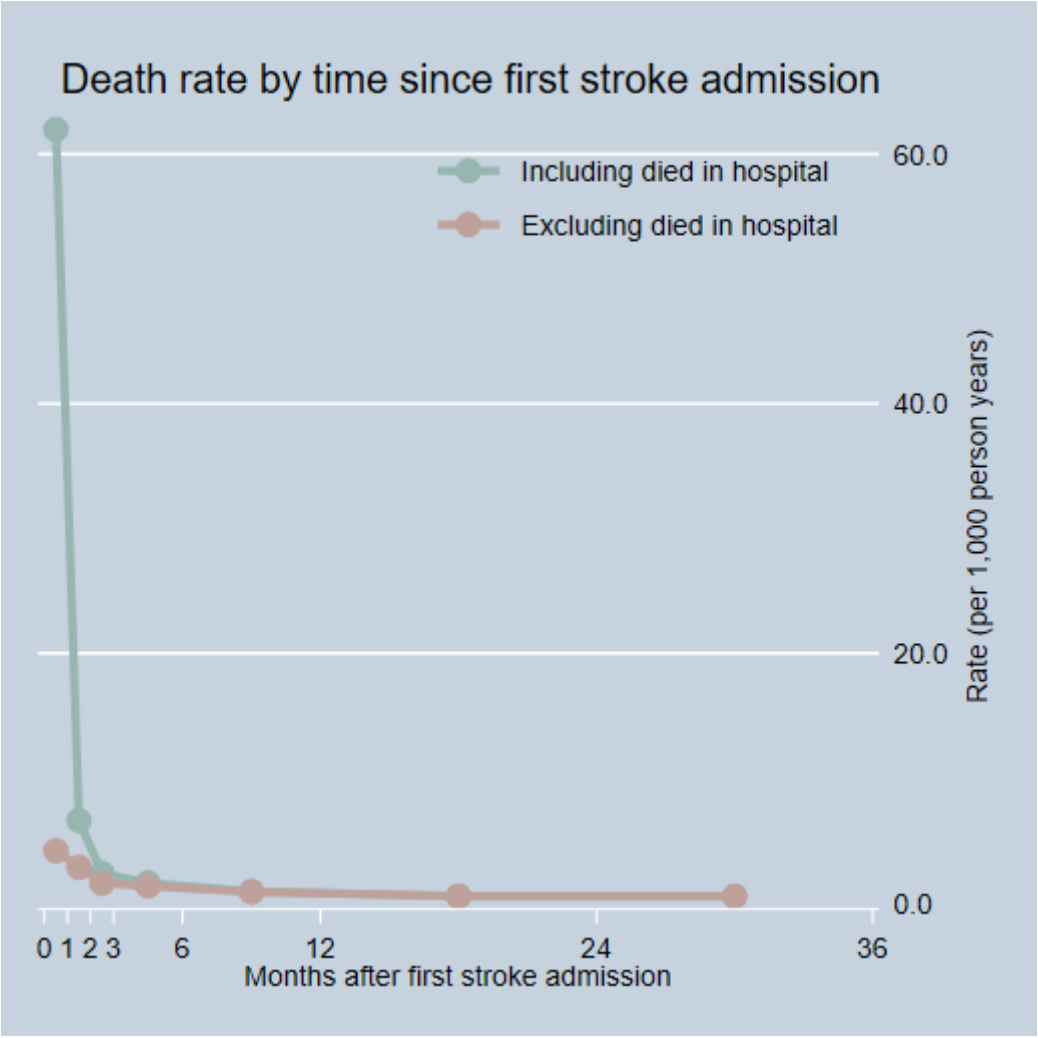
	Model A		Model B		Model C		Model D	
	Ratio		Ratio		Ratio		Ratio	
Indigenous status[3]	1.18	(0.95-1.47)	0.96	(0.77-1.19)	0.90	(0.72-1.13)	0.91	(0.73-1.15)
Age[4]	1.02	(1.01-1.02)	1.01	(1.00-1.01)	1.01	(1.00-1.01)	1.01	(1.01-1.01)
Sex[5]			1.10	(1.01-1.19)	1.10	(1.02-1.19)	1.10	(1.02-1.19)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One or two			1.65	(1.49-1.83)	1.65	(1.49-1.82)	1.65	(1.50-1.83)
Three or more			3.13	(2.85-3.44)	3.12	(2.84-3.43)	3.13	(2.84-3.44)
Remoteness[6]					1.04	(0.99-1.09)		
Socioeconomic advantage[7]					0.98	(0.95-1.01)		
Hospital & health service								
Cairns & Hinterland							0.96	(0.79-1.16)
Central Queensland							0.80	(0.63-1.01)
Central West							0.85	(0.40-1.78)
Darling Downs							0.80	(0.65-0.97)
Gold Coast							0.78	(0.65-0.92)
Mackay							0.73	(0.54-0.97)
Mater public hospitals							0.57	(0.37-0.87)
Metro North							1.00	reference
Metro South							1.05	(0.93-1.20)
North-west							1.10	(0.70-1.73)
South-west							0.72	(0.40-1.29)
Sunshine Coast							0.89	(0.76-1.04)
Torres and Cape							0.69	(0.32-1.51)
Townsville							1.04	(0.86-1.25)
West Moreton							0.75	(0.58-0.96)
Wide Bay							0.67	(0.55-0.82)
Private							0.70	(0.61-0.80)

1. Aged 25-84 at their first STROKE admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. Per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

7.4 Death after discharge from hospital

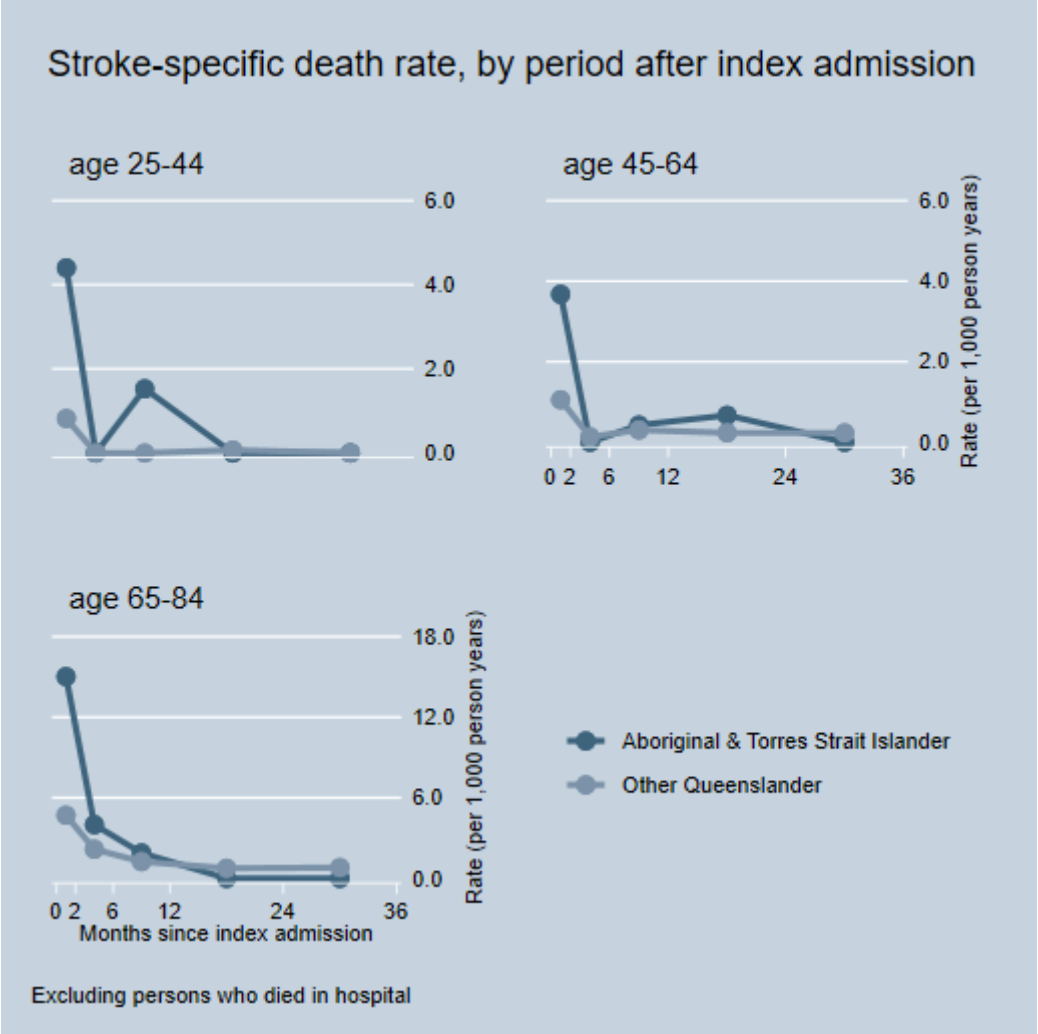
The stroke-specific death rate was much higher in the first month after first stroke admission than in subsequent months (Figure 13). Most deaths in the first month occurred in hospital. When deaths in hospital were excluded, the death rate in the first month remained higher than subsequent periods; the death rate decreased over several months and plateaued at a much lower rate after 6 months. This pattern of higher but decreasing death rates in the first several months occurred for both Aboriginal and Torres Strait Islander and other Queenslanders and in all age-groups (Figure 14).

Figure 13 Stroke cohort[1], stroke death rate by period after first stroke admission, Queensland 2010-2016



1. Aboriginal & Torres Strait Islander people and other Queenslanders combined, aged 25-84 years.

Figure 14 Stroke cohort, stroke death rate by period after first stroke admission, Queensland 2010-2016



The proportion of people who died from stroke after their first stroke admission increased with increasing age and was higher for Aboriginal and Torres Strait Islander than other Queenslanders at each age (Table 68). The difference was greater (relatively) at age 35 than at age 75.

Table 68 Stroke cohort[1], cumulative stroke fatality[2] (%) at 1, 6 and 36 months after first stroke admission by Indigenous status and selected ages, Queensland 2010-2016

	Other Queenslander			Aboriginal and Torres Strait Islander		
Time after first admission	Age (years)			Age (years)		
(months)	35	55	75	35	55	75
One	0.6	2.1	7.1	2.0	4.1	8.0
Six	0.8	2.6	8.7	2.5	4.9	9.5
Thirty six	1.0	3.3	10.9	2.9	5.7	11.1

1. aged 25-84 years, excluding those who died during first IHD admission.
2. Aalen-Nelson estimate of cumulative fatality (expressed as a percentage) age-adjusted and estimated for selected ages

The stroke-specific death rate for Aboriginal and Torres Strait Islanders was four times higher than for other Queenslanders during the first two months after the first stroke admission. The rate ratio decreased thereafter with wide confidence intervals that included 1.0 providing no strong evidence that the excess persisted after the first two months (Table 69).

Table 69 Stroke cohort[1], stroke-specific death rate ratio[2] (Aboriginal and Torres Strait Islander compared to other Queenslanders) by time period after first stroke admission

Time period (months)	Ratio[2]	(95% CI)
0-2	**4.49**	**(2.28-8.84)**
3-6	**2.29**	**(0.72-7.25)**
7-12	**2.50**	**(0.87-7.19)**
13-24	**1.37**	**(0.41-4.53)**
25-36	**0.00**	**(.-.)**

1. Excluding those aged 85 and over at the time of first stroke admission and those who died in hospital during first stroke admission

2. Mantel-Haenzel age-adjusted estimate of the death rate ratio, stratified by months after first admission

In separate multivariable analysis (Table 70), for Aboriginal and Torres Strait Islander and other Queenslanders, the stroke-specific death rate increased with increasing age and with increasing number of co-morbid conditions, and was not associated with socioeconomic advantage. For other Queenslanders, the death rate was lower for those admitted to private hospitals and the Sunshine Coast than other hospital and health services; comparison of death rates for hospital and health services was not reliable for Aboriginal and Torres Strait Islander people because of the small number of people treated by individual services. In multivariable analysis for the two groups combined, (Table 71) the death rate was 37% higher for Aboriginal and Torres Strait Islander than other Queenslanders when adjusted only for age (Model A); this disparity was partially reduced when also adjusted for number of co-morbid conditions (Model B), with little further reduction when also adjusted for other factors (Model C).

Table 70 Stroke cohort[1], multivariable analysis[2] of death rate in 36 months after discharge from first stroke admission[3], stratified by Indigenous status.

	Other Queenslanders		Aboriginal & Torres Strait Islanders	
	Ratio[2]		Ratio[2]	
Age at index admission[4]	1.06	(1.06-1.07)	1.03	(1.00-1.05)
Sex[5]	1.16	(1.06-1.27)	0.62	(0.35-1.08)
Co-morbidity score				
None	1.00	reference	1.00	reference
One or two	1.30	(1.17-1.45)	1.00	(0.48-2.08)
Three or more	1.65	(1.47-1.85)	2.20	(1.16-4.15)
Self-discharge	0.34	(0.13-0.92)	0.00	(.-.)
Socioeconomic advantage[6]	0.98	(0.94-1.01)	0.85	(0.62-1.15)
Hospital & health service				
Cairns & Hinterland	1.01	(0.80-1.27)	2.14	(0.48-9.59)
Central Queensland	0.92	(0.70-1.20)	2.97	(0.49-17.94)
Central West	0.89	(0.40-2.00)	.[7]	(.-.)
Darling Downs	1.03	(0.83-1.27)	2.77	(0.50-15.42)
Gold Coast	1.02	(0.85-1.23)	6.29	(0.86-46.00)
Mackay	1.30	(0.99-1.70)	4.28	(0.59-30.78)
Mater public hospitals	0.65	(0.42-1.02)	3.31	(0.29-37.34)
Metro North	1.00	reference	1.00	reference
Metro South	0.98	(0.84-1.14)	1.29	(0.21-7.73)
North-west	0.63	(0.23-1.68)	2.54	(0.46-14.08)
South-west	0.55	(0.24-1.23)	6.07	(1.00-36.73)
Sunshine Coast	0.70	(0.57-0.85)	0.00	(.-.)
Torres and Cape	0.93	(0.23-3.75)	1.94	(0.34-11.04)
Townsville	1.11	(0.88-1.38)	2.38	(0.49-11.54)
West Moreton	0.87	(0.66-1.13)	1.51	(0.14-16.89)
Wide Bay	0.85	(0.69-1.06)	2.73	(0.44-16.96)
Private	0.58	(0.49-0.68)	0.00	(.-.)

1. aged 24-84 at first IHD admission
2. Cox proportional hazard regression
3. i.e. excluding those who died during first admission
4. per year of age
5. female compared with male
6. per quintile increase in socioeconomic advantage
7. result not reported as result is based on less than 10 cases

Table 71 Stroke cohort[1], multivariable analysis[2] of the stroke death rate in the 36 months after first stroke admission, Queensland 2010-2016

	Model A		Model B		Model C	
	Ratio		Ratio		Ratio	
Indigenous status[3]	1.37	(1.04-1.80)	1.23	(0.93-1.62)	1.16	(0.87-1.54)
Age[4]	1.06	(1.06-1.07)	1.06	(1.05-1.06)	1.06	(1.05-1.06)
Se5[4]			1.13	(1.03-1.24)	1.13	(1.03-1.24)
Co-morbidity score						
None			1.00	reference	1.00	reference
One or two			1.29	(1.16-1.43)	1.29	(1.16-1.43)
Three or more			1.65	(1.48-1.85)	1.65	(1.47-1.84)
Self-discharge					0.35	(0.13-0.94)
Remoteness[6]					1.02	(0.97-1.08)
Socioeconomic advantage[7]					0.96	(0.93-0.99)

1. Aged 25-84 at their first stroke admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. Per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

7.5 Length of stay for first stroke admission

This analysis included members of the stroke cohort aged 25-84 years old who were admitted with a principal diagnosis of stroke and did not self-discharge from their first stroke hospital admission (n=19,251). The median length of stay was shorter for those who self-discharged than those who did not only for other Queenslanders, and not for Aboriginal and Torres Strait Islander people (Table 72).

Table 72 Stroke Cohort, length of stay by Indigenous status and reason for discharge

	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
Self-discharged	14.70	(36.41)	5	(1-15)	23.32	(62.59)	6.5	(3-17)
Other discharge reason	21.59	(38.94)	7	(3-25)	6.04	(8.61)	6	(2-25)

The cohort included 661 (3.4%) Aboriginal and Torres Strait Islander people. Overall, the median length of stay at first stoke admission was seven days (IQR 3-25 days). For Aboriginal and Torres Strait Islander people, length of stay increased with increasing age, was shorter in remote and very remote areas and longer in the most socioeconomic advantaged areas and for members of the cohort with a Charlson co-morbidity score of three or more (Table 73). For other Queenslanders, length of stay was longer for the oldest age group (65-84 years) than younger age groups, for females than males and people with Charlson co-morbidity scores of three or more, and was shorter for people living in very remote and the most socioeconomic advantaged areas. The differential between Aboriginal and Torres Strait Islander people and other Queenslanders was almost entirely restricted to the most advantaged socioeconomic quintile of place of residence (Table 74).

Table 73 Stroke cohort, average length of stay for first stroke admission, by Indigenous status and select demographics

	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
Age group								
25-44	17.57	(49.42)	5	(2-13)	24.83	(60.87)	5	(2-21)
45-64	21.89	(49.63)	5	(2-19)	25.42	(74.35)	6	(2-22)
65-84	21.72	(33.28)	8	(3-27)	26.90	(21.96)	9	(3-31)
Sex								
Male	21.49	(41.26)	7	(3-24)	27.97	(82.88)	6	(2-25)
Female	21.66	(35.44)	8	(3-26)	23.81	(47.31)	6	(2-25)
Remoteness								
Major cities	22.31	(37.86)	7	(3-27)	21.19	(30.43)	7	(2.5-35.5)
Inner regional	19.67	(35.36)	7	(3-23)	21.97	(50.93)	6	(2-22)
Outer regional	22.81	(44.43)	7	(3-22)	30.76	(87.39)	6.5	(3-28.5)
Remote	17.14	(35.16)	5	(2-14)	23.37	(60.79)	4	(2-22)
Very remote	20.73	(86.90)	3.5	(0-9.5)	25.08	(58.16)	5	(1-17)
Socioeconomic advantage								
Least advantaged	22.20	(42.73)	7	(3-25)	25.56	(57.22)	6	(2-23.5)
Quintile 2	21.19	(39.83)	7	(3-24)	25.04	(90.61)	6	(2-17)
Quintile 3	20.16	(30.27)	6	(3-23)	20.42	(32.82)	6	(3-27)
Quintile 4	21.88	(38.05)	7	(3-25)	23.74	(32.71)	6	(3-36)
Most advantaged	22.64	(36.75)	4	(4-27)	70.00	(157.11)	30	(3.5-50.5)
Co-morbidity score								
Score 0	22.14	(40.67)	7	(3-25)	26.77	(76.86)	6	(2-24)
Score 1	21.50	(34.64)	7	(3-26)	21.47	(35.72)	6	(2-27)
Score 2	18.78	(31.62)	7	(3-22)	18.13	(25.58)	6	(2-27.5)
Score 3+	21.01	(39.93)	8	(3-24)	30.39	(73.48)	8	(3-24)

1.Queensland residents aged 25-84 at first admission with principal diagnosis of stroke, excluding those who self-discharged

Table 74 Stroke Cohort[1], length of stay for Aboriginal and Torres Strait Islander people (relative to other Queenslanders) by area-level socioeconomic quintile, Queensland 2010-2016

Index of relative advantage and disadvantage quintile	Ratio[2]	95% CI
Least advantaged	1.15	(0.99-1.34)
Quintile 2	1.18	(0.94-1.48)
Quintile 3	1.01	(0.79-1.30)
Quintile 4	1.08	(0.77-1.52)
Most advantaged	3.09	(1.79-5.32)

1.Queensland residents aged 25-84 at first admission with principal diagnosis of stroke, excluding those who self-discharged

In multivariable analysis, adjustment for age (Table 75, Model A), sex, co-morbidity (Model B), and either remoteness and socioeconomic advantage (Model C) or hospital and health service (Model D) did not reduce the ratio (for Aboriginal and Torres Strait Islander people compared to other Queenslanders) for length of stay during first principal stroke admission. Compared to Metro North (reference category) almost all hospital and health services had a significantly lower ratio for length of stay, although some differences were small and/or not significant.

Table 75 Stroke cohort[1], multivariable analysis[2] of length of stay during first stroke admission, Queensland 2010-2016

	Model A		Model B		Model C		Model D	
	Ratio	95% CI	Ratio	95% CI	Ratio	95%CI	Ratio	95%CI
Indigenous status[3]	1.22	(0.10-1.35)	1.23	(1.11-1.37)	1.23	(1.10-1.37)	1.22	(1.01-1.37)
Age[4]	1.00	(1.00-1.00)	1.00	(1.00-1.00)	1.00	(1.00-1.00)	1.00	(1.00-1.01)
Sex[4]			1.00	(0.96-1.03)	1.00	(0.96-1.03)	1.01	(0.97-1.04)
Co-morbidity score								
Score 0			1.05	(1.00-1.11)	1.05	(1.00-1.11)	1.05	(0.99-1.11)
Score 1			1.01	(0.94-1.08)	1.01	(0.94-1.08)	1.02	(0.95-1.09)
Score 2			0.88	(0.71-0.95)	0.88	(0.81-0.95)	0.89	(0.83-0.96)
Score 3+			1.00	reference	1.00	reference	1.00	reference
Remoteness								
Major cities					1.10	(0.93-1.30)		
Inner regional					0.95	(0.81-1.12)		
Outer regional					1.13	(0.96-1.34)		
Remote					0.89	(0.71-1.11)		
Very remote					1.00	reference		
Socioeconomic advantage								
Least advantaged					1.03	(0.96-1.10)		
Quintile 2					0.96	(0.90-1.03)		
Quintile 3					0.90	(0.84-0.97)		
Quintile 4					0.96	(0.89-1.03)		
Most advantaged					1.00	reference		
Hospital & health service[6]								
Cairns & Hinterland							0.98	(0.89-1.08)
Central Queensland							0.71	(0.64-0.79)
Central West							0.71	(0.51-0.98)
Darling Downs							0.78	(0.71-0.85)
Gold Coast							0.86	(0.79-0.93)
Mackay							0.62	(0.54-0.70)
Mater public hospitals							0.73	(0.61-0.85)
Metro North							1.00	reference
Metro South							1.01	(0.95-1.09)
North-west							0.53	(0.42-0.67)
South-west							0.72	(0.56-0.91)
Sunshine Coast							0.74	(0.69-0.80)
Torres and Cape							0.61	(0.45-0.83)
Townsville							1.00	(0.91-1.11)
West Moreton							0.83	(0.75-0.92)
Wide Bay							0.73	(0.67-0.80)
Private							0.58	(0.54-0.62)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of stroke, excluding those who self-discharged
2. negative binomial regression
3. Aboriginal and Torres Strait Islander people compared to other Queenslanders
4. by year of age
5. females compared to males
6. per unit increase in socioeconomic advantage

7.6 Time to stroke re-admission

This analysis included members of the stroke cohort aged 25-84 years old who had been admitted with a principal diagnosis of stroke and had not died during their first stroke admission (n=17,289). 611 (3.5%) Aboriginal and Torres Strait Islander people were included in this cohort.

In total, 2,897 (16.7%) of the stroke cohort had a re-admission with a diagnosis of stroke during the follow-up period. A higher proportion of Aboriginal and Torres Strait Islander people than other Queenslanders had stroke re-admission (22.1% vs. 16.6%), and this was seen across age groups (Table 76). The difference was greatest in the 25-44 age group.

Table 76 Stroke cohort, proportion (%) who had a stroke re-admission

Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander
25-44	13.86	23.81
45-64	15.78	22.80
65-84	17.13	19.63

Time to re-admission was calculated as the time from discharge from first stroke admission to the next admission with a principal diagnosis of stroke, death, end of follow-up (30 months), or end of the study (31 December 2018), whichever occurred first. The maximum follow-up time was 30 months, with a mean follow-up of 24.5 months. Aboriginal and Torres Strait Islander people had a higher stroke re-admission rate than other Queenslanders (Figure 15). There was sharp rise in the number of stroke re-admissions in the first months after discharge from the first stroke admission and then the rate of re-admission slowed (Table 77). By 30 months, 19.1% of Aboriginal and Torres Strait Islander people and 13.1% of other Queenslanders had a stroke re-admission. Generally, the re-admission rate for Aboriginal and Torres Strait Islander members of the cohort was higher than for other Queenslanders across the 30 months follow-up (Table 78). There was no strong evidence that the stroke re-admission rate ratio changed over time; the rate ratio varied between time periods with overlapping confidence intervals.

Figure 15 Stroke cohort, 30-month Stroke re-admission rate by Indigenous status

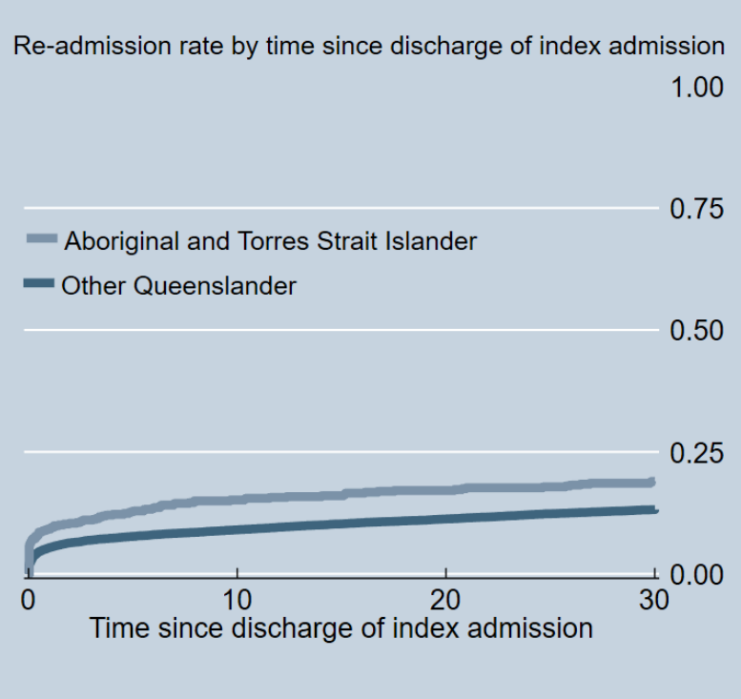


Table 77 Stroke cohort[1], stroke cumulative re-admission rate[2] (%) by Indigenous status and time since discharge from first principal stroke admission

Month	Other Queenslanders	Aboriginal and Torres Strait Islander
1	5.31	9.25
6	7.96	13.66
30	13.05	19.06

1. Queensland residents aged 25-84 years and excluding those who died in hospital during first stroke admission
2. Kaplan Meier failure function of the stroke re-admission rate calculated for each follow-up time period, expressed as a proportion (%)

Table 78 Stroke cohort[1], stroke re-admission rate ratio[2] (Aboriginal and Torres Strait Islander people compared to other Queenslanders) by time period after first stroke admission

Time period (months)	Ratio[2]	(95% CI)
0-2	1.45	(1.13-1.88)
3-6	2.08	(1.28-3.35)
7-12	1.81	(0.99-3.31)
13-24	1.01	(0.55-1.87)
25-30	2.01	(0.90-4.49)
0-30	1.52	(1.26-1.85)

1. Queensland residents aged 25-84 years and excluding those who died in hospital during first stroke admission
2. Mantel-Haenzel age-adjusted estimate of the re-admission rate ratio, stratified by months after first admission, and for months 0-36 combined

A lower proportion of females to males had a stroke re-admission, with the difference greater among Aboriginal and Torres Strait Islander than other Queenslanders (Table 79). For both groups, the re-admission rate increased with increasing remoteness. There was no strong evidence that age, socioeconomic status and co-morbidity were associated with stroke re-admission.

In multivariable analysis, stroke re-admission was associated with being Aboriginal and/or Torres Strait Islander, being male, and increasing co-morbidity and remoteness (Table 80). Aboriginal and Torres Strait Islander people had a 52% higher stroke re-admission rate when adjusted for age (Model A) and this reduced to 45% when also adjusted for sex and co-morbidity (Model B) and further to 23% when adjusted for remoteness and socioeconomic advantage (Model C). Model D adjusted for hospital and health service instead of remoteness and socioeconomic advantage and the differential further reduced to 19%. Central and western hospital and health services had a higher relative stroke re-admission rate compared to Metro North (reference category), as did the Torres and Cape. Sunshine Coast and Private had a relatively lower stroke re-admission rate than Metro North.

Table 79 Stroke cohort[1], cumulative 30-month stroke re-admission rate[2] (%) by Indigenous status and selected demographics, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islander	
	%	95% CI	%	95% CI
Age group				
25-44	11.70	(9.77-13.99)	20.46	(13.24-30.84)
45-64	13.27	(12.34-14.28)	19.55	(15.77-24.10)
65-84	13.89	(13.23-14.59)	16.73	(11.69-23.64)
Sex				
Male	14.30	(13.60-15.03)	21.48	(17.10-26.79)
Female	12.44	(11.66-13.27)	16.71	(12.99-21.36)
Remoteness				
Major cities	13.00	(12.31-13.73)	10.63	(6.16-18.01)
Inner regional	13.31	(12.35-14.34)	21.84	(14.95-31.27)
Outer regional	14.20	(12.83-15.71)	15.00	(10.95-20.36)
Remote	25.29	(19.40-32.56)	26.61	(17.67-38.86)
Very remote	28.58	(22.12-36.45)	32.87	(23.67-44.46)
Socioeconomic advantage				
Least advantaged	13.43	(12.43-14.50)	19.13	(15.09-24.09)
Quintile 2	12.73	(11.70-13.85)	15.69	(10.51-23.06)
Quintile 3	14.73	(13.54-16.02)	28.06	(20.02-38.48)
Quintile 4	13.70	(12.44-15.06)	8.39	(3.23-20.85)
Most advantaged	13.20	(11.80-14.75)	20.94	(8.39-46.76)
co-morbidity score				
None	12.22	(11.60-12.86)	17.78	(13.91-22.57)
One	14.97	(13.56-16.50)	24.06	(16.53-34.26)
Two	15.59	(13.79-17.60)	22.82	(14.39-35.07)
Three or more	18.31	(16.53-20.26)	16.26	(10.88-23.90)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of stroke excluding those who died during first index admission

2. Kaplan Meier fatality function for stroke re-admission (expressed as a percentage)

Table 80 Stroke cohort[1], multivariable analysis[2], time to stroke re-admission, 2010-2016, Queensland

	Model A		Model B		Model C		Model D	
	Ratio	95% CI	Ratio	95% CI	Ratio	95%CI	Ratio	95%CI
Indigenous status[3]	1.52	(1.25-1.84)	1.45	(1.19-1.76)	1.23	(1.01-1.51)	1.18	(0.96-1.46)
Age[4]	1.00	(1.00-1.01)	1.00	(1.00-1.00)	1.00	(1.00-1.00)	1.00	(1.00-1.01)
Sex[5]			0.86	(0.79-0.94)	0.86	(0.79-0.94)	0.86	(0.79-0.94)
Co-morbidity score								
None			1.00	reference	1.00	reference	1.00	reference
One			1.22	(1.09-1.38)	1.22	(1.08-1.37)	1.22	(1.09-1.37)
Two			1.27	(1.11-1.47)	1.28	(1.11-1.47)	1.29	(1.12-1.49)
Three or more			1.41	(1.25-1.60)	1.42	(1.26-1.61)	1.41	(1.25-1.60)
Remoteness[6]					1.19	(1.13-1.25)		
Socioeconomic advantage[7]					1.05	(1.01-1.09)		
Hospital & health service								
Cairns & Hinterland							0.99	(0.80-1.21)
Central Queensland							1.88	(1.54-2.27)
Central West							3.69	(2.38-5.74)
Darling Downs							1.01	(0.83-1.23)
Gold Coast							0.83	(0.69-1.01)
Mackay							0.97	(0.74-1.27)
Mater public hospitals							0.75	(0.51-1.11)
Metro North							1.00	reference
Metro South							0.89	(0.77-1.04)
North-west							1.84	(1.24-2.73)
South-west							2.83	(1.99-4.04)
Sunshine Coast							0.75	(0.62-0.90)
Torres and Cape							3.01	(2.02-4.62)
Townsville							0.66	(0.51-0.85)
West Moreton							0.81	(0.64-1.04)
Wide Bay							1.02	(0.85-1.23)
Private							0.82	(0.70-0.96)

1. Queensland residents, aged 25-84 at first admission with a principal diagnosis of stroke, excluding those who died during their first index admission
2. Cox proportional hazards regression
3. Aboriginal and Torres Strait Islander people compared to other Queenslanders
4. by year of age
5. females compared to males
6. per unit increase in remoteness
7. per unit increase in socioeconomic advantage

8 RHEUMATIC HEART DISEASE

8.1 Main findings

1. Aboriginal and Torres Strait Islander people had a higher RHD-specific death rate both in-hospital and after discharge of their index admission

2. Aboriginal and Torres Strait Islander people had a longer length of stay during first RHD admission than other Queenslanders in major cities, but not in other areas

3. Aboriginal and Torres Strait Islander people were less likely than other Queenslanders to be re-admitted for RHD within the first month after discharge of the index admission; however, the re-admission rate was similar by 30 months

8.2 The Rheumatic Heart Disease (RHD) cohort

The RHD cohort consisted of 12,097 Queensland residents who had their first hospital admission with a diagnosis of RHD in the period 1 July 2010 and 30 June 2016, 655 (5.4%) of whom were Aboriginal and/or Torres Strait Islander people. People for whom their first RHD admission was for palliative care or with missing data on Indigenous status were excluded.

The majority of cohort members were male, although the proportion of females was higher for Aboriginal and Torres Strait Islander people than for other Queenslanders (Table 81). Over half (54%) of Aboriginal and Torres Strait Islander people were aged under 45 years, while 80% of other Queenslanders were aged 65 year and over. A higher proportion of Aboriginal and Torres Strait Islander than other Queenslanders lived in northern and western Queensland and in areas there are more remote and with lower level of socioeconomic advantage. Over half of other Queenslanders had private health insurance, compared to only three percent of Aboriginal and Torres Strait Islander people. A higher proportion of Aboriginal and Torres Strait Islander people self-discharged from hospital.

The proportion of people with co-morbid conditions increased with increasing age and was higher for Aboriginal and Torres Strait Islander than other Queenslanders in all age-groups (Table 82). The most common co-morbidities were congestive heart failure, renal disease, diabetes, myocardial infarction, pulmonary disease, and cerebrovascular disease (Figure 16). Prevalence of these co-morbid conditions were similar for Aboriginal and Torres Strait Islander and other Queenslanders, except for congestive heart failure, which was more common in other Queenslanders and perhaps reflective of their older age, and diabetes, which was more common in Aboriginal and Torres Strait Islander people.

Figure 16 RHD cohort, most common co-morbidities (%), by Indigenous status, Queensland 2010-2016

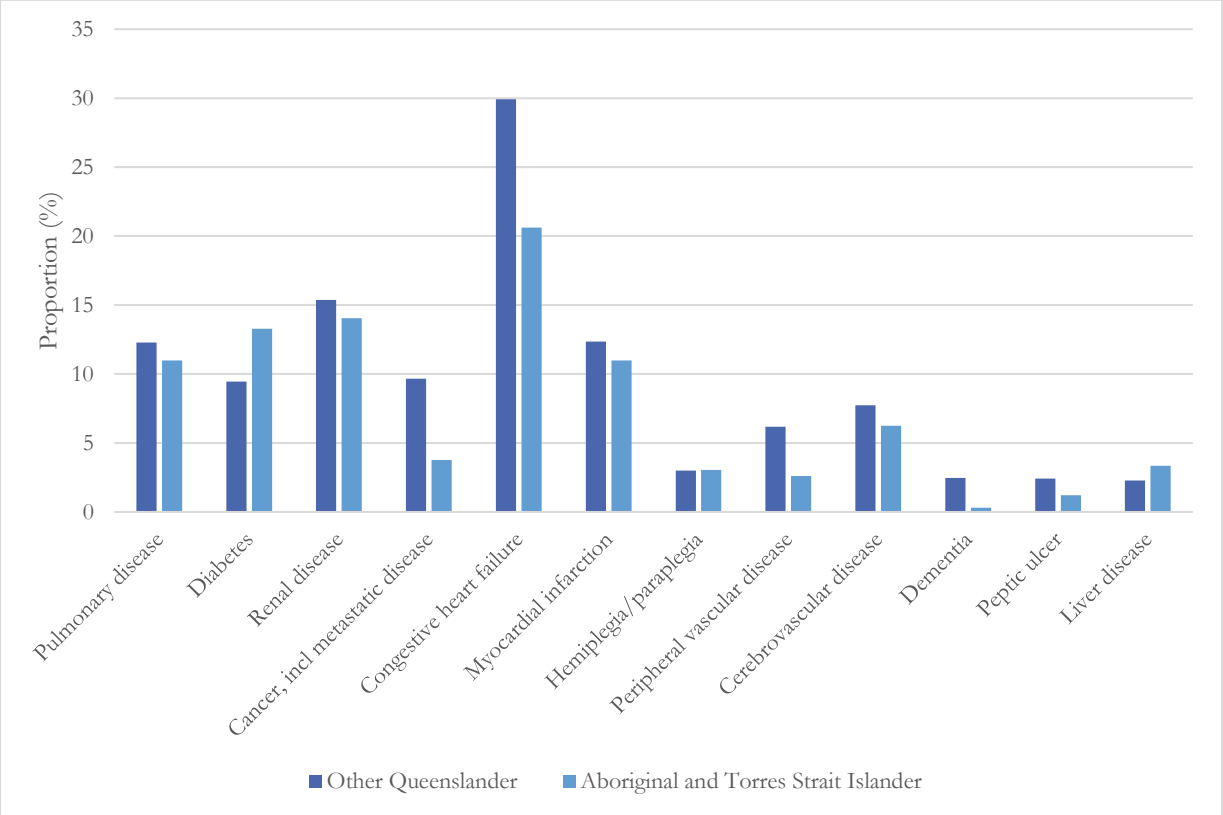


Table 81 Demographic characteristics (%), RHD cohort

	Other Queenslander N=11,442	Aboriginal and Torres Strait Islander N=655
Sex		
Male	46.9	35.4
Female	53.1	64.6
Age-group		
0-24	1.6	27.0
25-44	3.9	27.0
45-64	14.5	30.2
65-84	55.5	14.2
85-99	24.6	1.5
Hospital and health service		
Cairns & Hinterland	1.9	24.3
Central Queensland	0.9	1.4
Central West	0.0	0.2
Children's Health Queensland	0.3	1.4
Darling Downs	0.9	1.8
Gold Coast	2.9	0.8
Mackay	1.0	1.2
Mater public hospitals	1.2	2.4
Metro North	13.1	8.5
Metro South	7.5	5.5
North-west	0.2	8.5
South-west	0.0	0.5
Sunshine Coast	3.9	0.5
Torres and Cape	0.0	11.1
Townsville	5.3	25.5
West Moreton	1.9	1.7
Wide Bay	2.7	1.7
Private	56.2	3.1
Remoteness		
Major Cities	53.8	12.5
Inner Regional	32.2	9.9
Outer Regional	12.6	37.3
Remote	0.8	16.2
Very Remote	0.5	24.1
Socioeconomic advantage		
Least advantaged	25.0	58.8
Quintile 2	24.4	17.3
Quintile 3	20.3	12.8
Quintile 4	16.4	8.5
Most advantaged	13.9	2.6
Health insurance		
Insured	57.3	3.4
Not insured	41.8	92.4
Other	0.9	4.3
Self-discharge		
No	99.6	95.9
Self-discharged	0.4	4.1

Table 82 RHD cohort, proportion (%) with co-morbid conditions[1] by age-group, Queensland 2016-2010

	One or two		Three or more	
Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander	Other Queenslanders	Aboriginal & Torres Strait Islander
0-24	10.4	7.3	1.6	1.1
25-44	23.5	23.7	7.5	9.6
45-64	26.5	31.3	17.0	32.3
65-84	33.7	38.7	24.2	38.7
85+	36.4	30.0	30.9	40.0

1. Charlson co-morbidity score

8.3 Fatality

Analysis of RHD deaths in the RHD cohort was restricted to those aged 0-84 years at the time of their first RHD admission. Only 1.5% of Aboriginal and Torres Strait Islander members of the cohort were aged 85 years or older (Table 81). Due to small case numbers in many hospital and health service areas (Table 81), the analysis for RHD did not include this variable in order to protect anonymity.

8.3.1 Death in hospital

The proportion of people who died in hospital during their first RHD admission was higher for older than younger age-groups, for both deaths from RHD and from other causes (Table 83); it was not consistently higher for Aboriginal and Torres Strait Islander people than other Queenslanders.

Table 83 RHD cohort, proportion (%) who died in hospital during first RHD admission, Queensland 2010-2016

	Died from RHD		Died from other cause	
Age-group	Other Queenslanders	Aboriginal & Torres Strait Islander	Other Queenslanders	Aboriginal & Torres Strait Islander
0-24	0.0	0.0	3.3	0.6
25-44	0.0	0.6	2.3	0.0
45-64	0.2	0.5	3.6	6.1
65-84	0.5	2.2	5.2	3.2
85+	0.9	0.0	7.9	10.0

8.3.1.1 In-hospital deaths from RHD

In multivariable analysis, the proportion of people who died from RHD during their first hospital admission: increased with increasing age and with increasing number of co-morbid conditions and increasing remoteness; was similar for females as males; and was not strongly association with socioeconomic advantage (Table 84). When adjusted only for age (Model A), the proportion who died from RHD during their first hospital admission was over three times higher for Aboriginal and Torres Strait Islander than other Queenslanders; this reduced by only a small amount when also adjusted for co-morbidity (Model B) but was further reduced with remoteness and socioeconomic disadvantage were included (Model C). This indicates that the higher proportion of Aboriginal and Torres Strait Islander people living in more remote areas was partially responsible for the three times greater in-hospital RHD fatality of Aboriginal and Torres Strait Islander RHD patients (socioeconomic advantage was not associated with higher fatality when remoteness was included in the model). Hospital and health service was not included in multivariable analysis because the number of persons and deaths was too small to provide reliable estimates for individual health services. Likewise, the multivariable analyses were not stratified by Indigenous status due to small case numbers.

Table 84 RHD cohort[1], multivariable analysis[2] of the proportion who died from RHD during their first RHD admission, Queensland 2010-2016

	Model A		Model B		Model C	
	Ratio		Ratio		Ratio	
Indigenous status[3]	3.53	(1.12-11.14)	3.15	(0.98-10.13)	1.69	(0.49-5.78)
Age[4]	1.04	(1.01-1.06)	1.03	(1.00-1.06)	1.03	(1.01-1.06)
Sex[5]			0.95	(0.50-1.79)	0.97	(0.51-1.84)
Co-morbidity score						
None			1.00	reference	1.00	reference
One or two			1.95	(0.89-4.26)	1.93	(0.88-4.24)
Three or more			2.16	(0.94-4.93)	2.15	(0.93-4.99)
Remoteness[6]					1.56	(1.22-1.99)
Socioeconomic advantage[7]					1.04	(0.80-1.35)

1. Aged 25-84 at their first RHD admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. Per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

8.3.1.2 In-hospital deaths from other causes

The proportion who died during their first RHD admission from causes other than RHD increased with increasing age and level of co-morbidity and decreased with increasing socioeconomic advantage but was not associated with remoteness and was lower for women than men (Table 85).

Table 85 RHD cohort[1], multivariable analysis[2] of the proportion who died from other causes during their first RHD admission, Queensland 2010-2016

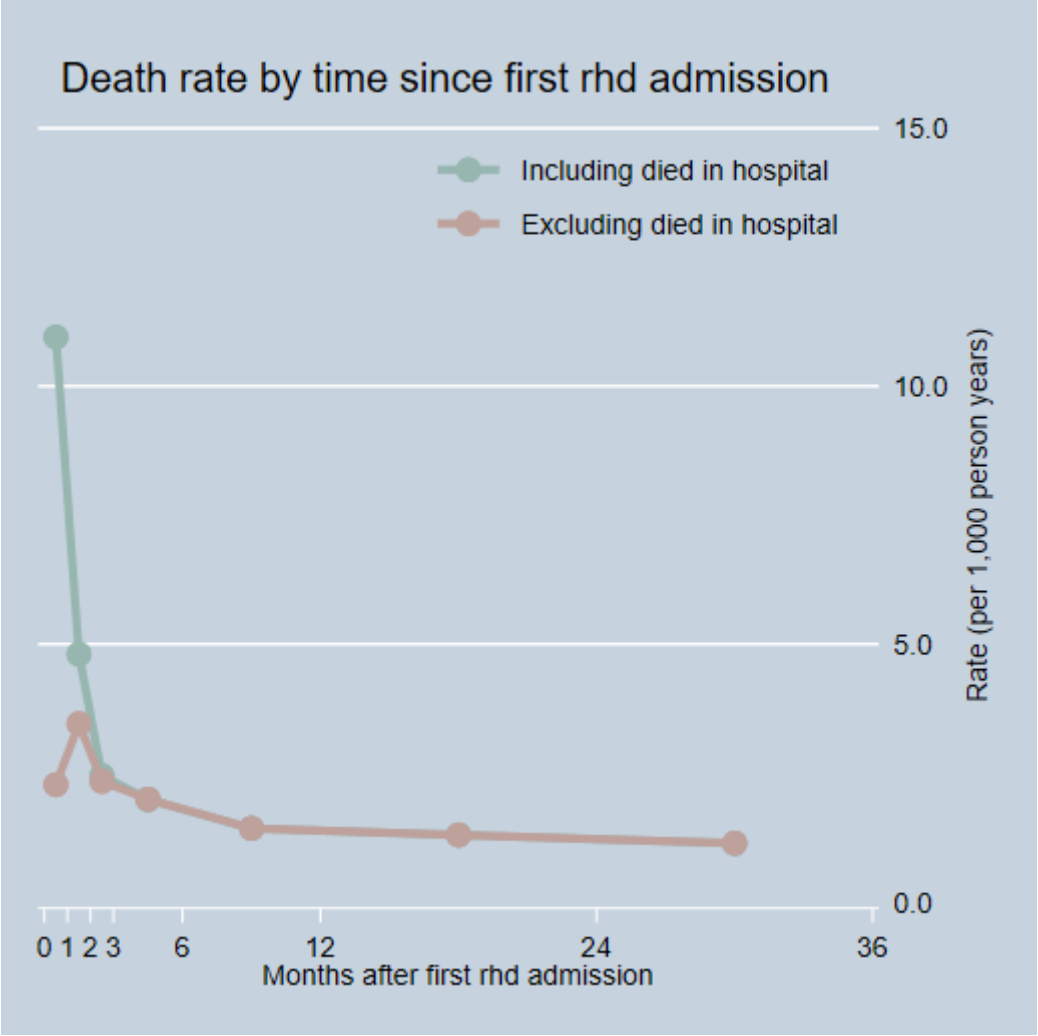
	Model A		Model B		Model C	
	Ratio		Ratio		Ratio	
Indigenous status[3]	0.86	(0.50-1.48)	0.74	(0.43-1.26)	0.68	(0.39-1.19)
Age[4]	1.02	(1.01-1.03)	1.01	(1.00-1.02)	1.01	(1.00-1.02)
Sex[5]			0.83	(0.69-1.00)	0.83	(0.68-1.00)
Co-morbidity score						
None			1.00	reference	1.00	reference
One or two			2.43	(1.86-3.16)	2.39	(1.83-3.11)
Three or more			4.55	(3.52-5.89)	4.42	(3.41-5.73)
Remoteness[6]					1.00	(0.89-1.13)
Socioeconomic advantage[7]					0.90	(0.84-0.97)

1. Aged 25-84 at their first RHD admission
2. modified Poisson regression
3. Aboriginal & Torres Strait Islander people compared to other Queenslanders
4. Per year increase in age
5. female compared to male
6. per one unit increase in remoteness category
7. per one unit increase in quintile of socioeconomic advantage

8.3.2 Death after discharge from hospital

The RHD-specific death rate was much higher in the first month after first RHD admission than in subsequent months (Figure 17). Most deaths in the first month occurred in hospital. When deaths in hospital were excluded, the death rate was higher in the first several months and decreased gradually thereafter.

Figure 17 RHD cohort[1], cause-specific death rate by period after first RHD admission, Queensland 2010-2016



1. Aboriginal & Torres Strait Islander people and other Queenslanders combined, aged 25-84 years.

The proportion of people who died from RHD after discharge varied by age and was higher for Aboriginal and Torres Strait Islander than other Queenslanders at each age (Table 86). The difference was greater (relatively) at age 35 than at age 75.

Table 86 RHD cohort[1], RHD cumulative fatality[2] (%) at 1, 6 and 36 months after first RHD admission by Indigenous status and selected ages, Queensland 2010-2016

	Other Queenslander			Aboriginal and Torres Strait Islander		
Time after first admission	Age(years)			Age(years)		
(months)	35	55	75	35	55	75
One	0.1	0.3	1.3	0.1	0.4	1.3
Six	0.2	0.7	2.8	0.4	1.4	5.4
Thirty-six	0.5	1.8	7.1	1.2	4.4	15.7

1. aged 25-84 years, excluding those who died during first RHD admission.
2. Aalen-Nelson estimate of cumulative fatality (expressed as a percentage) age-adjusted and estimated for selected ages

The RHD death rate for Aboriginal and Torres Strait Islander members of the cohort was higher than for other Queenslanders in all time periods up to 36 months after the first RHD admission (Table 87). There was no strong evidence that the death rate ratio changed over time; the death rate ratio varied between time periods with mostly overlapping confidence intervals. The RHD death rate was over two times higher for Aboriginal and Torres Strait Islander than other Queenslanders in older age-groups (Table 88); death rate ratios could not be calculated for younger age-groups because there was only one death in the three years after hospital discharge for people aged 0-44 years.

Table 87 RHD cohort[1], RHD death rate ratio[2] (Aboriginal and Torres Strait Islander people compared to other Queenslanders) by time period after first RHD admission

Time period (months)	Ratio[2]	(95% CI)
0-2	**4.59**	**(1.28-16.45)**
3-6	**3.20**	**(0.84-12.16)**
7-12	**1.26**	**(0.32-5.02)**
13-24	**1.59**	**(0.49-5.10)**
25-36	**4.80**	**(2.20-10.47)**
0-36	2.80	(1.72-4.56)

1. Excluding those aged 85 and over at the time of first RHD admission and those who died in hospital during first RHD admission
2. Mantel-Haenzel age-adjusted estimate of the death rate ratio, stratified by months after first admission, and for months 0-36 combined

Table 88 RHD cohort[1], RHD death rate ratio[2] by age-group, Aboriginal and Torres Strait Islander people compared to other Queenslanders, 2010-2016.

Age-group	Ratio[3]	
0-24[4]	.	(.-.)
25-44[4]	.	(.-.)
45-64	3.55	(1.73-7.27)
65-84	2.21	(1.13-4.31)
0-84	2.82	(1.74-4.58)

1. Excluding those aged 85 and over at the time of first RHD admission and those who died in hospital during first RHD admission
2. Mantel-Haenszel estimate of the death rate ratio for each age-group, adjusted for age within each age-group
3. Death rate ratio (95% confidence interval)
4. There was only one death in people aged 0-44 years.

In multivariable analysis, the RHD death rate was: two times higher for Aboriginal and Torres Strait Islander people; increased with increasing age and with increasing number of co-morbid conditions and was much higher for people who self-discharged; was lower for women than men; and was not associated with remoteness or socioeconomic advantage (Table 89).

Table 89 RHD cohort[1], multivariable analysis[2] of RHD death rate in 36 months after discharge from first RHD admission[3], stratified by Indigenous status.

	Other Queenslanders		Aboriginal & Torres Strait Islanders		Combined	
	Ratio[4]		Ratio		Ratio	
Indigenous status	na		na		2.09	(1.26-3.47)
Age at index admission[5]	1.07	(1.06-1.08)	1.07	(1.03-1.11)	1.07	(1.06-1.08)
Sex[6]	0.65	(0.53-0.80)	0.58	(0.23-1.46)	0.64	(0.53-0.79)
Co-morbidity score						
None	1.00	reference	1.00	reference	1.00	reference
One or two	1.94	(1.46-2.57)	1.79	(0.41-7.79)	1.94	(1.47-2.55)
Three or more	4.88	(3.75-6.36)	4.74	(1.25-17.98)	4.88	(3.77-6.32)
Self-discharge	4.84	(1.99-11.78)	3.38	(0.41-28.15)	4.59	(2.02-10.42)
Remoteness[7]	1.00	(0.87-1.15)	1.10	(0.76-1.59)	1.01	(0.89-1.15)
Socioeconomic advantage[8]	0.96	(0.89-1.04)	0.97	(0.64-1.47)	0.96	(0.89-1.04)

Abbreviation: na, not applicable.
1. aged 24-84 at first RHD admission
2. Cox proportional hazard regression
3. excluding those who died during first admission
4. death rate ratio (95% confidence interval)
5. per year of age
6. female compared with male
7. per one unit increase in remoteness category
8. per quintile increase in socioeconomic advantage

8.3.3 Length of stay for first RHD admission

This analysis included members of the RHD cohort aged 0-84 years and older who were admitted with a principal diagnosis of RHD and did not self-discharge from their first RHD hospital admission (n=1,935). There were no Aboriginal and Torres Strait Islander people in the 85+ year age group and less than ten people self-discharged from their first principal diagnosis RHD admission. Due to small numbers of Aboriginal and Torres Strait Islander cohort members (<10) in the 65-84 age group, the two oldest age groups were collapsed into a 45-84 age group. Similarly, due to small numbers in the co-morbidity score one, two and three groups, this variable was recorded into 'no co-morbidity' vs. 'any co-morbidity'.

The cohort included 108 (5.6%) Aboriginal and Torres Strait Islander people. Overall, the median length of stay at first stoke admission was six days (IQR 1-11 days); five days for Aboriginal and Torres Strait Islander people and six days for other Queenslanders.

Median length of stay during first RHD admission increased with increasing age for Aboriginal and Torres Strait Islander people and for other Queenslanders those aged 0-24 years had an average half a day shorter length of stay than people in the older age groups (Table 90). Length of stay was shorter for males than females among Aboriginal and Torres Strait Islander people, but shorter for females than males among other Queenslanders. For both Aboriginal and Torres Strait Islander people and other Queenslanders, length of stay was, on average, shorter for those without co-morbidity than those with co-morbidity. There was no clear pattern in length of stay by remoteness, although for Aboriginal and Torres Strait Islander people the median length for stay was longest for those living in major cities. Similarly, there was no clear pattern in length of stay by socioeconomic status for other Queenslanders, although median length of stay was shorter for Aboriginal and Torres Strait Islander people living in the most disadvantaged quintiles (Q1 and Q2) compared to the more advantaged quintiles (Q3 and Q4). These findings suggest that the length of stay may vary by sex, remoteness and socioeconomic status differentially for Aboriginal and Torres Strait Islander people and other Queenslanders.

Table 90 RHD cohort[1], average length of stay during first stroke admission by Indigenous status, Queensland 2010-2016

	Other Queenslanders				Aboriginal & Torres Strait Islander			
	mean	SD	median	IQR	mean	SD	median	IQR
Age group								
0-24	7.83	(10.08)	5.5	(2.5-8)	6.27	(10.19)	2	(1-8)
25-44	10.25	(14.57)	6	(0-10)	9.28	(16.06)	5	(2-9)
45-84	8.94	(12.78)	6	(0-12)	10.87	(15.17)	7	(2-11)
Sex								
Male	9.37	(12.74)	7	(1-12)	8.18	(11.73)	3	(1-12)
Female	8.61	(12.88)	5	(0-11)	8.89	(15.25)	5	(1-9)
Co-morbidity score								
None	7.43	(11.32)	5	(0-10)	7.52	(12.71)	4	(1-9)
At least one	11.45	(14.56)	8	(1-15)	11.52	(16.42)	7	(1-11)
Remoteness								
Major cities	8.61	(12.91)	6	(0-11)	13.92	(19.71)	8	(1-14)
Inner regional	9.03	(11.35)	7	(1-13)	6.80	(11.42)	2.5	(1-7)
Outer regional	10.83	(16.13)	8	(2-13)	4.86	(5.83)	2	(1-7)
Remote	10.33	(10.06)	7	(5-14)	14.72	(22.74)	6.5	(5-11)
Very remote	7.08	(5.04)	7.5	(3.5-9.5)	7.80	(10.20)	4.5	(1-11)
Socioeconomic advantage								
Least advantaged	9.94	(12.78)	7	(1-13)	9.34	(15.20)	4.5	(1-11)
Quintile 2	8.65	(11.17)	6	(1-11)	6.20	(8.45)	3.5	(2-7.5)
Quintile 3	8.00	(11.47)	5	(0-11)	6.36	(5.73)	5.5	(1-10)
Quintile 4	9.63	(15.83)	6	(0-12)	13.1	(21.36)	7.5	(5-9)
Most advantaged	8.55	(12.58)	6	(0-10)	-.-	(-.-)	-.-	(-.-)

1.Queensland residents aged 0-84 years and who did not self-discharge during first RHD admission

In multivariable analysis, with an interaction term between Indigenous status and remoteness (major city vs. other), length of stay was relatively longer for Aboriginal and Torres Strait Islander people than other Queenslanders in major cities, but was relatively shorter in regional and remote areas (Table 91). Age, sex and socioeconomic status was found to be not associated with length of stay during first RHD admission, while having co-morbidity was significantly associated with a longer length of stay.

Table 91 RHD cohort[1], multivariable analysis[2] of length of stay during first RHD admission, Queensland 2010-20163

Variable	Ratio	95%CI
Major cities		
Non-Indigenous	1.00	reference
Indigenous	1.64	(0.76-3.53)
Regional and remote areas		
Non-Indigenous	1.00	reference
Indigenous	0.63	(0.28-1.43)
Age[4]	1.00	(1.00-1.01)
Sex		
Male	1.00	reference
Female	0.97	(0.85-1.10)
Socioeconomic advantage[5]	1.00	(0.98-1.03)
Co-morbidity score		
None	1.00	reference
At least one	1.48	(1.30-1.69)

1.Queensland residents aged 0-84 years and who did not self-discharge during first RHD admission
2.negative binomial regression
3.adjusted for admission year
4.per year increase in age
5.per one unit increase in quintile of socioeconomic advantage

8.3.4 Time to RHD re-admission

This analysis included members of the RHD cohort aged 0-84 years old who had been admitted with a principal diagnosis of RHD and had not died during their first RHD admission (n=1,915). 107 (5.6%) Aboriginal and Torres Strait Islander people were included in this cohort.

Time to re-admission was calculated as the time from discharge from first RHD admission (based on principal diagnosis only) to the next admission with a principal diagnosis of RHD death, end of follow-up (30 months), or end of the study (31 December 2018), whichever occurred first. The maximum follow-up time was 30 months, with a mean follow-up of 23.2 months.

Aboriginal and Torres Strait Islander people had a similar RHD re-admission rate than other Queenslanders (Figure 18). There was sharp rise in the number of RHD re-admissions in the first months after discharge, particularly for other Queenslanders, and then the rate of re-admission slowed (Table 92). While a lower proportion of Aboriginal and Torres Strait Islander people than other Queenslanders had an RHD re-admission in the first month after the first index admission, the difference had narrowed by 6 months and further by 30 months (Table 92).

Figure 18 RHD cohort, 30-month Stroke re-admission rate by Indigenous status

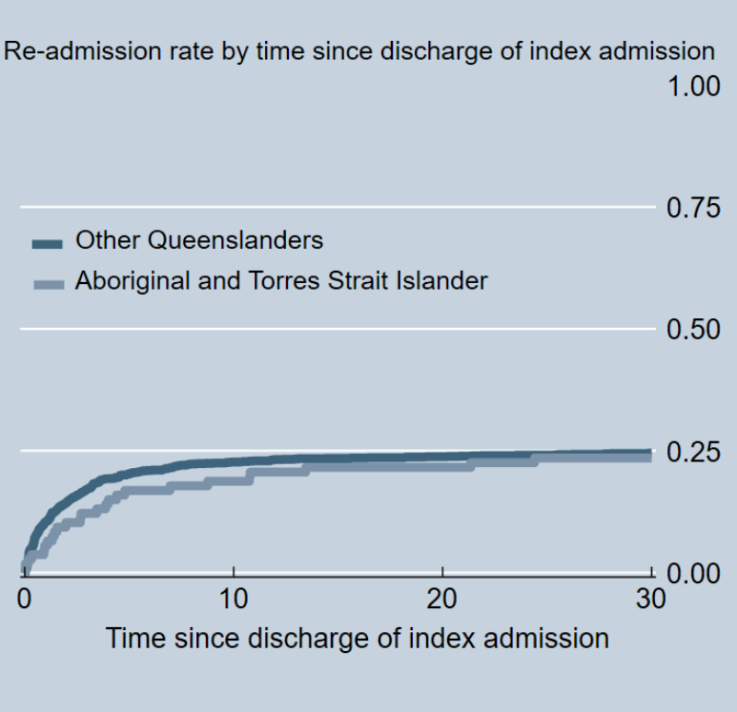


Table 92 RHD cohort[1], RHD cumulative re-admission rate[2] (%) by Indigenous status and time since discharge from first RHD admission (age adjusted)

Month	Other Queenslanders	Aboriginal and Torres Strait Islander
One	10.42	5.57
Six	20.96	16.86
Thirty	24.48	23.51

1. Including those aged 0-84 years at the time of first RHD admission (principal diagnosis) and excluding those who died in hospital during first RHD admission

2. Kaplan Meier failure function of the RHD re-admission rate calculated for each follow-up time period, expressed as a proportion (%)

Re-admission rates for RHD were highly variable with large confidence intervals. Generally, the re-admission rate was greatest (relatively) for those aged 45-64 years than other age groups and for females than males. Estimated rates were similar for those with and without co-morbidity for Aboriginal and Torres Strait Islander people, but lower for those with any co-morbidity for other Queenslanders. Aboriginal and Torres Strait Islander people had lower RHD re-admission rates than other Queenslanders in major cities, but higher rates in very remote areas (Table 93).

Table 93 RHD cohort[1], cumulative RHD re-admission rate[2] (%) at 30 months by Indigenous status, Queensland 2010-2016

	Other Queenslanders		Aboriginal & Torres Strait Islander	
	%	95% CI	%	95% CI
Age group				
25-44	23.08	(13.82-37.04)	21.95	(12.08-37.94)
45-64	26.16	(18.63-36.00)	28.39	(16.39-46.35)
45-84	21.37	(19.46-23.44)	20.00	(9.52-39.20)
Sex				
Male	18.55	(16.12-21.30)	18.24	(9.57-33.19)
Female	24.65	(21.99-27.57)	27.41	(18.02-40.34)
Remoteness				
Major city/inner regional	22.95	(20.94-25.11)	24.11	(10.80-48.61)
Outer regional, remote, very remote	12.75	(8.98-17.93)	23.57	(15.90-34.11)
Socioeconomic advantage				
Quintile 1 and 2b (least advantaged)	21.10	(18.45-24.07)	24.99	(16.90-36.01)
Quintile 3 to 5	22.20	(19.72-24.95)	19.23	(8.49-40.19)
Co-morbidity score				
None	23.80	(21.40-26.42)	23.75	(15.86-34.67)
At least one	18.23	(15.52-21.35)	22.96	(11.03-44.14)

1. Including those aged 0-84 years at the time of first RHD admission (principal diagnosis) and excluding those who died in hospital during first RHD admission

2. Kaplan Meier fatality function for RHD re-admission (expressed as a percentage)

9 ACUTE RHEUMATIC FEVER

9.1 Main findings

1. None of the 471 persons in the ARF cohort died in hospital and only three died within three years of their first hospital admission with a principal diagnosis of ARF.

2. 62% of the ARF cohort were Aboriginal and Torres Strait Islander people and 80% were aged 0-29 years at ARF index admission. Almost all of the Aboriginal and Torres Strait Islander people in the cohort were aged younger than 30 (93%) compared to 58% of other Queenslanders.

3. Length of stay at first ARF admission was slightly shorter for Aboriginal and Torres Strait Islander people than other Queenslanders (two vs. three days median).

4. The most notable differences observed in length of stay was between those living in major cities and inner regional areas compared to those living in less urban areas (four vs. two days median) and between those without co-morbidity compared to those with co-morbidity (two vs. five days median).

5. 30-day re-admission of ARF was higher for Aboriginal and Torres Strait Islander people compared to other Queenslanders, for those living in less urban areas compared to major cities and inner regional areas, and for those with compared to without co-morbidity. However, due to the small sample size, there was wide variation and the differences were not considered statistically significant.

6. The differential in the ARF re-admission rate decreased over follow-up, with an 85% higher re-admission rate for Aboriginal and Torres Strait Islander people than other Queenslanders 1 month post discharge of the index admission and a 75% higher rate at 30 months.

9.2 The ARF cohort

471 Queenslanders were admitted to a Queensland hospital between 1 July 2010 and 30 June 2016 with a diagnosis code of acute rheumatic fever (ARF). Of these, 294 were Aboriginal and Torres Strait Islander people, 93% of whom were aged under 30 years (Table 94). There were 177 other Queenslanders, only 58% of whom were aged under 30 years. None of these 471 persons died in hospital and only three died within three years of their first hospital admission with a principal diagnosis of ARF.

ARF is almost exclusively a disease of children and young adults, as is apparent in the age distribution of Aboriginal and Torres Strait Islander cohort members. It is not apparent why 42% of the other Queenslander cohort members were aged over 30 years; possibilities include that these are older adults admitted for treatment rheumatic heart disease (RHD) (e.g. valvular damage or heart failure) resulting from ARF episodes in childhood and ARF was incorrectly coded as their 'principal diagnosis' for that hospital episode; or that they are adults with RDH who suffered a repeated episode of ARF in adulthood; or that these people did indeed experience their first ARF episode in middle or late adult life. The latter would be inconsistent with the natural history of this disease. The aim of the Better Cardiac Care project is to investigate cardiac care for Aboriginal and Torres Strait Islander people, so this analysis was restricted to those aged under 30 years.

Demographic characteristics of the cohort members aged 0-29 years are presented in Table 95 (and for those aged 30 and over, in Table 96). More than 80% were aged between five and nineteen years (inclusive) at the time of their first ARF admission, for both Aboriginal and Torres Strait Islander and other Queenslanders (mean 12.4 years). The majority were males (61% of Aboriginal and Torres Strait Islanders). 62% of other Queenslanders lived in major cities or inner regional areas while 92% of Aboriginal and Torres Strait Islanders lived in outer regional or more remote areas. Most lived in disadvantaged areas: 74% of Aboriginal and Torres Strait Islanders and 61% of other Queenslanders lived in the two most disadvantaged quintiles. High proportions of Aboriginal and Torres Strait Islander people were admitted to hospitals in the northern and western hospital and health services (Cairns and Hinterland; North West; Torres and Cape; Townsville). Almost one-quarter of the other Queenslanders hospitalised for ARF were admitted to health facilities in the Cairns and Hinterland hospital and health service area, which was considerably higher than the proportion of the other Queenslander population that live in that area of the state. Approximately eight per cent of Aboriginal and Torres Strait Islander Queenslanders and five per cent of other Queenslanders had some co-morbidity (Charlson co-morbidity score of one or more). Chronic heart failure was the most common co-morbidity for Aboriginal and Torres Strait Islander people (4%).

Due to small numbers, some categories of variables were collapsed. No analysis of deaths was performed for the ARF cohort because of the very small number of deaths in cohort members.

Table 94 ARF cohort, age distribution (%), Queensland 2010-2016

Age-group (years)	Other Queenslander N=177	Aboriginal and Torres Strait Islander N=294	Total N=471
0-4	2.8	4.4	3.8
5-9	17.0	33.3	27.2
10-14	19.2	28.6	25.1
15-19	11.3	13.6	12.7
20-24	3.4	6.8	5.5
25-29	4.5	6.1	5.5
30-39	8.5	4.1	5.7
40-49	5.1	1.7	2.8
50-59	9.6	1.4	4.5
50-69	9.6	0.0	3.6
70+	9.0	0.0	3.4

Table 95 ARF cohort aged 0-29 years, demographic characteristics (%)

	Other Queenslander N=103	Aboriginal and Torres Strait Islander N=273
Sex		
Male	52.4	61.2
Female	47.6	38.8
Age-group		
0-4	4.9	4.8
5-9	29.1	35.9
10-14	33.0	30.8
15-19	19.4	14.7
20-24	5.8	7.3
25-29	7.8	6.6
Hospital and health service		
Cairns & Hinterland	24.3	37.0
Central Queensland	2.9	2.6
Central West	0.0	0.0
Children's Health Queensland	6.8	1.8
Darling Downs	0.0	1.8
Gold Coast	4.9	0.0
Mackay	1.0	0.7
Mater public hospitals	13.6	1.8
Metro North	7.8	2.2
Metro South	18.4	0.7
North-west	5.8	17.9
South-west	1.0	0.4
Sunshine Coast	1.0	0.4
Torres and Cape	0.0	18.3
Townsville	4.9	13.9
West Moreton	5.8	0.0
Wide Bay	1.9	0.4
Private	0.0	0.0
Remoteness		
Major Cities	50.5	3.7
Inner Regional	11.7	4.0
Outer Regional	31.1	42.1
Remote	6.8	24.5
Very Remote	0.0	25.6
Socioeconomic advantage		
Least advantaged	41.7	60.1
Quintile 2	19.4	14.3
Quintile 3	18.4	20.1
Quintile 4	14.6	2.9
Most advantaged	5.8	2.6
Health insurance		
Insured	9.7	0.7
Not insured	85.4	93.8
Other	4.9	5.5
Co-morbidity score		
At least one	4.9	8.4
Self-discharge		
No	98.1	98.5
Self-discharged	1.9	1.5
Died in hospital	0.0	0.0

Table 96 ARF cohort aged 30 years and over, demographic characteristics (%)

	Other Queenslander N=74	Aboriginal and Torres Strait Islander N=21
Sex		
Male	43.2	38.1
Female	56.8	61.9
Age-group		
30-39	20.3	57.1
40-49	12.2	23.8
50-59	23.0	19.0
60-69	23.0	0.0
70+	21.6	0.0
Hospital and health service		
Cairns & Hinterland	5.4	47.6
Central Queensland	2.7	0.0
Central West	0.0	0.0
Children's Health Queensland	0.0	0.0
Darling Downs	1.4	14.3
Gold Coast	5.4	0.0
Mackay	1.4	0.0
Mater public hospitals	2.7	0.0
Metro North	24.3	0.0
Metro South	21.6	4.8
North-west	0.0	9.5
South-west	0.0	0.0
Sunshine Coast	6.8	0.0
Torres and Cape	0.0	0.0
Townsville	2.7	14.3
West Moreton	1.4	4.8
Wide Bay	4.1	4.8
Private	20.3	0.0
Remoteness		
Major Cities	59.5	9.5
Inner Regional	21.6	14.3
Outer Regional	17.6	52.4
Remote	0.0	23.8
Very Remote	1.4	0.0
Socioeconomic advantage		
Least advantaged	21.6	76.2
Quintile 2	23.0	14.3
Quintile 3	25.7	4.8
Quintile 4	13.5	4.8
Most advantaged	16.2	0.0
Health insurance		
Insured	29.7	0.0
Not insured	68.9	100.0
Other	1.4	0.0
Co-morbidity score		
At least one	36.5	33.3
Self-discharge		
No	98.6	95.2
Self-discharged	1.4	4.8
Died in hospital	1.4	0.0

9.3 Length of stay for first ARF admission

This analysis included members of the ARF cohort aged 0-29 years old and older who were admitted with a principal diagnosis of ARF and did not self-discharge from their first ARF hospital admission (n=369). The cohort included 268 (72.6%) Aboriginal and Torres Strait Islander people.

Overall, the median length of stay at first ARF admission was two days (IQR 1-5 days) for Aboriginal and Torres Strait Islander people and 3 (IQR 2-7) for other Queenslanders. Median length of stay was 2 days (IQR 1-5) for males and 3 days (1-6 days) for females; 3 days (IQR 1-6) for Queenslanders aged 0-14 years at index admission and 2 days (IQR 1-5) for those aged 15-29 years at admission. Median length of stay was 4 days (IQR 2-7) for those living in major cities or inner regional areas and 2 days (IQR 1-5) for those living in outer regional, remote and very remote areas of the state; and 2 days (IQR 1-5) for those living in the least advantaged areas (socioeconomic advantage quintile 1), 3 days (IQR 2-6.5) for those in intermediate socioeconomic advantage (Q2 and Q3), and 2 days (IQR 1-4) for those in the most advantaged areas (Q4 and Q5). Queenslanders without co-morbidity had a median length of stay of 2 days (IQR 1-5) compared to 5 days (IQR 2-10) for those with co-morbidity.

9.4 Time to ARF re-admission

This analysis included members of the ARF cohort aged 0-29 years old who were admitted with a principal diagnosis of ARF (n=376). None of the ARF cohort had died in hospital. In total, 273 (72.6%) Aboriginal and Torres Strait Islander people were included in this cohort. Time to re-admission was calculated as the time from discharge from first ARF admission (based on principal diagnosis only) to the next admission with a principal diagnosis of ARF, death, end of follow-up (30 months), or end of the study (31 December 2018), whichever occurred first. The maximum follow-up time was 30 months, with a mean follow-up of 27.6 months.

Younger Queenslanders (0-14 years at index ARF admission) had a slightly lower, though not significantly different, 30-month re-admission rate than those aged 15-29 years (7.98%, 95%CI 5.28-11.98 vs. 9.84%, 95%CI 5.57-17.06;, respectively) and, as shown in Figure 19, Aboriginal and Torres Strait Islander people had a higher ARF re-admission rate than other Queenslanders. Therefore, the 1, 6 and 30-month re-admission rates shown in

Table 97 are age-adjusted and stratified by Indigenous status. The gap in the re-admission rate between Aboriginal and Torres Strait Islander and other Queenslanders is widest at one month post discharge from the index ARF admission. While the gap narrows, Aboriginal and Torres Strait Islander people still have a greater age-adjusted 30-month ARF re-admission rate compared to other Queenslanders (9.7% and 2.4% , respectively).

30-month re-admission rates are presented by sociodemographic group in Table 98. After adjusting for age, re-admission rates were greater among Aboriginal and Torres Strait Islander people than other Queenslanders, people living in outer regional, remote and very remote than those in major cities and inner regional areas, and those with than without comorbidity. Due to small case numbers within groups, categories of sociodemographic variables were collapsed into broader level groups, and the hazard ratios were only adjusted for age.

Table 97 ARF cohort[1], ARF cumulative re-admission rate[2] (%) by Indigenous status and time since discharge from first ARF admission (age adjusted)

Month	Other Queenslanders	Aboriginal and Torres Strait Islander
One	0.92	6.13
Six	1.40	7.94
Thirty	2.39	9.76

1. Including those aged 0-29 years at the time of first ARF admission (principal diagnosis) and excluding those who died in hospital during first ARF admission

2. Kaplan Meier failure function of the ARF re-admission rate calculated for each follow-up time period, expressed as a proportion (%)

Figure 19 ARF cohort, 30-month ARF re-admission rate by Indigenous status (age adjusted)

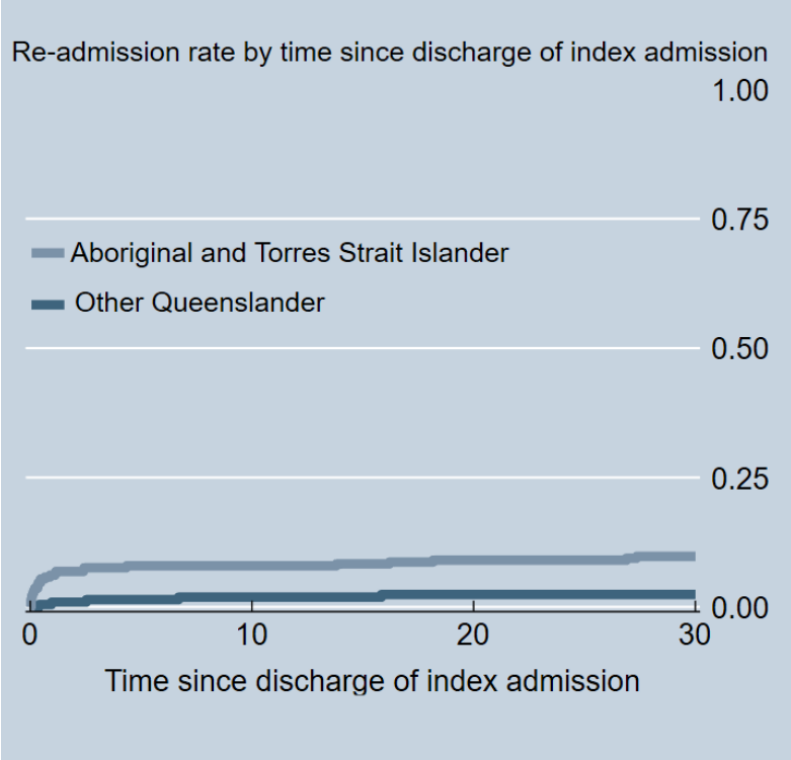


Table 98 ARF cohort[1], 30-month ARF cumulative re-admission rate[2] (%) by demographic characteristic (age adjusted)

Characteristics	Re-admission rate	Age-adjusted hazard ratio (95%CI)
Indigenous status		
Other Queenslander	2.39	1.00
Aboriginal and Torres Strait Islander	9.76	2.14 (0.82-5.54)
Sex		
Male	7.59	1.00
Female	8.77	1.06 (0.97-1.10)
Remoteness		
Major city/inner regional	4.57	1.00
Outer regional/remote/very remote	8.80	1.34 (0.55-3.26)
Socioeconomic advantage[3]		
Q1 and Q2 (least advantaged)	7.79	1.00
Q3 and Q4	8.28	0.96 (0.45-2.04)
Q5 (most advantaged)	8.27	0.86 (0.25-2.94)
Co-morbidity score		
None	7.55	1.00
At least one	16.08	1.98 (0.72-5.43)

1. Including those aged 0-29 years at the time of first ARF admission (principal diagnosis) and excluding those who died in hospital during first ARF admission
2. Kaplan Meier failure function of the ARF re-admission rate at 30 months after the separation of the index ARF admission, expressed as a proportion (%)
3. Quintiles (Q) of socioeconomic advantage

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