Hospital utilisation and funding for patients with selected chronic conditions – 4. Cardiovascular diseases

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In 2007-08, approximately 3.4 million (16%) Australians reported having a long-term cardiovascular disease (CVD)[1]. Various factors such as medical technology advancements have resulted in a substantial reduction in both death and hospitalisation rates over the past decades[2], and the incident rate of CVD is expected to decline by 40% between 2003 and 2033[3]. However, the disease group is expected to remain as one of the leading causes of burden to the healthcare system in the next decade[4], and the national admitted patient services expenditure for CVD is expected to reach approximately $7,100M by 2033, an increase of $4,602M (185%) from 2003[3]. Furthermore, whilst a decline in hospitalisation rates for patients with CVD that are directly related to their CVD may intuitively infer the lowering of need for admitted patient care among these individuals, earlier studies have shown that patients with CVD are commonly hospitalised for chronic conditions other than CVD[5-7].

This is the fourth report in a series looking at hospital utilisation and expenditure by the Queensland Government for hospital care for patients with various chronic conditions. Episodes of care with diagnoses of CVD (ICD-10-AM I00-I99.x) recorded were used to determine if a patient had 'ever' been coded with these conditions in the Queensland Hospital Admitted Patient Data Collection (QHAPDC) between 1 July 2003 and 30 June 2010. The methodology for defining the sample and in-scope admissions is described in Endo et al., 2012[5]. Where appropriate, hospital utilisation patterns were analysed separately for selected CVDs of interest, namely coronary heart disease (CHD), cerebrovascular disease, heart failure, chronic rheumatic heart disease (RHD) and hypertension. Relevant ICD-10-AM codes used to define these conditions can be found in Appendix A. Although conditions such as acute pericarditis may not be classified as a "chronic" cardiovascular condition, they were not excluded, for simplicity. The Indigenous status of a patient was based on whether the patient had ever identified as Indigenous in QHAPDC during the study period.

Characteristics of CVDs admissions

During the study period, there were 2,071,911 episodes of care by those patients who were ever coded with at least one CVD, comprising 342,878 individuals. Hypertension, which is often regarded as a risk factor for diseases rather than a disease itself, was the only CVD recorded for 14.6% of these patients. 11.1% of the episodes from ever-coded patients were from those who identified themselves as Indigenous, while 4.2% of the patients included in the cohort identified themselves as Indigenous. In 2009/10, more than 350,000 episodes (excluding the index episode) were from the 'ever coded' patients, which equates to approximately 38% of total admitted patient care in Queensland public hospitals[8] . Of these, 34,796 episodes (9.9%) had CVD as a principal diagnosis and 59,781 (17.1%) had CVDs only recorded as other diagnoses.

Table 1 displays the frequency of admission for the cohort of patients in 2009/10 who had 'ever' been admitted for CVD prior to 2009/10 and who did not link to death records or to a hospital record where discharge status was 'died in hospital' prior to the start of 2009/10, by Indigenous status. Overall, 30.1% of patients had at least one hospital admission in 2009/10, with 4.5% of them being admitted more than 3 times. The proportion increased to 8.9% for those who identified

themselves as Indigenous. Only 15.0% of patients had an admission with some form of CVD recorded.

Table 1. Frequency of admission for ever-CVD patients, 2009/10

No. of admissions in 2009/10	All admissions#*			CVD related admissions# ^*		
	Non-Indigenous	Indigenous	Total	Non-Indigenous	Indigenous	Total
0	158,373 (70.5%)	6,249 (58.9%)	164,622 (69.9%)	191,825 (85.4%)	8,267 (77.8%)	200,092 (85.0%)
1	36,426 (16.2%)	2,058 (19.4%)	38,484 (16.4%)	22,520 (10.0%)	1,383 (13.0%)	23,903 (10.2%)
2	14,145 (6.3%)	910 (8.6%)	15,055 (6.4%)	6,262 (2.8%)	478 (4.5%)	6,740 (2.9%)
3	6,289 (2.8%)	452 (4.3%)	6,741 (2.9%)	2,239 (1.0%)	215 (2.0%)	2,454 (1.0%)
4+	9,531 (4.2%)	948 (8.9%)	10,479 (4.5%)	1,918 (0.9%)	274 (2.6%)	2,192 (1.0%)
Total	224,764 (100.0%)	10,617 (100.0%)	235,381 (100.0%)	224,764 (100.0%)	10,617 (100.0%)	235,381 (100.0%)

Source: Queensland Hospital Admitted Patient Data Collection

#If a patient had an episode change or was transferred to another hospital, this series of episodes was grouped as an "admission". The admission was included if they were ever admitted with at least one CVD prior to and were alive at the start of 2009/10.

^CVD related admission is defined as an admission where CVD was coded at least once within the episodes of care included.

Co-existing conditions

1. Co-existing cardiovascular conditions

From all patients with CVD ever-coded during the study period, 172,913 (50.4%) had CVD as the principal diagnosis in their index episode[*]. Of these 172,913 patients, 38% had a principal diagnosis of CHD, 11% had cerebrovascular disease, 9% had atrial fibrillation and flutter (ICD-10-AM I48), and 6% had heart failure.

While this proportion reflects the distribution of the specific cardiovascular conditions prevalent within the cohort, it does not give any indication as to the relationship *between* the conditions. That is, a single individual can have multiple cardiovascular conditions recorded across multiple hospital stays. Figure 1 shows the overlap of different forms of CVD within the patient cohort. As an example, from 118,281 patients who were 'ever-coded' with CHD, 37,114 (31.4%) also had at least one diagnosis of heart failure, chronic RHD or cerebrovascular disease recorded within their historical hospital data. It is important to note that these are only based on what has been recorded within QHAPDC and do not necessarily reflect the prevalence of these conditions. That is, overlap of pre-existing conditions may be greater than what can be observed from the existing data.

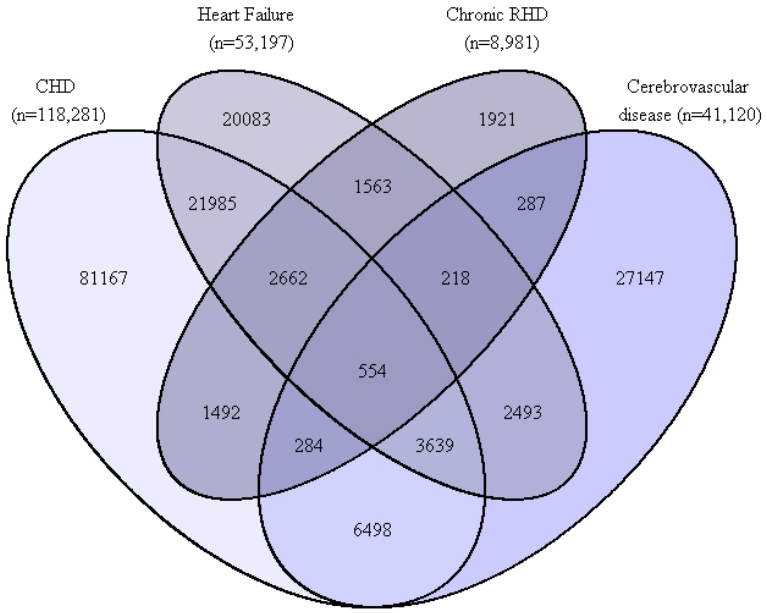
[*] It is important to note that while the index episode is the first admission to the public hospital for a patient within the covered time period, they may have had the chronic conditions for a number of years prior to this event.

2. Principal diagnosis and other diagnoses, where CVD was recorded

For those episodes where CVD was coded as a diagnosis, 42% of the episodes had CVD as the principal diagnosis (Figure 2). The most common 3-digit ICD-10-AM codes recorded as other diagnoses where a CVD was the principal diagnosis were:

- hypertension (I10; 37.2%)
- personal history of medical treatment (Z86.x; 25.2%), mainly from Personal history of tobacco use disorder (Z86.43),
- chronic ischaemic heart disease (I25.x; 24.2%),
- type 2 diabetes (E11.x; 17.3%) and;
- Disorders of lipoprotein metabolism and other lipidaemias (E78.x; 15.3%).

Figure 1. Overlap of 'ever-coded selected cardiovascular conditions' for patients 'ever coded' with at least one cardiovascular condition, 2003/04-2009/10



Source: Queensland Hospital Admitted Patient Data Collection

These five conditions consistently appeared as commonly recorded secondary diagnoses for episodes of care across the four principal diagnoses shown in Figure 1.

There were 745,479 episodes of care with CVD recorded as an other diagnosis.

- At the ICD-10-AM chapter level, 31.0% of the episodes of care also had CVD as their principal diagnosis.
- ICD-10-AM Chapter 21: *Factors influencing health status and contact with health services* (ICD-10-AM: Z00-Z99.x) accounted for a further 17.6% of principal diagnoses where more than 80% of these episodes were for renal dialysis (Z49.1, Z49.2; 53.6%), care involving use of rehabilitation procedures (Z50.x; 24.7%) or person awaiting admission to residential aged care service (Z75.11; 8.7%).
- Conditions such as type 2 diabetes (E11.x; 4.0%) and chest pain, unspecified (R07.4; 3.4%) were also recorded as principal diagnoses.

If episodes of care where the only CVD recorded as an other diagnosis was hypertension (n=255,994) were removed, the proportion of episodes with CVD recorded as principal diagnosis increased to 36.0%, while conditions in *Factors influencing health status and contact with health services* dropped to 15.1%. When hypertension was the only CVD recorded as an other diagnosis, 22.5% were for a condition in *Factors influencing health status and contact with health services,* where nearly 80% of these were for renal dialysis.

3. Principal diagnosis where CVD was not recorded

Between 2003/04-2009/10, 1,181,015 'ever-coded' episodes did not have a record of CVD within the episode of care at all. Of these episodes:

- more than 63% (750,103) had a principal diagnosis starting with '*Z*' (ICD-10-AM Chapter 21: *Factors influencing health status and contact with health services*) with 612,068 (81.6%) of these for renal dialysis (Z49.1, Z49.2) (Figure 3).
- Z51.1 (Pharmacotherapy session for neoplasm) and Z50.9 (Care involving use of rehabilitation procedure, unspecified) were also common, which contributed to 6.7% of the total episodes for this cohort.

Figure 2. Principal diagnosis where CVD was recorded

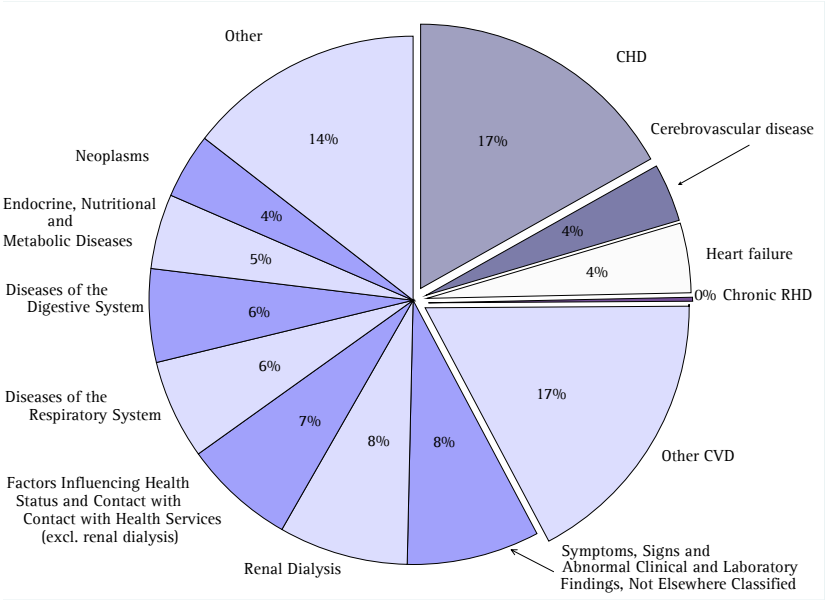
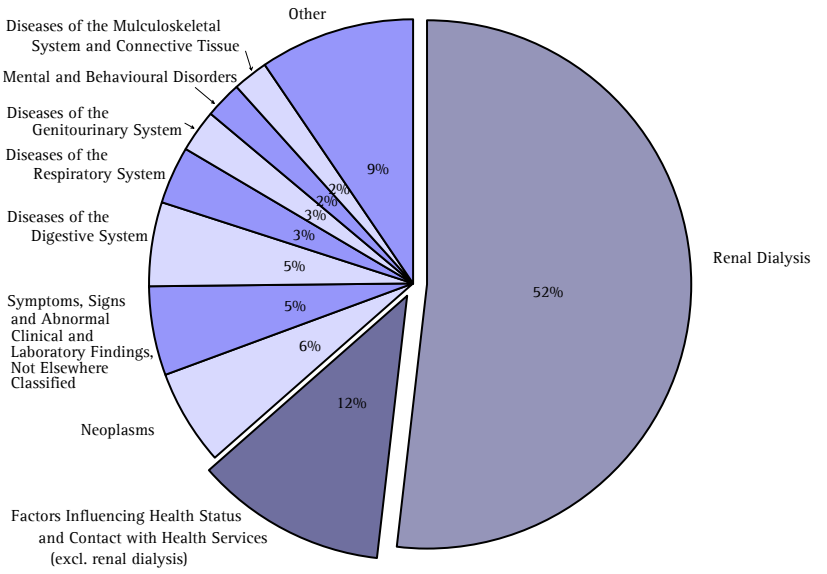


Figure 3. Principal diagnosis where CVD was not recorded



Source: Queensland Hospital Admitted Patient Data Collection

4. Common co-morbidities among the cohort

For patients with CVD ever recorded:

- 45% had at least one tobacco-related diagnosis *(Z86.43* – personal history of tobacco disorder, *Z72.0* – Tobacco use, current or *F17.x* – Mental and behavioural disorders due to tobacco)
- more than 22% of patients had type 2 diabetes
- other common co-morbidities include *E78.x* Disorders of lipoprotein metabolism and other lipidaemias (18%); *N39.x* Urinary tract infection, site not specified (13%); *N18.x* Chronic kidney failure (9.9%).

Procedures

In 2009/10, approximately 81% of episodes of care by patients with CVD ever recorded involved at least one form of health intervention or procedure. For episodes of care that had a principal diagnosis of one of the selected CVDs, there were variations in the number of episodes with an intervention code recorded. Approximately 88% of episodes with a principal diagnosis of chronic RHD had at least one intervention code recorded, with 64% of these containing at least one

intervention other than a diagnostic/allied heath/radiology procedure[†] (Table 2). For episodes with the principal diagnosis recorded as cerebrovascular disease, while 87% of episodes had at least one intervention code recorded, 76% of these episodes only had diagnostic/allied health/radiology interventions recorded.

Table 2. Type of procedures recorded for episodes of care with selected CVD, 2009/10

Type of episode of care	CHD	Stroke	Heart Failure	Chronic RHD	Other CVD
Intervention code recorded	**11,163 (54.1%)**	**4,970 (87.4%)**	**3,618 (61.0%)**	**256 (88.3%)**	**14,852 (61.3%)**
At least one intervention not diagnosis/allied health/ radiology type intervention*	5,278 (47.3%)	1,186 (23.9%)	794 (21.9%)	166 (64.8%)	7,282 (49.0%)
Diagnostic/allied health/radiology type interventions* only	5,885 (52.7%)	3,784 (76.1%)	2,824 (78.1%)	90 (35.2%)	7,570 (51.0%)
No intervention code	**9,462 (45.9%)**	**717 (12.6%)**	**2,314 (39.0%)**	**34 (11.7%)**	**9,370 (38.7%)**
Total	**20,625 (100.0%)**	**5,687 (100.0%)**	**5,932 (100.0%)**	**290 (100.0%)**	**24,222 (100.0%)**

Funding

In 2009/10, funding provided by the Queensland Government for treatment of patients who had been admitted for CVD at least once since 2003/04 totalled approximately $1.1 billion in admitted care settings (Table 2). Roughly 66% of this was for episodes with CVD recorded, even though these episodes accounted for only 35% of the total number of episodes. When CVD was recorded as the principal diagnosis, the total amount funded was approximately $432M, with 77.5% funded on the basis of Australian Refined Diagnosis Related Groups (DRG), and 20.3% were funded in an episode of care that attracted funding for critical care, which includes treatment within the Intensive Care Unit (ICU).

The average funding per episode for these episodes varied by type of CVD recorded as the principal diagnosis. On average, episodes of care with cerebrovascular disease recorded as the principal diagnosis received higher funding than episodes for CHD or heart failure. There was generally a higher inlier amount allocated for cerebrovascular disease DRGs than DRGs commonly used for CHD or heart failure and funding for ICU, sub/non-acute and psychiatric care for cerebrovascular disease was also higher on average than for CHD and heart failure. The average amount funded for episodes with chronic RHD as the principal diagnosis was more than 4 times higher than that for episodes with CHD as the principal diagnosis though the total amount funded was much less than the other CVD conditions due to the smaller number of patients with this condition (Figure 1). The higher average funding is mostly due to the nature of the episodes of care for RHD: more than 50% of these episodes were 'surgical' (based on the partition value of the allocated DRGs), which are generally more expensive than medical episodes, while only 22% of CHD episodes were surgical (Table 3).

For episodes of care where CVD was recorded only as an other diagnosis, the average funding was approximately $10,000. These episodes had much higher average funding than episodes of care where CHD or heart failure was recorded as the principal diagnosis. This is mostly driven by high

[†] Diagnostic/allied health/radiology type interventions were defined as having "Examination" as the procedural type axis (except block code 667 Cardiac catheterisation), or those in chapters 18, 19 or 20 of the Australian Classification of Health Interventions Tabular List version 69. National Centre for Classification in Health (NCCH). *Australian Classification of Health Interventions (ACHI) Tabular List Sixth Edition - 1 July 2008*. Sydney: NCCH, 2008.. Although a more sophisticated definition may be more appropriate, this method was deemed adequate for this report.

psychiatric and sub/non-acute type funding, which accounted for 26% of the total funding for this group. Approximately 71% of the episodes that contributed to the funding for psychiatric or sub/non-acute had a principal diagnosis of 'care involving rehabilitation procedure' (Z50.x), or 'problems related to medical facilities and other health care' (Z75.x). For these patients, when episodes of care involving renal dialysis were removed, the average funding for these episodes increased to roughly $11,700. Similar results were found for episodes with no CVD recorded, where the average funding increased from $2,500 to $4,200 per episode of care when episodes involving renal dialysis were removed.

Overall, 65% of episodes for the cohort did not include a diagnosis of CVD. These episodes were associated with funding of $644M, which could potentially be attributed to these conditions, if these conditions were treated within the episode of care.

Table 2. Average and total funding for episodes of care by type of diagnoses recorded for patients with CVD, 2009/10

	CVD as PD						
Type	CHD	Cerebrovascular disease	Heart failure	Chronic RHD	Other CVD	CVD as OD only	No CVD recorded
# of episodes (n)	20,625	5,687	5,932	290	24,222	80,032	255,515
Psychiatric ($)	$4,408.96	$63,983.23	$315.88	$0.00	$113,420.92	$43,630,823.43	$45,597,409.78
Sub/Non-Acute ($)	$711,170.51	$3,023,462.62	$1,974,299.10	$0.00	$3,633,349.30	$165,479,196.74	$81,733,403.23
ICU ($)	$42,145,665.87	$12,480,514.96	$4,672,485.76	$2,319,350.00	$26,270,851.35	$113,473,963.40	$10,601,384.23
DRG ($)	$100,557,563.75	$54,086,078.16	$37,583,063.59	$6,294,412.09	$136,327,308.04	$480,673,856.65	$506,203,269.57
Total ($)	$143,418,823.92	$69,654,039.36	$44,230,163.15	$8,613,762.10	$166,344,927.71	$803,257,840.32	$644,135,467.54
Total (av. $)	$6,953.64	$12,247.94	$7,456.20	$29,702.63	$6,867.51	$10,036.71	$2,520.93

Source: Queensland Hospital Admitted Patient Data Collection, pAWS_archive database

Table 3. Distribution of partition of Australian Refined Diagnosis Related Groups by type of principal diagnosis, 2009/10*

Principal diagnosis	Surgical	Medical	Other
CHD	22.3%	64.3%	13.4%
Cerebrovascular disease	13.0%	86.1%	1.0%
Heart failure	1.4%	95.4%	3.2%
Chronic RHD	52.4%	30.0%	17.6%
Other CVD	21.6%	71.3%	7.1%

*Restricted to episodes that attracted funding from DRG
Source: Queensland Hospital Admitted Patient Data Collection, pAWS_archive database

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Appendix A

Table A1. ICD-10-AM for selected cardiovascular diseases

Condition	ICD-10-AM
Coronary heart disease	I20-I25.x
Cerebrovascular disease	I60-I69.x
Heart failure	I50
Chronic rheumatic heart disease	I05-I09.x
Hypertension	I10
Cardiovascular disease	I00-I99.x