SERIOUS AND CONTINUING ILLNESS POLICY AND PRACTICE STUDY

EPIDEMIOLOGY OF CHRONIC HEART FAILURE

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EPIDEMIOLOGY OF CHRONIC HEART FAILURE

Chronic heart failure (CHF) is a condition where the pumping action of the heart is sub-optimal. It can result from a variety of diseases that damage or overload the heart, notably heart attack, high blood pressure or a damaged heart valve. It can occur suddenly, but more commonly becomes apparent over years. People with mild heart failure have few symptoms but in more severe cases they may experience chronic tiredness, reduced capacity for physical activity and shortness of breath. Once diagnosed, it is often associated with poor survival, not dissimilar to disseminated cancer. Chronic heart failure (CHF) is a general term that refers to the length of duration of heart failure, usually where the heart muscle has been irreversibly damaged.

Risk factors

Data from the Framingham study into the natural history of coronary heart disease, commenced in the US in 1949, provided insight into the modifiable risk factors of CHF. When these are examined in relation to CHF, the population attributable fraction (PAF) for high blood pressure is greatest, accounting for 39% of CHF in men and 59% in women. Previous myocardial infarction, despite its much lower prevalence in the population, (3-10%), was the second commonest contributor to CHF in men (34%) and in women (13%). Valvular heart diseases accounted for 7-8% of CHF (Kannel, 2000). Other less common but serious risk factors for CHF are diseases of the heart muscle (cardiomyopathy) due to alcohol abuse or infections, diabetes and obesity (NHF & CSANZ 2001, Cohn 1998). However, the effect of diabetes and obesity on CHF events is generally mediated through high blood pressure.

Quality of CHF Data

Reliable data on the prevalence and mortality associated with CHF are lacking in many parts of the world, limiting estimates of the true burden of disease associated with this condition. To calculate the burden, accurate estimates of the prevalence of the condition and its risk factors are essential. The accuracy turns on many factors: the acceptance of uniform diagnostic criteria, potential confounding conditions, appropriate age and risk factor prevalence figures for each population, and adjustments for revisions to the International Classification of Disease (ICD) codes when examining trends over years.

Despite well-known clinical features, CHF is often difficult to diagnose. Experts suspect that it is widely under-diagnosed, particularly in women, old people and obese people (Watson et al, 2000), based on clinical impression and subtle symptoms detected by self-report questionnaires. As a result of this expert impression, estimates of observed prevalence are often inflated by adding an underdiagnosed component, or correction factor, to prevalence of clinically observed CHF (Clark et al, 2004), (Horowitz et al, 2001). These factors may lead to over or under-estimation of the true prevalence of CHF (Cowie, 1999).

Heart failure is more likely to be listed as an associated cause of death than as the underlying cause. This will lead CHF to be regarded as a "mode of death" rather than an underlying "cause of death" (Goldacre et al, 2003). For example, in Australia in 2002, CHF represented 2% of all primary cause of mortality. This was inconsistent with the observed case fatality of CHF (24-28%) and the estimated incidence of 30,000 cases per year (Najafi et al, 2006). Thus currently available data only provide estimates, rather than clear evidence, of the prevalence, mortality and morbidity associated with CHF and should be interpreted cautiously.

GLOBAL PROFILE

Incidence and Prevalence

Internationally, the picture for CHF incidence and prevalence is unclear; but some information can be gleaned from the available hospital separations and mortality data. According to the American Heart Association (AHA) 2004 update on heart disease and stroke statistics, 15 million patients are believed to have symptomatic heart failure worldwide (AHA, 2004). Two reviews on incidence and prevalence of CHF in developed countries by Cowie (1999) and McMurray et al. (2000) revealed that:

a) the crude incidence (unadjusted for age) ranges from 1 to 5 cases per 1,000 in the general population
b) the crude prevalence of CHF ranges from 3 to 20 per 100, depends on age groups, in the general population
c) the incidence of heart failure is higher in men than in women at all ages.

According to the 44 year follow up of the Framingham Heart Study, CHF incidence approaches 10 per 1,000 population per year after age 65 years (AHA, 2006). In the US population, CHF affects an

estimated 2% of people aged 40 to 59 years, 5% aged 60 to 69 years, and 10% aged 70 or more. In addition, CHF prevalence is at least 25% greater among the Afro-American' population than among the European-American population (AIHW, 2004).

International analyses of long-term trends in the incidence of CHF are rare. Levy et al. (2002) examined data from the Framingham Heart Study, which suggested that between 1950 and 1999, the incidence of CHF in the United States fell by 30–40% among women but remained relatively unchanged for men.

International estimates of the prevalence of heart failure are more common. The most recent data for the United Kingdom indicated that the prevalence of heart failure is about 3% in people aged 45 years or more, with two-thirds of these cases confirmed using a combination of echocardiography and clinical examination and the remainder with suspected CHF (Davies et al, 2001).

Mortality

The population based burden of CHF mortality cannot be studied from conventional mortality statistics based on primary cause of death (Goldacre et al, 2005), as it is less likely that CHF is entered on death certificates as the underlying cause of death. For example in the UK, the death certificate explicitly forbids heart failure to be entered as the underlying cause of death (Cowie et al, 1997) as it is considered to be a 'mode of death'.

Burden of disease

There is a lack of published data on the international burden of CHF. The global burden of disease study did not include CHF in the cardiovascular diseases category (Murray et al, 1996; Mathers et al, 2004). Instead the study investigators classified 'congestive heart failure' under coronary heart disease and 'cardiomyopathy' under inflammatory heart disease. Thus extraction of information on the burden of CHF from the global burden of disease study is not possible. However, the lifetime risk of developing heart failure has been estimated at around 20% for Western countries (AIHW, 2004).

AUSTRALIAN PROFILE

Prevalence

Current estimates of the incidence and prevalence of CHF in Australia are based on a study by Clark et al. (2004) who used Australian Bureau of Statistics (ABS) population data combined with contemporary epidemiologic data from the UK (Clark et al, 2004). According to this study, 187,078 Australian men and 137,524 women had symptomatic CHF in 2000, with 22,000 new cases or 1.2 patients per 1,000 population. The AHIW estimates for the prevalence and incidence of the disease, also based on overseas findings are as follows (AIHW, 2004):

a) prevalence of CHF is 4% of the population over 45 years old, which is equal to over 300,000 current patients with CHF in 2000,
b) incidence of HF is approximately 30,000 individuals per year, which is equal to 0.4% of population over 45 years.

As the diagnosis of patients with mild heart failure is commonly missed, the actual numbers could be as high as twice these estimates.

There is a lack of data about the prevalence of CHF among Indigenous Australians. However, in 2001-02, hospitalisation for heart failure among Aboriginal and Torres Strait Islander People was approximately two to three times that of other Australians (AIHW, 2004).

Mortality

Heart failure is a major cause of illness and the third largest cause of death among heart, stroke and vascular diseases, claiming 2,729 lives in Australia in 2002 (AIHW, 2004). Heart failure as the underlying cause of death accounted for 8.3% of all deaths attributed to circulatory disease from 1997-2003 (Najafi et al, 2006).

Najafi et al. (2006) analysed the Australian CHF mortality record for calendar years 1997-2003 from AIHW data. This study found that of 907,242 deaths, heart failure was coded as the underlying cause of death for 29,341 (3.3%) and was mentioned anywhere in the death certificate in 135,268 (14.9%). In the same period, there was a decrease in the absolute, age specific and age standardised mortality rates from CHF either as the underlying cause of death or mentioned anywhere on the birth certificate for both sexes.

The AIHW data demonstrate a dramatic increase in CHF mortality with increasing age. Deaths from CHF occur mainly among older Australians, with 90.4% of the deaths occurring among those aged 75 years and over (AIHW, 2004). Figure 1 demonstrates that the mortality rate in persons aged 85 and over is sixfold greater than in those aged 75-85.

In 2002, more females across all ages died from heart failure than males, but death rates among males aged less than 85 years were higher than for females. This can be explained by the greater number of women than men who live to older ages, when death rates from heart failure are considerably higher. In 2000, the age standardised mortality rate from CHF was 14.1/100,000 in males and 13/100,000 in females in Australia (Table 1).

Table 1 demonstrates that CHF age specific mortality rate increases substantially with age. For both males and females over age 85 years, the mortality rate for CHF is over 800/100,000 population.

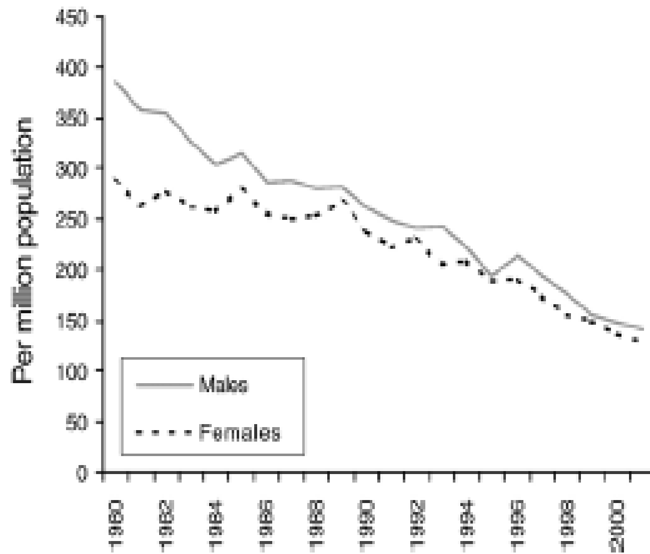
Table 1 also shows that the CHF mortality ratio is significantly higher in Aboriginal and Torres Strait Islanders, 3.8 times more in males and 2.2 times more in females, compared with other Australians.

There appears to be a substantial decline in the mortality from CHF over the last 20 years in Australia (Figures 2 - 3). This decline has occurred for both sexes, with the mortality gap between genders reducing over time. The national declining trend occurs in all Australian states and the Australian Capital Territory. The declining trend of CHF, which was recently reported by McLean

et al., is consistent with another recent study by Najafi et al. (Najafi et al, 2006), although different ICD codes were used to define CHF. However, based on data from National Cardiovascular Diseases Database, extracted from AIHW, McLean et al. reported a recent increase in CHF mortality since 1999 in some states including: Queensland (both sexes), Western Australia and ACT (females only) and the Northern Territory (males only) (McLean et al, 2007).

The author of this report extracted the Australian CHF mortality data (broadest definition I26-I51) from WHO database (WHOSIS, 2007) and found a similar trend (Figure 3).

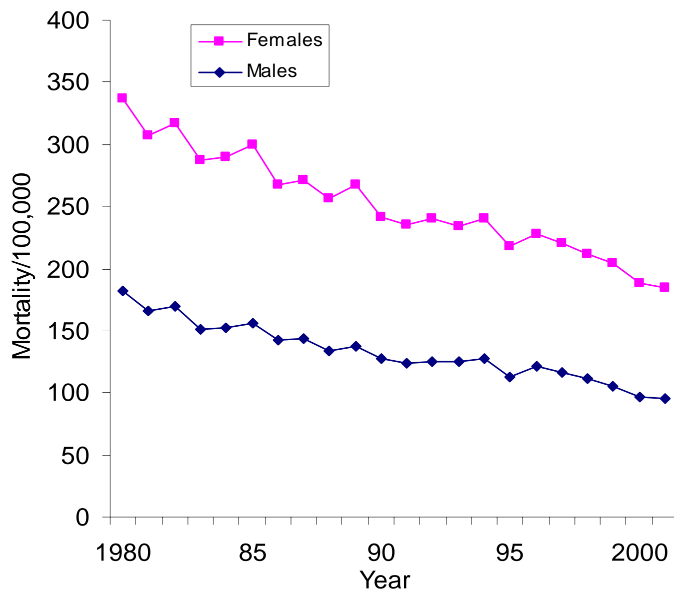
Figure 2. Heart failure mortality rates (ICD10 codes I50-I51)) for Australia between1980–2001



Age standardised using 2001 Australia population

Source: McLean et al. (McLean et al, 2007)

Figure 3. Diseases of pulmonary circulation and other forms of heart disease (ICD 10 codes I26-I51) mortality rates (ICD10 codes I50-I51)) for Australia between1980–2002



Age standardised using WHO standard population (Ahmad et al, 2004)
Source: Author from WHO mortality database (WHOSIS, 2007)

Table 1. Age standardised mortality rate from Heart Failure in different age groups in Australia

Year	Population subgroup	Males	Females	Persons
		Rate per 100,000 population		
2000	Age group (years)			
	45–54	0.9	0.4	0.6
	55–64	3.4	2.1	2.7
	65–74	16.8	11.0	13.8
	75-84	97.4	85.0	90.2
	85 and over	594.7	609.7	605
	All ages	14.1	13.0	13.4
2000-02	Aboriginal and Torres Strait Islander status			
	Standardises mortality ratio	3.8#	2.2#	2.8#
2000-02	Region*			
	Major cities	12.6	11.8	12.2
	Regional	17.0**	15.8**	16.4**
	Remote	25.3**	20.2**	22.9**

* Bsed on ASGC remoteness structure
** Statistically significant difference when compared with the first row in the population subgroup.
# Statistically significant difference from 1.0 (other Australians).
Notes:
1. Standardised mortality ratio = observed deaths divided by expected deaths. For further information see (AIHW, 2004).
2. Data for all ages.
3. Significance testing was not performed on the age groups.
4. All rates other than age-specific c rates and standardized mortality ratio are age-standardized (ASR) to the 2001 Australian population.
Source: AIHW National Mortality Database; Adapted from (AIHW, 2004)

Burden of disease

National morbidity in terms of the number of hospital separations for CHF has remained constant between 1997-2002. The point prevalence of CHF has been approximately 1% in people aged 50–59 years, 10% in people aged 65 years or more, and over 50% in people aged 85 years or more. It is one of the most common reasons for hospital admission and GP consultation in people aged 70 years and older (NHF-CSA, 2006). According to the results of BEACH study, the prevalence of diagnosed chronic heart failure (CHF) in the general practice patient population was estimated to be 3.5% (95% CI: 2.0–5.1). Mild CHF had been diagnosed in 2.0% of general practice patients, while 1.0% and 0.5% had been diagnosed with moderate and severe CHF respectively. In male patients, 4.0% (95% CI: 0.0–8.7) were diagnosed with CHF compared with 3.1% (95% CI: 0.9–5.3) of female patients. Patients aged 75 years or more had the highest age-specific rates, with 20.6% diagnosed with CHF (Britt et al, 2007). These figures highlight the burden experienced by GPs due to CHF.

The economic burden of CHF has been explored in an analysis of hospital costs among CHF patients using reimbursement for hospital activity, based on Diagnostic Related Groupings (DRG). Clark et al. found that the lowest average cost per day of hospitalisation for such patients was $600

according to 2000 costs. Based on estimates of incidence of CHF in Australia, the total cost of CHF-related hospitalisation in Australia during 2000 would have been $840 million. The total direct cost of CHF in 2000 was estimated in excess of $1 billion (Clark et al, 2004).

CHF IN THE AUSTRALIAN CAPITAL TERRITORY AND WESTERN SYDNEY

Prevalence and mortality

According to a cross-sectional study by Abhayarana et al. of 2,000 randomly selected residents of Canberra, the prevalence of CHF in the Australian Capital Territory (ACT) in 2002-03 was 6.3% (95% CI, 5.0-7.7%) (Abhayaratna et al, 2006). Among study subjects, 5.6% had clinical CHF that had been previously diagnosed and 0.6% had undiagnosed clinical HF. There are no data available on CHF prevalence in the ACT Chief Health Officer's reports.(Dugdale et al, 2006)

During the period 1997 to 2000, there were 281 deaths (2% of all deaths in those aged 20 years and more) coded as being primarily due to heart failure among Western Sydney residents (Table 4). Since 1997, in addition to the major underlying cause of death, a number of contributory causes of

death have also been coded. When all contributory causes of death are counted, a total of 1,917 adult deaths (14% of all deaths in those age 20 years and more) were coded as CHF (EIRE, 2004). From 1997-2002, in those aged 65 years and more, 274 heart failure deaths, 3% of all deaths, were recorded as HF in Sydney West Area Health Services (SWAHS). When death from heart failure as a contributory cause was added, there were a total of 1,792 deaths with heart failure as a contributory cause, 17% of all deaths. This was often accompanied by other forms of heart disease, pneumonia, chronic lower respiratory disease, etc (EIRE, 2004).

Morbidity

Table 2 demonstrates that the hospital separation rate due to heart failure is higher in SWAHS (272/100,000) compared to NSW (232/100,000). Blacktown local government area (LGA) had the highest separation rate (368/100,000) and Parramatta and Baulkham Hills LGAs had the lowest (207/100,000) hospital separation rates for CHF in SWAHS.

Table 2. Heart Failure Hospital Separation rate by area of residence and age/sex standardised rate for patients 20 years and older.

Area	Separations per year	Directly standardised separation rate per 100,000 population (99% CI)
NSW	13486	239 (237-240)
SWAHS	1186	272 (267-278)
Auburn	120	284 (265-305)
Baulkham Hills	150	207 (195-221)
Blacktown	446	368 (355-381)
Holroyd	208	308 (293-325)
Parramatta	261	207 (197-217)
Urban AHS	9286	222 (221-224)
Rural AHS	4099	286 (283-290)

1-1999-2002, 2 Direct method of age standardization
Source: EIRI (EIRE, 2004)

Table 3 demonstrates that while CHF is ranked the 11th underlying cause of death in SWAHS between 1997-2000, it is ranked the 4th multiple cause of death in that health area.

Table 3. Underlying and contributory causes of death in Western Sydney, 1997-2000

ICD code	**Condition**	**Underlying cause of death %**	**Multiple cause of deaths (% of total deaths)**
I20-I25	Ischaemic heart disease (IHD)	23.4	32.5
I60-I69	Cerebrovascular diseases (CVD)	9.2	16.0
C15-C26	Malignant neoplasm of digestive organ	7.2	8.0
Y01-Y98	External causes	6.0	10.1
C30-C39	Malignant neoplasm of respiratory & intrathoracic Organs	5.9	6.4
J40-J47	Chronic lower respiratory disease	4.9	12.0
C81-C96	Malignant neoplasm of lymphoid Haematopoietic & related tissue	2.9	3.6
I30-I49, I51,I52	Other forms of heart diseases	2.6	17.1
I70-I79	Disease of arteries arterioles and capillaries	2.0	5.9
C50	Malignant neoplasm of breast	2.0	2.5
I50	Heart failure	2.0	13.4

Source: EIRI (EIRE, 2004)

Table 4 shows chronic diseases mortality and comorbidities of related conditions in SWAHS.

Table 4. Chronic illnesses mortality and major comorbidities in all ages, Western Sydney and NSW residents, 1997-2000

UNDERLYING CAUSE OF DEATH	**WESTERN SYDNEY**		**NSW**	
	Total as underlying cause	**% co-existing condition**	**Total as underlying cause**	**% co-existing condition**
Ischaemic heart disease (ICD10 I20-I25)	3,361		39,538	
Co-existing contributory causes:				
Other forms of heart disease (I30-I49,I51,I52)		1,043 (31.0%)		12, 054 (30.5%)
Heart failure (I50)*		720 (21.0%)		9,146 (23.1%)
All forms of diabetes (E10-E14)		388 (12.0%)		3,858 (9.7%)
Organic mental disorders (F00-F09)		240 (7.1%)		2,064 (5.2%)
Diabetes (E10,E11)	125		1,322	
Co-existing contributory causes:				
Ischaemic heart disease (I20-I25)		79 (63.2%)		719 (54.4%)
Other forms of heart disease (I30-I49,I51,I52)		23 (18.4%)		282 (21.3%)
Heart failure (I50)		25 (20%)		211 (15.8%)
Heart Failure (I50)	282		4,108	
Co-existing contributory causes:				
Other forms of heart disease (I30-I49,I51,I52)		82 (29.1%)		852 (20.7%)
Pneumonia/influenza (J10-J18)		66 (23.4%)		1,132 (27.6%)
Renal failure (N17-N19)		68 (24.1%)		746 (18.2%)
Chronic lower respiratory disease (J40-J47)		45 (16.0%)		502 (12.2%)
Organic mental disorders (F00-F09)		27 (9.6%)		395 (9.6%)
Cerebrovascular disease (I60-I69)		27 (9.6%)		375 (9.1%)
Diabetes (E10-E14)*		38 (13.5%)		275 (6.7%)
Pneumonia n influenza (J10-J18)	188		2,704	
Co-existing contributory causes:				
Signs & symptoms (R50-R69)		32 (17.0%)		385 (14.2%)
Other forms of heart disease (I30-I49,I51,I52)		25 (13.3%)		260 (9.6%)
Heart failure (I50)		18 (9.6%)		218 (8.1%)
Ischaemic heart disease (I20-I25)		23 (12.2%)		295 (10.9%)
Other bacterial diseases (A30-A49)		33 (17.6%)		323 (11.9%)
Chronic obstructive pulmonary disease (J44)	521		6,614	
Co-existing contributory causes:				
Other forms of heart disease (I30-I49,I51,I52)		90 (17.3%)		867 (13.1%)
Heart failure (I50)*		104 (20.0%)		1,261 (19.1%)
Pneumonia/influenza (J10-J18)		135 (25.9%)		2,057 (31.1%)
Ischaemic heart disease (I20-I25)		112 (21.5%)		1,131 (17.1%)

* SCIPPS indexed conditions
Source: EIRI (EIRE, 2004)

Pneumonia and influenza (23%), renal failure (24%) and chronic lower respiratory diseases are the main comorbidities of heart failure mortality in Sydney west. Table 4 also demonstrates that heart failure is the second comorbidity of ischemic heart disease (21%), third comorbidity of diabetes (20%), second comorbidity of chronic obstructive pulmonary disease (20%) and the third comorbidity of pneumonia and influenza (10%) in SWAHS during 1997-2000.

Burden of disease

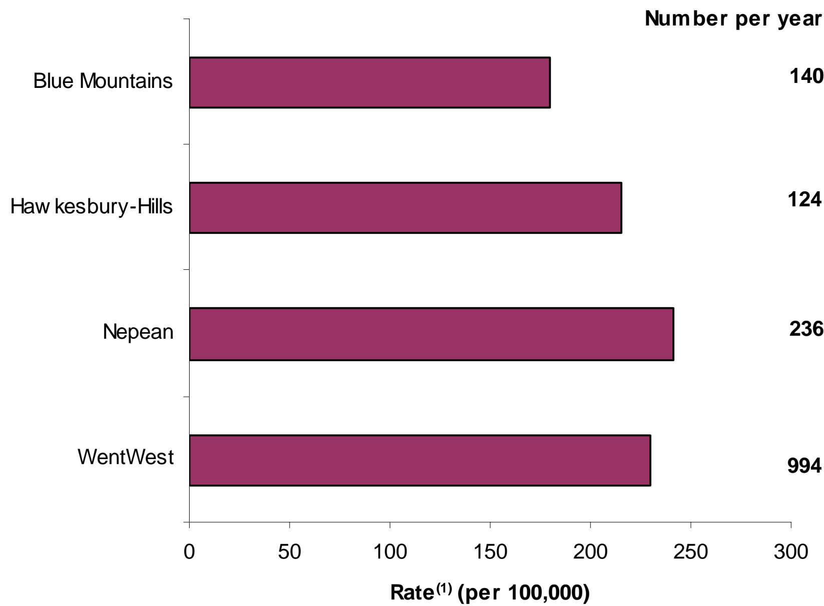
Information on the burden of CHF within Western Sydney and the ACT is taken from the Division of General Practice (DGP), Population Health Profiles, produced by the Public Health Information Development Unit of the University of Adelaide. The ACT DGP covers the entire ACT area. There are four DGPs that cover the majority of the SWAHS jurisdiction (the Lithgow LGA is the only exception, which is covered by the NSW Central West DGP): Blue Mountains, Hawkesbury-Hills (formerly Hawkesbury), Nepean and WentWest (formerly Western Sydney).

CHF, congestive heart failure in these reports, was classified as an ambulatory care sensitive (ACS) condition within each DGP. This classification identified conditions in which timely and effective care, delivered in primary care settings, could have reduced the risk of hospitalisation associated with the condition. Admissions to hospital for chronic ACS conditions could be avoided (avoidable hospitalisations) by effective management to prevent or reduce the severity of acute illness episodes.

CHF was among the top four chronic conditions, after diabetes, iron deficiency anaemia and hypertension, with the highest rate of avoidable hospitalisations in the Nepean, WentWest, Hawkesbury Hills, Blue Mountains and ACT DGPs in the period from 2001-2002 (Figures 4-5). Figure 4 illustrates the differences in rates of avoidable CHF hospitalisations for the Western Sydney DGPs and Figure 5 compares an aggregated, weighted average, Western Sydney rate with avoidable hospitalisations rate from ACT, New South Wales (NSW) and Australia.

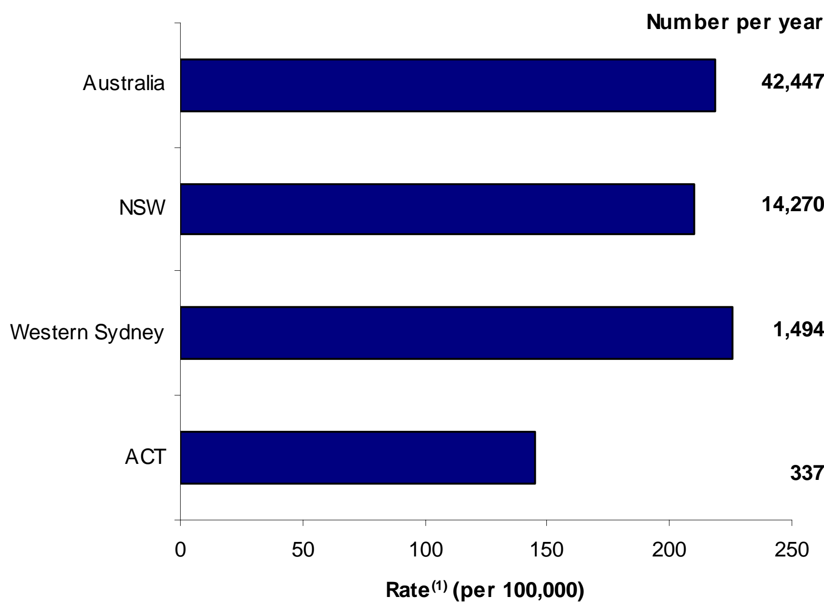
Avoidable mortality data from CHF were not available for Western Sydney and the ACT.

Figure 4: Avoidable CHF hospitalisation rates for the DGPs within Western Sydney (2001-02)



(1) Rate is the indirect age-standardised rate per 100,000 population
(2) Data from the Public Health Information Development Unit (PHIDU).
Adapted from: (PHIDU, 2007e; 2007d; 2007b; 2007c; 2007a)

Figure 5: Avoidable CHF hospitalisation rates for Western Sydney(2), ACT, NSW and Australia (2001-02)



(1) Rate is the indirect age-standardised rate per 100,000 population
(2) Author's calculation from data from the Public Health Information Development Unit (PHIDU). Calculation does not include data from the Lithgow LGA.
Adapted from: (PHIDU, 2007e; 2007d; 2007b; 2007c; 2007a)

Within the Western Sydney area, Indigenous Australians generally experienced a much higher rate of potentially avoidable hospitalisations for chronic illness, including CHF, compared to non-Indigenous Australians (SWHAS, 2006).

CONCLUSION

The information presented in this review highlights the burden of disease associated with CHF globally, within Australia and within the Western Sydney and ACT areas. Estimates of the prevalence of CHF in Australia indicate that this condition has become less prevalent in recent years. However, the prevalence of condition increases remarkably with age. Improvement in lowering the incidence and mortality of ischemic heart disease since 1968 in Australia is one of the main contributors to the decline of CHF mortality over the last 20 years. Among the survivors of the ischemic heart disease epidemic in Australia, there would be a cohort in whom residual heart failure was present, with their longevity enhanced because of the spectacular improvement in treatment for chronic heart failure that also occurred over this period. The decline in mortality reflects the fact that individuals are generally living longer with the condition, which may be a result of improved management of CHF and longer life expectancy in Australia. Taken together however, the increasing longevity of Australians and the cost of multiple admissions of patients with CHF supports the need to continue to improve the management of this condition in order to curtail its social and economic burden, which remains substantial and will increase due to the aging population.

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