Heart, Lung and Circulation (2014) **23,** 320–324
1443-9506/04/$36.00
http://dx.doi.org/10.1016/j.hlc.2013.10.056

ORIGINAL ARTICLE

Socioeconomic Status and Heart Failure in Sydney

Glenn R. Close [a], Phillip J. Newton [b], Simon C. Fung [a], A. Robert Denniss [a,c], Elizabeth J. Halcomb [d], Pramesh Kovoor [a,e], Simon Stewart [f], Patricia M. Davidson [b,g*]

[a]Western Sydney Local Health District, Australia
[b]Centre for Cardiovascular and Chronic Care, University of Technology Sydney, Australia
[c]University of Western Sydney, Australia
[d]University of Wollongong, Australia
[e]University of Sydney, Australia
[f]Baker IDI Heart and the Diabetes Institute, Australia
[g]Cardiovascular Nursing Research, St Vincent's, Sydney, Australia

Received 29 July 2011; received in revised form 14 August 2013; accepted 3 October 2013; online published-ahead-of-print 27 November 2013

Background Socioeconomic disadvantage is associated with an increased risk of developing heart failure and with inferior health outcomes following diagnosis.

Methods Data for hospitalisations and deaths due to heart failure in the Sydney metropolitan region were extracted from New South Wales hospital records and Australian Bureau of Statistics databases for 1999–2003. Standardised rates were analysed according to patients' residential local government area and correlated with an index of socioeconomic disadvantage.

Results Eight of the 13 local government areas with standardised separation rate ratios significantly higher than all NSW, and those with the six highest standardised separation rate ratios, were in Greater Western Sydney. Rates of heart failure hospitalisations per local government area were inversely correlated with level of socioeconomic status.

Conclusions Higher rates of heart failure hospitalisations among residents of socioeconomically disadvantaged regions within Sydney highlight the need for strategies to lessen the impact of disadvantage and strategies to improve cardiovascular health.

Keywords Socioeconomic factors • Health status • Health disparities • Heart failure • Sydney • Australia

Background

Internationally, socioeconomic disadvantage is associated with an increased risk of developing heart failure (HF) and with poorer outcomes [1–7]. Socioeconomic deprivation has been associated with adverse cardiovascular outcomes in Australian adults [8,9], but the level of risk has not been quantified [10] nor the causal relationships well understood. Rates of death due to HF are higher among those living in the most disadvantaged areas than among those in the least disadvantaged areas [8].

Socioeconomic status and place of residence is highly relevant in the context of current discussion of health reform in Australia and elsewhere [11,12]. We investigated the relationship between heart failure outcomes (rates of hospitalisations and deaths) and socioeconomic status in a study of hospitalisation and mortality rates in patients admitted to hospitals in metropolitan Sydney, New South Wales (NSW), Australia during the period 1999–2003. The Sydney metropolitan region is characterised by marked variation in socioeconomic status and includes some of the most advantaged and most disadvantaged populations in New South Wales [13].

*Corresponding author at: Level 7, 235-253 Jones Street (P.O. Box 123), Broadway, NSW, Australia. Tel.: +61 02 9514 4822; fax: +61 02 9514 4832; mobile: +61 414674134., Emails: patriciamary.davidson@uts.edu.au, pdavids3@jhu.edu

Patients and Methods

Data were extracted from Health Outcomes Statistical Toolkit (HOIST) data warehouse, maintained by the Centre for Epidemiology and Research in the New South Wales (NSW) Department of Health. Cases were defined as patients discharged with a principal diagnosis of HF (ICD10, I50 or ICD.9, 428). Where correlations with socio-economic indexes were estimated hospital data for the period 1999/2000–2001/2002 were used. Mortality data (for four, five-year periods up

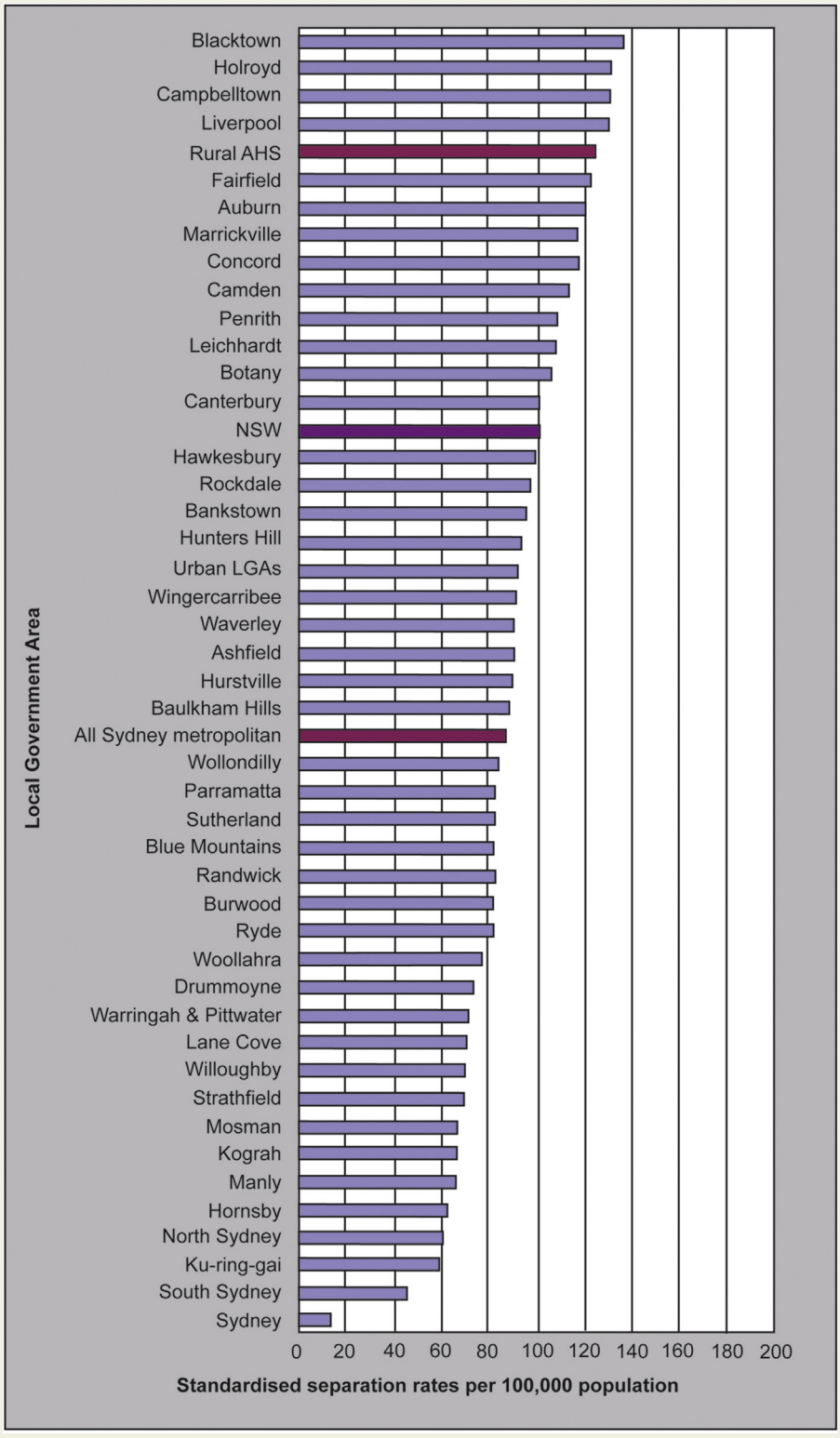

Figure 1 Standardised heart failure separations per 100,000 population.

to 1998–2002) and appropriate population data (for calculation of crude and standardised rates) from the Australian Bureau of Statistics (ABS) were also available in HOIST. Socio-Economic Indexes for Areas (SEIFA) were calculated providing summary measures derived from the national Census to measure different aspects of socioeconomic conditions by geographic area [14]. The SEIFA is a socio-economic indexes for a product developed by the Australian Bureau of Statistics that ranks areas in Australia according to relative socioeconomic advantage and disadvantage. The indexes are based on information from the five-yearly Census and pertain to the capacity to access material and social resources and the capacity to engage in society [15]. This includes variables pertaining to household income, education and occupation. A SEIFA score is standardised against a mean of 1000 with a standard deviation of 100. This means that the average SEIFA score will be 1000 and the middle two-thirds of SEIFA scores will fall between 900 and 1100. Information to derive SEIFA scores for this analysis was taken from the 2001 Census.

The main outcomes measured were:

- rates of hospitalisation due to heart failure, defined as an episode of inpatient hospital stay including at least one night, for which heart failure (International Classification of Diseases tenth revision code I50 or ninth revision code 428) was recorded as the principal reason for the admission at the time of separation (discharge, transfer or death)
- rates of death due to heart failure as the underlying cause identified on death certificates
- rates of death in which heart failure was listed as a contributory cause in hospital separation data.

As a proxy indicator of acute myocardial infarction (AMI) [16] we also measured the rate of major coronary events (the sum of the number of deaths for which coronary heart disease was recorded as the underlying cause and the number of hospital separations due to AMI following an admission of three days or more). Outcomes by residential local government area (LGA) were compared with those for all Sydney metropolitan regions and all NSW, and outcomes by LGA were correlated with SEIFA Index of disadvantage scores. Statistical analyses of data were performed using SAS (SAS Institute Inc.) [17] and SPSS (SPSS Inc.) software [18].

Results

Rates of hospitalisation due to heart failure varied substantially across NSW (Fig. 1). The standardised separation rate (SSR) for all metropolitan Sydney was significantly ($p < 0.01$) lower than for NSW overall (226.5 per 100,000 vs. 259.7 per 100,000, 99% CI 258.0–261.5). This difference was mainly due to high hospitalisation rates for HF among rural residents (322.7 per 100,000, 99% CI 318.9–326.6). Eight of the 13 local government areas with standardised separation rate ratios significantly higher than all NSW, and those with the six highest standardised separation rate ratios, were in Greater Western Sydney.

The variation in heart failure hospitalisation reflects the underlying variation in socioeconomic status across these LGAs. Fig. 2 shows the relationship between the heart failure SSR for Sydney LGAs and the corresponding ABS Index of Socio-economic Disadvantage (based on 2001 Census data).

There were an average of 480 adult (age 20 years and older) deaths per annum in Sydney residents recorded as being primarily due to heart failure during the five years 1998–2002. The age adjusted mortality rate among Sydney residents has tended to be lower than that for residents of rural

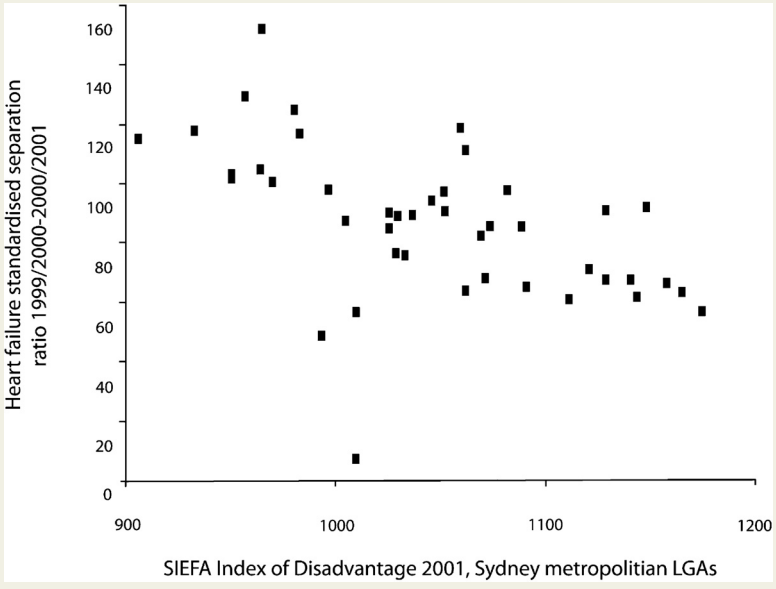

Figure 2 Socio-Economic Indexes for Areas (SEIFA) Index of Disadvantage 2001 Sydney Metropolitan Local Government Areas.

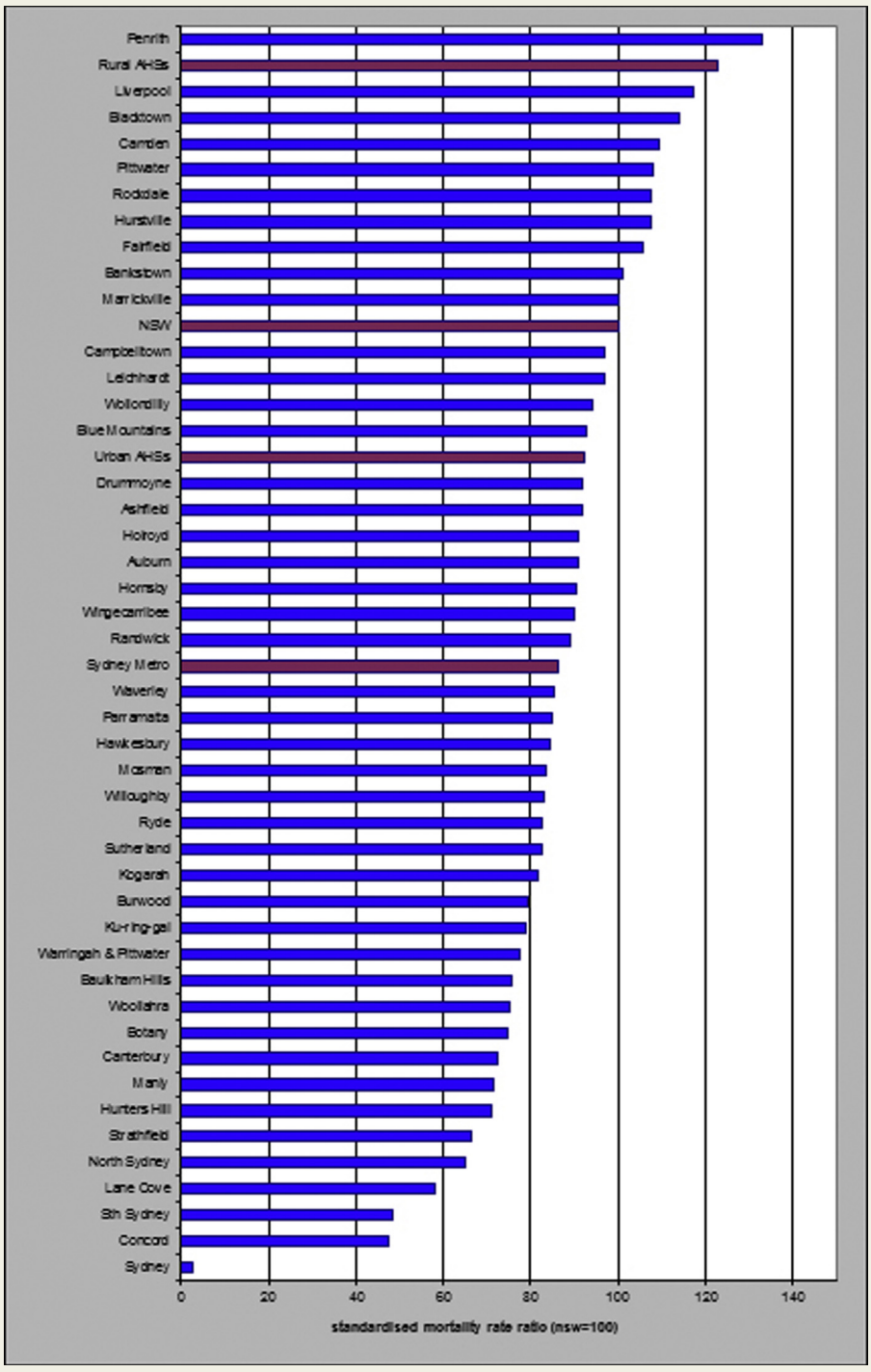

Figure 3 Standardised Mortality Ratio (New South Wales (NSW) = 100).

NSW, although rates for all groups have been decreasing in recent decades. The Standardised Mortality Ratio, the ratio of observed deaths in the study group to expected deaths in the general population varied significantly between LGAs hospitalisation rates (Fig. 3).

When all contributory causes of death in the 1998–2002 period were counted, there were about 3000 deaths per annum among adult (20 years and older) Sydney residents. Where HF was the underlying cause of death, other heart disease, pneumonia, renal failure, chronic lower respiratory disease and diabetes were common co-existing contributory causes.

There was a significant ($p < 0.001$) negative correlation (Spearman's rho = −0.6) between the SSR and SEIFA Index. Some of this variation may reflect the similar variation in major coronary event rate ratios (a composite variable of

myocardial infarction deaths and hospitalisation with length of stay of three days or more) that serves as a proxy indicator of CHD incidence [19]. There was a positive correlation between the 1999/2000–2001/2002 HF SSR and major coronary event rate ratios (rho = 0.6, $p < 0.0001$) and between the major coronary event rate ratios and 2001 Index of Socio-economic Disadvantage (rho = 0.5, $p < 0.0001$).

Discussion

Possible explanations for the observed correlation between socioeconomic status and adverse HF outcomes include increased rates of precursor conditions such as hypertension, coronary heart disease and diabetes and their risk factors, poorer management of diagnosed HF, and unequal access to health care services in the disadvantaged groups [1,20]. Data from NSW Health Surveys show that rates of smoking and exposure to tobacco smoke, inadequate vegetable consumption, inadequate physical activity and overweight/obesity generally increase with socioeconomic disadvantage [21]. In more affluent areas of Australia there are two-and-a-half times more GPs than less affluent areas [22].

The Greater Western Sydney region, a major population growth area representing 43% of the Sydney metropolitan total population [23], was over-represented among LGAs with the highest hospitalisation rates for heart failure. This region includes one of the five most disadvantaged LGAs in NSW [21] and is home to a highly culturally and linguistically diverse population [23]. Lower socioeconomic status and language barriers between patients and health professionals are both known indicators of high risk for hospital readmission for HF [20]. The largest urban communities of Aboriginal and Torres Strait Islander people live in the Greater Western Sydney region [23]. National hospitalisation rates for HF among Aboriginal and Torres Strait Islander peoples were approximately two-to-three times those of other Australians in 2001–2002 [8].

Conclusions

Findings presented highlight the importance of secondary prevention strategies to prevent HF in areas of known disadvantage. These findings support national health reform to reduce health disparities and address the impact of social determinants of health and address access to health care services. Clustering of higher rates of hospitalisation for HF and HF deaths in Western Sydney suggests the need for targeted, culturally appropriate strategies to overcome inequality in this region.

Acknowledgement

This study was supported in part by funding from the National Health and Medical Research Council 219452.

References

[1] McAlister F, Murphy N, Simpson C, Stewart S, MacIntyre K, Kirkpatrick M, et al. Influence of socioeconomic deprivation on the primary care burden and treatment of patients with a diagnosis of heart failure in general practice in Scotland: population based study. BMJ 2004;328:1110.
[2] Stewart S, Murphy N, McMurray J, Jhund P, Hart C, Hole D. Effect of socioeconomic deprivation on the population risk of incident heart failure hospitalisation: an analysis of the Renfrew/Paisley Study. Eur J Heart Fail 2006;8:856–63.
[3] Philbin E, Dec G, Jenkins P, DiSalvo T. Socioeconomic status as an independent risk factor for hospital readmission for heart failure. Am J Cardiol 2001;87:1367–71.
[4] Rathore S, Masoudi F, Wang Y, Curtis J, Foody J, Havranek E, et al. Socioeconomic status, treatment, and outcomes among elderly patients hospitalized with heart failure: findings from the National Heart Failure Project. Am Heart J 2006;152:371–8.
[5] Struthers A, Anderson G, Donnan P, MacDonald T. Social deprivation increases cardiac hospitalisations in chronic heart failure independent of disease severity and diuretic non-adherence. Heart 2000;83:12–6.
[6] Blair A, Lloyd-Williams F, Mair F. What do we know about socieconomic status and congestive heart failure? A review of the literature. J Fam Pract 2002;51:169.
[7] Riddell T. Heart failure hospitalisations and deaths in New Zealand: patterns by deprivation and ethnicity. N Z Med J 2004;118:U1254.
[8] Australian Institute of Health and Welfare. Heart, stroke and vascular diseases—Australian facts 2004. AIHW cat. No. Cvd 27. Canberra: AIHW and National Heart Foundation of Australia (Cardiovascular Disease Series No. 22); 2004.
[9] Australian Institute of Health and Welfare. Australia's health 2008. Cat. No. Aus 99. Canberra: AIHW; 2008.
[10] National Vascular Disease Prevention Alliance. Guidelines for the assessment of absolute cardiovascular disease risk. Melbourne: Heart Foundation; 2009.
[11] Carrington MJ, Jennings GL, Clark RA, Stewart S. Assessing cardiovascular risk in regional areas: the healthy hearts—beyond city limits program. BMC Health Serv Res 2012;12:296.
[12] Clark RA, Coffee N, Turner D, Eckert KA, van Gaans D, Wilkinson D, et al. Application of geographic modeling techniques to quantify spatial access to health services before and after an acute cardiac event, Clinical Perspective: The Cardiac Accessibility and Remoteness Index for Australia (ARIA) Project. Circulation 2012;125:2006–14.
[13] Population Health Division NSW Health. The health of the people of New South Wales – Report of the Chief Health Officer 2008; 2008.
[14] Australian Bureau of Statistics. Socio-economic Indices for Areas 2001. Canberra 2008.
[15] Pink B. Information paper: an introduction to Socio-economic Indexes for Areas (SEIFA), 2006. Canberra: Australian Bureau of Statistics (ABS); 2008.
[16] Mathur S. Epidemic of coronary heart disease and its treatment in Australia. Cat no. Cvd 21. Canberra: Australian Institute of Health and Welfare; 2002.
[17] SAS Institute Inc. SAS system for Windows.
[18] Harper S, Lynch J, Smith GD. Social determinants and the decline of cardiovascular diseases: understanding the links. Annu Rev Public Health 2011;32:39–69.
[19] Mathur S. Epidemic of coronary heart disease and its treatment in Australia. Cardiovascular Disease Series Number 20. AIHW cat. No. Cvd 21; 2002.
[20] National Heart Foundation of Australia and the Cardiac Society of Australia and New Zealand (Chronic Heart Failure Guidelines Expert Writing Panel). Guidelines for the prevention, detection and management of chronic heart failure in Australia, 2006. Melbourne: National Heart Foundation of Australia; 2006.
[21] Population Health Division NSW Health. The health of the people of New South Wales – Report of the Chief Health Officer 2008. Summary report. Sydney: NSW Department of Health; 2008.
[22] Hordacre A, Howard S, Moretti C, Kalucy E. Making a difference. Report of the 2005–2006 Annual survey of divisions of general practice. Adelaide: Primary Health Care Research & Information Service, Department of General Practice, Flinders University, and Australian Government Department of Health and Ageing; 2007.
[23] NSW Government Communities, NSW Office of Western Sydney. About Western Sydney; 2009.