Rural and urban differentials in primary care management of chronic heart failure: new data from the CASE study

Robyn A Clark, Kerena A Eckert, Simon Stewart, Susan M Phillips, Julie J Yallop, Andrew M Tonkin and Henry Krum

ABSTRACT

Objective: To determine whether primary care management of chronic heart failure (CHF) differed between rural and urban areas in Australia.

Design: A cross-sectional survey stratified by Rural, Remote and Metropolitan Areas (RRMA) classification. The primary source of data was the Cardiac Awareness Survey and Evaluation (CASE) study.

Setting: Secondary analysis of data obtained from 341 Australian general practitioners and 23 845 adults aged 60 years or more in 1998.

Main outcome measures: CHF determined by criteria recommended by the World Health Organization, diagnostic practices, use of pharmacotherapy, and CHF-related hospital admissions in the 12 months before the study.

Results: There was a significantly higher prevalence of CHF among general practice patients in large and small rural towns (16.1%) compared with capital city and metropolitan areas (12.4%) ($P < 0.001$). Echocardiography was used less often for diagnosis in rural towns compared with metropolitan areas (52.0% v 67.3%, $P < 0.001$). Rates of specialist referral were also significantly lower in rural towns than in metropolitan areas (59.1% v 69.6%, $P < 0.001$), as were prescribing rates of angiotensin-converting enzyme inhibitors (51.4% v 60.1%, $P < 0.001$). There was no geographical variation in prescribing rates of β-blockers (12.6% [rural] v 11.8% [metropolitan], $P = 0.32$). Overall, few survey participants received recommended "evidence-based practice" diagnosis and management for CHF (metropolitan, 4.6%; rural, 3.9%; and remote areas, 3.7%).

Conclusions: This study found a higher prevalence of CHF, and significantly lower use of recommended diagnostic methods and pharmacological treatment among patients in rural areas.

MJA 2007; 186: 441–445

Chronic heart failure (CHF) is a debilitating and deadly syndrome recognised as a major and increasing public health problem in developed countries as the population ages.[1] Australia has one of the highest population growths in the over-65-years age group,[2] and therefore the number of cases of CHF is predicted to rise further.[3] However, the true burden of CHF in Australia has only just begun to be measured, and there is a lack of data from rural and remote populations.[3,4]

The Cardiac Awareness Survey and Evaluation (CASE) study, conducted in 1998, examined the level of awareness of CHF and management practices among Australian general practitioners.[5] The study revealed that CHF was a common presentation in patients aged over 60 years (two in 10 patients). Furthermore, despite 10 years of evidence to support the use of angiotensin-converting enzyme (ACE) inhibitors, and strong emerging evidence for the use of β-blockers (which were previously thought to be contraindicated[6,7]), the study found that pharmacological management with ACE inhibitors was still relatively underutilised.

At the time, best-practice management for patients with CHF comprised (and still comprises) regular specialist review; diagnostic interventions such as echocardiography; pharmacological treatment including ACE inhibitors and β-blockers; non-pharmacological management involving education and self-monitoring (daily weight and symptom recognition); and lifestyle changes, such as exercise, moderation of fluid and salt intake, and smoking cessation.[8,9]

Significant inequalities in health are evident for rural and remote Australians for many health indicators, and mortality from circulatory diseases has been shown to rise with increasing remoteness.[10] Australians living in rural and remote areas also have less access to health care services, such as GPs, diagnostic facilities, specialist support and pharmaceutical services, compared with those living in metropolitan areas.[10] Currently there are no national rural and remote CHF prevalence data, although limited attempts have been made to derive estimates using international data.[11] A recent population-based study involving 1275 adults aged between 60 and 86 years found evidence of CHF in 6.3% (previously diagnosed CHF, 5.6% [95% CI, 4.4%–7.1%]; newly diagnosed CHF, 0.6% [95% CI, 0.3%–1.2%]).[4] However, the study did not examine urban and rural differences in CHF prevalence, nor provide comprehensive information on best-practice management in the primary care setting.

The CASE study is a rich and relevant source of Australian data on CHF management practices in primary care but, as yet, has not been evaluated from a rural and remote perspective. The aim of this study was therefore to determine whether CHF management differed between rural and urban primary care settings.

METHODS

Study design and sample

The study was a secondary analysis of data obtained from the CASE study, conducted in 1998. That study involved a large, cross-sectional, convenience sample of GPs from all Australian states. Each GP assessed 80 consecutive patients aged 60 years or older for the possibility of CHF. The aims, methods and initial findings have been reported previously.[5]

Diagnosis of chronic heart failure

As indicated in the original CASE report,[5] diagnosis of CHF (both newly and previously diagnosed) was based on modified World Health Organization criteria.[8]

Geographical dispersion

Rurality was determined using the Rural, Remote and Metropolitan Areas (RRMA) classification.[12] This is a geographical classification based on statistical local areas (SLAs), and allocates each SLA in Australia to a category based on population numbers and an index of remoteness. The RRMA classification was used to convert population estimates by SLA to estimates for each of seven

1 Prevalence of chronic heart failure (CHF) in the CASE population, by Rural, Remote and Metropolitan Areas (RRMA) category

Diagnostic category	Number with CHF (% of total in RRMA category; 95% CI)				χ^2 (df)	*P**
	Total (*n* = 20 895)	Capital cities and metropolitan (*n* = 15 770)	Large and small rural towns (*n* = 3357)	Other rural and remote areas (*n* = 1768)		
Total with CHF	2735 (13.1%; 12%–14%)	1950 (12.4%;† 12%–13%)	539 (16.1%;‡ 15%–17%)	246 (13.9%; 12%–16%)	34.297 (2)	< 0.001
Previously diagnosed	2335 (11.2%; 11%–12%)	1651 (10.5%;† 10%–11%)	475 (14.1%;‡ 13%–15%)	212 (12.0%; 10%–13%)	37.252 (2)	< 0.001
Newly diagnosed	400 (1.9%; 1%–2%)	299 (1.9%; 1%–2%)	67 (1.9%; 1%–2%)	34 (1.9%; 1%–3%)	0.148 (2)	0.93

* Overall *P* values for multiple contingency tables were obtained using χ^2 tests. $P < 0.05$ indicates a significant overall association between the two variables examined. † Percentage significantly lower than the overall average for RRMA categories. ‡ Percentage significantly higher than the overall average for RRMA categories. Bonferroni correction was applied to multiple contingency tables. df = degrees of freedom. CASE = Cardiac Awareness Survey and Evaluation. ◆

RRMA categories: capital cities; other metropolitan centres (urban centre population > 100 000); large rural centres (population 25 000–99 000); small rural centres (population 10 000–24 999); other rural areas (population < 10 000); remote centres (population > 5000); and other remote areas (population < 5000). To ensure estimates for the less populated rural and remote areas would be made with adequate confidence, the seven RRMA categories were collapsed into three: capital cities and metropolitan areas (RRMA 1–2); large and small rural towns (RRMA 3–4); and other rural and remote areas (RRMA, 5–7). In the event that the patient's postcode was missing, the postcode of the patient's GP was used instead.

Analysis

Data were analysed using SPSS version 12.01 (SPSS Inc, Chicago, Ill, USA). Overall *P* values for multiple contingency tables were obtained using χ^2 tests to compare demographic characteristics and management by geographical areas. Where significant overall differences were found, adjusted standardised residuals were examined to determine which RRMA category differed from the overall average. Adjusted standardised residuals in SPSS can be interpreted as *z* scores. Bonferroni corrections were applied by dividing obtained *P* values by the number of statistical comparisons made.

Additional study measures included CHF-related hospital admissions in the 12 months before the study. These data were obtained from GPs' patient medical records. To allow for meaningful analysis, the number of admissions per patient was categorised as none, 1, 2–3 or 4–14. Pharmacotherapy use comprised ACE inhibitor, diuretic (loop), β-blocker, and combinations of ACE inhibitor and β-blocker. Evidence-based practice was defined as use of an echocardiogram for diagnosis, combined with ACE inhibitor and β-blocker pharmacotherapy.

RESULTS

Three-hundred and forty-one GPs recruited 23 845 patients for the CASE study; 1785 patients were excluded from the analysis because of patient refusal or missing data, resulting in a baseline population of 22 060 patients (92.5%). Of these, 2905 were diagnosed with CHF: 2485 of these (86%) had been previously diagnosed, and 420 (14%) were newly diagnosed.

Postcode, which is essential for RRMA classification, was missing for 1165 patients (5.3%). Thus, the current analysis included 20 895 patients, 2735 of whom had a confirmed diagnosis of CHF: 2335 had been previously diagnosed, and 400 were newly diagnosed.

Among the 2735 patients with CHF, 1950 (71.3%) resided in capital cities and metropolitan areas, 539 (19.7%) in large and small rural towns, and 246 (9.0%) in other rural and remote areas.[5]

Prevalence of chronic heart failure

The overall prevalence of CHF among patients aged 60 years and over across Australia was 13.1%, comprising previously diagnosed cases (prevalence, 11.2%) and newly diagnosed cases (prevalence, 1.9%) (Box 1). Patients from capital cities and metropolitan areas experienced a significantly lower rate of CHF (12.4%), while those from large and small rural towns experienced a significantly higher rate (16.1%). Prevalence of previously diagnosed cases was higher in rural towns (14.1%) (Box 1). However, there was no significant geographical variation in prevalence of newly diagnosed cases (Box 1).

2 Number of previously diagnosed chronic heart failure (CHF) patients with CHF-related hospital admissions in the 12 months before the CASE study, by Rural, Remote and Metropolitan Areas (RRMA) category

No. of admissions	Number of patients (% of patients in RRMA category; 95% CI)				χ^2 (df)	*P*†
	Total (*n* = 2034)*	Capital cities and metropolitan (*n* = 1440)*	Large and small rural towns (*n* = 406)*	Other rural and remote areas (*n* = 188)*		
0	1324 (65%; 63%–65%)	942 (65%; 60%–68%)	265 (65%; 60%–70%)	117 (62%; 55%–69%)	4.627 (6)	0.06
1	440 (22%; 18%–23%)	318 (22%; 19%–24%)	82 (20%; 16%–24%)	40 (21%; 16%–28%)		
2–3	212 (10.4%; 9%–12%)	138 (9.6%; 8%–11%)	49 (12%; 9%–16%)	25 (13%; 9%–19%)		
4–14	58 (2.9%; 2%–4%)	42 (3%; 2%–4%)	10 (2.5%; 1%–4%)	6 (3%; 1%–6%)		

* Data on hospital admissions were missing for 701 patients. † Overall *P* values for multiple contingency tables were obtained using χ^2 tests. $P < 0.05$ indicates a significant overall association between the two variables examined. Bonferroni correction was applied to multiple contingency tables.
df = degrees of freedom. CASE = Cardiac Awareness Survey and Evaluation. ◆

3 Diagnosis of chronic heart failure (CHF) and pharmacotherapy used, by Rural, Remote and Metropolitan Areas (RRMA) category

	Number of patients (% of patients in RRMA category; 95% CI)				
	Total ($n = 2735$)	Capital cities and metropolitan ($n = 1950$)	Large and small rural towns ($n = 539$)	Other rural and remote areas ($n = 246$)	P*
Diagnosis					
WHO criteria used	400 (14.6%; 13%–15%)	299 (15.3%; 13%–17%)	67 (12.4%; 10%–15%)	34 (13.8%; 10%–18%)	0.22
Echocardiogram					
In previously diagnosed†	1423 (63.4%; 61%–65%)	1069 (67.3%;§ 64%–69%)	234 (52.1%;‡ 47%–56%)	120 (58.0%;‡ 51%–64%)	< 0.001
In newly diagnosed†	105 (30.0%; 25%–35%)	90 (34.5%;§ 30%–40%)	12 (20.3%; 12%–32%)	3 (10.0%;‡ 4%–26%)	0.04
Referral to specialist†	1485 (66.4%; 64%–68%)	1100 (69.6%;§ 67%–71%)	269 (59.1%;‡ 54%–63%)	116 (57.7%;‡ 51%–64%)	< 0.001
Pharmacotherapy					
ACEI	1601 (58.5%; 57%–60%)	1171 (60.1%;§ 58%–62%)	277 (51.4%;‡ 47%–56%)	153 (62.2%; 56%–68%)	< 0.001
Diuretic (loop)	1839 (67.2%; 65%–70%)	1305 (66.9%; 65%–69%)	373 (69.2%; 65%–73%)	161 (65.4%; 59%–71%)	0.49
β-blocker	320 (11.7%; 10%–13%)	230 (11.8%; 10%–13%)	68 (12.6%; 10%–16%)	22 (8.9%; 6%–13%)	0.32
ACEI + β-blocker	168 (6.1%; 5%–7%)	123 (6.3%; 5%–7%)	32 (5.9%; 4%–8%)	13 (5.3%; 3%–9%)	0.80
Evidence-based practice					
Echocardiogram + ACEI + β-blocker	119 (4.4%; 4%–5%)	89 (4.6%; 3%–5%)	21 (3.9%; 3%–6%)	9 (3.7%; 2%–7%)	0.70

* Overall P values for multiple contingency tables were obtained using χ^2 tests. $P < 0.05$ indicates a significant overall association between the two variables examined. † Denominators may vary from totals and are based on available data for echocardiogram and referral to specialist. ‡ Percentage significantly lower than the overall average for RRMA categories. § Percentage significantly higher than the overall average for RRMA categories. Bonferroni correction was applied to multiple contingency tables. ACEI = angiotensin-converting enzyme inhibitor. WHO = World Health Organization. ◆

Hospitalisation for chronic heart failure

The number of CHF-related hospital admissions in the 12 months before the study is shown in Box 2. Sixty-five per cent of patients previously diagnosed with CHF had no CHF-related hospital admissions in the previous 12 months, while the remaining 35% had a total of 1298 admissions, the majority having been admitted between one and three times in that year (32%). The mean number of admissions was 0.6 per patient (SD, 1.19; median, 0; and range, 0–14). There was no significant association between patient admission rates and RRMA geographical category ($P = 0.06$) (Box 2).

Comorbidities

Cardiovascular and other comorbidities, such as hypertension, asthma and diabetes, which may contribute to CHF in these patients, were also examined by RRMA geographical location. There was no significant difference in the rate of comorbidities or multiple comorbidities by RRMA category.

Diagnosis of chronic heart failure

Use of WHO criteria: Box 3 shows GP diagnostic practices for previously diagnosed and newly diagnosed cases of CHF by RRMA geographical category. Fifteen per cent of CHF patients were diagnosed using the recommended modified WHO criteria.[8] There was no statistically significant variation in the use of the recommended diagnostic criteria by GPs across RRMA geographical categories ($P = 0.22$).

Echocardiography: Sixty-three per cent of previously diagnosed patients (95% CI, 61%–65%) and 30% of newly diagnosed patients (95% CI, 25%–35%) were referred for an echocardiogram (Box 3). Echocardiogram referral was significantly more common in capital cities and metropolitan areas compared with other RRMA categories ($P < 0.001$ for previously diagnosed patients, and $P = 0.04$ for newly diagnosed patients).

Specialist referral: About 66% of patients with CHF were referred by their GP to a specialist. When specialist referral patterns were examined by RRMA category, referral was significantly lower in rural and remote areas (Box 3).

Pharmacotherapy

As originally reported in the CASE study, the overall rate of prescription of ACE inhibitors was 58%.[5] Rates of ACE inhibitor prescribing were significantly lower in rural towns than in other RRMA categories (Box 3). The mean dose of ACE inhibitor (for all brands) was within the medium–low range across all RRMA regions. There was no statistical difference in the mean dose of ACE inhibitor prescribed according to RRMA geographical areas. (Angiotensin II receptor blockers were not available for general use in 1998.)

A third (33%) of patients with CHF were not prescribed any diuretic therapy. There was no statistically significant difference in prescribing rates of diuretics between cities and rural areas ($P = 0.49$; 95% CI, 31%–35%). Nor was there a statistically significant difference in prescribing rates for β-blockers and combined ACE inhibitor/β-blocker by RRMA category, although frequency of prescribing was generally lower in rural and remote areas.

Evidence-based CHF management

The rate of use of evidence-based management for CHF (diagnosis by echocardiography, and prescription of an ACE inhibitor and β-blocker) was low overall in Australia, and consistently low across all geographical regions (capital cities and metropolitan areas, 4.6%; large and small rural towns, 3.9%; and rural and remote areas, 3.7%).

DISCUSSION

This secondary analysis of the CASE study data demonstrates significant differences between urban and rural and remote areas

in both the prevalence of CHF among patients aged 60 years and over, and the use of appropriate diagnostic methods and pharmacological treatments among those with CHF.

Specifically, a higher prevalence of CHF was found among patients in rural areas compared with urban areas. Rates of use of echocardiography for diagnosis and prescription of ACE inhibitors were lower in rural and remote areas compared with urban areas. No differences in β-blocker prescribing were detected, possibly because at the time of the CASE study (1998) these agents were only beginning to be introduced into clinical practice in Australia for treatment of CHF, and prescription was restricted to specialists.[13]

These data illustrate that this CHF group had multiple comorbidities, such as diabetes, asthma, hypertension, angina and valvular disease, occurring with equal frequency across all geographical regions. This finding has important implications in rural and remote settings, where the burden of care for all these conditions rests predominantly with primary care physicians and their multidisciplinary teams.[14] The fact that rural and remote patients were hospitalised as often as patients living in cities has particular relevance for health policy, as specialist cardiac services are limited in rural and remote Australia.[14] Furthermore, underutilisation of objective diagnostic assessment such as echocardiography may occur for the same reason.[14] This is supported by the lower percentage of patients from rural and remote areas referred to specialists compared with patients from metropolitan areas. This relative underutilisation of specialists may also underpin the lower prescribing of ACE inhibitors among rural and remote patients.[15,16]

These data have several limitations. First, they were collected some years ago, and their relevance to current practice could be questioned. However, the primary purpose of this analysis was to compare prevalence of CHF, and methods of diagnosis and prescribing between rural and remote and urban areas. Given that there have been no subsequent analyses of CHF management across the Australian population, these are the best data we have currently for these important assessments. Furthermore, there have been no major shifts in demographics or distribution of resources since that time to suggest that current findings would differ.

Another limitation is that the first Australian guidelines on heart failure management and diagnosis were not published until 2001[17] (ie, after the CASE primary analysis). Nevertheless, overseas guidelines had been published,[8] and the evidence base for CHF management had been widely disseminated in review publications and scientific meetings.[6,7,18] Furthermore, the principles of evidence-based diagnosis and management remain similar in 2006.

In addition, the results of this study depend largely on the accuracy of the definition of rural and remote versus metropolitan patients. Although the CASE cohort was shown to have a similar geographical distribution to the general population,[19] this was a non-randomised convenience sample, and we acknowledge that prevalence rates were analysed in this context. Postcodes were fundamental to the RRMA stratification. This secondary analysis also revealed 1165 missing patient postcodes (5.3%); consequently denominators for some results may vary from the original CASE report.[5]

In summary, the findings of this study suggest that there is a higher prevalence of CHF in rural and remote areas compared with urban areas of Australia, along with less likelihood of diagnosis using the objective criteria of echocardiography and underprescribing of evidence-based therapy. Although this study needs to be repeated with a more contemporary patient sample, the findings suggest that greater allocation of resources and improved access to specialists and diagnostic support need to be considered for rural and remote populations, to match those available in metropolitan areas.

ACKNOWLEDGEMENTS

Robyn Clark is a PhD Scholar supported by the National Institute of Clinical Studies and the National Heart Foundation of Australia.

We wish to thank the 341 GPs who participated in the CASE study, and Servier Laboratories, Australia, which provided input into the design as well as financial and logistical assistance in the conduct of the original CASE study.

We also acknowledge the original CASE report authors, Dr Robert Currie (North East Valley Division of General Practice, Melbourne, VIC), Mr Robert Djundjek (Servier Laboratories, Melbourne, VIC), and Professor Colin I Johnston (Austin and Repatriation Medical Centre, Melbourne, VIC).

COMPETING INTERESTS

Servier Laboratories manufactures the ACE inhibitor Coversyl. The company had no role in analysis of these data.

AUTHOR DETAILS

Robyn A Clark, MEd, FRCNA, PhD Scholar[1]
Kerena A Eckert, MPH, Research Fellow[2]
Simon Stewart, PhD, FCSA, Head, Preventative Cardiology Division[3]
Susan M Phillips, DPhil, Senior Project Officer[4]
Julie J Yallop, NZRN, Senior Research Fellow[5]
Andrew M Tonkin, MD, MRACP, FRACP, Head of Cardiovascular Research Unit[5]
Henry Krum, PhD, FRACP, Head[5]

1 Faculty of Health Sciences, University of South Australia, Adelaide, SA.
2 School of Medicine, University of Queensland, Brisbane, QLD.
3 Baker Heart Research Institute, Melbourne, VIC.
4 National Institute of Clinical Studies, Melbourne, VIC.
5 Centre of Clinical Research Excellence in Therapeutics, Department of Epidemiology and Preventive Medicine, Central and Eastern Clinical School, Monash University, Melbourne, VIC.

Correspondence:
henry.krum@med.monash.edu.au

REFERENCES

1 McMurray JJ, Stewart S. Epidemiology, aetiology, and prognosis of heart failure. *Heart* 2000; 83: 596-602.
2 National Heart Foundation of Australia. Cardiovascular disease. Australia's major health problem. Nov 2001. http://www.heartfoundation.com.au/downloads/cvd.htm (accessed May 2006).
3 Clark RA, McLennan S, Dawson A, et al. Uncovering a hidden epidemic: a study of the current burden of heart failure in Australia. *Heart Lung Circ* 2004; 13: 266-273.
4 Abhayaratna WP, Smith WT, Becker NG, et al. Prevalence of heart failure and systolic ventricular dysfunction in older Australians: the Canberra Heart Study. *Med J Aust* 2006; 184: 151-154.
5 Krum H, Tonkin AM, Currie R, et al. Chronic heart failure in Australian general practice. The Cardiac Awareness Survey and Evaluation (CASE) Study. *Med J Aust* 2001; 174: 439-444.
6 Swedberg K. The future: cardiovascular medicine in 10 years. *Heart* 2000; 84 Suppl 1: i148-i149.
7 Cleland JG, Swedberg K. Carvedilol for heart failure, with care. *Lancet* 1996; 347: 1199-1201.
8 World Health Organization/Council on Geriatric Cardiology Task Force on Heart Failure Education. Consensus guide to the management of heart failure. Geneva: WHO/CGC, 1997: 6-9.
9 Krum H, Jelinek MV, Stewart S, et al, on behalf of the CHF Guidelines Core Writers. Guidelines for the prevention, detection and management of people with chronic heart failure in Australia 2006. *Med J Aust* 2006; 185: 549-556.
10 Health services in the city and the bush: measures of access and use derived from linked administrative data. Canberra: Commonwealth Department of Health and Aged Care, 2001. (Occasional Papers: New Series No. 13.)
11 Clark RA, McLennan S, Eckert K, et al. Chronic heart failure beyond city limits. *Rural Remote Health* 2005; 5: 443.

12 Department of Primary Industries and Energy and Department of Human Services and Health. Rural, remote and metropolitan areas classification (RRMA). Canberra: Commonwealth of Australia, 1994.
13 Cleland JG, McGowan J, Clarke A, Freemantle M. The evidence for beta blockers in heart failure. *BMJ* 1999; 318: 824-825.
14 Humphreys J. Health service models in rural and remote Australia. In: Wilkinson D, Blue I, editors. The new rural health. Vol. 1. Melbourne: Oxford University Press, 2002: 273-298.
15 Australian Institute of Health and Welfare. Medical labour force. Canberra: AIHW, 1998. (AIHW Cat. No. HWL 15.)
16 Strong K, Trickett P, Titular I, Bhatia K. Health in rural and remote Australia: the first report of the Australian Institute of Health and Welfare on rural health. Canberra: AIHW, 1998. (AIHW Cat. No. PHE 6.)
17 National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand Chronic Heart Failure Guidelines Writing Panel. Guidelines for management of patients with chronic heart failure in Australia. *Med J Aust* 2001; 174: 459-466.
18 Clarke KW, Gray D, Hampton JR. How common is heart failure? Evidence from PACT (Prescribing Analysis and Cost) data from Nottingham. *J Public Health Med* 1995; 17: 459-464.
19 Australian Bureau of Statistics. 1996 census of population and housing. Canberra: Commonwealth of Australia. http://www.abs.gov.au/websitedbs/d3310114.nsf/Home/1996%20Census%20of%20Population%20and%20Housing (accessed Jul 2006).

(Received 3 Apr 2006, accepted 11 Dec 2006) ❑