Social disadvantage and variation in the incidence of end-stage renal disease in Australian capital cities

Cass, Alan; Cunningham, Joan; Wang, Zhiqiang; Hoy, Wendy

Published in:
Australian and New Zealand Journal of Public Health

DOI:
10.1111/j.1467-842X.2001.tb00587.x

Published: 01/08/2001

Document Version
Publisher's PDF, also known as Version of record

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Abstract

Objective: To evaluate variation in the incidence of end-stage renal disease (ESRD) within Australian capital cities. To explore the relation between the incidence of ESRD and socio-economic disadvantage.

Methods: We obtained data from the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA) regarding 5,013 patients from capital cities who started ESRD treatment between 1 April 1993 and 31 December 1998. We used the postcode at the start of treatment to calculate the average annual incidence of ESRD for each of 51 capital city regions using 1996 Census counts based on place of usual residence. We calculated standardised incidence ratios with 95% confidence intervals for each region. The standardised incidence ratios were examined in relation to the SEIFA Index of Relative Socio-economic Disadvantage (IRSD), derived from the 1996 Census. Low IRSD values indicate more disadvantaged areas.

Results: There is significant variation in the standardised incidence of ESRD within capital cities. There was a significant correlation (r=-0.41, p=0.003) between the standardised incidence ratio for ESRD and the SEIFA IRSD.

Conclusions and implications: Capital city areas that are more disadvantaged have a higher incidence of ESRD. Socio-economic factors may be important determinants of the risk of developing ESRD.

(*Aust N Z J Public Health* 2001; 25: 322-6)

Alan Cass

Menzies School of Health Research, Royal Darwin Hospital, Darwin and Cooperative Research Centre for Aboriginal and Tropical Health, Northern Territory

Joan Cunningham, Zhiqiang Wang and Wendy Hoy

Menzies School of Health Research, Northern Territory

Geographical differentials in morbidity and mortality have been demonstrated in Australian research.[1-4] These differences have been attributed to socio-economic status,[1-3,5,6] access to health services,[7-9] ethnicity[3] and racial discrimination.[10] There has been no previous report of variation in total ESRD incidence at a geographical level below that of State or Territory. A majority of the Australian population live in capital cities (63.1%), and in this study we have evaluated variation in incidence of ESRD within capital cities and the relation between the incidence of ESRD and social disadvantage.

Methods

Databases

The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) maintains a database of patients treated by maintenance dialysis or renal transplantation in Australia.[11] The registry is funded by the Australian Federal and State governments, the New Zealand Government and the Australian Kidney Foundation. All renal units that provide ESRD treatment in Australia participate in the registry. Survey forms are completed six monthly for all patients until (and including) the date of death. The only patients not registered are the few who die before being established on a maintenance dialysis or transplant program.[12] Postcode of residence at the start of treatment has been collected for all new patients entered into the ANZDATA Registry since 1 April 1993.

Data validity

Postcode of residence at the start of treatment is an imperfect indicator of the usual place of residence before starting treatment. We restricted this analysis to Australian capital cities, in part due to concern regarding the validity of postcode data for patients from remote areas. Renal units that provide dialysis and transplant services are concentrated within capital cities, and patients do not need to relocate within capital cities in order to access services.

Patients

From 1 April 1993 to the 31 December 1998, 8,158 patients started treatment. We excluded 50 patients (0.6%) from analysis because treatment was commenced overseas or the patient was an overseas visitor. We excluded a further three patients (0.04%) because no postcode data was available. 3,092 patients had postcodes from non-capital city areas. In total, 5,013 patients were included in the study.

Geography

We used Statistical Sub Divisions (SSDs) as our geographical units for analysis. SSDs are areas defined in the Australian Standard Geographical Classification[13] and are used by the Australian Bureau of Statistics (ABS) as geographical units for analysis. They aggregate to form Statistical Divisions

Submitted: December 2000
Revision requested: May 2001
Accepted: May 2001

Correspondence to:
Dr Alan Cass, Menzies School of Health Research, PO Box 41096, Casuarina, Northern Territory 0811. Fax: (08) 8927 5187; e-mail: alancass@menzies.edu.au

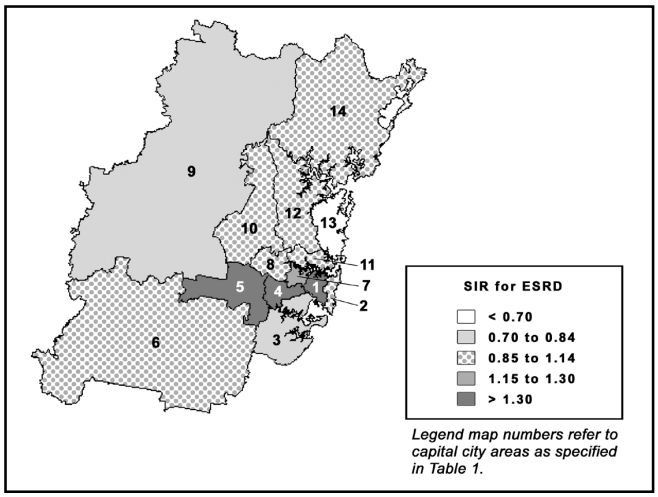

Figure 1: Sydney standardised incidence ratio for ESRD 1993-98.

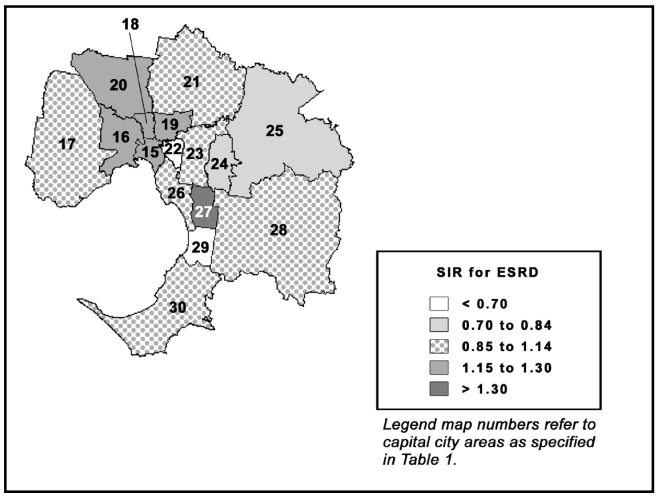

Figure 2: Melbourne standardised incidence ratio for ESRD 1993-98.

(SDs), which aggregate to form States and Territories. Capital cities contain several SSDs except Hobart, which is a single SSD. We assigned postcodes at entry to SSDs using concordances provided by the ABS. We also aggregated SSDs within Darwin and Canberra to form single geographical areas due to the small population size of SSDs within these capital cities. Seven hundred and ninety-nine patients (15.9%) had postcodes that crossed capital city SSD boundaries. These patients were allocated to regions based on the proportion of the population within each postcode that fall within the respective SSDs (ABS unpublished data).

Measurement of socio-economic status

The ABS has developed indexes to describe the socio-economic characteristics of an area. This study uses the Index of Relative Socio-Economic Disadvantage (IRSD). The IRSD is constructed using principal component analysis and is derived from attributes such as low income, low educational attainment, high unemployment and jobs in relatively unskilled occupations.[14] The higher an area's index value, the less disadvantaged that area is compared with other areas. The index scores are standardised so that the national mean score is 1000.

Statistical analysis

We used 'place of usual residence' counts from the 1996 Census (ABS unpublished data) as population denominators. We used indirect standardisation to calculate an age and sex standardised incidence ratio (SIR) with 95% confidence intervals for each region. Rates for the total Australian resident population were used as the reference. Pearson correlation coefficients were calculated to determine the association between the IRSD values for the 51 regions and the SIRs for ESRD. This analysis was weighted according to the size of the regional population. We estimated the percentage of cases of ESRD in the relatively disadvantaged capital city areas (IRSD < 1000) that could be avoided if these areas had the same adjusted incidence rate as the relatively advantaged capital city areas (IRSD > 1000). Statistical analysis was performed using Stata (Release 7.0, College Station, Texas, 2000).

Ethical approval

We obtained ANZDATA approval to analyse geographic data for patients starting treatment for ESRD between 1 April 1993 and 31 December 1998. We also obtained approval for the study from the joint institutional ethics committee of Royal Darwin Hospital and the Menzies School of Health Research.

Results

The standardised incidence ratio for ESRD within capital cities varied significantly from 0.37 to 3.23 (see Table 1). There was marked variation within most capital cities. Mapping the standardised incidence of ESRD reveals that significant geographic sectors of capital cities have an excess of ESRD in population terms. These are generally the sectors that include relatively disadvantaged SSDs.

In Sydney, the inner west and south-western sectors have the highest incidence (see Figure 1). In Melbourne, Greater

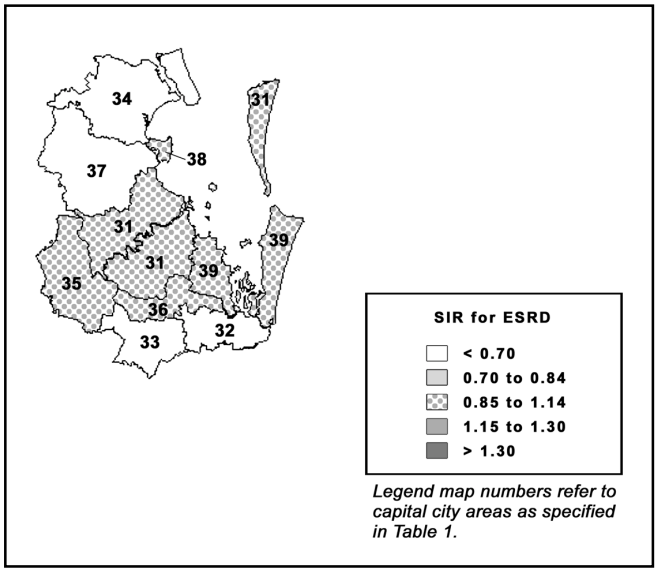

Figure 3: Brisbane standardised incidence ratio for ESRD 1993-98.

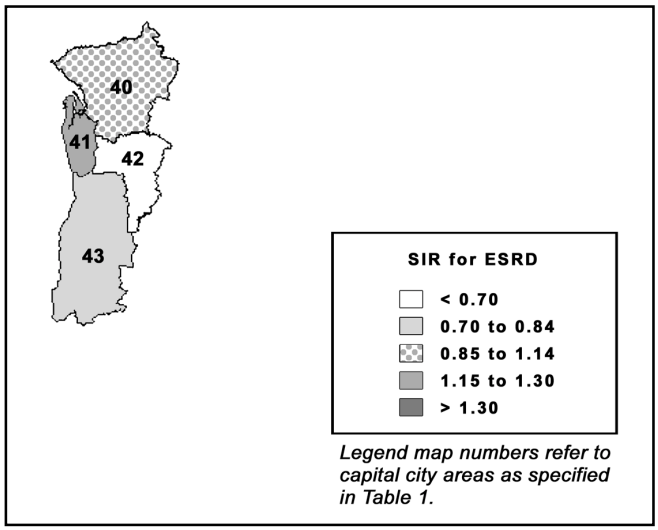

Figure 4: Adelaide standardised incidence ratio for ESRD 1993-98.

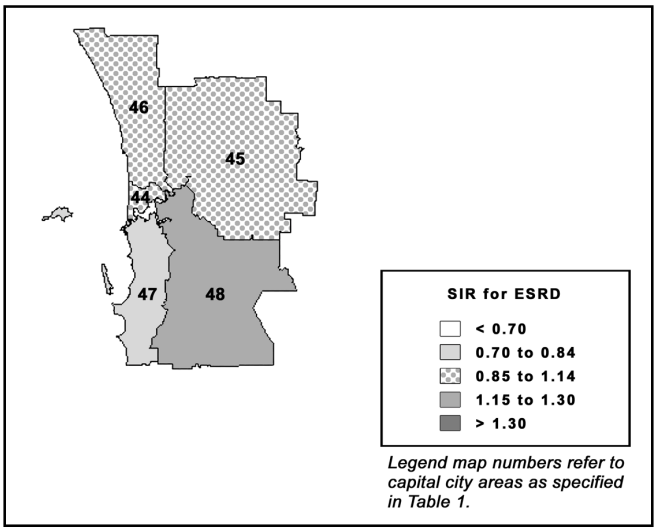

Figure 5: Perth standardised incidence ratio for ESRD 1993-98.

Dandenong City, the inner city and north-western sectors have the highest incidence of ESRD (see Figure 2). All the regions in Brisbane had average to below average standardised incidence of ESRD (see Figure 3 and Table 1). Brisbane City SSD, with almost 800,000 residents, had 60% of new cases in the total Brisbane area. There were few cases of ESRD in the areas with small resident populations; Gold Coast City Part A, Beaudesert Shire Part A and Redcliffe City (see Table 1). The corresponding 95% confidence intervals for the SIRs for these areas are broad. In Adelaide, the west has high incidence and the east low incidence (see Figure 4 and Table 1). In Perth, the south-eastern area has the highest incidence of ESRD (see Figure 5). Residents of Canberra (SIR 0.89) and Hobart (SIR 0.90) had close to average standardised incidence of ESRD. Darwin had the highest standardised incidence (SIR 3.23) (see Table 1).

There was a significant correlation (r=-0.41, p=0.003) between the standardised incidence ratio for ESRD and the IRSD (see Figure 6), which indicates a higher incidence of ESRD with greater disadvantage (lower IRSD scores). This analysis was weighted according to the size of the regional population. The Darwin region is a significant outlier, due to a much higher Indigenous proportion in the urban population (9.5%) and much higher Indigenous proportion of ESRD cases (63.5%). This region was excluded from the graphical representation of the relationship between disadvantage and the incidence of ESRD (see Figure 6), but included in the correlation. If the relatively disadvantaged capital city areas (IRSD <1000) had the same adjusted incidence rate of ESRD as the relatively advantaged capital city areas (IRSD >1000), 22.8% of cases, or 463 cases in this almost six-year period, would be avoided.

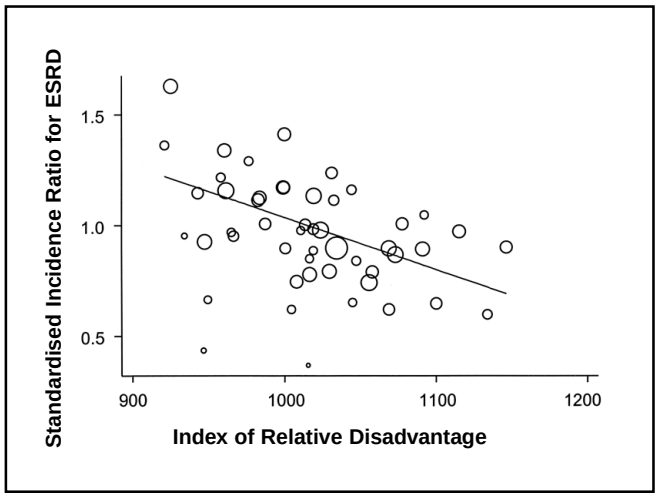

Figure 6: Incidence of ESRD in relation to social disadvantage (circle size proportional to area population).

Discussion

This study demonstrates that there is significant variation in the standardised incidence of ESRD within Australian capital cities. The variation is evident in each capital city where population size allows analysis at a smaller geographical level. The division of Brisbane into SSDs of very unequal population size impairs the ability to examine for variation in ESRD incidence. Within the Brisbane City SSD, of almost 800,000 resident population, there is a very wide range in the IRSD score at Collection District (CD) level, from a minimum of 548 to a maximum of 1,201. This indicates that Brisbane City SSD contains areas of both major disadvantage and advantage that are concealed due to the population and geographic size of the SSD. Analysis at the sub-SSD level within Brisbane City might be more appropriate to address the issue of geographical variation in incidence of ESRD.

The results of this study also indicate that variations in relative disadvantage are significantly associated with the standardised incidence of ESRD. The analysis includes all capital cities, not a selected subset. It is generally robust as the vast majority of areas have relatively large population size and number of ESRD cases in the study period. This finding is consistent with a body of

Australian and international literature regarding the social determinants of health and illness.

There are potential sources of bias in this analysis. The standardised incidence ratios are calculated using data from the ANZDATA Registry concerning number and geographical location of ESRD cases. If certain renal units provide incomplete reports of the number of patients starting treatment, it would bias results. However, all renal units that provide ESRD treatment in Australia participate fully in the registry.[12] Although there may be anecdotal evidence concerning remote areas, there is no

Table 1: Standardised incidence ratio for ESRD in capital cities, 1993-98.

City	Area (map references)	Population	Cases	SIR[a] (95% CI)
Sydney	Inner Sydney (1)	255,499	165	1.41 (1.21-1.65)
	Eastern Suburbs (2)	227,080	109	1.01 (0.83-1.22)
	St George-Sutherland (3)	393,497	142	0.74 (0.63-0.87)
	Canterbury-Bankstown (4)	290,138	188	1.34 (1.16-1.55)
	Fairfield-Liverpool (5)	302,046	197	1.63 (1.41-1.87)
	Outer South Western Sydney (6)	209,973	74	1.01 (0.79-1.26)
	Inner Western Sydney (7)	147,774	85	1.16 (0.93-1.44)
	Central Western Sydney (8)	268,683	137	1.13 (0.95-1.33)
	Outer Western Sydney (9)	293,242	90	0.79 (0.64-0.98)
	Blacktown-Baulkham Hills (10)	352,697	158	1.13 (0.96-1.33)
	Lower Northern Sydney (11)	264,779	123	0.97 (0.81-1.16)
	Hornsby-Ku-ring-gai (12)	236,562	102	0.90 (0.74-1.10)
	Northern Beaches (13)	212,387	68	0.65 (0.50-0.82)
	Gosford-Wyong (14)	263,055	152	1.12 (0.95-1.31)
Melbourne	Inner Melbourne (15)	215,427	120	1.24 (1.03-1.48)
	Western Melbourne (16)	389,408	205	1.16 (1.01-1.33)
	Melton-Wyndham (17)	113,637	34	0.89 (0.61-1.24)
	Moreland City (18)	131,082	83	1.22 (0.97-1.51)
	Northern Middle Melbourne (19)	235,942	137	1.17 (0.99-1.39)
	Hume City (20)	116,441	55	1.29 (0.97-1.68)
	Northern Outer Melbourne (21)	157,779	66	1.12 (0.86-1.42)
	Boroondara City (22)	146,657	42	0.60 (0.43-0.81)
	Eastern Middle Melbourne (23)	396,342	176	0.87 (0.74-1.01)
	Eastern Outer Melbourne (24)	225,159	73	0.79 (0.62-0.99)
	Yarra Ranges Shire Part A (25)	132,303	45	0.84 (0.61-1.12)
	Southern Melbourne (26)	364,925	166	0.90 (0.77-1.04)
	Greater Dandenong City (27)	126,887	79	1.36 (1.08-1.70)
	South Eastern Outer Melbourne (28)	186,260	67	0.98 (0.76-1.25)
	Frankston City (29)	105,728	29	0.62 (0.42-0.89)
	Mornington Peninsula Shire (30)	114,183	60	0.98 (0.75-1.26)
Brisbane	Brisbane City (31)	791,840	326	0.90 (0.80-1.00)
	Gold Coast City Part A (32)	40,462	7	0.44 (0.18-0.90)
	Beaudesert Shire Part A (33)	23,115	3	0.37 (0.08-1.08)
	Caboolture Shire Part A (34)	94,092	28	0.67 (0.44-0.96)
	Ipswich City (35)	114,675	43	0.97 (0.70-1.31)
	Logan City (36)	158,322	52	0.95 (0.71-1.25)
	Pine Rivers Shire (37)	103,517	24	0.65 (0.42-0.97)
	Redcliffe City (38)	48,369	25	0.95 (0.62-1.41)
	Redland Shire (39)	100,135	37	0.85 (0.60-1.17)
Adelaide	Northern (40)	327,224	133	0.93 (0.78-1.10)
	Western (41)	202,917	126	1.15 (0.96-1.37)
	Eastern (42)	211,655	65	0.62 (0.48-0.79)
	Southern (43)	308,391	116	0.78 (0.64-0.94)
Perth	Central Metropolitan (44)	111,680	55	1.05 (0.79-1.36)
	East Metropolitan (45)	205,454	87	1.00 (0.80-1.24)
	North Metropolitan (46)	379,721	159	0.98 (0.83-1.14)
	South West Metropolitan (47)	255,278	86	0.75 (0.60-0.92)
	South East Metropolitan (48)	289,519	146	1.17 (0.99-1.38)
Hobart	Hobart (49)	191,136	79	0.90 (0.71-1.19)
Darwin	Darwin (50)	78,397	85	3.23 (2.58-3.99)
Canberra	Canberra (51)	297,943	104	0.89 (0.73-1.08)

Notes:
(a) Indirectly age and sex standardised to the rates for the total Australian resident population. The value for all Australia = 1.00.

evidence that people with ESRD in capital cities are not referred for dialysis. Differential acceptance on to dialysis would also potentially bias results. The Australian Kidney Foundation and Australia and New Zealand Society of Nephrologists have recently released draft guidelines regarding caring for people with renal impairment.[15] The guidelines state: "The cardinal factor for acceptance on to dialysis is whether dialysis is likely to be of benefit to the patient. People in our society have equal rights to access public medical facilities (including treatment of ESRD) regardless of age, race, sex, religion and underlying disease". The guidelines relating to acceptance on to dialysis reflect a consensus view from clinical practice and thus differences in acceptance are unlikely to explain variation in incidence within capital cities.

Postcode of residence at the start of treatment may not be a valid indicator of the usual place of residence before starting treatment. If the postcode of a temporary residence at the time of starting treatment was recorded in ANZDATA, rather than the postcode of the usual place of residence, this would potentially bias results. It is unlikely that people would need to relocate within a capital city to access medical services or to commence ESRD treatment. However, people living in remote areas may need to change their residence around the time of starting treatment in order to access renal services.

Although some people included as capital cities cases may have moved from non-capital city areas to access treatment, renal treatment services are increasingly available in large regional centres. Patients are able to commence and stabilise on treatment in regional centres. Indeed, 3,092 patients (37.9% of the total cohort) have a non-capital city postcode at entry recorded. There is no evidence that patients who temporarily relocate to capital cities, and are incorrectly coded with the postcode of the temporary place of residence, are more likely to go to an area of low rather than high socio-economic status. Coding errors relating to temporary relocation to capital cities are unlikely to substantially affect incidence ratios of ESRD in the capital cities.

Research in nephrology has focused on an understanding of renal disease as caused by primary and proximal disease processes. This cannot explain all the variation in incidence of ESRD found in this study or the striking gradient in ESRD incidence from urban to rural areas found among Indigenous Australians.[16] To explain the significant association between relative disadvantage and the standardised incidence of ESRD observed in this study, we need to develop a framework for understanding the aetiology of renal disease that encompasses social and environmental determinants of health. The challenge will be to identify the pathways that connect the upstream social factors with the downstream disease processes that are known to lead to ESRD.

Acknowledgements

The data reported here have been supplied by the Australia and New Zealand Dialysis and Transplant Registry. The interpretation of these data is the responsibility of the authors and in no way should be seen as an official policy or interpretation of the Australia and New Zealand Dialysis and Transplant Registry. Alan Cass receives scholarship grants provided by the Centre for Kidney Research, New Children's Hospital. Sydney, and the Colonial Foundation. This study is an approved research project of the Cooperative Research Centre for Aboriginal and Tropical Health. Joan Cunningham is supported by a fellowship from the Menzies Foundation.

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