In closing, we quote Peter Townsend, one of the authors of the Black Report:⁴ 'While representations of inequality [in relation to, for example, education, race, gender, housing, occupation, earnings, disposable income] are important in themselves and can produce findings of value, they are very restrictive unless they are treated as differences due to, or reinforcing, or influential in shaping, an hierarchical society. We must not pretend they are elements which can be treated, in their relationships with health, as independent of the entire structure. Even more important, the entire social structure has to be invoked to contribute to the full explanation of health in relation to any single one of these elements. In looking for successful programmes to reduce inequalities in health this is the critical first step in devising strategy.'⁵

OBITUARY

It is with considerable regret that the *NSW Public Health Bulletin* notes the death of Sir Douglas Black on 13 September 2002 at the age of 89. During an illustrious career Sir Douglas's appointments included Professor of Medicine at the University of Manchester, first Chief Scientist at the United Kingdom Department of Health,

and President of the Royal College of Physicians. He will, however, be most widely remembered as the chairman of the committee that was commissioned by the UK government to enquire into health inequalities in the UK and published in 1980 what has been known ever since as 'The Black Report'. His obituary in the *BMJ* can be read at: <http://bmj.com/cgi/content/full/325/7365/661>.

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THE RELATIONSHIP BETWEEN THE INCIDENCE OF END-STAGE RENAL DISEASE AND MARKERS OF SOCIOECONOMIC DISADVANTAGE

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The relationship between socioeconomic disadvantage and the health of Australians has frequently been reported,¹⁻³ but there has been no research on the relationship between socioeconomic disadvantage and end-stage renal disease (ESRD). Research on patterns of incidence of ESRD has generally been limited to a description of differences according to age, sex, 'race', and state or territory. In this article we describe the relationship between the incidence of ESRD and indicators of socioeconomic disadvantage at the area level.

METHODS

We report two separate but related studies:

- ESRD incidence among indigenous Australians by Aboriginal and Torres Strait Islander Commission (ATSIC) region;⁴
- ESRD incidence in the total population by Statistical Sub-Division (SSD) within capital cities.⁵

We obtained approval for the studies from the joint institutional ethics committee of the Royal Darwin Hospital and the Menzies School of Health Research.

Databases

Both studies used data from the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA), which maintains a database of patients treated in Australia by maintenance dialysis or renal transplantation.⁶ The registry, funded by commonwealth and state governments and the Australian Kidney Foundation, enjoys the participation of all renal units that provide ESRD treatment. Individual data on levels of income, education, and employment are not collected by ANZDATA. We therefore used regional level socioeconomic data from the 1996 census and the National Perinatal Statistics Unit to examine the relationship between ESRD and disadvantage.

Statistical analyses

In both studies, we allocated patients to geographical regions and calculated an age- and sex- standardised incidence for ESRD. The methods used to allocate patients to regions have been discussed in detail elsewhere.^{5,7} We performed appropriate tests of correlation to determine the association between the standardised incidence ratios for ESRD and markers of regional disadvantage. In both studies, we used Australian Bureau of Statistics (ABS) population figures, derived using 1996 Census information on place of usual residence, to

calculate rates. The total Australian resident population was the index group (that is, where SIR = 1).

STUDY 1: INDIGENOUS ESRD INCIDENCE BY ATSIK REGION

From 1st January 1993 to 31st December 1998, 719 indigenous patients started treatment in Australia. The 36 ATSIK regions constituted the geographic units for our analysis because they are the smallest areas for which accurate population estimates are available.⁸

Because no generally accepted area-based index of socioeconomic disadvantage for indigenous Australians has been developed, we selected the following five indicators that feature in deprivation indexes:⁹⁻¹¹

- the proportion of adults who had left school aged 15 or less, or who had not attended school;¹²

- the unemployment rate (Community Development Employment Project [CDEP] participants have been classified as unemployed);¹²
- median household income divided by the average number of persons per household;¹³
- the average number of persons per bedroom;¹²
- the proportion of births less than 2500 grams.¹⁴

We generated an overall rank of socioeconomic disadvantage by combining the regional rankings on each indicator, with each indicator given equal weight.

Strong associations were evident between the incidence of ESRD and indicators of socioeconomic disadvantage (Table 1). The correlation with the overall rank of socioeconomic disadvantage was particularly strong (Table 1 and Figure 1).

TABLE 1

CORRELATION BETWEEN INDICATORS OF SOCIOECONOMIC DISADVANTAGE AND STANDARDISED INCIDENCE OF ESRD FOR INDIGENOUS AUSTRALIANS, 1993-98

Socioeconomic indicator (units)	Range	Correlation coefficient*	P value
Early school leavers (%)	12.5-52.4	0.68	<0.001
Unemployment rate (%)	20.2-74.8	0.72	<0.001
Household income (Aust\$ per household member per week)	\$80-194	-0.71	<0.001
House crowding(persons per bedroom)	1.1-3.2	0.84	<0.001
Low birthweight (%)	7.6-21.6	0.49	0.003
Summary rank of disadvantage	1-36	0.88	<0.001

* Spearman's rank correlation coefficients.
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FIGURE 1

SOCIOECONOMIC DISADVANTAGE AND INDIGENOUS ESRD INCIDENCE BY ATSIK REGION, 1993-98

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TABLE 2

STANDARDISED INCIDENCE OF ESRD IN SYDNEY, 1993–98

Area (map references)	Population	Cases	SIR* (95% CI)
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)

* Indirectly age and sex standardised to the rates for the total Australian resident population.

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FIGURE 2

SOCIOECONOMIC DISADVANTAGE AND CAPITAL CITY ESRD INCIDENCE BY STATISTICAL SUB-DIVISION (SSD), 1993–98

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STUDY 2: TOTAL ESRD INCIDENCE BY SSD IN CAPITAL CITIES

The 5013 patients who started ESRD treatment during 1993–1998 were included in this analysis. We analysed SSDs, as defined in the Australian Standard Geographical Classification,¹⁵ as our geographical units. With the exception of Hobart, which is a single SSD, capital cities contain several SSDs. These aggregate to form Statistical Divisions (SDs), which, in turn, aggregate to form states and territories. The majority (97 per cent) of patients in capital cities were non-indigenous.

The ABS has developed indexes to describe the socioeconomic characteristics of an area. This study used the Index of Relative Socioeconomic Disadvantage

(IRSD). The IRSD, constructed using principal-component analysis, is derived from attributes such as income, educational attainment, employment status, and occupation.¹⁶ The higher an area's index value, the less disadvantaged the area. The index scores are standardised so that the national mean score is 1000.

There was a significant correlation ($r = -0.41$, $p = 0.003$) between the standardised incidence ratio for ESRD and the IRSD (Figure 2), which indicates a higher incidence of ESRD in areas of greater disadvantage. There was up to three-fold variation within capital cities. In Sydney, an east–west corridor containing Inner Sydney, Canterbury–Bankstown and Fairfield–Liverpool areas had the highest standardised incidence of ESRD (Figure 3 and Table 2).

FIGURE 3

SYDNEY STANDARDISED INCIDENCE RATIO (SIR) FOR ESRD 1993–98

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DISCUSSION

These studies demonstrated a gradient in the incidence of ESRD among indigenous and non-indigenous Australians that is strongly associated with area-based markers of socioeconomic disadvantage. The gradient in the incidence of ESRD among indigenous Australians (at least 30-fold variation) is much steeper than the gradient in the general population (approximately three-fold variation), possibly indicating the relevance of both absolute poverty and relative disadvantage to ill-health. The findings of the few previous studies of the association between socioeconomic disadvantage and the incidence of ESRD have been inconsistent.^{17–20}

There are potential sources of bias in our studies. First, in the indigenous study, the propensity to identify as indigenous might differ between regions. ANZDATA relies on self-identification, as does the Australian Bureau of Statistics in its census collections. Because ESRD treatment requires frequent contact between patients and staff, and because renal staff have a strong awareness of ESRD among indigenous Australians, we believe that the quality of identification in this study is high. Problems in identification, which may lead to an imprecise estimate of the true incidence of ESRD among indigenous Australians living in urban areas, are unlikely to alter the large observed gradient in ESRD incidence. Second, in both studies, we have used area-based indicators of socioeconomic status, which measure the average level of disadvantage of all people in that area, to infer an association between disadvantage and the incidence of

ESRD. Factors operating at community level may directly affect health outcomes: people living in disadvantaged areas may have poorer access to preventive health services and may lack a community infrastructure that promotes healthy lifestyles. We do not exclude the possibility that other individual, area, or population level factors—not measured in this study—might explain our observed associations. Third, in both studies, we have described an association between current disadvantage and the incidence of ESRD. Typically renal disease progresses towards ESRD over at least several years. Therefore, the most relevant etiological data would be socioeconomic data from an earlier period.

What are the implications of our finding that populations in disadvantaged areas have a higher incidence of ESRD? First, clinicians understand renal disease from a biomedical perspective, with primary disease processes as the causes. The high ESRD incidence in indigenous populations has formerly been attributed to ‘racial’ differences in physiological and pathological responses, in turn regarded as being due to genetic factors,²¹ or to congenital factors such as low birthweight.²² Such a limited biomedical perspective cannot explain the strong association with socioeconomic disadvantage within the indigenous population. Access to treatment facilities for indigenous ESRD patients, particularly from remote areas, is known to be inequitable,⁷ and it is likely that the distribution of services within capital city areas does not accord with the need for these services. Equity in the provision of renal treatment facilities in disadvantaged

areas needs attention. A broader understanding of the etiology of ESRD, encompassing social, environmental, and cultural determinants of health, has implications for how and where to target prevention efforts. Public policy initiatives beyond the scope of the health care system will be required if we are to reduce the burden of chronic renal disease.

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