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**Measuring  
health  
inequalities**

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# MEASURING HEALTH INEQUALITIES IN NEW SOUTH WALES

Citation: *N S W Public Health Bull* 2001; 12(5): 120–125

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This paper presents information on some key indicators of inequality in health in NSW related to demographic, socioeconomic and geographic factors. Its purposes are to highlight some of the more striking health inequalities, and to describe some of the challenges in improving their measurement.

The information presented here is drawn from the reports *The health of the people of New South Wales: Report of the Chief Health Officer 2000*,<sup>1</sup> and the electronic report *NSW Health Surveys 1997 and 1998*.<sup>2</sup> More detailed information about a wide range of health inequalities is available in these reports.

## HEALTH INEQUALITIES BY SEX

Measurement of health inequalities between males and females is relatively simple because sex is available in all the major health data sources in NSW. These demonstrate substantial differences in health, and use of health services, between males and females. For example:

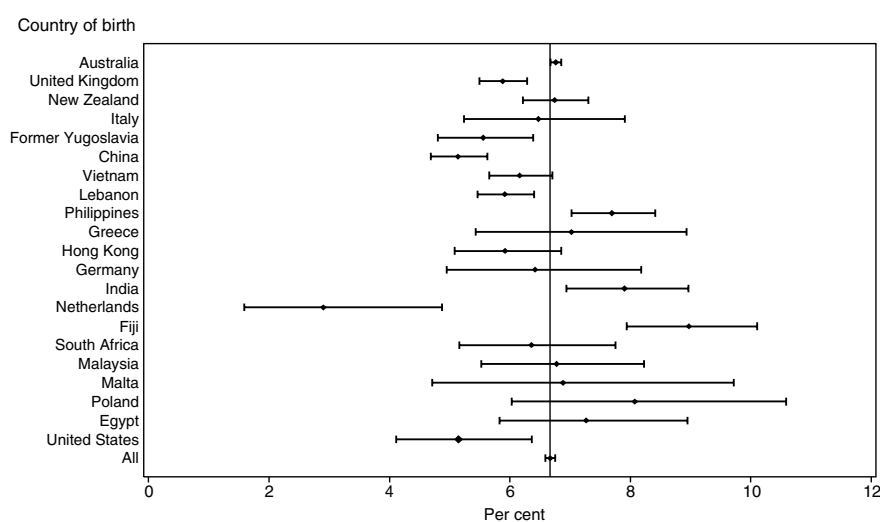
- Women have a longer life expectancy than men, although this difference is decreasing. Between 1965 and 1998, life expectancy at birth steadily increased from 67.1 to 76.5 years for males, and from 73.7 to 81.9 years for females.
- In the 1997 and 1998 NSW Health Surveys, women were more likely to report being admitted to hospital overnight and to report visiting a general practitioner in the last two weeks and the last 12 months, whereas men were more likely to report visiting an emergency department in the last 12 months.
- In the same surveys, men were more likely than women to report being current smokers and being overweight or obese. Men were less likely to report eating the recommended daily quantities of vegetables and fruit. However, fewer women than men reported adequate levels of physical activity.

## HEALTH INEQUALITIES BY COUNTRY OF BIRTH AND LANGUAGE SPOKEN AT HOME

Measuring health inequalities among country-of-birth and language groups is not straightforward in NSW. Data on language spoken at home is not available in some data sets (for example, Australian Bureau of Statistics mortality

**FIGURE 1**

### PREMATURE BIRTHS BY COUNTRY OF BIRTH OF MOTHER



Note: Births where gestational age was less than 37 weeks were classified as premature births. Infants of at least 400 grams birth weight or at least 20 weeks gestation were included. Upper and lower limits of the 95 per cent confidence interval for the point estimate least 20 weeks gestation were included. Upper and lower limits of the 95 per cent confidence interval for the point estimate

Source: NSW Midwives Data Collection (HOIST). Epidemiology and Surveillance Branch, NSW Department of Health.

data), and the accuracy of ethnicity data in others (such as the NSW Inpatients Statistics Collection) is unknown. Other limitations include the restricted availability of population denominator data (available only every five years from the Census) for calculation of rates, and the small size of many ethnic communities.

Available data demonstrate that in general, overseas-born residents have better health than Australian-born residents, possibly reflecting a 'healthy migrant effect'.<sup>3</sup> Rates of premature death, chronic diseases and recent illnesses tend to be lower for migrants. However, certain diseases and risk factors are more prevalent among some country-of-birth groups. Some key examples are:

- In the period 1994 to 1998, premature births varied by maternal country of birth, from 3.3 per cent for mothers born in the Netherlands to 8.8 per cent for mothers born in Fiji. Mothers born in the United Kingdom and Ireland, countries of the former Yugoslavia and China were less likely to give birth prematurely, while mothers born in Lebanon and Malta were more likely to have premature births (Figure 1).
- In 1997 and 1998, men and women born in New Zealand and men born in Vietnam and Lebanon, reported higher rates of current smoking than their Australian-born counterparts. Men and women born in Italy and women born in China, Vietnam and the Philippines, were less likely to report current smoking.

- While cervical cancer rates were higher in women born in China and Vietnam in 1993–1997 compared with Australian-born women, self-reported Pap Test screening rates were lower, particularly for women born in China.
- There were considerable differences in reported rates of toothache (sometimes, often or very often) in the past 12 months among country-of-birth groups. Men and women respondents born in Lebanon and China and men born in Vietnam, Laos or Cambodia reported higher than average rates of toothache (Figure 2).

### HEALTH INEQUALITIES BY INDIGENOUS STATUS

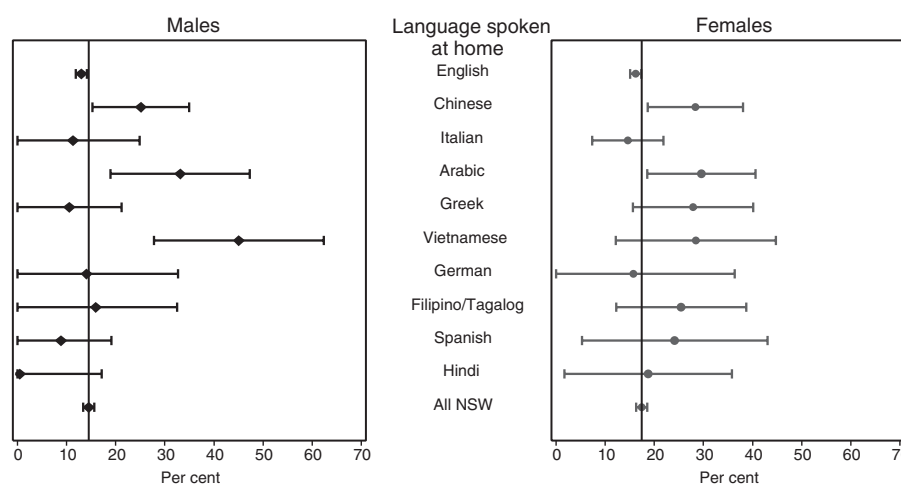
Indigenous status is generally poorly recorded in most health data collections; however, improvements have been made in recent times, particularly for death data. Additionally, examination of trends in indigenous health is complicated by increasing levels of self-identification as an indigenous person. This affects both health datasets and population denominator data.<sup>4</sup> Despite these limitations, poorer birth and health outcomes and higher prevalence of health risk factors among indigenous people have long been recorded and remain apparent in NSW. Some of the more striking differences include:

- There is currently little information about the mental health and wellbeing of indigenous Australians, nor is there an agreed method for assessing it.<sup>4</sup> However, in

**FIGURE 2**

#### TOOTHACHE EXPERIENCE BY LANGUAGE SPOKEN AT HOME

Toothache experienced very often, often and sometimes in previous 12 months by language spoken at home and sex, persons aged 16 years and over with at least one natural tooth, NSW 1998



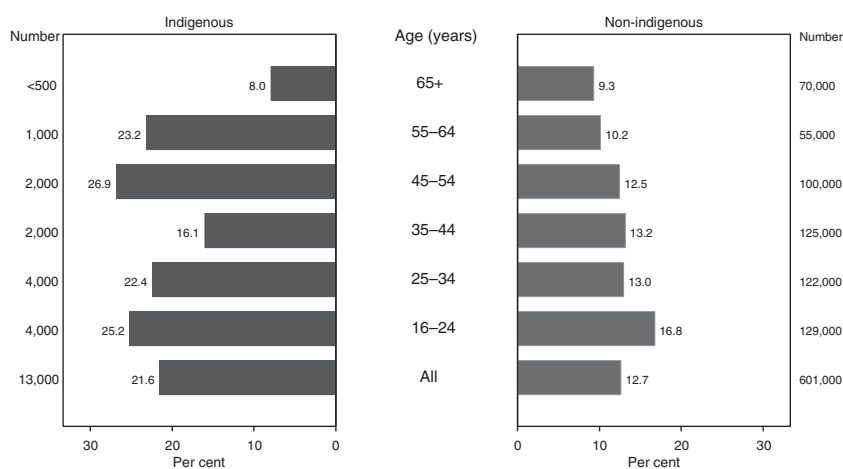
Note: Estimates based on 15,557 respondents with at least one natural tooth (0 in 1997; 15,557 in 1998). 36 (0.2%) not stated for toothache in the previous 12 months. 13,870 respondents spoke English at home; 1,669 respondents spoke a language other than English at home.

Source: NSW Health Survey 1998 (HOIST). Epidemiology and Surveillance Branch, NSW Department of Health.

**FIGURE 3**

**PSYCHOLOGICAL DISTRESS BY AGE AND INDIGENOUS STATUS**

Psychological distress score of 60 or more by age and indigenous status, persons aged 16 years and over, NSW, 1997 and 1998



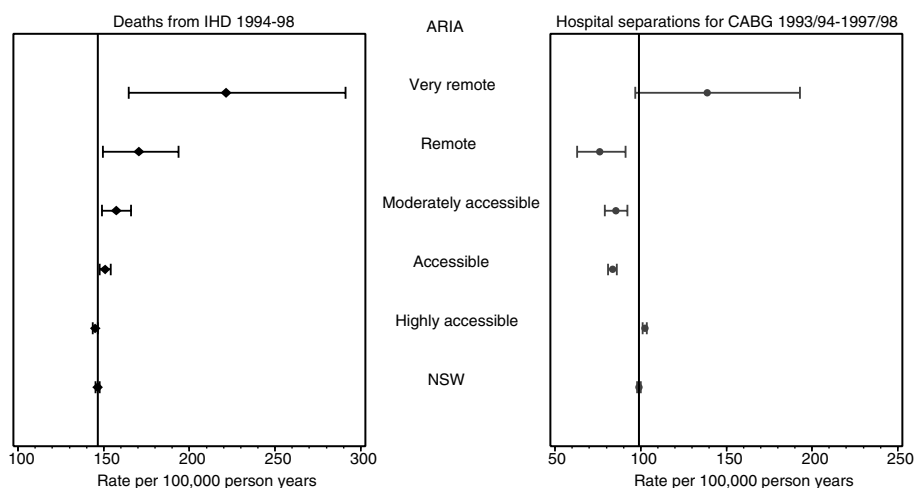
Note: Estimates based on 35,025 respondents (17,531 in 1997; 17,494 in 1998). There were 646 indigenous and 34,360 non-indigenous respondents.

Source: NSW Health Surveys 1997 and 1998 (HOIST). Epidemiology and Surveillance Branch, NSW Department of Health.

**FIGURE 4**

**DEATHS FROM ISCHAEMIC HEART DISEASE AND HOSPITALISATIONS FOR CORONARY ARTERY BYPASS GRAFTS, BY ACCESSIBILITY-REMOTENESS INDEX FOR AUSTRALIA (ARIA)**

Deaths from ischaemic heart disease and hospital separations for coronary artery bypass graft by ARIA, NSW



Note: Ischaemic heart disease was classified according to the ICD-9-CM diagnosis codes 410-414. Coronary artery graft was classified according to the ICD-9-CM procedure code 36.1. Statistical local areas were assigned to the Accessibility/Remoteness Index of Australia (ARIA). Rates were age-adjusted using the Australian population as at 30 June 1991. LL/UL95%CI of the standardised rate are shown.

Source: ABS mortality data and population estimates (HOIST). Epidemiology and Surveillance Branch, NSW Department of Health.

the 1997 and 1998 NSW Health Surveys,<sup>2</sup> the reported level of psychological distress, based on the Kessler 10 measure,<sup>5</sup> was higher among indigenous than non-indigenous respondents of both sexes (Figure 3).

- Among people who reported having an overnight hospital admission in the last 12 months, indigenous people (19.7 per cent) were more than twice as likely as non-indigenous people to rate the care they received in hospital as ‘fair’ or ‘poor’ (9.3 per cent).
- In 1997–1998, indigenous people living in rural areas in NSW (162 per 100,000 population) were just over three times more likely to receive haemodialysis than indigenous people living in urban areas (53 per 100,000 population), and five times more likely to receive haemodialysis than non-indigenous people living in rural areas (32 per 100,000 population).

### HEALTH INEQUALITIES BY PLACE OF RESIDENCE

Measurement of health inequalities associated with geographic remoteness has been facilitated by the development of the Accessibility–Remoteness Index for Australia (ARIA).<sup>6</sup> This is based on road distance travelled from major service centres and provides a measure of service access on a population basis. ARIA scores can be assigned on the basis of postcode of residence. Examples of inequalities demonstrated by analysis by ARIA category include:

- In 1994–1998, death rates from ischaemic heart disease increased progressively with increasing remoteness. By contrast, hospital separation rates for coronary artery bypass graft (CABG) showed a less consistent pattern, with little difference in rates for those living in remote and highly accessible areas, and slightly lower rates for those living in areas with intermediate levels of service access (Figure 4).
- In the 1997 and 1998 NSW Health Surveys, a higher percentage of people living in remote (60.0 per cent) and very remote (69.6 per cent) areas of NSW reported one or more alcohol drinking behaviours that are associated with an increased risk to health compared with those living in highly accessible areas (49.0 per cent).
- In the same surveys, a higher percentage of people living in remote (20.8 per cent) and very remote (41.3 per cent) areas of NSW reported having difficulties getting the health care they needed compared with those living in highly accessible areas (8.2 per cent).

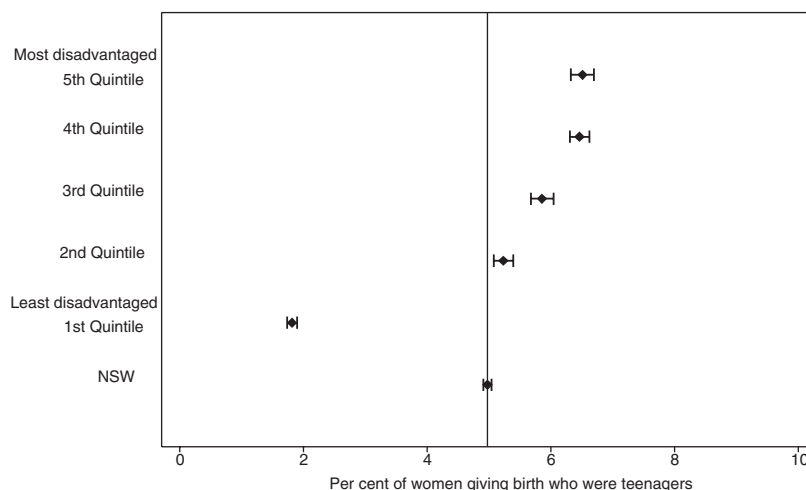
### HEALTH INEQUALITIES BY SOCIOECONOMIC DISADVANTAGE, LABOUR FORCE CATEGORY AND EDUCATION

Socioeconomic differentials in health can be measured using data on individuals (for example: level of education, employment status, or income) and relating it to a measure of that individual’s health. An alternative approach is to

**FIGURE 5**

#### TEENAGE MOTHERS BY INDEX OF RELATIVE SOCIOECONOMIC DISADVANTAGE

Teenage mothers by socioeconomic disadvantage score for LGAs, NSW 1994 to 1998

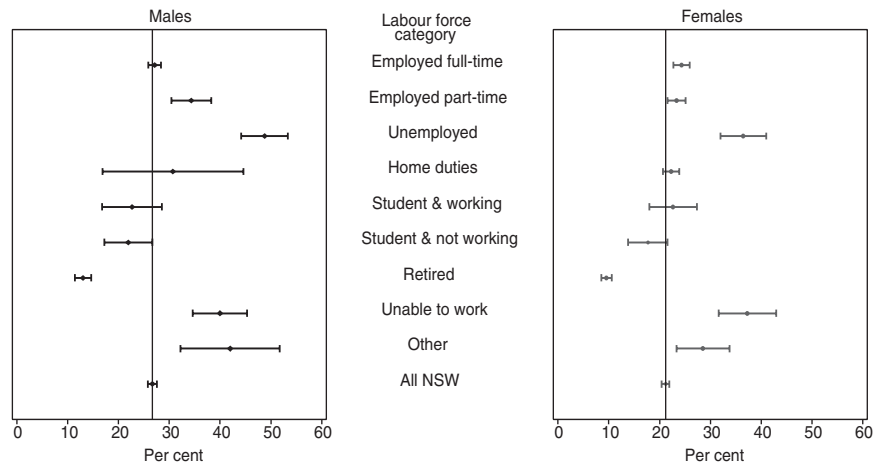


Note: Local Government Areas (LGAs) were classified into quintiles by scores based on the ABS Index of Relative Socioeconomic Disadvantage (IRSD). Lower and upper limits of the 95 per cent confidence interval for the point estimate are shown.

Source: NSW Midwives Data Collection and Census data, and SEIFA index (HOIST). Epidemiology and Surveillance Branch, NSW Department of Health.

**FIGURE 6****CURRENT SMOKING BY LABOUR FORCE CATEGORY**

Currently smoke daily or occasionally by labour force category and sex, persons aged 16 years and over, NSW 1997 and 1998



Note: Estimates based on 35,025 respondents (17,531 in 1997; 17,494 in 1998). 6 not stated for current smoking status.

Source: NSW Health Surveys 1997 and 1998 (HOIST). Epidemiology and Surveillance Branch, NSW Department of Health.

use aggregate socioeconomic characteristics of the populations of defined geographic areas (such as postcodes or local government areas) as a proxy for the socioeconomic status of individuals.<sup>3</sup> The Socioeconomic Indices for Areas (SEIFA) were developed for this purpose by the Australian Bureau of Statistics using census data.<sup>7</sup> The SEIFA index of relative socioeconomic disadvantage (IRSD) is compiled from 21 different census indicators summarising underlying social and economic variables of disadvantage, such as low income, low level of education, unemployment, recent migration, lack of fluency in English and indigenous status. Socioeconomic differentials demonstrated by analysis of NSW data using both of these approaches include:

- In 1994 to 1998, the likelihood of giving birth as a teenager was strongly associated with socioeconomic disadvantage. Teenage mothers represented 1.8 per cent of all women giving birth in the least disadvantaged quintile compared with 6.5 per cent of all women giving birth in the most disadvantaged quintile (Figure 5).
- In the 1997 and 1998 NSW Health Surveys, reported rates of current smoking increased with increasing levels of socioeconomic disadvantage. Both male and female respondents who were unable to work, unemployed or employed part-time had much higher reported rates of current smoking than the state average (Figure 6).

- In the same surveys, psychological distress,<sup>5</sup> was associated with socioeconomic disadvantage. Reported rates of psychological distress were lowest among men and women with university or other tertiary qualifications and highest among respondents who had not completed their high school certificate (Figure 7). It should be noted that the highest level of educational attainment was also strongly associated with age (generally lower level of educational attainment with increasing age).

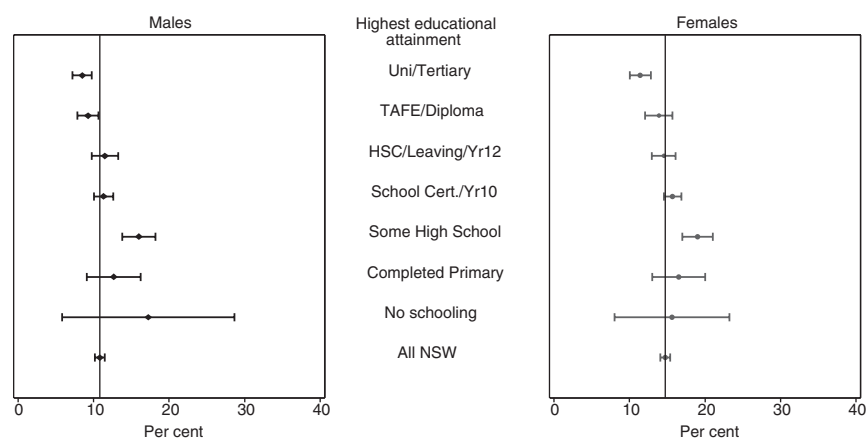
## DISCUSSION

The reports *The health of the people of New South Wales: Report of the Chief Health Officer 2000*,<sup>1</sup> and *NSW Health Surveys 1997 and 1998*,<sup>2</sup> demonstrate many inequalities in the health of the NSW population, based on sex, ethnicity, indigenous status, area of residence and socioeconomic factors. Whether these differences represent inequities in health relies on an assessment of their fairness and preventability.<sup>3,8</sup>

Much work is required to improve the measurement of inequalities in health. Issues include the appropriateness of focusing on individual level determinants of health when macrolevel determinants (such as unemployment and income) may have a far greater impact on health and require different policy interventions.<sup>9</sup> This is particularly important considering evidence that socioeconomic determinants that lead to poor health tend to be concentrated in the same groups in society.<sup>10</sup>

**FIGURE 7****PSYCHOLOGICAL DISTRESS BY LEVEL OF EDUCATION**

Psychological distress score of 60 or more by highest educational attainment and sex, persons aged 16 years and over, NSW 1997 and 1998



Note: Estimates based on 35,025 respondents (17,531 in 1997; 17,494 in 1998). 290 (0.8%) not stated for any question in the K10 instrument. Respondents who partially completed primary school are in the no schooling category which had 236 respondents.

Source: NSW Health Surveys 1997 and 1998 (HOIST). Epidemiology and Surveillance Branch, NSW Department of Health.

Also, for many conditions, notably non-communicable diseases such as cardiovascular diseases, the relationships between social and economic factors and health are more difficult to understand, and therefore to measure. Here, identifying the role of influences that operate throughout life—the ‘lifecourse approach’—may help to tease out differences both between and within socioeconomic groups, which may be different for different conditions.<sup>8</sup>

In future editions of the *Report of the Chief Health Officer* it is planned to present data on trends in health inequalities. Challenges include choosing indicators for monitoring the size and direction inequalities. A range of such indicators has been described by Mackenbach and Kunst,<sup>11</sup> and by Gakidou et al.<sup>12</sup> Selecting which ones to present involves making choices between measures of relative and absolute differences; individual–mean differences and inter-individual differences; and simple measures and more sophisticated ones. Ideally, such choices should be informed by eliciting information on community preferences, through mechanisms such as the NSW Health Survey.

**ACKNOWLEDGEMENTS**

Past and present staff of the Epidemiology and Surveillance Branch involved in the production of the *The health of the people of New South Wales: Report of the Chief Health Officer 2000* and *NSW Health Surveys 1997 and 1998* included Deborah Baker, Tim Churches, Devon Indig, Jill Kaldor, Kim Lim, Ru Nguyen, Hanna Noworytko, Tim Owen, Michelle Puech, Lee Taylor and

Margaret Williamson. Members of the Health Equity Forum assisted with text about health inequalities for the *Report of the Chief Health Officer 2000*.

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Updated information from *The health of the people of New South Wales: Report of the Chief Health Officer 2002* can be obtained from the website [www.health.nsw.gov.au/public-health/chorep](http://www.health.nsw.gov.au/public-health/chorep).

Updated information from the *New South Wales Adult Health Survey 2002* can be obtained from the website [www.health.nsw.gov.au/public-health/phbsup/adult\\_health\\_survey.pdf](http://www.health.nsw.gov.au/public-health/phbsup/adult_health_survey.pdf).

*The health of the people of New South Wales: Report of the Chief Health Officer 2004* and the *Adult Health Survey 2003* will be released in 2004.

# TRENDS IN POTENTIALLY AVOIDABLE MORTALITY IN NSW

Citation: *N S W Public Health Bull* 2002; 13(11–12): 226–236

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In Australia, mortality rates, prevalence of health risk behaviours (such as smoking and inadequate physical activity), and prevalence of risk factors (such as obesity), have been shown to be significantly higher in lower socioeconomic (SES) groups than in higher SES groups.<sup>1</sup> Similar inequalities in health have also been shown to exist in NSW.<sup>2</sup>

Avoidable mortality refers to deaths that *potentially* could be avoided either through prevention or through early medical intervention.<sup>3</sup> To assess the potential effect of health interventions, it is useful to classify each condition that causes avoidable death according to the level of intervention (primary, secondary, and tertiary) to which that condition is responsive. Primary avoidable mortality (PAM) consists of conditions that are preventable by change in individual behaviour or through population-level interventions including healthy public policy that, for example, may result in introducing laws to reduce exposure to hazards, such as tobacco smoke.<sup>3</sup>

The study of inequalities in PAM allows an analysis of the effectiveness of primary level health interventions in different socioeconomic status groups and highlights conditions for which primary prevention approaches can potentially reduce inequalities. This article describes trends and differences in PAM by sex and socioeconomic status for some of the diseases and injuries that are amenable to primary prevention.

## METHODS

Our analysis is based on death data for NSW for the period 1980–2000. All ‘premature’ deaths—that is, those that occur before 75 years of age—were classified into avoidable and unavoidable deaths, using the 9th revision of the International Classification of Diseases for deaths registered before 1999, and the 10th revision of the International Classification of Diseases for deaths registered from 1999 onwards.<sup>4</sup> Avoidable deaths were subcategorised using the algorithm of Tobias and Jackson,<sup>3</sup> which divides all cases of each potentially avoidable condition into three groups. Cases are allocated to each group based on the evidence for the proportion that could potentially be prevented using primary, secondary, or tertiary interventions. The proportions for lung cancer

are 0.95, 0 and 0.05 (for primary, secondary, and tertiary, respectively); for road traffic injury, they are 0.6, 0 and 0.4 respectively; and for ischaemic heart disease, they are 0.5, 0.25 and 0.25 respectively.

For example, for every 100 potentially avoidable deaths from ischaemic heart disease—where the proportions are 0.5, 0.25 and 0.25 respectively—it is estimated that 50 deaths could be avoided through primary interventions (for example, smoking cessation, improved diet, and increased physical activity); 25 deaths could be avoided through secondary interventions (lowering of cholesterol and blood pressure for those with early stage disease); and 25 deaths could be avoided through tertiary interventions (for example, angioplasties for those who have had heart attacks).

Socioeconomic (SES) groups were constructed using the Index of Relative Socioeconomic Disadvantage (IRSD), which is produced by the Australian Bureau of Statistics from census data.<sup>5</sup> Each local government area in NSW was assigned an IRSD according to the socioeconomic characteristics of the area’s residents such as income, occupation, education, non-English speaking background, and indigenous status.

Using the IRSD scores for the local government areas, the NSW population was split into three groups: the ‘lowest’ SES group, or the most disadvantaged 20 per cent of the population; the ‘highest’ SES group, or the least disadvantaged 20 per cent of the population; and the balance of the population, consisting of the middle 60 per cent of the population. IRSD scores from the 1986 census were used for the years 1980–1988; scores from the 1991 census were used for the years 1989–1993; and scores from the 1996 census were used for the years 1994–2000.

For each socioeconomic group and potentially avoidable condition, age-standardised rates were calculated for the period 1980–2000, using the Australian population as at 30 June 1991 as the reference population. Additionally, Poisson regression models were used to assess changes in death rates by SES group,<sup>6</sup> after adjusting for the effect of age.

## RESULTS

Rates of PAM have decreased steeply for the three SES groups and for both sexes between 1980 and 2000 (Figure 1), with the rates decreasing by 51 per cent in males and 44 per cent in females between 1980 and 2000. However, the decrease has been more rapid for the highest SES group, which experienced a decrease of 60 per cent in PAM in males between 1980 and 2000, compared with the lowest and middle SES groups, which both

experienced a decrease of about 50 per cent. For females, a similar pattern was observed, although the decrease was not as great, with decreases of 51 per cent (the highest SES), 42 per cent (the middle SES) and 45 per cent (the lowest SES).

The relative 'gap' in PAM between SES groups can be expressed as the percentage by which the PAM rate is higher in one SES group (for example, the lowest SES group) than in another SES group (for example, the highest SES group). The relative gap between groups was calculated using fitted values from Poisson regression models to enable identification of trends. Figure 2 shows that there was an increased relative gap between the highest SES group and the two lower SES groups between 1980 and 2000 for males and females. By contrast, the relative gap between the lowest and middle decreased slightly for males and remained almost constant for females between 1980 and 2000.

Ischaemic heart disease was the biggest contributor to PAM for all years between 1980 and 2000, accounting for 39 per cent of PAM in 1980 and 25 per cent of PAM in 2000. Rates of ischaemic heart disease decreased very steeply for males in all SES groups (see Figure 3). Rates also decreased for females in all SES groups, although the decrease was not as rapid as that observed for males (Figure 3). The relative gap between the highest and the lowest SES group, and between the highest and the middle SES group, also increased with time for both males and females (Figure 4). The gap between the middle and lowest SES groups remained almost constant between 1980 and 2000 for both males and females.

Lung cancer was the second biggest contributor to PAM for all years between 1980 and 2000, accounting for 21 per cent of PAM in 1980 and 35 per cent of PAM in 2000. Between 1980 and 2000, PAM for lung cancer decreased for males in all SES groups but increased slightly for females in the lowest and middle SES groups (Figure 5). The relative gap between the highest and the lowest SES group, and between the highest and the middle SES group, also increased with time for both males and females (Figure 6). The gap between the middle and lowest SES groups was almost constant between 1980 and 2000 for males and females.

Road traffic accidents were the third largest contributor to PAM in 1980, when they accounted for 15 per cent of primary avoidable deaths, and the fourth largest contributor to PAM in 2000, when they accounted for six per cent of primary avoidable deaths. PAM due to road traffic accidents decreased in all SES groups between 1980 and 2000, especially in males (Figure 7). Again, the relative gap between the highest and the lowest SES group, and between the highest and the middle SES group, also increased with time for both males and females (Figure 8).

The gap between the lowest and middle SES groups increased over time for both males and females (Figure 8).

## DISCUSSION

During the last two decades, there has been increasing interest in the differences in health experienced by different socioeconomic groups. Socioeconomic health inequalities have become the focus of health sector efforts in many countries around the world. Socioeconomic inequalities in health are not only evident in mortality rates; they are evident at every stage of the life course.<sup>7</sup>

In trying to explain these socioeconomic health inequalities, it has become clear that social, physical, economic, and environmental factors are the most fundamental determinants of health. Government policies and initiatives that address education, housing, and employment opportunities, are likely to have a significant influence on these factors.

Evidence suggests that some of the risk factors for primary avoidable conditions are more prevalent in the lower SES groups than in the highest SES groups. For example, tobacco smoking, which is a risk factor for ischaemic heart disease and lung cancer, was more prevalent in the lower SES groups in NSW in 1994 and 1997–1998 than in the highest SES group.<sup>7,8</sup> National data show that between 1980 and 1995 the prevalence of smoking among males decreased for all SES groups,<sup>8,9,10,11,12</sup> but the smallest decrease occurred in the lowest SES group (defined as lower blue collar workers). Overweight and obesity, which are risk factors for ischaemic heart disease, were higher in the lower SES groups than the highest in 1994 and in 1997–1998.<sup>7,13</sup> Excessive alcohol consumption (as measured by 'Heavy drinking days'), a risk factor for road traffic accidents, was significantly higher in the lowest SES group (39.5 per cent of those who drink occasionally or regularly) than in the highest SES group (32.8 per cent) in NSW in 1997–1998.<sup>13</sup>

As described in this article, the gradients in PAM that are seen with socioeconomic status also suggest that primary prevention strategies are much more effective in the highest SES group than in the middle and lowest SES groups. There is also international evidence to suggest that this is the case.<sup>7</sup> This might be because people from lower SES groups have less access to preventive health services, because health promotion messages might be less appropriate to these groups and because lower SES groups face greater impediments that hinder behavioural change.<sup>3,7</sup> Increasingly, health promotion messages are being designed to be more relevant to lower SES groups and culturally and linguistically diverse communities.<sup>16</sup> Over time, this should lead to a greater decrease in PAM in the lower SES groups.

It is also of interest that, in 2000, rates of PAM are only slightly higher—six per cent higher for males and five per cent higher for females—in the lowest SES group than in the middle SES group, and that the relative gap between these groups has decreased slightly for males and has been almost constant for females between 1980 and 2000 for PAM. The exception to this is road traffic accidents, where the gap between the lowest and middle SES groups increased between 1980 and 2000. This may be due to an overrepresentation in the lower SES group of people from rural areas, where rates of road traffic accidents are significantly higher.<sup>4</sup>

## CONCLUSION

To date, the call to reduce socioeconomic inequalities in health has mainly resulted in interventions targeted at the lowest SES group. PAM data and other health status<sup>4</sup> data indicate that in many cases the greatest gap is between the highest SES group and the rest of the population (lowest and middle SES groups). This raises a number of issues for health policy development:

- the need to continue to target the lowest SES group to maintain its rate of improvement in PAM in the future;
- the need to develop programs that are aimed at reducing the gap between the rest of the population and the highest SES group.

The biggest gains in health across the population will be in improving health outcomes for both the middle and lowest SES groups. This analysis suggests that interventions that target smoking, other risk factors for cardiovascular disease, and road traffic accidents in these groups are likely to have the biggest impact on reducing inequalities in PAM.

Inter-sectoral action is required to identify and address the determinants of health inequalities.

In NSW, a Health and Equity Statement has been developed in an attempt to reduce health inequalities through engaging the health sector, the community and other government and non-government organisations.<sup>15</sup>

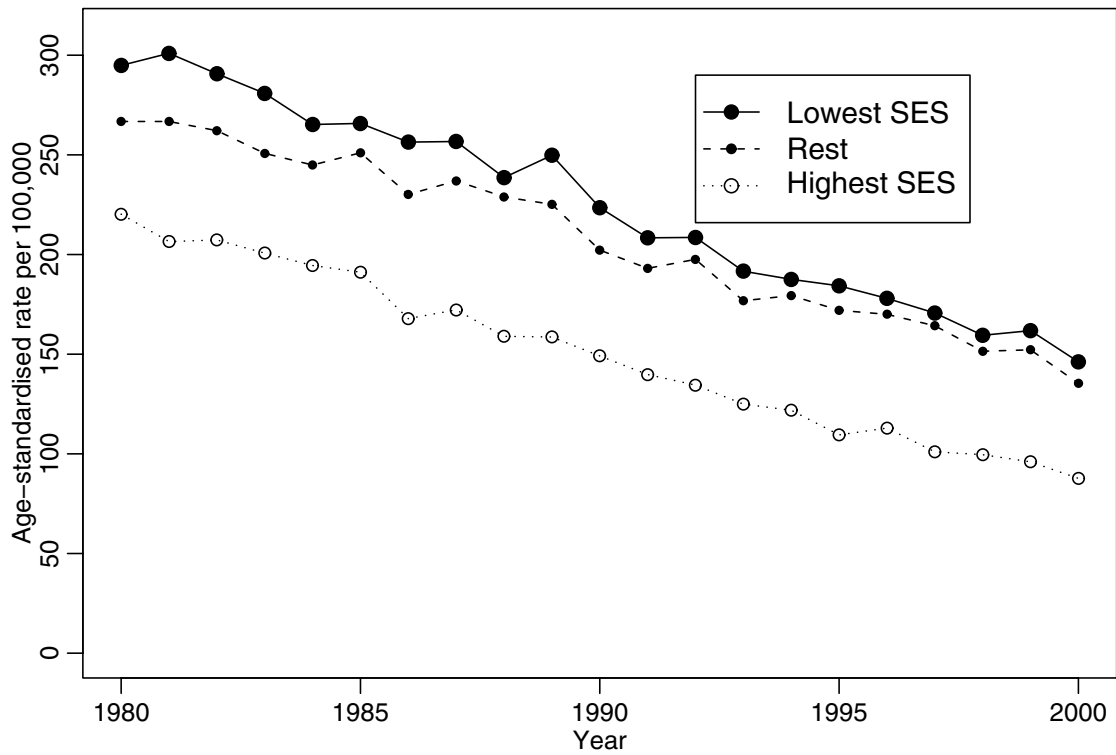
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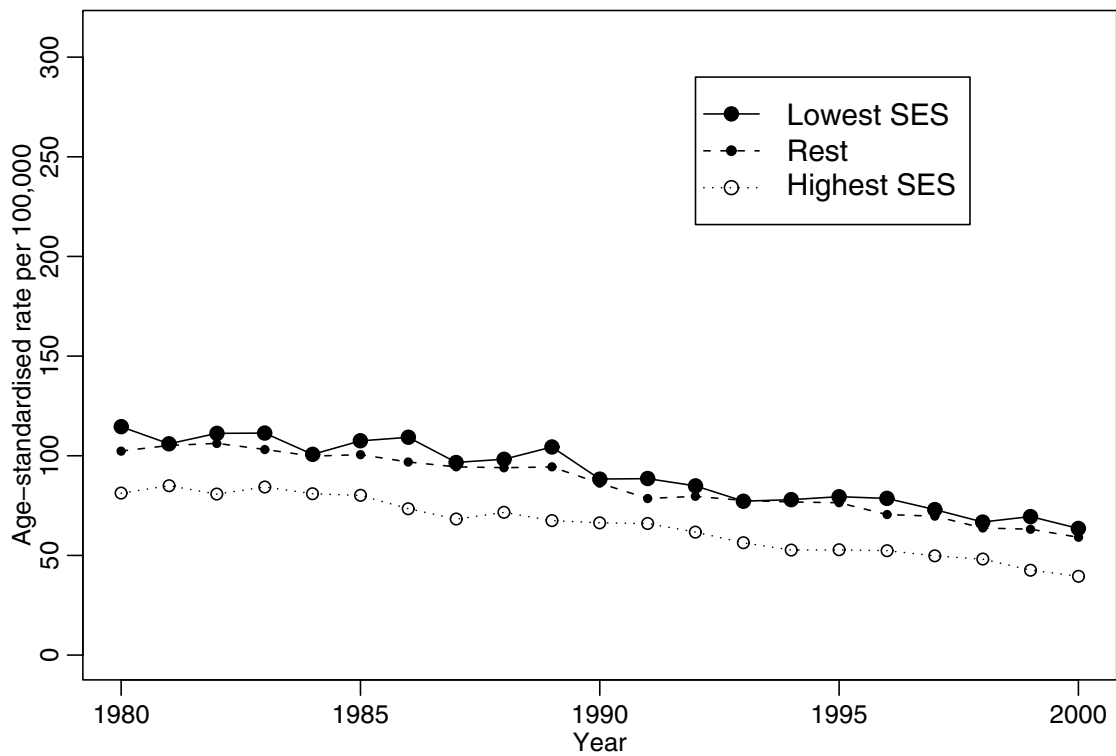
**FIGURE 1**

**PRIMARY AVOIDABLE MORTALITY, NSW, 1980–2000**

**(a) Males**



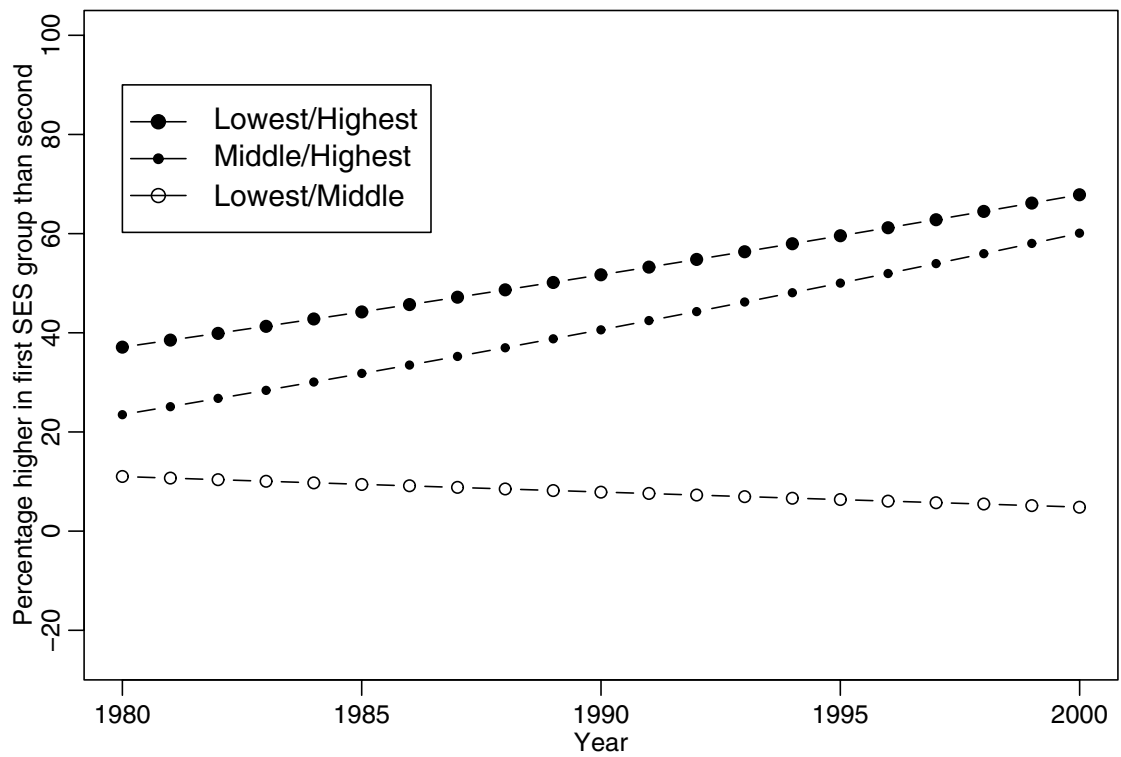
**(b) Females**



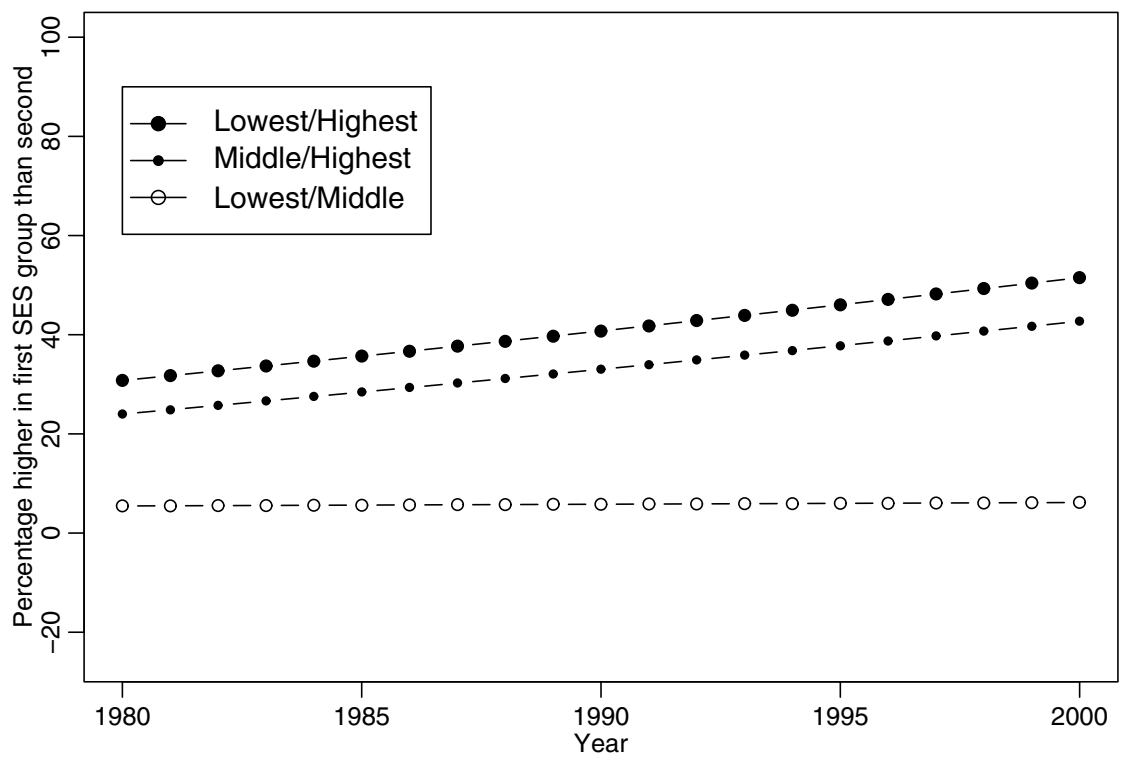
**FIGURE 2**

**GAPS IN PRIMARY AVOIDABLE MORTALITY, NSW, 1980-2000**

**(a) Males**

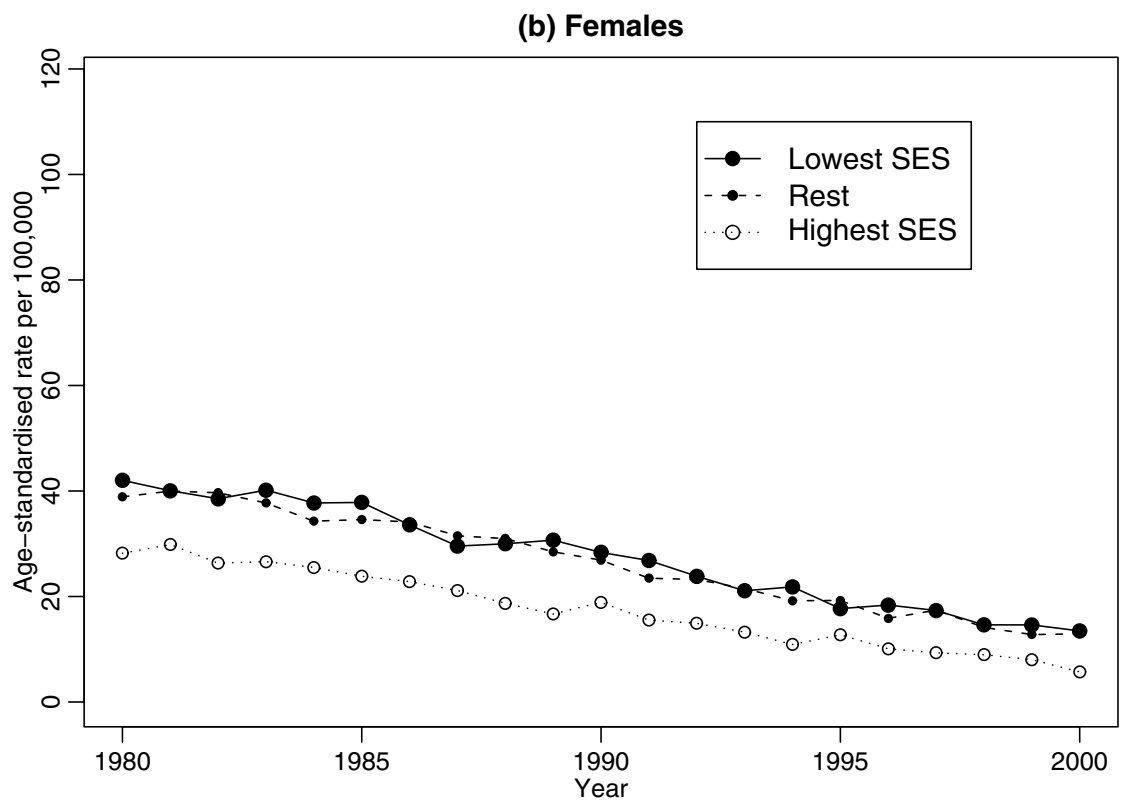
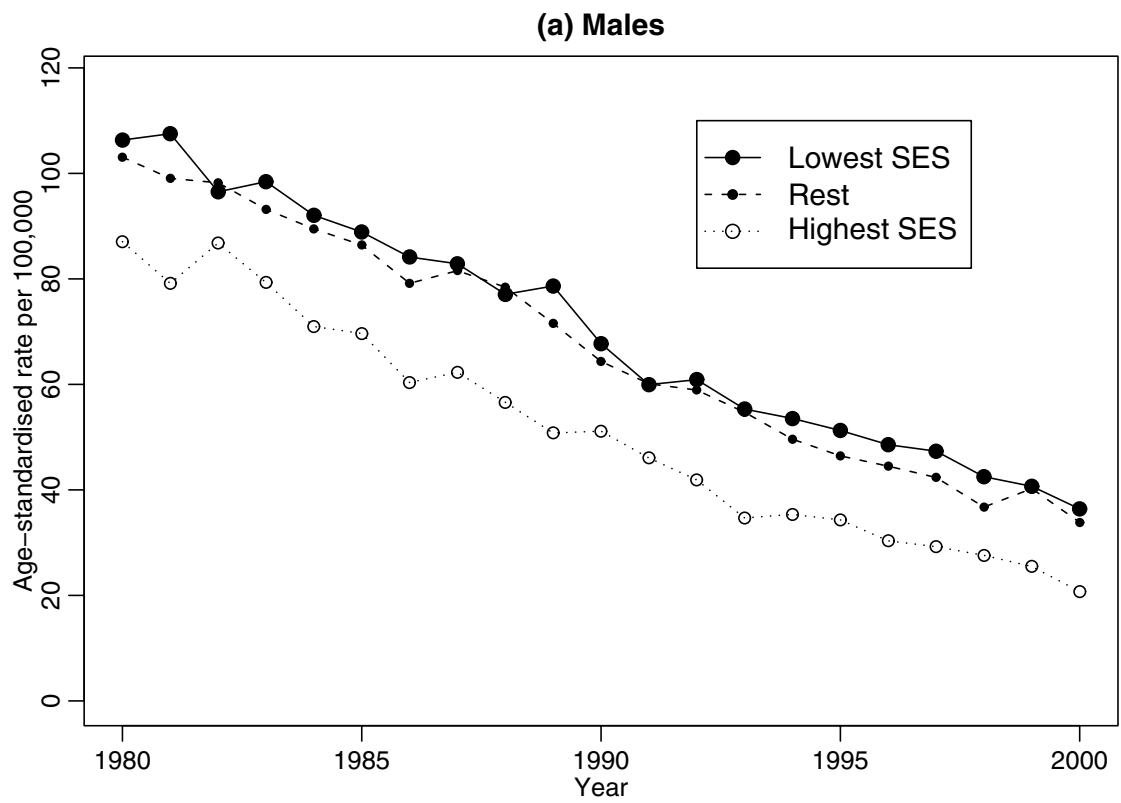


**(b) Females**



**FIGURE 3**

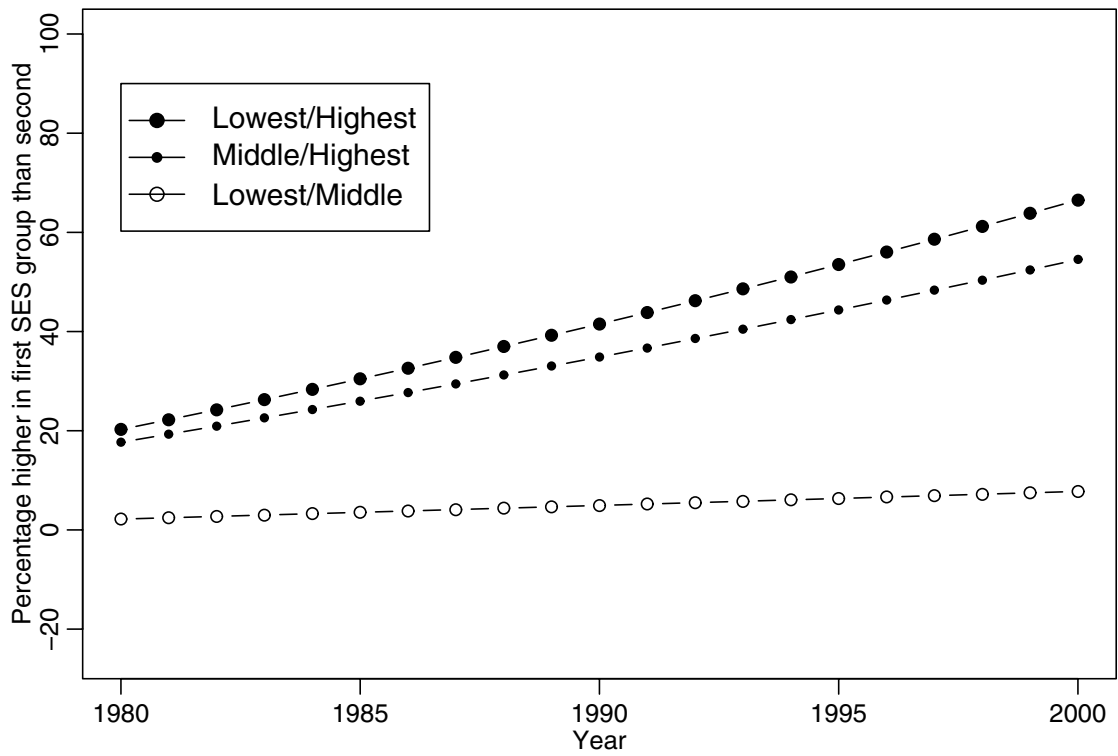
**PRIMARY AVOIDABLE MORTALITY DUE TO HEART DISEASE, NSW, 1980–2000**



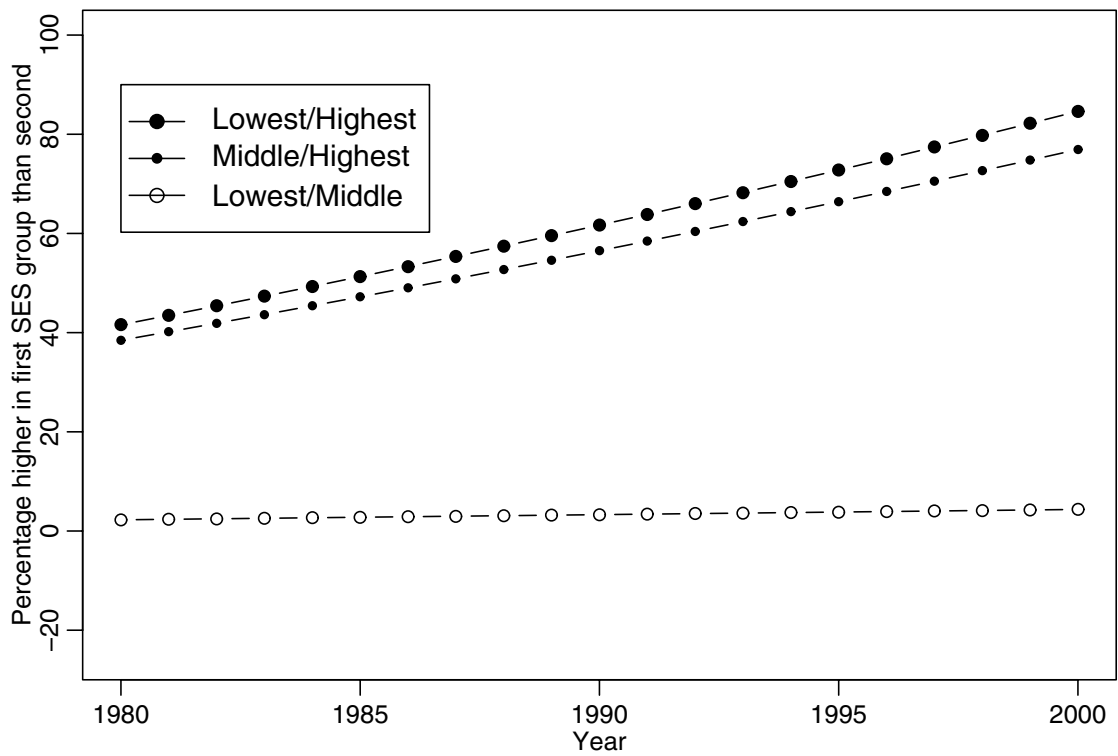
**FIGURE 4**

**GAPS IN PRIMARY AVOIDABLE MORTALITY DUE TO HEART DISEASE, NSW, 1980–2000**

**(a) Males**



**(b) Females**

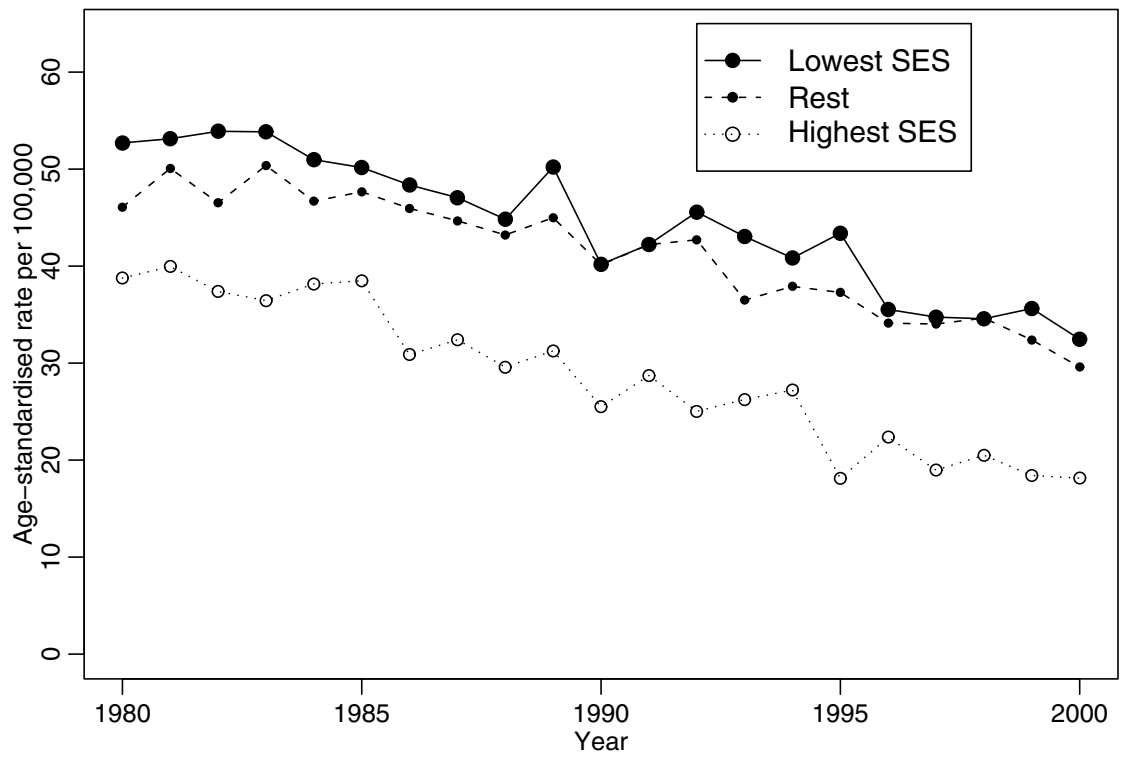




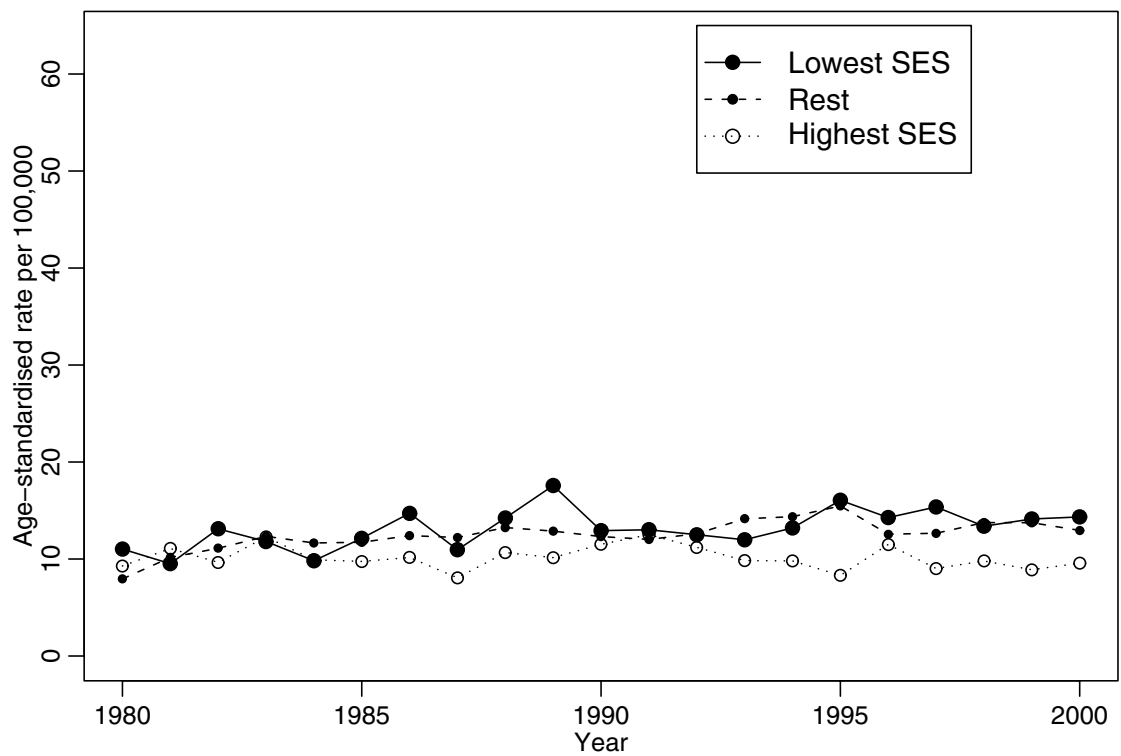
**FIGURE 5**

**PRIMARY AVOIDABLE MORTALITY DUE TO LUNG CANCER, NSW, 1980–2000**

**(a) Males**



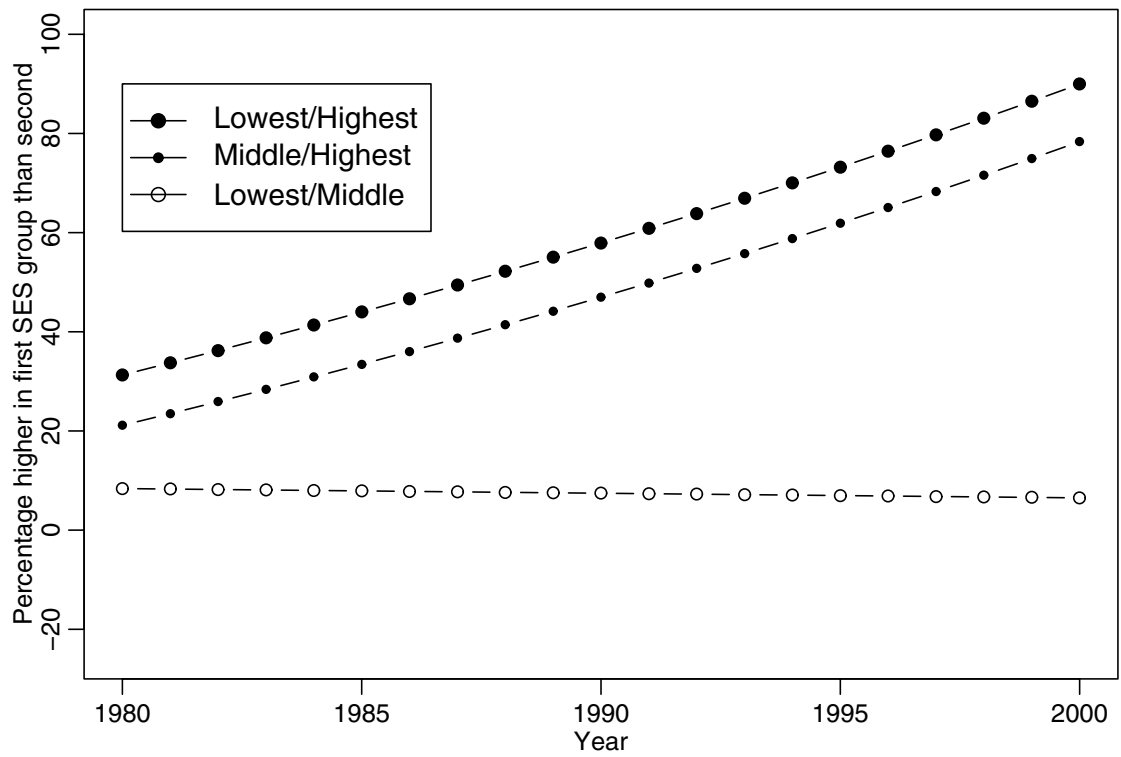
**(b) Females**



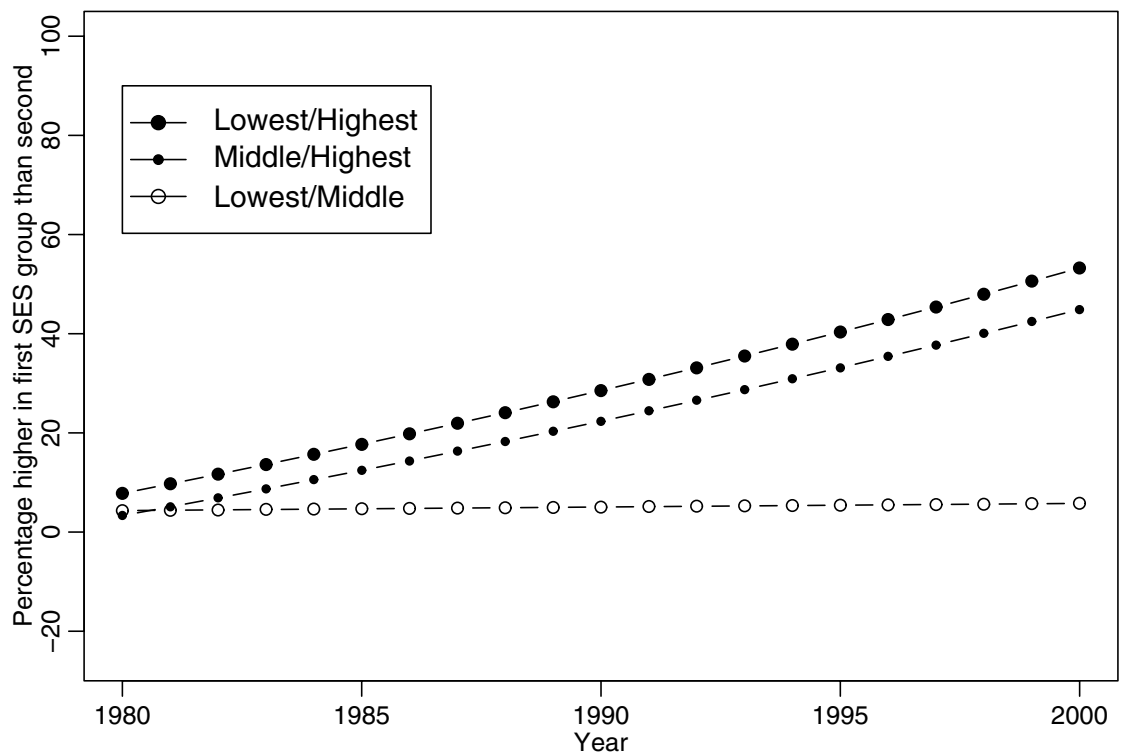
**FIGURE 6**

**GAPS IN PRIMARY AVOIDABLE MORTALITY DUE TO LUNG CANCER, NSW, 1980-2000**

**(a) Males**



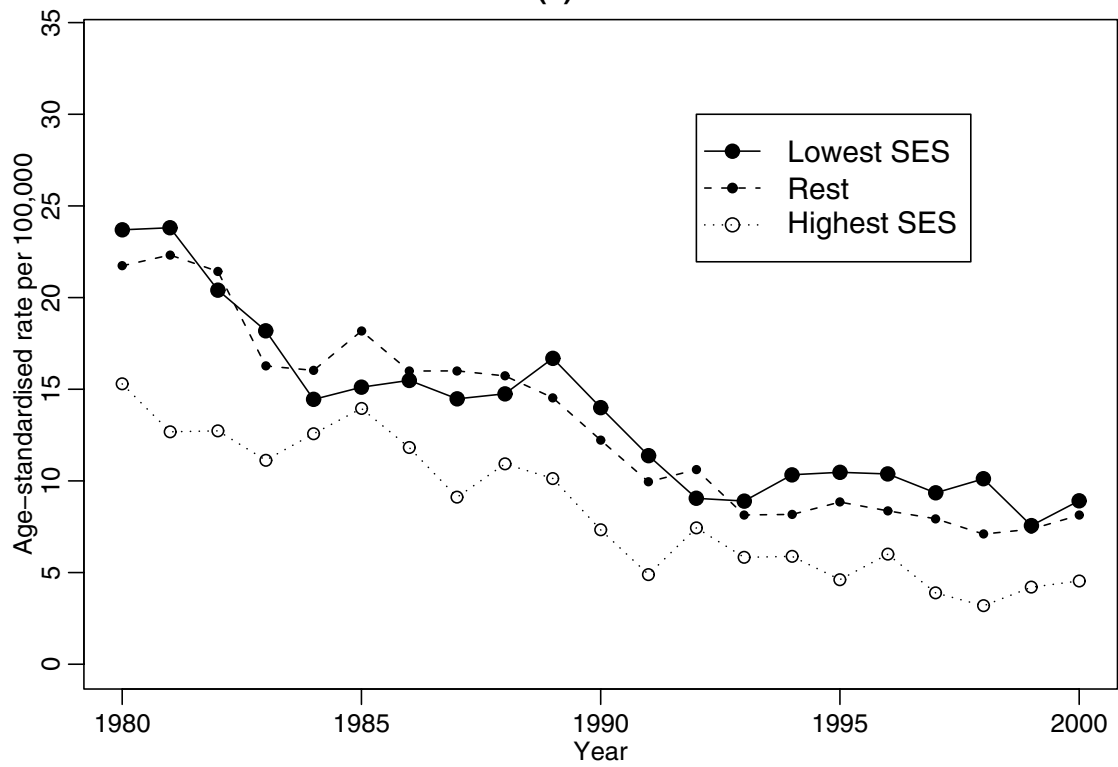
**(b) Females**



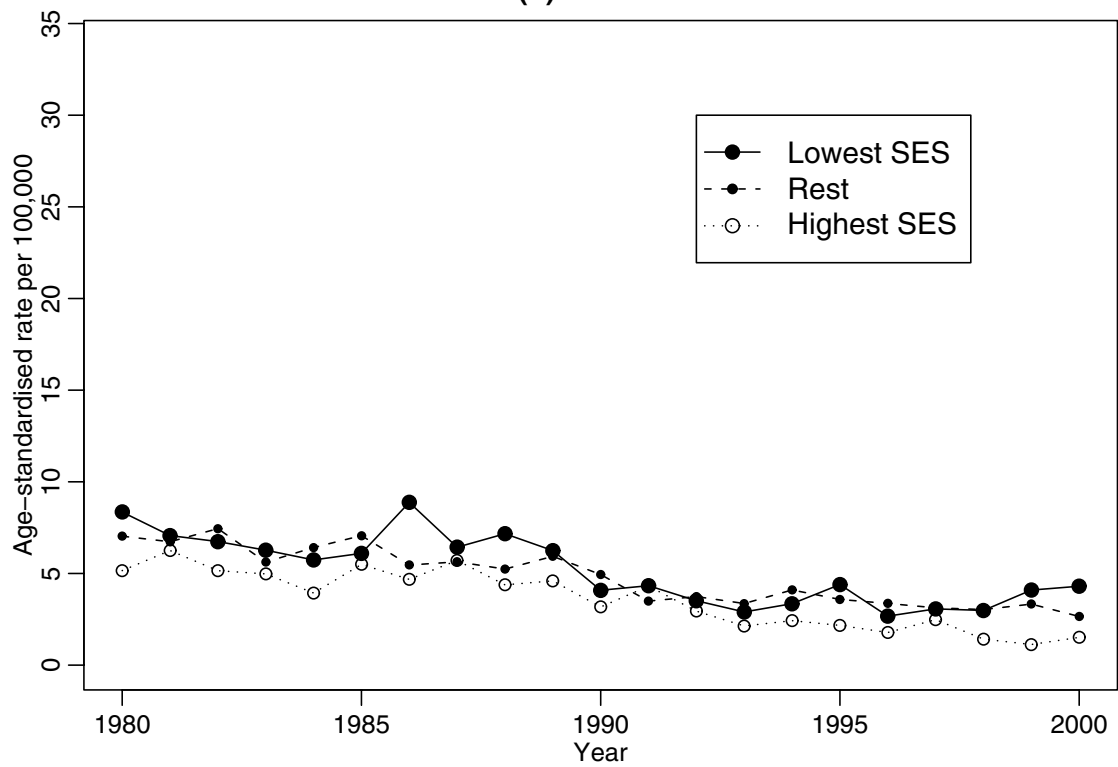
**FIGURE 7**

**PRIMARY AVOIDABLE MORTALITY DUE TO ROAD TRAFFIC ACCIDENTS, NSW, 1980–2000**

**(a) Males**



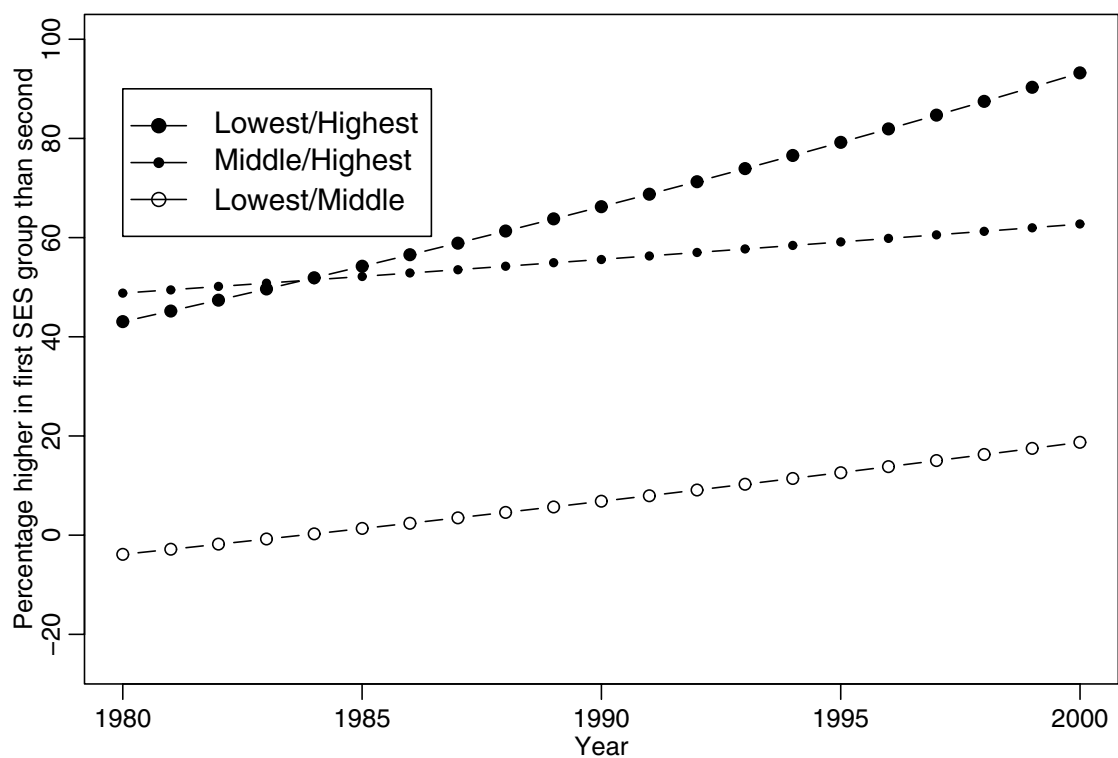
**(b) Females**



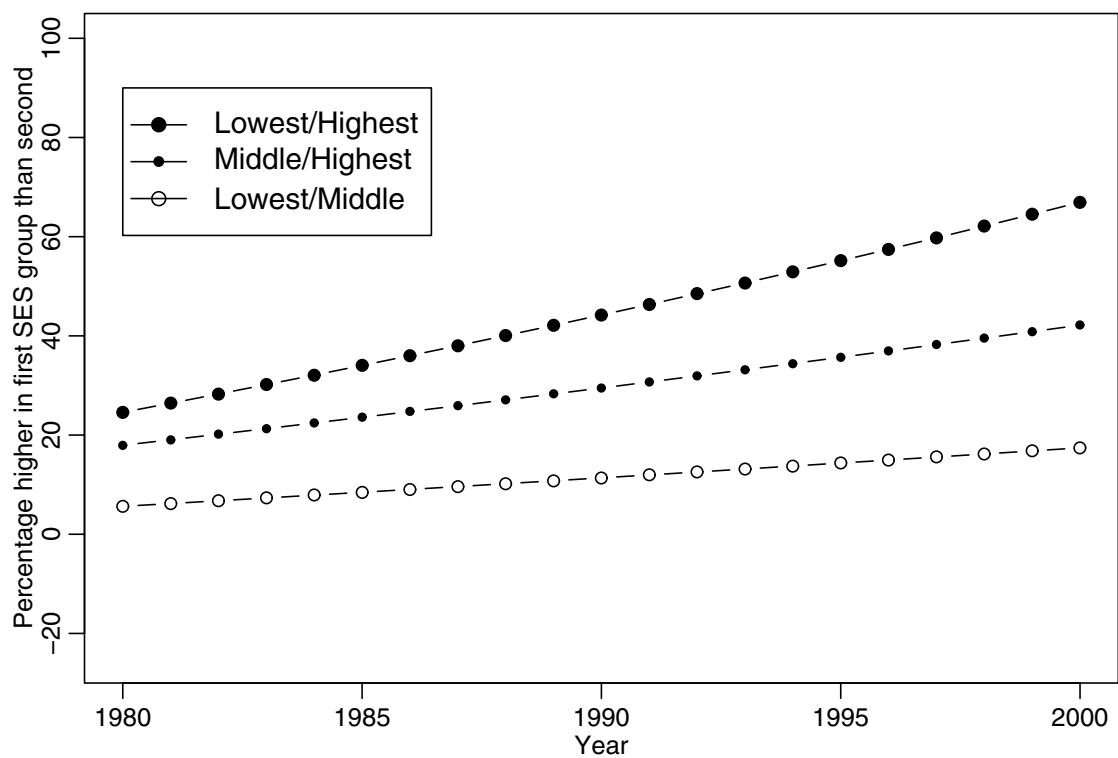
**FIGURE 8**

**GAPS IN PRIMARY AVOIDABLE MORTALITY DUE TO ROAD TRAFFIC ACCIDENTS, NSW, 1980–2000**

**(a) Males**



**(b) Females**



## WHAT IF NEW SOUTH WALES WAS MORE EQUAL?

Citation: *N S W Public Health Bull* 2002; 13(6): 123–127

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In the international health status ‘league tables’, Australia ranks among the best in the world. For example, on the measure of healthy life expectancy (that is, disability-adjusted life expectancy), the *World Health Report 2000* rated Australia second out of 191 countries.<sup>1</sup> However, as Sainsbury and Harris remind us in the guest editorial to the first issue in the health inequalities series of the *NSW Public Health Bulletin* (Volume 12, Number 5): ‘there are substantial inequalities in health in NSW and Australia’ and ‘these inequalities translate into large differences in levels of mortality and morbidity’.<sup>2</sup>

This article describes the excess mortality burden in NSW and focuses on the following questions: What if NSW was more equal? Each year, how many people in the State go to unnecessarily early graves?

Clearly, there is no unequivocal or precise answer to these two questions, as the answer depends on how ‘excess’ mortality is identified and measured. Despite the elusiveness of any definitive answer, the questions are worth posing because they remind us of the scope that still remains for reducing premature mortality across New South Wales.

### **BACKGROUND—APPROACHES TO MEASURING EXCESS MORTALITY**

The notion of excess (or avoidable, unnecessary, and preventable) mortality has a lengthy history, dating back at least to the mid-nineteenth century in the work of the English statistician, William Farr.<sup>3</sup> Concerted research interest in the topic, however, is more recent, developing over the past three decades or so.

Two basic types of methodologies have been employed to estimate excess mortality. The first type of methodology has been based on identifying causes of death that supposedly can be prevented in various ways. Work in this methodology derives from a compilation of a list of ‘unnecessary untimely deaths’ (that is, ‘sentinel health events’) by a working group on preventable and manageable diseases in the United States.<sup>4</sup> Subsequent researchers have used and extended this list in studies of avoidable mortality in a wide variety of geographic settings.<sup>5–10</sup> Early work in this methodology tended to focus on mortality from conditions amenable to medical intervention (that is, secondary and tertiary prevention), but some of the more recent studies have extended the concept of avoidability to cover primary prevention (that is, reducing the incidence of the condition through individual behavioural change and population level interventions).<sup>11,12</sup>

The second type of methodology has been based on the idea of selecting a favourable level of mortality as a standard and then defining excess deaths as those above that reference level. This, in fact, was the approach taken by Farr in the nineteenth century.<sup>3</sup> Farr noted that, in districts in England with the most favourable sanitary conditions, the crude death rate did not exceed 17 per 1000 population; and, accordingly, he adopted this rate as representing ‘natural’ deaths. Any deaths above this rate were deemed to be ‘unnatural’. Several variants of this ‘best mortality’ criterion have been used by modern researchers. One strategy has been to use the age-specific and sex-specific mortality prevailing in the highest social class as a benchmark.<sup>13,14</sup> Another has been to assemble the lowest age-specific and sex-specific death rates recorded in selected geographic units as a benchmark.<sup>15–17</sup> An interesting recent British study, meanwhile, has placed the ‘best mortality’ approach in a government policy framework, by estimating the effect on death rates if life in Britain was changed through three successful government policy initiatives: the achievement of full employment, the eradication of child poverty, and a modest redistribution of income.<sup>18</sup>

### **METHODS AND DATA**

For the analyses reported here, the ‘best mortality’ approach has been employed. Two geographic areas are used as ‘best mortality’ reference benchmarks, the Northern Sydney Area Health Service (NSAHS) and the Ku-ring-gai Local Government Area (KLGA). The NSAHS has the lowest age-standardised mortality rates for both males and females of the State’s 17 area health services,<sup>19</sup> while the KLGA—which is located within the NSAHS—has the lowest age-standardised and sex-standardised premature mortality ratio of any large (that is, >100,000 resident population) local government area within NSW.<sup>20</sup> These ‘best mortality’ positions have been consistently held by both geographic units for many years.

Unpublished deaths tabulations by age (in five-year groups), and by sex and cause, for the years 1995–1997 (combined) for NSW local government areas were purchased from the Australian Bureau of Statistics. Average annual age-specific and sex-specific death rates for the NSAHS (Model A) and KLGA (Model B) were calculated from these data and from 1996 estimated resident population (ERP) figures. These rates were then applied to NSW’s ERP and the ERPs of each of the State’s area health services to calculate the number of deaths the State as a whole (and each area health service) would have experienced if they had had the age-specific and sex-specific death rates of the reference populations.

Excess mortality was defined as the difference between the actual number of deaths experienced and the expected number, and excess deaths were expressed as a percentage

TABLE 1

## NUMBER OF LIVES POTENTIALLY 'SAVED,' AND OBSERVED DEATHS, NSW\*, 1995–1997

Age Group	Number of lives that could have been saved per year								Observed Deaths	
	Model A (NSAHS rates unadjusted)		Model B (KLGAs rates unadjusted)		Model C (NSAHS rates adjusted)**		Model D (KLGAs rates adjusted)**		New South Wales Average Annual Deaths 1995–1997	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
0–14	115	33	202	58	34	0	30	58	407	318
15–34	383	112	231	230	213	19	0	133	1098	373
35–54	720	311	1123	399	478	126	616	94	2199	1250
55–64	881	219	1097	465	689	92	641	90	2682	1534
65–74	1387	599	2787	1048	1067	349	2107	443	6137	3753
<b>Total</b>	<b>3486</b>	<b>1274</b>	<b>5440</b>	<b>2200</b>	<b>2481</b>	<b>586</b>	<b>3394</b>	<b>818</b>	<b>12523</b>	<b>7228</b>

\* Based on New South Wales' estimated resident population at 30 June 1996.

\*\* For some age groups the confidence interval adjustment made the NSAHS and KLGAs rates higher than the NSW ones. In such cases the number of lives potentially saveable was taken as zero.

of actual deaths to give an index of proportional excess mortality (PEMI). The procedure is thus simply indirect standardisation, but with selected 'best mortality' age-specific and sex-specific rates used as the standard, rather than the normal practice, in NSW Department of Health publications, of using rates for NSW as the benchmark.

To dampen the influence of random fluctuations in the data, three years of mortality statistics combined were used. To this end, one run of the NSAHS-based calculations of excess mortality (Model C) was conducted using the area's specific rates adjusted up to the upper limit of their respective 95 per cent confidence intervals to give a more conservative estimate of avoidable deaths. A similarly-adjusted KLGAs model (Model D) was also run.

The consideration of excess mortality was confined to deaths under 75 years of age. This is not to deny the occurrence and importance of avoidable deaths at higher ages. However, deaths before age 75 can be thought of as premature and thus of particular concern. Most of the previous work on excess (avoidable) mortality has used an upper age limit of 64 years; but, in recognition of improvements in life expectancy, the higher limit was chosen here.

## RESULTS

### All-causes mortality in NSW

Table 1 summarises the annual excess death toll for the State under the four models. Using the unadjusted NSAHS and KLGAs age-specific and sex-specific rates, Models A and B, produce excess mortality figures of 4760 and 7640 people respectively. On the other hand, the more conservative confidence interval-adjusted NSAHS rates (Model C) gives a total of 3067, while the adjusted KLGAs rates (Model D) yield an excess of 4212. The proportion of total actual deaths (males and females combined)

identified as excess varies from 24 per cent (Model A), to 39 per cent (Model B), to 16 per cent (Model C) to 21 per cent (Model D).

In all four models, males dominate the excess figures, with a sex ratio ranging from 4.2:1 in the adjusted NSAHS model to 2.5:1 in the unadjusted KLGAs model. The age group in which excess deaths are proportionately strongest varies among models (Table 2), though in absolute terms in each case the greatest number of such deaths is in the 65–74 year bracket.

### All-causes mortality by area health services

Estimates of excess mortality in each of the area health services are given in Table 3. Only the unadjusted NSAHS rates (that is, Model A) were employed for these calculations. In terms of this reckoning, excess deaths range in number from 514 in the Hunter Area to 122 in the Far West Area, with the NSAHS—by definition as the benchmark—having zero. These figures give each area health authority a simple quantitative indication of the 'saveable lives' (per the chosen algorithm) within its bounds. They of course, though, reflect the population size as well as mortality level of each area health service, and so the proportional excess mortality index (PEMI) also needs to be considered. By this measure, the Far West Area has the highest degree of excess mortality in the State, just under half of total deaths in that area rating as such. The Macquarie Area (37 per cent) and the New England Area (34 per cent) have the next highest indexes.

### Causes of death in NSW

The overall NSW results, disaggregated by leading causes of death, are presented in Table 4. Again only Model A (that is, NSAHS rates unadjusted) was used for these calculations. By this estimation, ischaemic heart disease offers the greatest absolute potential for saving lives (1113 people), followed by respiratory diseases and lung cancer.

**TABLE 2****PROPORTIONAL EXCESS MORTALITY INDEX, IN PERCENTAGES, NSW\*, 1995–1997**

Age Group	Model A (NSAHS rates unadjusted)		Model B (KLAGA rates unadjusted)		Model C (NSAHS rates adjusted)**		Model D (KLAGA rates adjusted)**	
	Males	Females	Males	Females	Males	Females	Males	Females
0–14	28	10	50	18	8	0	7	18
15–34	35	30	21	62	19	5	0	36
35–54	33	25	51	32	22	10	28	8
55–64	33	14	41	30	26	6	24	6
65–74	23	16	45	28	17	9	34	12
<b>Total</b>	<b>28</b>	<b>18</b>	<b>43</b>	<b>30</b>	<b>20</b>	<b>8</b>	<b>27</b>	<b>11</b>

\* Based on New South Wales' estimated resident population at 30 June 1996.

\*\* For some age groups the confidence interval adjustment made the NSAHS and KLAGA rates higher than the NSW ones. In such cases the number of lives potentially saveable was taken as zero.

**TABLE 3****PREVENTABLE MORTALITY BY AREA HEALTH SERVICE, NSW\*, 1995–1997**

Area health service	Lives that could have been saved	PEMI (%)	Area health service	Lives that could have been saved	PEMI (%)
Central Sydney	486	30	Northern Rivers	211	23
Northern Sydney	0	0	Mid North Coast	210	21
Southe Eastern Sydney	369	17	New England	219	34
South Western Sydney	511	25	Macquarie	142	37
Western Sydney	489	27	Mid Western	195	33
Wentworth	190	25	Far West	122	49
Central Coast	289	27	Greater Murray	291	31
Hunter	514	28	Southern	194	29
Illawarra	304	25	<b>NSW Total</b>	<b>4760</b>	<b>24</b>

Note: The area health service lives that could have been saved do not sum to the NSW total as area health service of residence details were not available for a small number of recorded deaths.

\* Based on New South Wales' estimated resident population at 30 June 1996.

Proportionally, respiratory diseases (41 per cent) and motor vehicle accident (41 per cent) deaths have the largest excess component. For some causes of death other area health services have lower rates than the NSAHS, and thus different cause-specific results would obviously be obtained if those areas were used as the standard.

## DISCUSSION

The results reported above clearly show the scope that still remains for reducing premature mortality in NSW, despite a very favourable level of life expectancy overall. Employing the 'best mortality' approach is a useful variation from the norm in the NSW Department of Health publications of using the overall State rates of mortality as the comparative benchmark. Taking the State level as the benchmark usefully identifies areas with above average mortality and need for special attention, but carries the risk of glossing over the potential for still further improvement in areas with better than average rates. The more rigorous best mortality criterion is a reminder of this potential.

Obviously, the assumption that all areas can achieve age-specific and sex-specific mortality rates as low as those in the 'best mortality' area does not completely hold. The higher mortality of some areas, for example, may reflect above average proportions of people exposed to determinants of health not amenable to prevention: for instance, genetic predisposition to certain diseases. However, the bulk of the inequality in mortality among population subgroups in NSW, and throughout Australia as a whole, is socially and behaviourally determined; and thus, at least theoretically, is open to improvement.

To return to the opening question of how many people in NSW each year go to unnecessarily early graves, the author's view is that the unadjusted NSAHS rates model (Model A) offers a reasonable working figure; that is, close to 5000 persons under the age of 75. The confidence interval adjustment (Models C and D) was introduced into the analysis in recognition of the fact that mortality rates comprise both random and systematic variation. That adjustment naturally reduced the identified excess toll.



TABLE 4

## PREVENTABLE MORTALITY FROM SELECTED CAUSE OF DEATH, NSW\*, 1995–1997

Cause of Death ICD9 Code	Name	Lives that could have been saved	PEMI (%)
153–154	Colorectal cancer	101	11
162	Lung cancer	531	35
410–414	Ischaemic heart disease	1113	30
430–438	Cerebrovascular disease	219	20
460–519	Respiratory diseases	575	41
E800–E949	Accidents	388	37
E810–E819	Motor vehicle accidents	210	41
E950–E959	Suicide	121	16
001–999	All causes	4760	24

\* Based on New South Wales' estimated resident population at 30 June 1996.


However, examination of area health service all-causes mortality patterns through the 1990s shows that:

- the NSAHS to have consistently had the lowest male and female rates;
- the relative mortality standing of the 17 area health services to have been very stable.

The correlation between the areas' 1990–1994 and 1994–1998 age-standardised and sex-standardised all-causes rates was  $r = 0.98$ . Hence the support for the unadjusted NSAHS model.

It might well be argued, though, that the feasible reduceable excess toll is even higher, as the unadjusted KLGA model (Model B) suggests. While, theoretically, the smaller population and number of deaths involved makes those rates more sensitive to random fluctuation, the KLGA, like the overall NSAHS of which it is part, has a consistent record of very favourable mortality and thus might be considered a proven achievable target level. Adopting the KLGA as the benchmark also has the benefit of identifying the scope for improvement that remains even within the area health service with the 'best mortality'. In turn, within the KLGA itself there are still deaths occurring that are avoidable.

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

Citation: *N S W Public Health Bull* 2002; 13(7): 147–151

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*Menzies School of Health Research*  
*Darwin, Northern Territory*

The relationship between socioeconomic disadvantage and the health of Australians has frequently been reported,<sup>1–3</sup> 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;<sup>4</sup>
- ESRD incidence in the total population by Statistical Sub-Division (SSD) within capital cities.<sup>5</sup>

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.<sup>6</sup> 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.<sup>5,7</sup> 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 ATSIC REGION

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

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:<sup>9–11</sup>

- the proportion of adults who had left school aged 15 or less, or who had not attended school;<sup>12</sup>
- the unemployment rate (Community Development Employment Project [CDEP] participants have been classified as unemployed);<sup>12</sup>
- median household income divided by the average number of persons per household;<sup>13</sup>
- the average number of persons per bedroom;<sup>12</sup>
- the proportion of births less than 2500 grams.<sup>14</sup>

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).

## 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,<sup>15</sup> 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.<sup>16</sup> 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).

## 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.<sup>17-20</sup>

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

**TABLE 1**

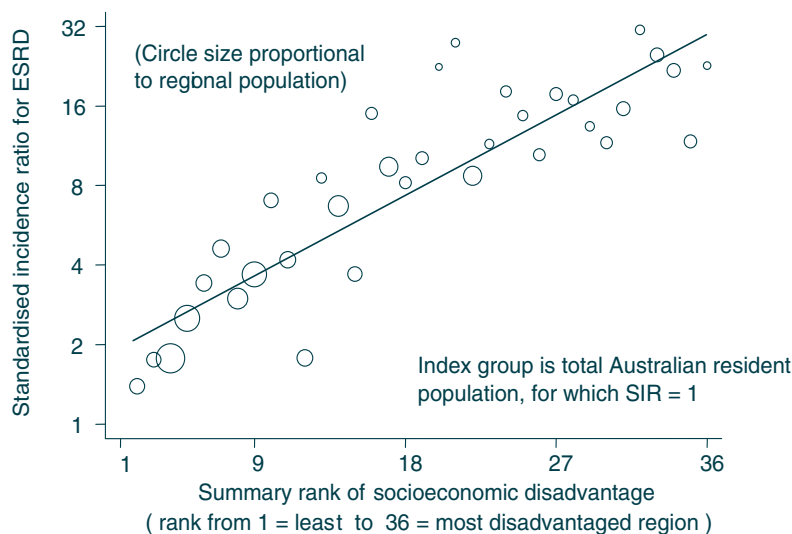
### CORRELATION BETWEEN INDICATORS AND STANDARDISED INCIDENCE OF ESRD FOR INDIGENOUS AUSTRALIANS

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 (\$ AUS 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 ATSI REGION, 1993-1998



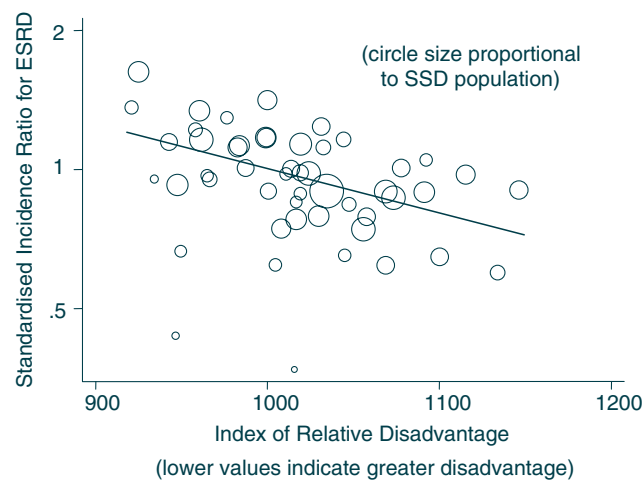
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**TABLE 2****STANDARDISED INCIDENCE OF ESRD IN SYDNEY 1993-98**

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.

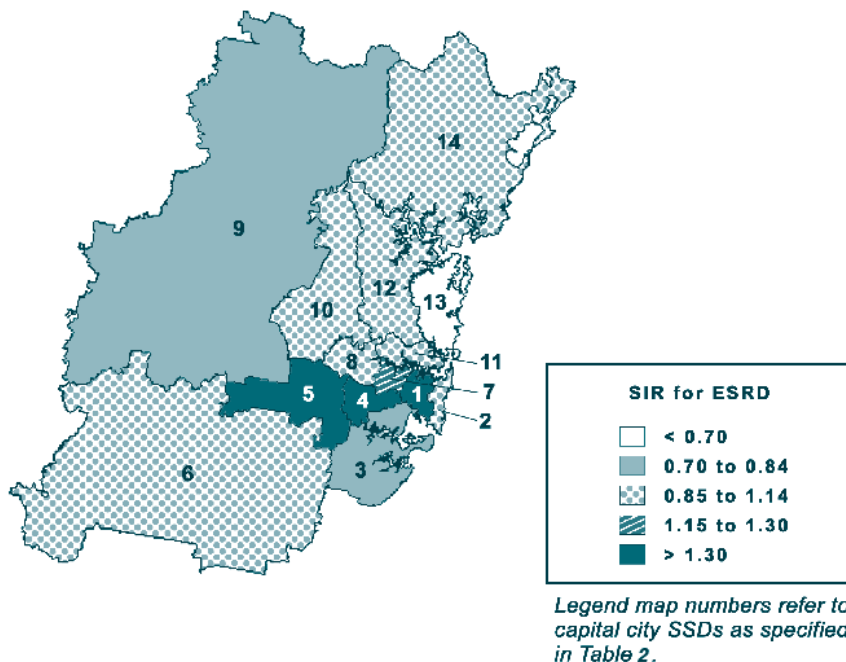
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**FIGURE 2****SOCIOECONOMIC DISADVANTAGE AND CAPITAL CITY ESRD INCIDENCE BY STATISTICAL SUB-DIVISION (SSD), 1993-1998**

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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

**FIGURE 3****SYDNEY STANDARDISED INCIDENCE RATIO (SIR) FOR ESRD 1993–98**

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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,<sup>21</sup> or to congenital factors such as low birthweight.<sup>22</sup> 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,<sup>7</sup> 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.

## 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 should not be seen as an official policy or interpretation of the Australia and New Zealand Dialysis and Transplant Registry. Alan Cass receives PhD scholarship funding from 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. We acknowledge the journals *Australian and New Zealand Journal of Public Health* and *Ethnicity and Disease* for permission to reproduce figures and tables in this article.

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## GROWING APART: FURTHER ANALYSIS OF INCOME TRENDS IN THE 1990S

Citation: *N S W Public Health Bull* 2002; 13(3): 51–53

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### BACKGROUND

There has been debate in Australia about whether income inequality is increasing. Using *annual* income data, a range of studies suggested that income inequality increased in the 1980s.<sup>1,2</sup> Using *weekly* income data, Harding found that income inequality had remained stable between 1982 and 1993–94,<sup>3</sup> and between 1982 and 1996–97.<sup>4</sup> However, it has since emerged that there may be major problems with the weekly income data collected in the 1982 Income Survey, so that there are now doubts about the reliability of results based on this data. In addition, recent research conducted by the National Centre for Social and Economic Modelling (NATSEM) has also suggested that income inequality in the 1996–97 Income Survey looks much too equal, relative to earlier and later surveys.<sup>5</sup> These issues, of possible data problems and data comparability, are currently being examined in a joint project by the Australian Bureau of Statistics (ABS) and the Social Policy Research Centre. This current article is thus restricted to an analysis of data collected at the end of the 1980s and in the 1990s.

### INCOME TRENDS

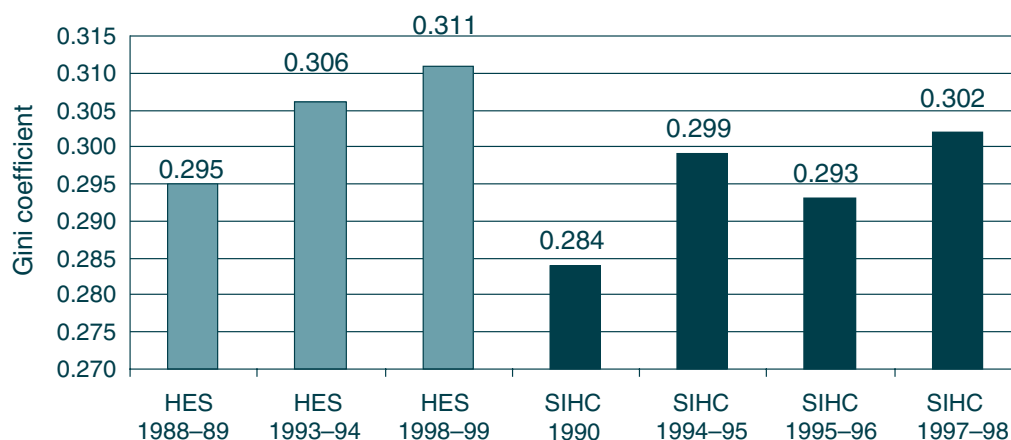
This article uses weekly income data from two sets of national sample surveys undertaken by the Australian

Bureau of Statistics to look at income inequality trends in the 1990s. The methodology of the study is described in detail in Harding and Greenwell.<sup>5</sup> In summary, the data sources are the unit record tapes released by the ABS for the Household Expenditure Surveys and the Income Surveys; the income unit used is the household; 'dependent children' means all persons aged less than 18 years living in the household except where the young person lived by themselves, with a spouse, or in a group household; the equivalence scale used is the square root of household size, which is widely used internationally; income is current weekly income; in the later surveys negative business and investment incomes have been reset to zero to maintain comparability with the earlier surveys; the measure of resources is disposable (after-income tax) income, adjusted by the equivalence scale to take into account the needs of households of different size; and the income distribution is determined by a ranking of people by their equivalent household income, so that a household containing five people is counted five times, not once, when calculating inequality.

One widely used measure of the change in aggregate income inequality is the Gini coefficient, which varies between 0 (when income is equally distributed) to 1 (when one household holds all income). In general, a higher Gini coefficient is associated with increasing inequality. As Figure 1 shows, data from both the Household Expenditure Surveys and the Income Surveys both suggest that income inequality increased over the course of the 1990s. Thus, the Gini coefficients derived from the Expenditure

**FIGURE 1**

**COMPARISON OF GINI COEFFICIENTS FOR EQUIVALENT DISPOSABLE HOUSEHOLD INCOME FROM THE EXPENDITURE AND INCOME SURVEYS**



Data source: ABS Household Expenditure Survey and Income Survey unit record files.



TABLE 1

## RANGE OF INDICATORS OF INCOME INEQUALITY, HOUSEHOLD EXPENDITURE SURVEYS AND INCOME SURVEYS

	Expenditure Surveys			Income Surveys		
	1988–89	1998–99	% change 1989–99	1990	1997–98	% change 90–98
<b>Weekly income at particular points in the distribution</b>						
95th percentile	\$1,770	\$2,103	18.8%	\$1,967	\$2,121	7.9%
90th percentile	\$1,533	\$1,775	15.8%	\$1,709	\$1,843	7.8%
75th percentile	\$1,155	\$1,318	14.1%	\$1,326	\$1,390	4.9%
Mean	\$908	\$1,011	11.4%	\$1,025	\$1,073	4.7%
Median	\$804	\$890	10.7%	\$944	\$956	1.3%
25th percentile	\$542	\$586	8.1%	\$624	\$625	0.1%
10th percentile	\$393	\$410	4.2%	\$443	\$449	1.5%
5 <sup>th</sup> percentile	\$343	\$327	-4.6%	\$364	\$376	3.2%
<b>Ratios</b>						
95/10 ratio (very top/bottom)	4.5	5.13	14.1%	4.44	4.72	6.3%
90/10 ratio (top/bottom)	3.9	4.33	11.2%	3.86	4.1	6.3%
90/50 ratio (top/middle)	1.91	2	4.6%	1.81	1.93	6.4%
50/10 ratio (middle/bottom)	2.04	2.17	6.2%	2.13	2.13	-0.1%
<b>Decile shares</b>						
Bottom 10%	3.2	2.7	-14.7%	3.1	3	-3.1%
Bottom 20%	8.1	7.4	-6.3%	8	7.7	-3.7%
Middle 20%	17.8	17.6	-1.2%	18.3	17.8	-2.7%
Top 20%	37.4	38.2	2.1%	36.1	37.5	3.9%
Top 10%	22.2	22.5	1.3%	20.9	22	5.6%

Note: The income measure is the International equivalent weekly disposable household income of individuals. All incomes have been adjusted for inflation to March 2001 dollars, using the CPI. The 95/10 ratio is the ratio between the incomes of those at the 95<sup>th</sup> percentile of the income distribution with those at the 10<sup>th</sup> percentile of the income distribution.

Source: ABS Household Expenditure Survey unit record files.

Surveys increase by 0.016 between 1988–89 and 1998–99, while those derived from the Income Surveys increase by 0.018 between 1990 and 1997–98.

Another popular way of looking at income inequality is to examine real (that is, inflation adjusted) incomes at different points in the income distribution. Percentile 10, for example, is the equivalent disposable household income of the person at the 10th percentile of the income distribution. According to the Household Expenditure Survey, weekly income at this point has remained fairly stable in real terms, rising from A\$393 in 1988–89 to A\$410 10 years later (Table 1). Above this point, incomes at the lower-middle and middle of the income distribution pick up between the 1993–94 and 1998–99 surveys, after little change over the previous five years. But perhaps the most significant movement is at the top end of the distribution, with the average real incomes of those at the 90th and 95th percentiles of the distribution increasing strongly over the last decade—and apparently particularly in the last half of the 1990s. For example, the left hand column in Table 1 indicates that real weekly incomes at the 95th percentile have increased from A\$1770 to A\$2103 over the 10 years to 1998–99, which is an increase of 18.8 per cent.

This suggests that there has been a growing gap between the top and the middle as well as between the top and the bottom. This is confirmed by the ratios between these various income points, shown in the middle panel in Table 1. Both the 90/10 and the 95/10 ratios have increased markedly over the 10 years to 1998–99. The gap between the top and the middle has also grown since 1988–89 but not by as much, as shown by the lesser increase in the 90/50 ratio over those 10 years. The relative distance between the middle and the bottom has apparently increased in the last 10 years, with median income now reaching 2.17 times that of the 10th percentile.

Do the Income Surveys tell us the same story about income inequality as the Expenditure Surveys? In comparing the two, we have to keep in mind the slightly different time periods covered. In particular, the Expenditure Surveys cover two additional years, so higher increases in income might be expected given the longer time period.

The Income Surveys tell a somewhat different story about what is happening at various points within the income distribution (Table 1). Relative to the Expenditure Surveys, the Income Surveys suggest that:

- the bottom has fared better;

- the middle has fared worse;
- the top has fared less well than indicated in the Expenditure Surveys.

However, there is still some consistency within the results from the two sets of data, in that the top has experienced larger gains in income than either the bottom or the middle over the 1990s. It is also important to note that, even after taking out the impact of inflation, both sets of surveys suggest that both the average and median (middle) households enjoyed higher incomes at the end of the 1990s than at the beginning.

### INCOME SHARES

Finally, the bottom panel of results in Table 1 present a third set of measures commonly used to look at income inequality. This is the share of total income received by various groups in the population. For example, according to the Expenditure Surveys, the poorest 10 per cent of the population saw their share of the income pie decline from 3.2 per cent to 2.7 per cent of the total. Similarly, the middle 20 per cent of the population, when ranked by their household income, experienced a marginal fall in their income share, down to 17.6 per cent of the total pie in 1998-99. The Income Surveys also suggest that the middle and the bottom lost ground over the 1990s. Both surveys indicate that the most affluent 10 and 20 per cent of the population increased their share of the pie.

### CONCLUSION

The results from the two sets of ABS data differ in some respects, but some clear conclusions emerge. First, income inequality has increased over the course of the 1990s, although it is not entirely clear how much of that increase occurred primarily in the first half of the decade. However, all of the inequality measures used suggest growing income inequality for the decade as a whole.

There has been strong growth in incomes at the top end of the income spectrum. Growth in incomes has been slower at the middle and the bottom of the income spectrum. As a result, the gap between the top and the middle, and between the top and the bottom, has increased during the 1990s. There has been a decline in the share of the total income cake going to the bottom 10 per cent and the middle 20 per cent of Australians. This has been offset by the increase in the share of total income going to the top 20 per cent of Australians.

It is not entirely clear how middle Australia has been faring relative to those on the lowest incomes. The Income Surveys suggest that the middle and the bottom have experienced comparable income increases over the course of the 1990s, so that the relative gap between the incomes of the two groups has remained constant. The Expenditure Surveys paint a very different picture and suggest that middle incomes have increased more rapidly than the incomes of those at the bottom of the income spectrum.

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