

# Socioeconomic disadvantage and changes in health risk behaviours in Australia: 1989–90 to 2001

Jake M. Najman,<sup>a</sup> Ghasem Toloo,<sup>b</sup> & Victor Siskind<sup>c</sup>

**Objective** Lower socioeconomic status (SES) is associated in industrialized countries with unhealthy lifestyle characteristics, such as smoking, physical inactivity and being overweight or obese. This paper examines changes over time in the association between SES and smoking status, physical activity and being overweight or obese in Australia.

**Methods** Data were taken from three successive national health surveys in Australia carried out in 1989–90 ( $n = 54\,576$ ), 1995 ( $n = 53\,828$ ) and 2001 ( $n = 26\,863$ ). Participants in these surveys were selected using a national probability sampling strategy, and aggregated data for geographical areas are used to determine the changing association between SES and lifestyle over time.

**Findings** Overall, men had less healthy lifestyles. In 2001 inverse SES trends for both men and women showed that those living in lower SES areas were more likely to smoke and to be sedentary and obese. There were some important socioeconomic changes over the period 1989–90 to 2001. The least socioeconomically disadvantaged areas had the largest decrease in the percentage of people smoking tobacco (24% decrease for men and 12% for women) and the largest decrease in the percentage of people reporting sedentary activity levels (25% decrease for men and 22% for women). While there has been a general increase in the percentage over time of those who are overweight or obese, there is a modest trend for being overweight to have increased (by about 16% only among females) among those living in areas of higher SES.

**Conclusion** Socioeconomic inequalities have been increasing for several key risk behaviours related to health; this suggests that specific population-based prevention strategies intended to reduce health inequalities are needed.

Bulletin of the World Health Organization 2006;84:976–984.

Voir page 982 le résumé en français. En la página 982 figura un resumen en español.

يمكن الاطلاع على الملخص بالعربية في صفحة 983.

## Introduction

There exists a strong, linear and progressive association between socioeconomic status (SES) and a variety of indicators of health, such as mortality and morbidity.<sup>1</sup> Socioeconomic disadvantage is associated with a wide range of risk behaviours that affect health,<sup>2–4</sup> and these risk behaviours make the major contribution to socioeconomic inequalities in health.<sup>5</sup> Cigarette smoking, physical inactivity and being overweight or obese are major risk factors associated with a considerable proportion of the total burden of disease for men and women in Australia. This paper addresses the possibility that there is a disproportionate trend towards a healthier lifestyle among those in the highest socioeconomic groups. While overall mortality rates may be declining, socioeconomic inequalities in health may be increasing.

## Tobacco smoking

Worldwide, the annual consumption of cigarettes per capita increased between 1970 and 1980. Since then, tobacco consumption has steadily decreased in most developed countries, although the magnitude of change varies from country to country. For example, while the prevalence of smoking in Australia, Canada and the United Kingdom dropped by about 50% between 1980 and 2000, New Zealand experienced a 63% decrease and Japan a 12% decrease.<sup>6</sup> Studies that show how the trend in smoking has changed among those of different SES are rare. A study in Britain showed that while there was a decline in cigarette smoking between 1973 and 1996 among both men and women, the pace of decline has been much faster for those who are the most affluent (the proportion who smoke declining from about 42% to 18%) compared with those classified as being in the poorer

classes (declining from 72% to 62%). Most remarkably, among the poorest group, the prevalence increased over the study period from about 76% to 80%.<sup>7</sup> There is a need to determine whether other countries reflect the pattern of SES-related changes in smoking that are evident in Britain.

## Physical activity

We have not identified any studies showing how levels of physical activity have changed over time among groups of different SES in developed countries. Generally, the proportion of people who engage in moderate-to-vigorous levels of leisure-time physical activities varies in different societies and by sociodemographic group. A baseline study of the prevalence of leisure-time physical activity in the European Union showed that between 40% and 90% of people engaged in some level of physical activity. Those who had higher levels of

<sup>a</sup> Queensland Alcohol and Drug Research and Education Centre (QADREC), Schools of Population Health and Social Science, University of Queensland, Herston Q 4006, Queensland, Australia. Correspondence to Professor Najman (email: j.najman@uq.edu.au).

<sup>b</sup> School of Social Sciences, University of Queensland, Herston Q 4006, Queensland, Australia.

<sup>c</sup> School of Psychology and Counselling, Queensland University of Technology, Queensland, Australia.

Ref. No. 05-028928

(Submitted: 5 December 2005 – Final revised version received: 18 July 2006 – Accepted: 25 July 2006)

education were more likely to exercise.<sup>8</sup> In the United States 23% of the adult population (28% of women and 17% of men) engage in no physical activity.<sup>9</sup> Physical inactivity appears to be more common among women, people who are less educated and those with low incomes.<sup>9–14</sup>

### Overweight and obesity

While there are ample data that point to changes in the rates of people being overweight and obese, there are few studies that look at socioeconomic changes in body mass index (BMI) over time within a particular country. Internationally, the prevalence of people who are overweight or obese is rapidly increasing in all age groups.<sup>15–17</sup> Being overweight or obese is associated with lower SES.<sup>18–22</sup> A baseline study in Great Britain showed that children from the lower SES group were three times more likely to be overweight or obese than those in the highest SES group.<sup>23</sup> A national longitudinal study in Canada found that the prevalence of being overweight among children aged 7–13 years nearly tripled from 1981 to 1996 (from 11.4% to 29.3%) and was negatively related to an individual's SES – that is, the lower the child's SES, the higher the likelihood of the child being overweight.<sup>19</sup>

A survey in Spain showed that men and women who had completed higher education were less likely to be overweight or obese, but the rates of being overweight and obese increased between 1987 and 1997 among all educational levels.<sup>21</sup> However, the magnitude of change was noticeably higher for men (140%) and women (219%) with lower educational qualifications. In a Swedish study the number of overweight or obese men and women who had completed secondary or tertiary education doubled

over the period 1986–1994, while for less-well educated people the numbers increased by about 60%.<sup>10</sup>

## Methods

### Data source

The data for this paper were obtained from successive National Health Surveys in Australia conducted in 1989–90, 1995 and 2001. (For details of the surveys and comparability issues, refer to publications by the Australian Bureau of Statistics in 2004<sup>24</sup> and 2001.<sup>25</sup>) Information was collected by the Australian Bureau of Statistics and constitutes a national probability sample with weighting that enables comparability over time. These surveys address the health status of all Australians, their use of health services and facilities, and health-related aspects of their lifestyles. The 1989–90 survey, which had a 96.1% response rate, gathered information from 22 202 households (54 576 individuals). In the 1995 survey the response rate was 91.5%, and a total of 21 787 households (53 828 individuals) completed the questionnaire. The 2001 survey had a 92% response rate and surveyed 17 918 households (26 863 individuals). In all three surveys, only respondents aged  $\geq 18$  years answered questions about smoking, and only those aged  $\geq 15$  years answered questions about BMI and exercise.

The Index of Relative Socioeconomic Disadvantage was developed by the Australian Bureau of Statistics.<sup>26</sup> It is based on the socioeconomic characteristics of those living in a particular geographical area. In its usual form this index is derived from Collectors' Districts, but to enable comparability over time this study has used aggregated Collectors' Districts, which constitute

Statistical Local Areas. The index is a measure of the percentage of low-income earners, those with relatively lower educational attainment and unemployment in a Statistical Local Area. The findings are likely to be similar but not identical to previously published cross-sectional reports based on Collectors' Districts.

In response to a special request, data for this paper have been provided by the Australian Bureau of Statistics in the form of estimates of the population distributions into the categories of the study variables. These estimates are produced by the bureau from the raw data using a complex weighting procedure, which includes adjustment for age, to reflect the sampling design and to achieve comparability over time. For the purposes of this paper, households have been divided into quintiles (20%) according to the index of their Statistical Local Area. The first quintile (Q1), or lowest score, indicates those who are the most disadvantaged. The fifth quintile (Q5), or highest score, indicates those who are the least disadvantaged.

Tobacco smoking was measured by asking whether the respondent currently smoked and whether the respondent had ever smoked. Questions concerning tobacco smoking were comparable over time.<sup>24</sup> The category of tobacco smoking includes manufactured cigarettes (packets), roll-your-own cigarettes, cigars and pipes, but it excludes chewing tobacco and the smoking of non-tobacco products. Regular smoking was defined as smoking one or more cigarettes (or pipes or cigars) per day as reported by the respondent. Smoking status was described as "current smoker", "ex-smoker" and "never smoked" at the time of interview.

The level of physical activity engaged in by the respondent was assessed

Table 1. Proportion of smokers by sex, Australian National Health Surveys 1989–90, 1995, 2001

Year of survey	Males <sup>a</sup>			Females <sup>a</sup>		
	Current smoker <sup>b</sup>	Ex-smoker	Never smoked	Current smoker	Ex-smoker	Never smoked
1989–90	31.1 (0.3)	30.9 (0.3)	38.0 (0.3)	24.4 (0.3)	17.9 (0.2)	57.7 (0.3)
1995	28.5 (0.3)	32.6 (0.3)	38.9 (0.3)	21.9 (0.2)	21.7 (0.2)	56.5 (0.3)
2001	27.3 (0.4)	30.8 (0.4)	41.8 (0.5)	21.4 (0.4)	22.4 (0.4)	56.2 (0.5)
$\chi^2$	69.7 <sup>c</sup>	1.17 <sup>d</sup>	41.3 <sup>c</sup>	60.3 <sup>c</sup>	152.5 <sup>c</sup>	7.8 <sup>e</sup>

<sup>a</sup> Values are percentages (standard error).

<sup>b</sup> Please see text for definitions of categories of smoker.

<sup>c</sup>  $P < 0.001$ .

<sup>d</sup> Not significant.

<sup>e</sup>  $P < 0.05$ .

Table 2. Proportion of respondents in Australian National Health Surveys who exercise, by level of physical activity<sup>a</sup> and sex, 1989–90, 1995, 2001

Physical activity level	Males <sup>b</sup>			Females <sup>b</sup>		
	1989–90	1995	2001	1989–90	1995	2001
Sedentary	37.2 (0.3)	34.9 (0.3)	30.9 (0.4)	37.4 (0.3)	35.2 (0.3)	32.0 (0.4)
Low	29.3 (0.3)	31.3 (0.3)	34.1 (0.5)	37.1 (0.3)	38.9 (0.3)	41.6 (0.5)
Moderate	25.0 (0.3)	25.9 (0.3)	26.2 (0.4)	21.8 (0.2)	22.0 (0.2)	22.5 (0.4)
High	8.5 (0.2)	7.9 (0.1)	8.8 (0.3)	3.7 (0.1)	3.9 (0.1)	3.9 (0.2)

<sup>a</sup> Scores for exercise level involve a series of questions concerning duration (in minutes) of walking, exercise and vigorous exercise during the past 2 weeks. The number of times the activity was undertaken was multiplied by the average time per session by intensity. Participants were classified as sedentary if they scored <100; this includes those who took no exercise. Participants were classified as engaging in low levels if they scored 100 to <1600. Participants were classified as engaging in moderate levels if they scored 1600 to <3200 and engaged in <2 hours vigorous exercise. Participants were classified as engaging in high levels of activity if they scored >3200 and engaged in ≥2 hours of vigorous exercise.

<sup>b</sup> Values are percentages (standard error).

by asking a series of questions. These questions were comparable over time<sup>24</sup> and asked about physical exercise undertaken for recreation, sport, or health and fitness purposes during the two weeks before the interview. Supplementary questions were asked about whether the level of exercise was sufficient to cause a moderate increase in heart rate. This measure excluded physical activity undertaken in the course of work and activity undertaken for reasons other than recreation, sport or health and fitness. Scores were given a numerical value based on the number of times the activity was undertaken, the average duration and its intensity.

The self-reported height and weight of respondents was used to calculate BMI. Questions asking respondents' height and weight were comparable over time.<sup>24</sup> No measurements of height and weight were taken as part of this survey, except where respondents were unsure of their weight or height and opted to be measured. The standard output classification defined for this survey provides

data to meet both National Health and Medical Research Council and WHO criteria. A respondent's BMI was labelled as underweight (< 18.5), normal (two categories were used for normal: 18.5 to < 20.0 and 20.0 to < 25.0), overweight (25.0 to < 30.0) and obese (≥ 30.0).

Standard errors for all estimates were derived from data supplied by the Australian Bureau of Statistics and from tables of relative standard errors published for each survey by the bureau.<sup>24</sup> Their inverse squares served as weights in the analyses performed here. Since the quintiles are, by definition, of roughly equal sizes and the survey years are approximately equidistant in time, we used a weighted regression approach with quintiles or survey years coded as 1, 2, etc. This yields a  $\chi^2$  value with 1 degree of freedom.

To present indicators of sampling variability — (standard errors or confidence intervals) — for every estimate would be excessively cumbersome and add little to the results. Therefore, confidence intervals are given only for the

derived estimates of change over time in each quintile group. Standard errors are appended to estimates in the tables showing risk factor distributions for the entire population (Table 1, Table 2, Table 3). In the tables with estimates by quintile, only a median standard error is given as an indication of sampling variability.

## Results

### Tobacco smoking

The proportion of males and females who smoked tobacco declined over the period 1989–90 to 2001 (Table 1;  $P < 0.001$  for both). Among males the proportion of ex-smokers remained steady while the proportion of never smokers rose ( $P < 0.001$ ). Among females the converse was true: there was a significant increase in the proportion of ex-smokers and a small decline in the proportion of never smokers. If we attribute at least part of the decline in tobacco smoking to an awareness of health promotion information, then males are being persuaded not to begin smoking but not to quit,

Table 3. Proportion of respondents in Australian National Health Surveys by category of body mass index (BMI) and sex, 1989–90, 1995, 2001

BMI category	Males <sup>a</sup>			Females <sup>a</sup>		
	1989–90	1995	2001	1989–90	1995	2001
Underweight (BMI<18.5)	1.8 (0.1)	1.4 (0.1)	1.1 (0.1)	6.1 (0.1)	4.5 (0.1)	4.2 (0.2)
Normal (BMI = 18.5–19.9)	4.3 (0.1)	2.8 (0.1)	2.4 (0.2)	10.2 (0.2)	8.4 (0.1)	8.0 (0.3)
Normal (BMI = 20–24.9)	46.9 (0.3)	40.3 (0.3)	36.6 (0.5)	48.5 (0.3)	42.9 (0.2)	39.7 (0.5)
Overweight (BMI = 25.0–29.9)	36.1 (0.3)	37.8 (0.4)	39.6 (0.5)	21.3 (0.2)	21.5 (0.1)	22.8 (0.4)
Obese (BMI>30)	8.4 (0.2)	11.2 (0.2)	14.7 (0.4)	9.5 (0.2)	11.0 (0.1)	15.4 (0.3)
Not stated	2.5 (0.1)	6.5 (0.1)	5.6 (0.2)	4.4 (0.1)	11.6 (0.1)	9.8 (0.2)

<sup>a</sup> Values are percentages (standard error).

Table 4. Proportion of current smokers and never smokers in Australian National Health Surveys by socioeconomic status (quintile) and sex, 1989–90, 1995, 2001

Socioeconomic status <sup>a</sup>	Males				Females			
	1989–90	1995	2001	% decrease each quintile <sup>b</sup>	1989–90	1995	2001	% decrease each quintile <sup>b</sup>
<b>Current smokers</b>								
Q1	37.2	33.5	35.0	5.9 (-4.2 to 15.0)	28.6	24.5	25.1	12.2 (1.3 to 22.0)
Q2	32.8	30.3	27.7	15.5 (7.7 to 22.7)	27.0	22.5	22.7	15.9 (7.3 to 23.8)
Q3	32.5	29.2	29.4	9.5 (0.2 to 18.0)	24.6	22.6	24.0	2.4 (-9.1 to 12.8)
Q4	29.0	27.9	28.5	1.7 (-9.4 to 11.7)	23.4	22.5	18.7	20.1 (8.0 to 30.6)
Q5	25.7	23.2	19.4	24.5 (16.0 to 32.2)	19.4	17.9	17.0	12.3 (1.6 to 22.0)
$\chi^2$	130.8 <sup>c</sup>	153.6 <sup>c</sup>	69.2 <sup>c</sup>	3.9 <sup>d</sup>	93.5 <sup>c</sup>	74.2 <sup>c</sup>	36.7 <sup>c</sup>	0.1
Median standard error	0.8	0.6	1.3	5.2	0.7	0.6	1.2	5.9
<b>Never smoked</b>								
				% increase <sup>b</sup>				% increase <sup>b</sup>
Q1	33.4	35.5	34.4	3.0 (-7.2 to 14.3)	54.7	54.5	54.2	-0.9 (-7.8 to 6.5)
Q2	37.2	36.1	40.7	9.4 (1.9 to 17.4)	56.2	55.5	56.1	-0.2 (-5.6 to 5.5)
Q3	38.1	38.6	40.1	5.2 (-3.1 to 14.3)	56.8	56.7	55.3	-2.6 (-8.7 to 3.9)
Q4	38.9	39.1	41.7	7.2 (-1.7 to 17.0)	58.3	56.1	56.2	-3.6 (-10.4 to 3.7)
Q5	41.3	43.7	49.6	20.1 (12.7 to 52.2)	61.5	59.3	58.6	-4.7 (-9.8 to 0.6)
$\chi^2$	46.5 <sup>c</sup>	79.8 <sup>c</sup>	47.6 <sup>c</sup>	5.8 <sup>c</sup>	29.1 <sup>c</sup>	16.2 <sup>c</sup>	3.6 <sup>d</sup>	1.5 <sup>d</sup>
Median standard error	0.9	0.7	1.4	4.4	1.0	0.9	1.5	3.2

<sup>a</sup> Socioeconomic status is divided into quintiles with quintile 1 (Q1) representing the lowest status (those who are most disadvantaged) and quintile 5 (Q5) representing the highest (those who are least disadvantaged).

<sup>b</sup> Values in parentheses are 95% confidence intervals.

<sup>c</sup>  $P < 0.001$ .

<sup>d</sup>  $P < 0.05$ .

while females are being persuaded to quit but they continue to “experiment” with tobacco smoking.

Table 4 displays the percentage of males and females in each index quintile who are current smokers by the year data were collected. For each year, and for both males and females, there is a highly significant inverse trend with the quintiles representing the most disadvantaged having higher percentages of smokers. It is also apparent that the percentage of smokers has declined in all quintiles. The percentage decline for males in quintile 5 (the quintile representing the highest SES) is particularly substantial although the overall trend is only just significant at the 5% level. For females the percentage declines in smoking across the quintiles appear to be unrelated to any socioeconomic trend. Table 4 also presents the percentage of males and females in each quintile who have never smoked. Again, there is a consistent and significant trend in the percentage of those who have never smoked as SES increases. This is the case for the data collected

over the periods 1989–90, 1995 and 2001, although in 2001 the trend did not achieve significance among females. The magnitude of increase over time in the percentage of respondents who never smoked appears to vary significantly with quintile only among males, with those in quintile 5 (representing the highest SES) in particular more likely to have never smoked than those in the lower quintiles (with lower SES). On the other hand, among females the percentage of never smokers decreased in all quintiles without any significant socioeconomic trend associated with the degree of the decline.

### Level of physical activity

In all three surveys about 2 in 3 males and 3 in 4 females reported levels of physical activity considered to be sedentary or low (Table 2). The proportion of the population doing exercise did not change much over the survey period. The only change during this period was a slight decrease in the number of people with a sedentary lifestyle and an increase

in the percentage of the population with low levels of exercise.

In 1989–90, around one third to two fifths of men and women in all areas reported a level of physical activity considered to be sedentary (Table 5). For each year in which survey data have been collected there is a highly significant trend for the percentage of males and females leading a sedentary lifestyle to increase as SES decreases — that is, moving from higher quintiles to lower quintiles. All areas exhibited a decline in the percentage of respondents who reported leading a sedentary lifestyle, with a significant trend for larger decreases among those in higher quintiles. The proportion of men reporting high levels of activity as part of their lifestyle has remained double the proportion of women over time in all quintiles (Table 5). The percentage of males and females engaged in high levels of physical activity tends to show that higher rates of high physical activity are more prevalent among those in the highest quintiles. This trend is broadly evident for each successive

Table 5. Proportion of respondents in Australian National Health Surveys with sedentary lifestyle or active lifestyle, by socioeconomic status and sex, 1989–90, 1995, 2001

Socioeconomic status <sup>a</sup>	Males				Females			
	1989–90	1995	2001	% decrease each quintile <sup>b</sup>	1989–90	1995	2001	% decrease each quintile <sup>b</sup>
<b>Sedentary</b>								
Q1	39.4	38.2	38.1	3.3 (-6.6 to 12.3)	39.9	39.9	35.9	10.0 (1.2 to 18.0)
Q2	40.8	37.0	33.9	16.9 (10.2 to 23.1)	40.0	35.6	35.5	11.2 (4.5 to 17.5)
Q3	39.5	36.5	32.3	18.2 (10.3 to 25.5)	39.4	36.8	34.3	12.9 (5.0 to 20.2)
Q4	37.0	35.7	29.0	21.6 (12.8 to 29.6)	35.5	35.3	29.2	17.7 (8.4 to 26.2)
Q5	31.1	28.3	23.1	25.7 (17.9 to 32.8)	32.8	29.2	25.5	22.2 (14.9 to 28.9)
$\chi^2$	83.3 <sup>c</sup>	121.4 <sup>c</sup>	77.7 <sup>c</sup>	11.7 <sup>d</sup>	63.8 <sup>c</sup>	117.3 <sup>c</sup>	55.9 <sup>c</sup>	6.8 <sup>d</sup>
Median standard error	0.9	0.7	1.3	3.9	0.9	0.7	1.3	3.9
<b>High levels of physical activity</b>								
				<b>% increase</b>				<b>% increase</b>
Q1	8.1	6.8	7.4	-8.6 (-31.1 to 13.9)	3.5	3.5	3.3	-5.7 (-40.4 to 28.9)
Q2	7.9	6.6	7.8	-1.3 (-19.6 to 17.1)	2.9	3.6	3.1	6.9 (-25.3 to 39.1)
Q3	8.1	8.5	8.0	-1.2 (-21.6 to 19.1)	3.8	4.0	3.7	-2.6 (-33.7 to 28.5)
Q4	7.6	8.4	9.9	30.3 (4.3 to 56.2)	4.4	4.1	4.9	11.4 (-33.7 to 28.5)
Q5	10.0	9.0	10.6	6.0 (-13.6 to 25.6)	4.0	4.5	4.8	20.0 (-9.6 to 49.6)
$\chi^2$	1.6 <sup>e</sup>	40.5 <sup>c</sup>	12.7 <sup>c</sup>	2.2 <sup>e</sup>	8.8 <sup>d</sup>	12.1 <sup>c</sup>	8.6 <sup>d</sup>	1.3 <sup>e</sup>
Median standard error	0.4	0.3	0.7	10.3	0.3	0.2	0.5	16.5

<sup>a</sup> Socioeconomic status is divided into quintiles with quintile 1 (Q1) representing the lowest status (those who are most disadvantaged) and quintile 5 (Q5) representing the highest (those who are least disadvantaged).

<sup>b</sup> Values in parentheses are 95% confidence intervals.

<sup>c</sup>  $P < 0.001$ .

<sup>d</sup>  $P < 0.01$ .

<sup>e</sup> Not significant.

national health survey, although non-significantly so among males in 1989–90. Over time the trend has become stronger with non-significant declines in the percentage of males and females in lower quintiles who engage in high levels of physical activity and increases in the proportions of males and females in higher quintiles who report high levels of physical activity. This trend does not reach statistical significance due to the large standard errors associated with the estimates of change.

### Overweight and obesity

The proportion of Australian men and women who are overweight or obese has increased over the period 1989–90 to 2001. A greater percentage of women were in the “underweight” and “normal” categories (BMI = 18.5–24.9) over the survey period (Table 3). The percentage of men and women who were normal weight declined between 1989–90 and 2001. The percentage of overweight men exceeded the percentage of overweight women in all three surveys, and the pro-

portion of overweight men and women increased between 1989–90 and 2001. The percentage of males and females who were obese increased over time, but the increases were similar over the period for males and females.

In Table 5 we present the percentage of males and females who were overweight and obese in each quintile over time. For the percentage of those who were overweight there is a consistent increasing trend for males in 1995 and females in the 1989–90 and 2001 surveys. There are relatively modest changes over time in the percentage of males and females who are overweight. Among males these increases in the percentage who were overweight appear to be of a similar magnitude for each quintile, whereas among females the relative increases in the proportion of those who are overweight are somewhat higher for those in the less disadvantaged quintiles ( $P < 0.01$ ). The percentage increase in obesity over the time 1989–90 to 1995 to 2001 is substantial. The increase does not appear to be related to the quintile

of the geographical area from which data were collected; the largest percentage increases in obesity occur among those in the lowest quintile, but the difference does not approach statistical significance. There appears to be a quintile trend in obesity, such that the percentage who are obese is significantly higher in lower quintiles, although among males in the earliest survey reported here only the highest quintile is linked to the apparent trend.

### Discussion

The prevalence of two of the three major risk factors discussed in this paper has declined over time. Overall, fewer Australians currently smoke and more have undertaken some low level of physical activity. Conversely, the risk factor of being overweight or obese is a growing concern.

### Tobacco smoking

There are strong socioeconomic inequalities in tobacco smoking in Australia for

all three time periods and for both males and females. There has been a trend over time for these socioeconomic inequalities to increase (only among males). In interpreting the changes in smoking rates it is relevant to reflect on Australian tobacco-control policies. Australia has been one of a handful of countries leading the world in tobacco-control policies.<sup>w27</sup>

Some of the main gains in policy in Australia include:<sup>w27</sup>

- being among the first countries to test and publish the tar and nicotine content of cigarettes;
- being one of the first countries to ban all forms of tobacco advertising and sponsorship;
- being one of the first countries to require large and explicit warnings to be published on cigarette packets;
- implementing numerous national mass media anti-smoking campaigns;
- introducing extensive restrictions on smoking in public venues; and
- using the taxation system to substantially increase the real price of cigarettes as a strategy to address smoking by the most economically disadvantaged.<sup>w28</sup>

Despite the clear success Australia has had in reducing levels of tobacco consumption, it appears that socioeconomic inequalities are increasing and that strategies are needed to more obviously target those who are socioeconomically disadvantaged.

### Physical activity

There are strong socioeconomic inequalities in terms of physical activity in Australia for all three time periods and for both males and females. In terms of SES there have been increasing inequalities among those who lead a sedentary lifestyle in Australia over time (among both males and females). Efforts to increase levels of physical activity in Australia have been relatively piecemeal. All developed nations are confronting technological changes that reduce high levels of physical activity among their populations. Although there may be some health benefits to engaging in moderate levels of activity, the evidence indicates that about 30 minutes or more of moderate physical activity is needed daily.<sup>w29</sup> In Australia efforts to increase physical activity have primarily involved mass media campaigns.<sup>w29</sup> In addition, there has been a move to improve the

quality of municipal facilities (bicycle paths, walking paths, exercise and recreation facilities in public locations). Although a supportive physical environment provides increased opportunities for physical activity,<sup>w30</sup> there is little evidence that such opportunities are being taken up, particularly by those who are socioeconomically disadvantaged. There is a real need to learn more about the social and physical barriers that prevent those who are most disadvantaged from engaging in higher levels of physical activity.

### Overweight and obesity

The percentage of people who are overweight and obese reflects socioeconomic inequalities in Australia in all three time periods. There is some evidence that inequalities in SES in terms of being overweight have decreased over time (only among females). In Australia, policies have been enacted to improve patterns of food consumption in concert with mass media campaigns to increase physical activity. These have included some mass media efforts that focused on the nutritional content of foods. For example, the ingredients of all foods sold in supermarkets and, in many instances, in chain fast food and other restaurant franchises, must be displayed publicly. There has been a particular emphasis on displaying the calorific, fat and sodium content of foods, which legislation requires to be displayed on food containers. There have also been efforts to improve the nutritional quality of foods available to children at school canteens. While these policies clearly have an impact on national patterns of food consumption there are contrary forces (for example, advertising by the fast food industry, the increased availability and range of fast foods, an increased desire for take-away foods) that encourage less healthy eating patterns. There is little evidence that taxation policies are being used to encourage more desirable patterns of food consumption. To the extent that national patterns of food consumption are having an impact on the percentage of those who are overweight or obese, our findings point to some decrease in socioeconomic inequalities in terms of those who are overweight (only among females) and no apparent changes in SES inequalities in terms of obesity. In general, our results are consistent with other studies of the relationships between SES

and health-related risk factors or behaviours,<sup>4</sup> and, in particular, the trends we observed are similar to those Bennett<sup>w31</sup> observed in the 1980s in Australia.

Our results indicate that across several important risk behaviours, some socioeconomic inequalities have increased and one has decreased. Compared with more than a decade ago, males and females who have a higher SES have generally adopted a lifestyle that is healthier overall while those who have a lower SES have either not changed or have adopted a less healthy lifestyle.

The strengths of the study are its large population samples, which have been weighted to produce comparisons over time, the use of effectively identical questions about most of the lifestyle behaviours, and the use of an identical index of socioeconomic disadvantage over time. However, in considering our findings some caveats need to be considered. First, the data are based on the percentages of people behaving in a particular way in geographical areas with particular characteristics. As Robinson<sup>w32</sup> noted many years ago, one cannot simply generalize from the characteristics of areas to assert that the associations hold for individuals who live in those areas. The size of the aggregated area chosen is likely to have an impact on the magnitude of the observed association. Furthermore there is likely to be a pattern of migration "in" and "out" for some geographical areas so apparent changes over time reflect patterns of migration rather than changing patterns of health-related behaviour. It is not possible to know whether the above possibilities account for our findings. While residential mobility may be reasonably high over the decade, and that is the period of time considered by this research, much of this mobility is likely to be limited to geographical areas with similar characteristics.

### Conclusions

In some areas of health-related lifestyles Australia has been at the forefront of international policies (for example, tobacco control). The decline in tobacco consumption is particularly notable. While Australia has clearly performed well by international standards in tobacco control (consumption levels have declined to about 20% of the population) Australia's performance in encouraging physical activity and desirable levels of BMI has been relatively ineffective.

In some key lifestyle-related factors, such as tobacco consumption and living a sedentary lifestyle, socioeconomic inequalities have increased. It is not clear why we are witnessing a growth in socioeconomic inequalities in risk behaviours related to health. While in Australia there have been numerous efforts to persuade the population to adopt a healthier lifestyle, these efforts have targeted only those who are among the most economi-

cally disadvantaged, and these efforts have not been as effective for those who are among the most economically disadvantaged. Because so few international comparative studies are available it is impossible to know whether Australian policies have been more or less effective in limiting socioeconomic inequalities in health risk. Comparative studies across countries have the capacity to permit the identification of policies that are

effective in reducing socioeconomic inequalities. Unfortunately such studies do not exist.

Our findings suggest that while there is likely to be a continuing decline in overall rates of mortality, these findings provide an explanation of increasing inequalities in SES associated with mortality in Australia.<sup>w33</sup> ■

**Competing interests:** none declared.

## Résumé

### Situation défavorisée sur le plan socioéconomique et comportements à risque pour la santé en Australie (période étudiée : 1989-90 à 2001)

**Objectif** Un faible statut socioéconomique est associé à des composantes peu saines du mode de vie telles que tabagisme, inactivité physique et excès de poids ou obésité. L'article examine l'évolution en fonction du temps en Australie de l'association entre un tel statut d'une part, et le tabagisme, l'activité physique et la présence d'un excès de poids ou d'une obésité, d'autre part.

**Méthodes** Les données ont été tirées de trois enquêtes nationales de santé, menées successivement en Australie en 1989-90 (n = 54 576), 1995 (n = 53 828) et 2001 (n = 26 863). Les sujets de ces enquêtes ont été sélectionnés par une méthode d'échantillonnage probabiliste appliquée à l'échelle nationale et des données agrégées par zones géographiques ont été utilisées pour déterminer l'évolution dans le temps de l'association entre faible statut socioéconomique et mode de vie.

**Résultats** Globalement, ce sont les hommes qui avaient le mode de vie le moins sain. En 2001, il existait, pour les femmes comme pour les hommes, des relations inverses entre la faiblesse du statut socioéconomique et la proportion de fumeur, le manque

d'activité physique (sédentarité) et le pourcentage d'obèses. Des changements socioéconomiques importants sont intervenus sur la période 1989-90 à 2001. C'est dans les zones les moins désavantagées sur le plan socioéconomique que l'on a relevé la plus forte diminution du pourcentage de fumeurs (baisse de 24 % pour les hommes et de 12 % pour les femmes) et du pourcentage de personnes déclarant une activité sédentaire (baisse de 25 % pour les hommes et de 22 % pour les femmes). Malgré l'augmentation globale de la proportion de personnes en surpoids ou obèses au cours du temps, l'accroissement du pourcentage d'individus en surpoids a été modeste (de 16 % seulement pour les femmes) dans les zones associées à un statut socioéconomique élevé.

**Conclusion** Les inégalités socioéconomiques se traduisent de plus en plus par l'aggravation de plusieurs comportements à risque pour la santé : des stratégies de prévention destinées à des populations spécifiques seraient donc à prévoir pour réduire les inégalités en matière de santé.

## Resumen

### Inferioridad socioeconómica y cambios en los comportamientos de riesgo para la salud en Australia: 1989/1990 - 2001

**Objetivo** Un estatus socioeconómico (ESE) bajo tiende a asociarse a modos de vida poco saludables, en los que confluyen el tabaquismo, la inactividad física y el sobrepeso o la obesidad. En este artículo se examinan los cambios experimentados a lo largo del tiempo por la asociación entre el ESE y los tres factores mencionados en Australia.

**Métodos** Los datos empleados proceden de tres encuestas nacionales de salud sucesivas llevadas a cabo en Australia en 1989-90 (n = 54 576), 1995 (n = 53 828) y 2001 (n = 26 863). Los participantes en esas encuestas fueron seleccionados mediante una estrategia de muestreo aleatorio a nivel nacional. La evolución de la relación entre el ESE y el modo de vida se determinó a partir de los datos agregados de zonas geográficas.

**Resultados** En general el modo de vida de los hombres era menos saludable. En 2001, tanto en hombres como en mujeres, las tendencias inversas observadas en lo tocante al ESE mostraron que quienes vivían en zonas desfavorecidas tendían con más frecuencia a fumar, a llevar una vida sedentaria y a presentar

obesidad. Durante el periodo 1989/90 - 2001 se produjeron algunos cambios socioeconómicos importantes. Las áreas menos desfavorecidas socioeconómicamente presentaron la mayor disminución del porcentaje de personas fumadoras (disminución del 24% entre los hombres, y del 12% entre las mujeres) y la mayor disminución del porcentaje de personas que referían llevar una vida sedentaria (disminución del 25% en los hombres, y del 22% en las mujeres). Si bien se ha producido con el tiempo un aumento general del porcentaje de personas con sobrepeso u obesidad, se observa una tendencia moderada al incremento del sobrepeso (de aproximadamente un 16% en las mujeres) entre las personas que viven en las zonas de mayor ESE.

**Conclusión** Se observa un aumento de las desigualdades socioeconómicas para varios comportamientos de riesgo importantes relacionados con la salud, lo que parece indicar que se necesitan estrategias de prevención específicas basadas en la población y orientadas a reducir las desigualdades en salud.

## ملخص

## الحرمان الاجتماعي والاقتصادي والتغيرات في السلوكيات الصحية المحفوفة بالمخاطر في أستراليا في الفترة 1989-1990 وحتى 2001

يعيشون في مناطق ذات مستوى اجتماعي واقتصادي أكثر انخفاضاً ليصبحوا من ذوي المعدلات الأكثر تدخيناً للسجائر، والأكثر خمولاً، وذلك وفقاً لتصنيف حياة الخمول، وأكثر بدانة. وهناك بعض التغيرات الاجتماعية والاقتصادية الهامة التي حدثت بمرور الزمن من الفترة 1990/1989 وحتى 2001. وقد كان لدى المناطق الأقل حرماناً اقتصادياً واجتماعياً أكبر نصيب من النقص في النسبة المئوية للمدخنين (24% نقص بين الرجال و12% بين النساء)، وأكبر نقص في النسبة المئوية لمن أبلغ عن مستوى حياة خاملة (25% نقص بين الرجال و22% بين النساء) فيما كان هناك ازدياد إجمالي في النسبة المئوية لمن هم مفرطو الوزن أو يعانون من السمنة بمرور الوقت. وكان هناك اتجاه وسطي للميل للسمنة للزيادة (بمقدار 16% من النساء فقط) وذلك من بين من يعيش في مناطق ذات مستوى اقتصادي واجتماعي مرتفع أكثر.

**الاستنتاج:** يزيد التفاوت الاقتصادي والاجتماعي من العديد من السلوكيات الرئيسية المحفوفة بالمخاطر الصحية، مما يشير إلى أن الحاجة ماسة إلى استراتيجيات للوقاية تركز على السكان لخفض التفاوت الصحي.

**الهدف:** يترافق المستوى الاجتماعي والاقتصادي المنخفض مع نمط حياة ذي خصائص منافية للصحة، مثل التدخين والخمول وفرط الوزن والسمنة. وندرس في هذه الورقة التغيرات التي طرأت على مر الزمان والتي تجمع بين المستوى الاجتماعي والاقتصادي المنخفض وبين التدخين والخمول وفرط الوزن والسمنة في أستراليا.

**الطريقة:** أُجِدَّت المعطيات من ثلاثة مسوحات وطنية متعاقبة أجريت في أستراليا في عام 1990/1989 (وعدد المشاركين 576 54) و عام 1995 (وعدد المشاركين 828 53) و عام 2001 (وعدد المشاركين 863 26). وقد اختير المشاركون في هذه المسوحات باستخدام استراتيجية وطنية للاحتتمالات، كما استخدمت المعطيات المتجمعة في المناطق الجغرافية لتعيين الترافق في التغيرات في المستوى الاجتماعي والاقتصادي المنخفض ونمط الحياة مع مرور الزمن.

**الموجودات:** يمكن القول على وجه الإجمال أن الرجال بشكل عام أقل التزاماً بنمط الحياة الصحي. ففي عام 2001 كانت هناك اتجاهات معاكسة لدى كل من الرجال والنساء في المستوى الاجتماعي والاقتصادي المنخفض ممن

## References

- Najman JM, Davey-Smith G. The embodiment of class-related and health inequalities: Australian policies. *Aust N Z J Public Health* 2000;24:3-4.
- Wardle J, Steptoe A. Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *J Epidemiol Community Health* 2003;57:440-3.
- Lynch JW, Kaplan GA, Salonen JT. Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic lifecourse. *Soc Sci Med* 1997;44:809-19.
- Adler NE, Boyce T, Chesney MA, Cohen S, Folkman S, Kahn RL, et al. Socioeconomic status and health: the challenge of the gradient. *Am Psychol* 1994;49:15-24.
- Lynch J, Davey Smith G, Harper S, Bainbridge K. Explaining social disparities in coronary heart disease: comparing relative and absolute risk approaches. *J Epidemiol Community Health* 2006;60:436-41.
- World Health Organization. *Tobacco control country profiles*, 2003. Available from: [http://www.who.int/tobacco/global\\_data/country\\_profiles/en/](http://www.who.int/tobacco/global_data/country_profiles/en/).
- Jarvis MJ, Wardle J. Social patterning of individual health behaviours: the case of cigarette smoking. In: Marmot MG, Wilkinson RG, eds. *Social determinants of health*. Oxford: Oxford University Press; 1999. pp. 240-255.
- Martinez-Gonzales A, Varo JJ, Santos J de I, Gibney M, Kearney J, Martinez JA. Prevalence of physical activity during leisure time in the European Union. *Med Sci Sports Exerc* 2001;33:1142-6.
- Crespo CJ, Ainsworth BE, Keteyian SJ, Heath GW, Smit E. Prevalence of physical inactivity and its relation to social class in U.S. adults: results from the Third National Health and Nutrition Examination Survey, 1988-1994. *Med Sci Sports Exerc* 1999;31:1821-7.
- Lindstrom M, Isacson SO, Merlo J. Increasing prevalence of overweight, obesity and physical inactivity: two population-based studies 1986 and 1994. *Eur J Public Health* 2003;13:306-12.
- Prevalence of leisure-time and occupational physical activity among employed adults - United States, 1990. *MMWR Morbidity and Mortality Weekly Report* 2000;49:420-4.
- Hawkins SA, Cockburn MG, Hamilton AS, Mack TM. An estimate of physical activity prevalence in a large population-based cohort. *Med Sci Sports Exerc* 2004;36:253-60.
- King GA, Fitzhugh Bassett DR Jr, McLaughlin JE, Strath SJ, Swartz AM, Thompson DL. Relationship of leisure-time physical activity and occupation activity to the prevalence of obesity. *International Journal of Obesity and Related Metabolic Disorders*. *Int J Obes* 2001;25:606-12.
- O'Loughlin J, Paradis G, Kishchuk N, Barnett T, Renaud L. Prevalence and correlates of physical activity behaviours among elementary schoolchildren in multiethnic, low income, inner-city neighbourhoods in Montreal, Canada. *Ann Epidemiol* 1999;9:397-407.
- Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA* 2004;291:2847-50.
- Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA* 2002; 288:1728-32.
- Chinn S, Rona RJ. Prevalence and trends in overweight and obesity in three cross sectional studies of British children, 1974-94. *BMJ* 2001;322:24-6.
- Lin YC, Yen LL, Chen SY, Kao MD, Tzeng MS, Huang PC, et al. Prevalence of overweight and obesity and its associated factors: findings from National Nutrition and Health Survey in Taiwan, 1993-1996. *Prev Med* 2003; 37:233-41.
- Willms JD, Tremblay MS, Katzmarzyk PT. Geographic and demographic variation in the prevalence of overweight Canadian children. *Obes Res* 2003; 11:668-73.
- Klein-Platoc C, Wagner A, Haan MC, Arveiler D, Schlienger JL, Simon C. Prevalence and sociodemographic determinants of overweight in young French adolescents. *Diabetes Metab Res Rev* 2003;19:153-8.
- Rodriguez Artalejo F, Garcia EL, Gutierrez-Fisac JL, Banegas Banegas JR, Lafuente Urdinguio PJ, Dominguez Rojas V. Changes in the prevalence of overweight and obesity and their risk factors in Spain, 1987-1997. *Prev Med* 2002;34:72-81.
- de Looper M, Bhatia K. Australian health trends 2001. Canberra, Australian Institute of Health & Welfare 2001. AIHW Cat. No. PHE 24.
- Jebb SA, Rennie KL, Cole TJ. Prevalence of overweight and obesity among young people in Great Britain. *Public Health Nutr* 2004;7:461-5.
- Australian Bureau of Statistics. *Health risk factors - a guide to time series comparability from the National Health Survey, Australia*. Canberra: Australian Bureau of Statistics; 2004. (Occasional paper. Catalogue No. 4826.0.55.001.)

Refereces web version only, available at <http://www.who.int/bulletin/en>



## Jake M. Najman et al.

25. Australian Bureau of Statistics. *National Health Survey: users' guide*. Canberra: Australian Bureau of Statistics; 2001. (Catalogue No. 4363.0.55.001.)
26. Australian Bureau of Statistics. *Census of population and housing socioeconomic indexes for areas, Australia*. Canberra: Australian Bureau of Statistics; 1996. (Information paper. Catalogue No. 2039.0.)
27. Chapman S, Byrne F, Carter SM. Australia is one of the darkest markets in the world: the global importance of Australian tobacco control. *Tob Control* 2003;12:1-3.
28. Scollo M, Younie S, Wakefield M, Freeman J, Icasiano F. Impact of tobacco tax reforms on tobacco prices and tobacco use in Australia. *Tob Control* 2003;12:59-66.
29. Sparling PB, Owen N, Lambert EV, Haskell WL. Promoting physical activity: the new imperative for public health. *Health Educ Res* 2000;15:367-76.
30. Giles-Corti B, Donovan RJ. The relative influence of individual, social and physical environment determinants of physical activity. *Soc Sci Med* 2002;54:1793-1812.
31. Bennett S. Cardiovascular risk factors in Australia: trends in socioeconomic inequalities. *J Epidemiol Community Health* 1995;49:363-72.
32. Robinson WS. Ecological correlations and the behaviour of individuals. *Am Sociol Rev* 1950;15:351-7.
33. Williams GM, Najman JM, Clavarino A. Correcting for numerator/denominator bias when assessing changing inequalities in occupational class mortality: Australia 1981-2002. *Bull World Health Organ* 2006;84:1-6.

In Vol. 84, issue number 12, 2006, page 980, the first sentence in the second paragraph under "Overweight and obesity" should read as follows:

"We calculated the percentage of males and females who were overweight and obese in each quintile over time [data not shown]."

This article has received corrections in agreement with the ERRATUM published in Volume 85 Number 2.