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A comparison of the association between socioeconomic position and cardiovascular disease risk factors in three age cohorts of Australian women: findings from the Australian Longitudinal Study on Women's Health

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Abstract

Objectives To assess the associations between three measurements of socioeconomic position (SEP) – education, occupation and ability to cope on available income – and cardiovascular risk factors in three age cohorts of Australian women.

Methods Cross-sectional analysis of three cohorts of Australian women aged 18–23, 45–50 and 70–75 years.

Results In general, for all exposures and in all three cohorts, the odds of each adverse risk factor (smoking, obesity and physical inactivity) were lower in the most advantaged compared with the least advantaged. Within each of the three cohorts, the effects of each measurement of SEP on the outcomes were similar. There were, however, some notable between-cohort differences. The most marked differences were those with smoking. For women aged 70–75 (older), those with the highest educational attainment were more likely to have ever smoked than those with the lowest level of attainment. However, for the other two cohorts, this association was reversed, with a stronger association between low levels of education and ever smoking among those aged 18–23 (younger) than those aged 45–50 (mid-age). Similarly, for older women, those in the most skilled occupational classes were most likely to have ever smoked, with opposite findings for mid-age women. Education was also differently associated with physical inactivity across the three cohorts. Older women who were most educated were least likely to be physically inactive, whereas among the younger and mid-age cohorts there was little or no effect of education on physical inactivity.

Conclusion These findings demonstrate the dynamic nature of the association between SEP and some health outcomes. Our findings do not appear to confirm previous suggestions that prestige-based measurements of SEP are more strongly associated with health-related behaviours than measurements that reflect material and psychosocial resources.

Keywords: cardiovascular disease, risk factors, socioeconomic position, women

Introduction

Different measurements of socioeconomic position (SEP) reflect different aspects of this construct that may be related to health-related outcomes in different ways. Further, socioeconomic inequalities in health outcomes are dynamic and vary over time, between countries and between different populations. It has been suggested that SEP measurements which largely reflect status or prestige, such as education, are more likely to be related to adverse cardiovascular disease behaviours than measurements that reflect material or psychosocial resources.[1] The suggestion is that prestige-based measurements represent membership of social groups, the cultures of which strongly influence behaviours, such as smoking, diet and physical activity. In support of this argument, a study of Finnish men found that differences between income groups in the risk of acute myocardial infarction were not explained by behavioural risk factors, whereas differences among groups categorized by education were explained by these factors.[2]

Further, socioeconomic inequalities in health outcomes are dynamic, varying over time, between countries and between populations.[3,4] The associations between different dimensions of SEP may vary over time, because the social definition and meaning of prestige, work relationships, population income and

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resource distribution vary over time. For example, educational attainment among women is likely to have very different cultural meaning for different birth cohorts over the last century as increasing proportions of women were able to obtain university degrees. Similarly, as women enter the work place in greater numbers, the associations between occupational-based measurements of SEP and health outcomes are likely to vary.

In this study, we examine the associations of three measures of SEP – education, occupation and ability to cope on current income – with cardiovascular disease risk factors – smoking, obesity and physical inactivity – in three age cohorts of Australian women. Our aim is to compare the relative magnitudes of these associations across the three cohorts. Educational attainment reflects social standing and prestige, although the extent to which obtaining a higher educational qualification is esteemed is likely to be different for women born in 1973–1978 (younger cohort), 1946–1951 (mid-age) and 1921–1926 (older). Further, although education has been theorised as reflecting status and prestige, it is also related to employment potential, which in turn is related to material resources and working environment and relationships.[5,6] Occupation in this study has been classified according to the Australian Standard Classification of Occupations (ASCO).[7] ASCO is a hierarchical skill-based measure that groups together occupations requiring similar levels of education, knowledge, responsibility, on-the-job training and experience.[7] It has been shown to have moderate levels of agreement with a classification of occupations based on community-perceived prestige.[8] Thus, the ASCO classification will reflect status and prestige as well as employment relationships. While this classification does not explicitly rank occupations according to income, the strong relationship between the skill requirement of a job and its financial reward will mean that this measurement also reflects material resources. We therefore conceptualize these two measurements (education and occupation) as reflecting all three aspects of status/prestige, material resources and employment relationships and thus as composite measures of SEP. Our measure of ability to cope on available income will reflect both material and psychosocial resources, because it will be determined both by actual income and by an individual's assessment of whether this is sufficient to purchase the resources that are seen subjectively as necessary or important. Thus, if the hypothesis that the association between SEP measurements that largely reflect status or prestige are more likely to be related to adverse cardiovascular disease behaviours than measurements that reflect material or psychosocial resources is correct in this population, we would anticipate associations between this latter measurement and risk factors to be weaker than associations between education and occupational categorization and these risk factors.

Methods

The Australian Longitudinal Study on Women's Health (ALSWH) is a study of factors affecting the health and well-being of three cohorts of women who were aged 18–23, 45–50 and 70–75 years, respectively, at the time of Survey 1 in 1996. Women were selected randomly from the national Medicare health insurance database (which includes all permanent residents of Australia regardless of age, including immigrants and refugees) with intentional overrepresentation of women living in rural and remote areas. Further details of the recruitment methods and response have been described elsewhere.[9,10]

The response proportion for each of the three cohorts were similar, with 14 779 (41% of those invited) of the younger cohort, 14 099 (52%) of the mid-age cohort and 12 940 (37%) of the older cohort responding. Ethical approval for the study was obtained from the University of Newcastle Research Ethics Committee.

Each measurement of SEP was categorized in a hierarchical order from most disadvantaged to most advantaged. Participants were asked to report their educational attainment in seven pre-defined categories from 'no formal qualification' to 'higher university degree'. Participants in the mid-age and older cohorts were asked to report their own and, where relevant, their spouse/partner's occupation in one of nine pre-defined categories from 'never had a paid job' to 'manager/administrator', classified according to the second edition of the ASCO.[7] Occupation of the head of the household was defined as the highest occupational group of the woman or her spouse/partner; or the woman only for single women. Women in the younger cohort were asked about which occupation they were studying for. For the analyses with occupational social class, only the mid-age and older cohorts of women are considered in this article. The women were also asked 'how do you manage on the income you have available' and were provided with five-response categories: 'impossible', 'difficult all of the time', 'difficult some of the time', 'not too bad' and 'easy'.

For each measure of SEP, an 'index of inequality' was derived.[11–13] This takes account of differences in the proportions of participants in each category for the different measures and between the three cohorts. It is therefore a form of standardization which enables the different SEP measures and measures across the three cohorts to be compared. Comparisons between different measures and different cohorts are possible, because the measurements are all put onto the same scale, and estimates of inequality based on these scores are less influenced by extremes of the exposure distribution.[11–13] The index of inequality is obtained by deriving a score from 0 to 1, the lowest to highest SEP, for each measure based on the mid-point of the proportion of the cohort in each category. For example, if 10% of the women in one of the cohorts were in the lowest occupational group and 15% were in the next category, women in the lowest category would be assigned a value of 0.05 (0.10/2) and those in the second category a value of 0.175 [(0.1 + 0.15)/ 2], and so on for each category. An odds ratio, termed the 'relative index of inequality', is then obtained by regressing each of these SEP scores on a binary outcome in a logistic regression model. If outcomes are continuous and linear-regression models are used then a 'slope of inequality' is obtained. The virtue of these

standardized measures is that they are directly interpretable in terms of outcome difference between the highest (score 1) and lowest (score 0) values of the socioeconomic indicator; this is a relative effect when the outcomes are binary and logistic, or Poisson-regression models are used, or an absolute effect when continuous outcomes are being assessed and linear regressions are used.[11–13] For each measure and each cohort, the results are always for the comparison of the extremes – the highest compared with the lowest SEP position. For the construction of the indices of inequality, each SEP variable was kept in their original pre-defined categories (seven for education, nine for occupation and five for ability to cope on current income). In the descriptive analyses (Table 1), however, education has been collapsed into five categories and occupational social class into five categories for the ease of presentation.

Body mass index was calculated from self-reported weight and height, and the outcome of obesity was defined as a body mass index ≥30 kg/m^2 (versus BMI < 30). Detailed smoking histories were requested, and smoking was categorized as current versus past/never in some analyses and ever (current or past) versus never in other analyses. Level of physical activity was determined from self-reported frequency of engaging in a number of listed activities of different intensity with a score reflecting frequency and intensity computed for each woman as previously described.[14] This score was dichotomized using a threshold of 15 (<15 versus ≥15), with 15 approximating five episodes of less vigorous activity or three episodes of vigorous activity per week.

Information on potential covariates – age, marital status (never, married/cohabitating, separated/divorced or widowed), area of residence (urban, rural or remote based on an index of distance to the nearest urban centre),[15] country of birth [Australia, other English-speaking countries (predominantly the United Kingdom and New Zealand), other European countries, Asian countries, other], number of pregnancies (none, one, two, three or more), use of hormone contraception (never, <1, 1–4, ≥5 years of use), use of hormone-replacement therapy (never, <1, 1–4, ≥5), a history of hysterectomy or oophorectomy – was obtained from the questionnaire responses.

Statistical analyses

Multiple-logistic regression was used to assess the associations of the socioeconomic indices of inequality with each of the CVD-risk factors for each cohort separately. In the simplest model, we adjusted for age only. Model 2 included marital status, area of residence, country of birth, number of pregnancies, use of hormone contraception, and use of hormone-replacement therapy. In the third model, we also added the other outcomes to determine whether, e.g. any associations with smoking were affected by levels of physical activity and obesity. In the final model, we further adjusted for the other indices of inequality to determine the independent contributions of education, occupation and difficulty coping with their income. Likelihood-ratio tests were computed to examine differences in effect across the three cohorts. In addition to the logistic-regression model, which provides a relative outcome, where differences were noted, either between cohorts or measurements, we also plotted the crude percentages of each outcome by the original categories for each cohort. This enables the reader to examine differences between the original SEP categories. All analyses were conducted using Stata version 8.0 (Stata Inc., TX, USA).

Results

Table 1 summarizes the characteristics of the women in each cohort. The distributions of all of these characteristics varied between the three cohorts (all p-values for χ^2 test of differences between the three cohorts for all variables <0.001). Women in the younger cohort were the most likely to be current smokers and those in the older cohort least likely. Women in the mid-age were the most likely of the three to be obese, whereas the younger women were more likely to be physically active than either of the other two. Nearly 35% of the older cohort had no formal educational qualifications compared with 18% in the mid-age cohort and 3% in the younger cohort. The prevalence of having a university degree appeared similar in the younger and mid-age birth cohorts, but many of the younger cohort were too young to have completed a university degree at the time of the survey. When those who were still in education were excluded from the analysis, the proportion of those with a degree in the younger cohort was greater than that in the mid-age cohort (23.6 versus 14.0%, $p < 0.001$). Despite occupational and educational characteristics identifying the older cohort as the most disadvantaged, this cohort was least likely to report difficulties coping on their available income.

For several of the individual exposures or covariates, there were small amounts of missing data, usually of less than 5%, but information on either their own or spouse's occupation was missing for 28% of the older cohort. Complete data were available for all covariates included in any model on 11 214 (76%) in the younger cohort, 11 684 (83%) in the mid-age cohort and 9331 (72%) in the older cohort. None of the distributions of the outcomes varied between those with missing data on exposures and covariates and those without these missing data (all p-values >0.3). Further, the simple-age-adjusted odds ratios for those with maximum data were similar to those found in the complete data subsets summarized in Tables 2–5. All further analyses are conducted only upon those with complete exposure and covariate information.

Table 2 summarizes the associations between education and ability to cope with income for each outcome in each of the three cohorts and between occupation and these outcomes for the mid-age and older cohorts. In general, for all the relative indices of inequality and in all three birth cohorts, the odds of each adverse risk factor (current smoking, obesity and physical activity) were lower in the most advantaged compared with the least advantaged, meaning that women with most education, higher level occupations and least difficulty coping with their

Table 1 Participant characteristics of the three cohorts of the Australian Longitudinal Study on Women's Health, at Survey 1 (1996)

	Younger cohort (18–23 years) (*N* = 14 779)	**Mid-age cohort (45–50 years) (*N* = 14 099)**	**Older cohort (70–75 years) (*N* = 12 940)**
Age Mean (SD)	20.7 (1.5)	47.7 (1.5)	72.6 (1.5)
Smoking [*n* (%)]			
Never	7355 (53.4)	7328 (53.3)	7533 (62.7)
Past	2157 (15.7)	3880 (28.6)	3564 (29.7)
Current	4251 (30.9)	2454 (18.1)	924 (7.7)
Body Mass Index [*n* (%)]			
Normal/underweight (<25 kg/m^2)	9941 (78.4)	7116 (53.5)	6395 (53.3)
Overweight (25–29.9 kg/m^2)	1940 (15.3)	3742 (28.2)	3933 (32.8)
Obese (≥30 kg/m^2)	805 (6.4)	2435 (18.3)	1666 (13.9)
Physical activity score [*n* (%)]*			
Inactive (<15)	6469 (44.1)	8147 (58.3)	7252 (58.3)
Active (>15)	8198 (55.9)	5835 (41.7)	5191 (41.7)
Education [*n* (%)]			
No formal qualification	435 (3.0)	2556 (18.3)	4261 (34.8)
School-certificate only	9959 (67.8)	6781 (48.6)	6186 (50.6)
Post-school certificate/diploma	2675 (18.2)	2657 (19.1)	1343 (11.0)
University degree	1618 (11.0)	1952 (14.0)	443 (3.6)
Occupation of head of household [*n* (%)]			
Never been employed	—	78 (0.6)	959 (9.3)
Machine operator/manual	—	1430 (10.5)	1594 (15.4)
Trade/clerk/sales/service	—	3961 (29.2)	3187 (30.9)
Para-professional	—	1194 (8.8)	877 (8.5)
Professional/managerial	—	6915 (50.9)	3715 (36.0)
Coping with available income [*n* (%)]			
Impossible	521 (3.5)	358 (2.6)	176 (1.4)
Difficult all of the time	2213 (15.0)	1749 (12.5)	720 (5.7)
Difficult some of the time	4888 (33.2)	4028 (28.8)	2521 (19.9)
Not too bad	5232 (35.5)	5783 (41.3)	6437 (50.9)
Easy	1867 (12.7)	2087 (14.9)	2799 (22.1)
Marital status [*n* (%)]			
Single (never married/cohabitated)	11236 (76.4)	461 (3.3)	361 (2.8)
Married/cohabitating	3320 (22.6)	11616 (82.8)	7178 (56.5)
Divorced/separated/widowed	141 (1.0)	1947 (13.9)	5161 (40.6)
Number of times pregnant [*n* (%)]			
Never	11978 (81.6)	870 (6.3)	1024 (8.2)
1	1629 (11.1)	903 (6.6)	888 (7.1)
2	718 (4.9)	3935 (28.6)	2514 (20.1)
≥3	349 (2.4)	8071 (58.6)	8101 (64.7)
Time ever used hormonal contraception [*n* (%)]			
Never	4112 (28.0)	1592 (11.3)	9604 (75.4)
<1 year	2600 (17.7)	1801 (12.8)	775 (6.1)
1–4 years	6201 (42.2)	3892 (27.7)	908 (7.1)
≥5 years	1780 (12.1)	6776 (48.2)	1457 (11.4)
Time ever used hormonal replacement therapy [*n* (%)]			
Never	—	10233 (72.9)	9914 (77.9)
<1 year	—	1467 (10.5)	934 (7.3)
1–4 years	—	1643 (11.7)	936 (7.4)
≥5 years	—	699 (5.0)	947 (7.4)
Hysterectomy [*n* (%)]			
No	—	10822 (77.2)	8418 (66.0)
Yes	—	3204 (72.8)	4331 (34.0)
Bilateral oophorectomy [*n* (%)]			
No	—	13055 (93.4)	10453 (83.3)
Yes	—	921 (6.6)	2101 (16.7)
Area of residence [*n* (%)]			
Urban	8140 (55.2)	5117 (36.4)	5227 (40.7)
Rural	6028 (40.9)	7965 (56.8)	7328 (57.0)
Remote	579 (3.9)	956 (6.8)	303 (2.4)

Table 1 Continued

	Younger cohort (18–23 years) (*N* = 14 779)	Mid-age cohort (45–50 years) (*N* = 14 099)	Older cohort (70–75 years) (*N* = 12 940)
Country of birth [*n* (%)]			
Australia	13383 (91.4)	10570 (76.0)	9330 (77.2)
Other English-speaking countries	563 (3.8)	1867 (13.4)	1519 (12.6)
Other European countries	155 (1.1)	929 (6.7)	983 (8.1)
Asian countries	404 (2.8)	398 (2.9)	159 (1.3)
Other	142 (1.0)	149 (1.1)	92 (0.8)

*Physical-activity score derived from response to frequency questions regarding vigorous, less vigorous and work-related activity; a score of 15 approximates to 5 episodes of less vigorous activity or 3 episodes or vigorous activity per week.

income were least likely to be smokers, obese or physically inactive. Within each of the three cohorts, the effect of each measurement of SEP – occupation, education and ability to cope on available income – was similar on each outcome (p-values for difference in effect between exposures ≥0.1). The only exceptions to this were the effect of education on either current or ever smoking in the older cohort. For current smoking, the effect of education was weaker than that for the ability to cope on current income (p-value for difference in effect = 0.02); for ever smoking, the effect of education was in the opposite direction to that for either occupation or ability to cope on current income (both p-values <0.01). For several of the effects, there was statistical evidence that the magnitude of the effects differed between the cohorts, with p-values for interactions <0.01. However, because most of the associations were in the same direction and generally showed marked inverse associations between each measure of SEP and adverse risk factors, we will only discuss in detail the major cohort differences.

One of the most important differences across the three cohorts appears to be the effect of educational attainment and occupation on smoking. Education had very little association with current smoking in the older cohort. In contrast, women with the highest levels of educational attainment in the younger and mid-age cohorts showed markedly lower odds of being a current smoker compared with those with the lowest educational attainment ($p < 0.001$ for difference in effect between older and mid-age cohorts, and $p = 0.001$ for difference in effect between older and younger cohorts). When 'ever smoking' was examined as the outcome, there was a trend across the three cohorts, such that the older women with the highest educational attainment were more likely to have ever smoked than those with the lowest level of attainment, whereas for the other two cohorts this association was reversed. Further, there was a stronger association between low levels of education and ever smoking among the younger than among the mid-age women (all p-values for two-way interactions <0.001, and p-value for a linear trend in the effect magnitude across the three cohorts <0.001). Similarly, older women in the most skilled occupational classes were most likely to have ever smoked, but the effect was in the opposite direction of mid-age women (p-value for interaction <0.001). In contrast to the effect on smoking, education had a much more marked effect on physical inactivity among the older cohort than either of the other two cohorts, with the odds of being inactive (comparing the most with least educated) being markedly higher among the older cohort than among the other two cohorts (both p-values for interaction <0.001).

Occupation was inversely associated with obesity in the mid-age and older cohorts. The association between ability to cope with available income and both obesity and physical inactivity was weaker for the younger cohort than for either of the other cohorts (all p-values for interaction <0.001). In particular, ability to cope with available income was not associated with physical inactivity among the younger women, whereas in both the mid-age and the older cohorts, those with least difficulty coping with their available income had lower odds of being physically inactive compared with those who found it most difficult to cope on their income.

Tables 3–5 summarize the multivariable associations of education, occupation and ability to cope with income in each of the three cohorts. Adjustment for potential confounding factors (model 3) did not markedly alter any of the unadjusted associations, as described above. For many of the outcomes, all three measurements of SEP combined additively on the log-odds scales to affect the gradient in adverse-risk factors (model 4).

Figures 1 and 2 show the crude percentages of women who were ever smokers and who were physically inactive in the three cohorts by educational status. Figure 1 illustrates the difference in direction between educational attainment and smoking behaviour comparing the older cohort with either of the other two cohorts. It can also be seen that the absolute difference between those with no educational qualification and those with a degree is greater in the younger compared with the mid-age cohort, which is also consistent with results for the relative index of inequality. Of note, because smoking is more common among the younger and mid-age women than the older cohort, despite those from lower educational levels being less likely to smoke than those from higher educational levels within the older cohort, for most educational groups both younger and mid-age women in each SEP category smoke more than older

Table 2 Age-adjusted associations of education, occupation and ability to cope with available income with smoking, obesity and inactivity among three cohorts of Australian women: smaller values of the index indicate greater differences between the least and most advantaged, and values near unity indicate no difference

Exposure	Relative index of inequality: odds ratio of being a 'current smoker' comparing most with least advantaged (95% CI)			Relative index of inequality:odds ratio of being an 'ever smoker' comparing most with least advantaged (95% CI)			Relative index of inequality: odds ratio of being 'obese 'comparing most with least advantaged (95% CI)			Relative index of inequality: odds ratio of being 'inactive' comparing most with least advantaged (95% CI)		
	Younger cohort	Mid-age cohort	Older cohort	Younger cohort	Mid-age cohort	Older cohort	Younger cohort	Mid-age cohort	Older cohort	Younger cohort	Mid-age cohort	Older cohort
Education	0.48 (0.45–0.56)	0.33 (0.28–0.39)	0.83 (0.64–1.08)	0.42 (0.37–0.50)	0.66 (0.58–0.75)	1.39 (1.20–1.60)	0.58 (0.42–0.80)	0.34 (0.30–0.43)	0.50 (0.40–0.61)	0.79 (0.68–0.91)	0.77 (0.68–0.88)	0.38 (0.33–0.44)
Occupation	—	0.41 (0.35–0.49)	0.67 (0.51–0.89)	—	0.66 (0.59–0.75)	1.24 (1.06–1.45)	—	0.46 (0.39–0.54)	0.39 (0.31–0.49)	—	0.77 (0.68–0.88)	0.47 (0.40–0.54)
Ability to cope with income	0.38 (0.34–0.43)	0.32 (0.27–0.38)	0.38 (0.30–0.50)	0.40 (0.36–0.44)	0.51 (0.45–0.58)	0.59 (0.52–0.68)	0.60 (0.48–0.75)	0.38 (0.32–0.44)	0.46 (0.38–0.57)	0.95 (0.86–1.05)	0.64 (0.57–0.73)	0.61 (0.53–0.70)

CI, confidence interval.

women. The one exception is among women with university degrees, among whom the older cohort is the most likely to have ever smoked. Similarly, for physical inactivity, the absolute differences shown in Fig. 2 are consistent with the results for the relative index of inequality, demonstrating a marked decline in the proportion who are physically inactive as educational qualifications increase among the older cohort, but little or no difference in inactivity levels between those whose highest qualification was a school-leaving certificate, a higher diploma or a university degree in either of the younger or mid-age cohort. Of note, despite the similarity in patterns between education and inactivity levels in the younger and mid-age cohorts, in absolute terms the younger women were considerably less likely than the mid-age women to be inactive at any level of education.

Discussion

Main findings of this study

In general, women from the most advantaged SEP were less likely to smoke, be obese and be physically inactive than those from the least advantaged positions, for three cohorts of Australian women. Within each cohort, the effects of education, occupation and ability to cope on available income on the outcomes were similar to each other. However, there were some important differences between the cohorts in these associations. The most notable was the difference in the effect of education and occupation on smoking between the older women and the younger and mid-age women. For both of the latter cohorts, women who were most educated and, for the mid-aged women, those in the most skilled jobs were least likely to have ever smoked, whereas for older women the opposite was true. Education was also differently associated with physical inactivity across the three cohorts. Older women who were most educated were least likely to be physically inactive, whereas among the younger and mid-age cohorts there was little or no effect of education on physical inactivity. These differences were also apparent when examining absolute effects which highlight the between-cohort difference in risk behaviours. For example, younger women were less likely to be physically inactive than mid-age women at all levels of education. Also, apart from those with university degrees, the younger women were more likely to have ever smoked than women in either of the other two cohorts. There were also important similarities in associations across the cohorts. For most associations, the three measurements of SEP all contributed independently to the risk behaviours.

Limitations of this study

We used self-report for both exposures and outcomes, and it is possible that the accuracy of this self-report may vary across the cohorts. The response proportion varied from 37 to 52% across the three cohorts, being highest for the mid-age cohort. There were also missing data on some exposures and covariates,

Table 3 Multivariable associations education, occupation and ability to cope with available income with smoking, obesity and inactivity among a cohort of Australian women aged 45–50 ($N = 11\,684$)

	Relative index of inequality: odds ratio for each outcome comparing most to least advantaged (95% CI)			
Exposure	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Education				
Current smoker	0.33 (0.28–0.39)	0.36 (0.31–0.42)	0.35 (0.30–0.41)	0.44 (0.37–0.52)
Ever smoked	0.66 (0.58–0.75)	0.71 (0.62–0.81)	0.70 (0.61–0.81)	0.80 (0.69–0.93)
Obesity	0.34 (0.30–0.43)	0.42 (0.37–0.48)	0.42 (0.37–0.48)	0.50 (0.44–0.57)
Physical inactivity	0.77 (0.68–0.88)	0.80 (0.70–0.91)	0.88 (0.77–1.00)	0.95 (0.84–1.08)
Occupation				
Current smoker	0.41 (0.35–0.49)	0.42 (0.36–0.49)	0.41 (0.35–0.49)	0.67 (0.57–0.79)
Ever smoked	0.65 (0.59–0.74)	0.66 (0.59–0.76)	0.66 (0.59–0.77)	0.82 (0.72–0.95)
Obesity	0.46 (0.39–0.54)	0.49 (0.42–0.58)	0.49 (0.42–0.58)	0.73 (0.62–0.86)
Physical inactivity	0.77 (0.68–0.88)	0.79 (0.69–0.90)	0.87 (0.77–0.99)	0.93 (0.82–1.06)
Ability to cope with available income				
Current smoker	0.32 (0.27–0.38)	0.33 (0.28–0.39)	0.32 (0.27–0.38)	0.38 (0.32–0.45)
Ever smoked	0.51 (0.45–0.58)	0.50 (0.44–0.57)	0.50 (0.44–0.57)	0.55 (0.49–0.63)
Obesity	0.38 (0.32–0.44)	0.40 (0.34–0.48)	0.40 (0.34–0.48)	0.46 (0.39–0.55)
Physical inactivity	0.64 (0.57–0.73)	0.70 (0.62–0.79)	0.77 (0.69–0.87)	0.78 (0.69–0.88)

CI, confidence interval; model 1, adjusted for age only; model 2, as model 1 plus area or residence, marital status, country of birth, number of pregnancies, use of hormonal contraception, use of hormonal replacement, hysterectomy and bilateral oophorectomy; model 3, as model 2 plus adjustment for other outcomes – smoking, body mass index and exercise score; model 4, as model 3 plus mutual adjustment for other socioeconomic position (SEP) scores – education, occupation and ability to cope with available income.

Table 4 Multivariable associations education, occupation and ability to cope with available income with smoking, obesity and inactivity among a cohort of Australian women aged 70–75 ($N = 7836$)

	Relative index of inequality: odds ratio for each outcome comparing most to least advantaged (95% CI)			
Exposure	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Education				
Current smoker	0.83 (0.64–1.08)	0.83 (0.64–1.08)	0.83 (0.64–1.08)	0.89 (0.69–1.16)
Ever smoked	1.39 (1.20–1.60)	1.29 (1.10–1.52)	1.27 (1.07–1.49)	1.11 (0.91–1.35)
Obesity	0.50 (0.40–0.61)	0.52 (0.42–0.65)	0.59 (0.47–0.74)	0.81 (0.65–1.01)
Physical inactivity	0.38 (0.33–0.44)	0.40 (0.35–0.46)	0.42 (0.37–0.48)	0.51 (0.44–0.59)
Occupation				
Current smoker	0.67 (0.51–0.89)	0.68 (0.52–0.89)	0.64 (0.49–0.84)	0.74 (0.56–0.97)
Ever smoked	1.24 (1.06–1.45)	1.22 (1.02–1.45)	1.19 (0.99–1.42)	1.23 (1.02–1.50)
Obesity	0.39 (0.31–0.49)	0.43 (0.34–0.54)	0.46 (0.36–0.58)	0.56 (0.44–0.71)
Physical inactivity	0.47 (0.40–0.54)	0.49 (0.42–0.58)	0.52 (0.44–0.61)	0.67 (0.57–0.79)
Ability to cope with available income				
Current smoker	0.38 (0.30–0.50)	0.37 (0.29–0.48)	0.33 (0.26–0.42)	0.40 (0.32–0.51)
Ever smoked	0.59 (0.52–0.68)	0.59 (0.50–0.69)	0.57 (0.48–0.67)	0.59 (0.49–0.71)
Obesity	0.46 (0.38–0.57)	0.46 (0.38–0.54)	0.47 (0.39–0.57)	0.48 (0.40–0.58)
Physical inactivity	0.61 (0.53–0.69)	0.69 (0.60–0.80)	0.75 (0.65–0.87)	0.83 (0.72–1.16)

CI, confidence interval; model 1, adjusted for age only; model 2, as model 1 plus area or residence, marital status, country of birth, number of pregnancies, use of hormonal contraception, use of hormonal replacement, hysterectomy and bilateral oophorectomy; model 3, as model 2 plus adjustment for other outcomes– smoking, body mass index and exercise score; model 4, as model 3 plus mutual adjustment for other socioeconomic position (SEP) scores – education, occupation and ability to cope with available income.

with the extent of missing data also being greatest in the younger and older cohorts. However, comparisons between participants and the national census on a range of characteristics also suggested that the cohorts were representative of Australian women of similar ages.[9]

What is already known on this topic

The difference in the effect of education and occupation on smoking behaviour across the three birth cohorts is consistent with the model of the smoking epidemic proposed by Lopez

Table 5 Multivariable associations education and ability to cope with available income with smoking, obesity and inactivity among a cohort of Australian women aged 18–23 ($N = 9713$)

	Relative index of inequality: odds ratio for each outcome comparing most with least advantaged (95% CI)			
Exposure	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Education				
Current smoker	0.48 (0.40–0.56)	0.59 (0.49–0.71)	0.60 (0.49–0.72)	0.75 (0.62–0.90)
Ever smoked	0.48 (0.45–0.56)	0.59 (0.49–0.70)	0.60 (0.50–0.71)	0.73 (0.60–0.89)
Obesity	0.58 (0.42–0.80)	0.65 (0.47–0.90)	0.67 (0.48–0.93)	0.68 (0.49–0.94)
Physical inactivity	0.79 (0.68–0.91)	0.83 (0.72–0.97)	0.83 (0.72–0.98)	0.91 (0.78–1.06)
Ability to cope with available income				
Current smoker	0.38 (0.34–0.43)	0.43 (0.38–0.48)	0.43 (0.38–0.48)	0.44 (0.39–0.49)
Ever smoked	0.38 (0.34–0.43)	0.47 (0.42–0.52)	0.47 (0.42–0.53)	0.48 (0.42–0.55)
Obesity	0.60 (0.48–0.75)	0.61 (0.49–0.76)	0.62 (0.49–0.78)	0.61 (0.49–0.76)
Physical inactivity	0.95 (0.86–1.05)	1.00 (0.91–1.10)	1.04 (0.95–1.14)	1.06 (0.96–1.16)

CI, confidence interval; model 1, adjusted for age only; model 2, as model 1 plus area or residence, marital status, country of birth, number of pregnancies and use of hormonal contraception; model 3, as model 2 plus adjustment for other outcomes – smoking, body mass index and exercise score; model 4, as model 3 plus mutual adjustment for other socioeconomic position (SEP) scores – education and ability to cope with available income.

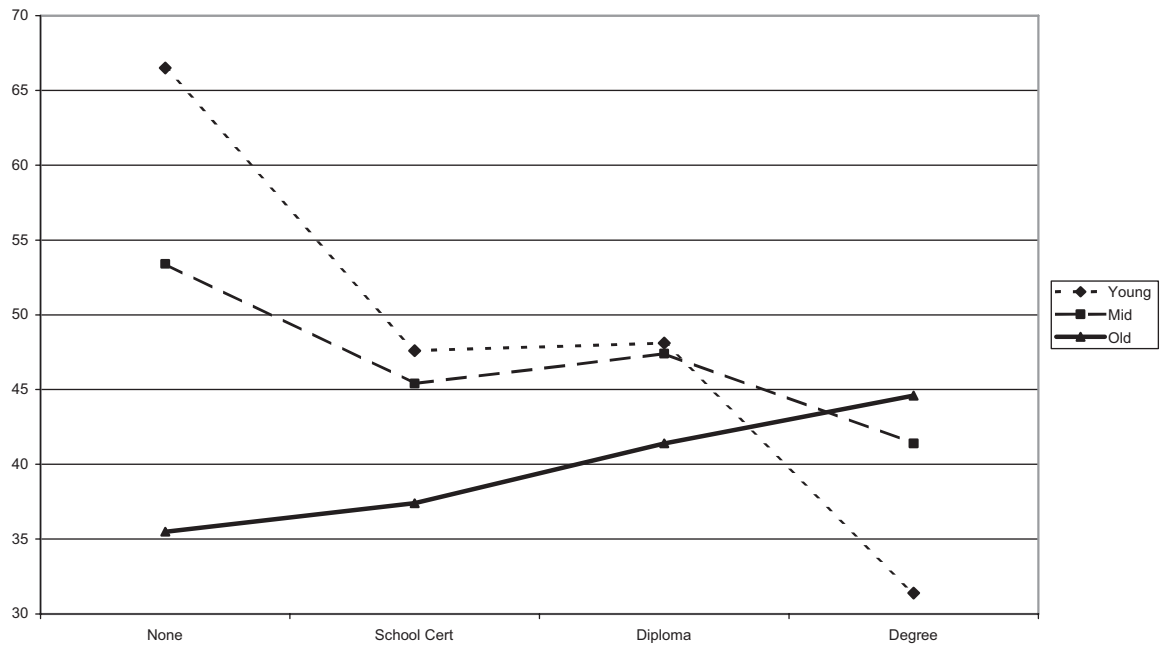

Figure 1 Percentage of women who reported ever-smoking cigarettes, by educational attainment, in three cohorts of Australian women: younger (18–23 years, $N = 14\,779$), mid-age (45–50 years, $N = 14\,099$) and older (70–75 years, $N = 12\,940$).

and colleagues.[16] Historically, women's smoking started in the 1920s in Australia, the United Kingdom and the United States, a little later in northern Europe and later still in southern Europe.[17] Consistent with the epidemic in men's smoking, women's smoking peaked about 40 years after it began, and thus rates are declining in Australia, the United States and northern Europe, but this decline has yet to begin in southern Europe. Within these general population changes, there is evidence from a number of countries that socioeconomic differentials have changed in ways that are consistent with a diffusion process led by younger, more educated women, who are the first to start smoking and the first to quit. Our finding that, among women born between 1921 and 1926, those who were most educated and in the most skilled jobs were more likely to have ever smoked, whereas for mid-age and younger women the opposite was true is consistent with this pattern. By contrast, the older women showed the same pattern as the mid-age and younger women in the association between and

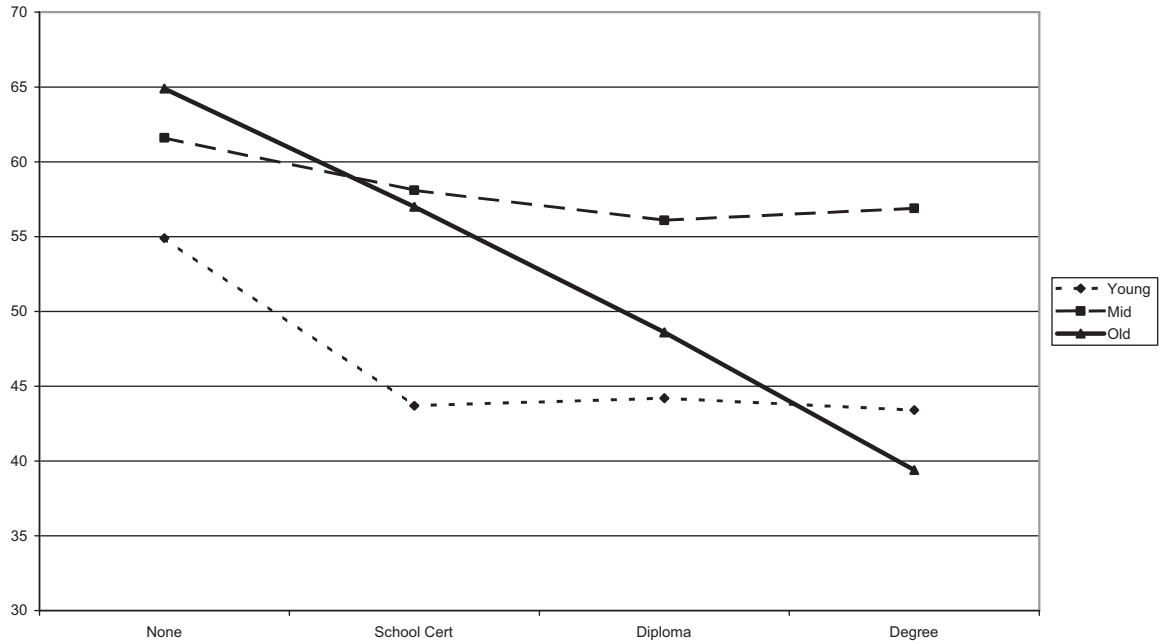

Figure 2 Percentage of women who were physically inactive, by educational attainment, in three cohorts of Australian women: younger (18–23 years, $N = 14\,779$), mid-age (45–50 years, $N = 14\,099$) and older (70–75 years, $N = 12\,940$)

ability to cope on available income and smoking – in all three cohorts, those who reported finding it most difficult to cope on their available income were more likely to have ever smoked or be current smokers. This may reflect the association between psychological stress and smoking behaviour among women.[18]

With the exception of the associations with smoking among older women, for all three measurements of SEP and in all three cohorts, those from the lowest SEP had worst risk factors. Considering their duration in many developed countries, socioeconomic inequalities in health outcomes appear entrenched. However, demonstrations of social-class crossovers for some conditions in some countries, coupled with the evidence that risk factors such as those examined here, and other important determinants of health outcomes, can be improved suggests otherwise.[19] The widening socioeconomic gradients in health-related behaviours in many countries has led to special initiatives aimed specifically at reducing such behaviours among the most socioeconomically disadvantaged groups.[20] However, such approaches may be unsuccessful if they are not combined with broader initiatives aimed at reducing socioeconomic inequalities across the life course.[21]

Our finding that, for most of the health behaviours we examined, the different measurements of SEP combined to increase risk is a further illustration of the importance of the need to include several measurements of different aspects of SEP in epidemiological studies, when considering this as a confounding factor in associations.[22]

What this study adds

In conclusion, we have found that low education, occupation and ability to cope on available income combine to increase the risk of being obese and physically inactive in three cohorts of Australian women. Among older women, those with greatest levels of education were more likely to have ever smoked, but this association was in the opposite direction among women from the other two cohorts. This work further illustrated the importance of recognizing that SEP is not always associated in the same direction with adverse health outcomes in all populations and that examining differences between socioeconomic differentials in health outcomes can help to understand mechanisms underlying associations.[4,23] We found no evidence that health-related behaviours were more strongly associated with prestige-based measurements of SEP than with measurements that more strongly reflected material or psychosocial resources.

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