The Association Between Health and Education in Australia: Indigenous/non-Indigenous Comparisons

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Abstract

Relative to the rest of the population, Indigenous Australians are disadvantaged across a number of outcomes. Not only is income lower, but so is life expectancy. Furthermore, the incidence of a number of chronic conditions is much higher (especially after controlling for the younger age profile). There are a number of interrelated historic, social and economic reasons for these poorer outcomes, but one important factor is likely to be substantially lower education levels. That is, Indigenous Australians are much less likely to finish high school, and for those that do, less likely go on to university or other studies. This paper looks in an empirical way at the relationship between education and health for Indigenous Australians, comparing it to similar associations for the non-Indigenous population. Using probit model estimates on data from the 2001 National Health Survey, two traditional health outcomes (self-assessed health and chronic conditions) as well as a set of health risk-factors are examined. For all health measures used, those with lower education levels have significantly worse health outcomes. Interestingly, education is found to have a significantly different magnitude of association for some measures across Indigenous and non-Indigenous Australians.

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1 Motivation, context and review of literature

Introduction

Education can have benefits for individuals and society. Much of the research to support this has focused on the effect education has on an individual's economic outcomes, usually employment and/or earnings (for example Card 2001, and for Australian specific work Borland 2002). There has also been research in this area looking specifically at Indigenous Australians. For example, Junankar and Liu (2003), Hunter (2004) and Biddle (2005) all found predicted employment and income benefits for Indigenous Australians that were often higher than for the non-Indigenous population

Education, however, may lead to more than just better employment opportunities or higher potential income. Wolfe and Haveman (2001) list a number of possible non-market and social effects of education. These include an association between individuals' education and:

- Higher levels of schooling of their children;
- Improved ability to make efficient choices, including consumer choices;
- Outcomes for individuals in their neighbourhood;
- The ability to plan fertility decisions;
- Their children's health; and
- Their own health outcomes.

This paper focuses on the last potential linkage and, more specifically, looks at the association between an individual having finished high school and their reporting one of a number of poor health outcomes. It focuses on how this association varies between Indigenous and non-Indigenous Australians and with a person's age.

Education and health

A number of authors have found empirical support for a relationship between education and health. Quantifying the direct effect of education on health, Lleras-Muney (2005) found that an additional year of education lowers the probability of dying in the next 10 years by at least 3.6 percentage points.[1] Gilleskie and Harrison (1998) found similar results in terms of morbidity and, using self assessed health as the variable of interest, Kennedy (2002) also found an association between education and health that was similar in Australia and Canada.

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Research looking at the association between health and education (either explicitly or along with other variables) has also focussed on sub-groups within the population. Looking at differences between African Americans and whites in the US, Crimmins and Saito (2001) found differences in healthy life expectancy for both population sub-groups. Interestingly, they also found that "at lower levels of education, the differences in healthy life expectancy between African Americans and whites are greater than at higher education levels". This implies that education may affect health differently for different groups of people.

There are three broad explanations for the measured relationship between education and health. Education might lead (directly or indirectly) to improved health; the two may be associated because of a third variable; or good health may lead to higher education levels (Kennedy 2002). It is notoriously difficult to separate these effects, and all three are likely to explain at least some of the relationship.

Looking at the first possibility, following Grossman (1972) we can think of people investing in education and health inputs (amongst other things) with the aim of maximising their lifetime utility. Their utility may consist of utility from goods and as well as the utility gained from a healthy life. Under this model, education might lead to higher levels of health because those with higher levels of education might have a greater range or better mix of health inputs available to them. Those with higher levels of education might also be better able to make use of the inputs that they do have. In other words education may lead directly to better health outcomes through increasing a person's health-related knowledge, or alternatively increasing the ability to make efficient use of such information. Doing so may increase the likelihood of a person engaging in beneficial health behaviour, or alternatively not engaging in behaviour likely to be harmful to one's health. Gilleskie and Harrison (1998) found empirical support for both linkages.

In Australian high schools, students undertake subjects directly related to health and physical education. For example, in NSW, students are required to undertake 300 hours in 'Personal Development, Health and Physical Education'. According to the 2004 syllabus (NSW Board of Studies 2004), the "syllabus is concerned with developing the knowledge and skills and fostering the attitudes that will empower students to adopt healthy lifestyles". Similar subjects are studied in the other States and Territories. Feinstein et al. (2003) present evidence that learning during adulthood contributing to shifts in attitudes and behaviour linked to health outcomes.

It is not always the case, however, that a person's behaviour will match their knowledge. Kenkel (1991) found that although "part of the relationship between schooling and the consumption of cigarettes, alcohol and exercise is explained by differences in health knowledge ...most of schooling's effects on health behaviour remain after differences in knowledge are controlled for". That is, not only do individuals with higher education levels benefit from having access to better health related information, they may also have greater confidence in using it towards improving their health.

Education might also have an impact on health outcomes through its impact on other intermediate variables which affect a person's ability to obtain health inputs. This was referred to in Grossman (1972) as technical efficiency although as Kennedy (2002) argues, it can perhaps be better thought of as the individual being more productive in generating health inputs. Those with higher education levels may be better able to obtain employment and those that are employed, experience more pleasant working conditions and higher wages or other forms of income. These economic factors may in turn affect health by allowing a person to avoid some of the negative health consequences of 'low-status' jobs (Marmot et al. 1997), or through increasing the ability to pay for health or health related inputs (e.g. medicines, health insurance, specialist services, gym membership, better housing, etc).

This last explanation may be particularly relevant for Indigenous Australians who are much more likely to suffer from poor employment, income and housing outcomes. As shown by Table 1, Indigenous Australians have poor outcomes both in absolute terms (the first column) and relative to the non-Indigenous population (the last column). Although some of these outcomes may in part be explained by cultural preference (e.g. living in larger households or away from major cities), most if not all the outcomes could quite conceivably be associated with poorer health for the individual, all else being equal (positively or negatively depending on the variable).

Another immediate variable that has received attention in the literature is autonomy or empowerment (Boughton 2000). According to Ross and Mirosky (1999), "because education develops one's ability to gather and interpret information to solve problems on many levels, it increases one's control over events and outcomes in life". Not only do the authors see personal control as having a direct effect on health through the knowledge of the most beneficial actions to take, they also outline how the perception of having control over one's life is also important. That is, if one does not

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feel that their actions are likely to affect outcomes in their life, i.e. outcomes are determined more by powerful others, luck, fate or chance, then a person may be less likely to undertake actions like exercising, eating a healthy diet and quitting smoking that others might engage in.

For the Indigenous population, an education that leads to a loss of culture may negatively impact on a sense of control and hence health. However, one which is inclusive and hence enhances individuals' control over their lives may also enhance their ability and confidence in taking control over their health (Boughton 2000).

Table 1. Selected socioeconomic outcomes by Indigenous status - 2001

	Indigenous	Non-Indigenous	Ratio
Unemployed (percent of those in the labour force))	20.0%	7.2%	2.79
Employed (percent of population)	52.1%	58.9%	0.82
Individual income (average $2001)	$212.6	$379.7	0.56
Household income (average $2001)	$787.1	$1009.8	0.78
Household size (average persons)	3.4	2.6	1.31
Home ownership (percent household who own or are buying)	26.8%	72.9%	0.37
Living in major city*	30.0%	67.0%	0.45

Source: Altman, Biddle and Hunter (2004) and *AIWH (2003)

The second explanation for there being a relationship between education and health as outlined in Kennedy (2002) is that there may be a third factor (or set of factors) that is often unobserved by researchers but is associated with both education and health. One possibility is time preference. Those with low discount rates (i.e. they value the future relatively highly) are more likely to believe the future benefits of education outweigh the immediate costs (including the income foregone). All else being equal these people may be more likely to finish high school or obtain post-school qualifications (for a critical review of the time preference literature, see Frederick, Loewenstein and O'Donoghue 2002).

Taking care of one's own health also often involves short-term costs but long term benefits. Furthermore there are a number of factors contributing to poor health that have short term benefits but long term costs. For example, smoking whilst young can have some social benefits for an individual (Cawley, Markowitz and Tauras 2004) but the health costs (in terms of increased rates of lung cancer, heart disease, emphysema, etc.) are not often felt until the individual is much older. So, even with complete information and the ability to process this information, an

individual with a relatively high discount rate may still take up smoking. Other health behaviour that may be costly in the short terms but have long term benefits are exercise, a balanced diet, hygienic surroundings and regular vaccinations and/or medical check-ups.

For the Indigenous population, time preference could perhaps be better expressed as confidence about the future. If Indigenous Australians are less confident about the future even before they get to late secondary school, then they are less likely to believe in the efficacy of investing in health and education. However, rather than time preference a third factor related to health and education that is perhaps more applicable to the Indigenous population are the geographic, language and social barriers to accessing services. That is, the barriers that prevent Indigenous Australians accessing education are likely to affect the barriers to accessing health services in a similar way. This may explain the measured association between education and health for the Indigenous population.

Another variable that may influence both one's own education and one's own health is the education of one's mother. That is, children who have educated parents (especially their mothers) may be more likely to continue on at school and have better health. Therefore, without controlling for a mother's education, the relationship between education and health as an adult may overstate the causation between the two. The health transitions literature documents these links in developing countries (Caldwell and Caldwell 1995) and for the Australian Indigenous population (Gray and Boughton 2001).

The third explanation for why there is an association between education and health presented in Kennedy (2002) is that healthy individuals are better able to undertake education in the first place. That is, there is a possibility of reverse causality for some health conditions. Consider an individual who has one or more of a number of childhood or adolescent conditions. The child may suffer from physical difficulties that make it difficult to attend school or undertake schoolwork. Alternatively they may suffer from poor hearing or sight that makes it difficult to pay attention in class. If these child and adolescent health problems also lead to adult health issues (independent of the effect education has on them) then this may explain some of the association between adult health and a person's education level.

There is a large amount of research looking at Indigenous child health and its effect on educational participation (Zubrick et al. 2006). In particular, Collins (1999: 150) identifies that "hearing loss has a profound impact on a child's learning" and notes that this may particularly be an issue for those for whom English is a second language. Furthermore, the

Australian Institute of Health and Welfare (AIHW 2005) identifies Otitis Media as a major issue in remote Australia especially. Collins (1999) and MCEETYA (2001) also identify poor nutrition (both before school age and once at school) as being another contributing factor to poor education outcomes for Indigenous Australians.

Indigenous Australians and their health

Indigenous Australians have substantially poorer health outcomes than the rest of the Australian population. For example, life expectancy at birth is much lower with an age gap between Indigenous and non-Indigenous Australians estimated to be 21 years for males (56 years as opposed to 77) and 19 years for females (63 years as opposed to 82) (AIWH 2003).

There are similarly poor health outcomes for Indigenous Australians found across other measures of health. For example, after adjusting for differences in age structure, almost twice as many Indigenous Australians reported their health as either fair or poor as opposed to good, very good or excellent than the non-Indigenous population (one-third compared to 18% in ABS 2004a). Indigenous Australians suffer disproportionately from circulatory system diseases, diabetes, chronic kidney disease, cancer, respiratory diseases, communicable diseases, injury and poisoning, vision and hearing problems, oral health and mental health, including suicide (AIWH 2003).

Although there is much statistical research looking at the health disparities between Indigenous and non-Indigenous Australians, there is relatively little looking explicitly at the relationship between education and health for the Indigenous population of Australia (AIHW 2005). Although not looking at education and one's own health, Gray and Boughton (2001) provide some evidence of there being a link between a mother's education and the actions that she took with regards to their child's health. Rather than finding a linear relationship between education and children's health service usage, however, the authors find a U-shaped relationship where those with the highest education levels and those with the lowest education levels are most likely to report their children having taken a health action.

There is less research looking at adult health. AIHW (2005) report that those who have higher levels of secondary schooling are more likely to have excellent/very good self assessed health, less likely to have a disability or long-term condition and less likely to be a current smoker or have high risk alcohol consumption. Although the paper doesn't focus on the link between education and health, Booth and Carroll (2005) look at the socio-

economic determinants of health for Indigenous Australians and used education as one of the explanatory variables. They find that, in addition to income and employment having an association with self assessed health, those with low levels of education report statistically significantly lower levels of self assessed health. However, even after controlling for the effect of the socio-economic controls, an Indigenous person's health is lower than a comparable non-Indigenous Australian.

Contribution to the literature

This paper estimates the relationship between a number of health or health related outcomes and education, whilst controlling for other factors that may be expected to be associated with health. The major contribution to the literature is that it looks at the relationship between education and health separately for Indigenous and non-Indigenous Australians, allowing the relationship to vary by age. The main way in which these results can be used is when determining who is more likely to suffer from poor health outcomes. Although one may not be able to use these results to say unequivocally whether it is education itself that is improving health, nonetheless, it is still important to know whether certain sub-groups of the population are suffering from poor health. That is, by obtaining an estimate for health outcomes at different ages and levels of education, health interventions may be better targeted.

The remainder of the paper is structured as follows. The next section (Section 2) outlines the data used in this study and the methods used to measure the relationship between education and health. Section 3 presents results from the empirical estimations (mainly via graphical form) and Section 4 concludes with a discussion of the importance of the results.

2 Data and Methods

The analysis is restricted to those aged 20 to 64, focusing on those who have had time to complete high-school, but not those who are likely to have retired.

2.1 Data

The data for this study comes from the 2001 National Health Survey, carried out by the ABS. This survey contained a second Indigenous sample that was used to supplement the original survey. After exclusions, the resulting

sample contained 13,991 Australians between the ages of 20 and 64 of which 1,123 identified as being Indigenous. For more information on the survey see ABS (2004b).

Table 2 gives the age distribution of the Indigenous and non-Indigenous samples, as well as the proportions of a number of other important variables used in this study. Table 2 shows that Indigenous Australians are more likely to have all the poor health outcomes used in the paper (explained below) and: are less likely to have completed Year 12; have lower incomes; are younger; and are more likely to live in Remote areas.

Table 2. Proportions of sample with given characteristics (or averages of continuous variables) by Indigenous status

Variable name	Indigenous	Non-Indigenous
Dependent variables		
Self assessed health fair or poor+	0.31	0.17
Chronic condition+	0.47	0.37
Risky alcohol consumption+	0.37	0.31
Unhealthy weight+	0.74	0.56
Low exercise+	0.38	0.29
Current smoker	0.51	0.26
Ever was a smoker	0.70	0.52
Independent variables		
Age*	38.26	41.07
Completed high school	0.27	0.56
Female	0.61	0.53
Born overseas	n.a.	0.27
Not married	0.55	0.42
Lives in inner regional area	0.19	0.20
Lives in outer regional area	0.36	0.11
Lives in remote Australia	0.20	0.02
Equivalised household income*	582.8	1224.7

Note: Variables marked with an asterisk(*) are continuous variables and the numbers therefore represent the average value for the sample.

2.2 Method - Specifications

Three separate sets of equations that link a poor health variable to different sets of explanatory variables are estimated. Appendix 1 outlines these equations in more detail. They are, however, summarised below with the motivation for their conclusion.

· Specification 1: In the simplest specification, poor health is assumed to be a function of a set of demographic and geographic variables, as well as a set of terms that interact age, age squared and Indigenous status. This allows the relationship between Indigenous status and health to be plotted without controlling for education.

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· Specification 2: The main set of equations includes the same variables as in Specification 1, but also includes a set of variables that interact education status with age, age squared and Indigenous status. Doing so allows testing of whether education is associated with poor health and whether this association is different for Indigenous Australians and different at different ages.

· Specification 3: The final specification includes a mediating variable (household equivalised income) that is interacted with age. Doing so allows testing of whether the relationships with education remain after controlling for income (in a reasonably simple way).

Given these three specifications a set of hypotheses is tested. These are expressed first as a potential question of interest, and then as the alternative hypothesis. The null hypothesis is that the variables all equal zero. Similar hypotheses are tested on each specifications to see whether results change without the inclusion of certain variables (presented in an Appendix).

Box 1 Hypothesis tests

- Age hypothesis: Does the probability of having the given health outcome vary by age after controlling for education and income? $H1: \gamma_{2,2}, \gamma_{2,3}, \gamma_{2,4}, \gamma_{2,5} \neq 0$;
- Indigenous hypothesis: Does the variation in the health outcome by Indigenous status remain after controlling for education and income? $H1: \gamma_{2,1}, \gamma_{2,4}, \gamma_{2,5} \neq 0$
- Age/Indigenous hypothesis: Does any variation in health outcomes between Indigenous and non-Indigenous Australians vary by age after controlling for education and income? $H1: \gamma_{2,4}, \gamma_{2,5} \neq 0$
- Education hypothesis: Is high school completion associated with variation in the probability of experiencing poor health (after controlling for income)? $H1: \gamma_{3,1}, \gamma_{3,2}, \gamma_{3,3}, \gamma_{3,4}, \gamma_{3,5}, \gamma_{3,6} \neq 0$;

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- Education/Age hypothesis: Does this association vary with age (after controlling for income)? $H1: \gamma_{3,3}, \gamma_{3,4}, \gamma_{3,5}, \gamma_{3,6} \neq 0$;
- Education/Indigenous hypothesis: Are there differences in the benefits of education for Indigenous and non-Indigenous Australians (after controlling for income)? $H1: \gamma_{3,2}, \gamma_{3,5}, \gamma_{3,6} \neq 0$;
- Income hypothesis: Is there an association between health and income? $H1: \gamma_{4,1}, \gamma_{4,2}, \gamma_{4,3}, \neq 0$; and
- Income/age hypothesis: Does the association between health and income vary by age? $H1: \gamma_{4,2}, \gamma_{4,3}, \neq 0$

2.3 Method – Health variables

For the dependent variable, the latent variable of interest, h_i^*, is unobserved.

However, we do observe a number of health related variables $h_{(),i}$. Those health related binary variables are related to the latent variable via equation below.

$$h_{(),i} = \begin{cases} 1 & if\ h_i^* \geq c_{()} \\ 0 & if\ h_i^* < c_{()} \end{cases}$$

These binary health related variables can be broken into two types. The first type is traditional health outcomes:

$$h_{(Lowhealth),i} = Self\ assessed\ health\ poor\ or\ fair$$
$$h_{(cond),i} = Has\ chronic\ condition$$

The second type of health variable used are those variables that could be thought of more as health behaviour variables:

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$$h_{(alc),i} = Risky\ alcohol\ consumption$$
$$h_{(weight),i} = Body\ mass\ index\ outside\ healthy\ range$$
$$h_{(excer),i} = Low\ exercise\ levels$$
$$h_{(evr\_smo),i} = Ever\ was\ a\ smoker$$
$$h_{(cur\_smo),i} = Current\ smoker$$

These variables and they way in which the equations are estimated are given in Appendix 1.

3 Empirical results

The presentation of results begins by graphing the predictions from the simplified equation outlined in Equation . The first result presented is the estimated probability that an individual reported that their health was either fair or poor (i.e. low health). This probability is plotted by age whilst keeping sex (male), marital status (married) and migration (born in Australia) constant.

Figure 1. Probability of having 'low health' by age and Indigenous status

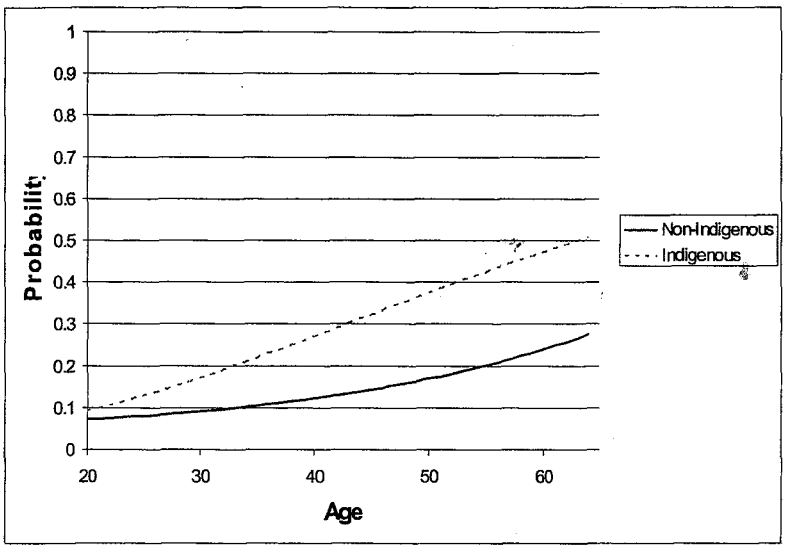

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Figure 1 shows that Indigenous Australians are estimated to be more likely to report that their health is either fair or poor and that this difference increases with age. For example, a 25 year old Indigenous Australian is about 1.7 times more likely to report having low health than a non-Indigenous Australian. This rises to almost 2.5 times more likely for those who are 55 years old.

The next set of figures plots the probability of having the remainder of the (poor) health outcomes by age.

Figure 2a Chronic disease

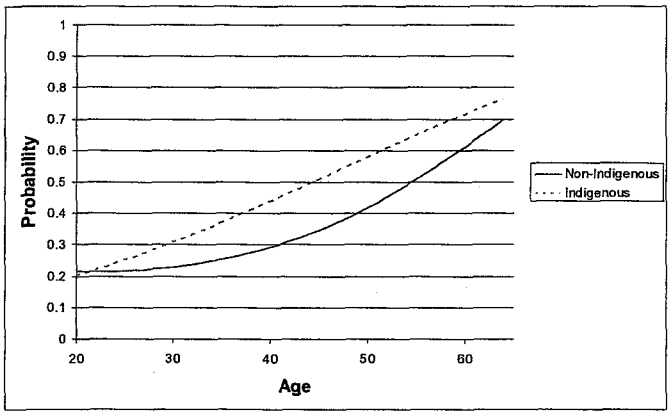

Figure 2b Alcohol consumption

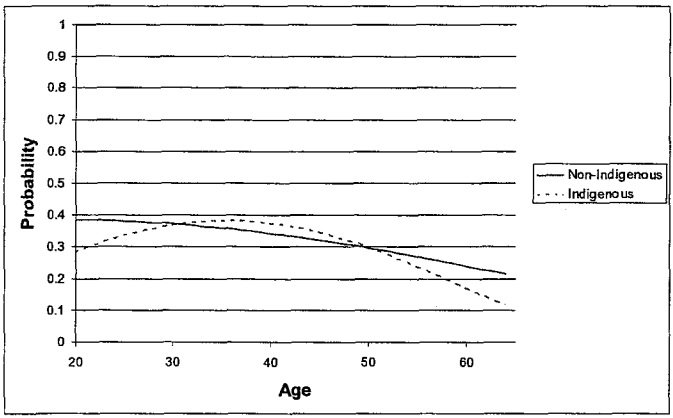

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Figure 2c Unhealthy weight

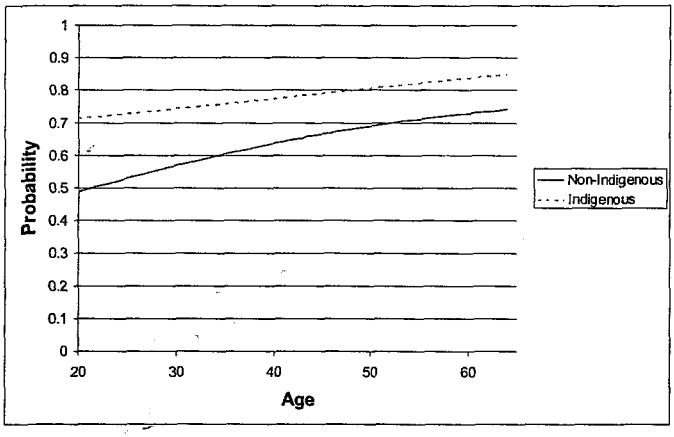

Figure 2d Low exercise

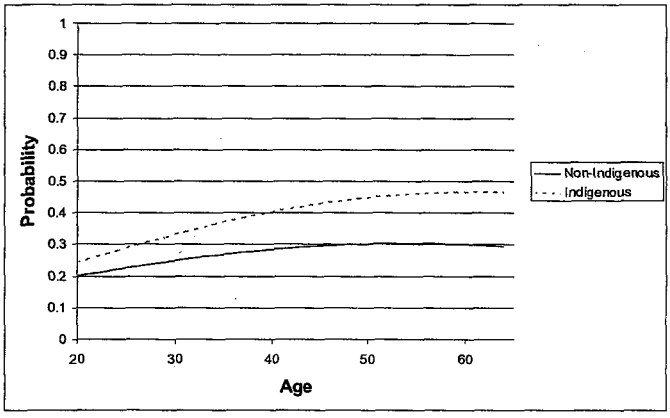

Figure 2e Current smoker

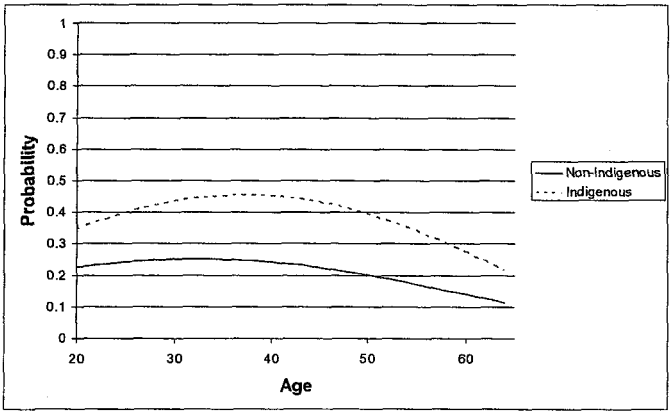

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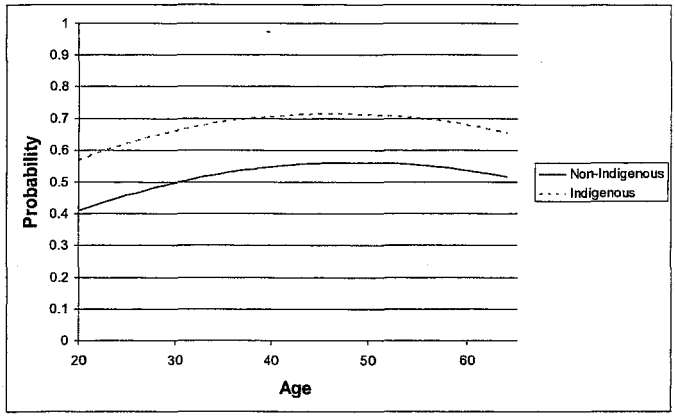
Figure 2f Ever was a smoker



These graphs show that the disparity between Indigenous and non-Indigenous Australians in terms of having a chronic disease was broadly similar for the probability of reporting low health, although the disparity was not estimated to increase by age as much as it does for the more subjective health measure. The patterns for the other health variables are also reasonably consistent, although for some age groups and variables (the very old and very young for alcohol consumption and the very young for low exercise) Indigenous Australians have similar and occasionally lower probabilities. For all the health outcomes, there is statistically significant variation by age and Indigenous status.

The next set of graphs look at how the health outcomes vary by education status (using the predictions from Specification 2). To do so Indigenous and non-Indigenous Australians are presented separately, and for each of these groups, a separate line is plotted for those who completed high-school (the broken line) and those who didn't (the unbroken line). The first figure plots the probability of reporting low health for non-Indigenous Australians.

Figure 3 shows that for non-Indigenous Australians, those who did not complete high school were more likely to report their health as being either fair or poor. This does not seem to vary by the person's age. Figure 4 plots the corresponding figures for the Indigenous population. It shows that, like non-Indigenous Australians, the Indigenous population who has completed high-school is less likely to report low health than those who did not. However, for the Indigenous population, the difference appears to increase slightly with age.

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Figure 3. Probability of having low health by education status for non-Indigenous Australians

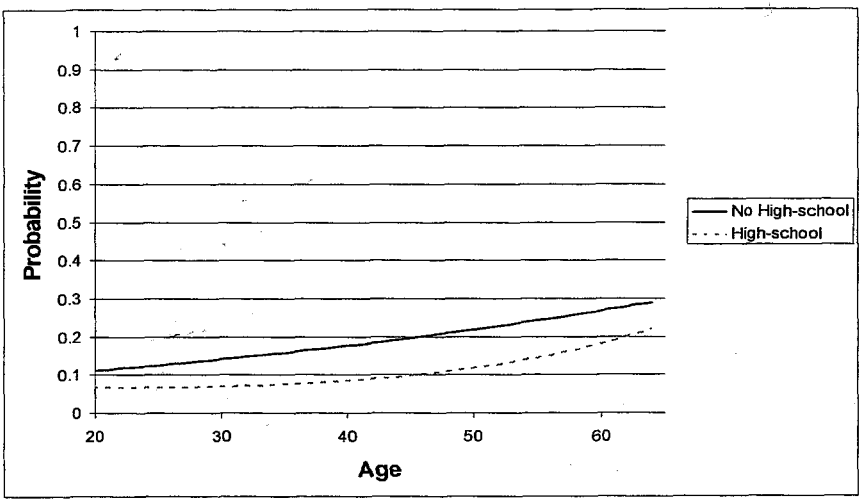
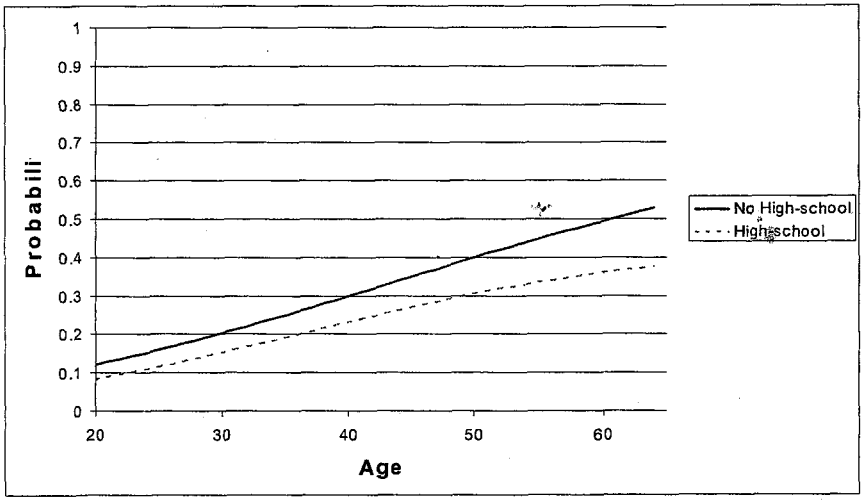


Figure 4. Probability of having low health by education status for Indigenous Australians



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How then do the rest of the health outcomes vary by education and what are the statistical significance of these relationships? These results are summarised in Table 3 which presents the results from the hypothesis tests on the health outcome variables and Table 4 which gives the results for the health behaviour variables.[2]

Table 3. Results from two sided hypothesis tests of the joint significance of the sets of variable presented in Box 1 - Health outcome variables.

Hypothesis	Dependent variable Self assessed health	Chronic condition
Age hypothesis 3	<0.01	<0.01
Indigenous hypothesis 3	<0.01	<0.01
Age/Indigenous hypothesis 3	<0.10	n.s.
Education hypothesis 3	<0.01	<0.01
Education/Age hypothesis 3	n.s.	n.s.
Education/Indigenous hypothesis 3	n.s.	n.s.
Income hypothesis 3	<0.01	<0.01
Income/age hypothesis 3	n.s.	n.s.

Table 4. Results from two sided hypothesis tests of the joint significance of the sets of variables presented in Box 1 - Health behaviour variables

Hypothesis	Dependent variable Alcohol	Weight	Exercise	Current Smoker	Ever was smoker
Age hypothesis 3	<0.01	<0.01	<0.01	<0.01	<0.01
Indigenous hypothesis 3	<0.10	<0.01	<0.01	<0.01	<0.01
Age/Indigenous hypothesis 3	<0.05	n.s.	n.s.	n.s.	n.s.
Education hypothesis 3	n.s.	<0.01	<0.01	<0.01	<0.01
Education/Age hypothesis 3	<0.05	n.s.	n.s.	<0.01	<0.01
Education/Indigenous hypothesis 3	n.s.	n.s.	n.s.	n.s.	n.s.
Income hypothesis 3	<0.01	<0.05	<0.01	<0.01	<0.01
Income/age hypothesis 3	n.s.	n.s.	n.s.	n.s.	n.s.

For both dependent variables, there is variation in the health outcome by age and Indigenous status which remain even after controlling for education status and income. For the self assessed health dependent variable, the interaction of age and Indigenous status interaction terms are significant at the 10% level of significance, however for the chronic condition variable, the interaction terms are not significant. Table 3 also shows that those who had completed high-school had a significantly different probability of having the two health outcomes, although the

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difference was not found to vary by age or Indigenous status. The income variable was significant, however the effect was not found to vary by age.[3]

Table 4 shows that even after controlling for education and income, the probability of reporting the health behaviour variables is significant. Interestingly though, the Indigenous status variables in the risky alcohol consumption estimations are only significant at the 10% level of significance. Table 4 also shows that for all of the variables, the probability of reporting each of the health behaviours is significantly different for those who have completed high-school. For three of the variables, the difference by education level is significantly different across ages. For the alcohol variable, those who have completed high-school have a similar probability of risky alcohol consumption amongst the young, but when a person gets older they have a higher probability. For smoking status, the difference by education is high amongst the young, but converges across ages. Once again, income had a significant association with reporting the poor health outcome, however this association was not found to vary by age.

5 Conclusions

The aim of this study was to look at the association between education and health for Indigenous Australians. Using seven binary measures of poor health (two traditional health outcomes and five health behaviours), the results presented here confirm that for Indigenous Australians, completion of high school is associated with better health outcomes. A second aim was to see whether this association was the same for Indigenous and non-Indigenous Australians. In general there was no strong evidence for there being a difference for Indigenous and non-Indigenous Australians. The association between education and health was, however, found to vary by age for three of the dependent variables (the alcohol and smoking variables).

The first conclusion to be made from the results is therefore confirmation that health interventions for Indigenous Australians may be especially required for those with lower levels of education. Those who had not completed high school were much more likely to report their health as being either fair or poor, were much more likely to report low levels of exercise, and were much more likely to be smokers (especially amongst the young).

Without being able to establish causality, it is however difficult to be too prescriptive with regards to the extent to which health disparities could

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be reduced by reducing disparities in education. Discussion at the start of the paper identified three reasons why health in the adult population may be associated with education. That is, education may lead to better health outcomes, they both may be caused by a third variable or poor health may hinder education achievement. While there are econometric techniques to separate these effects to a certain extent, the data required to do so for the Indigenous Australian population does not exist. The final conclusion from this paper is therefore also to confirm that to provide the best policy advice, good quality panel data with sufficient numbers of Indigenous Australians would be of great use.

Notes

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[1] These results were robust to the author controlling for endogeneity between education and health

[2] Similar results to Figure 4 can be constructed for the other six variables using the coefficient estimates in Table A2 to A7 and are available from the author upon request.

[3] In results not reported in this paper, the analysis was repeated using an ordered probit model for the five category self assessed health variable. The only result that varied was that the income and age interaction was now statistically significant at the 1% level of significance. Full results are available from the author upon request.

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Appendices

Appendix 1: Equations and estimation methodology

The first specification begins with a simple equation linking a latent variable for 'poor health' with a number of other variables that are expected to explain health outcomes:

$$h_i^* = \alpha_1 X_{1,i} + \alpha_2 \left(Age \times Ind \right)_i + \mu_i$$

Here, for individual i the latent (poor) health variable, h_i^*, is expressed as a function of a set of geographic, demographic and family formation variables, X_{1i}, as well as a set of terms that interact age and Indigenous status. The size of the association between these explanatory variables and health is given by the vectors of coefficients α_1 and α_2.

The demographic and geographic variables used in this study $\left(X_1 \right)$ are included to capture other factors likely to be associated with health. These include:

- A constant;
- Sex – the base case is male, with a binary variable set up indicating whether the person is female;
- Country of birth (for the non-Indigenous population) – the base case is being born in Australia with a single variable constructed for those born overseas;
- Marital status – the base case is being married with those who have never been married or those who are separated or divorced included in the one binary variable; and
- Region – the base case is living in a major city with variables set up for those who live in an inner regional, outer regional and remote area.

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The second term in equation includes interactions between age and Indigenous status. These interaction terms are expanded on below:

$$\alpha_2 \left(Age \times Ind \right)_i = \alpha_{2,1} Ind_i + \alpha_{2,2} Age_i + \alpha_{2,3} Age_i^2 + \alpha_{2,4} \left(Ind \times Age \right)_i + \alpha_{2,5} \left(Ind \times Age^2 \right)_i$$

Age is constructed as a continuous variable ranging from 20 to 64 and enters both as a linear term and as a quadratic. A dummy variable for Indigenous status is set-up such that Ind = 1 if the person identified as being Indigenous and 0 otherwise.

The second (and main) specification has in addition a set of variables for education status. By including these variables, it is possible to see whether a person's health status varies by their education, and whether this variation is different for Indigenous and non-Indigenous Australians. The expanded model and interaction terms used are given below in equations and , respectively. These follow closely Ross and Wu (1996).

$$h_i^* = \beta_1 X_{1,i} + \beta_2 \left(Age \times Ind \right)_i + \beta_3 \left(Age \times Edu \times Ind \right)_i + \varepsilon_i$$

where

$$\beta_3 \left(Age \times Edu \times Ind \right)_i = \beta_{3,1} Edu_i + \beta_{3,2} \left(Edu \times Ind \right)_i + \beta_{3,3} \left(Edu \times Age \right)_i + \beta_{3,4} \left(Edu \times Age^2 \right)_i + \beta_{3,5} \left(Edu \times Ind \times Age \right)_i + \beta_{5,6} \left(Edu \times Ind \times Age^2 \right)_i$$

Education is measured as a dummy variable (Edu) where: $Edu = 1$ if the person completed either Year 11 or Year 12 and equals 0 otherwise. The omitted category is therefore an individual who has not completed year 11 or 12. This paper focuses on high-school completion as opposed to a continuous years of schooling variable because: such results have not been estimated for the Indigenous population before; post-school qualifications, especially university degrees, are relatively uncommon for the Indigenous population; and there is still a large proportion of the population who have not completed high-school, and furthermore, high-school completion rates of recent cohorts are relatively low. Those who completed Year 11 only were included as they appeared to have a similar health profile to those who completed Year 12 as opposed to Year10. Sensitivity checks with those who have completed Year 11 only not included showed that results were not sensitive to their inclusion

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The previous two sets of equations have not included any of the mediating variables traditionally used in empirical analysis. Instead, in equation the direct and indirect relationships between education and health have been estimated together. This was done for two reasons:

- Firstly it is the association between education and health which is the focus of this paper, not the causal pathways; and
- Secondly, especially in remote areas, neither income nor employment may represent the best measure of access to resources. However, the data used does not contain any measures of resources obtained from the customary or hybrid economy (Altman, Buchanan and Biddle 2006).

Nonetheless, it still may be of interest to policy makers whether the association between education and health is still present after the association between one or more mediating variables is taken into account. Equation below uses income as the mediating variable to see whether this is the case.

$$h_i^* = \gamma_1 X_{1,i} + \gamma_2 \left(Age \times Ind\right)_i + \gamma_3 \left(Age \times Edu \times Ind\right)_i + \gamma_4 \left(Age \times Inc\right)_i + \omega_i$$

Here income is measured as a continuous variable and is equivalised at the household level using the 'modified' OECD equivalence scale (first adult = 1.0, other adults = 0.5, each child = 0.3). The income variable is interacted with both age and age squared as shown by the following equation:

$$\gamma_4 \left(Age \times Inc\right)_i = \gamma_{4,1} Inc_i + \gamma_{4,2} \left(Age \times Inc\right)_i + \gamma_{4,3} \left(Age^2 \times Inc\right)$$

Given the results using income are not the focus of the paper (i.e. the main results do not try and separate out the direct from indirect effects of education on health), the above two equations are somewhat simplified. That is, to fully separate out the direct and indirect effects, the possibility that income and health are jointly determined would have to be taken into account. However doing so requires either longitudinal data or a set of variables associated with income but not health. Given that the data to do so is not readily available, such an exercise was not attempted (see also Booth and Carroll 2005 for an example of estimating a single equation with income as an independent variable using the NHS).

The self assessed health variable on the 2001 NHS asked individuals to

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rate their own health on a five point scale, ranging from excellent to very good, good, fair and poor. Those who rated their own health as being fair or poor were classified as having 'low health.'

Using self assessed health in comparisons between population subgroups is problematic because the interpretation of the question may be different for different groups (Sibthorpe Anderson and Cunningham 2001) and may be affected by the place on the survey in which the questions were asked (Crossley and Kennedy 2002). For this reason, the second health outcome variable is whether or not a person reported that they had at least one from a set of self reported long term conditions. The conditions included are: heart disease; cancer; diabetes (types 1 & 11); gout; other mental illness; other disease of the nervous system; bronchitis/emphysema; ulcer; hernia; kidney disease; other diseases of the urinary system; asthma; rheumatism; cerebrovascular disease; and arthritis and osteoporosis.

In the 2001 NHS, the alcohol question was preceded by the statement that "Some people may drink more or less than others, depending on their lifestyle and individual choices". The individual was then asked, amongst other things, about their consumption of alcohol for the 3 most recent drinking days in the past 7 days prior to interview which was then extrapolated to 7 days based on the number of drinking days. This was then coded into risk levels by the ABS, with this paper using those identified as having risky alcohol consumption as the variable of interest. To measure whether a person is outside the health weight range, the Body Mass Index (BMI), or a person's weight in kilograms divided by the square of their height in metres was used, with the ABS cut-offs applied (which is the standard outlined by the World Health Organisation). The cut-off for low exercise levels was also based on ABS (2004b) cut-offs.

It could have been assumed that education impacts on the first two health outcomes directly and through its effect on the latter health behaviour variables which then have their own impact on health outcomes. While modelling the relationship between education and health in such a way may have had some intuitive appeal it was not done because: it is important to first establish the binary relationships; there are long lags between some of the behavioural variables and the more traditional outcome variables; and most of the second set of behavioural variables can be thought of as aspects, not just causes of overall health and well-being (WHO 2004).

Equations , , and or more accurately the error terms in the equations

$(\mu_i, \varepsilon_i, \omega_i)$ are assumed to be distributed normally with a mean of zero and a variance of one. Furthermore, they are assumed to be distributed independently of the set of explanatory variables and hence the use of a binary variable in the estimating equations implies the use of the probit model. This model was estimated using maximum likelihood estimation via the version 8 of the software package Stata (intercooled). Robust standard errors were estimated.

Given the number of interaction terms used in the estimation equations, it would be difficult to interpret the parameter estimates themselves. For this reason, results are presented via a graphical approach and parameter estimates kept to an Appendix. When making comparisons within and across the Figures, however, the parameter estimates and hypothesis tests are used to test whether any differences are statistically significant.

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Appendix 2: Coefficients and standard errors

Table A1. Low health

Independent variable	Model 1 Coefficient	Standard error	Model 2 Coefficient	Standard error	Model 3 Coefficient	Standard error
Female	-0.0259	0.0254	-0.0309	0.0256	-0.0689	0.0260
Born overseas	0.0479	0.0302	0.0954	0.0307	0.0453	0.0314
Not married	0.2613	0.0262	0.2569	0.0263	0.1864	0.0272
Lives in inner regional area	0.0336	0.0330	-0.0134	0.0332	-0.0526	0.0336
Lives in outer regional area	0.1047	0.0392	0.0524	0.0395	0.0173	0.0397
Lives in remote Australia	-0.0611	0.0725	-0.0964	0.0725	-0.1262	0.0735
Age	0.0028	0.0079	0.0129	0.0123	0.0329	0.0146
Age squared	0.0002	0.0001	0.0000	0.0001	-0.0002	0.0002
Indigenous status	-0.6222	0.5263	-0.4628	0.6782	-0.2830	0.6822
Indigenous status * age	0.0464	0.0265	0.0292	0.0328	0.0182	0.0330
Indigenous status * age squared	-0.0004	0.0003	-0.0002	0.0004	-0.0001	0.0004
Completed high school			0.2429	0.3450	0.1590	0.3490
Completed high school * Indigenous status			-0.6218	1.3221	-0.7258	1.3385
Completed high school * age			-0.0340	0.0166	-0.0272	0.0168
Completed high school * age squared			0.0004	0.0002	0.0004	0.0002
Completed high school * Indigenous status * age			0.0459	0.0726	0.0504	0.0736
Completed high school * Indigenous status * age squared			-0.0006	0.0010	-0.0007	0.0010
Equivalised income					-0.0001	0.0002
Equivalised income squared					0.0000	0.0000
Equivalised income * age					0.0000	0.0000
Equivalised income * age squared					0.0000	0.0000
Constant	-1.5991	0.1669	-1.4840	0.2694	-1.6371	0.3107
Adjusted R-squared	0.0478		0.0624		0.0801	

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Table A2. Chronic condition

Independent variable	Model 1 Coefficient	Standard error	Model 2 Coefficient	Standard error	Model 3 Coefficient	Standard error
Female	-0.0259	0.0254	-0.0309	0.0256	-0.0689	0.0260
Born overseas	0.0479	0.0302	0.0954	0.0307	0.0453	0.0314
Not married	0.2613	0.0262	0.2569	0.0263	0.1864	0.0272
Lives in inner regional area	0.0336	0.0330	-0.0134	0.0332	-0.0526	0.0336
Lives in outer regional area	0.1047	0.0392	0.0524	0.0395	0.0173	0.0397
Lives in remote Australia	-0.0611	0.0725	-0.0964	0.0725	-0.1262	0.0735
Age	0.0028	0.0079	0.0129	0.0123	0.0329	0.0146
Age squared	0.0002	0.0001	0.0000	0.0001	-0.0002	0.0002
Indigenous status	-0.6222	0.5263	-0.4628	0.6782	-0.2830	0.6822
Indigenous status * age	0.0464	0.0265	0.0292	0.0328	0.0182	0.0330
Indigenous status * age squared	-0.0004	0.0003	-0.0002	0.0004	-0.0001	0.0004
Completed high school			0.2429	0.3450	0.1590	0.3490
Completed high school * Indigenous status			-0.6218	1.3221	-0.7258	1.3385
Completed high school * age			-0.0340	0.0166	-0.0272	0.0168
Completed high school * age squared			0.0004	0.0002	0.0004	0.0002
Completed high school * Indigenous status * age			0.0459	0.0726	0.0504	0.0736
Completed high school * Indigenous status * age squared			-0.0006	0.0010	-0.0007	0.0010
Equivalised income					-0.0001	0.0002
Equivalised income squared					0.0000	0.0000
Equivalised income * age					0.0000	0.0000
Equivalised income * age squared					0.0000	0.0000
Constant	-1.5991	0.1669	-1.4840	0.2694	-1.6371	0.3107
Adjusted R-squared	0.0478		0.0624		0.0801	

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Table A3. Risky alcohol consumption

Independent variable	Model 1 Coefficient	Standard error	Model 2 Coefficient	Standard error	Model 3 Coefficient	Standard error
Female	-0.1508	0.0224	-0.1477	0.0225	-0.1334	0.0226
Born overseas	-0.2818	0.0282	-0.2896	0.0284	-0.2680	0.0285
Not married	0.1870	0.0230	0.1858	0.0231	0.2180	0.0235
Lives in inner regional area	0.0252	0.0293	0.0277	0.0294	0.0484	0.0296
Lives in outer regional area	0.1027	0.0351	0.1093	0.0353	0.1276	0.0354
Lives in remote Australia	0.2300	0.0637	0.2356	0.0638	0.2481	0.0639
Age	0.0083	0.0069	0.0155	0.0114	0.0181	0.0128
Age squared	-0.0002	0.0001	-0.0003	0.0001	-0.0004	0.0001
Indigenous status	-1.3278	0.4767	-1.4450	0.6278	-1.4274	0.6301
Indigenous status * age	0.0700	0.0248	0.0774	0.0312	0.0769	0.0314
Indigenous status * age squared	-0.0009	0.0003	-0.0010	0.0004	-0.0009	0.0004
Completed high school			0.3656	0.2983	0.3327	0.3022
Completed high school * Indigenous status			1.4868	1.1484	1.5512	1.1472
Completed high school * age			-0.0223	0.0147	-0.0212	0.0150
Completed high school * age squared			0.0003	0.0002	0.0003	0.0002
Completed high school * Indigenous status * age			-0.0957	0.0642	-0.0990	0.0641
Completed high school * Indigenous status * age squared			0.0014	0.0009	0.0014	0.0009
Equivalised income					0.0003	0.0001
Equivalised income squared					0.0000	0.0000
Equivalised income * age					0.0000	0.0000
Equivalised income * age squared					0.0000	0.0000
Constant	-0.3642	0.1405	-0.4885	0.2423	-0.6214	0.2672
Adjusted R-squared	0.0269		0.0278		0.0324	

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Table A4. Unhealthy weight

Independent variable	Model 1 Coefficient	Standard error	Model 2 Coefficient	Standard error	Model 3 Coefficient	Standard error
Female	-0.2571	0.0218	-0.2604	0.0219	-0.2646	0.0220
Born overseas	-0.2063	0.0260	-0.1860	0.0262	-0.1933	0.0264
Not married	-0.0628	0.0224	-0.0678	0.0225	-0.0792	0.0229
Lives in inner regional area	0.0931	0.0283	0.0704	0.0285	0.0646	0.0286
Lives in outer regional area	0.1073	0.0347	0.0815	0.0350	0.0775	0.0350
Lives in remote Australia	0.2690	0.0669	0.2548	0.0673	0.2529	0.0673
Age	0.0279	0.0066	0.0348	0.0110	0.0278	0.0121
Age squared	-0.0001	0.0001	-0.0003	0.0001	-0.0002	0.0001
Indigenous status	0.9391	0.4827	1.1002	0.6272	1.0381	0.6286
Indigenous status * age	-0.0213	0.0253	-0.0338	0.0314	-0.0308	0.0314
Indigenous status * age squared	0.0002	0.0003	0.0003	0.0004	0.0003	0.0004
Completed high school			0.1330	0.2909	0.1827	0.2933
Completed high school * Indigenous status			1.1849	1.3516	1.1473	1.3506
Completed high school * age			-0.0177	0.0142	-0.0201	0.0144
Completed high school * age squared			0.0002	0.0002	0.0003	0.0002
Completed high school * Indigenous status * age			-0.0823	0.0797	-0.0804	0.0796
Completed high school * Indigenous status * age squared			0.0015	0.0011	0.0014	0.0011
Equivalised income					-0.0002	0.0001
Equivalised income squared					0.0000	0.0000
Equivalised income * age					0.0000	0.0000
Equivalised income * age squared					0.0000	0.0000
Constant	-0.5262	0.1363	-0.4935	0.2359	-0.3234	0.2564
Adjusted R-squared	0.0351		0.0386		0.0391	

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Table A5. Low exercise

Independent variable	Model 1 Coefficient	Standard error	Model 2 Coefficient	Standard error	Model 3 Coefficient	Standard error
Female	-0.0195	0.0225	-0.0255	0.0227	-0.0446	0.0229
Born overseas	0.1550	0.0269	0.2087	0.0273	0.1859	0.0275
Not married	-0.0387	0.0233	-0.0478	0.0235	-0.0826	0.0241
Lives in inner regional area	0.0414	0.0293	-0.0066	0.0297	-0.0281	0.0299
Lives in outer regional area	0.0872	0.0354	0.0304	0.0356	0.0111	0.0357
Lives in remote Australia	0.0589	0.0647	0.0335	0.0658	0.0218	0.0659
Age	0.0304	0.0070	0.0289	0.0111	0.0475	0.0130
Age squared	-0.0003	0.0001	-0.0003	0.0001	-0.0005	0.0001
Indigenous status	-0.0935	0.4752	-0.0575	0.6063	0.0875	0.6098
Indigenous status * age	0.0136	0.0243	0.0042	0.0298	-0.0051	0.0300
Indigenous status * age squared	-0.0001	0.0003	0.0000	0.0003	0.0002	0.0004
Completed high school			-0.3208	0.3064	-0.4528	0.3100
Completed high school * Indigenous status			-0.0286	1.2083	-0.0487	1.2098
Completed high school * age			-0.0038	0.0150	0.0052	0.0152
Completed high school * age squared			0.0000	0.0002	-0.0001	0.0002
Completed high school * Indigenous status * age			0.0072	0.0671	0.0072	0.0671
Completed high school * Indigenous status * age squared			-0.0001	0.0009	-0.0001	0.0009
Equivalised income					0.0002	0.0002
Equivalised income squared					0.0000	0.0000
Equivalised income * age					0.0000	0.0000
Equivalised income * age squared					0.0000	0.0000
Constant	-1.3367	0.1452	-0.9737	0.2392	-1.1880	0.2750
Adjusted R-squared	0.0109		0.0272		0.0322	

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Table A6. Current smoker

Independent variable	Model 1 Coefficient	Standard error	Model 2 Coefficient	Standard error	Model 3 Coefficient	Standard error
Female	-0.1429	0.0231	-0.1435	0.0233	-0.1713	0.0235
Born overseas	-0.0495	0.0285	-0.0065	0.0289	-0.0365	0.0292
Not married	0.4181	0.0238	0.4203	0.0240	0.3743	0.0246
Lives in inner regional area	0.0738	0.0301	0.0220	0.0307	-0.0058	0.0308
Lives in outer regional area	0.2033	0.0357	0.1481	0.0362	0.1247	0.0363
Lives in remote Australia	0.2286	0.0649	0.2048	0.0655	0.1924	0.0658
Age	0.0348	0.0073	0.0071	0.0114	0.0249	0.0130
Age squared	-0.0005	0.0001	-0.0003	0.0001	-0.0006	0.0001
Indigenous status	-0.1742	0.4629	-0.3668	0.6100	-0.2391	0.6115
Indigenous status * age	0.0348	0.0240	0.0306	0.0301	0.0220	0.0302
Indigenous status * age squared	-0.0004	0.0003	-0.0003	0.0004	-0.0002	0.0004
Completed high school			-0.9800	0.3102	-1.1095	0.3124
Completed high school * Indigenous status			-0.8902	1.1853	-0.9383	1.1747
Completed high school * age			0.0158	0.0154	0.0248	0.0156
Completed high school * age squared			0.0000	0.0002	-0.0001	0.0002
Completed high school * Indigenous status * age			0.0688	0.0669	0.0707	0.0661
Completed high school * Indigenous status * age squared			-0.0010	0.0009	-0.0010	0.0009
Equivalised income					0.0001	0.0002
Equivalised income squared					0.0000	0.0000
Equivalised income * age					0.0000	0.0000
Equivalised income * age squared					0.0000	0.0000
Constant	-1.2330	0.1480	-0.2075	0.2430	-0.3631	0.2717
Adjusted R-squared	0.0508		0.0683		0.0764	

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Table A7. Ever was a smoker

Independent variable	Model 1 Coefficient	Standard error	Model 2 Coefficient	Standard error	Model 3 Coefficient	Standard error
Female	-0.1977	0.0215	-0.1982	0.0217	-0.2137	0.0218
Born overseas	-0.1164	0.0257	-0.0788	0.0260	-0.0982	0.0262
Not married	0.1964	0.0222	0.1959	0.0224	0.1645	0.0229
Lives in inner regional area	0.0761	0.0280	0.0258	0.0283	0.0076	0.0285
Lives in outer regional area	0.1427	0.0343	0.0891	0.0348	0.0728	0.0348
Lives in remote Australia	0.0860	0.0639	0.0639	0.0645	0.0559	0.0647
Age	0.0459	0.0065	0.0027	0.0110	0.0084	0.0122
Age squared	-0.0005	0.0001	-0.0001	0.0001	-0.0002	0.0001
Indigenous status	0.3243	0.4647	-0.2801	0.6278	-0.2576	0.6298
Indigenous status * age	0.0057	0.0241	0.0234	0.0310	0.0206	0.0311
Indigenous status * age squared	-0.0001	0.0003	-0.0002	0.0004	-0.0002	0.0004
Completed high school	-0.9551	0.1348	-1.5046	0.2935	-1.5723	0.2958
Completed high school * Indigenous status			0.7580	1.1436	0.7291	1.1439
Completed high school * age			0.0394	0.0142	0.0446	0.0144
Completed high school * age squared			-0.0003	0.0002	-0.0003	0.0002
Completed high school * Indigenous status * age			-0.0296	0.0640	-0.0287	0.0640
Completed high school * Indigenous status * age squared			0.0003	0.0009	0.0003	0.0009
Equivalised income			0.4431	0.2390	-0.0001	0.0001
Equivalised income squared					0.0000	0.0000
Equivalised income * age					0.0000	0.0000
Equivalised income * age squared					0.0000	0.0000
Constant					0.4696	0.2625
Adjusted R-squared	0.0210		0.0383		0.0416	

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Appendix 3: Hypothesis tests without income included in the model

The following box presents the hypothesis tests conducted on the model without any income variables.

Box 2. Hypothesis tests 2

- Age hypothesis 2: Does the probability of having the given health outcome vary by age after controlling for education but not income? $H1: \beta_{2,2}, \beta_{2,3}, \beta_{2,4}, \beta_{2,5} \neq 0$;
- Indigenous hypothesis 2: Does the variation in the health outcome by Indigenous status remain after controlling for education but not income? $H1: \beta_{2,1}, \beta_{2,4}, \beta_{2,5} \neq 0$
- Age/Indigenous hypothesis 2: Does any variation in health outcomes between Indigenous and non-Indigenous Australians still vary by age after controlling for education but not income? $H1: \beta_{2,4}, \beta_{2,5} \neq 0$
- Education hypothesis 2: Is high school completion associated with variation in the probability of experiencing poor health without controlling for income? $H1: \beta_{3,1}, \beta_{3,2}, \beta_{3,3}, \beta_{3,4}, \beta_{3,5}, \beta_{3,6} \neq 0$;
- Education/Age hypothesis 2: Does this association vary with age? $H1: \beta_{3,3}, \beta_{3,4}, \beta_{3,5}, \beta_{3,6} \neq 0$; and
- Education/Indigenous hypothesis 2: Are there differences in the benefits of education for Indigenous and non-Indigenous Australians without controlling for income? $H1: \beta_{3,2}, \beta_{3,5}, \beta_{3,6} \neq 0$

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Table A8. Results from the two sided hypothesis tests of the joint significance of the sets of variables presented in Box 2 - Health outcome variables

Hypothesis	Dependent variable Self assessed health	Chronic condition
Age hypothesis 2	<0.01	<0.01
Indigenous hypothesis 2	<0.01	<0.01
Age/Indigenous hypothesis 2	<0.05	n.s.
Education hypothesis 2	<0.01	<0.01
Education/Age hypothesis 2	n.s.	n.s.
Education/Indigenous hypothesis 2	n.s.	n.s.

Table A9. Results from the two sided hypothesis tests of the joint significance of the sets of variables presented in Box 2 - Health behaviour variables

Hypothesis	Dependent variable Alcohol	Weight	Exercise	Current Smoker	Ever was smoker
Age hypothesis 2	<0.01	<0.01	<0.01	<0.01	<0.01
Indigenous hypothesis 2	<0.10	<0.01	<0.01	<0.01	<0.01
Age/Indigenous hypothesis 2	<0.05	n.s.	n.s.	n.s.	n.s.
Education hypothesis 2	<0.05	<0.01	<0.01	<0.01	<0.01
Education/Age hypothesis 2	<0.01	n.s.	n.s.	<0.01	<0.01
Education/Indigenous hypothesis 2	n.s.	<0.10	n.s.	n.s.	n.s.

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