

Modelling Potential Impact of Improved Survival of Indigenous Australians on Work- Life Labour Income Gap Between Indigenous and Average Australians

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Binod Nepal
Laurie Brown

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National Centre for Social and Economic Modelling
University of Canberra ACT 2601 Australia

Phone + 61 2 6201 2780

Fax + 61 2 6201 2751

Email natsem@natsem.canberra.edu.au

Website www.natsem.canberra.edu.au

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Abstract

This study compares work-life labour income of Indigenous and average Australians and assesses potential impact of bridging mortality gaps on their work-life earning gaps using a life-table model which took account of the survival, employment and income trajectories from 25 to 64 years. Age-specific employment and average annual income data were derived from the 2006 Census for three educational groups: certificate or higher levels of education, Year 12, and less than Year 12 education. Results show that depending on educational qualifications, work-life labour income of Indigenous people is likely to be just over two-fifths to about two-thirds of work-life labour income of average Australians. If Indigenous Australians were to have the same level of survival as to average Australians, the work-life labour income gap would narrow by about four to seven percentage points. Bridging the adult mortality gap alone has only a small impact on bridging economic gaps persisting between Indigenous and other Australians.

Key words: Indigenous, lifetime income, disadvantage, Australia

Introduction

Indigenous peoples have lower standards of living and poor health status relative to non-Indigenous peoples worldwide (Anderson et al 2006; King, Smith and Gracey 2009; Subramanian, Smith and Subramanyam 2006). Australia is no exception; it has been one of the frequently cited cases of wide socioeconomic and health gaps between Indigenous and non-Indigenous peoples. Aboriginal and Torres Strait Islanders (referred hereafter as Indigenous) are the most disadvantaged community in modern Australian society. The extent of disadvantage experienced by the Indigenous population is reflected in the statistics on a wide range of social and economic indicators. Most widely cited by academics as well as policy makers is the life expectancy gap between Indigenous and average Australians. Most recent estimates by the Australian Bureau of Statistics (ABS 2009) show that, in 2005-2007, the life expectancy at birth of Indigenous males was estimated to be 67.2 years, 11.5 years shorter than that of non-Indigenous males (78.7 years); for females, it was 72.9 years for Indigenous, 9.7 years shorter than that of non-Indigenous (82.6 years).

The health gap is underpinned by differences in a host of socio-economic factors. Indigenous peoples are lagging behind non-Indigenous Australians in many dimensions of life such as education, employment, and income (Altman, Biddle and Hunter 2008; Bradley et al 2007; Daly and Smith 1996; Daly 1995). Indigenous Australians are likely to be younger, less educated and less likely to be employed as compared to other Australians (Daly and Smith 1996; Daly 1995). An analysis by the Steering Committee for the Review of Government Service Provision (SCRGSP 2007) showed that in 2004-05, a smaller proportion (22%) of Indigenous than non-Indigenous people (47%) had completed year 12; and non-Indigenous people were more than twice as likely as Indigenous people to have completed a post secondary qualification of certificate level 3 or above. It also found that labour force participation rate for Indigenous people (59%) was just about three quarters of that for non-Indigenous people (78%). Median gross equivalised income of Indigenous households was also found to be much lower (\$340) than that of non-Indigenous households (\$618) in 2004-05.

Though this evidence establishes that Indigenous people are far behind other Australians in many dimensions of socio-economic wellbeing, little is known about how these gaps relate to lifetime socio-economic outcomes and to what extent bridging the mortality gaps would marrow lifetime economic outcomes. Using data on historical trends, a few studies have attempted to predict the socio-economic prospect of Indigenous people. They have shown that it may take several decades to uplift Indigenous status as par other Australians (Altman et al 2008). In this study, we compare labour income over the working life disaggregated by broad educational categories of Indigenous Australians and Australians in general. The purpose here is not to derive free-standing precise estimates for any of the population subgroups considered but to compare their relative position with respect to selected economic outcomes. This paper essentially provides a different perspective in examining the impact of socioeconomic disadvantages accumulating over the working life and as such contributes to the 'close the gap' debate in Australia.

The 'close the gap' debate has been a recurring theme in the public policy discourse in Australia for some time. Most cited in this debate is the wide gap in health status, especially the life-expectancy gap, between Indigenous and average Australians. It has also been recognised that there are gaps in other areas such as education, employment, income and housing and these factors underpin the health gaps (Aboriginal and Torres Strait Islander Social

Justice Commissioner 2005). Booth and Carroll (2008), for example, found that the almost half of the gaps in self-assessed health of Indigenous and non-Indigenous populations was explained by economic factors. Health has also been found to be associated with education (Biddle 2006b). This paper focuses on socioeconomic dimensions, particularly education, employment and income. Income reflects individuals' standards of living and ability to purchase goods and services. Employment is the main source of income for most individuals and families. Ability to engage in gainful employment depends on education and training. It was well recognised that education enhances sense of personal control, physical functioning, health, productivity and lifetime earnings (Becker 1962; Danziger, Kalil and Anderson 2000; Mirowsky and Ross 1998; Schultz 1961). Therefore, the results are disaggregated by the educational achievement of the groups studied.

The remainder of the paper is structured as follows. Section 2 describes the data sources and the life-table modelling approach taken in this study. A brief overview of the input data is also included in this section. Section 3 presents the results from the modelling exercise. Finally, Section 4 concludes by discussing the main findings and their limitations.

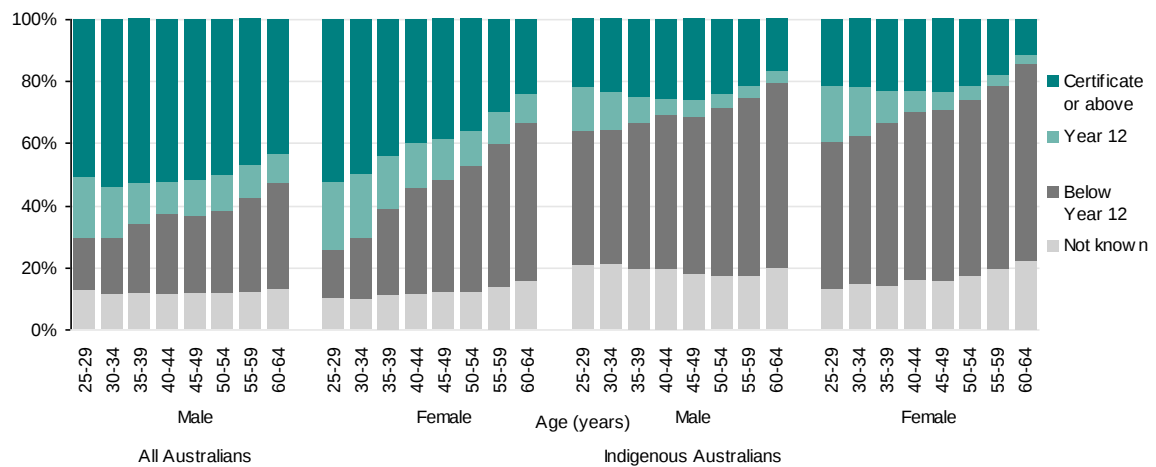
Data and Methods

This study focuses on three important dimensions of wellbeing, namely, survival, employment and income. Work-life income is the main outcome measure which was derived by taking account of survival, employment and income trajectories over the working life between 25 and 64 years inclusive. It was derived by using a life-table model developed in an Excel spreadsheet. The estimates are disaggregated by education.

Education: Data on education were obtained from the 2006 Census. The distribution of population by educational categories considered in this study is shown in Figure 1. The proportion of people with a certificate or higher educational qualification is highest among average Australian (labelled 'all') males. We have not shown data for young people under 25 years for age many of whom are likely to be studying. Research shows that Indigenous people are likely to start post-school qualification late into their life, even after the age of 25 years (Biddle 2006a). The results on work-life income are presented for ages 25, 30 and 35 years.

The proportion of average Australian (denoted as 'all') women who have a certificate or higher education is comparable with that of men 25-29 and 30-34 years of age but drops steadily at later ages. This reflects that women's participation in higher education has increased in the recent past. Indigenous males and females are far behind average Australians in terms of attaining a certificate or higher educational qualification. A large proportion of Indigenous people are early school leavers having less than 12 years of education or no educational qualification. Educational status was not specified in the 2006 Census for about one-tenth to one-fifth of the population. This category was omitted from the modelling.

Figure 1 Percentage distribution of Indigenous and all Australian males and females by highest level of educational qualification

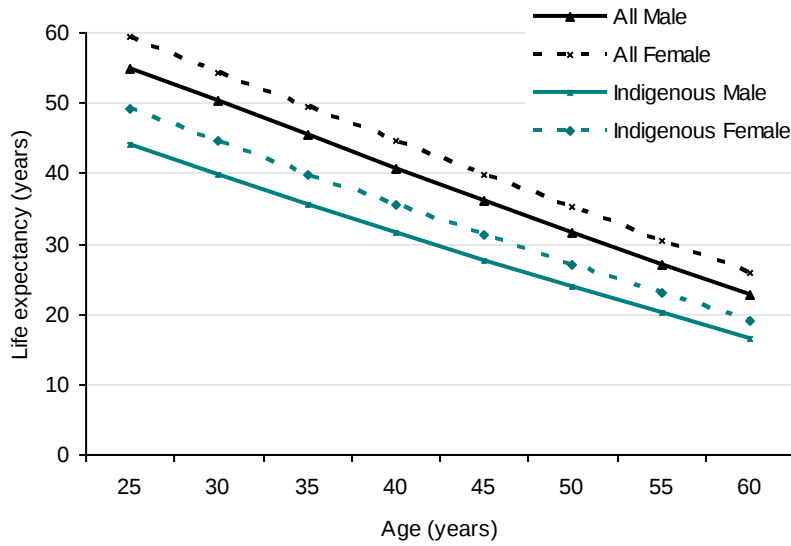


Source: Authors' calculation from 2006 Census tables obtained on special request from ABS.

Survival: Mortality data were drawn from published life tables. Separate sets of period life tables were used for Indigenous and all Australian males and females. The life tables describe the mortality schedule of these populations and calculate average life expectancy at various ages. Indigenous life tables were available as abridged tables with 5-year age intervals (ABS 2009). For all Australian males and females, abridged life tables were reconstructed by aggregating up values from complete (single-age) life tables published by the Australian Bureau of Statistics (2007b). The ages were grouped into five-year groups except at the beginning (0 and 1-4 years) and at the end (85 years and over). The life table columns used for further analysis were number of survivors at the beginning of each age group (generally denoted as l_x) and number of surviving persons in the age interval (generally denoted as ${}_nL_x$).

As shown in Figure 2, Indigenous males and females have shorter remaining life compared to that of average Australian males and females across the ages shown here. At age 25, for example, Indigenous males are expected to live 44 years or nearly 11 years shorter than average Australian males, and Indigenous females are expected to live 49 years or 10 years less than average Australian females. Females are expected to out live males, among Indigenous as well as the Australians in general.

Figure 2 Life expectancy of Indigenous and all Australians, at various ages, 2005-2007

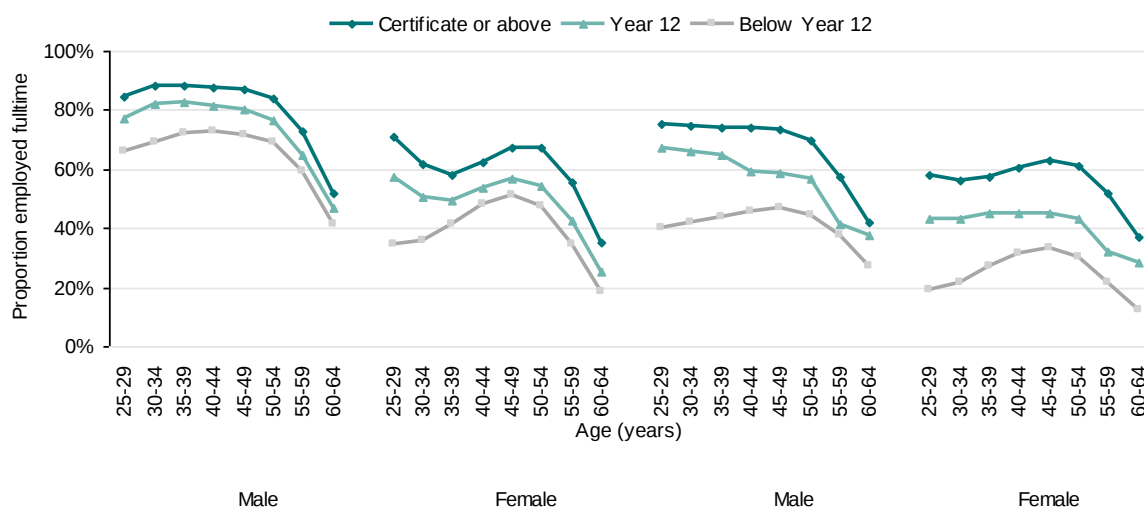


Source: Data from ABS life tables (ABS 2007b; 2009).

There are some limitations regarding comparability of the life tables of Indigenous and average Australians. The life table for Australians in general, is based on a sufficiently large and fairly accurately reported database (ABS 2007b). For Indigenous Australians, the life tables are, however, based on small numbers and dubious quality of reporting of deaths and hence they are duly designated as ‘experimental’ suggesting that mortality estimates for Indigenous populations need to be interpreted with caution (ABS 2009).

Employment: The proportions of employed people (sometimes called as employment rates in this paper) by 5-year age groups (25-29, 30-34, ..., 60-64) were calculated from the full enumeration tables from the 2006 Census of Population and Housing (Figure 3). These data were used as input data in the life table model. These proportions vary by education, gender, and Indigenous status. The age pattern of employment among males exhibits a curvature shape, with a plateau between early 30s to late 40s. But, among women, this is bimodal, with peaks in late 20s and late 40s and a trough in late 30s. The bimodal shape among women reflects the drop-out from, and returns to, paid employment associated with their reproductive and parenting role. Employment is lower for Indigenous males and females compared to that for Australians in general. The modelling assumes that people who are aged 25 years at present will follow these age-patterns of employment when they grow.

Figure 3 Percentage of total population who are employed by highest level of education, Australia, 2006



Source: Authors' calculation from 2006 Census tables obtained on special request from ABS.

Here employment refers to full-time equivalent employment. Two part-time workers were assumed to be equivalent to one full-time worker. Those reported as employed but away from work were proportionately distributed to full-time and part-time categories.

It was assumed that mortality rates were the same for people in any labour force status. It was a strong but necessary assumption in view of the absence of age-specific mortality rates by labour force status of Indigenous and other populations, and also in view of computational complexity. Unlike some work-life tables which are based on the hypothetical proportions of labour force participation rates, the work-life tables in this study are computed by using actual proportions of employed and unemployed populations out of the total population. If longitudinal data providing annual changes in employment status by educational qualifications were available for the population groups being examined, more refined estimates of work years could be calculated by using increment-decrement methods.

Income: Age specific average income was derived from the 2006 Census. As the Census tables only provide income ranges, a median dollar amount within each range was imputed by using data from the 2005-06 Survey of Income and Housing (SIH)(ABS 2007c). The imputed income value represented a median income derived from the SIH within the income range that matched to the Census income range. Since SIH did not include information on Indigenous status, income of the Indigenous population was estimated by applying the ratio (\$669/\$800) of median incomes of Indigenous to average Australians working full time as reported in the 2006 wave of the Household, Income and Labour Dynamics in Australia (HILDA) Survey (Melbourne Institute 2008). The reason for using SIH rather than HILDA for deriving age-specific income is that the later could not provide enough samples to generate tables disaggregated by the variables of interest.¹ The base year for the modelling is taken to be

¹ HILDA is perhaps the most up-to-date data that identifies Indigenous status of the respondents. Another source of income data for Indigenous people could be the 2002 National Aboriginal and Torres Strait

2006 for which the employment and income data are available from the Census. Age-specific average annual incomes used as input data in this modelling are shown in Appendix Table 1.

Net present value of current work-life income

The life-table model developed in this study to derive work-life earnings follows the techniques that have been in use in demographic and economic literature dealing with potential lifetime earnings and returns to education. This approach is particularly suited to the data scarce situations where employment and income data come from cross-sectional sources such as censuses and mortality data come from different sources such as life tables. In this type of models, the most basic approach is to add up average age-specific earnings in a year for the given age and above (e.g., Day and Newburger 2002). More sophisticated techniques derive the lifetime earnings by taking into account the productivity or proportion employed, the probability of survival, and the rate of discount of future earnings (e.g., Wei 2001; Weisbrod 1961). This study uses the later approach. The net present value of work-life income was calculated as follows:

$$I_{ewx} = [{}_nI_x * {}_nL_{wx} + ({}_nI_{x+n} * {}_nL_{wx+n}) (1+r)^n / (1+d)^n] / I_x$$

where

I_{ewx} = work-life labour income estimated at age x,

${}_nI_x$ = Average annual income of working people in the age group x to x+n,

${}_nI_{x+n}$ = Average annual income in the next age group,

${}_nL_{wx}$ = Life table working population in the age group x to x+n. This is obtained by multiplying life-table population (${}_nL_x$) by proportion employed (${}_nW_x$): ${}_nL_{wx} = {}_nL_x \times {}_nW_x$.

r = rate of wage growth,

d = discount rate,

I_x = number of persons survived to exact age x

Monetary flows over time and future benefits are generally discounted and the results presented as net present value (NPV). NPV of a cash stream over a given period of time is the sum of the discounted values in each year of the period. Discounting essentially gives more weight to costs and benefits that occur in the near future and less weight to those that occur more distant in time. For example, as Trendle (2007) points out before valuing a decision of whether or not to undertake additional education, people will tend to discount future earnings, i.e. an additional \$100 in a years time is not valued as much as an additional \$100 now. If a person values a dollar next year at 90 cents now, their discount rate is 10 per cent. For this reason, the value of the additional wages accruing from additional education must be discounted. The higher the discount rate, the lower the values of future incomes.

The choice of an appropriate discount rate is open to debate – conventional practice in many health economic studies has been to use a discount rate of either 3 or 5 per cent (Drummond et al 2005). In lifetime labour income studies, a discount rate for future earnings of 5 per cent is common. This value is close to the long-term yield in Australian Government Bonds. Hence, in this study, a figure of 5 per cent is considered to reflect a medium scenario estimate. But, we also present alternative estimates based on discount rates of 3 and 10 per cent to test the sensitivity of work-life earnings to different discount rates.

The results presented in the next section should be interpreted as what happens to work-life labour income, 65 years being the upper cut-off age, if the current age pattern of mortality, employment, and income prevail over the life of an individual aged 25 years in 2006. Rate of wage growth is assumed to be 1.04%. This figure was derived from the index numbers of average weekly earnings of adults working full time (ABS 2008).

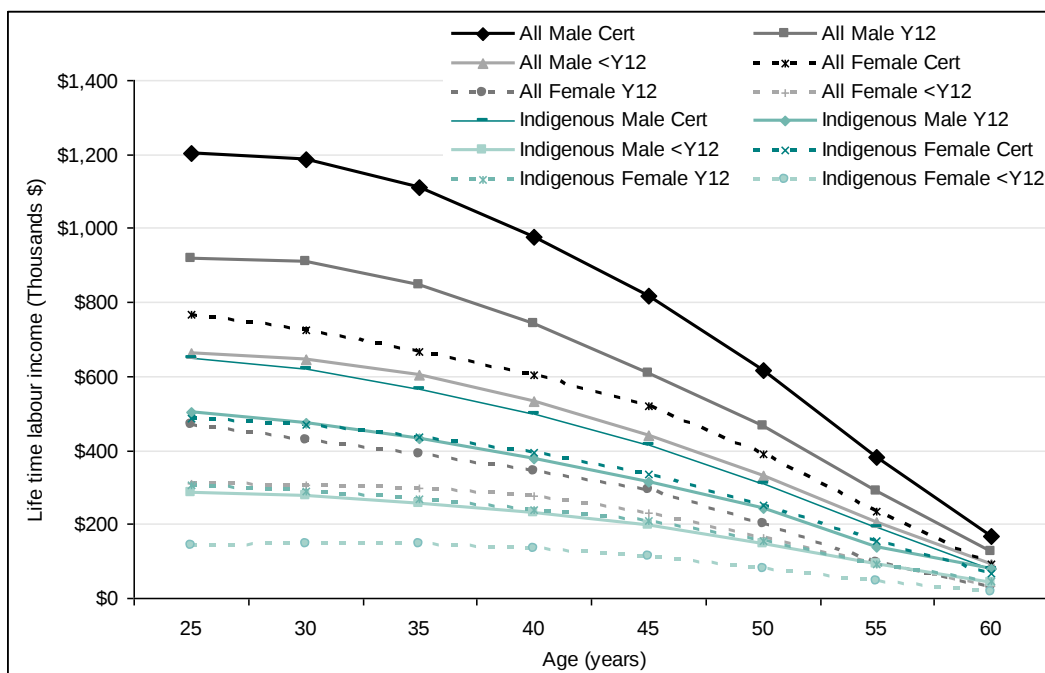
Results

This section presents the results from the life-table modelling of labour income outcomes disaggregated by the three broad levels of educational attainment. Figure 4 presents estimated work-life earnings from full-time equivalent employment. These estimates are derived by applying the annual income growth rate of 1.04 per cent and a discount rate of five per cent.

As shown in Figure 4, average Australian males who have a certificate or higher educational qualification are expected to earn the highest amount over their working life, followed by males with 12 years of education. Indigenous females with less than 12 years of education are expected to have the lowest work-life earning prospect. At age 25 years, the work-life earning of average Australian males with certificate or higher education is 1.2 million which is about 8.4 times the expected lifetime earning (\$143,000) of Indigenous females with less than Year 12 education.

It can further be inferred from Figure 4 that in terms of work-life income prospect, more educated individuals are generally better off than less educated, males are better off than females and Indigenous Australians are worse off than average Australians. While Indigenous Australians appear to be disadvantaged in general, education appears to ameliorate this gap to some extent. For example, Indigenous females with certificate or higher education are above the average Australian females with less than Year 12 education in terms of prospective work-life labour income.

Figure 4 Expected labour income over the working life, Australia, 2006



Notes: cert = certificate or higher education,

Y12 = Year 12,

<y12 = less than Year 12 education.

Assumptions: annual 1.04% income growth and 5% discount rate.

Source: Authors' calculation

To look more closely at the gap in work-life earnings between Indigenous peoples and all Australians within each educational groups, we present in Table 1 (upper panel) the Indigenous work-life earnings as a percentage of average Australian work-life earnings. Assuming a five per cent discount rate, average work-life labour income of Indigenous Australians is likely to be just 43 to 69 per cent of work-life labour income of Australians in general. The gap is slightly wider among males than females. Indigenous males aged 25 years are expected to earn over their working life between 43 and 55 per cent of what average Australian males would earn over their working life. In the case of Indigenous females aged 25 years, their expected work-life earnings would be between 46 per cent and 65 per cent of earnings of average Australians females. The relative gaps in prospective work-life earnings between Indigenous and average Australians at ages 30 and 35 years are only marginally different from that at age 25 years. The gap in work-life earnings is wider for males as well as females who have less than Year 12 education. This underscores the importance of education in bridging the income gap between Indigenous and other Australians.

Impact of bridging the adult mortality gap

The lower panel of Table 1 presents a hypothetical scenario showing the impact on work-life earnings of eliminating the mortality gap between Indigenous and average Australians

(keeping the educational and employment patterns as they are). It shows percentage point reductions in work-life earnings if the age-specific mortality pattern of Australians in general is applied to the Indigenous population. If Indigenous Australians were to have adult age-specific mortality rates identical to that of average Australians, then the gaps in work-life labour incomes would be narrowed by about four to seven percentage points (with a discount rate of 5%). For males, the gaps in work-life labour income would be narrowed by about 6-7 percentage points and for females by 4 percentage points.

Table 1 Work-life income gap within the same educational categories, and impact of bridging the mortality gap

	Discount rate = 3%			Discount rate = 5%			Discount rate = 10%		
	Age 25	Age 30	Age 35	Age 25	Age 30	Age 35	Age 25	Age 30	Age 35
Work-life income gap: Indigenous work-life income as percentage of average Australian work-life income									
Male									
Certificate or above	53	51	50	54	52	51	56	54	52
Year 12	53	52	51	55	52	51	58	54	52
Below Y12	43	42	42	43	43	43	44	43	43
Female									
Certificate or above	63	65	65	63	65	65	63	65	66
Year 12	66	69	69	65	68	69	64	68	49
Below Y12	47	48	49	46	48	49	45	49	50
Reduction in gap: Percentage points by which the income gap would be narrowed if mortality patterns were identical									
Male									
Certificate or above	7	8	8	6	6	7	4	4	5
Year 12	7	8	8	6	6	7	4	4	5
Below Y12	8	8	8	6	7	7	4	5	5
Female									
Certificate or above	4	4	5	4	4	4	2	3	3
Year 12	4	4	5	4	4	4	2	3	3
Below Y12	5	4	4	4	4	4	3	3	3

Note: Annual income growth of 1.04 per cent assumed.

Source: Authors' calculation.

Sensitivity analysis

We assumed a five per cent discount rate as a standard rate. Nevertheless, a sensitivity analysis was also conducted to assess the variations due to different discount rates. In addition to estimates based on five per cent discount, Table 1 presents alternative estimates of expected work-life income based on a lower (3%) and a higher (10%) discount rate. Absolute

values of the expected work-life income estimates are not presented here as our interest is to look at the relative gaps. Table 1 suggests that a lower discount rate would show a marginally larger gap and a higher discount rate would show a marginally lower gap in work-life earnings between Indigenous Australians and Australians in general. The impact of the earning gaps from improved Indigenous mortality is larger with a smaller discount rate and vice versa. While the results are fairly stable across the discount rates tested here, the marginal changes observed here suggest that it is appropriate to take account of these variations when interpreting the results.

Discussion

This study provided an insight into the lifetime economic disadvantages to Indigenous people as compared to average Australians. Our purpose was to look at the relative positions of subgroups considered here rather than to obtain an absolute dollar amount. Prospective work-life labour income of a 25-year-old Indigenous female with less than Year 12 education could be as low as one-tenth of that of an average 25-year-old Australian male with a certificate or higher level of education. The former is the most disadvantaged and the latter the least disadvantaged subgroup considered in this modelling. The modelling suggests that depending on educational qualifications, work-life labour income of Indigenous Australians is likely to be just over two-fifth to about two-third of work-life labour income of average Australians. Bridging the gap in adult mortality pattern would narrow the work-life income gap marginally by about four to seven percentage points. The increase in work-life income of Indigenous Australians noted in this modelling is a result of better survival rather than better earning per se.

In short, the results supports the prevailing knowledge that males are better off than females, more educated are better off than less educated, and Indigenous are worse off than average Australians in terms of lifetime economic prospects. The findings are broadly in agreement with previous studies, such as Biddle (2007), that predicted the lifetime prospect of Indigenous and non-Indigenous Australians but the magnitude of the gaps may not necessarily be identical because of the differences in data and methods applied.

This study offered a lifetime perspective by bringing age-specific mortality, employment, and income patterns together. Taking mortality into account was important as it is substantially different between Indigenous and non-Indigenous Australians, and between males and females. A limitation, however, is that mortality rates are not adjusted by educational status owing to lack of data. They are likely to be different for people in different educational categories, as is the case in the United States, for example (Meara, Richards and Cutler 2008). Future studies should attempt to adjust age-specific adult mortality by educational level and the most likely outcome from doing this would widen the earning gaps observed here.

The findings of this study highlight the importance of education as a foundation for greater employment and income prospect over the lifetime. Previous studies that looked at lifetime earnings have established that educational differences in earnings tend to be large (Day and Newburger 2002; Nepal et al 2008; Wei 2001). This study suggests that while Indigenous people are likely to have a bleaker prospect compared to other Australians within the same educational and gender category, a higher level of education boosts relative economic prospect of Indigenous people. As an example, we found in this study that lifetime

employment and income prospects of Indigenous females with certificate or more education are likely to be better than that of average Australian females with less than Year 12 education. The findings support the previous literature on the positive contribution of education (Daly 1995; Junankar and Liu 2003).

These estimates are synthetic and they are not meant to measure causality. They suggest what may happen if the current age-specific patterns of mortality, employment, and earnings prevail in the future. Changes in these factors in the future are likely to alter the relative positions and gaps in economic outcomes of various segments of the Indigenous Australians and Australians in general. It has been suggested that employment of Indigenous Australians has not improved in the recent past and it is likely to worsen in the future (Hunter, Kinfu and Taylor 2003). This may only widen the gaps in lifetime income prospects between Indigenous and average Australians.

The value of the study could have been enhanced if the analysis had compared Indigenous with non-Indigenous rather than with all Australians which included Indigenous persons. This could not be done as life tables were unavailable for non-Indigenous. Yet the results for Australians in general can broadly be ascribed to non-Indigenous because almost 98 per cent of Australians are non-Indigenous (ABS 2007a).

The contribution of the study may also have been broadened by breaking down 'certificate or higher education' category. This was considered at the planning stage but it was soon realised to be inappropriate as there was a small number of Indigenous people, especially, Indigenous females, who had this level of education. Likewise, subnational estimates would enrich the study, as employment, income, and life expectancy vary across Australia (ABS 2009; Biddle and Taylor 2009; Halchuk 2006). This would be a basis for further work but it should also be noted that disaggregation to smaller geographic units increases noise and problems of small numbers.

Despite a number of limitations, the findings of the study are expected to make a positive contribution to the current debate among academics as well as policy makers regarding the socio-economic gaps between Indigenous and other Australians (Altman et al 2008; Pholi, Black and Richards 2009). The importance of this issue cannot be understated, with overcoming Indigenous disadvantage now placed firmly at the centre of the Australian Government's reform agenda (Department of Families Housing Community Services and Indigenous Affairs 2009). As we show in this study, only bridging the gap in mortality, which is the central theme of the 'close the gap' campaign, would only bridge a small portion of the wide socio-economic gap. That is, closing the gap in lifetime labour income would need to address mortality as well as other gaps simultaneously. While we recognise that a multipronged approach is needed to address this complex issue, this study reinforces our belief that investment in the education of Indigenous Australians is a key course of action to help bridge the gap.

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Appendix Table 1 Estimated average annual income from full-time equivalent employment,
2006

		Male			Female	
	Certificate					
Age	or above	Year 12	Below Y12	Certificate or above	Year 12	Below Y12
Indigenous Australians						
15-19	16,199	17,607	16,354	17,180	16,359	14,136
20-24	31,875	26,807	25,681	28,453	24,676	21,807
25-29	38,239	34,084	29,591	35,553	31,564	22,959
30-34	44,098	38,574	32,411	40,163	33,028	27,090
35-39	45,702	41,218	33,762	40,752	34,038	27,956
40-44	46,332	43,909	34,166	41,138	31,585	28,283
45-49	47,220	42,677	34,484	42,547	37,610	29,260
50-54	48,051	48,462	34,563	43,676	38,939	29,314
55-59	46,964	39,265	33,784	39,745	34,482	29,220
60-64	40,434	45,257	32,740	39,036	35,042	31,049
All Australians						
15-19	21,087	21,266	19,387	21,378	19,441	17,503
20-24	40,875	32,769	32,668	36,716	31,119	28,544
25-29	53,784	44,341	39,823	48,300	40,868	32,703
30-34	62,361	52,028	43,607	56,768	40,938	34,235
35-39	70,268	57,770	46,517	59,148	43,587	35,030
40-44	70,547	60,102	46,855	57,380	38,557	35,664
45-49	72,363	58,083	48,275	58,907	46,358	37,778
50-54	73,545	60,615	47,684	60,540	44,895	37,959
55-59	69,006	58,700	45,866	57,180	34,176	38,528
60-64	66,436	54,112	44,521	53,149	23,068	35,017

Source: Derived from 2006 Census tables obtained on special request from ABS, Survey of
Income and Housing 2006, and Household Income and Labour Dynamics in Australia
Survey, Wave 6.