Narrower Health Inequalities in Australia:
Impacts Simulated Using a Dynamic Microsimulation Model*

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Abstract

This paper reports on an application of a dynamic microsimulation model which accounts – amongst many other variables - for the links between Australians' socioeconomic status and their health. The full model simulates individuals' life cycles over a 20 to 30 year period. Its base year data was developed using a 1 per cent unit record Census sample of the Australian population.

First the way health - proxied by mortality and disability status – has been modelled is described. The link between these two indicators reflects the fact that healthy people generally live longer than the disabled. Next the methodology used in constructing four types of socioeconomic status (SES) indicators is detailed and comparisons in outcomes across indicators are provided. An important finding is that the generally accepted conclusion that people in the lowest SES quintile have the worst health could only be replicated with one of the four indicators considered - the geographic area based SES index derived from the Census.

Finally, the paper reports on a simulation in which a hypothetical policy that reduces health inequalities is compared with a simulation with no policy change. In the former, the hypothetical policy is assumed to result in lifting the health status of all Australians to that of people in the most advantaged SES quintile - a quintile that is considered to indicate the upper bound of potential improvements. Policies of that kind could involve, for example, government initiatives that encouraged doctors to provide patients in poorer areas with recommendations on how to adopt healthier lifestyles. Such policies may be complemented by subsidies being offered for the activities/expenditures required to bring about the desired lifestyle changes (eg gym fees if the recommendation involved more physical exercise).

Key findings are that, if such a policy change were implemented, close to one million fewer Australians would be disabled, over 180,000 life years would be saved, health care costs would be A$3 billion lower and the government could save A$1 billion on the disability support pension.

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CONTENTS

1 Introduction

There has been growing interest internationally in health inequalities and the way they are linked to differences in socioeconomic status. In Australia one of the important questions raised in its National Health Performance Framework was whether health status – amongst other things - is 'the same for everyone'.

This paper reports on an application of a dynamic microsimulation model in which we estimate the health benefits – in terms of lower mortality and disability rates – of a situation in which the health of all Australians has been improved to match that of people in the most advantaged socioeconomic group. Related changes in health care and disability pension expenditures are also estimated (Section 6).

As with all modelling exercises, the findings reported are heavily influenced by the assumptions underlying the simulations. While in future many similar simulations could be carried out under different assumptions, the purpose of this paper is to illustrate the much greater complexities that use of a dynamic microsimulation model can bring to analyses of health inequalities than what has been possible with traditional methods.

The application in this paper illustrates the types of analyses that are possible after completion of the first stage of a broader project (described in Sections 2 and 3).

2 The dynamic microsimulation model

The dynamic microsimulation model – DYNAMOD[1] - to which a health_SES module has been added is a model able to project the entire Australian population forward. In the application reported in this paper the model simulates individuals' life cycles between 1986 and 2020, with results reported in 1998 – the year for which model results can be compared with official statistics – and a date 20 years later, that is 2018.

The model is based on a 1 per cent representative sample of the Australian population (150,000 persons) extracted by the Australian Bureau of Statistics (ABS)

[1] The basic modules constructed during the initial stage of DYNAMOD's development are described in Antcliff et al (1996). King et al (1999a) provide an overview of stage 2 of DYNAMOD's development, with details in Abello et al (2002), Bækgaard (2002 a and b), King et al (2002), King et al (1999b) and Robinson et al (2002). Stage 3 is described in Kelly (2002).

from its 1986 Census.[2] It was developed over the past decade by the National Centre for Social and Economic Modelling, University of Canberra.

The simulations account for future events occurring in the lives of persons' in the model's Base population - such as couple formation, birth of a child, education, leaving home, migration, divorce, being employed, income from work and government, wealth accumulation, becoming disabled, recovering from disability and death.

In the version used in this paper an indicator of socioeconomic status has been added to the original model. This SES measure was developed so that the two health status indicators already in the model – mortality and disability[3] – could be differentiated by socioeconomic status. Thus now the mortality and disability statistics in the input data to DYNAMOD - Walker (2002) - reflect the well known pattern of poor Australians becoming disabled and dying at younger ages than better off Australians.

Further development is planned in which the current (0,1) disability variable will be extended to also indicate progression of the diseases causing disability - with various stages of severity. However, in this paper the model used retains the (0,1) characteristic for disability.[4]

3 Indicators of health status

In this paper we are using disability and mortality as indicators of health status. In the literature mortality is probably the most commonly used such indicator. Because in many instances mortality is a result of years lived with one or more chronic diseases - which gradually progress from none to mild and then severe disability - we also considered disability as an indicator of health status. Clearly, disability will

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[2] With the complete 1 per cent sample the weight for each DYNAMOD person - when estimating total population results - would be 100. However, because some records had been deleted in the model's Base dataset – eg in cases of 'non-response' – the weight attached to each person in the model is 103.

[3] In recognition of the strong links between disability (which mainly arises from disabling chronic illnesses) and mortality, these two variables are linked in DYNAMOD through a complex set of equations – see Walker (2002).

[4] Once severity of disability is also modelled, it will be possible to simulate the time people will choose to quit the workforce – or in old age give up independent living and move to a nursing home. It will then be possible to estimate the financial consequences for individuals and governments of such 'exits' – ie from the workforce and from independent living arrangements.

have a considerable impact not only on people's quality of life, but also on their financial situation and on whether they receive government benefits.

In Australia's statistical collections disability is defined as a limitation, restriction or impairment which has lasted - or is likely to last - for at least six months and restricts every day 'core activities'. These core activities are grouped under the headings of communication, mobility and self care (ABS 1999b, p.66-7). In 1998, 78 per cent of people with a severe or profound core activity restriction had a physical disorder as their main disabling condition (ABS 1999c, p.7).

It is worth noting that, in every day life, even a mild disability will have a highly restricting effect on a person's functionality. Examples of mild disability are an inability to easily walk 200 metres, walk up and down stairs without a handrail, or use public transport.

As an additional development, we intend in future to disaggregate disability in the model into its stages of severity – starting with no impact on everyday life, through having a mild impact and finally a severe disabling impact. We then intend to link severity of disability to individual's ability to obtain or maintain a job or, in older age, to continue to live independently.

4 Modelling socioeconomic status

The most commonly used indicators of SES internationally are the geographically based indicators of socioeconomic advantage or disadvantage. In Australia these are produced by the Australian Bureau of Statistics (ABS) as part of its population Censuses. They are the Socio-economic Indexes for Areas (SEIFA), with the index of relative socioeconomic disadvantage being the most commonly used. The ABS often attaches these indicators to respondents in its surveys – such as its 1998 Disability survey (ABS 1999a).

Some have questioned the wisdom of researchers relying uniquely on SEIFA indexes (McCracken, 2001), while others have endeavoured to construct more appropriate and/or accurate indicators (see this paper and Thurecht et al 2002).

In this paper we have endeavoured to compare several SES indicators that could be constructed from available data, and made some conclusions about the strengths and weaknesses of each.

4.1 SES indicators used to construct the enhanced model's input data

The way the input datasets on mortality and disability have been modified to account for SES differences in DYNAMOD has been described elsewhere (Walker 2002 and 2001b). Brief summaries are provided below.

Mortality

For mortality by SES there was only one generally available data source: the SEIFA indicator produced by the ABS. Because they are based on a generally collected statistic - the last residential address of the deceased - SEIFA type indicators are commonly used internationally in studies of mortality. Other SES measures cannot in general be constructed because of lack of the required data.

In the original model the disability (and mortality) related input variables were only disaggregated by age and gender. While nearly all of these were based on official statistics, one variable in the original model, the recovery rate from disability, had to be created due to lack of published data. When adding a socio-economic dimension to DYNAMOD, we only slightly modified these original values [5]

Disability

For disability a range of SES related indicators were available from the ABS's 1998 Disability survey (1999b) – such as SEIFA (socioeconomic disadvantage), family income or equivalent family income. This latter is defined in Appendices A and B). However, for sake of consistency with the way SES had been accounted for mortality, the same SEIFA indicator was chosen for disability as for mortality.

It is worth considering the differences that could have been expected if either the 'family income' or the 'equivalent family income' had been chosen instead of the SEIFA. These differences are illustrated in Appendix C, Figure C.1. The first striking feature of this Figure is that it shows little variation in the age distribution of the population across SEIFA quintiles. For example, 0-14 year olds account for some 20 per cent of people *in each SEIFA quintile*; 15-54 year olds for close to 15 per cent; and people aged 55 years or more for between 4 and 12 per cent in each SEIFA quintile.

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[5] 'Recovery from disability' data embedded in the original input data is described in (Antcliff et al 1996, p. 115). Because of lack of actual statistics on recovery rates, to account for SES in the enhanced model, we adjusted the original estimates in the following way: recovery from disability for SES quintile 3 was assumed to be the same as in the original data; for quintiles 4 and 5 we adopted 5 and 10% higher rates; for quintiles 1 and 2 we adopted 5 and 10% lower rates.

This is expected, because with the SEIFA *all persons* residing in a particular geographic area (such as a particular 'postcode') will be allocated the same SEIFA quintile – thus eliminating any actual SES related variation amongst the inhabitants of that area.

Second, much greater variability is shown in the charts of Figure C.1 where SES is indicated by 'Family income' or 'Equivalent family income'. In particular, with these SES categories considerably higher proportions of older people are allocated to quintiles 1 and 2, with very few persons in the 65+ age group being allocated to the two top SES groups (quintiles 4 and 5). This is consistent with a well known pattern in Australia - ie that once people retire their cash incomes are likely to decline considerably. Thus, with SES indicators based on income alone, retired people will be classed as 'poor', although their wealth may be considerable. While the SEIFA is takes account of wealth to some extent, wealth is not considered at all with the other two SES indicators.

Third, with the income-based indicators there are considerably higher proportions of 35 to 54 year olds in quintiles 4 and 5 (around 20 per cent) than when the SEIFA is used (around 15 per cent). These people are often referred to as DINKS ('double-income-no-kids') – that is couple families without children with both partners working. ABS surveys regularly show DINKS to be in the most advantaged SES groupings.

Finally, once family size is also taken into account – ie with the Equivalent family income indicator – striking features are the very high proportion of children in quintile 2 (nearly 30 per cent), and their much reduced proportion in quintile 5 (where now the DINKS dominate). There are also higher proportions of 35-44 year olds in quintile 2 (than with the Income-based indicator), many of whom are the parents of the children in that quintile. These families, with a relatively high number of children, are the so-called 'working poor' – that is families with parents who have low levels of educations and who often need to take on several low paid jobs to make ends meet.

A priori, we expect that such 'downward shifts' of the generally healthier children and their younger adult parents will have the effect of showing an improvement in the health of the quintile 2 group relative to the indicators that do not account for family size. Also, for reasons given later (Section 4.3), the 'Equivalent family income' indicator is considered to be closer to the ideal SES measure than the other two indicators. However, even that indicator could be considerably improved if it also took account of the wealth that families – and especially older people - possessed.

Emerging patterns

The SEIFA based patterns emerging from the enhanced model's input data for mortality and disability (Walker 2002 and 2001a and b) display the familiar

characteristics reported by most researchers using SEIFA type indicators with virtually any health-based dataset - see for example Mathers, Vos and Stevenson (1999, p.39) , Thurecht et al (2001, p.17) and Figure 1 below. That is, a near linear gradient with a negative slope becomes apparent when moving from the most disadvantaged group toward the least disadvantaged group.

4.2 Adding SES indicators to the model's Base dataset

Because simulations in DYNAMOD start in 1986, with a number of key variables - such as disability status, expected date of death and wealth accumulation - only being handled in the simulation phase, at first sight it seemed that it may not be necessary to model SES status within the model's Base dataset. However, after examining the model's output it became apparent that because 'date of death' and the 'periods of disability' were allocated in the model using survival functions *prior* to the start of the simulations[6] – for many individuals in the model's Base population the initially estimated 'date of death' and 'periods of disability' still prevailed in 1998 and in later years. Because of this, it was important to impute SES to DYNAMOD's Base population (in addition to accounting for it in the simulation phase).

To impute SES status to each individual in the Base dataset we first computed an indicator of SES status using two variables already in that dataset: total income and superannuation (ie the only indicator of wealth in that dataset):

SES_status = yearly income + annualised super[7]

Next we summed individuals' SES_status indicator up within each family and allocated that summed value to each family member. Then we sorted the Base population by SES_status and divided that population into five equal parts – thus creating the variable 'SES quintile' into which families belonged.

There was also a need to re-impute disability status to each individual in the model's Base dataset. This was necessary because in the original Base data disability has only been allocated by age and gender and we now required an allocation by SES as well. In addition, we used the 1998 Disability survey as the basis of this imputation, while in the original Base data the imputations were based on the 1993 Disability survey. We also incorporated a scaling factor which was chosen so that the distribution of

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6 These variables are only handled again in the simulation phase for those individuals for whom a change in disability status is indicated. In such cases the date of the death is also changed in line with the higher mortality rates indicated for the disabled in the input dataset.

7 We used a constant, 0.052, to convert lump sum values for superannuation into an annuity. The value of 0.052 has been chosen to match the constant used in the corresponding equation in the simulation phase of the model (see Section 4.3).

disability in the model's output for 1998 - by age, gender and SES - closely matched the same distribution in the ABS's 1998 Disability survey (that is the data source used for re-basing the model's input data for disability – see Section 4.1).

4.3 SES indicators in the simulation phase of the model

Because of the wide range of variables available in DYNAMOD, the choice of possible SES indicators for the simulation phase were much greater than for construction of the input mortality and disability data. In particular, a comprehensive indicator of family wealth is available in DYNAMOD (accumulated over people's life courses – Kelly, 2002).

Ideally, an indicator of socioeconomic status would account for families' incomes, wealth and size.

Income is generally strongly related to educational levels and to having a job in a related occupation (eg a person who completed medical studies is likely to have a job as a general practitioner or a specialist). The literature on this issue indicates that out of the many possible indicators of SES, income is the single most effective summary measure (Walker and Abello , 2000, Section 2.4).[8]

Wealth is also important because as people age, many accumulate wealth. Thus, although Australians' cash incomes are likely to decline considerably once they leave the workforce, their SES may not decline commensurately since many will have considerable wealth (often in the form of expensive houses, cars and various forms of investments) – Kelly (2002). As noted earlier, amongst the three indicators readily available from the ABS's 1998 Disability survey – SEIFA, family income and equivalent family income - only the SEIFA index accounts to some extent for families' wealth.

Finally the *size of the family* under consideration will be important, since what a family of one earning A$50,000 a year can afford, per family member, will be considerably more than what a family of five with the same income will have per family member. In other words, individuals' *living standards* will be dependent on the number of persons in their families (Saunders (1996, pp 115-8). The equivalent family income measure is the one that takes account of family size. In this paper 'equivalent family income' was computed using the modified OECD scale – with the

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[8] For example, DHAC (1999, p. 6) reported that international studies found that most of the variation in life expectancy could be related to differences in income distribution. Also, Vinson (1999, p.6) reported on a UK study which concluded - based on examination of a range of indicators of social deprivation - that family income was a good single 'proxy' indicating disadvantage.

equivalence scale factors being the sum of 1.0 for the first adult, 0.5 for the second adult and 0.3 for each dependent child. Details are in Appendix B.

Based on the above, an SES measure that would be close to the *ideal* would be one that was a function of yearly 'equivalent family income' as well as an annualised indicator of wealth.

Three different SES indicators were constructed within the simulation part of the model, each computed at the end of the relevant financial year:

> Income_Wealth = Family income (earned + government benefits) + annualised wealth; [9]
>
> Income = Family income (earned + government benefits);
>
> Equivalent Income_Wealth = Equivalent family income (earned + government benefits) + annualised wealth.

We chose these three SES indicators for a number of reasons. First, the Income_Wealth indicator was chosen because it was closest to the SEIFA index used to construct the model's input mortality and disability datasets (Section 4.1). Thus, simulations using the Income_Wealth indicator will be the most coherent – and thus most credible – ones presented in this paper. Second, the Income indicator was chosen because it is often used in the literature (usually in cases where lack of complex data is an issue). Third, the Equivalent Income_Wealth indicator was chosen because it is considered to be the *most appropriate* indicator for comparing living standards (Appendix B) and it also accounts for wealth. Equivalent income indicators[10] are also the most commonly used SES measures in socioeconomic studies (eg Saunders 1996, Walker and Abello 2000), with equivalent income deciles being often available in ABS statistical collections.

5 Calibrating the model – mortality and disability by socioeconomic status

DYNAMOD has been calibrated in a number of respects by earlier researches – see Footnote 1. In this Section we describe calibration of the new work comparing simulated mortality and disability results for 1998 with published statistics for the same year.

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[9] We used a constant of 0.052 - the observed 5.2% rate of return on renting private homes - to convert total wealth into an annuity. This was because most of the wealth of Australians has been shown to arise from ownership of their homes (Kelly 2002).

[10] Without considering wealth, generally due to lack of suitable data.

5.1 Mortality

In 1998 there were 127,202 deaths registered in a total population of 19,707,500 (ABS 1999d, p.5). This was equivalent to a nationwide mortality rate of 0.65 per cent. The number of deaths in the model's input data is very similar (127,293 deaths a year over three years: 1995 to 1997).

Since in 1998 the simulated mortality rate in DYNAMOD was 0.66 per cent, it can be concluded that the model's results match quite well the official statistics available for that year.

5.2 Disability

The imputed disability status to the model's Base data was scaled so that the simulated outcomes for 1998 matched the patterns in the 1998 ABS survey reasonably closely at the SES quintile and broad age groups levels. This was achieved through use of single scaling factor of 0.7. [11]

ABS data (1999c) indicates that in 1998 there were 3.61 million disabled persons in Australia, accounting for 19.3 per cent of the Australian population. By comparison, the number of disabled simulated in DYNAMOD for 1998 was 3.67 million accounting for 19.3 per cent of the model's population. Once again, this suggests that the model results match quite well the actual data available for that year.

Figure 1 illustrates the quite close match between the 1998 Disability survey patterns by SEIFA quintile and DYNAMOD simulations for the same year using the Income_Wealth SES indicator. The Figure also illustrates the near linear downward gradient implied when using the SEIFA (mentioned in Section 4.1.

Looking at the 1998 component of Figure 2 (Section 6.4) it is clear that, overall, the Income_Wealth indicator provides a closer pattern to that of the SEIFA than either of the other two indicators considered. This is expected because the SEIFA accounts for family income, for certain items of wealth (such as the average value of homes in the area),[12] and it does not take account of family size.

There was also a need to calibrate for the observed rise in the overall disability rate from 15 per cent in 1981 to 18 per cent in 1993, and to 19 per cent in 1998 (ABS 1999c,

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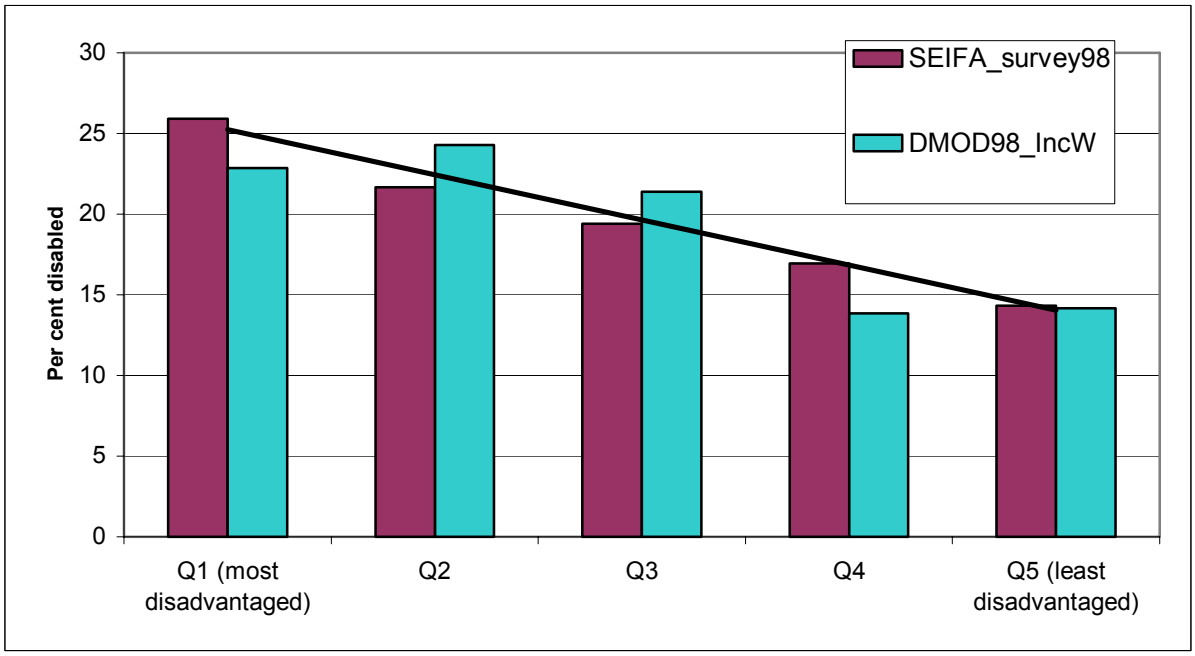
[11] An improved match could be achieved by using different scaling factors for different quintiles and/or age groups.

[12] The detailed imputations of wealth in DYNAMOD show that the value of a family's home makes up a high proportion of that family's wealth – Kelly (2002).

p.6). The ABS noted that the greater part of the increase between 1993 and 1998 was for people with severe and profound restrictions.

Figure 1: **Proportions disabled, ABS survey and DYNAMOD, Income_Wealth indicator, Base case, 1998**



Source: ABS Disability survey, 1998 and DYNAMOD simulations

This suggests that improved medical technology had the effect of keeping disabled people alive longer. This is in line with the conclusion of Davis et al (2002) – gained through a study across four ABS Disability surveys – that "two thirds or more of the increase in life expectancy over the decade 1988 to 1998 is taken in a state of disability" - Davis et al (2002, p. 1).

The rise in the overall disability rate from 18.02 per cent in 1993 to 19.30 per cent in 1998 suggests that in DYNAMOD simulations we should allow for an increase of 1.28 per cent in the disability rate over each five year period. However, there are reasons why a 1.28 per cent figure may be too high. For example:

- surveys tend not to be strictly comparable across time;
- there is now greater diagnosis and people are more open about self-reporting on disability issues (ABS 2001, p.iv); and
- the just released 2001 National Health Survey by the ABS indicates that the upward trend in the proportion of people with chronic diseases (and related disabilities) may have slowed considerably (Walker et al 2003).

For these and other reasons, in the simulations we chose a lower rate of increase: that is 1 per cent every 5 years.

6 Simulating a narrowing in health inequalities

6.1 Assumptions

All the assumptions made in DYNAMOD as 'default' prior to the adding the SES component apply to the simulations reported in this paper. These assumptions are detailed in the numerous papers documenting the model - see Section 2, Footnote 1. The main assumptions of relevance to the application reported in this paper are that earned income and government transfers are projected over time in constant dollars, allowing for a 1 per cent per annum real growth in these variables. Wealth is then estimated in the model on the basis of variables such as household savings rates - with growth rates three to four times that of total incomes (Kelly 2002).

The key assumptions made within the newly added SES components are that:

- the mortality and disability rates embedded in the model's input dataset remain unchanged over the simulation period; and
- the nationwide disability rate rises in the simulations by 1 per cent every 5 years (Section 5.2).

As with most 'default' settings, the assumptions can be changed if necessary> however, such changes would require additional programming and a re-specification of the model's alignment processes.

There are other less important assumptions. These are mentioned in other Sections of the paper.

6.2 Base Case and Scenario

In the application reported below we compare mortality and disability rates under a Base or 'Do nothing' simulation with corresponding rates under an illustrative Scenario.

For both the Base case and the Scenario simulations, we imputed SES using the Income_Wealth indicator. The reason for choosing that indicator is that it produced outputs that were closest to those obtained using the SEIFA indicator (Sections 4.3 and 5.2).

Since DYNAMOD's Base population is based on a 1 per cent sample of Australia's population, the number of deaths projected by the model will be relatively small. Because about 5 per cent of the population die each year compared with some 20 to 25 per cent being disabled, the model's mortality estimates will be less reliable than its disability estimates. In particular, the projected mortality rates for younger age

groups – which have relatively low death rates - should be interpreted with caution.[13]

We chose a 20-year time horizon for the simulations. Results will be reported for 1998 and for 2018.

Base Case

The Base case concerns simulations in which all the model's 'default' parameters remain unchanged throughout the simulation period. The Base case is sometimes called the 'Do nothing' case, because it assumes that past trends will continue and that there will be no changes in policies.

Scenario

The Scenario evaluated in this paper is one in which all Australians are assumed to have the same mortality and disability rates as people in the least disadvantaged SES quintile (ie quintile 5). There is Australian and international evidence that Quintile 5 can be considered to be an upper bound of potential health improvements (Hayen et al, 2002).[14] Analyses using a similar scenario, using mortality as an indicator of health, is reported in the literature (eg Turrell and Mathers 2000) - Section 7.

Policies to bring this Scenario about could involve, for example, government initiatives that encouraged doctors to provide patients in lower SES groups with recommendations on how to adopt healthier lifestyles. Such policies may be complemented by subsidies being offered for the activities/expenditures required to bring about the desired lifestyle changes (eg gym fees if the recommendation involved more physical exercise).

Results under the Scenario will be compared with the Base case. To facilitate comparisons with earlier studies, we will make use of Deferred Mortality (and Deferred Disability) indicators. These show the per cent of deaths (or disability) that would be deferred in a particular year if the Scenario had been implemented.

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[13] For example, for the 15-24 year age group the model estimated only 6 deaths in 2018 (equivalent to 618 persons, when weighted).

[14] Hayen et al (2002, p. 228) found that primary prevention strategies implemented in New South Wales had led to much greater health benefits in the most advantaged SES group – in terms of less cancers, heart disease, etc – than in the rest of the population. They also referred to similar evidence internationally.

6.3 Impact on mortality

The number of deaths simulated for 1998 and 2018 in the Base case and the Scenario are presented in Table 1. From these statistics we computed 'deferred mortality' estimates - defined as the per cent of deaths that would have been deferred if the Scenario had been implemented.

Although not reported in the Table, it is worth noting that close to 70 per cent of all deaths were estimated to occur within the 75+ age group. This is as would be expected, given that average life expectancies for both men and women are above age 75. [15]

Table 1 shows that, in 1998, 5 per cent of deaths (5,500) could have been deferred under the Scenario compared with the Base case.

Table 1: **Deferred mortality* by age using the Income_Wealth indicator of SES, 1998 and 2018**

	Base Case No of deaths** a	**Scenario** No of deaths** b	**Deferred deaths*** Per cent 100*(a-b)/a
		1998	
0-14	2900	2300	21
15-34	3400	3100	9
35-64	11500	6400	44
65_74	24100	21200	12
75+	77500	80900	-4
ALL ages	119400	113900	5
		2018	
0-14	2100	1600	24
15-34	2500	1600	36
35-64	13200	9800	26
65_74	37600	31300	17
75+	127900	124100	3
ALL ages	183300	168400	8

* Per cent of deaths that would have been deferred if the Scenario had been implemented – that is if all quintiles had the same mortality rate as the highest socioeconomic group.

** Estimated in DYNAMOD, weighted (weight = 103)

[15] Based on life expectancies at birth which, in 2000, were 77 years for men and 82 years for women – Dunn et al (2002, p.8).

Under the Base case these 5,500 deaths can be seen as 'premature deaths'[16]– that is avoidable deaths that occur before 75 years of age (Dunn et al 2002, p.xiv; Hayen et al). In 2018 premature mortality was estimated at 8 per cent – that is, 13,900 fewer persons would have died had the Scenario been implemented. Because we assumed that the patterns of mortality rates in 1998 – by age, sex and SES - would continue throughout the simulation period, differences between the 1998 and 2018 number of deaths in Table 1 arise from one source only: population ageing.

Assumed that all who have been 'saved' under the Scenario would live to age 75, we estimated 'years of life saved' under the Scenario by taking the difference between age 75 and the mid-point of the 10 year age group to which the individuals who would have died under the Base case belonged, and multiplying this difference by the estimated number of lives saved under the Scenario. The 'years of life saved' estimates were 183,300 and 185,000 for 1998 and 2018 respectively (Table 2).

Finding relatively similar numbers of 'years of life saved' under the Scenario in 1998 and in 2018 may be surprising, given that in 2018 many more people were simulated to die than in 1998 (Table 1). The reason for the Table 2 results is that, in 2018, considerably fewer young people died (with potentially very high 'years of life saved' per person) and many more older people died (with potential for only a few 'years of life saved' per person). In essence, in 2018 the lower number of 'years of life saved' arising from fewer young people dying virtually offset the higher 'years of life saved' arising from more older people dying than in 1998.

Table 2: **Years of lives saved**

	Base Case** Premature deaths* (No) ***a***	**Scenario**** Premature deaths* (No) ***b***	**Number of lives saved** ***a-b***	**Years of lives saved#**
1998	41,900	33,000	8,900	183,300
2018	55,400	44,300	11,100	185,000

* Premature deaths were deaths occurring below the age of 75.
#Years of lives saved were estimated at the mid-point of 10-year age groups after the first 0-14 group.
**Estimated in DYNAMOD, using the Income_Wealth SES indicator. Weighted (weight = 103)

16 Dunnet al (2002, p, 11 notes that this 'premature deaths' indicator "can be used as a measure of the cost of mortality to a population"`.

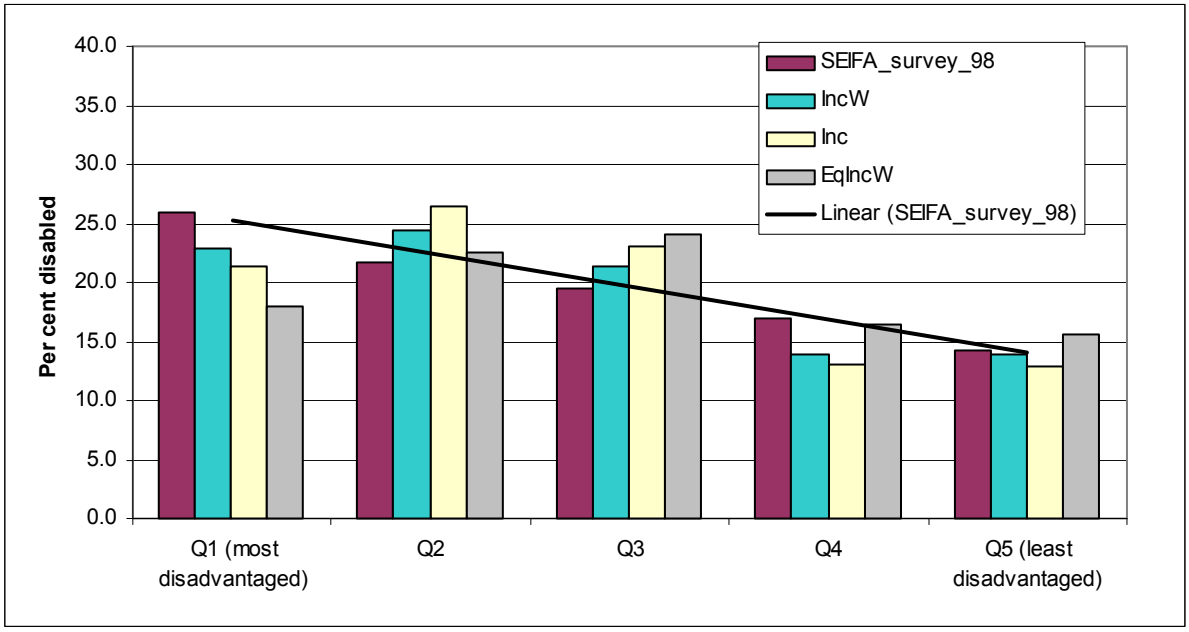
6.4 Impact on the disabled

Proportion disabled by type of SES indicator

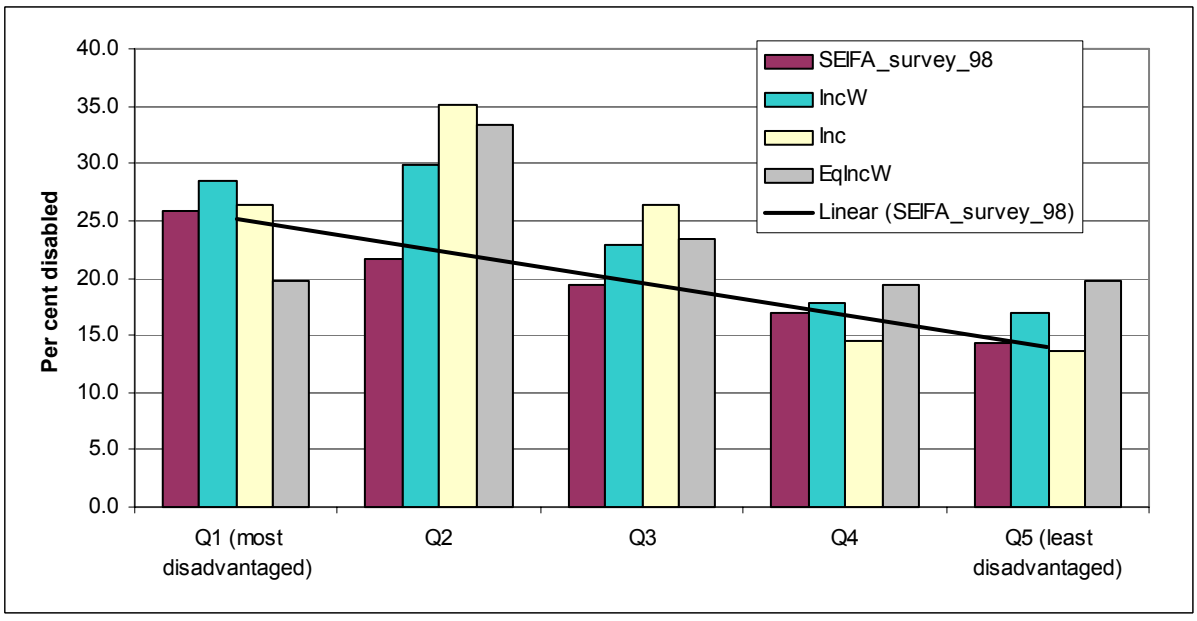
Figure 2 allows examination, under the Base case, of the impact of using different SES indicators on the distribution of the disabled across SES quintiles.

Figure 2: **Proportion of population disabled by type of SES indicator, Base Case**

1998



2018



Source: DYNAMOD simulations

As expected, Figure 2 shows that the Income_Wealth indicator produces results that are closest to those obtained with the SEIFA index (Section 4.1). Of particular interest is the finding that the familiar near linear negative gradient produced by the SEIFA no longer holds with the other SES indicators. While in 1998 the proportion of disabled is highest in quintile 1 with the SEIFA, with the other SES indicators the highest proportion is either in quintile 2 or in quintile 3.

Probably the most unexpected result is that, with the Equivalent Income_Wealth indicator, the middle quintile has the highest proportion of disabled. With this indicator the conclusion is that the 40 per cent most disadvantaged Australians (quintiles 1 and 2) have better health than the middle 20 per cent of the population (quintile 3) - a finding different from the familiar 'the poor have the worse health' conclusion in the literature (generally using the SEIFA) .

What is the reason for this apparent reversal of previous findings? The answer is that, by changing the way SES is defined, people of different ages have shifted from one quintile to another.

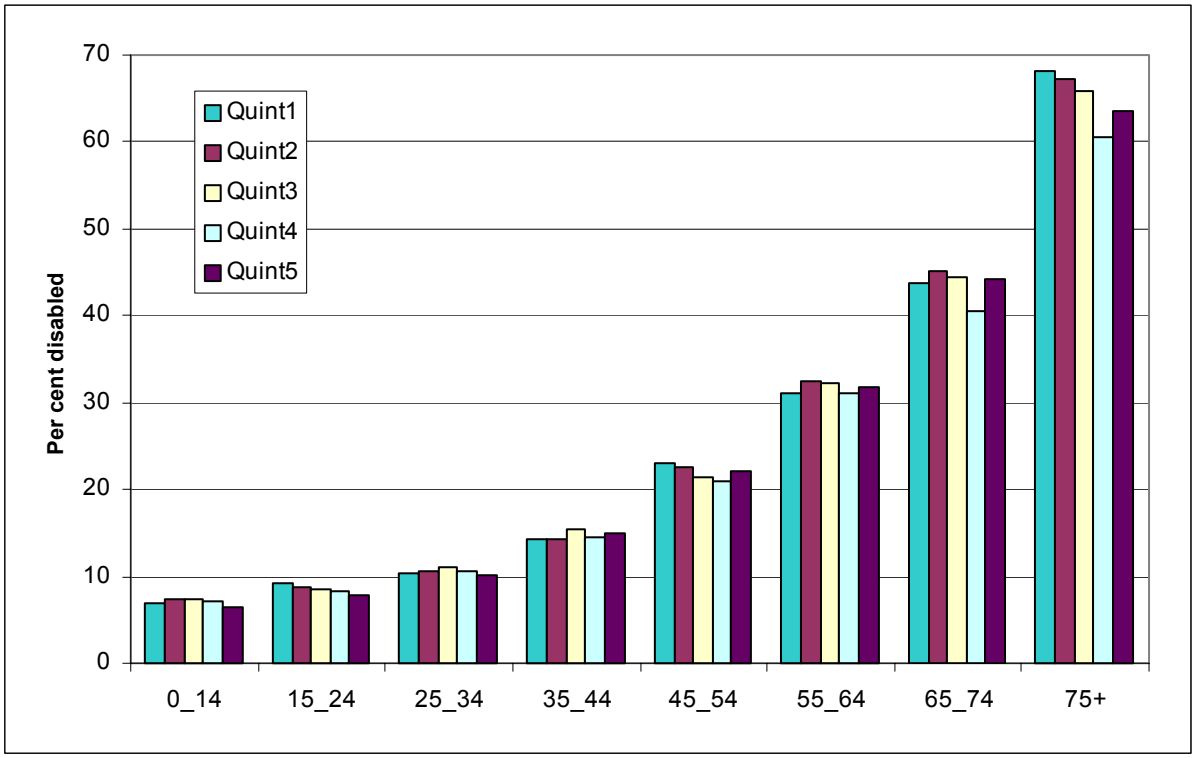
The obvious shifts are the couples with and without children who are classified under the 'equivalent' SES measure into a lower quintile than before (mainly quintiles 1 and 2). This means that, with the 'equivalent' measure, there will be a higher proportion of younger – and healthier - people in the lower quintiles than with the other SES indicators, and a higher proportion of *single* older – and less healthy – people in quintiles 3, 4 and 5. For example, in 1998, persons aged 75+ accounted for over 12 per cent of quintile 3 with the 'equivalent' SES measure, compared with only 7 per cent with the Income_Wealth indicator (Tables D.2 and D.5). Hence the unexpected pattern for the 'equivalent' indicator in Figure 2 for 1998.

The other initially surprising finding is that this 1998 pattern with the 'equivalent' indicator no longer holds 20 years later. In 2018, a very much higher proportion of the disabled are in quintile 2 than in any of the other quintiles. This pattern is explained by the significant ageing of the population that occurred during the 20 year study period, combined with a 7 per cent decline in the average size of Australian families (Table E.3). Part of the reason for the decline in average family size is the higher proportion of *single* person families in 2018 than in 1998. On the 2018 chart of Figure 2 this manifests itself in more older people being in quintiles 4 and 5 – with associated increases in the proportion disabled – and fewer people shifting to quintile 3 when the 'equivalent' SES measure is used.

As a result of population ageing, in 2018 there are considerably fewer younger people in the 'equivalent' quintile 2 (16 per cent compared with 22 per cent in 1998) and more older people in that quintile (18 per cent compared with 11 per cent for the 65 to 74 age group, and 20 per cent compared with 9 per cent for the 75+ age group) – Tables D.5 and D.6. For the same reasons, the considerably higher proportion of disabled in quintile 2 in 2018 is evident with all the other simulated SES indicators as well.

An important conclusion to be drawn from the above is that the pattern and extent of health inequalities depends to a considerable extent on the way the SES indicator used distributes people of various ages across the related SES quintiles. While *within age groups* there is in general quite a slight pattern of declining health (Figure 3), when we consider the proportion of disabled by SES *quintiles* the strong impact of age on health tends to dominate.

Figure 3: **Proportion of disabled by age and SES, Income_Wealth indicator, Base case, 1998**



Source: DYNAMOD simulations

Numbers disabled: Base case and Scenario

In Table 3 we computed 'deferred disability' as the proportion of Base case disabled people who were no longer simulated to be disabled under the Scenario. The Table shows that, overall, there would be around 20 per cent fewer disabled persons under the Scenario than under the Base case.

The simulated differences are considerably greater for younger people than for older Australians and indicate, in part, later onset of disabling diseases under the Scenario

compared with the Base case. It is worth noting, however, that we are not as confident of the results for the 75+ group than for other age groups.[17]

Table 3: **Deferred disability* by age using the Income_Wealth indicator of SES, 1998 and 2018**

	Base Case No disabled** a	**Scenario** No disabled** b	**Deferred disability*** No disabled a-b	**Deferred disability*** Per cent 100*(a-b)/a
		1998		
0-14	264504	169847	94657	35.8
15-34	502228	345977	156251	31.1
35-64	1514821	1056883	457938	30.2
65_74	644265	551153	93112	14.5
75+	744381	712245	32136	4.3
ALL ages	3670199	2836105	834094	22.7
		2018		
0-14	267285	175512	91773	34.3
15-34	538484	331145	207339	38.5
35-64	2064532	1416662	647870	31.4
65_74	1072848	949042	123806	11.5
75+	1172346	1204997	-32651	-2.8
ALL ages	5115495	4077358	1038137	20.3

* Proportion of disabled people under the Base case for whom disability could be deferred under the Scenario – that is if all quintiles had the same disability rate as the highest socioeconomic group.
** Estimated in DYNAMOD, weighted (weight = 103)

Figure 4 compares the Base case and Scenario results by SES for 1998 and 2018. It illustrates the finding that disability rates in Australia would be significantly lower if the health of all Australians could be lifted to that of the most advantaged SES quintile (ie quintile 5). Figure 4 also illustrates the earlier finding in this Section that patterns of health by SES cannot be considered 'static'. Health inequalities observed at one point in time - and measured in a particular way - are likely to change considerably over time, as well as across different types of SES indicators.

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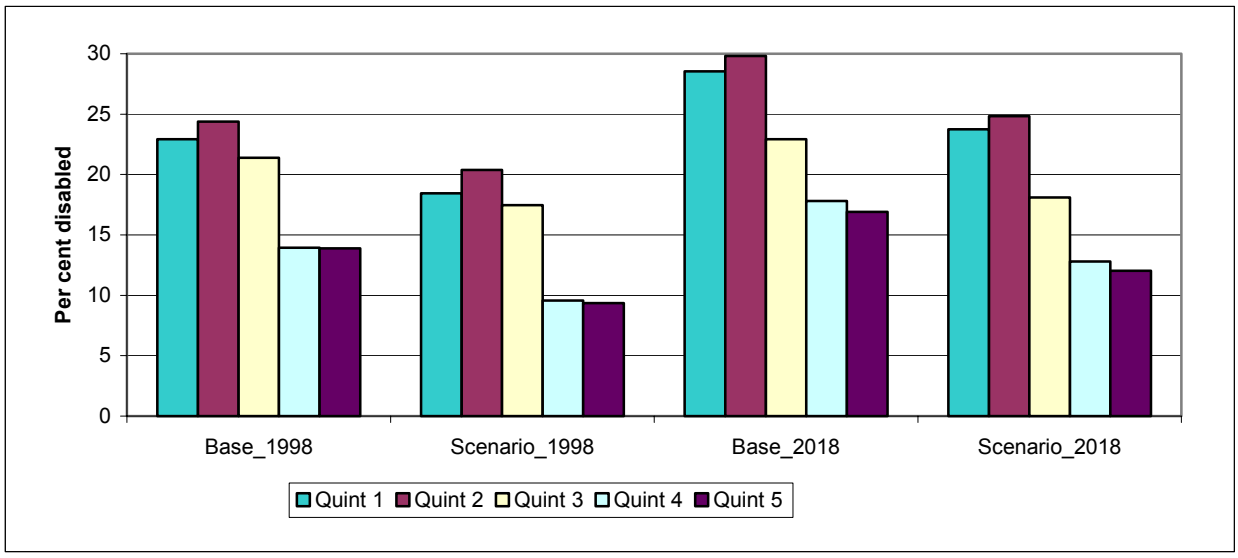
[17] This issue arises from the survey-based official statistics we used to construct the model's input data, Such surveys have relatively few observations for older age groups (especially the 75+ group). The model's input data has been 'smoothed' to arrive at estimates at the 'single years of age' level (for ages 0 to 104). Because of the sparsity of actual survey records for older age groups, the modifying effect of the smoothing process has been greater such groups than for younger people.

Figure 4: **Comparison of the proportion disabled under the Base Case and the Scenario with Income_Wealth indicator of SES, 1998 and 2018**



Source: DYNAMOD simulations.

6.5 Impact on expenditures for the disabled

Health care costs

Total health costs in Australia in 2000-01 were estimated at A$60.8 billion, with around 70 per cent of that having been funded by government. This was equivalent to A$3,153 per capita. (AIHW , 2002 pp. 5 and 13). While there are no estimates available for the costs of treating and caring for the disabled, such expenditures are likely to be significantly higher than the average health costs for *all* Australians – able bodied as well as disabled.[18] For purposes of this study, we assumed that the cost associated with disability in 1998 was A$3,153 per person on average. If at a later date more disaggregated cost data become available – eg health costs estimated

[18] Estimates available for the most expensive illness, cardiovascular disease (CVD), indicate that in 1993-94 the cost of CVD in Australia amounted to A$3.9 billion. This represented 12 per cent of total recurrent health expenditure (Mathers and Penm, 1999a, p. xii). ABS 1999c (Table 10) shows that, in 1998, 9 per cent of the disabled had diseases of the circulatory system as 'main disabling condition', with around half of these having as 'main condition' heart disease. The same source shows that the most common 'main disabling conditions' were diseases of the musculoskeletal system (mainly arthritis) . Total expenditures on musculoskeletal disorders were estimated to amount in 1993-94 to $3.0 billion (Mathers and Penm, 1999b, p. 18).

separately for the disabled - then it will be possible to arrive at more accurate cost estimates.

In 1998, 834,094 fewer Australian were estimated to be disabled under the Scenario than under the Base Case (Table 3). Thus, in that year implementation of the Scenario would have resulted in health cost savings of:

A$3,153 * 834,094 =A $2.63 billion

The corresponding estimate in 2018 – assuming constant 1998 prices - is:

A$3,153 * 1,038,137=A $3.27 billion

Disability support pension expenditures

Another government expenditure that may grow more slowly under the Scenario than under the Base case is the disability support pension. This pension provides income support to people with a disability who are unable to work full-time. Between 1980 and 2000, the number of disability support pension recipients nearly trebled (from 229,200 to 602,300). The reasons provided by ABS (2002) for these increases include more people living alone (thus can easier meet the related asset and income tests); improvements in mortality (ie people who would have died before are now kept alive disabled); ageing population; and increases in severe restriction rates amongst the disabled.

Although AIHW (2001) forecasts considerable future increases in the number of disabled Australians with a severe or profound restriction – the ones most likely to qualify for the disability support pension – in this paper our cost estimates will be based on the assumption adopted in the rest of the paper – that is that 'past trends will continue'. As a result, the findings below are likely to be underestimates.

In 2000, 602,300 people aged 15 years and over received a total of A$5.2 billion disability support pension - A$8634 per recipient that year. Assuming that in 1998 a similar number, 601,300 persons (ie 16% of the disabled), received a disability support pension, and that the same proportion (16%) would apply to the number of 'deferred disabled' in Table 3 (ie 834,094), then the costs saved in 1998 under the Scenario (through fewer disability support recipients) would be:

A$8,634 * 834,094 * 0.16 = A$1.15 billion.

The corresponding estimate for 2018 - assuming constant 1998 prices - is:

A$8,634 * 1,038,137 * 0.16 = A $1.43 billion

6.6 Estimated total benefits from implementation of the Scenario

Overall, we estimated that there would be around 180,000 life years saved each year if the Scenario were implemented.

In addition, the total savings in 1998 arising from implementation of the Scenario were estimated to be around A$ 2.6 billion a year from lower health care costs, and around A$ 1.2 billion a year from lower disability support pension expenditures – a total of around A$4 billion a year. In 2018, this total was estimated at around A$5 billion.

7 Comparisons with findings from earlier studies

It is interesting to compare the findings in this paper with those from earlier studies using SEIFA type indicators for SES and mortality as a proxy for health status. In this Section two earlier publications will be discussed. The first is an Australian study on socioeconomic inequalities in mortality (Turell and Mathers, 2000). The second is a British study entitled "Inequalities in life and death: what if Britain was more equal" (Mitchell, Shaw and Dorling, 2000). In the former mortality data were analysed for the same period, 1995-97, as the period used in constructing DYNAMOD's input mortality data. In the latter, the SEIFA type indicator - named 'social class' - was also Census and geographic area based, and was computed on the basis of variables such as income, wealth and occupation.

In both these publications only the population aged 0-64 years was considered. The Turell and Mathers study distinguished between three age groups: 0-14, 15-24 and 25-64. One of its key finding was that "If it were possible to reduce death rates .. to a level equivalent to that of the least disadvantaged area, premature all-cause mortality for males in each age group would be lower by 22%, 28% and 26% respectively, and for females, 35%, 70% and 56%." - Turell and Mathers (2000, p.238). In that paper 'excess' or 'premature' mortality was defined as the "per cent of deaths that would be avoided if all quintiles had the same mortality rate as Q1 (ie the highest socioeconomic status group)" – p.236.

When compared with our simulated 'deferred mortality' estimates for 1998 (Table 1), these findings seem somewhat high. Reasons for this may be that Turrell and Mathers used different population groups, or a somewhat different dataset from the one available for purposes of this study. For our study we used an extract from the data reported in Dunn et al (2002).

Mitchell et al (2000) focus more on the components underlying the differences in socio-economic status, such as wealth and lower incomes due to unemployment. Examples of their findings are that: 7597 lives could be saved (7% of all deaths under age 65) if wealth redistribution patterns in the UK were reduced to those of the early 1980s; or 92% of avoidable child deaths could be prevented in areas where the death

rates were higher than the national average if child poverty were eradicated; or 2504 lives could be saved through achievement of full employment.

The only finding that is at all comparable with those presented in this paper relate to child mortality. In Table 1 of this paper we reported that, in 1998, 600 deaths could have been avoided amongst children under 15 if the mortality rates for everyone in that age group had been reduced to that of children in the highest socioeconomic group (ie the Scenario). Because in Mitchell et al (2000) the comparison groups were the national average for mortality and 'poverty' for SES, their definition of 'avoidable deaths' was different from the definition of 'deferred death' adopted in this paper. Thus their conclusion that "92% of avoidable child deaths could be prevented in areas where the death rates were higher than the national average if child poverty were eradicated " can be broadly seen as being equivalent to our conclusion that a 100% of avoidable deaths could be deferred if all children aged 0-14 had the same mortality rate as children in the highest socioeconomic quintile.

A comment regarding the earlier studies referred to above - which is relevant to many studies of that kind - is that once mortality - as well as its precursor, disability - are to be investigated in combination, it is not sufficient to consider only part of the total population (ie the 0-64 age group). Indeed, since in 1998 close to 80 per cent of deaths occurred amongst the 65+ age group, the use of mortality as a 'proxy' for health in the 0-64 age subgroup will lead to significant underestimation of the benefits of narrower health inequalities.

One reason why studies may consider the 0-64 age group only is that the official statistics may not cover all ages and people residing at all locations. However, truncating analyses to accommodate the available data collections is likely to have the effect of official statistics continuing to be incomplete. In Australia, the majority of people die well above age 64 (Footnote 15) and often do so in an institution (eg hospital, nursing home) rather than their own homes.

In addition, the degenerative diseases that are the main causes of disabilities (and eventual deaths) have their onsets at ages well below 64. Thus, analyses of the kind reported in this paper need to be able to consider individuals' complete life courses. This will only be possible once official data collections cover full populations. With sample surveys, data for small sub-populations (such age groups above 75 years and people living institutions), tend to be unreliable when disaggregated by SES (and other relevant variables).

In this paper we have overcome to some extent the incomplete nature of the relevant statistical collections, since in microsimulation models different variables can be imputed from different data sources - and thus achieve complete (but synthetic) coverage of all relevant variables. However, imputation cannot be seen as an adequate response to the issue of 'incomplete data collections' in analyses of the effects of population ageing – especially now when further increases in life expectancies are expected due to progress in medical and pharmaceutical

technologies arising from recent 'breakthroughs' such as the mapping of the human genome (Brown et al, 2002).

8 Summary of key findings

In this paper we illustrated the considerably greater complexities that use of a dynamic microsimulation model could bring to analyses of health inequalities than what has been possible with traditional methods. While in most analyses reported in the literature mortality alone is used as 'proxy' for health status, in this study we considered both mortality and disability. We argued that disability was as important as mortality, because it affected people's quality of life; reduced the number of productive years they had; and had considerable implications for health expenditures by individuals and governments.

We addressed the issue - questioned in the literature – of the wisdom of researchers relying uniquely on officially computed geographically based indicators of socioeconomic status (SEIFA). In this paper we accounted for several types of SES indicators. These were simulated within the dynamic microsimulation model and compared with the SEIFA. One indicator was based on family income, another on a combination of family income and wealth, and a third on equivalent family income combined with wealth – the latter taking account of family size. Reasons were given as to why the SES indicator based on equivalent income and wealth was the preferred one (Section 4).

An important finding was that the pattern and extent of health inequalities emerging from the analyses depended to a considerable extent on the type of SES indicator used. It was shown that different indicators allocated people of a given age to different SES quintiles. Since age is the dominant predictor of health, such a re-allocation significantly altered the patterns of health inequalities across SES quintiles. Indeed, the familiar near-linear gradient with a negative slope - when moving from the most disadvantaged toward the least disadvantaged SES quintile - only held with the SEIFA index (Section 6.4).

Using the SES indicator that gave the closest results to the SEIFA-based input data to the model (Section 4.1), we compared a Base case simulation with a Scenario in 1998 and in 2018. The Scenario was one in which all Australians were assumed to have the same health status as people in the least disadvantaged SES quintile (ie quintile 5) - see Section 6.2. The findings were that if the Scenario were implemented:

- around 180,000 life years would could be saved annually (Section 6.3);
- around 800,000 fewer persons would have been disabled in 1998, and 1 million fewer in 2018 (Section 6.4); and

- savings of around A$4 billion a year could be achieved in 1998 (and A$5 billion in 2018), due to lower health care costs and lower government outlays on Australia's disability support pension (Section 6.5) .

Data deficiencies that hindered the following of individuals throughout their life courses, and the limitations of studies which used mortality as a 'proxy' for health status for the subpopulation aged 0-64 years only, were discussed (Section 7).

The application in this paper illustrates the types of analyses that are possible after completion of the first stage of a broader project. In the second stage, with additional extensions of the model's capabilities, it will be possible to estimate the impact of narrower health inequalities on people's decisions as to when to exit from labour force, or give up independent living due to health reasons (Sections 2 and 3).

A Definitions and abbreviations

ABS	Australian Bureau of Statistics
Core activities	Communication, mobility and self care (ABS 1999b, p.66)
Dependent	children under 16 years of age, and full-time dependent students up to 25 years of age
Disability	A limitation, restriction or impairment, which has lasted, or is likely to last, for at least six months and restricts every day 'Core activities' (ABS 1999b, pp.66-7).
Enhanced model	DYNAMOD with elements of the Health_SES module incorporated.
Equivalent family income (or wealth)	Total gross annual family cash income (or wealth) – earned and received from government - accounting for differences in family size.
SES	Socioeconomic status
Survival function for mortality	The probability that a person aged x at time s, whose survival is being studied at time t, will still be alive at age $x+t-s$ (ie $t-s$ years later).

B The OECD method for computing equivalent family income and wealth indicators

Equivalent family[19] income is a measure of income adjusted for the differing needs of various families (eg due to differences in family size). The aim is to have a measure through which the *standard of living* of different families can be compared. For further detail see Saunders (1996, pp 115-8).

In this paper, once the gross incomes (earned and/or received from government) of adults in the family had been added up to obtain the family's income, equivalent family income was computed using the modified OECD scale (Mejer and Siermann, 2000). This method uses equivalence scale factors (ESF) with:

- a weight of 1 for the first adult in the family;
- a weight of 0.5 for each subsequent adult in the family; and
- a weight of 0.3 for each dependent child.[20]

The equation for the equivalent family income (EFI) is:

$$EFI = \text{Gross Family Income}/ESF$$

These family-based EFI values were then assigned to each family member.

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[19] In this paper 'family' has the same meaning as 'income unit' in ABS surveys.

[20] Refer to Harding, A. and Szukalska A. (2000), "Financial Disadvantage in Australia", p.36.

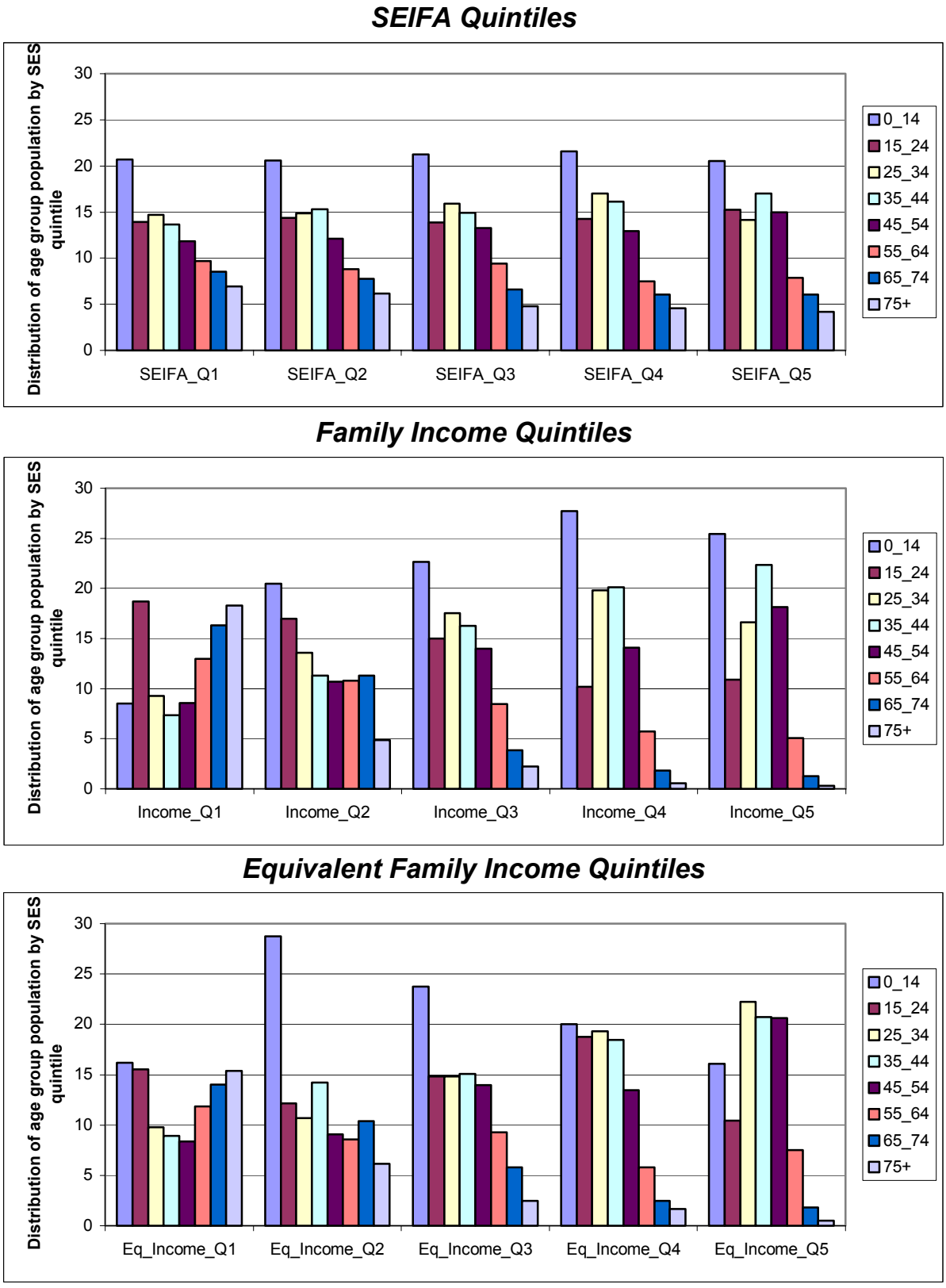
C Differences in the distribution of the population by types of SES indicator

Using the ABS's 1998 Disability survey (ABS 1999a), Figure 1 illustrates how markedly different the population distributions are across quintiles with different types of SES indicator s. That is, we illustrate how the old (generally with worse health) and the young (with excellent or better health) end up in different SES quintiles as we change the way SES is measured. The illustrations make use of the SES indicators that could be constructed using the variables available in the 1998 survey. Apart from the SEIFA index, these were:

- Family income: total weekly cash income (income unit level;[21] and
- Equivalent Family income – as defined in Appendix B.

[21] In the survey 9.8% of the respondents did not indicate their income. For purposes of this exercise we deleted these records. In other instances – eg when it is important to study the full population – incomes could be imputed to 'non-response' records (for example in line with patterns at the national level).

Figure C.1: **Distribution of the population by age within SES quintiles, 1998**



Source: ABS, 1998 Disability Survey (unit record files)

D Distribution of the population by SES quintile and age, 1998 and 2018

Table D.1: **Distribution of the population by age and Income_Wealth SES indicator, 1998 and 2018** (Per cent)

	0_14	15_24	25_34	35_44	45_54	55_64	65_74	75+	All ages
1998	20.0	14.0	15.3	15.2	13.4	9.1	7.3	5.6	100
2018	17.0	12.1	13.0	13.3	13.8	13.0	10.5	7.3	100

Table D.2: **Distribution of the population by age and Income_Wealth SES indicator, 1998** (Per cent)

	IncW_Q1	IncW_Q2	IncW_Q3	IncW_Q4	IncW_Q5
0_14	10.9	15.2	19.7	26.6	27.8
15_24	26.8	14.5	10.4	10.1	8.4
25_34	11.3	14.4	16.6	18.7	15.6
35_44	7.7	9.9	14.8	20.2	23.5
45_54	9.3	11.3	12.1	16.3	17.9
55_64	14.5	11.8	7.7	5.7	5.6
65_74	10.2	12.0	11.5	2.0	0.8
75+	9.3	10.8	7.2	0.5	0.3
ALL ages	100	100	100	100	100

Table D.3: **Distribution of the population by age and Income_Wealth SES indicator, 2018** (Per cent)

	IncW_Q1	IncW_Q2	IncW_Q3	IncW_Q4	IncW_Q5
0_14	7.7	11.2	18.0	23.4	24.6
15_24	26.4	12.0	8.1	7.4	6.4
25_34	12.7	13.8	15.8	14.3	8.5
35_44	5.7	6.8	12.5	18.8	23.0
45_54	5.2	9.5	13.3	18.4	22.6
55_64	13.1	15.4	14.1	11.2	11.0
65_74	13.8	18.5	12.5	4.7	3.1
75+	15.5	12.6	5.7	1.8	0.9
ALL ages	100	100	100	100	100

Table D.4: **Distribution of the population by age and Equivalent Income_Wealth SES indicator, 1998 and 2018** (Per cent)

	0_14	15_24	25_34	35_44	45_54	55_64	65_74	75+	All ages
1998	20.1	14.0	15.3	15.2	13.4	9.1	7.3	5.6	100
2018	16.9	12.2	13.0	13.3	13.8	13.0	10.5	7.3	100

Table D.5: **Distribution of the population by age and Equivalent Income_Wealth SES indicator, 1998** (Per cent)

	EqIncW_Q1	EqIncW_Q2	EqIncW_Q3	EqIncW_Q4	EqIncW_Q5
0_14	19.3	22.1	20.7	23.1	15.2
15_24	23.9	13.9	11.4	12.5	8.5
25_34	11.2	12.6	13.3	18.1	21.2
35_44	10.0	11.4	12.8	18.4	23.3
45_54	10.6	9.9	9.8	14.6	22.0
55_64	16.1	9.8	6.4	5.7	7.4
65_74	6.4	11.0	13.4	4.2	1.7
75+	2.6	9.3	12.1	3.3	0.6
ALL ages	100	100	100	100	100

Table D.6: **Distribution of the population by age and Equivalent Income_Wealth SES indicator, 2018** (Per cent)

	EqIncW_Q1	EqIncW_Q2	EqIncW_Q3	EqIncW_Q4	EqIncW_Q5
0_14	16.4	15.7	20.5	20.4	11.7
15_24	27.3	10.3	10.0	8.3	4.6
25_34	14.0	10.4	14.0	14.5	12.0
35_44	7.5	6.9	12.0	17.5	22.5
45_54	6.6	7.3	11.3	16.8	26.9
55_64	14.1	11.5	11.9	12.1	15.5
65_74	9.2	18.1	13.0	7.3	5.0
75+	4.8	19.7	7.2	3.3	1.9
ALL ages	100	100	100	100	100

Table D.7: **Distribution of the population by age and Income SES indicator, 1998 and 2018** (Per cent)

	0_14	15_24	25_34	35_44	45_54	55_64	65_74	75+	All ages
1998	20.1	14.0	15.3	15.2	13.4	9.1	7.3	5.6	100
2018	17.0	12.1	13.0	13.3	13.8	12.9	10.5	7.3	100

Table D.8: **Distribution of the population by age and Income SES indicator, 1998** (Per cent)

	Inc_Q1	Inc_Q2	Inc_Q3	Inc_Q4	Inc_Q5
0_14	11.5	14.3	18.4	26.8	29.4
15_24	22.9	15.8	11.6	11.2	8.5
25_34	9.3	13.1	15.4	20.1	18.7
35_44	8.0	9.5	13.7	20.7	24.2
45_54	13.1	11.0	11.4	16.0	15.5
55_64	22.4	9.2	5.5	4.6	3.4
65_74	9.4	12.0	14.6	0.6	0.3
75+	3.4	15.1	9.5	0.1	0.0
ALL ages	100	100	100	100	100

Table D.9: **Distribution of the population by age and Income SES indicator, 2018** (Per cent)

	Inc_Q1	Inc_Q2	Inc_Q3	Inc_Q4	Inc_Q5
0_14	6.7	8.6	15.2	25.3	29.1
15_24	19.9	14.0	11.3	9.3	6.2
25_34	7.5	8.9	14.9	18.5	15.1
35_44	5.2	4.8	10.7	19.8	26.1
45_54	8.7	10.3	13.1	18.7	18.0
55_64	31.1	13.2	8.0	7.4	5.0
65_74	17.5	19.4	14.3	1.0	0.4
75+	3.4	20.6	12.5	0.1	0.0
ALL ages	100	100	100	100	100

E Family size, income and wealth, 1998 and 2018

Table E.1: **Family size, income and wealth by SES quintile*, 1998**

.	**Family Size** Mean (No)	**Family Income** Mean ($)	**Family Income and annualised wealth** Mean ($)	**Wealth as a proportion of income** (%)
IncW_Quint1	1.377	7645	10374	35.7
IncW_Quint2	1.667	19565	24819	26.9
IncW_Quint3	2.07	30016	37246	24.1
IncW_Quint4	2.413	44899	53425	19.0
IncW_Quint5	2.626	76020	90879	19.5
ALL quints	1.939	36562	44525	21.8

* Quintiles obtained using the Income_wealth SES indicator

Table E.2: **Family size, income and wealth by SES quintile*, 2018**

	Family Size Mean (No)	**Family Income** Mean ($)	**Family Income and annualised wealth** Mean ($)	**Wealth as a proportion of income** (%)
IncW_Quint1	1.2366	9513	13458	41.5
IncW_Quint2	1.6005	20769	31458	51.5
IncW_Quint3	1.9485	32194	48132	49.5
IncW_Quint4	2.1592	49413	68242	38.1
IncW_Quint5	2.2375	81088	112752	39.0
ALL quints	1.8048	40819	57967	42.0

* Quintiles obtained using the Income_wealth SES indicator

Table E.3: **Change in family size, income and wealth by SES quintile* between 1998 and 2018**

	Family Size (%)	**Family Income** (%)	**Family Income and annualised wealth** (%)	**Wealth as a proportion of income** (%)
IncW_Quint1	-10.2	24.4	29.7	16.2
IncW_Quint2	-4.0	6.2	26.7	91.7
IncW_Quint3	-5.9	7.3	29.2	105.5
IncW_Quint4	-10.5	10.1	27.7	100.7
IncW_Quint5	-14.8	6.7	24.1	99.8
ALL quints	-6.9	11.6	30.2	92.9

* Using the Income_Wealth indicator of SES

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