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**Measuring the economic impact of illness – a microsimulation approach to measuring
the impacts on government and individuals**

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ABSTRACT: The Australian government's economic policy is currently driven by the findings of the Intergenerational Report which found that ageing of the population, coupled with strong growth in health and disability support pension spending, would force the Australian Government unsustainably into deficit over the long term. One of the main solutions identified by the Australian Government as a central part of its strategy to manage the anticipated costs of population ageing has been to increase the labour force participation of older workers. However, high rates of chronic illness amongst the older working age population currently reduce the potential of this policy for managing long-term government budget balances and for improving the living standards of older Australians.

In this paper, we describe a new approach within Australia to measure the relationship between illness and the economy. Health&WealthMOD is a new microsimulation model designed to determine the economic impacts of disease on older workers aged 45 to 64 years. The model estimates the relationship between early retirement and illness — by costing the losses to individuals (through lost earnings and wealth accumulation including pension plans on living standards in retirement) and to the Australian Government (through lost taxation revenue and additional government pension and benefit payments and on national GDP). The future economic impacts of trends in chronic illness amongst older workers are also estimated. The importance of using microdata to deal with some of the challenging measurement issues such as capturing the socio-economic distribution of illness and co-morbidity and their relationship to economic impacts will be discussed.

BACKGROUND

Following the release of the Intergenerational Report in 2002 and the Productivity Commission's report on the Economic Impacts of Ageing in 2005 (Commonwealth of Australia, 2002; Productivity Commission, 2005; Schofield & Rothman, 2006), two major challenges for Australia as our population ages were identified: sustainable funding of health services and emerging labour shortages. The labour shortages will be caused by declining fertility and ageing of the population, and exacerbated by the retirement of the large baby boomer cohort (Schofield & Beard, 2005). These labour shortages threaten the future sustainability of the Australian Government budget balance as they will limit economic growth and taxation revenue.

The previous Treasurer, referring to the Intergenerational Report, observed that “growth in the number of people of working age was expected to fall from around 1.2 per cent per annum over the last decade to almost zero in forty years’ time... But the number of people aged over 65 is expected to double over that period. This means that the ratio of working age people to support every person aged over 65 is expected to halve within forty years. Instead of 5 people of working age to support each person over 65 there will be 2½ people of working age for each person over 65. In the absence of significant policy change, this transition will involve a decline in Australia’s trend economic growth rate and put unsustainable pressure on Government finances.” (The Treasurer the Hon Peter Costello MP, 2005)

Further compounding labour shortages driven by the shrinking pool of labour are the age groups in which the highest rates of labour growth will occur. Our analysis shows that 28 per cent of total growth from 2006 to 2026 will come from the 60-64 year age group and 56 per cent from the 50 to 64 age groups — the age groups with traditionally low labour force participation rates and from which Australians are more likely to be retiring than entering the labour force (Australian Bureau of Statistics, 2005; Schofield, 2007). This will only add to labour shortages already seen in numerous industries (Department of Education Science and Training, 2005).

In response to emerging labour shortages and their wider impacts on the economy, both the previous Prime Minister and Treasurer have promoted the idea of deferred or gradual retirement as part of the solution to funding Australia's future health, welfare and other services (The Prime Minister the Hon John Howard MP, 2003). For example, the then Treasurer recently said "if we are going to make this economy sustainable, we have got to ...encourage older people to maintain a connection with the workforce ...With people living longer and in better health they have the capacity to maintain a connection with the workforce" (The Treasurer, 2005). Australia is not facing these pressures alone with governments across much of the developed world attempting to increase the labour market activity rate and employment among older workers (Meyhew & Rijkers, 2004).

However, about 50% of men and 20% of women retire early as a result of their own ill health according to the ABS Retirement and Retirement Intentions Survey (Australian Bureau of Statistics, 1998) and the important relationship between health and early retirement has also been noted by the then Treasurer (The Treasurer, 2004). Therefore an understanding of the health reasons for early retirement is just as important in supporting longer employment and better health in old age as economic arrangements such as reducing age discrimination in the workplace or providing economic incentives to work longer. Unplanned early retirement also has significant personal financial consequences by reducing earned income, superannuation contributions and savings, and lowering living standards in older age (Kelly, 2003; Kelly, Percival & Harding, 2002).

While there is now a significant body of work estimating the physical burden of disease and related health costs in Australia, the authors have identified that indirect costs, that is, costs beyond those to the health system, are rarely included (Australian Institute of Health and Welfare, 2004). This is surprising given that a number of studies have concluded that indirect costs are, for a number of conditions, greater than the direct costs to the health system (Begley et al., 2001; Taylor, Pezzullo & Keeffe, 2006). Australian private industry has undertaken a number of studies of the economics of illness which provide a useful starting point. A recent study, which primarily estimated the health costs of arthritis also broadly estimated some of the financial impacts on individuals and the

New Zealand government (Access Economics, 2005a). Similar studies were published in relation to visual impairment (Taylor, Pezzullo & Keeffe, 2006), cardiovascular disease (Access Economics, 2005b), and diabetes for Australia (Colagiuri et al.) and another for macular degeneration (although macular degeneration mostly effects older people and has limited effect on labour force participation) (Access Economics, 2006). International studies have used similar methods (Begley et al., 2001; Henriksson & Jonsson, 1998; Moore, Mao, Zhang & Clark, 1997; World Health Organisation, 2005).

However, these previous works have been quite limited in their scope (for example, excluding superannuation and asset accumulation) and somewhat crude in the methods used, mostly as a result of using highly aggregated data. For example, estimates of lost income have assumed that all persons included in the study would, without illness, have achieved average earnings and paid an average amount of tax (Access Economics, 2005a). This generalisation does not take into account evidence that both income and type of illness differ by age, sex, education and occupation. For example, a higher degree is related to 100% higher earnings in later working life (Johnson & Lloyd, 2000). In addition, the estimates are based at a single point in time, and as there is no age distribution underlying the data, there has been no capacity to estimate the accumulated lost earnings or wealth accumulation from retirement through to traditional retirement age or losses from the retirement income stream. A further limitation of these types of studies is that there is no distributional information about the extent of incapacity and therefore it is difficult to estimate the probability of intervention leading to potential workforce participation. It is this information that good economic data used in up-to-date microsimulation models of health, income, tax, government benefits and wealth can provide.

MEASUREMENT OF ECONOMIC IMPACT OF ILLNESS

We are developing a new microsimulation model, Health&WealthMOD, to estimate the economic impacts of illness leading to early retirement. Figure 1 shows the schematic diagram of Health&WealthMOD.

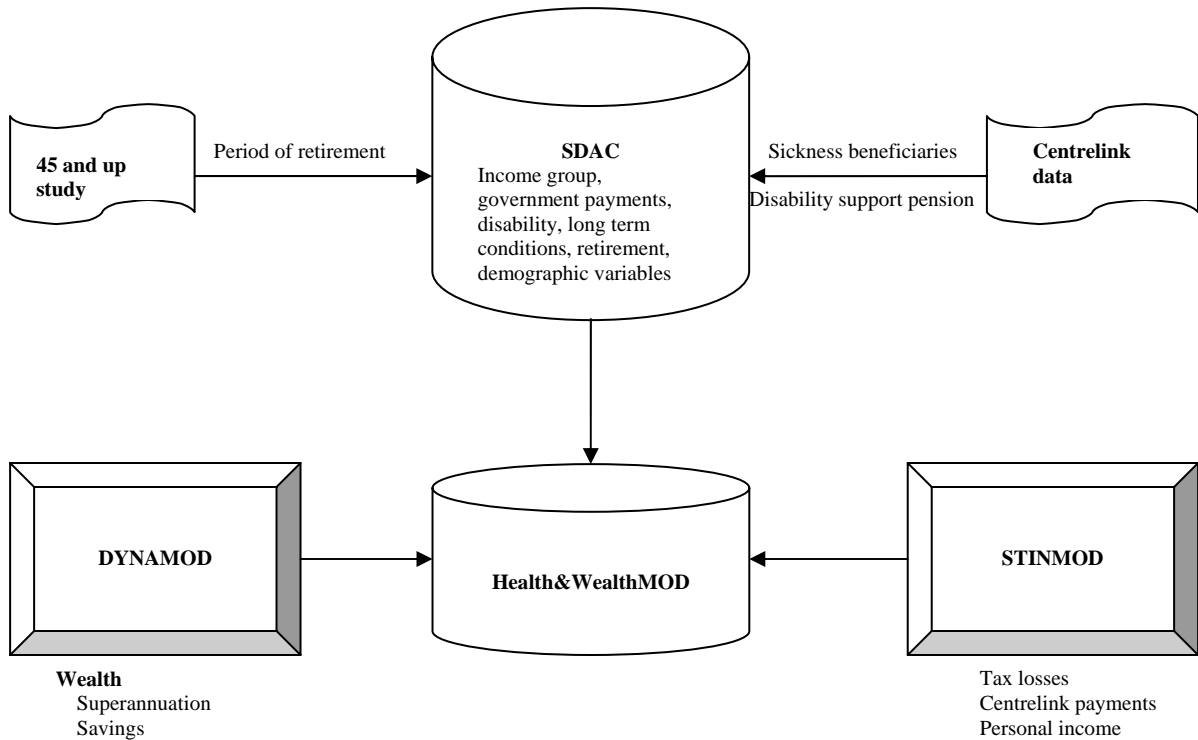


Figure 1. Health&WealthMOD

DATA SOURCES

This study used the unit record data for the sub-population aged 45 to 64 years from the Australian Bureau of Statistics' Survey of Disability, Ageing and Carers (SDAC) conducted in 2003. The survey collected demographic (eg. age, sex, family type, region and state of residence) and socio-economic information (level and field of education, income, benefits received) including information on labour force participation (labour force participation, employment restrictions, retirement). It also collected information on long term health conditions (long-term conditions, health status, type and extent of disability, support and care required). This is an individual level sample survey of the Australian population weighted to represent the whole Australian population. In addition to SDAC data, this study also used unit record data for the of 45 to 64 years aged population of the 45 and Up Study, a large scale prospective study of NSW residents aged 45 years and over. The 45 and Up Study aims to recruit at least 250,000 men and women from the NSW general population. Our study analysed the data for the 36,645 records, which were available at the time of this analysis.

Synthetic matching

In order to estimate the total cost of early retirement due to ill health or disability, we need to estimate the total individual income, savings, taxation revenue and benefits lost in each year from the time of retirement to the traditional retirement age of 65 years. As income does not remain constant from age 45 to 65, income at each age will need to be imputed to capture the total lost income from retirement to age 65. Although the SDAC recorded the time since respondents last worked, the variable categories stopped after two years. Therefore all respondents who had retired for two or more than two years were grouped in the same category. As more detail on duration of retirement and age of retirement was needed to simulate total income and savings lost, we imputed estimates of retirement period for those who were retired for more than two years from the 45 and Up Study data, which had detail information on retirement age.

It is highly unlikely that exactly matched records for the same person would be found in the two surveys as the SDAC is a sample of the whole Australian population and the 45 and Up Study is limited to NSW residents. Furthermore the surveys were undertaken several years apart so respondent information would have changed during that time. Even if the records in the two surveys belonged to the same person for NSW residents in the SDAC population, there is no unique identifier to confirm it. Thus a one-to-one match between the records of two surveys was not possible.

Therefore the records from the two surveys were matched using a synthetic matching technique (Figure 2). Matching was done based on groups, with each group (represented by a bin in Figure 2) defining distinctive population characteristics. All the records with certain population characteristics were matched with the records of the other survey that had the same population characteristics. The retirement periods of the individuals with the same population characteristics in the 45 and Up Study were then used as “donor” records to provide the retirement period for the “recipient” records of respondents in the SDAC with the same population characteristics. The basic assumption was that the distribution of retirement period would be similar for the two groups with similar

population characteristics provided that the variables that define the population characteristics were good predictors of the retirement period. The matching was based on five variables, which were found to be significant predictors of duration of retirement using an ordinary least square regression method. The variables were age group, sex, marital status, health status and highest education.

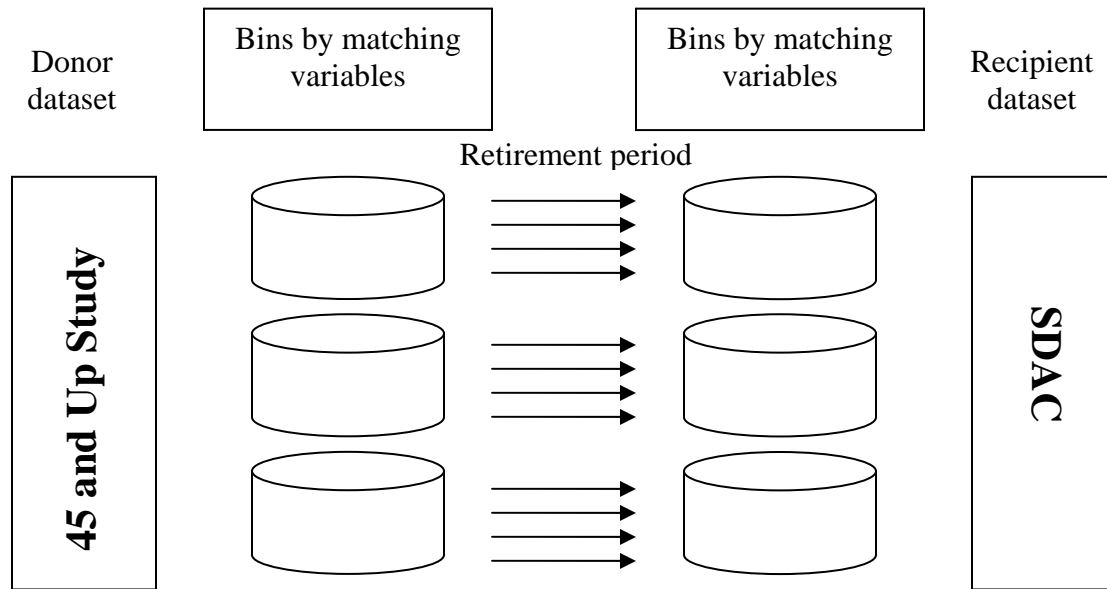


Figure 2. Synthetic matching

Modelling income, government benefits, taxation and wealth accumulation

Once we have imputed the age of retirement, we can use Health&WealthMOD to estimate the lost income of those who retired due to ill health by comparing the incomes of those retired due to ill health and other groups, such as those still working or retired for other reasons. However, by linking with other purpose-built wealth, income, tax and government benefit models such as STINMOD and DYNAMOD, we can significantly improve the scope and currency of this type of information in a way that allows us to markedly improve estimates of the impact of poor health and disability on labour force participation, income and tax and benefits. Health&WealthMOD will simulate the economic losses for individuals and government because of early retirement due to illness (Figure 3).

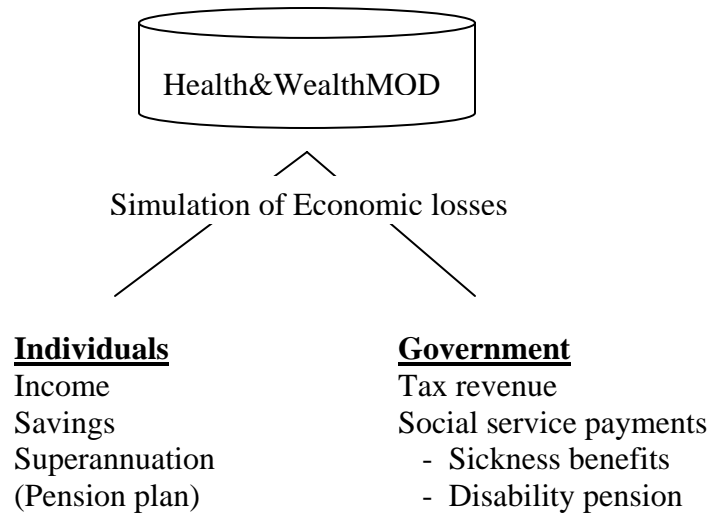


Figure 3. Economic losses to individuals and government

STINMOD

STINMOD is Australia’s most widely used tax-benefit model. It was developed by the National Centre for Social and Economic Modelling (NATSEM) in 1994 (Lambert, Percival, Schofield & Paul, 1994). It simulates personal income tax (Lambert, 1994), Centrelink pensions and benefits (Schofield, 1994), Veterans payments and AUSTUDY (payments to students). The main advantage of STINMOD is the capacity to capture the complex interactions between the social security and taxation systems and to identify unintended effects. It has been used as the basis for a wide range of analyses and simulations beyond the tax benefit simulations it was originally intended to run.

STINMOD has a representative population with a base population built on the Australian Bureau of Statistics’ Surveys of Income and Housing Costs (SIHC). These are individual level surveys of a sample of the population living in private dwellings, weighted to represent the Australian population in these residences. The data underpinning the model is aged to represent the current financial year and three future years known as “outyears” which are used in budget estimates when new policy is announced.

STINMOD will be used in conjunction with Health&WealthMOD to identify exactly how much of each type of government cash transfer particular families should receive,

given their demographic, family and earned income characteristics. It will also be used to identify the income tax payments that families should pay and the various tax rebates and deductions that they should receive.

Wealth models

The Household, Income and Labour Dynamics in Australia (HILDA) Survey (Melbourne Institute, 2006) is a panel study which began in 2001. In the second wave conducted in 2002, additional data relating to household assets were collected. These wealth variables which include superannuation balances, the value of the family home, and a variety of other assets and debts will be used to impute a range of current wealth values onto the base population of Health&WealthMOD.

There are a number of methods of projecting future personal wealth. The model developed by NATSEM – a dynamic microsimulation model (DYNAMOD) – is a complex, general-use tool that can answer a myriad of questions and dynamically handle changes to influences over time. This model looks at the circumstances of every individual, every month, and makes decisions based on their circumstances at that time. The workings of the model are outlined in Antcliff (1993) and the development of the wealth module is described in detail in Kelly (2003).

Since the development of DYNAMOD, the HILDA survey has become available and it provides more reliable estimates for 2002 than those simulated by DYNAMOD. However, the projection techniques used to simulate superannuation in DYNAMOD are suitable for inclusion in Health&WealthMOD and will be adapted to suit. The projection of other household assets will also use the techniques developed for DYNAMOD. In addition to projecting the values of these assets, rates of return will be assigned to each of them so that estimates of investment income can also be projected to estimate living standards of older Australians in retirement.

PRELIMINARY RESULTS

The preliminary analysis of Health&WealthMOD explored the association between long-term health conditions and premature retirement in older working age Australians.

A clear relationship between health status and the rate of labour force participation was found with higher rate of labour force participation among people with excellent to very good health compared to people with poor health (Schofield et al., 2007). It was found that the labour force participation rate decreased with an increase in the number of long-term health conditions individuals had. The analysis of the base population of Health&WealthMOD suggested that about 45% (663 thousands) of 45 to 64 years old Australians were out of the workforce due to ill health, reducing Australia's GDP by around \$15 billion per year. The highest number of people out of the labour force was due to back problems followed by arthritis and mental and behavioural disorders (Schofield et al., Accepted May 2008). The lower labour force participation among people with long-term health conditions identified in these studies highlights the importance of increasing efforts to treat and reduce risk factors for these conditions.

The rate of employment of older working Australians with chronic health conditions varied between industries. Older workers with chronic conditions were more likely to be employed in the retail trade, and health and community services compared to the reference industry of property and business services. It was less likely to find older workers with cancer working as managers and administrators than working as professionals (Schofield et al., 2008). A number of industries which employed a significantly higher number of older workers with chronic illnesses are growth industries. Thus, the rates of disease may increase as these industries continue to grow if the chronic conditions are work related. However, if they are unrelated to work, it may mean that the working environment of these industries is suited to older workers with chronic conditions, potentially providing expanding employment opportunities for older workers.

Once the linking of Health&WealthMOD with STINMOD and wealth models is completed, we will be able to simulate the total economic loss for individuals and the government due to early retirement of older working Australians due to their ill health.

CONCLUSIONS

This paper described a new microsimulation model Health&WealthMOD developed to estimate the total cost of early retirement due to ill health for individuals and the government. This model has numerous advantages over the currently used methods. It can capture lifetime impacts of premature retirement because of illness and thus, will be a useful addition to the current work on burden of disease and health system. The linking of Health&WealthMOD with STINMOD and wealth data allows us to not only estimate lost income but also to estimate lost savings and wealth such as superannuation and asset accumulation and losses in tax revenue for the government. Health&WealthMOD will be able to measure the economic impacts of the government policies aimed at improving the health of the Australian workforce.

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REFERENCES

Access Economics (2005a) *The Economic Cost of Arthritis in New Zealand: Arthritis New Zealand.*

- Access Economics (2005b) *The Shifting Burden of Cardiovascular Disease in Australia*: National Heart Foundation of Australia.
- Access Economics (2006) *The Impact of Age-related Macular Degeneration*: Centre for Eye Research Australia.
- Antcliff S (1993) *An Introduction to DYNAMOD*, Canberra: NATSEM.
- Australian Bureau of Statistics (1998) *Retirement and Retirement Intentions Survey*, Canberra: Australian Bureau of Statistics.
- Australian Bureau of Statistics (2005) *Population Projection for Australia, 2002 - 2101*, Canberra: Australian Bureau of Statistics.
- Australian Institute of Health and Welfare (2004) *Health System Expenditure on Disease and Injury in Australia 2000-01*, Canberra: AIHW.
- Begley C E, Annegers J F, Swann A C *et al.* (2001) 'The lifetime cost of bipolar disorder in the US: an estimate for new cases in 1998', *Pharmacoeconomics*, 19(5 Pt 1), 483-95.
- Colagiuri S, Conway B, Grainger D *et al.* Cost of type 2 diabetes care in Australia - the DiabCost study. Answers that matter. (Lilly, Diabetes Australia).
- Commonwealth of Australia (2002) *Intergenerational Report 2002-03*, Canberra: Department of The Treasury.
- Department of Education Science and Training (2005) *National and State Skill Shortage Lists Australia 2005*, Canberra: Department of Education, Science and Training.
- Henriksson F and Jonsson B (1998) 'The economic cost of multiple sclerosis in Sweden in 1994', *Pharmacoeconomics*, 13(5 Pt 2), 597-606.
- Johnson P and Lloyd R (2000). Does Higher Education Pay? Proceedings of 19th Conference of Economics, Gold Coast.
- Kelly S (2003) *Estimating the Wealth of Australians: A new approach using microsimulation*, PhD thesis: University of Canberra, unpublished thesis.
- Kelly S, Percival R and Harding A (2002). Women and Superannuation in the 21st Century: Poverty or Plenty?, Competing Visions. Proceedings of the National Social Policy Conferences, SPRC Report 1/02, University of New South Wales, pp 223-249.
- Lambert S (1994) *Modelling Income Tax and the Medicare Levy*, Canberra: NATSEM.
- Lambert S, Percival R, Schofield D *et al.* (1994) *An Introduction to STINMOD: A Static Microsimulation Model*, Canberra: NATSEM.
- Melbourne Institute (2006) *The HILDA Survey*: Melbourne Institute, University of Melbourne.
- Meyhew K and Rijkers B (2004). How to improve the human capital of older workers. Paper prepared for the joint seminar on human capital and labour market performance. Brussels. December
- Moore R, Mao Y, Zhang J *et al.* (1997) *Economic Burden of Illness in Canada 1993*, Ottawa: Public Health Agency of Canada.
- Productivity Commission (2005) *Economic implications of an ageing Australia*, Canberra: Productivity Commission.
- Schofield D (1994) *Modelling Social Security*, Canberra: NATSEM.
- Schofield D and Rothman G (2006). Projections of Commonwealth Health Expenditure in Australia's First Intergenerational Report. Modelling Our Future: Population

- Ageing, Health and Aged Care. A. Gupta and A. Harding. Amsterdam, Elsevier B. V. **16**: 149-168.
- Schofield D J (2007) 'Replacing the projected retiring baby boomer nursing cohort 2001-2026', *BMC Health Serv Res*, 787.
- Schofield D J and Beard J R (2005) 'Baby boomer doctors and nurses: demographic change and transitions to retirement', *Med J Aust*, 183(2), 80-3.
- Schofield D J, Fletcher S L, Earnest A *et al.* (2008) 'Where are older workers with chronic conditions employed?' *Med J Aust*, 188(4), 231-4.
- Schofield D J, Passey M E, Earnest A *et al.* (2007) 'Are we getting healthier as we grow older? Implications for babyboomer labor force participation', *Ann N Y Acad Sci*, 1114230-40.
- Schofield D J, Shrestha R N, Passey M E *et al.* (Accepted May 2008) 'A role for prevention in increasing labour force participation of older workers', *Med J Aust*.
- Taylor H R, Pezzullo M L and Keeffe J E (2006) 'The economic impact and cost of visual impairment in Australia', *Br J Ophthalmol*, 90(3), 272-5.
- The Prime Minister the Hon John Howard MP Address to the Symposium on Mature Age Luncheon. Sydney. www.pm.gov.au/news/speeches/speech462.html [accessed 27 August 2003]
- The Treasurer (2004). Australia's demographic challenges. Speech, Marriott Hotel. 25 February
- The Treasurer (2005). Doorstop Interview Toorak Place Retirement Village Melbourne. 24 October
- The Treasurer the Hon Peter Costello MP (2005). Sustaining prosperity: New reform opportunities for Australia, Address to the Australian/Melbourne Institute Conference Dinner. Melbourne. 31 March 2005
- World Health Organisation (2005) *Preventing Chronic Diseases: A Vital Investment*, Geneva: WHO.