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The personal and national costs of CVD: Impacts on income, taxes, government support payments and GDP due to lost labour force participation☆,☆☆

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ABSTRACT

Background: CVD has the ability to interrupt an individual's ability to participate in the labour force, and this can have considerable follow-up on impacts to both the individual and the state. This study aimed to quantify the personal cost of lost income and the cost to the state from lost income taxation, increased benefit payments and lost GDP as a result of early retirement due to CVD in Australians aged 45–64 in 2009.
Methods: Cross-sectional analysis of the base population of Health&WealthMOD, a microsimulation model built on data from the Australian Bureau of Statistics' *Survey of Disability, Ageing and Carers* and STINMOD, an income and savings microsimulation model.
Results: Individuals aged 45 to 64 years who have retired early due to CVD have a median value of total weekly income of only $268 whereas those who are employed full time are likely to have almost five times this. The national aggregate impact of CVD through the loss of labour force participation amongst 45 to 64 year olds, equated to around AU$1.1 billion in lost income, $AU225 million in lost income taxation revenue, AU$85 million in additional government benefit payments, and AU$748 million in lost GDP, in 2009 alone.
Conclusions: The costs of CVD to both individuals and the state are considerable. Whilst individuals bear the economic costs of lost income in addition to the burden of the condition itself, the state impacts are loss of productivity from reduced workforce participation, lost income taxation revenue, and increasing government support payments — in addition to direct health care costs.

1. Introduction

Cardiovascular disease (CVD) places a massive burden upon the health of individuals globally, being the leading cause of death [1]. In Australia it continues to be a leading cause of death and is the second largest contributor to the burden of disease [2], currently accounting for 18% of the national burden of disease[3]. It is estimated that 16% of the Australian population — 3.5 million people, had a long-term CVD in 2007–08 [2].

Not only is CVD a major health burden, but it is also a large economic burden — with the treatment of CVD comprising a large proportion of the GDP of most industrialised countries [4–6]. The total health expenditure on CVD in Australian in 2004–05 was $5.9 billion (AU), 11% of all health expenditure [7]. Whilst these direct medical costs of CVD are some of the largest for any health condition [7], the indirect costs of CVD (such as lost productivity and workforce participation) may be much larger than the direct costs [4]. CVD impacts upon the functional ability of individuals — one quarter of CVD sufferers reported being disabled to the extent that their core activities, such as mobility, self-care and communication were affected.

As the prevalence of CVD increases with age [2], older workers are much more likely to have their labour force participation affected by disability from the disease. Those with CVD are also more likely to have their employment affected [2]. Indeed CVD has some of the highest proportion of individuals not in the labour force amongst the 45 to 64 year old Australian. Over half the individuals with heart disease and other diseases of the circulatory system are out of the labour force [8]. With the ageing of the Australian population [9], this is a key concern as an increasing proportion of individuals will be moving into the age bracket where CVD is increasingly common,

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right at a time when Australia will need to maximise the participation of its older workers to maintain government revenue to fund health services for an ageing population [10].

This paper explores the costs of the early retirement of older workers due to CVD. It quantifies, for the 45 to 64 year old Australian population, the amount of income lost to individuals, and the lost amount of taxation revenue, increased government benefit payments and lost national GDP loss due to individuals exiting the labour force at the national level as a result of early retirement due to CVD. It will also quantify the difference of these values between those who have retired early due to CVD and those in the labour force full time and part time to show how much could be saved had the conditions been prevented and individuals remained in the labour force.

2. Materials and methods

2.1. Data

The output dataset of a microsimulation model, Health&WealthMOD, which is Australia's first microsimulation model of health and disability, was used to analyse the associated impacts that ill health has on labour force participation, personal income, and government revenue and expenditure. It was specifically designed to measure the economic impacts of ill health on Australian workers aged 45 to 64 years. The process by which Health&WealthMOD was built is outlined in detail in Schofield et al. [11].

The base population of Health&WealthMOD was unit record data extracted from the Survey of Disability, Ageing and Carers conducted by the Australian Bureau of Statistics in 2003.[12] From this dataset, individual records were extracted for those aged 45–64 years. The details extracted for each individual in the base population included demographic variables (for example, age, sex, family type, state of residence, and ethnic background), socioeconomic variables (level and field of education, income, benefits received), labour force variables (labour force participation, employment restrictions, retirement), and health and disability variables (chronic conditions, health status, type and extent of disability, support and care required).

Using a separate microsimulation model—STINMOD—additional economic information such as individual income, government support payments and tax liability was imputed onto the base data. STINMOD is Australia's leading model of income tax and government support payments [13–14], and is maintained and developed for the Australian Government by the National Centre for Social and Economic Modelling. Income and wealth information was imputed onto the base population of Health&WealthMOD by identifying persons with similar characteristics on STINMOD and "donating" their income and wealth information onto Health&WealthMOD using a process commonly used in microsimulation modelling called synthetic matching [15]. Eight variables: sex (2 groups), income unit type (4 groups), type of government pension/support (3 groups), income quintile (5 groups), age group (4 groups), labour force status (4 groups), hours worked per week (5 groups), highest educational qualification (2 groups) and home ownership (2 groups), that were common to both datasets and strongly related to income were chosen as matching variables for synthetic matching.

The data were then aged to reflect the 2009 Australian 45 to 64 year old population. The up-rating was used to account for the disability and illness, demographic, labour force, earnings growth and other changes that had occurred between 2003 and 2009.

Respondents' health conditions were classified in the SDAC 2003 by the Australian Bureau of Statistics using ICD10 codes. People who reported their main long term health condition as heart disease (ICD10 code: I00–I52), angina (ICD10 code: I20), myocardial infarction (ICD10 code: I21–22), other heart diseases (ICD10 code: I23–52), hypertension (ICD10 code: I10–15), stroke (ICD10 code: I64) and other diseases of the circulatory system (ICD10 code: I60–63, I65–70, I73–89, I97–99) were considered to have CVD in this study.

2.2. Statistical methods

Initial descriptive analysis was undertaken to determine the mean and median weekly income, taxation payments, and social security benefits attributable to individuals employed full time, employed part time, and not in the labour force due to CVD.

A multiple linear regression model of the log of weekly income was used to analyse the differences between weekly incomes of people in the labour force (full-time and part-time) who reported no chronic health conditions and people not in the labour force due to CVD. Analyses were repeated for weekly transfer income and weekly tax liability. Co-variates: age group, sex and highest education were adjusted for all regression models. Regression analysis was undertaken on log-transformed data in order to satisfy the assumptions of linear regression analysis, and regression diagnostics confirmed that the assumptions were reasonably satisfied.

The national economic impacts of CVD, when it leads to exit from the labour force amongst those aged 45 to 64 years were estimated. This was done with the assumption that people who reported being out of the labour due to CVD would have the same labour force participation rates as people with no chronic condition, if they did not have CVD. Some of these people who were out of the labour force due to CVD might still have other chronic conditions other than CVD (which they cite as their main condition). These other conditions might keep them out of the labour force even if they did not have CVD. However, there was no data available to estimate what proportion of these people would be out of the labour force due to other chronic conditions if they did not have CVD. Thus, we conducted a sensitivity analysis as follows:

(1). that if individuals who were out of the labour force due to CVD did not have these conditions that they would otherwise have had the same labour force participation rates as people with no chronic health conditions, or
(2). that individuals who were out of the labour force due to CVD would otherwise have had the same labour force participation rates as people with conditions other than CVD. This assumption was used as the sensitivity analysis for estimating the national economic impacts.

The impact of CVD on national GDP was calculated based on the Commonwealth Treasury's GDP formula:

$$GDP = (GDP/H)\times(H/EMP)\times(EMP/LF)\times\left(LF/Pop15^{+}\right)\times Pop15^{+}$$

where GDP = Gross Domestic Product; H = total hours worked; EMP = total number of persons employed; LF = total labour force; and $Pop15^{+}$ = population aged 15 years and over [9].

The analyses were undertaken using SAS V9.1 (SAS Institute Inc., Cary, NC, USA). All statistical tests were two sided with the significance level set at 5%.

3. Results

Amongst those surveyed in the Survey of Disability, Ageing and Carers who were aged between 45 and 64 years, there were 46 individuals who were out of the labour force due to CVD; there were 2273 who were employed full time with no chronic health condition, and 781 who were employed part time with no chronic health condition. Once weighted, these data represented 27,000 individuals not in the labour force due to CVD, 1,410,000 individuals employed full time with no chronic health condition, and 421,300 individuals employed part time with no chronic health condition within the Australian population aged 45 to 64 years.

Those who were out of the labour force due to CVD had a median weekly income (income from all sources, including transfer income) of AU$268. This is around half of the median weekly income of those employed part-time with no condition (AU$559 per week), and around one-fifth the weekly income of those employed full time with no chronic condition — AU$1 226 (Table 1). Of their total weekly income — those not in the labour force due to CVD received a median of AU$254 per week in government transfer income, whereas those in employment receive none (as a median value). Not being in employment, those out of the labour force due to CVD pay no tax per week — whereas those employed full-time pay a median value of AU $223 per week in tax.

When compared to those with no health condition in full time employment and adjusted for age, sex and education, those out of the labour force due to CVD receive 74% less per week on average in total income (Table 2). They also pay significantly less per week in taxation, and receive significantly more in government transfer payments.

Those employed part-time with no long term health condition also have significantly lower incomes, pay less taxation, and receive more in transfer payments than those employed full time. However the percentage differences between those employed full time and those employed part time, are not as great as those employed full time and those not in the labour force due to CVD (Table 2).

When aggregated, the national impact of CVD when it leads to exit from the labour force is $1.1 billion in lost income, $225 million in lost taxation revenue, and an additional $85 million in government transfer payments per year (Table 3) assuming that otherwise those with CVD would have had the same labour force participation rates as people with no chronic health conditions. The results of the sensitivity analysis show that lost income, tax and additional social security payments would be about 10% lower if it were assumed that if individuals who