ECONOMIC MODELLING OF THE NET COSTS ASSOCIATED WITH NON-PARTICIPATION IN SPORT AND PHYSICAL ACTIVITY

This report was prepared for
Medibank Private
by Econtech Pty Ltd.

30 July 2007

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Executive Summary

Introduction

Physical inactivity is a term used to identify people who do not get the recommended level of regular physical activity. The National Physical Activity guidelines (NPA guidelines) for Australians recommend 30 minutes of moderate-intensity physical activity a day as the minimum requirement for good health. However, to be considered 'physically active' the National Physical Activity Survey (NPAS) states you should participate in at least 150 minutes of moderate-intensity physical activity over at least five sessions in a week. Research by the World Health Organisation (WHO) [1] suggests that physical inactivity increases all causes of mortality, doubles the risk of cardiovascular disease, type 2 diabetes, and obesity. It also increases the risks of colon and breast cancer, high blood pressure, depression and anxiety. Furthermore, the WHO (2003)[2] estimates that physical inactivity causes 2 million deaths per year worldwide, about 10 to 16 per cent of breast cancer, colon cancer and diabetes cases, and about 22 per cent of coronary heart disease (ischaemic heart disease).

Despite these consequences of physical inactivity, the 2000 NPAS estimated that at least 54 per cent of Australian adults (aged 18-75 years) failed to undertake the recommended accumulation of 150 minutes of moderate physical activity over at least five sessions in a week to achieve health benefits.[3]

To further cement its reputation as an advocate of healthier more active lifestyles, Medibank Private commissioned Econtech to estimate the **direct** gross and net costs associated with non-participation in sports and physical inactivity to the Australian economy.

Generally, the total gross economic cost of physical inactivity includes three main components, direct costs, indirect costs and intangible costs. As mentioned above, this report focuses on quantifying the **direct** gross and net cost of physical inactivity to Australia in the form of monetary values. As such, given that the indirect and intangible costs are not included in the cost of inactivity presented in this report, these estimates are considered conservative. Nonetheless, the report discusses some of the likely indirect and intangible costs of physical inactivity in a qualitative way.

Advantages over Previous Work

To our knowledge, the first attempt to estimate the direct gross costs of physical inactivity on the Australian economy was by Stephenson et al. (2000)[4]. The Stephenson et al. study used the Population Attributable Risk (PAR) approach to estimate the direct gross costs of physical inactivity on the Australian economy. This study estimated the direct health care costs attributable to physical inactivity to be around $377 million per annum (in 1993/94 prices). Particularly, the Coronary heart disease (CHD) costs were estimated to be $161 million, $28 million for type 2 diabetes, $16 million for colon cancer, $101 million for stroke, $16 million for breast cancer, and up to $56 million for depressive disorders.

[1] WHO (2002). Risks to health-promoting healthy living. World health report, pp 60.
[2] World Health Organisation (2003), Global Strategy on Diet, Physical Activity and Health.
[3] Australian Institute of Health and Welfare (2001). Physical Activity Patterns of Australian Adults. Canberra.
[4] Stephenson, P., Bauman, A., Armstrong, T., Smith, B., and Bellew, B. (2000). The cost of illness attributable to physical inactivity in Australia: A preliminary study, The Commonwealth Department of Health and Aged Care and the Australian Sports Commission.

Stephenson et al's study is useful in that it provides information about the direct gross costs of physical inactivity on the Australian economy.
In comparison, this Econtech study effectively extends the work of Stephenson et al. by estimating the direct net costs associated with physical inactivity to the Australian economy. There are four important differences between these studies.

- Firstly, Econtech has used the most up to date estimate on the prevalence of physical inactivity in the Australian population as well as the most recent health care expenditure figures to estimate the direct gross costs of physical inactivity on the Australian economy.
- Secondly, Econtech's direct gross cost estimates of physical inactivity focus primarily on seven medical conditions that are found to have a strong link with physical inactivity. In contrast, the direct cost estimate obtained by Stephenson et al. only accounted for six medical conditions.
- Thirdly, Econtech has used more comprehensive and recent relative risk estimates from the academic literature.
- Fourthly, this Econtech study estimates the direct net costs of physical inactivity on the Australian economy. This involved estimating the direct cost offsets associated with being physically active.

As such, Econtech's direct net cost estimates of physical inactivity presented in this study have greater advantages in terms of accuracy and comprehensiveness.

Results

Chart A shows the prevalence of physical inactivity in Australia for the periods 1997, 1999, 2000 and 2007. The estimates for the periods 1997, 1999 and 2000 were obtained from the National Physical Activity Surveys (NPAS).[5] The 2007 estimate was calculated by assuming the 2000 NPAS estimate of physical inactivity remained unchanged between 2000 and 2007.

The 2007 estimate of the prevalence of physical inactivity was used as an input to estimate the direct gross costs of physical inactivity on the Australian economy. The 2007 estimate was chosen because the evidence regarding trends of physical inactivity over the years is limited and generally inconclusive. For example, according to the NPAS, the proportion of the adult population that was physically inactive increased by 5.9 per cent between the periods 1997-1999. However, there was a slight decline from 1999 to 2000 by 1.1 per cent. Furthermore, data from the National Health Survey[6] for periods 1995, 2001 and 2004/05 showed that on average, the proportion of people in the sedentary[7] group decreased from 1995 to 2004/05, but the proportion of people in the moderate[8] and high[9] groups also decreased. It is therefore difficult to determine if the Australian population is becoming more physically inactive or active. As such, for this report, Econtech used a conservative estimate of prevalence of physical inactivity (2007 estimate) to calculate the direct gross costs of physical inactivity on the Australian economy.

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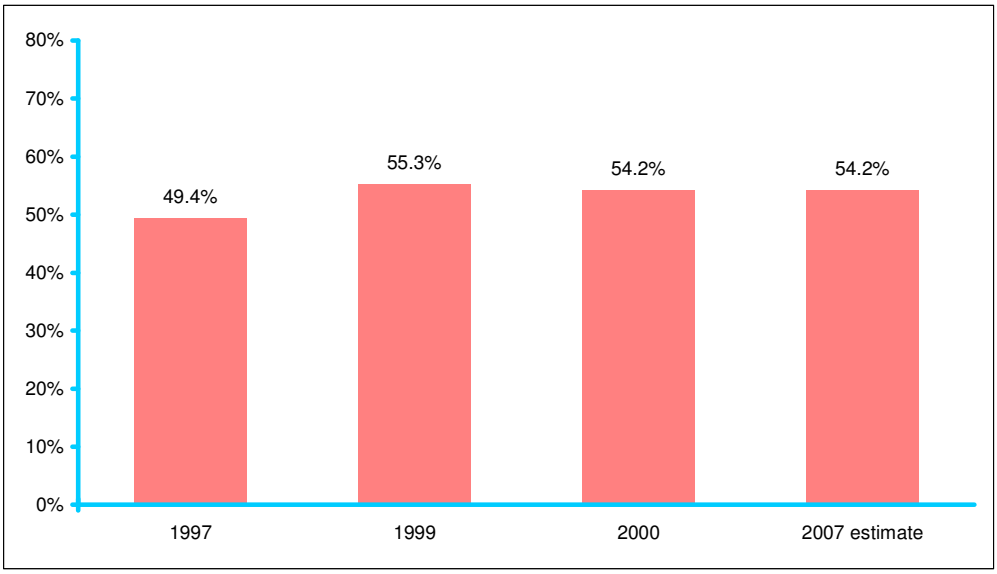
[5] Australian Institute of Health and Welfare analysis of the 1997, 1999 and 2000 National Physical Activity Surveys. Canberra.
[6] Australian Bureau of Statistics, National Health Survey cat no. 4364.0.
[7] Defined as people that exercised less than 100 minutes in the two weeks previous to the survey.
[8] Defined as people that exercised between 1600 to 3200 minutes, or more than 3200 minutes but less than 2 hours of vigorous exercise in the two weeks previous to the survey.
[9] Defined as people that exercised more than 3200 minutes and 2 hours or more of vigorous exercise in the two weeks previous to the survey.

Chart A
Prevalence of Physical Inactivity in Australia 1997, 1999, 2000 and 2007 (estimate)



Source: Econtech and 1997, 1999 and 2000 National Activity Surveys.
Note: (a) The estimates presented in this chart are age standardised.[10]
(b) 2007 estimate was calculated by assuming the prevalence of inactivity remains unchanged for the period 2000-07.

The scientific literature reviewed by Econtech for this report suggests that the lack of regular physical activity is associated with an increased risk of mortality and morbidity from heart and vascular diseases, particularly coronary heart disease (CHD). It was also found that there is strong association between physical inactivity and an increased risk of stroke, type 2 diabetes, mental disorder, breast cancer, colon cancer and the incidence of fall related injuries (particluarly amongst the ederly). Given this evidence, this report focuses on estimating the direct gross cost attributable to inactivity for these seven medical conditions.

To estimate the proportion of the main medical conditions[11] that may be attributable to physical inactivity amongst adult Australians (or the proportion of medical condition that may be prevented by eliminating inactivity), Econtech calculated the Population Attributable Risk (PAR). This is the maximum proportion of medical conditions attributable to the specific exposure (i.e. to physical inactivity). The PAR is based on the incidence of medical conditions in the exposed group (i.e. physically inactive group) as compared with the non-exposed group (i.e. physically active group).

Using the PARs estimates and information about the total health costs of each medical condition, Econtech calculated the direct gross costs attributable to physical inactivity amongst adults. After estimating the direct gross costs, the cost offsets of inactivity were calculated as the expenses associated with participation in physical activity including sports

[10] Age-standardised rates enable comparisons to be made between populations which have different age structures. It effectively minimises the effects of differences in age composition and thus facilitates valid comparison of rates for populations with different age compositions.
[11] The term 'main' is used to indicate the seven medical conditions more closely related to physical inactivity as identified earlier, and focussed on throughout the report.

injuries and fitness-related expenses (e.g. health studio charges). The direct cost of sports injuries in Australia was estimated by using a study by Aisbett et al. (2003)[12]. This study estimated the cost of injury in New South Wales for 1998/99. The NSW estimate of sport injuries was adjusted for inflation and scaled to the Australian population. To calculate the fitness-related expenses, Econtech used the 2003/04 ABS Household Expenditure Survey to obtain data on total household expenditure on health and fitness studios.

Table A shows the estimated net costs of physical inactivity of adults in the Australian economy. The total gross cost estimate reflects the direct (health care) costs of physical inactivity related to seven medical conditions that are considered to have a strong causal relation with physical inactivity. The cost offset reflects the expenses associated with participation in physical activity, including sports injuries and fitness-related expenses (e.g. gym membership).

As shown in Table A, the direct gross cost attributable to physical inactivity for the main medical conditions that are the focus of this report is $1,494 million per annum (2006/07 prices). This direct gross cost of physical inactivity represents 17 per cent of the total health cost of these seven medical conditions. That is, 17 per cent of the total health cost of treating these seven medical conditions can be attributed to physical inactivity.

Furthermore, Table A shows that the direct (health care) costs of sports injuries are estimated to be around $179 million per annum. Additionally, the total annual expenditure on sports and exercise products was estimated to be $653 million. As such, the total direct cost offsets from not engaging in physical activity are estimated to be around $831 million per annum.

The net costs of physical inactivity are shown at the bottom of the left hand column of Table A. These net costs are calculated as the direct gross costs of physical inactivity less the cost offsets from not engaging in physical activity (i.e. the expenses associated with participation in physical activity). This gives an estimated direct net cost of physical inactivity of $663 million per annum to Australia.

Importantly, this direct net cost is considered to be a conservative estimate because it does not include the indirect and intangible costs of physical inactivity or the prevalence of physical inactivity amongst children. If the indirect and intangible costs of physical inactivity amongst adults were taken into account, the inactivity cost figure would be much higher.

[12] Aisbett, C., Potter, M. (2003) Injury Costs: A valuation of the burden of injury in New South Wales 1998-1999, Injury risk management centre.

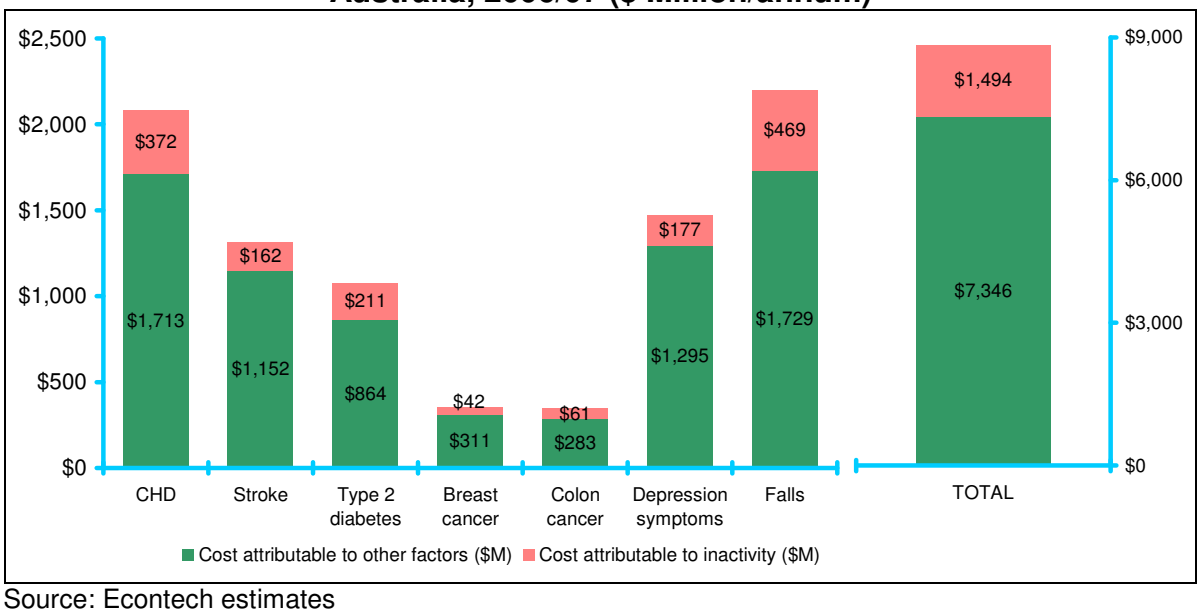
Table A
Direct Net Cost of Physical Inactivity in Australia, 2006/07 ($ million/annum)

Gross Cost		Costs Offset (cost of exercising)	
Disease	**Direct Health Cost attributable to physical inactivity**		**Direct cost attributable to being physically active**
CHD	$371.5	Direct health costs of sports injuries	$178.5
Stroke	$162.4	Expenditure on sport and exercise products	$652.9
Type 2 diabetes	$210.7		
Breast	$42.2		
Colon cancer	$61.4		
Depression symptoms	$177.3		
Falls	$468.7		
Total gross cost	**$1,494.3**	**Offset**	**$831.4**
Total net cost of inactivity	**$662.9**		

Source: Econtech estimates
Notes: (a) CHD stands for coronary heart disease.

For illustration purposes, Chart B shows the total direct health cost of each main medical condition and the share of this cost that can be attributed to physical inactivity.

Chart B
Direct Health Costs Attributable to Physical Inactivity by Medical Condition, Australia, 2006/07 ($ Million/annum)



Source: Econtech estimates

It is estimated that the total direct health expenditure in Australia equals $97.9 billion (2006/07 prices).[13] Hence, physical inactivity amongst adults alone represents 1.5 per cent of the total direct health expenditure in the Australian economy. This suggests that if physical inactivity was eliminated and even just the adult Australian population adopted regular moderate physical activity, then the Australian economy could potentially save 1.5 per cent in the direct health care expenditures. In comparison, according to WHO (2003)[14], physical inactivity alone may have contributed as much as $98.7 billion per annum or 4.3 per cent (2006/07 prices) to US direct medical costs.

The 1.5 per cent accounts only for the adult population and only the direct health costs associated with the seven identified medical conditions, and it can therefore be expected that the percentage of Australia's total health expenditure for the seven identified medical conditions attributable to physical inactivity is possibly higher than 1.5 per cent.

Conclusion

This study estimated the direct gross costs and net costs associated with physical inactivity of Australian adults.

The results presented in this report demonstrate that poor health arising from physical inactivity generates clear economic and social costs to the Australian community. This includes the direct costs of greater health expenditures by the public and private sectors. These direct gross costs have been balanced against the costs offsets in sports injuries and other expenses from engaging in physical activity such as expenditure on sports and exercise products.

The results presented in this report also demonstrate that strategies aimed to reduce physical inactivity in Australia can bring significant benefits to the Australian economy. Indeed, the estimate of the net cost of physical inactivity provided in this study represents the potential cost savings that would occur if the adult Australian community adopted healthier more active lifestyles. As such, the cost estimates outlined in this study provide a sound starting point for considering strategies to overcome physical inactivity.

[13] Australian Institute of Health and Welfare (2006). Health expenditure in Australia, 2004-05. Second edition. AIHW cat no. HWE 35 Canberra.
[14] World Health Organisation (2003). Global Strategy on Diet, Physical Activity and Health.

1. Introduction

The National Physical Activity guidelines (NPA guidelines) for Australians recommend 30 minutes of moderate-intensity physical activity on most days of the week as the minimum requirement for good health. However, to be considered 'physically active' the National Physical Activity Survey (NPAS) states you should participate in at least 150 minutes of moderate-intensity physical activity over at least five sessions in a week. The World Health Organisation (WHO) in the 2002 World Health Report[15] highlighted that physical inactivity is a significant common and preventable risk factor for chronic non-communicable diseases (NCDs). Furthermore, the WHO suggests that physical inactivity increases all causes of mortality, doubles the risk of cardiovascular disease, type 2 diabetes, and obesity. It also increases the risks of colon cancer (also known as bowel cancer) and breast cancer, high blood pressure, depression and anxiety.

According to the WHO (2003)[16], physical inactivity is estimated to cause 2 million deaths per year worldwide. Adding to this, physical inactivity is estimated to cause, globally, about 10 to 16 per cent of breast cancer, colon cancer and diabetes cases, and about 22 per cent of coronary heart disease (ischaemic heart disease).

Despite the consequences of physical inactivity, the WHO estimates that at least 60 per cent of the world population fails to achieve the minimum recommendation of 30 minutes of moderate physical activity daily. In Australia, the 2000 NPAS estimated that at least 54 per cent of Australian adults (aged 18-75 years) failed to undertake the recommended accumulation of 150 minutes of moderate physical activity over at least five sessions in a week to achieve health benefits.[17]

Poor health arising from physical inactivity generates clear economic and social costs to the community. This includes the direct costs of greater health expenditures by the public and private sectors. Furthermore, there are indirect costs that arise from lower labour supply as physical inactivity shortens life expectancy and increases presenteeism and absenteeism.

Data from developed countries indicate that the direct costs of physical inactivity are significant. For instance, in the United States, Colditz (1999)[18] estimated that the costs associated with inactivity and obesity accounted for some 9.4 per cent of the national health expenditure in 1995. In Canada, it is estimated that in 1999, $2.1 billion of the total direct health care costs were attributable to physical inactivity.[19] Furthermore, according to WHO (2003)[20], physical inactivity alone may have contributed as much as $98.7 billion (2006/07 prices) per annum or 4.3 per cent to the US direct medical costs. In comparison, in this report, Econtech estimated that physical inactivity alone contributed as much as $1,494 million per annum or 1.5 per cent (2006/07 prices) to total direct health expenditure in Australia.

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[15] WHO (2002). Risks to health-promoting healthy living. World health report, *pp 60*.
[16] World Health Organisation (2003), Global Strategy on Diet, Physical Activity and Health.
[17] Australian Institute of Health and Welfare (2001). Physical Activity Patterns of Australian Adults.
[18] Colditz, G. A. (1999). Economic Costs of Obesity and Inactivity. Med Sci. Sports Exerc., 31(11):663-67
[19] Gledhill N., Katzmarzyk P., Shephard R. (2000). The economic burden of physical inactivity in Canada, *Cmaj,* 163:1435-40.
[20] World Health Organisation (2003). Global Strategy on Diet, Physical Activity and Health.

To further its reputation as an advocate of healthier more active lifestyles, Medibank Private commissioned Econtech to estimate the direct gross and net costs associated with non-participation in sports and physical activity to the Australian economy. This also represents the potential gross and net gains available from overcoming non-participation in physical activity.

Generally, the total gross economic cost of physical inactivity includes three main components, direct costs, indirect costs and intangible costs. As mentioned above, this report focuses on quantifying the **direct** gross and net cost of physical inactivity to Australia in the form of monetary values. As such, given that the indirect and intangible costs are not included in the cost of inactivity presented in this report, these estimates are considered conservative. Nonetheless, the report discusses some of the likely indirect and intangible costs of physical inactivity in a qualitative way.

This report is structured as follows.

- Section 2 presents estimates of the prevalence of physical inactivity in Australia.
- Section 3 provides evidence on the medical diseases and conditions related to physical inactivity.
- Section 4 presents estimates of the direct (health care) costs of medical conditions related to physical inactivity.
- Section 5 quantifies the relation between disease morbidity and mortality and physical inactivity.
- Section 6 estimates the economic costs of physical inactivity.
- Section 7 provides a general discussion on the indirect and intangible costs of physical inactivity.
- Section 8 presents the conclusions.
- Section 9 presents the references used to prepare this report.

While all care, skill and consideration has been used in the preparation of this report, the findings refer to the terms of reference of Medibank Private and are designed to be used only for the specific purpose set out below. If you believe that your terms of reference are different from those set out below, or you wish to use this report or information contained within it for another purpose, please contact us.

The specific purpose of this report is to estimate the broad direct gross and net costs of physical inactivity in Australia.

The findings in this report are subject to unavoidable statistical variation. While all care has been taken to ensure that the statistical variation is kept to a minimum, care should be taken whenever using this information. This report only takes into account information available to Econtech up to the date of this report and so its findings may be affected by new information. Should you require clarification of any material, please contact us.

2. Prevalence of Physical Inactivity in Australia

This section presents an overview of studies and surveys that examine the prevalence of physical inactivity in Australia. From this overview, the most accurate estimate of physical inactivity is selected to be used as an input for the modelling of the direct gross cost of inactivity to the Australian economy.

The United States (US) Surgeon General's Report on Physical Activity and Health (1996)[21] confirmed the perception that substantial health gains were possible if the community adopted more regular moderate physical activity. This is because physical activity is considered to be an important factor in improving health and wellbeing. The objective of the US Surgeon General's Report was to indicate the role of physical activity in preventing disease and on the status of interventions to increase physical activity. The major conclusion derived from this report was that the American population could substantially improve their health and quality of life by including moderate amounts of physical activity in their daily lives.

The results from the US Surgeon General's Report were important in establishing the importance of physical inactivity as a major risk factor for ill health. In Australia, physical inactivity is now recognised as being the 4th most important risk factor for ill health behind tobacco, high blood pressure and high body mass.[22] Although physical inactivity is ranked the 4th most important risk factor for ill health, it should be noted that physical inactivity contributes to the two other risks ranked above it – i.e. high blood pressure and high body mass. Physical activity is considered to play an important role as a preventative factor in five of the six national health priority areas - cardiovascular disease, cancer control, mental health, diabetes mellitus, and injury prevention and control.[23]

The United States General's Report outlined the required amount of physical activity to obtain a health benefit. Following this, the DHAC[24] developed the National Physical Activity guidelines (NPA guidelines) for Australians.[25]

Under the NPA guidelines, it is recommended that Australians put together at least 30 minutes of moderate-intensity physical activity on most days of the week as the minimum requirement for good health. However, to be considered 'physically active' the NPAS states you should participate in at least 150 minutes of moderate-intensity physical activity over at least five sessions in a week[26] as the minimum requirement to be considered physically active. Moderate-intensity physical activity is defined as being intense enough to cause a slight and noticeable increase in an individuals breathing and heart rate. The NPA guidelines also recommend that for additional health and fitness benefits, 30 minutes or more of vigorous activity on 3–4 days of the week should be added to the minimum recommendation. Vigorous intensity physical activity is defined as being intense enough to

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[21] United States Department of Health and Human Services (USDHHS) (1996). Physical activity and health: a report of the Surgeon General. Atlanta, GA: US. Department of Health and Human Services. Centres for Disease Control and Prevention, National Centre for Chronic Disease Prevention and Health Promotion.

[22] Australian Institute of Health and Welfare (2007). The Burden of Disease in Australia 2003.

[23] Armstrong, T., Bauman, A & Davies, J. (1999). Physical activity patterns of Australian adults, Australian Institute of Health and Welfare, Canberra

[24] Now known as the Department of Health and Ageing.

[25] Department of Health and Ageing (DHAC), 1999, National Physical Activity Guidelines for Australians. Canberra: DHAC.

[26] Each session should contain at least 10 minutes of continuous moderate intensity activity.

represent a substantial challenge to an individual and refers to a level of effort in which a person should experience a large increase in breathing or heart rate.

There have been several attempts to measure physical activity in Australia since the late 1970s. Early efforts included physical activity questions in the National Heart Foundation Risk Factor Prevalence surveys in 1980, 1983 and 1989.[27] There were also efforts to characterise physical activity participation in a sport and recreation context between 1984 and 1987.[28]

The National Health Survey (NHS), collected by Australian Bureau of Statistics (ABS) for 1989, 1995, 2001 and 2004/05, collected information about the health status of Australians, their use of health services and facilities, and health related aspects of their lifestyle. The results of this survey show the physical activity levels of the Australian population based on a four-category system. The four categories are sedentary, low, moderate and high levels of physical activity. The results of this survey are not used to measure the prevalence of inactivity in Australia in this report because the results of the NHS cannot be assessed directly in terms of the NPA guidelines.

As such, to obtain estimates of the prevalence of physical inactivity in Australia, Econtech used the latest 2000 National Physical Activity Survey (NPAS). The reason for selecting the NPAS over the NHS is because the NPAS followed the NPA guidelines and therefore provides a more accurate estimate of the prevalence of physical inactivity.

The NPAS undertaken by the Australian Institute of Health and Welfare used the NPA guidelines to classify people into active/inactive categories. As such, this survey classified people as physically active if they accumulated 150 minutes of at least moderate intensity leisure time physical activity over at least five sessions in a week.[29] In contrast, the NPAS classified people as physically inactive if they completed less than 150 minutes per week of moderate intensity physical activity.

The NPAS was conducted in 1997, 1999 and 2000. These three surveys were conducted during the same period of each year (the last two weeks of November and the first two weeks of December) to ensure that participation rates were not affected by seasonal conditions. Each year, the survey consisted of the Active Australia core survey questions[30], and additional supplementary questions covering demographics, height weight, recognition and recall of specific physical activity promotional messages.

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[27] National Heart Foundation of Australia. (1989). Risk factor prevalence study No. 3. Canberra: NHF

[28] Bauman, A., Owen, N. and Rushworth, R.L. (1990), Recent trends and socio-demographic determinants of exercise participation in Australia. Community Health Studies, 14, 19-26.

[29] Leisure-time physical activity is exercise, sports, recreation, or hobbies that are not associated with activities as part of one's regular job duties, household, or transportation. Moderate intensity activity is activity that causes a slight but noticeable increase in breathing and heart rate, for example brisk walking, digging in the garden or medium paced cycling.

[30] Examples of the core questions asked in the NPAS include - In the last week, how many times have you walked continuously, for at least 10 minutes, for recreation, exercise or to get to or from places?, and What do you estimate was the total time that you spent walking in this way in the last week?.

The NPAS method was a random sample population telephone survey (using CATI methodology)[31] conducted by the Hunter Valley Research Foundation. The electronic white pages was utilised to generate a random sample of households, and an adult aged 18-75 years was then randomly selected from within each household.

Those who participated were asked a series of questions (lasting about 10 minutes) on their participation in, and knowledge and understanding of physical activity. This survey was able to estimate the proportion of the Australian population that was physically inactive based upon the NPA guidelines. Details of this survey and the methods used to calculate the prevalence rates are described in Armstrong et al. (2000).[32]

The NPAS classifies people in three main categories: sedentary, insufficient and sufficient. Sedentary refers to the portion of the population that undertake little to no physical activity, insufficient refers to the people who undertake physical activity but not enough to be classified as physically active and sufficient refers to the portion of the population that achieved 150 minutes of at least moderate intensity leisure time physical activity over at least five sessions in a week.

Chart 2.1 shows the prevalence of physical inactivity for Australian adults for the periods 1997, 1999, 2000 and 2007. The estimates for the periods 1997, 1999 and 2000 were obtained from the National Physical Activity Surveys (NPAS).[33] The 2007 estimate was calculated by assuming the 2000 NPAS estimate of physical inactivity remained unchanged between 2000 and 2007.

The 2007 estimate of prevalence of physical inactivity was used as an input to estimate the direct gross costs of physical inactivity on the Australian economy. The 2007 estimate was chosen because the evidence regarding trends in physical inactivity over the years is limited and generally inconclusive. For example, according to the NPAS, the proportion of the adult population that was physically inactive increased by 5.9 per cent between the periods 1997-1999. However, there was a slight decline from 1999 to 2000 by 1.1 per cent. Furthermore, data from the National Health Survey[34] for periods 1995, 2001 and 2004/05 showed that on average, the proportion of people in the sedentary[35] group decreased from 1995 to 2004/05, but the proportion of people in the moderate[36] and high[37] groups also decreased. It is therefore difficult to determine if the Australian population is becoming more physically inactive or active. As such, for this report, Econtech used a conservative estimate of prevalence of physical inactivity (2007 estimate) to calculate the direct gross costs of physical inactivity amongst adults on the Australian economy.

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[31] Computer Assisted Telephone Interviewing (CATI) is a telephone surveying technique in which the interviewer follows a script provided by a software application. The software is able to customize the flow of the questionnaire based on the answers provided, as well as information already known about the participant.

[32] Armstrong T,, Bauman A., and Davies J. (2000). Physical activity patterns of Australian adults. Results of the 1999 National Physical Activity Survey. Canberra: Australian Institute of Health and Welfare.

[33] Australian Institute of Health and Welfare analysis of the 1997, 1999 and 2000 National Physical Activity Surveys. Canberra.

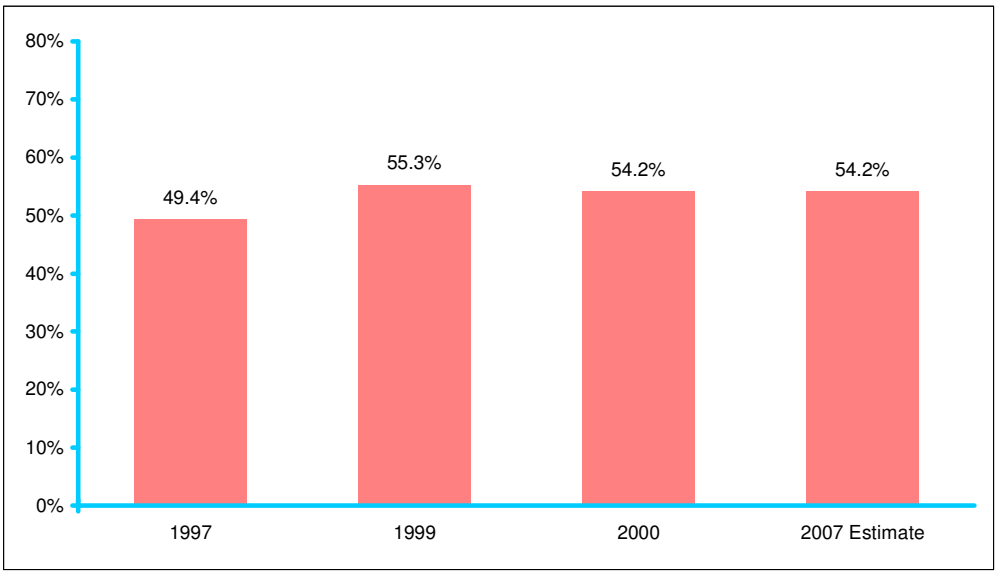
[34] Australian Bureau of Statistics, National Health Survey cat no. 4364.0.

[35] Defined as people that exercised less than 100 minutes in the two weeks previous to the survey.

[36] Defined as people that exercised between 1600 to 3200 minutes, or more than 3200 minutes but less tan 2 hours of vigorous exercise in the two weeks previous to the survey.

[37] Defined as people that exercised more than 3200 minutes and 2 hours or more of vigorous exercise in the two weeks previous to the survey.

Chart 2.1
Prevalence of Physical Inactivity in Australia 1997, 1999, 2000 and 2007 (estimate)



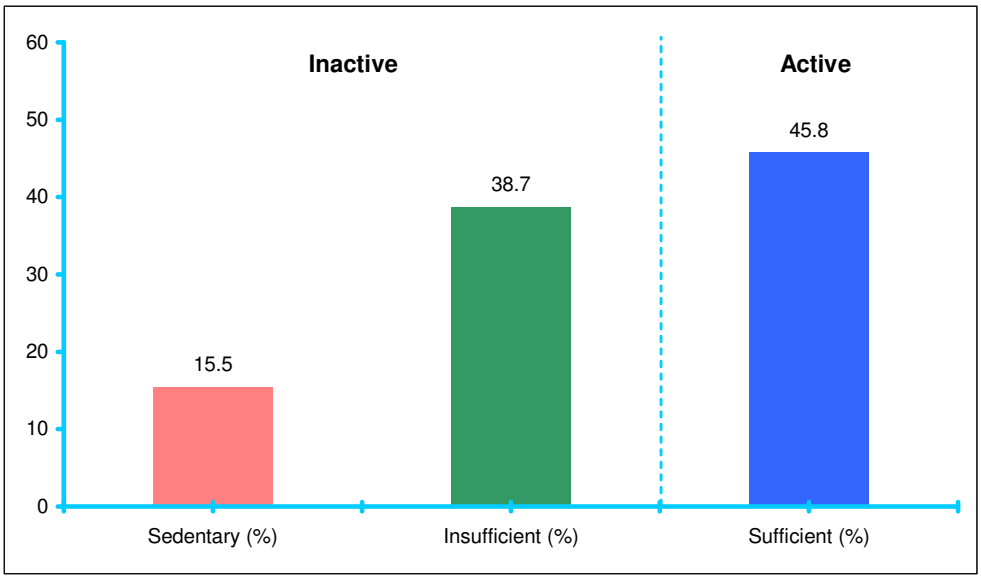
Source: Econtech and 1997, 1999 and 2000 National Activity Surveys.
Note: (a) The estimates presented in this chart are age standardised.[38]
(c) 2007 estimate was calculated by assuming the prevalence of inactivity remains unchanged for the period 2000-07.

As shown in Chart 2.1, the 2007 estimate shows that 54.2 per cent of Australians aged 18-75 years currently do not undertake sufficient physical activity to obtain a health benefit (i.e. were inactive). This means that about 9 million adult (aged 18-75) Australians are physically inactive in 2007.

Chart 2.2 presents further details about the 2000 NPAS. Importantly, as mentioned before, for this report, it is assumed that the prevalence of physical inactivity in 2007 is the same as the prevalence reported by the 2000 NPAS. As shown in this chart, in 2000, 15.5 per cent (about 2.6 million) of adult Australians were considered sedentary and 38.7 per cent (about 6.4 million) were not having sufficient physical activity. This translates into a total of 54.2 per cent of Australians classified as inactive.

[38] Age-standardised rates enable comparisons to be made between populations which have different age structures. It effectively minimises the effects of differences in age composition and thus facilitates valid comparison of rates for populations with different age compositions.

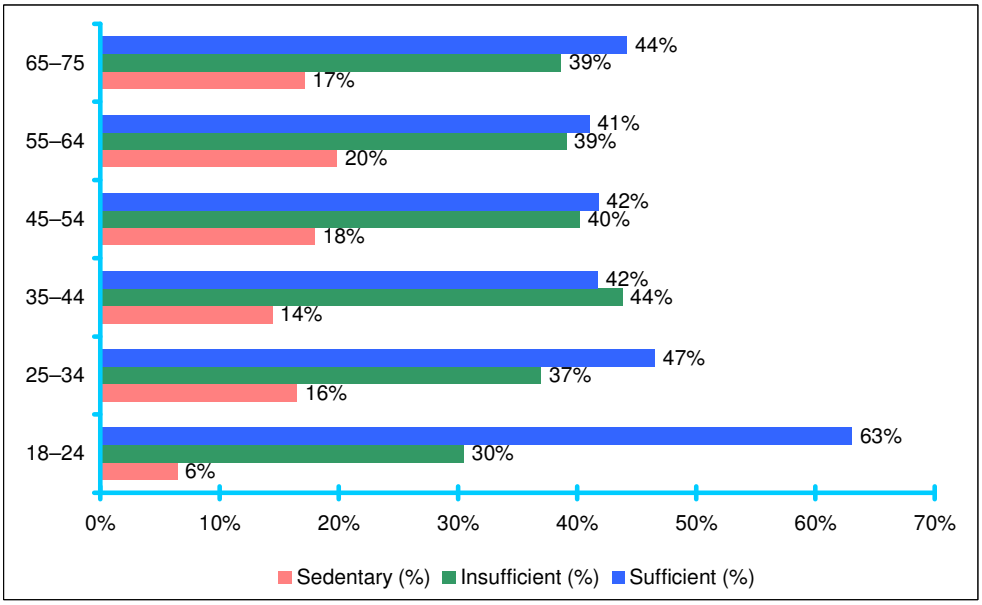
Chart 2.2
Percentage of People Achieving Sedentary, Insufficient and Sufficient levels of Physical Activity, 2000



Source: National Physical Activity Survey, 2000.

Chart 2.3 shows that in general, the level of physical activity declined with age. Also, people within the 18-24 age cohort were more likely than older people to achieve sufficient levels of physical activity amongst Australian adults.

Chart 2.3
Percentage of People by Age Group Achieving Sedentary, Insufficient and Sufficient Levels of Physical Activity (per cent), 2000



Source: National Physical Activity Survey 2000.

The 2007 estimate of the prevalence of physical inactivity (54 per cent) presented in this section will be used later in this report to estimate the direct gross and net cost of physical

inactivity to the Australian economy. It is important to remember that this estimate only examines the prevalence of physical inactivity among people aged between 18-75 years. This is because there is no reliable data on trends in physical activity in children and adolescents in Australia at this point in time. Furthermore, data relating to children and adolescents have been characterised by a lack of accurate population-level physical activity monitoring and survey collection.[39]

Given that the estimates of prevalence of physical inactivity presented in this report do not include children and adolescents, it is possible that the total inactivity figures could be higher. As such, more comprehensive and recent data would better reflect the current prevalence of physical inactivity in Australia.

[39] Trost, S.G. (2005). Discussion paper for the development of recommendations for children's and youths' participation in health promoting physical activity. Australian Department of Health and Ageing.

3. Medical Conditions Related to Physical Inactivity

The previous section provided estimates of prevalence of inactivity in Australia. This section will outline the medical conditions that are found to have a strong causal relationship with physical inactivity.

The existing medical literature shows that people who participate in moderate to vigorous levels of physical activity and/or have high levels of cardiorespiratory fitness have a lower mortality rate than those with a sedentary lifestyle.[40] Furthermore, the WHO (2003) indicated that physical activity can reduce the risk of disease by improving glucose metabolism, reducing body fat and lowering blood pressure - these are the main ways in which physical activity is thought to reduce the risk of heart disease and diabetes.

There is strong evidence that lack of regular physical activity is associated with an increased risk of mortality and morbidity from heart and vascular diseases, particularly coronary heart disease (CHD).[41] There is also some association between physical inactivity and an increase in risk of some types of stroke (also known as cerebrovascular disease). Evidence presented in studies using different measurement techniques (e.g. self-reported physical activity, fitness assessments, motion sensors) show similar associations between physical inactivity and type 2 diabetes.[42] [43] Furthermore, the medical literature also shows a relationship between physical inactivity and some cancers, particularly an increased risk for breast cancer and colon cancer (also known as bowel cancer).[44] Physical inactivity is also related to the incidence of fall related injuries, particularly among the elderly.[45]

Existing medical studies show that the strongest evidence for the health benefits of physical activity is in reducing the risk of mortality and morbidity from cardiovascular disease. [46] Indeed, the literature shows that, compared with those that are at least moderately physically active, people who are sedentary have a 50 per cent increase in the risk of a fatal or non-fatal cardiovascular event such as coronary heart disease.[47]

In the United States, it is estimated that approximately 35 per cent of coronary heart disease mortality is due to physical inactivity. The significance of this relationship lies in the fact that coronary heart disease is the leading cause of death in the United States with over 700,000 deaths annually.[48]

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[40] Paffenbarger, R. Hyde, R.T, wing, A.L. (1993). The association of changes in physical activity level and other lifestyle characteristics with mortality among men. New England Journal of Medicine, 328, 538-545.
[41] Coronary heart disease is also known as ischaemic heart disease, heart attack and related disorders.
[42] Weiderpass E., Persson I., Adami H. (2000). Body size in different periods of life, diabetes, hypertension, and risk of postmenopausal endometrial cancer. Cancer Causes Control 11:185-92.
[43] Huang T., Goran M., (2003). Prevention of type 2 diabetes in young people: a theoretical perspective, Paediatric Diabetes 4(1), 38–56.
[44] Mathers C., Vos T. & Stevenson C. (1999). The burden of disease and injury in Australia. Cat. no. PHE 17. Canberra:AIHW
[45] Lord, S. (1995). The effect of a 12 month exercise trial on balance, strength and falls in older women, Journal of American geriatrics Society, 43:1198-1206.
[46] Berlin JA & Colditz GA 1990. The meta-analysis of physical activity in the prevention of coronary heart disease. American Journal of Epidemiology 132(4): 612–627.
[47] Ibid.
[48] Department of Health (1999), New York State.

As mentioned before, physical activity also has a major role in the prevention and treatment of type 2 diabetes. Besides diet, lack of physical activity is considered another major behavioural risk factor for the development of type 2 diabetes. The medical literature suggests that type 2 diabetes prevalence is consistently lower in populations with higher levels of physical activity. In large longitudinal studies in adults, the health benefit of regular physical activity on reducing the incidence of type 2 diabetes is well documented.[49] Furthermore, Helmrich et al. (1991)[50] found that both aerobic and resistance types of exercises are strongly associated with a decreased risk of type 2 diabetes. The authors found that each increase of 500 kcal[51] in energy expenditure per week is associated with a decreased incidence of type 2 diabetes of 6 per cent.

The medical literature reviewed for this study also shows a relationship between physical inactivity and some cancers. For instance, Colditz et al. (1997)[52] showed the protective effect of physical activity on the risk of colon cancer. In particular, Colditz et al. found that physical activity can reduce the risk of colon cancer by 22 per cent.

Physical inactivity is also associated with an increased risk of endogenous hormone-related cancer (especially breast cancer).[53] Most evidence suggests that physical inactivity increases breast cancer risk in both premenopausal and postmenopausal women.[54] Physical inactivity increases the incidence of breast cancer by increasing the number of ovulatory cycles, and increasing ovarian estrogen production. Physical inactivity will also increase body fat and could also increase fat-produced estrogens.[55]

Studies have also shown that low levels of physical activity are associated with poor mental health. For example, it has been found that women involved in leisure time physical activity at least once a week had better psychological well-being and less depressiveness, compared to more sedentary women.[56] These findings confirm those of Stephens (1988)[57], who showed that physical activity is positively associated with good mental health (positive mood, general well-being, relatively infrequent symptoms of anxiety and depression), particularly in women.

Adding to the work of Stephens (1988), Nicola et al. (2007)[58] examined associations between leisure-time physical activity and Common Mental Disorder (CMD), defined as anxiety and depression. Among the 1,158 men that participated in the study, those who participated in any heavy-intensity leisure-time activity had reduced odds (60 per cent) of

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[49] Huang T., Goran M., (2003). Prevention of type 2 diabetes in young people: a theoretical perspective, Pediatric Diabetes 4 (1), 38–56.

[50] Helmrich SP, Ragland DR, Leung RW, et al. (1991), Physical activity and reduced occurrence of non-insulin-dependent diabetes mellitus. N Engl J Med ; 325:147-52.

[51] Kcal, an abbreviation for kilocalorie. A unit of energy, which is equivalent to 1000 calories.

[52] Colditz G., Cannuscio C. & Frazier A. (1997). Physical activity and reduced risk of colon cancer: implications for prevention. Cancer Causes and Control 8: 649–667.

[53] World Health Organisation (2003). Global Strategy on Diet, Physical Activity and Health.

[54] McTiernan A., Kooperberg C., White E., Wilcox S., Coates R., Adams-Campbell L., Woods N., Ockene J. (2003) Recreational physical activity and the risk of breast cancer in postmenopausal women. *J Am Med Assoc*, 290:1331-1336.

[55] Ibid.

[56] Ibid.

[57] Stephens T. (1988) Physical activity and mental health in the United States and Canada. Evidence from four population surveys. Prevent Med, 17: 35–47.

[58] Nicola J., Anne M., John G., Debbie A., Glyn L. (2007). Physical activity and common mental disorder: results from the Caerphilly study. American Journal of Epidemiology 165(9).

CMD 5 years later.[59] In an Australian study by Mummery et al. (2002)[60], physical activity in older adults was found to be related to positive mental health.

Exercise can also help to reduce the risk of falling in older adults. Several studies have revealed the beneficial role of physical activity in reducing the risks of falls among the elderly.[61] [62] Physical activity can help improve balance. This in turn helps older people by improving mobility and functional capacity, and reducing the risk of falls and injuries.[63]

There is evidence that inactivity relates to several other medical conditions such as gallbladder, hypertension, osteoarthritis, and osteoporosis. However, the evidence linking physical inactivity with these medical conditions is still inconclusive.

Evidence within the literature has shown that physical activity can protect against gallbladder disease.[64] Nonetheless, this evidence is confined to a few studies and is inconsistent. In addition, there is evidence suggesting that higher levels of leisure-time physical activity are associated with a reduced incidence of hypertension; but the results are not always consistent.[65] Also, physical activity appears to be of benefit for controlling the symptoms of osteoarthritis and maintaining the health of joints. However, there is limited evidence that physical activity itself can prevent osteoarthritis.[66] There is also some evidence that for those afflicted by osteoporosis, physical activity may assist in relieving symptoms and functional capacity.[67] However, it is unclear what type of physical activity would have to be undertaken to avoid/reduce the incidence of osteoporosis.[68]

Because of the inconclusive evidence, this Econtech study does not quantify the cost of inactivity attributed to gallbladder, hypertension, osteoarthritis, and osteoporosis. However, the exclusion of these diseases in this study does not mean physical inactivity is not important in their prevention, or that there is no evidence suggesting a causal relationship.

Given the evidence in the literature discussed in this section, this report focuses on estimating the direct gross cost attributable to physical inactivity in adults for seven medical conditions. The reason for this is that the epidemiological evidence is reasonably strong for these medical conditions, suggesting a causal relationship between physical inactivity and the increased risk of mortality and/or incidence of these conditions.

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[59] The investigation involved following the group of middle age men for 5 years (1989/93) and 10 years (1993/97).

[60] Mummery, K., Schofield, G. and Caperchione, C. (2002). Physical activity and mental health status in a population of older adults, Central Queensland University.

[61] Lord, S. (1995). The effect of a 12 month exercise trial on balance, strength and falls in older women, Journal of American geriatrics Society, 43:1198-1206.

[62] Gillespie, N., McMurdo M. (1998). Falls in old age: inevitable or preventable? Scottish Medical Journal, 43:101-03.

[63] Gregg, E., Casperson P., (2000). Physical activity, falls, and fractures among older adults: A review of the epidemiologic evidence, Journal of the American geriatrics Society, 48:883-93.

[64] Vega, K., Johnston, D. (1999). Exercise and the Gallbladder. NEJM, 341: 836-837.

[65] Fagard, R. (2005). Physical activity, physical fitness and the incidence of hypertension, Journal of hypertension, 23:265-67.

[66] Armstrong, T., Bull, F., Dixon, T., Ham, S., Neiman, A., and Pratt, M. (2004). Global and Regional Burden of Disease Attribution to Selected Major Risk Factors, WHO.

[67] Minor, M. (1991). Physical activity and the management of arthritis. Annals of Behavioural medicine; 13:117-24.

[68] Vuori I (2001). Dose–response of physical activity and low back pain, osteoarthritis, and osteoporosis. Medicine and Science in Sports and Exercise, 33:S551–586.

4. Cost of Selected Medical Conditions to the Health Sector

The previous section outlined the medical conditions that are considered to have a strong causal relation with physical inactivity and defines the medical conditions that will be the focus of this report. This section provides estimates of the expenditure on these medical conditions.

An essential input into the modelling of the direct gross cost of physical inactivity of adults to the Australia economy is the cost of physical inactivity-related conditions to the health sector. These costs were sourced from the Australian Institute of Health and Welfare (AIHW)[69] which provides estimates of the total allocated recurrent health expenditures on disease and injury for both the public and private sectors. The AIHW cost estimates include expenditures on:

- the costs of services for admitted and non-admitted patients in both public and private hospitals, and expenditure of medical services for private patients in hospitals;
- the costs of 'out-of-hospital medical services' - includes private medical services provided by both GPs and specialists;
- expenditure on prescribed medications covered by both the Pharmaceutical Benefits Scheme (PBS) and non-PBS, as well as over-the counter medicines. Pharmaceuticals that are dispensed in hospitals are included in the estimates of hospital costs;
- expenditure on allied health services, which includes services delivered outside hospitals by paramedical professionals such as physiotherapists, occupational therapists and speech therapists; and
- expenditure on aged care homes, which includes expenditure on residents who require and receive a level of care that fall within one of the four highest levels in residential aged care services. The expenditure in this category is not entirely for health purposes. Much of this expenditure is on food, lodging and other necessities of daily life of residents.

The latest expenditure estimates by AIHW are for the year 2000/01. Econtech updated these costs to 2006/07 prices using the Health Consumer Price Index (HCPI).[70] Additionally, Econtech adjusted the expenditure estimates by taking into account population growth from the 2000/01 to the 2006/07 period.

Chart 4.1 shows the direct health care costs for both the public and private sectors for physical inactivity-related conditions for 2006/07. As shown in the chart, the total estimated health care cost for preventing and treating the main[71] medical conditions related to physical inactivity in 2006/07 is $8,841 million. Interestingly, fall related injuries were the biggest contributor to total health care costs for the main medical conditions, followed by coronary heart disease.

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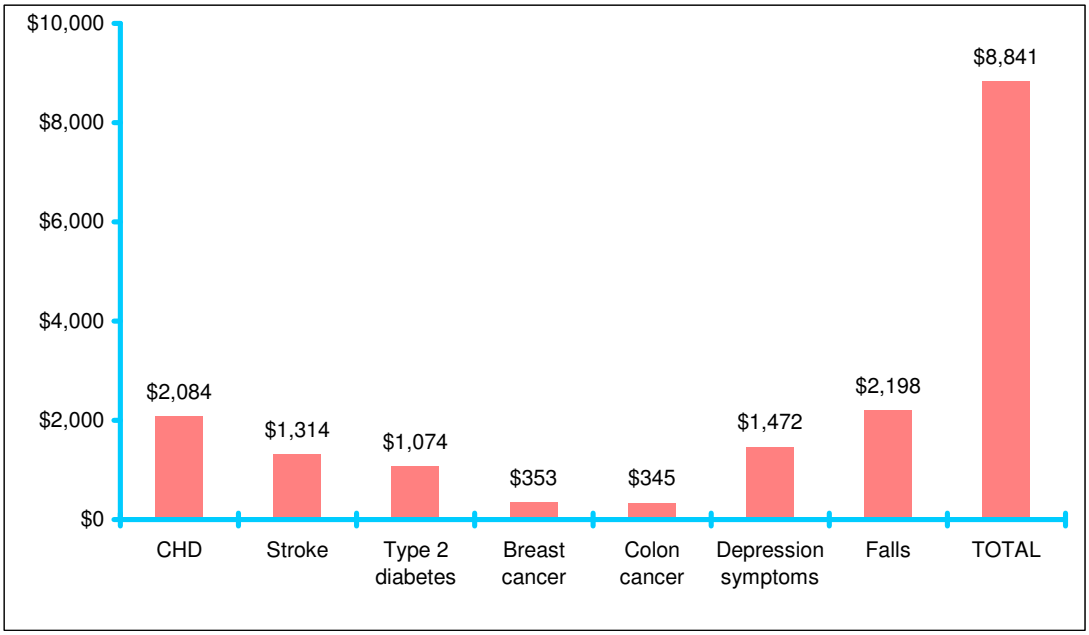
[69] Australian Institute of Health and Welfare (2005). Health system expenditure on disease and injury in Australia, 2000-01. Second edition. AIHW cat no. HWE 28 Canberra.

[70] Health CPI index obtained from ABS Cat no. 6401.0.

[71] The term 'main' is used to indicate the seven medical conditions more closely related to physical inactivity as identified earlier, and focussed on throughout the report.

Chart 4.1
Allocated Recurrent Health Expenditure for Seven Medical Conditions Related to Physical Inactivity, 2006/07 ($ million)



Source: Estimated by Econtech using data from Australian Institute of Health and Welfare (2005), ABS Cat no. 6401.0 and ABS Cat no. 3101.0
Note: CHD stands for coronary heart disease.

5. Physical Inactivity and Risk of Disease Morbidity & Mortality

The previous section outlined the health system expenditure on the main medical conditions that have a strong relation with inactivity. This section estimates the proportion of the main medical conditions that are attributable to physical inactivity.

To estimate the proportion of medical conditions that may be attributable to physical inactivity (or the proportion of medical conditions that may be prevented by eliminating inactivity), Econtech calculated the Population Attributable Risk (PAR). This is the maximum proportion of medical conditions attributable to the specific exposure (i.e. to physical inactivity). The PAR is based on the incidence of medical conditions in the exposed group (i.e. physically inactive group) as compared with the non-exposed group (i.e. physically active group).

The PAR is calculated using the following formula[72]:

$$\textit{Population Attributable Risk} = P(RR-1)/1+P(RR-1)$$

Where:

P = prevalence of inactivity in the population; and

RR = relative risk (of medical condition outcome) in the sedentary/insufficient activity group, compared with the active group.

The relative risk is a measure of the strength of association between physical inactivity and medical condition outcome. The relative risk compares the rates of health or disease in individuals. For example, those who smoke are more than ten times as likely to develop lung cancer, compared to non-smokers.[73] However, the PAR depends on the relative risk and prevalence of physical inactivity (risk factor) in the population. As such, the PAR measures the incidence of a disease in the population as a result of the risk factor in the population.

Using the concept of PAR, Econtech estimated the proportion of the main medical conditions that can be attributed to physical inactivity. This PAR value also illustrates the potential reduction in the risk of the main medical conditions that could be achieved if the adult Australian population become more physically active. The PAR estimate obtained in this section will be used in Section 6.2 to estimate the direct gross costs associated with physical inactivity.

To estimate the PAR for each of the main medical conditions, Econtech used the prevalence of physical inactivity among Australian adults presented in Section 2 and the relative risk of the main medical conditions[74]. The relative risk estimates for the main medical conditions related to physical inactivity were taken from Armstrong et al. (2004)[75] and Stephenson et al.

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[72] Stephenson, P., Bauman, A., Armstrong, T., Smith, B., and Bellew, B. (2000). The cost of illness attributable to physical inactivity in Australia: A preliminary study, The Commonwealth Department of Health and Aged Care and the Australian Sports Commission.

[73] Ibid.

[74] The relative risk is determined by dividing the rate of the disease among inactive people by the rate of disease among active people.

[75] Armstrong, T., Bull, F., Dixon, T., Ham, S., Neiman, A., and Pratt, M. (2004). Global and Regional Burden of Disease Attribution to Selected Major Risk Factors, WHO.

(2000)[76]. To estimate the relative risk values for medical conditions related to physical inactivity, Armstrong et al. (2004) conducted a meta-analysis[77]. In contrast, Stephenson et al. (2000) only calculated the average relative risk estimates from the literature. Since Armstrong et al. (2004) provided a more comprehensive analysis of the literature and is more recent when compared to Stephenson et al. (2000), Econtech used six of the relative risk estimates from the Armstrong et al. (2004) study and only one relative risk estimate from the Stephenson et al. (2000) study.

The relative risk estimates for the main medical conditions related to physical inactivity used to calculate the PARs are shown in Table 5.1.

Table 5.1
Relative Risk Estimates for Selected Medical Conditions

Medical Conditions	Relative Risk
CHD	1.40
Stroke	1.26
Type 2 diabetes	1.45
Breast cancer	1.25
Colon cancer	1.40
Depression symptoms	1.25
Falls	1.50

Source: Armstrong et al. (2004) and Stephenson et al. (2000).
Note: CHD stands for coronary heart disease.

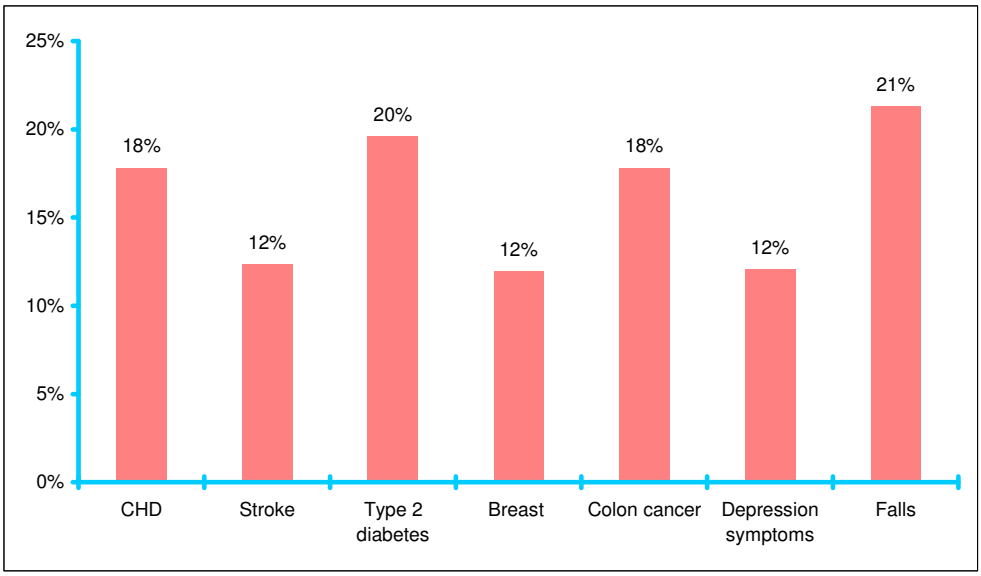
As mentioned before, the relative risk is a measure of the strength of association between physical inactivity and a particular medical condition. For instance, Table 5.1 suggests that those people who are physically inactive show a 1.4 fold increase (40 per cent increase) in the risk of CHD, compared to the physically active. Similarly, the estimates in Table 5.1 suggest that, compared to the physically active, those physically inactive show a 26 per cent increase in the risk of stroke, a 45 per cent increase in the risk of type 2 diabetes and a 25 per cent increase in the risk of breast cancer.

Using the relative risk estimates presented in Table 5.1, Econtech calculated the PAR for each of the main medical conditions related to inactivity. These estimates are shown in Chart 5.1. These PAR estimates illustrate the proportion of the medical conditions that can be attributable to physical inactivity.

[76] Stephenson, P., Bauman, A., Armstrong, T., Smith, B., and Bellew, B. (2000) The Commonwealth Department of Health and Aged Care and the Australian Sports Commission

[77] A meta-analysis is a statistical procedure that uses results of several studies. It synthesises results of several independent studies which address a set of related hypothesis. The advantage of a meta-analysis is that it incorporates comprehensive research evidence of several sources and provides an accurate estimate of effects.

Chart 5.1
Population Attributable Risk (PAR) Estimates for Medical Conditions Related to Physical Inactivity (per cent)



Source: Econtech estimates.
Note: CHD stands for coronary heart disease.

Table 5.2 shows a comparison of Econtech's PAR estimates with PAR estimates from two previous studies (Stephenson et al., 2000[78] and Colditz, 1999)[79] . Stephenson's study was for Australia, and Colditz was for the United States. As shown in the chart, generally, Econtech's PAR estimates are very similar to the estimates from these two studies.[80]

Table 5.2
Comparison of PAR Estimates Between Different Studies (per cent)

Medical Conditions	Econtech Study	2000 Australian study	US Study
CHD	18%	18%	22%
Stroke	12%	16%	n/a
Type 2 diabetes	20%	13%	12%
Breast	12%	9%	5%
Colon cancer	18%	19%	22%
Depression symptoms	12%	10%	n/a
Falls	21%	18%	18%

Source: Econtech, Stephenson et al. (2000) and Colditz (1999)
Note: CHD stands for coronary heart disease.

[78] Stephenson, P., Bauman, A., Armstrong, T., Smith, B., and Bellew, B. (2000). The cost of illness attributable to physical inactivity in Australia: A preliminary study, The Commonwealth Department of Health and Aged Care and the Australian Sports Commission.
[79] Colditz, G. A. (1999). Economic Costs of Obesity and Inactivity. Med Sci. Sports Exerc., 31(11):663-67
[80] The US study did not examine the incidence of stroke and depression.

6. Economic Costs of Inactivity in Australia

This section estimates the direct gross and net cost of inactivity in Australia. Generally, the total gross economic cost of physical inactivity can be divided in three main components:

- *Direct costs.* These costs refer to greater health expenditures by the public and private sectors for the prevention, diagnosis and treatment of medical conditions related to inactivity.
- *Indirect costs.* These costs relate to issues such as decreased longevity (shorter life expectancy), increased presenteeism and absenteeism, and increased disability.
- *Intangible costs.* These are costs to the ill person and their family in terms of their reduction of quality of life due to such issues as pain, disability, anxiety and suffering.

The net costs of inactivity can be calculated as the direct gross costs less the expenses associated with participation in physical activity, including sports injuries and out-of-pocket costs such as gym membership fees and equipment expenses.

Importantly, as mentioned in Section 1, this report focuses on quantifying the **direct** gross and net cost of physical inactivity to Australia in the form of monetary values.

This section is divided as follows. Section 6.1 outlines the advantages of Econtech's study over previous work undertaken in the area. Section 6.2 estimates the direct gross costs of physical inactivity. Section 6.3 estimates the direct net costs of physical inactivity.

6.1 Comparison with Previous Work

The first attempt to estimate the direct gross costs of physical inactivity on the Australian economy was by Stephenson et al. (2000)[81]. The Stephenson et al. study used the Population Attributable Risk (PAR) approach to estimate the direct gross costs of physical inactivity on the Australian economy. This study estimated the direct health care costs attributable to physical inactivity to be around $377 million per annum (in 1993/94 prices). Particularly, the Coronary heart disease (CHD) costs were estimated to be $161 million, $28 million for type 2 diabetes, $16 million for colon cancer, $101 million for stroke, $16 million for breast cancer, and up to $56 million for depressive disorders.

In comparison, this Econtech study effectively extends the work of Stephenson et al. by estimating the direct net costs associated with physical inactivity to the Australian economy. There are four important differences between these studies.

- Firstly, Econtech has used the most up to date estimate on the prevalence of physical inactivity in the Australian population as well as the most recent health care expenditure figures to estimate the direct gross costs of physical inactivity on the Australian economy.
- Secondly, Econtech's direct gross cost estimates of physical inactivity focus primarily on seven medical conditions that are found to have a strong link with

[81] Stephenson, P., Bauman, A., Armstrong, T., Smith, B., and Bellew, B. (2000). The cost of illness attributable to physical inactivity in Australia: A preliminary study, The Commonwealth Department of Health and Aged Care and the Australian Sports Commission.

physical inactivity. In contrast, the direct cost estimate obtained by Stephenson et al. only accounted for six medical conditions.

- Thirdly, Econtech has used more comprehensive and recent relative risk estimates from the academic literature.
- Fourthly, this Econtech study estimates the direct net costs of physical inactivity on the Australian economy. This involved estimating the direct cost offsets associated with being physically active.

As such, Econtech's direct net cost estimates of physical inactivity presented in this study have greater advantages in terms of accuracy and comprehensiveness.

6.2 Direct Gross Costs of Physical Inactivity

Using the PAR estimates for the main medical conditions related to physical inactivity calculated in Section 5 and the health expenditure associated with these conditions presented in Section 4, Econtech calculated the direct gross costs attributable to physical inactivity. This information is presented in Table 6.1.

Table 6.1
Direct Health Costs Attributable to Physical Inactivity by Medical Condition, Australia, 2006/07 ($ Million/ per annum)

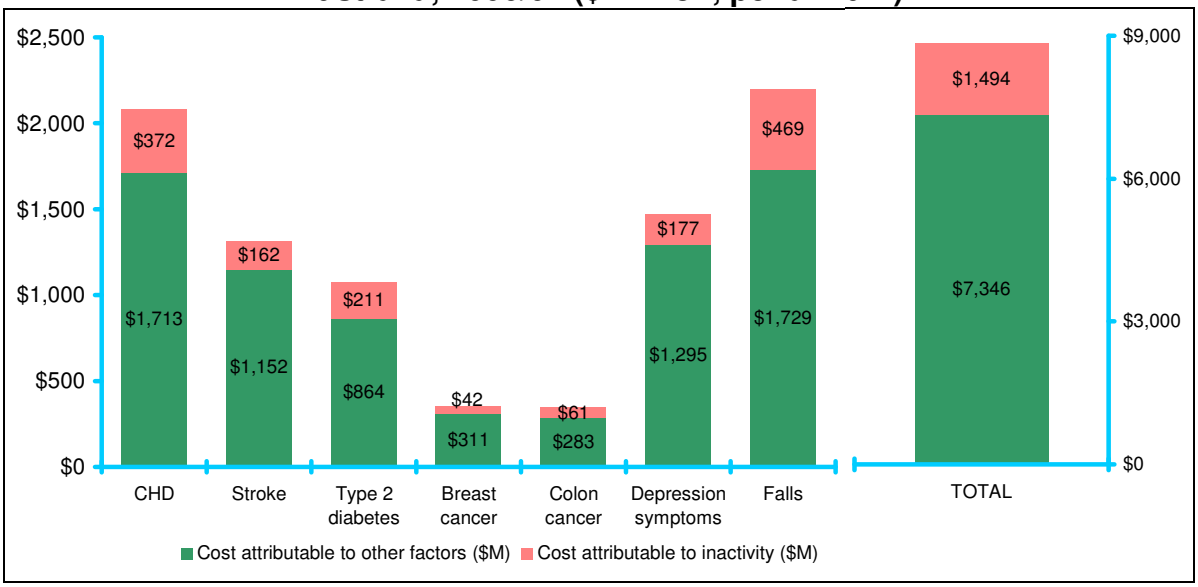
Medical conditions	Total cost of disease ($m, 06/07 prices)	Cost attributable to physical inactivity ($m, 06/07 prices)	Proportion of Costs (per cent)
CHD	$2,084.5	$371.5	18%
Stroke	$1,314.3	$162.4	12%
Type 2 diabetes	$1,074.2	$210.7	20%
Breast cancer	$353.4	$42.2	12%
Colon cancer	$344.6	$61.4	18%
Depression symptoms	$1,472.3	$177.3	12%
Falls	$2,197.5	$468.7	21%
TOTAL	**$8,840.7**	**$1,494.3**	**17%**

Source: Econtech estimates.
Note:
(a) CHD stands for coronary heart disease.
(b) Other medical conditions have not been included in this study because the evidence presented in the medical literature is inconclusive and is thus weak.

As shown in Table 6.1, the direct gross cost attributable to physical inactivity for the main medical conditions that are the focus of this report is $1,494 million per annum (2006/07 prices). This direct gross cost of physical inactivity represents 17 per cent of the total direct health cost of these seven medical conditions. That is, 17 per cent of the total direct health cost of treating these seven medical conditions can be attributed to physical inactivity amongst Australian adults.

For illustration purposes, Chart 6.2 shows the total direct health cost of each medical condition shown in Table 6.1 and the share of this direct cost that can be attributed to physical inactivity.

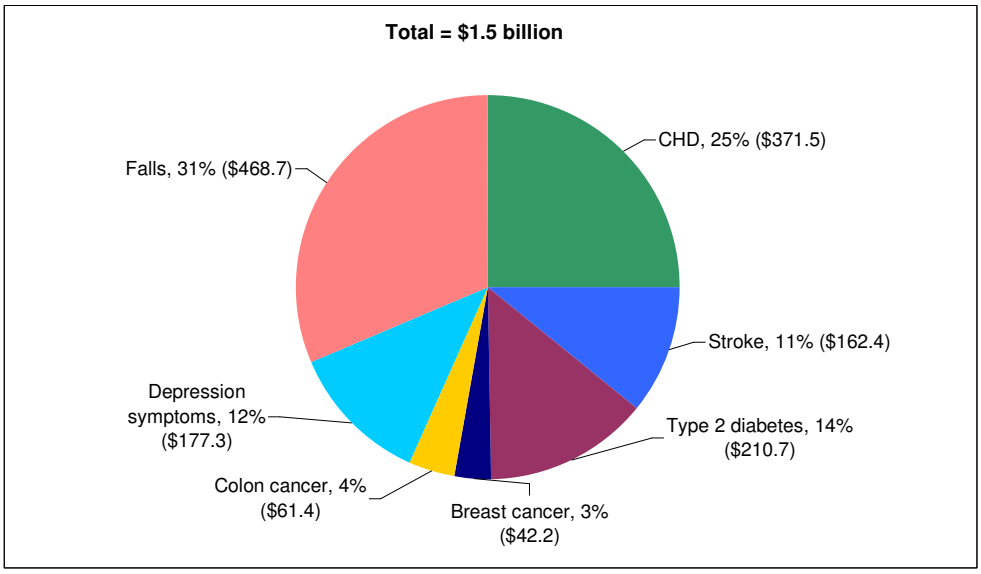
Chart 6.2
Direct Health costs attributable to physical inactivity by medical condition, Australia, 2006/07 ($ Million, per annum)



Source: Econtech estimates

For illustration purposes, Chart 6.3 shows the contribution of each medical condition to the overall direct gross inactivity cost of $1,494 million shown in Table 6.1.

Chart 6.3
Contribution of Medical Conditions to Overall Direct Gross Inactivity Cost



Source: Econtech
Note: CHD stands for coronary heart disease.

It is estimated that the total direct health expenditure in Australia equals $97.9 billion (2006/07 prices).[82] Hence, physical inactivity alone represents 1.5 per cent of the total direct

[82] Australian Institute of Health and Welfare (2006). Health expenditure in Australia, 2004-05. Second edition. AIHW cat no. HWE 35 Canberra.

health expenditure in the Australian economy. This suggests that if physical inactivity was eliminated and the adult Australian population adopted regular moderate physical activity, then the Australian economy could potentially save 1.5 per cent in the direct health care expenditures. In comparison, according to WHO (2003)[83], physical inactivity amongst adults may have contributed as much as $98.7 billion per annum or 4.3 per cent (2006/07 prices) to US direct medical costs.

As mentioned before, the direct gross cost estimates presented in this report only include medical conditions that have a strong link to physical inactivity as established in the medical literature (it does not include medical conditions for which a weak link to physical inactivity has been found). Additionally, the direct gross cost estimates do not include the indirect and intangible costs of physical inactivity. As such, the direct gross costs of physical inactivity estimated in this section are considered to be conservative.

6.3 Direct Net Costs of Physical Inactivity

Section 6.2 estimated the direct gross costs of physical inactivity. This section estimates the direct net costs of physical inactivity. The direct net costs of inactivity can be calculated as the direct gross costs less the expenses associated with participation in physical activity including sports injuries and fitness-related expenses (e.g. health and fitness studios).

For the fitness-related expenses, Econtech used the 2003/04 ABS Household Expenditure Survey to obtain data on total household expenditure on health and fitness studio charges.[84] After adjusting by inflation[85] and population growth[86], Econtech estimated the annual expenditure on health and fitness studios by all households in 2006/07 to be $653 million per annum.

This estimate of fitness-related expenses is considered conservative as it does not include other categories of expenses available in the ABS Household Expenditure Survey that could be related to physical activity. These other categories of expenses were not included because they are not purely related to physical activity as they include recreational activities too.

To estimate the cost offsets associated with sports injuries in Australia in 2006/07, Econtech used a study by Aisbett et al. (2003)[87]. This study estimated the cost of injury in New South Wales for 1998/99. This study found that the direct cost of sports injuries to NSW in 1998/99 was $40.1 million. Using this NSW estimate adjusted by inflation and scaled to the Australian population, Econtech estimated the direct health care costs of sports injuries in Australia in 2006/07 to be $178.5 million (this estimate includes both public and private expenditures).[88]

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[83] World Health Organisation (2003). Global Strategy on Diet, Physical Activity and Health.

[84] Health and fitness studio charges includes both male and female expenditure on aerobic classes, callisthenics, exercise classes, fitness assessments, fitness classes, fitness memberships, gym work-outs, health parlours, saunas, slimming and health parlours, and turkish baths.

[85] Prices were adjusted with the ABS Sports and other Recreation CPI (Cat no. 6401.0).

[86] Population was adjusted with ABS Cat no. 3101.0

[87] Aisbett, C., Potter, M. (2003) Injury Costs: A valuation of the burden of injury in New South Wales 1998-1999, Injury risk management centre.

[88] Importantly, this estimate does not include the indirect costs of sports injuries in Australia; this would include the value of lost output due to reduced productivity caused by injury and any resultant disability

Finally, Econtech calculated the direct net costs of physical inactivity. As shown at the bottom of the left hand column of Table 6.3, the direct net costs of physical inactivity can be calculated as the direct gross costs of physical inactivity less the cost offsets from not engaging in physical activity (i.e. the expenses associated with participation in physical activity). This gives an estimated direct net cost of physical inactivity of $663 million per annum to Australia.

Importantly, this direct net cost is considered to be a conservative estimate because it does not include the indirect and intangible costs of physical inactivity. If the indirect and intangible costs of physical inactivity were taken into account, the inactivity cost figure would be much higher.

Table 6.3
Direct Net Cost of Physical Inactivity in Australia, 2006/07 ($ million/annum)

Gross Cost		**Costs Offset (cost of exercising)**	
Disease	**Direct Health Cost attributable to physical inactivity**		**Direct cost attributable to being physically active**
CHD	$371.5	Direct health costs of sports injuries	$178.5
Stroke	$162.4	Expenditure on sport and exercise products	$652.9
Type 2 diabetes	$210.7		
Breast	$42.2		
Colon cancer	$61.4		
Depression symptoms	$177.3		
Falls	$468.7		
Total gross cost	**$1,494.3**	**Offset**	**$831.4**
Total net cost of inactivity	**$662.9**		

Source: Econtech estimates.
Note:
(a) CHD stands for coronary heart disease.
(b) Expenditure on sports and exercise products includes expenditure on aerobic classes, callisthenics, exercise classes, fitness assessments, fitness classes, fitness memberships, gym work-outs, health parlours, saunas, slimming and health parlours, and turkish baths.

(morbidity) and losses due to premature death (mortality). Hence, the estimate provided is considered to be conservative.

7. Indirect and Intangible Costs of Physical Inactivity

This section provides a general discussion on the indirect and intangible costs of physical inactivity. As mentioned before, the indirect costs of physical inactivity relate to issues such as decreased longevity (shorter life expectancy), increased presenteeism and absenteeism, and increased disability. The intangible costs relate to the cost to the ill person and their family in terms of their reduction of quality of life due to such issues as pain, disability, anxiety, and suffering. Specifically, the discussion in this section will focus on the effects of physical inactivity on life expectancy and quality of life.

To investigate the indirect costs of physical inactivity on life expectancy, it is helpful to refer to a study by the AIHW on the burden of disease and injury in Australia (ABD study).[89] The ABD study measured the national burden of disease[90] in Australia using a measure called the disability-adjusted life year (DALY). The DALY includes the years lost due to disability (YLD)[91] and the years of life lost (YLL). A DALY is equivalent to the loss of one year of *healthy* life and it allows the burden of disease in a population to be measured as the gap between current health and an ideal situation where everyone lives to old age, free of disease and disability.[92]

In 2003, the ABD study estimated that the YLL accounted for 49 per cent of the total burden of disease and injury in Australia. The single largest cause of YLL for both males and females was coronary heart disease, and contributed to 218,143 YLL for the 2003 period. For males, lung cancer ranked second, followed by suicide and self inflicted injuries. In females, stroke ranked second, followed by breast cancer and lung cancer.

In order to determine the portion of mortality and YLL associated to physical inactivity in the Australian population, Stephenson et al. (2000) used the PAR approach for 5 diseases to estimate the number of deaths that occurred in Australia in people younger than 70 years old as a result of being physically inactive. The results of this study are shown in Table 7.1. This table shows that there were 11,824 deaths that occurred in people younger than 70 years old in 1996 due to 5 medical conditions and 1,930 or 16 per cent of these deaths were attributable to physical inactivity. Furthermore, the deaths that occurred as a result of physical inactivity led to 95, 535 years of life lost in people younger than 70 years old.

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[89] Begg S., Vos T., Barker B., Stevenson C., Stanley L., Lopez AD. (2007). The burden of disease and injury in Australia 2003. PHE 82. Canberra: AIHW.

[90] A general term used in public health and epidemiological literature to identify the cumulative effect of a broad range of harmful disease consequences on a community, including the health, social, and economic costs to the individual and to society.

[91] Calculated from incidence cases in a base year and interpreted as the number of healthy years lost due to disability that will accrue into the future from new cases of disease in the base year.

[92] Mathers C., Theo Y., Stevenson C. and Begg S. (2001), the burden of disease and injury in Australia, World Health Organization, 79(11).

Table 7.1
Number of Deaths Attributable to Physical Inactivity in People Younger than 70 Years Old by Medical Condition, Australia, 1996

Disease	Number of deaths in people younger than 70 years old	Number attributable to physical inactivity	Number of years of life lost (YLL)	Number of YLL attributable to physical inactivity	Percent of all YLL due to inactivity
CHD	6,355	1,144	380,308	68,455	71.7
Stroke	1,675	268	99,425	15,908	16.7
Colon cancer	1,475	283	15,495	2,975	3.1
Type 2 diabetes	819	104	48,610	6,173	6.5
Breast cancer	1,500	131	23,260	2,024	2.1
TOTAL	**11,824**	**1,930**	**567,098**	**95,535**	**100**

Source: Stephenson et al. (2000).

Other studies have directly estimated the relationship between physical inactivity and life expectancy. The results suggest that being physically active increase total life expectancy for both men and women. For example, Franco et al. (2005)[93] found that compared to low levels of physical activity, moderate and high levels of physical activity produced a respectively 1.3 and 3.7 year increase in total life expectancy in men. For women, moderate and high physical activity levels were estimated to produce a respectively 1.5 and 3.5 difference in life expectancy. Also, in a study of two hypothetical groups of 1000 35-year-old men (followed for 30 years), Hatziandreu et al. (1988)[94] predicted that life expectancy would be extended and 1,138 quality adjusted life years would be saved for the group that was prescribed exercise.

The influence of physical activity on health and quality of life in the aging process is also well documented in the academic literature (e.g. Strawbridge et al., 1996; Ferrucci et al., 1999 and Spirduso et al., 2001).[95] [96] [97] In a study among elderly women in Denmark, Puggaard (2003)[98] showed that regular training significantly improves physical ability with regard to physical performance tests, maximal oxygen uptake and maximal walking speed. Another study by Grimby et al. (1992)[99] illustrated from a sample of elderly men and

[93] Franco, H., Laet C., Peeters A., Jonker J., Mackenbach J. and Nusselder W. (2005). Effects of Physical Activity on Life Expectancy with Cardiovascular Disease, Arch Intern Med.; 165:2355-2360.
[94] Hatziandreu, E., Koplan, J., Weinstein, M., Capersen, C., and Warner, K. (1988) A Cost-Effectiveness Analysis of Exercise as a Health Promotion Activity American, Journal of Public Health 78:1417-1421.
[95] Strawbridge WJ, Cohen RD, Shema SJ and Kaplan GA (1996). Successful aging: predictors and associated activities. Am J Epidemiol: 144: 135–141.
[96] Spirduso WW and Cronin DL (2001). Exercise dose–response effects on quality of life and independent living in older adults. Med Sci Sports Exerc: 33(Suppl. 6): S598–S608.
[97] Ferrucci L, Izmirlian G, Leveille S, Philips CL, Corti M-C, and Brock DB (1999). Physical activity and active life expectancy. Am J Epidemiol: 149: 645–653.
[98] Puggaard L. (2003). Effects of training on functional performance in 65, 75 and 85 year-old women: experiences deriving from community based studies in Odense, Denmark. Scand J Med Sci Sports: 13: 70–76.
[99] Grimby G., Grimby A., Frändin K., Wiklund I. (1992). Physically fit and active elderly people have a higher quality of life, Scandinavian Journal of Medicine & Science in Sports, 2(4): 225-230.

women aged 76 that increases in physical activity levels led to decreased problems with energy, pain, emotional reactions and physical mobility. Adding to this, Grimby et al. also found increased physical activity corresponded to less social isolation.

8. Conclusion

This study estimated the direct gross costs and net costs associated with physical inactivity of adults in Australia.

The results presented in this report demonstrate that poor health arising from physical inactivity generates clear economic and social costs to the Australian community. This includes the direct costs of greater health expenditures by the public and private sectors. These direct gross costs have been balanced against the costs offsets in sports injuries and other expenses from engaging in physical activity such as expenditure on sports and exercise products.

The results presented in this report also demonstrate that strategies aimed to reduce physical inactivity in Australia can bring significant benefits to the Australian economy and community. Indeed, the estimate of the net cost of physical inactivity provided in this study represents the potential cost savings that would occur if Australians adopted healthier more active lifestyles. As such, the cost estimates outlined in this study provide a sound starting point for considering strategies to overcome physical inactivity.

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