Original Article

A cost benefit analysis of weight management strategies

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Over the past twenty years, obesity has become a major topic of concern. In particular, this paper estimates that the number of obese adults has risen from around 2.0 million in 1992/93 to about 3.1 million in 2005. With the prevalence of obesity on the rise, the associated economic cost is also increasing significantly. The annual cost of obesity in 1992-93 was estimated at around $840 million per year. This paper shows that the annual cost of obesity in Australia could now be as high as $1,721 million. With the cost of obesity rising, the ability to assess and compare alternative programs for reducing the current prevalence of obesity is very important. This involves weighing up the costs and benefits of the different strategies. So, in addition to providing an updated estimate of the potential cost of obesity in Australia, this paper uses a weight management program to illustrate the methodology used in assessing alternative intervention programs. For illustration, the expected benefit per enrolment in a weight loss program was calculated at $690. The associated cost of the program was $202 per enrolment. It should be noted that the estimate of the cost is more precise than the broad estimate of the average benefit. Nevertheless, the average benefit outweighs the cost by an overwhelming ratio of over three-to-one. So a more detailed analysis is unlikely to overturn the general conclusion that the average benefit clearly outweighs the cost, even if the precise ratio of benefits to costs is likely to change.

Key Words: **obesity, cost benefit, weight loss strategy, weight reduction programs, health economics**

Introduction

Over the past twenty years, obesity has become a major topic of concern. In particular, the prevalence of obesity in the Australian adult population has more than doubled since 1981, from around 8% to an estimate of around 20% in 2005.[1] Obesity is a key contributor to many serious health problems that Australian's suffer. For example, obesity has been directly linked to diseases such as:[2]

- non-insulin dependent diabetes mellitus;
- gallstones;
- hypertension;
- breast cancer;
- colon cancer;
- coronary heart disease; and
- obesity itself.

Individuals who suffer from obesity (and its related health problems) experience many disadvantages. These disadvantages take the form of social and economic costs. Social costs arise because society often has a negative view of those individuals who suffer from obesity. Obese adults are regularly given labels such as lazy or greedy (The Association for the Study of Obesity)[5]. Because of these views, obesity may lead to social discrimination.

Obesity and its related health problems also have an economic cost to the individual and the broader community. These economic costs can be either direct or indirect. The direct health costs include hospital admissions, hospital days, medical consultations, pharmaceutical scripts, and referrals to allied health practitioners. The indirect health costs refer to the value of production lost due to premature death and absenteeism.

With the prevalence of obesity on the rise, the associated economic cost is also increasing significantly. The annual cost of obesity in 1992-93 was estimated at around $840 million per year. A study in 2004 showed this cost potentially doubling by 2000.[3] This paper uses more recent estimates of the prevalence of obesity to provide an updated estimate of the potential cost of obesity in Australia.

The Australian Government is also recognising the need to address the growing overweight and obesity problems in the community. This recognition led to the establishment of the National Obesity Taskforce in November 2002.[6] The aim of this taskforce was to develop a national action plan for tackling the increasing incidence of overweight and obesity in Australia. In 2003, the taskforce released its National Action Agenda for children and young people and their families in their paper *Healthy Weight 2008, Australia's Future*. This action plan focuses on promoting healthy weight strategies for young people. It is hoped that this, in turn, will lead to less overweight and obesity issues across the population into the future. However, while this is a positive long term strategy, it does not address the problems associated with existing overweight and obesity levels.

So, in addition to a long-term healthy weight strategy, intervention programs for reducing the current prevalence of obesity are also important. There are a number of different types of programs available, which attempt to tackle the problem of excess weight. These can range from joining a gym, undertaking a weight reduction pro-

Table 1. Survey data on obesity rates in Australia

Date	Obesity Rate	Survey Data	Survey Method	Age Coverage
1980	8.4%	Risk Factor Prevalence Surveys	measured	25-64yr
1983	9.3%	Risk Factor Prevalence Surveys	measured	25-64yr
1989	10.9%	Risk Factor Prevalence Surveys	measured	25-64yr
1995	18.7%	ABS National Nutrition Survey	measured	19yr+
1999–00	20.8%	Australian Diabetes, Obesity and Lifestyle Study	measured	25yr+
2001	16.5%	ABS National Health Surveys	self-reported	18yr+

Sources: 1. AIHW analysis of the 1980, 1983 and 1989 Risk Factor Prevalence Surveys[9], 1995 National Nutrition Survey[7] and 1999–2000 Australian Diabetes, Obesity and Lifestyle (AusDiab) Study[10]; 2. ABS National Health Surveys[11]

gram, taking weight loss pills and at the more extreme, surgical intervention.

In assessing any intervention strategy, it is necessary to weight up its costs and benefits. So, in addition to providing an updated estimate of the potential cost of obesity in Australia, this paper uses a weight management program to illustrate the methodology used in assessing alternative intervention programs.

Thus, this paper updates the analysis undertaken in Murphy *et al.* (2005)[3], by updating the estimates to 2005. This update uses estimates of the prevalence of obesity that are based on measured Body Mass Indexes (BMI's) rather than self reported heights and weights. It also uses an updated analysis of a weight management program to illustrate the appropriate type of methodology to apply when assessing alternative strategies to combat the growing problem of obesity.

While all care, skill and consideration has been used in the preparation of this paper, this paper is designed to provide broad estimates to illustrate the potential econo-mic impacts of weight loss strategies. The findings in this paper are subject to statistical variation. This statistical variation could be reduced, but not eliminated, by conducting a detailed analysis, as distinct from the broad analysis undertaken here.

Prevalence of obesity in Australia

In analysing the cost and benefits of weight reduction strategies, the first step is to estimate the current prevalence of obesity across Australia. Thus, this section uses published survey data on obesity rates to estimate the level of obesity in 2005. This paper uses historical

obesity rates to estimate the current prevalence of obesity in Australian adults. This paper follows the World Health Organisation's body mass index (BMI) classification of obesity. There are a number of different studies that provide historical data on obesity rates in Australia. However, care must be taken when using this data to produce a set of historical rates across years. This is because there is variation in the coverage and methodology applied in the different data sources. Table 1 shows the aggregate prevalence rates over a number of years, from a number of studies. The table also identifies whether the data is self-reported or measured, and also indicates the age-coverage under each survey.

The ABS National Health Survey[11] uses self-reported information on height and weight to estimate the level of obesity in Australia. Self-reported data are known to underestimate the true level of obesity. This is because weight tends to be under-reported and height over-reported. As such, this paper focuses on the other survey data, which reports obesity rates that have been calculated using measured heights and weights. Thus, this paper depends largely on data from the AIHW analysis of the 1980, 1983 and 1989 Risk Factor Prevalence Surveys, 1995 National Nutrition Survey[7] and 1999–2000 Australian Diabetes, Obesity and Lifestyle (AusDiab) Study.[9] These survey results provide estimates that are not subject to the biases of self-reporting.

Figure 1 provides the obesity rates from the AIHW analysis, broken into different age groups and years. As can be seen in Figure 1, these surveys cover different age ranges. For example, the National Nutrition Survey covered all adult age groups (18 years and over), while
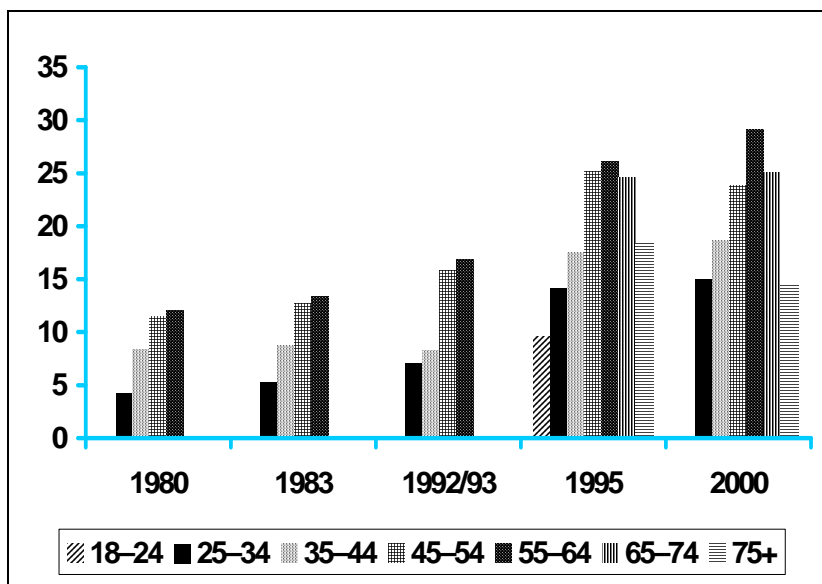
Figure 1. Obesity rates by age group
Source: AIHW analysis[9]

the Risk Factor Prevalence Surveys[11] focused on groups between the ages of 25 and 64 years old. While illustrating the variation in age coverage across the surveys, Figure 1 also shows that (across all surveys) it is the 45-74 year old group who shows greater tendencies towards obesity.

By drawing on data from all the surveys and using estimates to fill in any gaps, this paper constructed broad estimates of the number of obese Australian adults (18 years plus) in the past decade. Figure 2 shows these broad estimates. Figure 2 estimates that the number of obese adults has risen from around 2.0 million in 1992/93 to about 3.1 million in 2005. This increase in obesity is likely to flow through to higher costs in terms of both the health costs of obesity related diseases and the cost to the economy of lost productivity. These costs are now estimated in the following section.
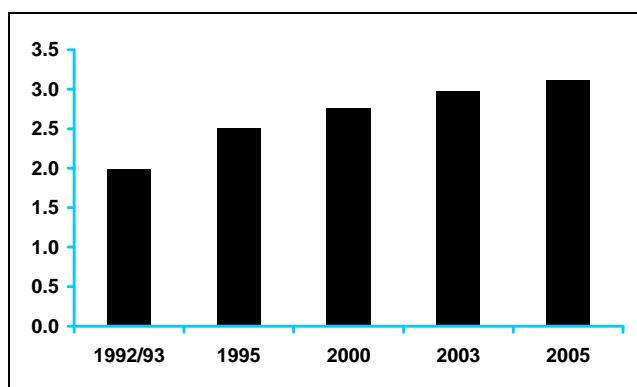

Figure 2. Number of Obese Adults (million persons)
Source: AIHW analysis.[9]
Notes: 1. 1992/93 estimate is based on a weighted average of 1989 and 1995 obesity rates. 2. Conservatively assumes adult obesity rates post 2000 are, on average, 0.1% higher per year.

Cost of obesity
A number of previous studies have attempted to estimate the total cost of obesity. According to the National Health and Medical Research Council, 2002[12], "the estimated cost of obesity in 1992/93 was $840 million per year, of which 63% can be attributed to the health system". These cost estimates refer to the contribution of obesity to the costs of the following diseases:[3]

- non-insulin dependent diabetes mellitus;
- gallstones;
- hypertension;
- breast cancer;
- colon cancer;
- coronary heart disease; and
- obesity itself.

In their 2005 paper, Murphy & Yates[2], used growth estimates for both obesity numbers and health costs to provide a broad update of the NHMRC cost estimates. Their analysis found that the cost of obesity could have reached $1,520 million by 2003. This paper uses a similar approach to provide a broad estimate of the possible cost of obesity in 2005.

As estimated in the previous section, the number of obese adults is estimated to have risen from 2.0 million (in 1992/93) to 3.1 million (in 2005). The price of health

services has risen by 31% over the same period. Applying both of these factors, this paper estimates the cost of obesity may now be as high as $1,721 million. Of this amount, $1,084 million would take the form of direct health costs, and $637 million would be indirect health costs.

The direct health costs include hospital admissions, hospital days, medical consultations, pharmaceutical scripts, and referrals to allied health practitioners. Most of these costs are met by Commonwealth and State Governments, while the remainder are met by individuals. The indirect health costs refer to the value of production lost due to premature death and absenteeism.

Figure 3 shows the estimated cost of obesity of $1,721 million in 2005. This implies a prevalence cost per year for each obese adult of $554.
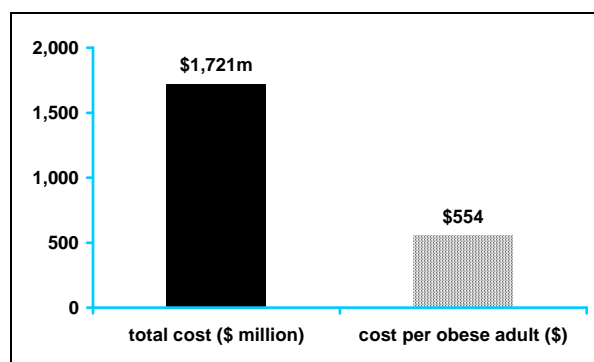

Figure 3. Annual cost of obesity
Note: The above represents only a broad update to 2005 of the original NHMRC estimates for 1992/93. A detailed analysis would construct cost estimates for 2005 by consistently applying the original methodology to current data.

This was calculated as the estimated total prevalence cost for 2005 of $1,679 million, divided by the estimated number of obese adults in 2005 of 3.1 million.

There are a number of other studies which also provide estimates for the current cost of obesity. The results of these studies range from a current annual cost of $1,300 million to $8,600 million (National Obesity Taskforce (2003)[6], Gross (2006)[7]). While our broad estimate falls within this range, a true comparison could only be made after close examination of the methodologies underlying each of the alternative studies. With the cost from obesity potentially as high as $1,721 million per year, intervention strategies for reducing the prevalence of obesity are important. In assessing any intervention strategy, it is necessary to weight up its costs and benefits. This paper now illustrates the methodology used in assessing alternative intervention programs.

Costs and benefits of weight reduction strategies
There are a number of weight reduction strategies that attempt to tackle the problem of excess weight. These strategies can include exercise programs, alternative eating plans, and/or pharmaceutical or surgical intervention. This paper uses a weight reduction program, such as Weight Watchers[13], to illustrate the costs. On the cost side, this paper uses a Weight Watchers 12-week

package deal for illustrative purposes. This involves a total fee of $202 per enrolment ($33 registration fee + $169 meeting fee on a 12 week package deal).

Determining the benefits of a weight reduction program is more complex. It is necessary to estimate the impact of additional enrolments in the program on the prevalence of obesity in Australia. The estimated reduction in obesity can than be valued using the estimate of the annual cost of obesity from the previous section.

The first step in estimating the benefits from a weight reduction program is to estimate the benefit from each enrolment in the program. It is well known that weight reduction programs often achieve large short-term reductions in weight. However, the benefits from such programs depend not on the incidence of short-term weight reductions, but rather on the incidence of permanent weight reductions.

A person following a low calorie diet will almost inevitably experience a significant reduction in weight. However, if the person reverts to previous behaviour at the conclusion of the diet, then that person's weight will gradually revert to its original level. Translating a short-term weight reduction into a lasting control of weight relies on permanent changes in behaviour in areas such as diet and/or physical activity. Well-known weight reduction programs such as Weight Watchers aim to achieve permanent changes in behaviour.

In the United States, the National Heart, Lung and Blood Institute (NHLBI)[14] examined 34 articles on weight loss from low calorie diets. It found "low calorie diets can reduce total body weight by an average of 8% over 3 to 12 months". Information on the more important issue of the incidence of permanent weight loss is more difficult to obtain. Nevertheless, the NHLBI conclude that "LCDs (low calorie diets) are recommended for weight loss in overweight and obese persons".

In Sweden, Asp et al., (2002)[4] reviewed the scientific literature on obesity published between 1996 and 2001. They report similar findings to the NHLBI on short-term weight loss. Specifically, they report weight loss "as a rule in the range of 3 to 10 kg during the first year". More importantly, they also report on the incidence of permanent weight loss stating that "approximately one fifth of those who undergo treatment based on the Weight Watcher approach, and reach their goals, achieve a permanent weight loss of 10% or more of their original weight". So one fifth or 20% of those who follow a weight watchers program achieved a permanent weight loss of at least 10%. For the purposes of this report, this needs to be converted to a cure rate for obesity.

This requires discounting for two factors. First, not everyone who enrols in a program follows the program, whereas the 20% figure refers only to those who do reach their goals. Second, not everyone who achieves a weight loss of over 10% will have been cured of obesity. Some will still be obese despite their substantial weight reduction, while others will have only been overweight rather than obese to begin with.

Based on these considerations, the 20% estimate of substantial permanent weight loss for those who follow a program has been discounted to a 10% lasting control rate for obesity per enrolment. It is acknowledged that this is

a "ball park" estimate only, which would be investigated further in a more detailed analysis.

The benefit from each enrolment in a program depends not only on the program's obesity lasting control rate, but also on the value of each lasting control. The starting point for estimating the value of each lasting control is the estimate from the previous section of a prevalence cost per year for each obese adult of $554.

In crude terms, permanently curing an adult of obesity will remove this prevalence cost for the balance of that persons' life. In practice the situation is more complex, because the costs of a person's obesity are not the same from one year to the next, but rather will rise from a lower level to a higher level with age, as health complications from that obesity develop. This would need to be taken into account in a more detailed analysis.

Nevertheless, the value of an obesity cure is broadly estimated at $6,903. This is based on an assumed residual life expectancy of 20 years, and the prevalence cost of $554 per year, which gives a gross value from a lasting control in avoided costs of $11,078. This is reduced to a present value of $6,903, after applying a real time rate of discount to future cost savings of 5 per cent per year.

These estimates are broad. A more detailed analysis would consider the epidemiology of obesity and associated diseases and project on a year-by-year basis the impact of the proposed intervention.

The expected benefit per enrolment in an illustrative weight reduction program can now be estimated. Based on the estimated obesity lasting control rate per enrolment of 10%, and the present value of each obesity lasting control of $6,903, the expected benefit is $690. This expected benefit can now be balanced against the associated cost of $202 per enrolment. Figure 4 presents this comparison and shows the net benefit per additional enrolment is estimated at $428. This is the difference between the estimated benefit of $623 and the indicative cost of $195.
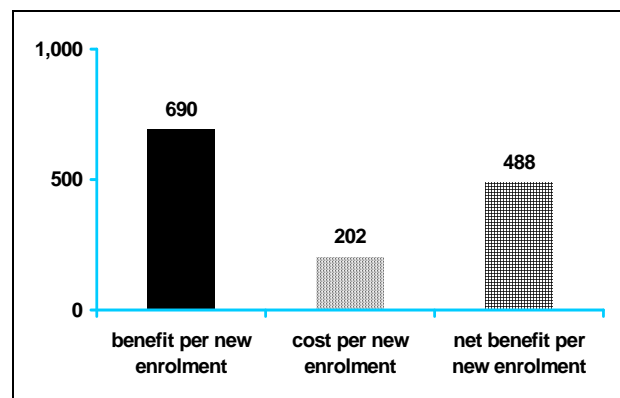

Figure 4. Illustrative Economic assessment of weight loss programs

Conclusion

With the annual cost from obesity now estimated at $1,721 million per year, intervention strategies for reducing the prevalence of obesity are important. In assessing any intervention strategy, it is necessary to weight up its costs and benefits. There are costs associated with undertaking any program to tackle the rising problem of

obesity, whether it be an advertising campaign to en-courage children to exercise, enrolment in a weight re-duction program, joining a gym, taking weight loss pills or, at the more extreme, surgical intervention. Some costs will be born by the Government and some by the individual. These costs need to be compared to the ex-pected benefits of the program. In assessing the benefits of individual programs or strategies, it is   important to estimate the benefits in terms of a "lasting control". Some programs may be very successful in terms of short-term weight reduction, but may not result in a lasting control of weight. Lasting control relies on permanent changes in behaviour in areas such as diet and/or physical activity.

For illustration, the expected benefit per enrolment in a weight loss program was calculated at $690. The asso-ciated cost of the program was $202 per enrolment. Thus the total benefit per enrolment is greater than the expected cost, with an implied social net benefit of $428, and a social benefit to cost ratio of over 3. Thus, this weight reduction program easily passes a cost-benefit test.

The estimate of the cost is more precise than the broad estimate of the average benefit. Nevertheless, the average benefit outweighs the cost by an overwhelming ratio of over three-to-one. So a more detailed analysis is unlikely to overturn the general conclusion that the average benefit clearly outweighs the cost, even if the precise ratio of benefits to costs is likely to change.

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Original Article

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體重管理策略的成本效益分析

過去二十年，肥胖逐漸成為一個令人關注的議題。本文估計肥胖人口從 1992~93 年的 200 萬增加到 2005 年的 310 萬人。隨著肥胖盛行率的上升，相關的經濟成本也顯著的增加。1992~1993 年間，估計每年約花費 8 億 4 千萬元。本文指出，在澳洲每年肥胖的花費可能高達 17 億 2 千 1 百萬元。隨著肥胖花費的上升，評估及比較各種不同降低現行肥胖盛行率的計畫便顯得非常重要。這些包含估量不同策略的成本與效益。因此，除了提供最新的澳洲潛在的肥胖成本之外，本文還使用一個 體重管理計畫來說明不同介入計畫的分析方法。舉例來說，預期每位加入減重計畫的會員每年成本為 690 元。而計畫的相關成本為每位會員 202 元。必須注意的是成本的估計比粗估的平均效精確。儘管如此，平均效益對成本的比例仍是壓倒性的超過 3：1。所以即便有更精確的分析，也是無法反轉平均效益大於成本的結果。

關鍵詞：肥胖、成本效益、減重策略、減重計畫、衛生經濟學