REDUCING THE PREVALENCE OF ALZHEIMER’S DISEASE:

MODIFIABLE RISK FACTORS OR SOCIAL DETERMINANTS OF HEALTH?

TALKING ABOUT ALZHEIMER’S ACROSS AUSTRALIA

FIGHTDEMENTIA.ORG.AU
## ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>AIHW</td>
<td>Australia Institute of Health and Welfare</td>
</tr>
<tr>
<td>APSC</td>
<td>Australian Public Service Commission</td>
</tr>
<tr>
<td>CALD</td>
<td>Culturally and Linguistically Diverse</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
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<tr>
<td>PAR</td>
<td>Population Attributable Risk</td>
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<tr>
<td>PBS</td>
<td>Pharmaceutical Benefits Scheme</td>
</tr>
<tr>
<td>TAFE</td>
<td>Technical And Further Education</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
<tr>
<td>YBM</td>
<td>Your Brain Matters</td>
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Suggested citation:

This discussion paper reviews the existing evidence on dementia risk reduction, behavioural psychology, and financial costs of dementia in order to support evidence-based policy making that will reduce the future prevalence of dementia in Australia.

The data presented in this paper demonstrates that reducing the prevalence of dementia in the future will result in lower expenditure in the future. Alzheimer’s Australia NSW estimates that should a 10% reduction in cases attributable to the seven modifiable factors be achieved by 2020, as much as $280m could be saved with a 20% reduction producing savings of up to $570m. By 2050, a 10% reduction potentially yields a saving of up to $4.5bn, whilst a 20% reduction could produce savings of up to $8.3bn. Given the lead-times required to reduce individual and community risk profiles, action is required now in order to achieve these potential savings.

Without a significant medical breakthrough the number of Australians living with dementia is expected to increase to almost 900,000 by 2050. Evidence suggests that there are seven key modifiable risk factors for dementia. They are: diabetes; midlife obesity; smoking; depression; cognitive inactivity or low educational attainment; midlife hypertension; and physical inactivity. Policy settings which bring about reductions in individual and community risk profiles against these seven factors will consequently result in a decrease in the projected number of people with dementia by 2050.

The content of this paper is focused on the approximately 30% of cases of Alzheimer’s which are attributed to modifiable factors. Its content and recommendations may have implications for other types of dementia that are vascular in origin. It is also important to establish that risk reduction is just that - it is not a guarantee of prevention.

Dementia has a significant cost to society, to individuals and to their family members in more than just financial terms as outlined in this paper. There are significant social and individual impacts of dementia. From a policy perspective, decisions about resource allocation today need to be set against future benefits and consideration of whether they represent an effective and efficient use of present funds for uncertain future outcomes.

Policy making needs to weigh up both the inter-dependencies and inter-linkages between actions which seek to reduce the prevalence of dementia and the consequences of this on other areas of social policy. As will be outlined in this paper, the seven key risk factors are linked to many other health and social conditions in Australia. Therefore, policy settings which support reductions in cases of dementia will produce multiple benefits in other health, social and economic indicators for the Australian population.

This discussion paper argues for a long-term and comprehensive approach to address the issue of rising prevalence of dementia.

Alzheimer’s Australia NSW therefore recommends the following:

1. The Australian and State Governments to commit to a ‘prevention dividend’ approach to policy and program delivery. Specific brain health initiatives which address this include:

   i. Australian Government to continue to invest in the Your Brain Matters dementia risk reduction program.

   ii. Australian Government identify opportunities to incorporate brain health messaging in other preventative health campaigns around smoking, obesity and diabetes.

   iii. Australian and State Governments use
innovative social impact bonds to fund partnerships between non-Government organisations to implement evidence-based approaches which improve health outcomes.

iv. The Australian and State Governments assess Closing the Gap health policies to ensure they also address the need to reduce dementia risk.

v. Australian and State Governments implement dis/incentives for healthier dietary choices including taxes on foods known to increase the dementia burden.

2. Australian Government prioritise research funding through the NHMRC into how to encourage the population to embrace dementia reduction behaviour, in particular for populations of social and health disadvantage.

There remains a need to acknowledge that individual choice and responsibility has a strong role to play in addressing the risk factors discussed in this paper. To support the recommendations to Government, Alzheimer’s Australia will continue to promote the following messages to the broader population:

1. Look after your heart;
2. Be physically active;
3. Mentally challenge your brain;
4. Follow a healthy diet;
5. Enjoy social activity.
Dementia prevalence and cost

Dementia is the term used to describe the symptoms of a large group of illnesses which cause a progressive decline in a person’s functioning, including loss of memory, intellect, rationality, social skills and physical functioning. Dementia is the single greatest cause of disability in older Australians aged 65 years and over, and the third leading cause of disability burden overall. There are over 100 types of dementia including Alzheimer’s disease (which is the most common), vascular dementia, fronto temporal dementia and dementia with Lewy Bodies.

In 2014 it was estimated that there were 332,000 Australians living with dementia. Without a significant medical breakthrough this number is expected to increase to almost 900,000 by 2050. There are an estimated 1.2 million Australians involved in care of someone with dementia.

Dementia is fatal and there is currently no cure. Dementia is the third leading cause of death in Australia overall, and the second leading cause of death for Australian women. The top two causes of death are currently heart disease and cerebrovascular diseases, both of which are in decline due to advances in treatment and prevention.

Researchers have estimated that without new treatments or interventions, over 3 million Australians will develop dementia between 2012 and 2050. Yet, an intervention that could delay the onset of dementia by two years, introduced in 2020, would reduce the cumulative number of people developing dementia between 2012 and 2050 by 13 percent, or 398,000 people. Further, an intervention capable of delaying onset by five years, introduced in 2020 would reduce the cumulative number by almost one third by 2050, meaning there would be 935,000 fewer people living with dementia over the 30 year period than otherwise expected.

The financial costs of dementia to the Australian economy are significant. Total direct health and aged care system spending on people with dementia was at least $4.9 billion in 2009-10. As the population ages, the growing demand for care not only poses direct costs to the health and aged care system, it also creates significant costs of an indirect nature to the government in terms of social welfare payments as well as lost productivity as people provide informal care at home. Dementia will become the third greatest source of health and residential aged care spending within two decades, costing approximately one percent of gross domestic product (GDP).

Dementia risk reduction / Modifiable risk factors

The biggest risk factor for developing dementia is age. One in every eight people aged 65 years and over has dementia, with this figure doubling every five years after the age of 65. Family history, heredity and genetics play a role in determining an individual’s likelihood of developing some types of dementia. Not all types of dementia can be attributed to environmental or lifestyle factors, and risk reduction is no guarantee of individual’s prevention. However, risk reduction has a strong role to play at a population level and at this stage represents the most effective approach to reduce the prevalence and societal impact of dementia.

As a result of the high financial and social costs of dementia worldwide, a growing body of research aims to identify risk factors which may increase an individual’s likelihood of developing Alzheimer’s disease by calculating the proportion of cases that can be attributed to modifiable risk factors. Seven risk factors have been
identified as having important implications for the prevalence of Alzheimer’s disease specifically. They are:

- diabetes
- midlife obesity
- smoking
- depression
- cognitive inactivity or low educational attainment
- midlife hypertension
- physical inactivity

It is important to note that these seven modifiable risk factors are connected and interdependent. For instance, having one condition predisposes an individual to be more susceptible to developing another condition due to the fact that many of the risk factors are interrelated. In addition, there are a range of complex social factors that influence both education and health.

**Current dementia risk reduction approaches**

**“Your Brain Matters” – Australia**

Australia is a world leader in combating dementia through risk reduction. The Your Brain Matters (YBM) program is currently funded by the Australian Government and is the world’s first publicly funded dementia prevention program. It has been developed and delivered through the Alzheimer’s Australia federation. YBM guides individuals on how to look after their brain health, based on the evidence that modifiable health and lifestyle factors are associated with the risk of developing dementia. Research suggests that living a brain healthy life, particularly during mid-life, may reduce a person’s risk of developing dementia.

There are five steps involved in the program:

- Look after your heart;
- Be physically active;
- Mentally challenge your brain;
- Follow a healthy diet;
- Enjoy social activity.

For more information about the program, see http://www.yourbrainmatters.org.au/

**Risk reduction approaches in other countries**

Whilst not a complete list, other resources across the world include:

- Brain Health – Alzheimer’s Association of America
- Your Brain Health - Alzheimer’s Foundation of America
- Be Head Strong – Alzheimer’s Society UK
- Dementia Guide – National Health Service UK (which presents six recommendations then directs you elsewhere to learn more about it thereby losing the connection with dementia risk reduction)
- Dementia – Can We Reduce the Risk – Alzheimer’s Disease International
Social determinants of health

The World Health Organisation (WHO) defines social determinants of health as the “circumstances in which people are born, grow up, live, work and age, and the systems put in place to deal with illness. These circumstances are in turn shaped by a wider set of forces: economics, social policies, and politics.” Public health research has demonstrated persistent statistical associations between social conditions and health. People of higher socioeconomic status consistently exhibit better health than those who experience less favourable social conditions. Further, research suggests that health vulnerability is comprised of both individual and societal factors. As stated above, there are a range of complex factors that influence a person’s health status. Whilst there is a correlation/association between the risk factors, they are not deterministic and causative in all cases.

With this in mind, risk reduction programs such as YBM may have a limited population pool in which its messages can be successful. Education and the subsequent increased cognitive activity, has a principle role and is key to social mobility and good health outcomes over the life course. The other six modifiable risk factors for Alzheimer’s disease are more common in people with low educational attainment and from low socio-economic backgrounds. It is therefore important that in addition to addressing individual actions, dementia risk reduction address socially determined aspects of health through macro-level policy settings.

In short, context matters and for Aboriginal communities the statistics on prevalence of Alzheimer’s disease are evidence of this. Prevalence rates are three to five times higher than the non-Aboriginal population due to higher risk profiles for each of the seven risk factors discussed in this paper, and for other risk factors such as heart disease, blood cholesterol, diet and alcohol consumption. It is clear that the circumstances and resources available to Aboriginal people in Australia are not equal to the non-Aboriginal population. Therefore, for disadvantaged communities, focusing on changes to the social environment will reap great benefits in improving their health indicators. The Closing the Gap initiative is attempting to do this and has made some progress in improving health indicators for the Aboriginal population in Australia, however, much more is needed.

The analysis presented in this paper raises the question of how successful public health interventions aimed at behaviour modification will be if there is also not provision for addressing social determinants of health.
Research published in 2014 indicates that approximately one third of Alzheimer’s disease cases worldwide are potentially attributable to seven key modifiable risk factors\textsuperscript{xxii}. This research took into account the multi-causality (association of risk factors) and the total proportion of cases of Alzheimer’s disease attributable to these risk factors.

This discussion paper outlines the seven modifiable risk factors for Alzheimer’s disease and uses the population attributable risk (PAR) calculations from Norton, Matthews, Barnes, Yaffe and Brayne\textsuperscript{xxiv} to highlight the specific number of Alzheimer’s disease cases attributable to each risk factor in Australia. The population attributable risk calculations for Australia were supplied by Norton et al. to Alzheimer’s Australia NSW via personal correspondence.

The PAR is the proportion of people with a disease in a population that can be attributed to a given risk factor, assuming that there is a causal relationship. It takes into account the strength of the association between the risk factor and the outcome as well as the prevalence of the risk factor\textsuperscript{xxv}.

From 2014 data, future calculations for the number of cases were then derived for 2020, 2030, 2040 and 2050 by applying the population attributable risk percentage for each risk factor to the ABS population projection for each of these years. For example, in 2030 2,347 cases of Alzheimer’s disease could be attributed to diabetes.

After producing these projections, Alzheimer’s Australia NSW calculated the reduction in the number of cases of Alzheimer’s disease if the prevalence of each of the seven risk factors could be reduced by 10 percent and 20 percent for each of the following decades. This calculation used simple interest rather than compounding reductions each decade. Compounding the reductions would have produced even further reductions in prevalence estimates.

The future costs of dementia and potential savings from the reduced prevalence were then calculated using a combination of direct and indirect costs. The available evidence on indirect costs was inconsistent so a sensitivity analysis was included for a high and low cost scenario. The future costs were calculated using a 5% indexation rate.

A literature review was conducted alongside this analysis to support the discussion and recommendations made in this paper. The review examined research and grey literature on dementia risk reduction theory and programs, psychological theories of behaviour change and motivation, and policy change in health and social policy.

The evidence collected was then evaluated for potential intervention strategies that could reduce the prevalence of each risk factor and thereby the prevalence of Alzheimer’s disease (and dementia) in Australia.

Recommendations for Governments across Australia were then developed using a Delphi consensus approach with a range of staff across Alzheimer’s Australia.
SEVEN MODIFIABLE RISK FACTORS FOR ALZHEIMER’S DISEASE AND POPULATION ATTRIBUTABLE RISK

Introduction

Base case data has been generated from population attributable risk (PAR) data applied to the 2014 ABS population projection to derive the number of cases of Alzheimer’s disease attributable for each type of risk factor using the methodology of Norton et al. (2014)xxvi. Of the estimated 332,000 people with dementia in Australia in 2014, a total of 61,162 cases1 could be attributed to these seven key risk factors as shown below in Table 1. The modifiable nature of these risk factors suggests that at an individual or population level we have the potential to influence these figures, either increasing or preferably decreasing the prevalence of Alzheimer’s disease.

Table 1: The Seven Key Risk Factors, Population Attributable Risk and the Estimated Number of Cases Attributable in Australia

<table>
<thead>
<tr>
<th>Type of Risk Factor</th>
<th>PAR (confidence range)</th>
<th>Number of cases attributable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>1.9%</td>
<td>1,409</td>
</tr>
<tr>
<td>Obesity</td>
<td>13.9%</td>
<td>10,305</td>
</tr>
<tr>
<td>Smoking</td>
<td>9.4%</td>
<td>6,969</td>
</tr>
<tr>
<td>Depression</td>
<td>8.9%</td>
<td>6,598</td>
</tr>
<tr>
<td>Cognitive/Education</td>
<td>7.3%</td>
<td>5,412</td>
</tr>
<tr>
<td>Midlife Hypertension</td>
<td>16.3%</td>
<td>12,084</td>
</tr>
<tr>
<td>Physical Inactivity</td>
<td>24.8%</td>
<td>18,386</td>
</tr>
</tbody>
</table>

The financial importance of this work is highlighted by the cost estimates shown in Figure 1 below. Based on the established population projections and costs of dementia, Alzheimer’s Australia NSW estimates that the direct and indirect costs of dementia could be as high as nearly $73b by 2050. Within the next five years, it is forecast that the equivalent figure will be nearly $17b. The large increase in the intervening 30 year period is due in large part to the effect of inflation (5%), but also due to the growing number of people living with dementia. It is vital that a coherent policy approach be implemented to reduce this future financial (not to mention social and emotional) impact on Australian society.

Figure 1: Estimated population with dementia in Australia and Projected Direct and Indirect Costs from 2010 to 2050 ($billions)

Assumptions and sources of data used in the following tables include:


2) Direct costs source: AIHW, 2012, Dementia in Australia.


1 This figure equates to 30% of the population with Alzheimer’s disease, which is estimate to be 70% of the total population with dementia - 332,000 (in 2014).
4) Direct and indirect costs calculations: Future value of money calculated using inflation rate of 5% and 2010 costs as the present value with the number of payments the number of years between 2010 and the years shown.

5) Indirect cost sensitivity is based on low of 1.6hr/d and high of 3.7hr/d from source: Wimo, Winblad and Jonsson (2010) The worldwide societal costs of dementia: Estimates for 2009, Alzheimer’s and Dementia, 6, pp.98-103.


Note: some of the calculations in the following tables may show discrepancies of ‘1’ due to rounding.

1. Diabetes

Diabetes is a chronic condition that occurs when insufficient glucose is converted to energy because there is an absolute and relative lack of insulin. Insulin is the chief agent responsible for converting glucose (usually found in food sources) into energy and thus plays an important role in ensuring the metabolic effectiveness of all bodily organs. There are two types of diabetes: Type 1 and Type 2. Although the exact cause for Type 1 diabetes is largely unknown, it is known that Type 2 diabetes is influenced by environmental and lifestyle factors and comprises 85-90% of all diabetes cases in Australia.

It is estimated that approximately one million people in Australia have diabetes, with an additional 700,000 individuals yet to be medically diagnosed. Like many other lifestyle-related diseases, the rate of Type 2 diabetes has increased over recent years. In 2012, 4.2 percent of the Australian population was diagnosed with diabetes, with the prevalence projected to double by the year 2025. Sixty percent of all cases of Type 2 diabetes are potentially preventable.

Estimates from 2012 indicate that type 2 diabetes costs the Government more than $10 billion per year, including carer costs of $4.4 billion, productivity losses of $4.1 billion, associated health system costs of $1.1 billion, and costs related to obesity as a result of Type 2 diabetes of $1.1 billion.

Diabetes and dementia

Diabetes has been associated with Alzheimer’s disease. Alzheimer’s disease and Type 2 diabetes share common cellular and molecular mechanisms. Insulin resistance is the mechanistic link between Type 2 diabetes and Alzheimer’s disease and there may be a link between Alzheimer’s disease and obesity-related insulin resistance. Furthermore, the presence of diabetes earlier in life has the potential to double the incidence of dementia, Alzheimer’s disease and vascular dementia. Due to the strong relationship between Alzheimer’s disease and diabetes, some researchers and clinicians suggest that Alzheimer’s disease could be considered Type 3 diabetes.

PAR for Diabetes

Alzheimer’s Australia NSW estimates that approximately 1,409 cases of Alzheimer’s disease in Australia can be attributed to diabetes as shown in Table 2 below. As the prevalence of diabetes is increasing there will be both an increased population with diabetes and an increased proportion of the population with Alzheimer’s disease attributable to diabetes. Our analysis indicates that this will increase to 1,696 in 2020, 2,334 in 2030, 3,129 in 2040 and up to 3,782 in 2050.

However, our analysis indicates that lowering the prevalence of diabetes has the potential to reduce the number of cases of Alzheimer’s disease within the Australian population as shown in Table 2 below.

Table 2: Population Attributable Risk for Diabetes

<table>
<thead>
<tr>
<th>Year</th>
<th>PAR Diabetes (%)</th>
<th>2014</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>1.9%</td>
<td>1,409</td>
<td>1,696</td>
<td>2,334</td>
<td>3,129</td>
<td>3,782</td>
</tr>
<tr>
<td>Reduce by 10%</td>
<td>NA</td>
<td>1,527</td>
<td>2,101</td>
<td>2,816</td>
<td>3,404</td>
<td></td>
</tr>
<tr>
<td>Reduce by 25%</td>
<td>NA</td>
<td>1,357</td>
<td>1,867</td>
<td>2,504</td>
<td>3,026</td>
<td></td>
</tr>
</tbody>
</table>
Figures 2 and 3 below highlight our estimates of the potential saving of up to $23m with a 10% reduction in the population with diabetes attributable Alzheimer’s disease and up to $46m should a 20% reduction be achieved by 2050.

Figure 2: Cost savings with a 10% reduction in population with diabetes attributable Alzheimer’s disease.

Figure 3: Cost savings with a 20% reduction in population with diabetes attributable Alzheimer’s disease.

2. Midlife Obesity

There are a number reasons why a person may become/be obese, with the most common being the development of bad food and exercise habits from a young age. Obesity commonly occurs as a result of energy intake exceeding energy expenditure and the subsequent surplus being stored as fat.

Australia has seen a sharp increase in the number of overweight or obese adults over the last few decades. In 2011-12, approximately 60 percent of Australian adults were classified as overweight or obese, with more than a quarter (27 percent) falling into the obese category. Australia ranks fourth on the obesity scale within the Organisation for Economic Cooperation and Development (OECD). Approximately 6.3 million middle-aged Australians are obese, with an estimated 7,200 Australians dying each year due to obesity and obesity-related disease.

Healthcare costs for overweight and obese Australians substantially exceed those for Australians of normal weight. In 2008, the total annual cost of obesity to Australia (including health system costs, loss of productivity costs and caring costs) was estimated to be approximately $58 billion; $21 billion of which were indirect costs in the form of subsidies, pensions, unemployment benefits and sick pay. In 2010, the annual direct cost per person increased from $1472 for those of normal weight to $2788 for people who are obese. The direct costs of obesity are associated with four main medical conditions – cardiovascular disease, type 2 diabetes, osteoarthritis and some specific forms of cancer.

Midlife obesity and dementia

Insulin resistance plays a particularly important role in explaining the association between midlife obesity and Alzheimer’s disease. Research suggests that the majority of overweight or obese people in midlife are also insulin resistant, which has been linked to an increased risk of cognitive impairment. Midlife obesity has consistently shown a strong and independent association with an increased risk of Alzheimer’s disease and dementia; although being overweight later in life is a positive for brain health. Obesity and insulin resistance are associated with...
an impaired vasodilator response, which is an independent predictor of cardiovascular disease and plays an integral role in predisposing people to the development of dementia and Alzheimer’s disease\(^{\text{xlvi}}\). With earlier onset of obesity and insulin resistance, there is potential for cognitive decline to occur at an earlier age, further increasing the burden of Alzheimer’s disease\(^{\text{xlvi}}\).

**PAR for Midlife Obesity**

Alzheimer’s Australia NSW estimates that approximately 10,305 cases of Alzheimer’s disease can be attributed to midlife obesity. Our analysis indicates that by 2020 this will increase to 12,409, 17,077 in 2030, 22,894 in 2040, before reaching approximately 27,668 in 2050. The relationship between midlife obesity and Alzheimer’s disease has been attributed to insulin resistance that is common amongst overweight and obese people. This indicates that as midlife obesity becomes an increasingly prevalent issue, Alzheimer’s and dementia will also increase accordingly.

Success with strategies to reduce midlife obesity could result in the types of reduction shown in Table 3, with resultant reductions in direct and indirect costs as shown in Figure 4 with a 10% reduction and Figure 5 with a 20% reduction. Alzheimer’s Australia NSW estimates potential savings of up to $168m with a 10% reduction in the population with obesity attributable Alzheimer’s disease, and up to $336m should a 20% reduction be achieved by 2050.

**Table 3. Population Attributable Risk for Midlife Obesity**

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases attributable</td>
<td>10,305</td>
<td>12,409</td>
<td>17,077</td>
<td>22,894</td>
<td>27,668</td>
</tr>
<tr>
<td>Reduce by 10%</td>
<td>NA</td>
<td>11,168</td>
<td>15,370</td>
<td>20,605</td>
<td>24,901</td>
</tr>
<tr>
<td>Reduce by 20%</td>
<td>NA</td>
<td>9,927</td>
<td>13,662</td>
<td>18,315</td>
<td>22,134</td>
</tr>
</tbody>
</table>

![Figure 4: Cost savings with a 10% reduction in population with midlife obesity attributable Alzheimer’s disease.](image1)

![Figure 5: Cost savings with a 20% reduction in population with midlife obesity attributable Alzheimer’s disease.](image2)
3. Smoking

Tobacco smoking is a major risk factor for coronary heart disease, stroke, peripheral vascular disease, numerous cancers, and other diseases and conditions\textsuperscript{viii}. The prevalence of smoking has not been consistent over the years with figures rising and falling with the emergence of new health promotion initiatives and policy implementations\textsuperscript{xix}.

There are an estimated 1 billion smokers worldwide. The tobacco epidemic kills nearly 6 million people a year, 5 million of whom are smokers or ex-smokers, and 600,000 nonsmokers exposed to second-hand smoke\textsuperscript{x}. The prevalence of adult smokers in Australia is currently 17.5 percent of the population, which equates to approximately 4.1 million Australians\textsuperscript{ix}. Tobacco smoking is responsible for up to 15,000 deaths in Australia every single year, adding up to more than the combined total of deaths attributed to homicide, illicit drug use, HIV and road accidents\textsuperscript{lix}.

There is a strong association between tobacco smoking and the two leading causes of death in Australia (cancer, and heart disease) that comes at a $31 billion cost to the Australian Government each year\textsuperscript{x}. Direct health and workplace costs of smoking are estimated to be approximately $15.6 billion, while indirect costs in the form of lost productivity and early death are also quite substantial\textsuperscript{x}. The prevalence of tobacco smoking in Australia is declining, dropping by three percent since 2010. Recent sales figures released by the ABS indicate that total consumption of tobacco products in the 2014 March quarter was the lowest ever recorded\textsuperscript{xi}.

Smoking and dementia

It has been suggested that tobacco smoking doubles the risk of dementia via several mechanisms\textsuperscript{xii}. Vascular risk factors are the most recognised causal pathway that may ultimately cause cerebrovascular disease, stroke, and coronary heart disease, which are in turn related to an increased risk of developing dementia\textsuperscript{xiii}. Smoking also accelerates the rate at which atherosclerosis develops in which blood vessels begin to narrow, depriving the brain cells of proper oxygen, nutrient, and by-product exchange, potentially leading to oxidative stress and excitotoxicity which often leads to poor neuronal health\textsuperscript{xiv}. Research also suggests that a history of smoking has a detrimental impact on an individual’s cognitive functioning\textsuperscript{xv}. The brain is not immune to the long-term consequences of heavy smoking however cessation of smoking may possibly inhibit or postpone the development of cognitive impairment and dementia\textsuperscript{xvi}.

PAR for Smoking

Analysis by Alzheimer’s Australia NSW suggests that approximately 6,969 cases of Alzheimer’s disease can be attributed to smoking. By 2020, this number will increase to 8,392, to 11,549 by 2030, 15,844 in 2040 before peaking at 18,711 in 2050.

Reducing rates of smoking through a range of interventions has the potential to benefit individuals through reduced health costs, improved quality of life and longer life expectancy and benefit the government and employers through reduced public healthcare costs and improved productivity.

Success with such interventions could result in the types of reduction shown in Table 4, with resultant reductions in direct and indirect costs as shown in Figure 6 with a 10% reduction and Figure 7 with a 20% reduction. Alzheimer’s Australia NSW estimates potential savings of up to $114m with a 10% reduction in the population with smoking attributable Alzheimer’s disease, and up to $227m should a 20% reduction be achieved by 2050.

<table>
<thead>
<tr>
<th>Number of cases attributable</th>
<th>2014</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce by 10%</td>
<td>NA</td>
<td>7,553</td>
<td>10,394</td>
<td>13,934</td>
<td>16,840</td>
</tr>
<tr>
<td>Reduce by 20%</td>
<td>NA</td>
<td>6,714</td>
<td>9,239</td>
<td>12,386</td>
<td>14,969</td>
</tr>
</tbody>
</table>
4. Depression

Depression is characterised by long periods of sadness that impact on the way people feel about themselves and may result in a loss of interest in doing things that they would normally enjoy. Up to 3 million Australians suffer from depression and anxiety disorders each year\textsuperscript{\textsubscript{ix}}. One in seven Australians will experience depression in their lifetime\textsuperscript{\textsubscript{xi}}.

In addition to the detrimental impact on an individual’s personal life, depression can also have a direct effect on work and productivity in terms of absenteeism\textsuperscript{\textsubscript{xii}}. Both direct and indirect costs of depression are $12.6 billion a year. While the majority of these costs relate to lost productivity and job turnover, this figure also includes the cost of subsidised medical care, counseling and antidepressants.

Depression and dementia

The association between depression and dementia is a relatively newly discovered one, however already a substantial body of literature outlining the association has emerged. There is evidence that people living with lifetime depression have a two-fold chance of developing Alzheimer’s disease and exhibit more Alzheimer’s disease related neuropathology\textsuperscript{\textsubscript{xiii}}. There is much discussion as to whether depression is a psychological reaction to cognitive decline or whether it appears as an early symptom in people with dementia. Research suggests that the use of benzodiazepines and corticosteroids for the treatment of depression may have a neurotoxic effect through changes in white matter, a sign of vascular dementia and Alzheimer’s disease\textsuperscript{\textsubscript{xiv}}.

PAR for Depression

Alzheimer’s Australia NSW analysis suggests that approximately 6,598 cases of Alzheimer’s disease can be attributed to depression, with that number continuing to increase to 7,639 by 2020 and more than doubling to 17,715 cases in 2050.
Table 5: Population Attributable Risk for Depression

<table>
<thead>
<tr>
<th>PAR for depression = 8.9%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Number of cases attributable</td>
</tr>
<tr>
<td>Reduce by 10%</td>
</tr>
<tr>
<td>Reduce by 20%</td>
</tr>
</tbody>
</table>

Earlier diagnosis and treatment of depression in Australia could result in the types of reduction shown in Table 5, with resultant reductions in direct and indirect costs as shown in Figure 8 with a 10% reduction and Figure 9 with a 20% reduction. Alzheimer’s Australia NSW estimates potential savings of up to $108m with a 10% reduction in the population with depression attributable Alzheimer’s disease, and up to $215m should a 20% reduction be achieved by 2050.

Figure 8: Cost savings with a 10% reduction in population with depression attributable Alzheimer’s disease.

5. Cognitive inactivity or low educational attainment

In Australia, 84 percent of adults aged 25-34 possess the equivalent of a high-school degree, higher than the OECD average of 82 percent\(^{lxvi}\). ABS data on educational attainment shows that 8.5 million people aged 15-64 completed their high school to end of Year 12, and of this amount 69.1 percent went on to achieve a non-school qualification. Fifty-five percent of people who did not complete Year 12 went on to achieve a non-school qualification, most commonly at the certificate level\(^{lxvii}\).

Government expenditure on education includes all levels of education, including pre-school, primary, secondary, university, and technical and further education (TAFE) and excludes expenditure on courses provided by non-educational institutions such as the vocational learning programs of private businesses. Australia Government expenditure on education totalled $79.6 billion in 2012-13 with a large proportion (51 percent) of that being allocated to primary and secondary education\(^{lxviii}\). The NSW Government budget for education, training and early childhood education in 2014-15 is $14.4 billion\(^{lxix}\).
Cognitive inactivity and dementia

Cognitive inactivity has been documented as a factor that could influence the onset and development of dementia. Mentally demanding occupations, possession of higher IQ and participation in mentally stimulating leisure activities all play a part in reducing general cognitive decline and dementia\textsuperscript{19}. Recent research suggests that higher levels of cognitive activity in childhood, middle age, and old age are associated with slower rates of cognitive decline\textsuperscript{1x}. There is evidence to suggest that cognitive inactivity, as well as low educational attainment, play an important role in the development of dementia\textsuperscript{20}.

A growing body of literature has identified subjective cognitive complaints as a preclinical phase of dementia, which has provided an opportunity for planning and implementing preventative strategies and interventions that may reduce the long-term incidence of cognitive disorders\textsuperscript{20}. This preclinical stage has allowed for the application of advanced cognitive training research to take place and its effectiveness to be assessed over a ten-year period. Results demonstrate a significant improvement in reasoning and speed of processing skills, as well as better activities of daily living at the completion of the ten year period than those who had not engaged in preventative action. This research suggests that irrespective of the age at which cognitive activity is increased, improvements in brain pathology and functioning should be present\textsuperscript{20}.

Higher levels of cognitive functioning are influenced by educational and occupational level, thus those with higher educational attainment are more likely to experience higher levels of cognitive functioning and a reduced rate of cognitive decline\textsuperscript{20}. Researchers suggest two neurobiological factors may play an integral role in explaining the association between cognitive inactivity and the onset of Alzheimer’s disease\textsuperscript{20}. Firstly, cognitive activity may directly reduce the accumulation of neuritic plaques and neurofibrillary tangles, which are pathologies commonly present in people with dementia\textsuperscript{20}. Secondly, cognitive activity improves the development of the interconnected neural systems responsible for sending messages through the brain and maintaining them well into old age\textsuperscript{20}. The adage ‘use it, or lose it’ applies when considering risk of Alzheimer’s and cognitive activity.

PAR for cognitive inactivity and low educational attainment

5,412 cases of Alzheimer’s disease are attributable to cognitive inactivity/low educational attainment. This number is projected to grow to 14,531 by 2050 should the current educational attainment figures remain constant over the next 36 years (Table 6).

Table 6: Population Attributable Risk for Cognitive Inactivity and Low Educational Attainment

<table>
<thead>
<tr>
<th>Year</th>
<th>2014 (Cases)</th>
<th>2020 (Cases)</th>
<th>2030 (Cases)</th>
<th>2040 (Cases)</th>
<th>2050 (Cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce by 10%</td>
<td>5,412</td>
<td>6,517</td>
<td>8,969</td>
<td>12,024</td>
<td>14,531</td>
</tr>
<tr>
<td>Reduce by 20%</td>
<td>NA</td>
<td>5,865</td>
<td>8,072</td>
<td>10,821</td>
<td>13,078</td>
</tr>
</tbody>
</table>

Increasing levels of educational attainment and opportunities for ongoing learning in Australia could result in the types of reduction shown in Table 6, with resultant reductions in direct and indirect costs as shown in Figure 10 with a 10% reduction and Figure 11 with a 20% reduction. Alzheimer’s Australia NSW estimates potential savings of up to $88m with a 10% reduction in the population with cognitive inactivity/low education attainment attributable Alzheimer’s disease, and up to $176m should a 20% reduction be achieved by 2050.
6. Midlife Hypertension

Blood pressure refers to the force exerted by the blood on the walls of the arteries. The main causes of high blood pressure are being overweight, high levels of alcohol consumption, physical inactivity, and high dietary salt intake. Although hypertension predominantly affects middle-aged and elderly Australians, steps to prevent the incidence of hypertension can be taken at any age. Midlife hypertension is increasingly being recognised as a factor to be addressed in order to reduce the risk of developing vascular dementia in the later years of life.

It is estimated that 30 percent of all Australians over the age of 25 have high blood pressure – this equates to approximately 3.7 million Australians. Of all Australians with hypertension, 76.3 percent were overweight or obese and 42.7 percent reported doing no exercise in the week leading up to the National Health Survey conducted by the ABS.

The cost of hypertension to the Australian government is substantial. Recent Pharmaceutical Benefit Scheme (PBS) data shows that during the 2007-08 financial year, almost 3 million Australians filled prescriptions for anti-hypertensive medicines, with blood pressure lowering medications ranking second highest cost medicine group subsidized by the PBS. However the actual number of users may be higher as this figure only accounts for those receiving the medicine at a subsidised cost.

Midlife hypertension and dementia

Several longitudinal studies have shown positive correlation between the presence of hypertension in midlife and the onset of cognitive decline 15 to 20 years later. Hypertension has been shown to decrease the vascular integrity of the blood-brain barrier which can lead to cell damage, reductions in neuronal or synaptic function, and cell death. It has also been suggested that midlife hypertension increases the accumulation of beta amyloid, which directly contributes to Alzheimer’s disease pathology. A number of studies have highlighted the role of hypertension in the pathogenesis of Alzheimer’s disease and dementia. The brain is a vascular organ; meaning that blood vessels...
carry blood away from the heart to organs such as the brain, thus any damage occurring to these blood vessels will impair the ability for them to carry oxygenated blood to the brain, resulting in brain function deteriorating\textsuperscript{xxviii}. There is also some evidence suggesting that people in their forties who have chronic uncontrolled hypertension have an accelerated rate of brain ageing\textsuperscript{xxix}.

**PAR for Midlife Hypertension**

12,084 cases of Alzheimer’s disease can be attributed to midlife hypertension. In 2020, this number is expected to grow to 14,552, to 20,026 in 2030, 26,847 in 2040, before increasing to 32,445 in 2050 as shown in Table 7.

<table>
<thead>
<tr>
<th>PAR for midlife hypertension</th>
<th>2014</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases attributable</td>
<td>12,084</td>
<td>14,552</td>
<td>20,026</td>
<td>26,847</td>
<td>32,445</td>
</tr>
<tr>
<td>Reduce by 10%</td>
<td>NA</td>
<td>13,097</td>
<td>18,024</td>
<td>24,162</td>
<td>29,201</td>
</tr>
<tr>
<td>Reduce by 20%</td>
<td>NA</td>
<td>11,642</td>
<td>16,021</td>
<td>21,478</td>
<td>25,956</td>
</tr>
</tbody>
</table>

Earlier diagnosis and treatment of midlife hypertension in Australia could result in the types of reduction shown in Table 7, with resultant reductions in direct and indirect costs as shown in Figure 12 with a 10% reduction and Figure 13 with a 20% reduction. Alzheimer’s Australia NSW estimates potential savings of up to $197m with a 10% reduction in the population with midlife hypertension attributable Alzheimer’s disease, and up to $394m should a 20% reduction be achieved by 2050.
7. Physical Inactivity

Regular physical activity is an important contributor to good overall health. Regular physical activity promotes and maintains a healthy weight and reduces chronic disease risk. The national physical activity and sedentary behaviour guidelines suggest an accumulated total of 150-300 minutes of moderate or 75-150 minutes of vigorous physical activity per week. In addition, muscle strengthening activities should be completed on at least two days each week for adults aged 18-64. The results of the 2012 National Health Survey revealed that only 43 percent of adults actually met the ‘sufficiently active’ threshold for physical activity.

Research conducted in 2007 calculated the gross and net direct health costs of physical inactivity for seven medical conditions including coronary heart disease, stroke, type 2 diabetes, and depression amongst others. The research suggested that 17 percent of the total health cost of treating these seven conditions can be attributed to physical inactivity amongst Australian adults – equating to approximately $1.5 billion in direct healthcare costs alone.

Physical inactivity and dementia

There is an association between physical inactivity and a decline in cognitive performance however recent research has focused on the association between physical activity, heart health, and consequent brain health.

Physical activity has the potential to serve as a protective factor against the development of dementia in addition to other health benefits. Improved cerebral blood flow, a reduction in vascular factors, a decrease in the secretion of stress hormones, and the ability to stimulate brain plasticity are amongst the many biological benefits associated with physical activity. Research has proposed physical activity to be one of the most promising preventative strategies against cognitive impairment in the elderly population due to the resulting positive neurological changes to white matter.

PAR for Physical Inactivity

Alzheimer’s Australia NSW analysis suggests that 24.8 percent of Alzheimer’s disease cases can be attributed to lack of physical activity, translating to approximately 18,386 cases in 2014. This figure is expected to rise in 2020 to 22,140, to 30,469 in 2030, 40,847 in 2040 before reaching 49,364 cases in 2050 as shown in Table 8.

Table 8: Population Attributable Risk for Physical Inactivity

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>18,386</td>
<td>22,140</td>
<td>30,469</td>
<td>40,847</td>
<td>49,364</td>
</tr>
<tr>
<td>attributable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce by 10%</td>
<td>NA</td>
<td>19,926</td>
<td>27,422</td>
<td>36,762</td>
<td>44,428</td>
</tr>
<tr>
<td>Reduce by 25%</td>
<td>NA</td>
<td>17,712</td>
<td>24,375</td>
<td>32,678</td>
<td>39,491</td>
</tr>
</tbody>
</table>

Increasing physical activity levels in Australia could result in the types of reduction shown in Table 8, with resultant reductions in direct and indirect costs as shown in Figure 14 with a 10% reduction and Figure 15 with a 20% reduction. Alzheimer’s Australia NSW estimates potential savings of up to $300m with a 10% reduction in the population with depression attributable Alzheimer’s disease, and up to $600m should a 20% reduction be achieved by 2050.
Figure 14: Cost savings with a 10% reduction in population with Physical Inactivity attributable Alzheimer’s disease.

Figure 15: Cost savings with a 20% reduction in population with Physical Inactivity attributable Alzheimer’s disease.
The calculations presented in the previous section are based on a reduction in the number of cases of dementia as a result of Alzheimer’s disease only. However, it is likely that a reduction in these modifiable risk factors for Alzheimer’s disease in the Australian population will also contribute to a reduction in the prevalence of other forms of dementia with lifestyle risk factors, such as vascular dementia and alcohol related dementia. It follows, therefore, that the cost reductions outlined may underestimate the actual potential savings if we can reduce the overall prevalence of dementia through measures that will reduced the modifiable risks. Norton et. al. note that:

“Public health interventions targeted at vascular risk factors (e.g. physical inactivity, smoking, midlife hypertension, midlife obesity, and diabetes), depression, and low educational attainment will probably achieve the greatest reduction in the prevalence of the modifiable risk factors and will provide other major benefits to society and health-care systems.”

If we understand health outcomes to be a result of social, cultural and economic factors as in a social determinants of health framework, the main focus of Government policy settings in the future should be on increasing educational attainment and providing access to ongoing learning opportunities. From the perspective of reducing the prevalence of Alzheimer’s disease in the future, a socially determined view of health would see that this has implications on the other six key risk factors. For example, people with higher levels of educational attainment generally have lower rates of diabetes, depression, hypertension, smoking and obesity, and are more likely to be physically active.

The highest PAR for Alzheimer’s disease is physical inactivity, at almost 25 percent. Therefore, increasing levels of physical activity represents the biggest opportunity to reduce prevalence of Alzheimer’s disease. It would also impact on reducing other modifiable risk factors including obesity, diabetes, and hypertension. Physical activity is one of the three key components of YBM. Increasing physical activity levels of Australians has been a focus for a number of public health issues, however, levels of inactivity continue to rise while the population who undertake physical activity to the recommended levels declines. Policy makers should make this an immediate focus – getting Australians active by whatever incentives and disincentives are shown to be effective.

The timeframe for addressing each modifiable risk factor will vary as will the length of time it takes to see the reduction in the prevalence of dementia, and the social and financial impact. The modification with the longest timeframe before the benefit is derived is education. Increasing education retention rates now will not lead to a reduction in dementia prevalence immediately; rather we will see the benefit in approximately 50-70 years later. A reduction in midlife hypertension has the potential to have the quickest impact/efffect as it may only be a few years from ‘midlife’ until symptoms of Alzheimer’s disease become apparent.

As shown in the analysis above, the greatest cost savings can be achieved for risk factors with the highest PAR i.e. physical inactivity, obesity and midlife hypertension. Achieving a 20% reduction in cases attributable to these three risk factors could result in a combined saving of over $414m by 2020, $675m by 2030, $1.1b by 2040 and $1.3b by 2050. With the linkage of these risk factors to other public health costs and chronic disease management, the figures cited above for costs savings would multiply exponentially should costs of other diseases be included. For example, obesity intervention policies aimed at reducing the prevalence of obesity will yield strong economic and social benefits by reducing the prevalence of associated diseases. Reducing obesity through a range of interventions has the potential to benefit individuals through
reduced health costs, improved quality of life and longer life expectancy and benefit the government and employers through reduced public healthcare costs and improved productivity. Alzheimer’s Australia NSW would argue that expenditure on initiatives to reduce the exposure of the population to these risk factors will reduce costs elsewhere. This represents a double-dividend for Government spending and an efficient use of taxpayers money.

Most successes in public health initiatives have utilised coercive measures (eg. limiting areas where smoking is permitted, random breath testing with associated fines and penalties). Physical inactivity and obesity are both, unfortunately, complex, systemic issues where coercion is unlikely to succeed on its own. McKinsey Global Institute argues that to address these issues, the following is needed:

1. a multi-pronged approach to addressing rising obesity rates,
2. changes to the environment and societal norms which requires some level of Government regulation and/or community based action,
3. engagement from as many sectors as possible with a mixed approach of top-down and bottom-up,
4. employment of as many interventions as possible, learn from these approaches, and allow for agencies and organisations to be innovative, and
5. conduct research to understand what approaches are most effective, with emphasis on action research and evaluation as ways of improving the existing knowledge base.

Most crucially, in its analysis of 74 interventions to reduce obesity, McKinsey Global Institute came to the conclusion that the cost savings and higher productivity outweigh the direct investment required to deliver the interventions.

Research has shown that incentives and disincentives work in the form of taxes, sanctions, rebates and subsidies. One recent publication showed that adding a tax to soft drinks would bring down their consumption. The authors recommended an excise tax would be more effective than a sales tax at reducing consumption rates. Therefore policy makers should use them to promote desirable behaviours and reduce deleterious behaviours to effect change in the modifiable risk factors. One of the most prominent examples of success is in the steady decline in smoking rates in Australia. As described in the case study below, the disincentives were complemented by other activities which supported the long-term downward trend in smoking rates.

Case study of smoking reduction:

There have been a number of interventions that have played an instrumental role in making it more difficult for individuals to smoke in Australia, in particular the youth. One of the most influential tobacco control policies is the price and the tax the Australian government has placed on cigarettes, which affects the youth in particular as they are more price sensitive than adults. Another important intervention is changes to the way the media portray tobacco smoking in society. Additionally bans on where individuals can smoke has played an important role in restricting the opportunities for individuals to smoke. The fight and victory for plain packaging is a step in the right direction.

More specifically, in Australia smoking cessation programs have played an instrumental role in raising awareness of the potentially fatal cost of smoking, whilst also providing individuals with an opportunity to quit. Some of these methods or programs include: receiving advice from healthcare professionals, nicotine replacement therapy; hospital-based smoking interventions; community
based interventions, paid or unpaid media advertising; and Quitlines. These are the more common types of cessation programs available.

The success of each of these programs differs depending on a number of variables. One important variable is the demographic of a community. For example many of the above mentioned programs are useful for a lot of Australian communities, but because of the lack of research involving Aboriginal and Torres Strait Islander communities there is a gap or a part of the population that may need additional or different approaches to achieve reductions in smoking.

Limitations of risk reduction programs

Altering human behaviours, as risk reduction programs principally aim to do, requires a thorough understanding of the mechanisms underlying motivation and behavioural change. Understanding psychological theories is important in knowing how to affect long-term behavioural change to achieve social policy objectives. The principle limitations of dementia risk reduction programs are that there is no certainty that an individual will develop dementia and dementia is believed to be a problem for some people when they are older. People also discount the likelihood that something bad will happen to them, which is accentuated for issues that are complex and/or distant in time or location. The Alzheimer’s Association in the USA succinctly describes this issue:

“Insights about potentially modifiable risk factors apply to large population groups, not to individuals. Studies can show that factor X is associated with outcome Y, but cannot guarantee that any specific person will have that outcome. As a result, you can “do everything right” and still have a serious health problem or “do everything wrong” and live to be 100.”

To address these challenges, a number of psychological theories may be effective in generating motivation and achieving behavioural change on an individual level. These include:

- **Rational choice model** is a framework often used to implement various public policies. It assumes that people rationally seek to maximise their own welfare by assessing choices before them in terms of costs and benefits.

- **Social capital theory** stresses the importance of community in a sense of achieving a goal. This relates to the notion of diffusion of innovation through an ecological approach, which focuses on changing behaviour of significant figures around an individual’s life leading to changes in social norms.

- **Goal setting** is where a goal is set and an individual or team work towards achieving it. For a goal to be most effective, it needs to be specific and challenging. Locke found that individuals do not actually ‘do their best’, but underachieve so ‘do your best’ may be ineffective. There is a linear relationship between goal difficulty and task performance. This differs across all individuals, depending on prior experience and other intrinsic (e.g. education,) and extrinsic (e.g. social support) factors.

- **Self-efficacy** can be defined as the “beliefs about personal ability to perform behaviours that bring desired outcomes.” Self-efficacy is an important element that influences activity choice, effort and persistence and underpins an individual’s willingness and capacity to modify their behaviour.

Coupled with a focus on increasing self-efficacy in risk reduction program participants, self-regulation is also crucial for positive behaviour changes. Bandura outlines six key processes through which self-regulation is attained, which can be helpful in designing dementia risk reduction campaigns:
1. Self-monitoring
2. Goal setting
3. Feedback about your performance and how it may be improved. This would be particularly beneficial in cases where individuals are having trouble modifying their behaviour. Feedback could enable people to adjust their approach and strategies to behaviour change.
4. Self-Reward: Short-term and frequent rewards ensures that individuals remain focused on their goal. Linking progress with further rewards allows people to feel personal satisfaction from their improvement.
5. Self-Instruction: this practice is a healing and individual-centred form of therapy, which involves people “talking to themselves” to aid their transition into new behaviours.
6. Enlistment of Social Support to encourage self-control, monitoring, competition, social conformity and feedback.

The examples of risk reduction resources in existence in other countries identified earlier in this paper would appear to be very limited when analysed against the evidence of psychological theories which support long-term behavioural change. The international risk reduction resources are web-based information guides only and their reach, impact and effectiveness in altering behaviour in the broader population to follow the steps advocated for is very questionable.

**Successes of Your Brain Matters in Australia**

The Your Brain Matters (YBM) program has been funded by the Australian Government through $4 million over 3 years (2012/13 to 2014/15). For a program with a national reach and coverage that has been a pioneer in the field of risk reduction, it has achieved a lot with such a small investment. The investment of $1.33m per annum represents less than 0.6% of the present value of the potential annual savings it could contribute to by 2020.

Successes of the YBM program so far include developing a range of interactive tools such as a website (includes free membership to 21 day challenge), e-learning tool for workplaces, and a facilitator-led interactive workplace program. Alzheimer’s Australia has also developed an Indigenous-specific resource, Your Story Matters, which includes a DVD, poster, booklet and community service announcement. This is backed up by the use a range of communication channels to ensure the message reaches as broad an audience as possible. Alzheimer’s Australia has also developed resources for and work with culturally and linguistically diverse (CALD) communities.

The YBM program has reframed the use of ‘dementia risk reduction’ to ‘brain health’ to engage younger people in the overarching message of leading a brain and heart healthy lifestyle. To complement the strategy of reaching out to a younger audience, Alzheimer’s Australia also developed the world’s first dementia risk reduction app – BrainyApp. The app was funded by Bupa Health Foundation, not the Australian Government.

To achieve greater impact and reach population groups that may not have considered the YBM message, Alzheimer’s Australia has partnered with other organisations such as the Heart Foundation and Fitness Australia. These partnerships have been beneficial, but they are resource intensive.

Two key population surveys of Australians aged 20-75 years, conducted in 2012cix and 2014cx, reveal that since the launch of YBM, changes are beginning to take place in public perceptions of dementia risk reduction. Yet with only a little over one-third of people expressing a firm belief that it is possible to reduce the risk of dementia in later life, the message needs further promotion. The importance of staying mentally active as a risk reduction approach is fairly well understood, however, these surveys reveal a low level of understanding of the association between dementia and cardiovascular factors, such as exercise and diet.

The YBM program is more consistent with the evidence presented, with scope for improvement through increased resourcing to build enhanced functionality and capability which builds on the theoretical framework of behavioural psychology discussed. An evaluation by Alzheimer’s Australia Victoria of its YBM training delivered in a range of workplaces found that 93% of voluntary program participants agreed they had increased in their knowledge of dementia. Perhaps more importantly, 90% of participants have indicated their intent to make lifestyle changes in the near future. This compares to 36% in a general population surveycxi.

Alzheimer’s Australia has adopted an innovative and creative approach in the 3 years of the YBM program with the aim of getting Australians to think about their brain health. Much more is needed, and programs like YBM play a vital role in raising awareness of the connection between brain health and vascular conditions, mental health and well-being, and physical activity.
CONCLUSION

This paper argues that Australia needs a long-term and comprehensive approach to address the issue of rising prevalence of dementia. The adoption of a ‘prevention dividend’ approach to policy making which is internally consistent and mutually supportive of the goal of individual and community health will help in reducing the prevalence of dementia in the future and its direct and indirect cost on society. Central to this policy direction is an approach to education that maximises accessibility and minimises barriers to higher levels of education for all Australians.

To address the other six risk factors, a range of levers are available to Governments - legislation, sanctions, regulations, taxes and subsidies, the provision of public services and information and guidance material. The development of these needs to draw on the work of behavioural and economic psychology to understand what motivates people, how to change their behaviours for the better, and what incentives and disincentives can be put in place to steer or nudge people towards better choices.

In such a comprehensive policy approach, any new initiatives need to be mutually supportive and complementary. The Australian Public Service Commission (APSC) publication Changing Behaviour: A Public Policy Perspective is instructive to policy makers in designing a long-term comprehensive approach to dementia risk reduction. The ASPC publication framework is based on four key elements for which this discussion paper argues a dementia prevalence reduction model for Australia should be developed:

1. Regulation, Legislation, Sanctions, Taxes, Subsidies
2. Provision of public services
3. Addressing Social, Economic and Cultural Determinants of Health
4. Tailoring Initiatives for Disadvantaged Groups

Your Brain Matters has a critical role to play in the ongoing quest to reduce the prevalence of dementia in the future. It is an important component of the levers discussed above in that it provides valuable, evidence-based information to the public about how they as individuals can reduce their risk. As described above, Your Brain Matters has achieved a lot in a short period of time with very limited resources. Additional resources which improve the program based on the psychological frameworks presented above and working in partnership with other disease groups could significantly enhance its capacity and reach to contribute to reduced prevalence of dementia and other modifiable diseases in the future. The current investment in this program represents a tiny fraction of the potential savings it contributes to.
RECOMMENDATIONS

This paper has highlighted that these levers do not have to be expensive policies to be effective, but what is also apparent is that the interventions will be cost-effective. Reductions in the prevalence of dementia will save future taxpayers and families from the direct and indirect costs of supporting a person with dementia. Action is needed by Governments across Australia to implement coherent, comprehensive policies that achieve a reduction in the number of people living with dementia.

Alzheimer’s Australia NSW therefore recommends the following:

1. The Australian and State Governments to commit to a ‘prevention dividend’ approach to policy and program delivery. Specific brain health initiatives which address this include:
   a. Australian Government to continue to invest in the Your Brain Matters dementia risk reduction program.
   b. Australian Government identify opportunities to incorporate brain health messaging in other preventative health campaigns around smoking, obesity and diabetes.
   c. Australian and State Governments use innovative social impact bonds to fund partnerships between non-Government organisations to implement evidence-based approaches which improve health outcomes.
   d. The Australian and State Governments assess Closing the Gap health policies to ensure they also address the need to reduce dementia risk.
   e. Australian and State Governments implement dis/incentives for healthier dietary choices including taxes on foods known to increase the dementia burden.

2. Australian Government prioritise research funding through the NHMRC into how to encourage the population to embrace dementia reduction behaviour, in particular for populations of social and health disadvantage.

There remains a need to acknowledge that individual choice and responsibility has a strong role to play in addressing the risk factors discussed in this paper. To support the recommendations to Government, Alzheimer’s Australia will continue to promote the following messages to the broader population:

1. Look after your heart;
2. Be physically active;
3. Mentally challenge your brain;
4. Follow a healthy diet;
5. Enjoy social activity.
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