



An Australian Government Initiative

Dementia Risk Reduction: What do Australians know?

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The Dementia Collaborative Research Centres are an Australian Government funded initiative established to advance Australian research into dementia and the translation of research into clinical practice. The three Centres each focus on a different area of dementia research:

- Assessment and better care outcomes
- Prevention, early intervention and risk reduction
- Consumers, carers and social research

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FOREWORD

The objective of this paper is to provide an overview of surveys that have been conducted in recent years that give some insights into the understanding of Australians about risk reduction of dementia.

Health prevention is centre stage again in discussion of future health policies. The National Preventative Health Taskforce, chaired by Professor Rob Moodie, has been established by the Federal Labor Government to frame new policies that will provide strong national leadership in preventative health activities.

Alzheimer's Australia welcomes the new focus on health prevention and has over the last three years, documented the evidence on risk reduction of dementia as part of the organisation's work and also, more recently, as a partner of the Dementia Collaborative Research Centre Number 2. The evidence from research shows that there are positive health and lifestyle choices everyone can make to keep their brains healthy. Of course, they are likely to benefit their general physical health as well.

An important, initial step in the formulation of policy in preventative health is to understand more about community awareness of how the risk of a chronic disease may be reduced. This publication contains valuable information on awareness among Australians of how they may be able to reduce their risk of dementia and the factors that need to be considered in developing education for risk reduction.

The Alzheimer's Australia **Mind Your Mind**[®] public education program on risk reduction of dementia is an important element of our awareness work in seeking to correct misperceptions in the Australian community that dementia is an inevitable consequence of old age.

The work of the Dementia Collaborative Research Centre Number 2: Prevention, Early Intervention and Risk Reduction is enabling Australia to make a contribution to international research on risk reduction of dementia. I feel privileged to assist in forging this creative partnership between the research community and Alzheimer's Australia with the hope that these insights will inform future public health educational programs.



Associate Professor Marc Budge

Director, Dementia Collaborative Research Centre Number 2: Prevention, Early Intervention and Risk Reduction
President, Alzheimer's Australia

September 2008

EXECUTIVE SUMMARY

Dementia has a significant impact on our health care system and this is set to increase. In Australia and worldwide, the prevalence of dementia is expected to rise rapidly as the population ages. By 2050, there is predicted to be well over 100 million people living with a diagnosis of dementia. However, modelling shows if the average onset of Alzheimer's disease could be delayed by five years, this would result in 50% fewer new cases each year. In Australia this would mean 48.5% fewer people with AD and cumulative savings in the direct cost of dementia of \$67.5 billion by 2040.

A number of modifiable risk factors have consistently been shown to be associated with dementia. There is converging evidence that mental stimulation, social engagement, healthy eating, exercise and prevention or treatment of cardiovascular risk factors may reduce the risk of developing dementia.

There is general consensus in the literature that public health interventions to modify risk factors have the potential to reduce dementia incidence by reducing risk or delaying onset. To design and implement effective interventions, an understanding of the current awareness of, and attitudes to, dementia risk reduction in the community is required.

This paper examines surveys of the general public that included questions related to dementia risk reduction. Between 1999 and 2008 Alzheimer's Australia has commissioned or been involved with eight Australian surveys. A further five surveys from the UK and North America were identified. These were reviewed to assess public awareness of the current evidence for dementia risk reduction.

On average, 51% of Australians believed risk reduction is possible, while 20% believed nothing can be done to reduce dementia risk and 28% were unsure. When asked how risk could be reduced, or when presented with factors and asked which would reduce risk, mental activity was nominated by more people than any other strategy, followed by a healthy diet and physical exercise. Most people agreed that social activity and low alcohol consumption could reduce risk when prompted, but very few mentioned these unprompted. On average, the majority of people did not agree that reducing vascular risk factors (smoking, high blood pressure and high cholesterol) could reduce dementia risk.

Consistent with Australian findings, almost 1 in 5 North Americans said that nothing can be done to reduce risk and only around 1 in 3 people surveyed in the UK agreed that lifestyle affects dementia risk.

Survey findings also revealed that few people are currently taking steps to reduce their dementia risk and many lack motivation to do so.

These findings suggest there is poor knowledge of the current evidence for dementia risk reduction. There is some awareness of the links between mental stimulation and dementia risk reduction, and physical health and dementia risk reduction, which could be built upon. Importantly, there is very little awareness of the association with cardiovascular risk factors, highlighting a pressing need to educate the public that preventing or better managing vascular risk factors can also reduce their risk of dementia. Other chronic diseases including cardiovascular disease, diabetes and obesity are the focus of public health prevention policy, but regrettably there is no recognition of the links between reducing these conditions and reducing risk of dementia.

There is an identified need to develop and implement community wide strategies to increase awareness of behaviours that may reduce dementia risk or delay onset, to facilitate people to change their behaviour, and to increase their motivation to do so. Effective public education regarding dementia risk reduction will not be easy as many people believe that dementia is a normal part of ageing or that it is the result of genetic factors or disease that they can do little about.

While dementia remains incurable, addressing modifiable risk factors provides a strategy that can be adopted now to reduce the prevalence of those with dementia this century and the associated social and economic costs to society. It is imperative that action is taken now to raise awareness among Australians of dementia risk reduction.

INTRODUCTION

The prevalence of Alzheimer's disease (AD) and other dementias is expected to increase rapidly as the population ages. Around 26 million people worldwide are currently estimated to be living with AD and this is expected to increase to over 100 million by 2050, at which time 1 in 85 persons will be living with the disease [1]. The related personal and financial costs of this growth in dementia cases will impact on families, healthcare systems and economies.

However, delaying the onset or slowing the progression of dementia could lessen the impacts dramatically. It has been predicted that delaying AD onset and progression by 2 years would mean 18 million fewer cases in 2050, with 16 million fewer late stage cases that require the most intensive and costly care [1]. Modelling done by Access Economics in Australia predicted that if the average onset of AD was delayed by 5 years from 2005, there would be a 50% reduction in new cases each year [2]. This would result in 48.5% fewer cases and a cumulative saving to the Australian economy of \$67.5 billion by 2040.

The identification of health and lifestyle factors consistently associated with increased risk of dementia has led to the notion that interventions to modify these factors may reduce risk of, delay onset of, or even prevent dementia. It has been suggested by some that much of the assumed prevention of dementia by improving risk factors would be attenuated by people living longer, as age remains the largest risk factor for dementia [3,4]. However, most believe that such interventions can indeed reduce the incidence of dementia and recommend that health promotion strategies for reducing risk should be implemented now [5-7].

Dementia risk is likely determined by interactions between genetic, environmental and behavioural components over the life span. While there is no conclusive evidence that changing behaviour can prevent dementia, there is growing evidence that certain lifestyle factors are associated with maintained cognitive health and reduced risk of dementia. These are often conceptualised as delaying factors that postpone the onset of dementia [8]. Targeting these to achieve reduced incidence of dementia in the ageing population could have enormous social and economic benefit.

Of course, there are many different causes of dementia, each associated with different risk factors. The ones most researched are AD and vascular dementia, the two most common forms, and these appear to be associated with overlapping risk factors. Several factors have been consistently identified as relevant to the risk of dementia and public education about potentially modifiable risk factors is seen as important [6,7,9].

As such, consumer organisations around the world are promoting risk reduction strategies based on the evidence of associations between modifiable lifestyle factors and risk of dementia. For example, Alzheimer's Australia's **Mind your Mind**[®] program [10] aims to educate the general community that mental, physical and social activity, healthy diet and habits, regular health checks and control of vascular risk factors, and avoiding head injury may help to reduce the risk of developing dementia.

In 2005, the US Congress established a partnership between the Centers for Disease Control and Prevention (CDC) and the Alzheimer's Association to educate the public about cognitive health. This initiative recently released a National Public Health Road Map to Maintaining Cognitive Health [11]. One of the major priorities identified is to "determine how diverse audiences think about cognitive health and its associations with lifestyle factors" [11, p. 2]. Work toward this is underway with one of the aims being to identify gaps in knowledge about cognitive health and related risk factors.

Others have also identified the need to assess current knowledge, perceptions and attitudes around the potential for dementia risk reduction, so that education programs can be most effectively targeted [12-14]. There is, however, very little published literature on this issue to date. Coulson and colleagues [15,16] examined older people's knowledge and practice of lifestyle behaviours related to vascular risk factors, but questioned people on their perceptions of the behaviours themselves, rather than their perceptions or knowledge of dementia risk reduction per se.

Low and Anstey [13] examined patterns of beliefs underlying what behaviours the public see as being able to reduce the risk of dementia. They concluded that public perceptions of what might reduce dementia risk are influenced by general beliefs about health rather than by scientific evidence. Yeo and colleagues [14] surveyed older people in the Manchester region of the UK and found overall poor knowledge of risk and protective factors for dementia. Their brief report provided details of responses to only a few of the factors included in their questionnaire and the survey included only people aged 56 to 96 years.

The current paper discusses findings from a number of unpublished surveys of the general public conducted in Australia, North America and the UK that have asked questions related to what people know about dementia risk reduction. The implications of these findings for public health education are discussed with reference to current evidence and calls for promotion and intervention programs aimed at reducing dementia risk in the community.

METHODOLOGY

Surveys of the general public that included questions related to dementia risk reduction were identified either by direct requests to Alzheimer's organisations or by internet searches. Responses to survey questions asking about people's beliefs in regard to whether dementia risk can be reduced and what factors are associated with reduced risk were assessed to determine what proportion of the general public are aware of current evidence. Responses to questions about people's current healthy lifestyle behaviours, what motivates their behaviour and factors that might affect motivation were also assessed.

Australian surveys

Alzheimer's Australia has commissioned or been involved with eight surveys between 1999 and 2008 that have assessed Australians' knowledge of dementia risk reduction, among a range of issues related to dementia. The methods used for these Australian surveys are summarised in Table A1 (see Appendix A). The majority were conducted by telephone interview and were part of omnibus surveys. All assessed the general public's knowledge of a range of dementia issues, not just risk reduction. None distinguished between different types of dementia in questions about risk reduction, but most mentioned AD using phrases including, "dementia, which has many causes including Alzheimer's disease", "dementia (including Alzheimer's disease)", and "Alzheimer's disease or dementia".

Demographic quotas and weighting of results were used by all surveys to ensure samples were representative of the Australian population according to age, gender and location of residence. One survey was conducted in the state of Victoria only [17], while the remainder were conducted Australia wide. For the purposes of this review, where the same question was asked by multiple surveys, results were combined in order to provide an average across surveys of the number of Australians who gave certain responses.

International surveys

Other organisations worldwide have commissioned similar public surveys, and five recent surveys were identified that included questions relevant to dementia risk reduction. While complete reports were available for some, only brief press releases were available for others. The methods used for these surveys, where provided in the available reports, are summarised in Table A2 (see Appendix A). For the purposes of this review, relevant findings from the identified international surveys were compared with Australian findings.

RESULTS AND DISCUSSION

Do the public believe it is possible to reduce dementia risk?

Four Australian surveys including a total of 5238 respondents, asked participants if they think it is possible to reduce the risk of developing dementia, and obtained similar results [18-21] (see Table B1, Appendix B, for results from each survey).

On average across these four surveys, **51% of Australians said that it is possible to reduce risk, 20% said that it is not possible and 28% didn't know.**

A fifth Australian survey of 2000 people had 72% of participants agree that it is possible to reduce risk, but did not report how many said it is not possible or didn't know [12]. This survey asked the question regarding risk reduction after presenting a vignette about a person with dementia and asking questions related to recognition of what was wrong with the person, treatments and prognosis. Perhaps prior prompting about dementia issues led more people to respond that they believed risk could be reduced.

Two earlier Australian surveys did not ask directly whether people believed risk reduction was possible, but instead gave people a list of lifestyle and health approaches and asked which of them they believed would reduce the risk of developing dementia [17,22]. On average across these surveys, 25% of participants responded that none of the given factors would reduce risk, suggesting that the remaining 75% believe that risk reduction is possible. Prompting with potential risk reduction strategies also appears to lead to a higher number of people responding positively that risk can be reduced.

A more recent survey asked participants whether each of a list of factors "might help to" reduce the risk of developing dementia rather than "would" reduce the risk [23]. In this case, only 10% of people responded that none of the factors might reduce risk.

A US survey found that 17% of participants agreed with the statement that nothing can be done to reduce the risk of developing dementia [24]. This result is consistent with the numbers of Australians who believe that it is not possible to reduce risk.

The Australian and American findings suggest that up to around 1 in 5 people believe nothing can be done to reduce the risk of dementia, while the majority either believe risk reduction is possible, or at least plausible, or are unsure.

What factors do the public associate with potential dementia risk reduction?

Figure 1 shows the percentages of respondents who suggested particular risk reduction strategies in open questions. Three surveys, involving a total of 4838 Australians, asked only those who first said they believed risk reduction is possible an open question about what can be done to reduce risk [12,18,21] (see Table B2, Appendix B, for results from each survey). In all cases the most commonly cited factor was mental activity, proposed by an average of almost half the respondents. A healthy diet was proposed by 30% of people, physical activity by 28% and social activity by 13%. Other factors were mentioned by less than 10% of participants, including developing medications, not smoking, reducing alcohol or drugs, reducing exposure to aluminium or chemicals, and increasing education and awareness. An average of 15% of people who thought risk reduction was possible said they did not know what could be done to reduce dementia risk.

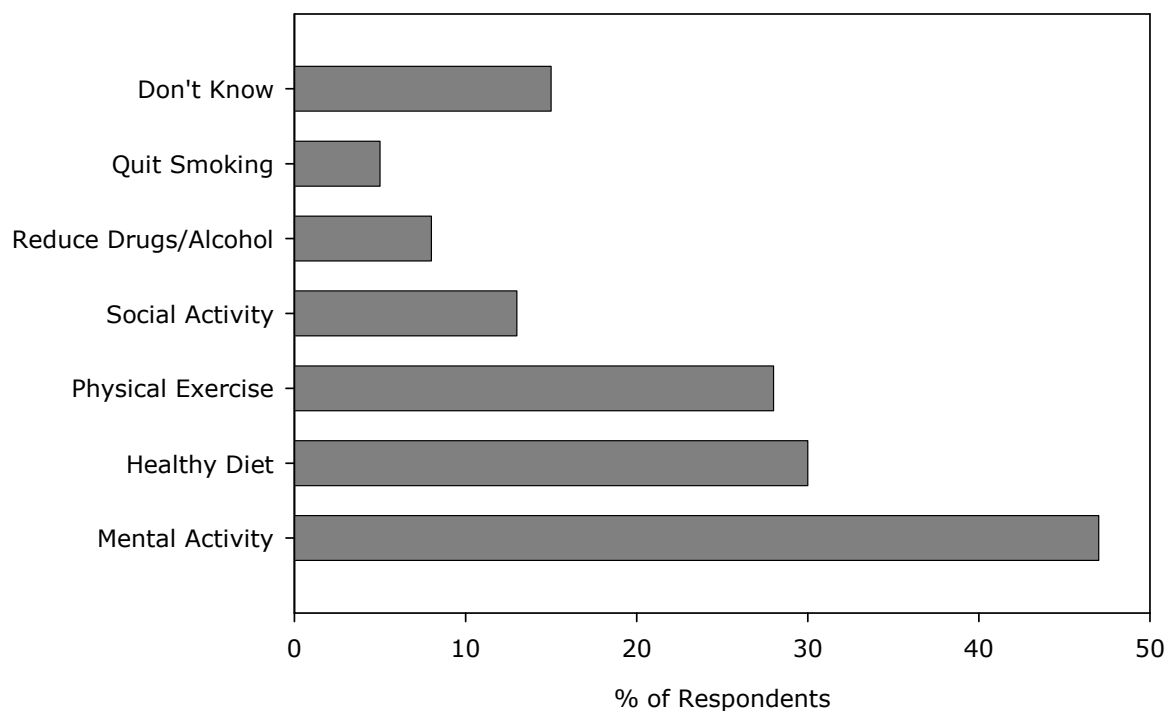


Figure 1 – Average percentages of Australian survey respondents who suggested (unprompted) strategies to reduce dementia risk

The findings in terms of what factors people most feel would reduce risk were similar for the surveys that asked closed questions, giving people a list of factors and asking which of them would reduce the risk of dementia. Three Australian surveys asked only people who had first answered that they believe it is possible to reduce risk whether each of a list of factors would reduce risk [19,20,21]. People in this group were most likely to agree that the given factors would reduce risk and less than 1% agreed with none of the listed factors. Figure 2 shows the average percentages of respondents who agreed that given risk reduction strategies may reduce risk (see Table B3, Appendix B, for results from each survey). Across a total of 4234 Australians, nearly all agreed that mental activity would reduce risk, more than 4 out of 5 agreed with improving diet and physical exercise, 71% with reducing smoking, 63% with reducing high blood pressure and 54% with reducing high cholesterol. In two of these surveys, an average of 93% agreed that keeping socially connected would reduce risk [20,21]. In two surveys 89% agreed with reducing alcohol and drug consumption [19,20], and in the third 80% agreed that having low or moderate alcohol consumption may reduce risk [21].

Other surveys did not first ask if people thought risk could be reduced, and including all participants led to lower rates of people agreeing that the factors given would reduce dementia risk (see Table B4, Appendix B, for results from each survey). Two surveys involving a total of 2069 Australians asked whether each factor “would” reduce the risk of developing dementia [17,22]. Figure 3 shows the average percentages of respondents who agreed that the given risk reduction strategies would reduce risk. On average, 1 in 4 people said that nothing would reduce risk. Two-thirds of people agreed that mental activity would reduce risk, while less than half agreed with reducing drugs and alcohol and with improving diet. Around 1 in 3 people agreed with increasing physical activity, while 1 in 4 or less agreed with reducing smoking, reducing high blood pressure and reducing high cholesterol.

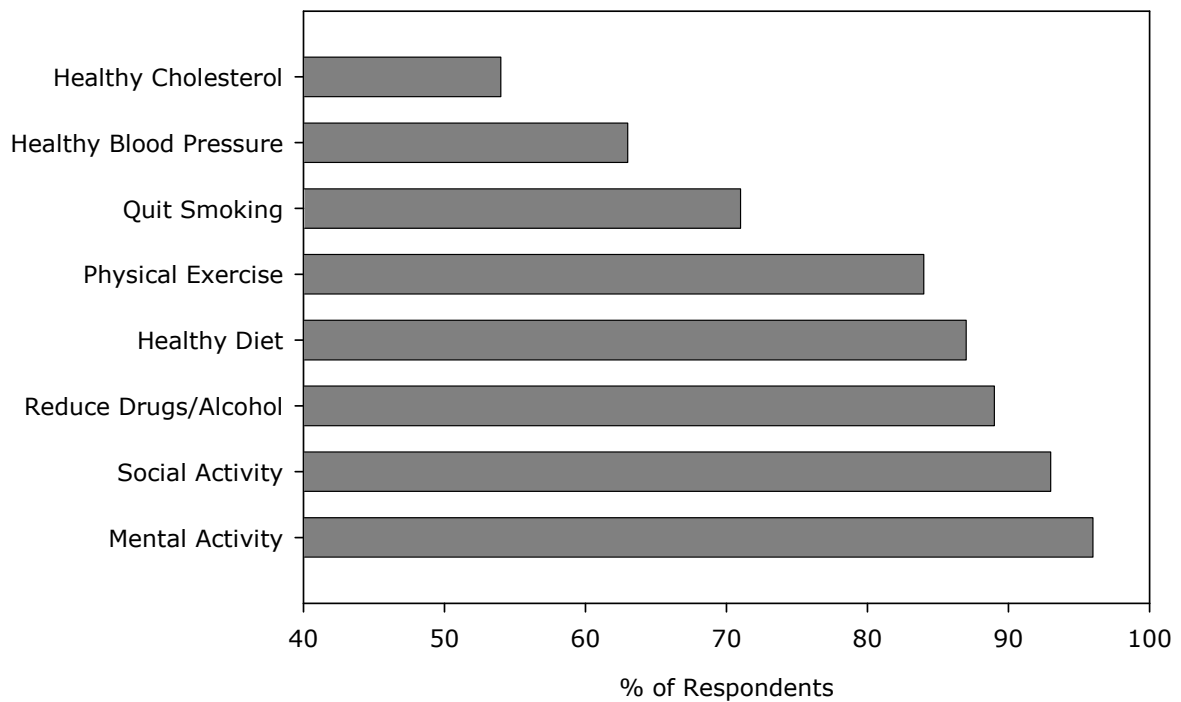


Figure 2 – Average percentages of Australian survey respondents (including only those who first agreed it is possible to reduce risk) who agreed that given strategies would reduce dementia risk

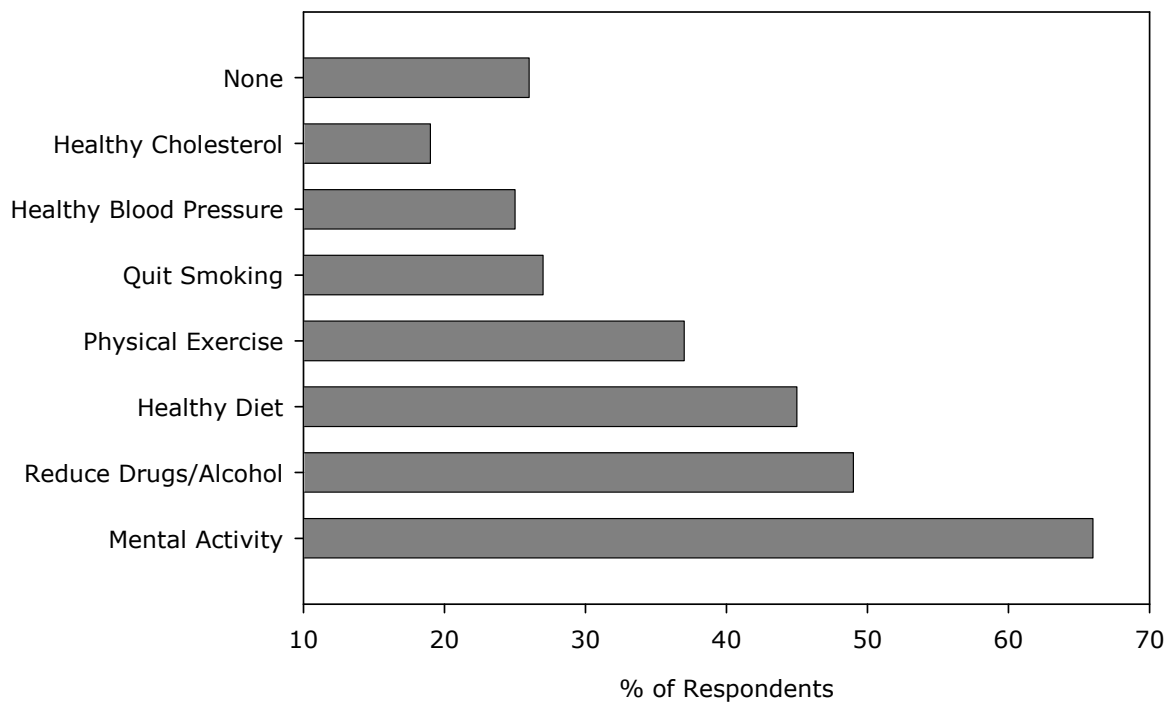


Figure 3 – Average percentages of Australian survey respondents (including all participants) who agreed that given strategies would reduce dementia risk

Another survey of 1380 Australians asked whether each factor “might help to” reduce risk [23] (see Table B4, Appendix B, for results). In this case, only 10% of people said that nothing can be done to reduce risk. More people agreed that each of the factors “might” reduce risk compared to those who agreed they “would” reduce risk in the other two surveys [17,22].

Results were relatively consistent for a survey of 2000 Australians that asked whether certain interventions or factors would increase, decrease or not change risk [12] (see Table B4, Appendix B, for results). The factor most people said would decrease risk was mental activity. This was followed by physical activity, social activity, reducing alcohol consumption, maintaining healthy blood pressure, ceasing smoking and maintaining healthy cholesterol levels.

In a recent UK public survey, 62% of people said they thought their lifestyle had no impact on their chance of developing a form of dementia [25]. In an earlier survey conducted in Scotland, 37% of people agreed that changing your lifestyle can reduce your chance of getting dementia, while 30% disagreed and 34% did not know [26]. These surveys did not report findings for knowledge of individual lifestyle factors, but suggest that only about one-third of people think that their lifestyle can impact on their dementia risk.

The Australian survey findings suggest low levels of knowledge of lifestyle factors that may reduce dementia risk. Only mental activity was mentioned by more than 1 in 3 people when asked what can be done to reduce the risk of developing dementia. Despite growing scientific evidence for the association of dementia risk with a number of lifestyle factors (discussed below), public awareness does not seem to be keeping pace [13].

Mental activity

It is well documented that higher levels of education, more mentally demanding occupations, higher IQ and higher levels of engagement in mentally stimulating leisure activities are all associated with reduced risk of developing dementia [8,27] and with decreased cognitive decline [28]. This has been interpreted as evidence for the concept of cognitive reserve, whereby complex mental activity throughout life builds a reserve that allows flexible cognitive strategies to be employed in the face of neurodegeneration and delays the onset of dementia, potentially explaining why some individuals remain free of dementia symptoms despite a large burden of Alzheimer’s disease neuropathology [27]. In their systematic review of cohort studies of the association between brain reserve and dementia risk, Valenzuela and Sachdev [27] found that dementia risk was reduced by 46% in high brain reserve individuals.

Mental activity and intelligence are usually correlated, leading to the suggestion that those who are more likely to engage in mentally demanding activities may be less genetically predisposed to dementia [8]. However, twin studies have shown significant effects of education that cannot be explained by genetic or family environmental factors alone [8].

The factor consistently seen by Australians as most plausible in reducing dementia risk was mental activity. Unprompted, nearly half of those surveyed suggested mental activity as a risk reduction strategy. When prompted with lists of potential strategies, at least two-thirds agreed that mental activity would reduce risk. The Australian survey findings suggest that many people relate exercising the brain to keeping it healthy, especially when prompted. However, the numbers able to suggest this unprompted probably better reflects how many people actually know or believe this association, which is less than half.

Consistent with the Australian findings, when Canadians were asked what they think you should do to keep your brain healthy, the most commonly cited factors were exercising the brain (27%) and reading (20%) [29]. However, the awareness of what type of mental activity is actually associated with reduced dementia risk may not be very high, especially in regards to lifespan factors of education and occupation. A UK study of older adults aged 56 to 96 years found that only 6% identified not being well educated as a risk factor for dementia [14].

Given there is some public awareness of the link between mental stimulation and cognitive health, exploiting and expanding this awareness in dementia risk reduction promotion makes sense. However, whether this can have an impact in groups who are older or less well educated is questionable. Those who are more highly educated are more likely to attain higher occupational status and engage in mentally stimulating leisure activities. Differences in engagement in mentally demanding pursuits may therefore begin early and persist throughout life. Public education aimed at reducing dementia risk through encouraging mental activity may therefore need to take a life-long perspective [8,11].

While intervention in the area of mental activity may not be easy, it is considered important. Indeed, it has been suggested that education levels in developing countries will need to improve in line with increased life expectancy to avoid an extreme rise in dementia rates [27].

Exercise and diet

Two recent reviews of studies examining the relationship between physical activity and cognition in older people concluded that while findings are mostly consistent with a reduced risk of cognitive decline and dementia in regular exercisers, more research is needed to conclusively determine the effects of physical activity on cognition and dementia [30,31]. Others have highlighted the need for more research to determine what type, intensity and frequency of exercise should be recommended for different age groups to best maintain cognitive health with ageing [32,33]. There is also a need to determine how exercise optimally fits in with other lifestyle factors that have a positive effect, such as diet, mental activity and social interactions [32,33].

While there are conflicting findings, some studies suggest that higher intakes of folate, vitamin B12, antioxidants including vitamins C and E, omega-3 fatty acids and unsaturated fats, lower intake of saturated fat, and higher adherence to the Mediterranean diet are associated with reduced risk of cognitive decline and dementia [34-38]. While recent reviews have concluded that the evidence is limited for many of these [35,39,40], several studies have now shown that high intake of saturated and transunsaturated (hydrogenated) fats is associated with increased risk of dementia, while intake of polyunsaturated and monounsaturated fats protects against cognitive decline in older people [7].

In the Australian surveys that asked an open question about how risk could be reduced, improving diet and increasing physical exercise followed mental activity as the most cited risk reduction strategies. When people were given factors and asked whether these could reduce risk, diet and exercise followed mental activity and reducing drug or alcohol consumption as the factors most people agreed would reduce risk. The survey findings in regard to exercise and diet may reflect attitudes about general health. There are constant health messages about the benefits for cardiovascular health of increasing physical exercise and eating a healthy, low saturated fat diet. People may associate general health with brain health and therefore see good diet and exercise habits as plausible ways of protecting brain health. The open question results suggest though that less than 1 in 3 people make this association unprompted.

The recommendations for diet and exercise to reduce cardiovascular risk are likely to be applicable to reducing dementia risk and there is a recognised need to raise public awareness of this through health promotion [7].

Alcohol and drugs

Light to moderate consumption of alcohol has been associated with a reduced risk of developing dementia compared to those who do not drink at all [41]. However, regular binge drinking in midlife was associated with an increased risk of dementia [42]. While alcohol abuse is a known risk factor for dementia, there is no evidence available for an association between abuse of other drugs and increased risk of dementia.

Reducing alcohol and drug consumption was a factor many survey respondents agreed might reduce risk when this was included in lists. This may reflect general beliefs about potential detrimental effects of alcohol and illicit drugs on the brain. However, reducing drugs or alcohol was mentioned by less than 10% of people when they were not prompted but instead asked how risk might be reduced [12,18,21].

Different surveys used different phrases for this factor, including "reducing alcohol consumption" [12], "reducing drug and/or alcohol consumption" [17,18,22], "reducing drug and excessive alcohol consumption" [19,20] and "having low or moderate alcohol consumption" [21,23]. Unfortunately, it is not possible to know from these survey results whether alcohol or other drugs are perceived to be more closely associated with dementia risk, or what people believe about the effects of different amounts of alcohol.

Recommendations regarding safe alcohol consumption for general health are likely to be applicable to reducing dementia risk and the survey results highlight the need to include this message in risk reduction education. This is one area in which there is potentially some good news for the public, in that moderate alcohol consumption is associated with lower dementia risk.

Social activity

Several studies have shown an association between levels of social activity and risk of dementia. Loneliness was recently shown to be associated with an increased risk of cognitive decline and dementia [43] and social network size was found to mediate the relationship between Alzheimer's disease pathology and cognitive function [44]. Higher levels of mental, physical and social activity within leisure activities were all found to be associated with a reduced risk of dementia, and those whose activities included high levels of two or all three components had the lowest risk [45].

Unprompted, social activity was suggested by an average of only 13% of people as a way to reduce risk, whereas a majority of people agreed that social activity or keeping socially connected would reduce risk when prompted. These findings that few people associate social activity with a lower risk of dementia unless prompted with the idea, and increasing evidence that social isolation increases dementia risk, suggest a need to raise awareness of this association.

Vascular risk factors

Recent reviews have highlighted the many studies indicating that cardiovascular risk factors also increase the risk of cognitive decline and dementia, and that public health interventions that target lifestyle modifications and control of vascular risk factors have the potential to reduce risk or delay onset of dementia [9,46]. Importantly, vascular risk factors are associated with increased incidence of Alzheimer's disease, the most common cause of dementia [46,47]. Consequently, the relationship between vascular risks and cognitive function is a major focus of the US Healthy Brain Initiative Road Map [11].

The vascular factor perhaps most consistently associated with increased risk of cognitive decline and dementia is midlife hypertension. Treatment of hypertension has also been shown to reduce the risk of dementia, with greater benefit from longer term treatment [47]. A recent meta-analysis demonstrated that smoking is associated with an increased risk of dementia and cognitive decline and concluded that public health messages about smoking should include advice that it may increase the risk of dementia [48].

Drawing a link between heart health and brain health would take advantage of beliefs that cardiovascular health is linked to a healthy lifestyle [7,13]. This could include building the message that control of vascular risk factors may assist in preventing cognitive decline and dementia into existing health promotion strategies for diabetes, hypertension, stroke and heart disease [12,49]. There is evidence that community based vascular health interventions can be effective [50,51]. For example, several community programs for detection and control of hypertension have resulted in reductions in the incidence of heart disease and stroke and have been shown to be cost effective [51]. Nationwide public health programs in the US and Finland have also achieved improvements in cardiovascular risk factors and reductions in subsequent disease and mortality [51].

Vascular risk factors associated with increased risk of dementia were the least well known by survey respondents. Australian surveys that asked an open question about how risk might be reduced reported response rates less than 1% or no responses related to blood pressure, cholesterol, diabetes or other cardiovascular risk factors [12,18,21]. Two surveys reported that an average of 5% of people suggested not smoking as a way to reduce risk [12,21]. Even when prompted, fewer people agreed that reducing or quitting smoking, reducing high blood pressure or reducing high cholesterol would reduce dementia risk than any of the other given strategies.

Similar low rates of knowledge of the association between vascular factors and dementia risk have been found in other surveys around the world. In an online survey of 1859 Canadians, only 34% of people agreed that "diabetes, hypertension, high cholesterol and obesity are all risk factors of Alzheimer's" while 51% were unsure and 15% disagreed [29]. In the oldest group of respondents (over 65 years) 21% disagreed that these are risk factors. In a UK study of older adults, 23% agreed that high blood pressure is a risk factor and 19% agreed that smoking is a risk factor [14]. The Canadian survey found that 70% agreed that "smoking negatively impacts brain health" [29], but did not ask whether people believed smoking affects dementia risk. A perceived link between smoking and brain health could be exploited to increase awareness that an increased risk of dementia is another good reason for not smoking.

Despite the consensus that there is a demonstrated link between vascular risk factors and dementia risk, and that these risk factors for dementia are perhaps the most readily modified through lifestyle and medical interventions, the public remain generally unaware of the association. The survey findings highlight that perhaps the greatest need for further public education is in the area of vascular risk factors for dementia.

Interpretation and generalisability of survey results

There were typically large differences between the number of people who gave specific responses to open questions about how dementia risk can be reduced and the number who endorsed specific items in closed questions on risk reduction in the Australian surveys. For example, 8% of people who agreed risk reduction is possible mentioned reducing drug or alcohol consumption when asked how risk could be reduced, whereas 89% agreed that this could reduce risk when prompted.

Closed questions are more likely to lead participants by providing answers that they may not have known, but may consider to be feasible when suggested to them, while open questions are more likely to elicit true knowledge or opinions [12]. The survey findings therefore suggest that while most people do not know many of the factors associated with increased risk of dementia, many more agree when prompted that it is plausible that factors associated with general health and wellbeing may reduce risk.

There were also differences in findings between the Australian surveys in terms of how many people agreed that factors reduce dementia risk. Much of the difference can be attributed to methodological differences, specifically in the varying wording of questions. People were more likely to agree that given factors reduce dementia risk when they were asked to choose whether factors increase or decrease risk rather than asked if factors would reduce risk. They were also more likely to agree with factors when they were asked if they "might" rather than "would" reduce risk. More people also agreed that factors would reduce risk when only those who had first agreed that risk reduction is possible were included rather than the whole sample. Discrepancies between surveys were smaller when questions were asked in very similar ways and of similar samples, but were still up to 10%. This highlights the difficulty in drawing firm conclusions about the quantitative level of knowledge among the general public from a single survey.

Some Australian surveys examined demographic effects on dementia risk reduction knowledge, but results were not always consistent. More highly educated people were generally more likely to think that dementia risk could be reduced [12,20,21] and to suggest that mental activity and healthy diet could reduce risk [12,21], but less likely to agree that reducing high blood pressure, cholesterol and smoking could reduce risk [20,21]. Young people (18-24 years) were more likely to agree that reducing high blood pressure, cholesterol and smoking could reduce risk [19,21]. In one survey, young people (under 30 years) were more likely to think nothing can be done to reduce risk [22]. Another survey found that older participants (over 65 years) were significantly less likely to say that risk could be reduced [12].

Most of the surveys reviewed here were telephone polls, which were conducted in such a way as to obtain as broad a representation of society as possible. Despite this, it is recognised that those who agree to participate are more likely to be English speaking, better educated and from higher socioeconomic backgrounds and so may not accurately reflect the general population [12]. In particular, the findings may not apply to people from culturally and linguistically diverse backgrounds. Further research will be needed to determine how age, gender, socioeconomic status, education and cultural background influence knowledge of factors affecting dementia risk, and practice of healthy lifestyle behaviours [11,16].

Are people taking steps to reduce their dementia risk?

In a survey for Alzheimer Scotland, respondents were asked, "Would you do any of the following if you thought it could reduce your risk of getting dementia?" [26]. Between 17 and 26% of people said they were not considering undertaking the behaviours, which included physical, mental and social activity, healthy diet and moderate alcohol consumption. Between 31 and 54% said they had been undertaking the behaviours for 6 months or more, but whether they were doing so to reduce their risk of dementia was not specified.

In a US survey, only 14% of Americans said they are making lifestyle changes to reduce their risk of dementia [24]. However, 62, 48 and 45% said they are making lifestyle changes to reduce their risk of heart disease, diabetes and cancer, respectively, behaviour that may also have benefits for lowering dementia risk.

In another US survey, 84% of Americans said they do activities to keep their brain fit [52]. Participating in healthy lifestyle activities may be associated more with physical health and general brain fitness than with reducing dementia risk.

One Australian survey, after asking which of a list of behaviours would reduce the risk of developing dementia, asked which of those steps people were taking specifically to reduce their risk of being affected by dementia, and 49% answered none [17]. The report concluded that education campaigns should focus on converting awareness of risk factors into behaviour change [17]. Others have also stressed that education not only needs to raise awareness of risk factors, but to encourage and facilitate people to actively engage in risk reduction behaviours [15,16,50].

Does knowledge correlate with practice?

Development of public health promotion efforts needs to take account of the issue that increasing knowledge of healthy behaviours does not ensure increasing practice. Disparity between knowledge and behaviour has been highlighted by research in several health areas [15]. For example, a US report on the health benefits of physical activity was released 10 years ago, and Americans have been bombarded with messages to get fit since then, but their exercise patterns have changed little and only 1 in 4 adults aged over 55 engage in regular exercise [53].

Coulson and colleagues [15,16] found good knowledge of the importance of regular exercise and good nutrition among older people, but much lower levels of practising these behaviours. In an Australian sample of people over 55 years of age, 96% knew that exercising three times a week was important, but 49% did not practise this behaviour [15]. In a comparable Canadian sample, 95% knew of the importance of regular exercise, but 39% did not practise it [16]. Similar discrepancies between knowledge and practice were observed for nutrition and other health promoting lifestyle factors, leading to the recommendation that health education needs to facilitate people to apply knowledge of healthy behaviours in their everyday life [15,16].

What factors might motivate behavioural change?

While raising community awareness and knowledge about the risk factors associated with dementia and how risk can be reduced is an obvious and important first step, there is also a need to consider what might affect people's motivation to adopt risk reducing behaviours. One identified factor is the perception of risk [12]. People may be more likely to change their behaviour if they perceive themselves to be personally vulnerable to developing dementia. Although people's concerns about developing dementia may be dependent on their age [22,26], some public surveys suggest that the majority of people are not particularly worried about developing dementia [12,23,24] and that dementia is not considered as important a health issue as cancer or heart disease [18,24].

Therefore, public education to increase awareness and understanding of the condition itself, its rising prevalence, and the fact that there is currently no cure or effective treatment, may be needed to improve motivation to adopt risk reduction messages [12,17]. Young and middle-aged people in particular may not perceive themselves to be at risk, as they see dementia as a disease of old age [18]. The brain pathologies that cause dementia are thought to begin many years, perhaps decades, before symptoms are noticeable [54], and many of the observed effects of lifestyle on risk may be related to life-long pursuits [8]. Public education should include this evidence to encourage early adoption of a risk reducing lifestyle.

Another important factor in motivating people may be the perception of one's ability to modify risk. Recent Australian survey findings suggest that people see genetics, ageing and brain disease as causes of dementia, and feel therefore that there is little they can do about it [12,18]. Additionally, the erroneous belief that dementia is a normal part of ageing is still held by many people, with between 10 and 33% of survey respondents agreeing with this concept [12,18,24,26,30,55]. Public education programs may therefore need to include information about what causes and increases the risk for dementia, in order to encourage thinking that many risk factors are within people's control to change.

Little is known about people's motivations in relation to dementia risk reduction behaviours. A Canadian survey asked people about their motivation to engage in various brain healthy behaviours [29]. For eating healthy and exercise, the most commonly cited motivations were to feel good and maintain a healthy weight, and brain health was not mentioned. For social activities and mental activities, around 1 in 3 people said they did these for their mental health, while the majority did them for enjoyment. Further research is needed to determine what currently motivates people and what will be required to motivate different groups of people to adopt dementia risk reducing behaviours.

Is improved public awareness and practice achievable?

Even if public education can convince people that they personally are at some risk and that there is something they can do about reducing that risk, as well as provide motivation to do so, there will remain many barriers for different sections of the community to modifying their behaviour according to dementia risk reduction messages. For many of the recommended behaviours there is no easy, quick solution, instead long-term lifestyle changes are required in addition to taking responsibility for one's own health. The myriad socioeconomic, cultural and other barriers to achieving these goals for some individuals and communities are beyond the scope of this paper, but cannot be ignored if risk reduction programs are to be effective and eventually achieve reduced prevalence of dementia.

Despite the inherent difficulties, there is evidence that community based health interventions can be effective in terms of reducing disease incidence as well as being cost effective [50,51]. There are examples of successful community based interventions in a range of health promotion and disease prevention areas including physical activity, hypertension, heart disease, diabetes and various types of cancer [50,51,53]. Also, results of nationwide public health programs targeting heart disease and stroke demonstrate that such initiatives can produce substantial improvements in risk factors and rates of subsequent disease and mortality [51].

While effective public education regarding dementia risk reduction will not be easy and may involve substantial cost, the potential benefits are enormous. There is general consensus that promoting risk reduction can have an impact on the rates of dementia in the ageing population, with subsequent rewards for individuals, societies and economies [5,6,7,15,46]. Promoting risk reduction may also raise awareness about dementia and its causes, leading more people to seek assessment and resulting in earlier identification and treatment of dementia, which will become especially important as new interventions become available [55,56]. There is consensus that while further research is needed to clarify many issues around risk factors for dementia and the effects of modifying them, there is ample evidence to now start promoting lifestyle modifications that may reduce the risk of dementia or delay its onset [6,7,9,12]. It is commonly recognised that well accepted public health principles take as many as 20 years to be implemented widely [46], so there is no time to lose.

CONCLUSIONS

The public surveys reviewed here reveal that the majority of the general public lack awareness of the risk factors associated with dementia and of the health and lifestyle modifications that might reduce risk. In particular, there is little knowledge of the link between cardiovascular risk factors and dementia risk. This should be an important target for public education given the strong evidence for this link and the known potential for modification of vascular risk factors.

There is much that is still unknown about public knowledge however, especially how different sectors of the community perceive the issues. In order to determine how best to change behaviour through public interventions, further information about people's understanding, attitudes and motivations around dementia risk reduction will be required. In particular, the level of awareness and attitudes among diverse groups in the community should be investigated to better understand, and intervene in, the target audiences for dementia risk reduction promotion.

While further clarifying gaps in public knowledge will help refine education programs, the evidence reviewed in this paper highlights the need for action to be taken now to raise awareness of dementia risk factors and motivation to address them. Dementia risk reduction education programs will need to be adequately resourced for the long-term and will require the cooperation of health professionals and health policy makers if they are to be effective and achieve the ultimate goal of curbing the rising incidence of dementia.

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APPENDIX A – Methodology tables

Table A1 – Methods employed in Australian public surveys

Survey	Method	Sample
Newspoll Market Research [21] Conducted March 2008	Telephone interview (part of omnibus)	N = 1834 Selected telephone numbers using random digit dialling, person with most recent birthday chosen Aged 18+ Quota for each geographical area Weighted by age, gender, highest schooling and area
Stollznow Research [23] Conducted October 2007	Questionnaire (part of omnibus)	N = 1380 Recruited from a panel of people who had agreed to participate in occasional market research Aged 16+ Weighted by age and geographical location
Colmar Brunton Social Research [18] Conducted July 2006	Telephone interview (dementia only)	N = 1004 Selected from telephone directory Age and gender quotas within each state
Low & Anstey [12] Conducted December 2005	Telephone interview (dementia only)	N = 2000 Selected from telephone directory, person with most recent birthday chosen Aged 18+ Gender and geographical location quotas Weighted by age
Newspoll Market Research [20] Conducted August 2005	Telephone interview (part of omnibus)	N = 1200 Selected from telephone directory, person with most recent birthday chosen Aged 18+ Quota for each telephone area code Weighted by age, gender and highest schooling
Newspoll Market Research [19] Conducted September 2004	Telephone interview (part of omnibus)	N = 1200 Selected from telephone directory, person with most recent birthday chosen Aged 18+ Quota for each telephone area code Weighted by age, gender and highest schooling
Stollznow Research [22] Conducted March 2004	Questionnaire (part of omnibus)	N = 1469 Recruited from a panel of people who had agreed to participate in occasional market research Aged 16+ Weighted by age and geographical location
Yann Campbell Hoare Wheeler [17] Conducted June 1999	Telephone interview (part of omnibus)	N = 600 Selected from telephone directory Victoria only Aged 18+ Weighted by population parameters

Table A2 – Methods employed in North American and UK public surveys

Survey	Method	Sample
For Alzheimer's Society UK [25] Reported 30 June 2007	Not reported	N = over 1000 National survey
Leger Marketing [29], for Alzheimer Society Canada Conducted October 2006	Online survey	N = 1859 Randomly selected Weighted by age, gender and geographical location
For American Society on Aging [52] Conducted April 2006	Telephone interview	N = 1000 Aged 42+ Balanced by gender and geographic region Weighted to reflect population
Market Research UK Limited [26], for Alzheimer Scotland Conducted December 2005	In-home interview (part of omnibus)	N = 1040 Aged 16+ Quotas for age, gender and geographical location
For Alzheimer's Association USA [24] Conducted December 2003	Telephone interview	N = 600 Aged 35+ Nationally representative

APPENDIX B – Results tables

Table B1 – Percentages of Australians responding to questions about whether they believe dementia risk reduction is possible

	Low & Anstey, 2006	Newspoll, 2008	Colmar Brunton, 2006	Newspoll, 2005	Newspoll, 2004
Agree	72	59	46	51	49
Disagree	-	19	21	17	23
Don't know	-	21	33	31	27

Questions:

Low & Anstey, 2006 [12] Do you think it is possible to reduce the risk of getting some forms of dementia?

Newspoll, 2008 [21] Thinking now about dementia, which has many causes including Alzheimer's disease. Please tell me if you personally agree or disagree that it is possible to reduce the risk of a person developing dementia.

Colmar Brunton, 2006 [18] Do you think there is anything that can be done to reduce the risk of developing dementia (including Alzheimer's disease)?

Newspoll, 2005 [20] Thinking now about dementia, which has many causes including Alzheimer's disease. Please tell me if you personally agree or disagree that it is possible to reduce the risk of a person developing dementia.

Newspoll, 2004 [19] Thinking now about dementia, which has many causes including Alzheimer's disease. Please tell me if you personally agree or disagree that it is possible to reduce the risk of a person developing dementia.

Table B2 – Percentages of Australians who suggested strategies to reduce dementia risk (open questions)

	Newspoll, 2008	Colmar Brunton, 2006	Low & Anstey, 2006
Mental activity	54	49	39
Healthy diet	33	27	31
Physical exercise	32	21	30
Social activity	15	11	14
Reduce drugs / alcohol	10	9	5
Reduce / quit smoking	4	-	6
Nothing / don't know	17	13	16

Questions:

Newspoll, 2008 [21] As far as you are aware, what do you think a person can do to help reduce the risk of developing Alzheimer's disease or another form of dementia?

Colmar Brunton, 2006 [18] What do you think a person can do to reduce the risk of developing dementia (including Alzheimer's disease)?

Low & Anstey, 2006 [12] Do you think it is possible to reduce the risk of getting some forms of dementia? If yes, how?

Table B3 – Percentages of Australians (only those who first agreed risk reduction is possible) who agreed that the given strategies may reduce dementia risk

	Newspoll, 2008	Newspoll, 2005	Newspoll, 2004
Mental activity	97	95	96
Healthy diet	90	88	82
Physical exercise	92	85	75
Social activity / connectedness	95	90	-
Reduce drugs / alcohol	80	88	90
Reduce / quit smoking	75	68	70
Reduce high blood pressure	67	63	60
Reduce high cholesterol	58	52	53
Avoid head injury	78	-	-

Questions:

Newspoll, 2008 [21] As far as you are aware, which of the following, if any, may help reduce the risk of a person developing Alzheimer's disease or another form of dementia?

Newspoll, 2005 [20] As far as you are aware, which of the following, if any, would help to reduce the risk of a person developing dementia?

Newspoll, 2004 [19] As far as you are aware, which of the following, if any, would help to reduce the risk of a person developing dementia?

Table B4 – Percentages of Australians (all survey respondents) who agreed that the given strategies may reduce dementia risk

	Stollznow, 2007	Low & Anstey, 2006	Stollznow, 2004	YCHW, 1999
Mental activity	84	82	66	66
Healthy diet	69	-	40	49
Physical exercise	67	79	34	40
Social activity / connectedness	68	78	-	-
Reduce drugs / alcohol	56	72	45	52
Reduce / quit smoking	52	62	29	24
Reduce high blood pressure	41	68	20	29
Reduce high cholesterol	35	58	17	20
None	10	-	27	22

Questions:

Stollznow, 2007 [23] As far as you are aware, which of the following might help to reduce the risk of developing Alzheimer's disease or dementia?

Low & Anstey, 2006 [12] Tell me if you think each item increases, decreases or does not change the chances of getting dementia.

Stollznow, 2004 [22] As far as you are aware, which of the following would reduce the risk of developing Alzheimer's disease or dementia?

Yann Campbell Hoare Wheeler, 1999 [17] As far as you are aware, which of the following would reduce the risk of developing dementia?

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