

## Dementia risk factors for Australian baby boomers

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### Abstract

Baby boomers are individuals born in the years 1946 to 1965. The objective of this paper was to define the risk factors for dementia and Alzheimer's disease (AD) and their relevance to Australian baby boomers, with the aim of providing evidence-based guidelines for dementia prevention. A series of PubMed searches (1994-2010) were conducted with relevant key words. Data was included from the Australian Bureau of Statistics (ABS) in relation to baby boomers in Australia. Article titles and abstracts were assessed by two reviewers for inclusion. Searches through ABS revealed no specific study on baby boomers at a national level; information was only available for Western Australia, South Australia and Queensland. A number of genetic and non-genetic risk factors for dementia were identified most of which remain controversial and require further study. We did not identify significant differences in the prevalence and incidence of dementia in those under 65 years in Queensland, South Australia and Western Australia. There were no correlations of risk factors and dementia between the Australian states. Modification of risk factors has not been proven to reduce the incidence and prevalence of dementia and AD in baby boomers. Nevertheless, on available evidence, we recommend: i) active management of cardiovascular risk factors such as hypertension; ii) the encouragement of a healthy lifestyle (eg, weight reduction, exercise) as offering the best pathways to reduce the emerging dementia risk for baby boomers. The implications are that activities promoting a healthy heart might lead to a healthy brain and help to prevent dementia.

### Introduction

Dementia is one of the most important problems facing our society. The recent US study '2008 Alzheimer's Disease Facts and Figures' from the authors of the Framingham Heart Study reveals that Alzheimer's disease (AD) and dementia have outstripped cancer and stroke as a more common cause of death.<sup>1</sup> We are concerned that this change not only represents a shift in assessment and treatment of

cancer and stroke, but displays the importance of identifying risk factors for AD and dementia. The United States Alzheimer's Disease study showed that the baby boom generation, which is defined as residents born between the years of 1946 to 1965, seem to be at particular risk of developing AD or dementia. Of the 78 million baby boomers in America, at least 10 million are expected to get dementia in their remaining lifetime.<sup>1</sup> Based on the percentage of baby boomers in Western Australia, South Australia and Queensland, we estimate the percentage of baby boomers at an Australian National level to be 29% of a total population of approximately 21.5 million. Therefore, of the estimated 6,235,000 baby boomers in Australia, at least 798,000 are expected to develop dementia in their lifetime, if Australia follows the United States trend, posing enormous economic costs and challenges to the health care system. The US trend towards increased risk of developing dementia is likely to be similar for Australia's baby boomers on account of epidemiological trends reported by the Australian Bureau of Statistics (ABS) for Western Australian, South Australia and Queensland.<sup>2</sup> There are no data available on the most populated states of Victoria and New South Wales. The epidemiological trends include risk factors such as smoking, obesity and sedentary life style. This paper further defines the risk factors for dementia and AD and how they might be correctable in the future. The aim is to provide evidence-based guidelines for dementia prevention in the 21st century as relevant to the Australian population.

### Materials and Methods

The PubMed database was interrogated from 1994-2010 using key words of dementia, Alzheimer's disease, baby boomers and evidence-based guidelines. Articles were assessed by two reviewers for inclusion based on methods and relevance. The Australian Bureau of Statistics (ABS) makes information publicly available on their website and information was identified for Western Australia, South Australia and Queensland. The ABS did not possess information at the time of the study for the other states or for the nation as a whole.

### Results

#### 2008 Alzheimer's Disease Facts and Figures: USA

The recent 2008 Alzheimer's Disease USA study states the problem in the United States

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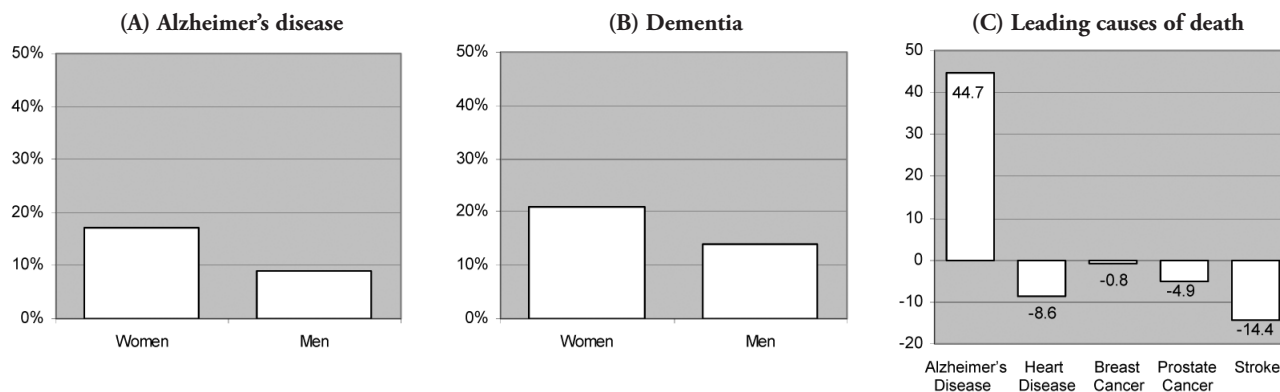
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where it is estimated that 10 million (1 in 8) American baby boomers will develop AD.<sup>1</sup> Currently in 2008 an estimated 5.2 million Americans of all ages have AD, with about one in 8 people older than 65 (approximately 13%) having the disease.<sup>1</sup> Women are more likely to develop AD than men, probably because they live longer.<sup>3</sup> Therefore, the female gender itself is not a risk factor once age is considered. The lifetime risk for AD cannot be predicted from birth; however, the lifetime risk of developing AD is one in 6 for women and in 10 for men who live to be at least 55 (Figure 1A). The remaining lifetime risk of any dementia, including AD for women and men is higher than that of AD alone (Figure 1B). This lifetime risk of dementia and AD will substantially increase in the future unless there are new preventative treatments. This study raises implications for the 78 million baby boomers in America, of which it is estimated that 10 million can expect to develop AD in their remaining lifetime. The authors note that these are conservative estimates due to the nature of data and that the true lifetime risk to baby boomers would actually be greater. As many as half a million new cases will develop every year by 2010. By 2050 that number is expected to grow to one million. The years 2000 to 2005 have seen the decline in death rates of heart disease, breast cancer, prostate cancer and stroke; however, the rates of AD have increased by almost 45% (Figure 1C). This decline in death rates from other causes of death could further increase rates on dementia as people live longer. Currently AD is among the top 10 leading causes of death for people of all ages, and number 5 for those 65 years and older. However, it is important to note that AD and dementias co-exist with other medical conditions, including hypertension, coronary



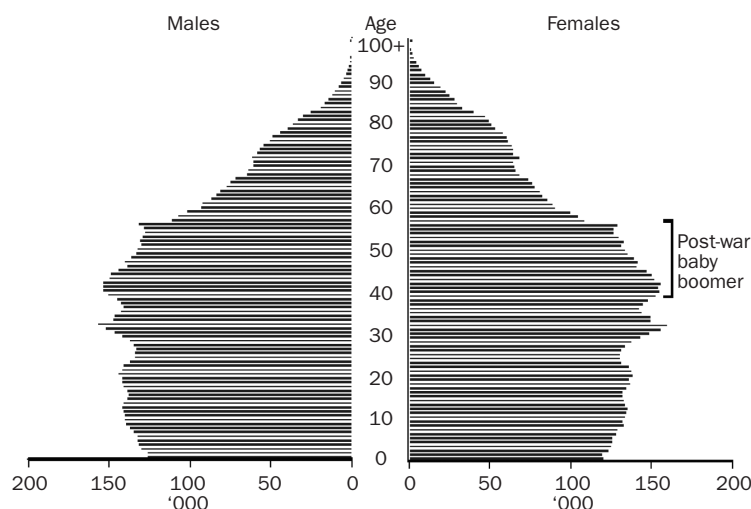
**Figure 1. (A) Percentage of women and men who will develop Alzheimer's disease in their remaining lifetime if they live to be at least age 55, Framingham Heart Study. (B) Percentage of women and men who will develop dementia in their remaining lifetime if they live to be at least age 55, Framingham Heart Study. (C) Percentage change in leading causes of death from 2000 to 2005.**

Source: Alzheimer's Association, 2008 Alzheimer's Disease Facts and Figures.<sup>1</sup>

artery disease, cognitive heart failure and others.<sup>4</sup> The AD USA study also shows that people with fewer years of education are more likely to develop AD and dementia, a finding supported by other studies.<sup>5-8</sup> Importantly, the implications of AD on health care, long-term care and end-of-life care services are of great concern. Most individuals develop AD and other dementias as a co-morbidity with one or more other serious medical conditions. Financial and emotional costs of this disease, with particular attention to carers, must also be emphasized.<sup>9</sup>

### The demography of Australian baby boomers

An overview of the epidemiology of Australia's baby boomers based on the Australian Bureau of Statistics (ABS) data raises concern over their risk of developing AD and dementia. According to the ABS, the baby boom generation refers to all Australian residents born in the years 1946 to 1965, including those who migrated to Australia from countries which did not experience the baby boom.<sup>2</sup> The total percentage of baby boomers in Australia is 28.7%. Figure 2 shows the Population Pyramid of Australia in 2003 and the ages of the baby boomers.<sup>10</sup> Three separate ABS studies specific to baby boomers in Western Australia,<sup>11</sup> South Australia<sup>12</sup> and Queensland<sup>13</sup> have been identified from which we have made assumptions pertaining to the whole of Australia. For the purposes of this paper the most important results of these studies were those of self-assessed health status, smoking status, alcohol consumption and exercise patterns, as they are potential risk factors for AD and correctable in the future (Table 1). In 2001, Western Australia's 557,000 baby boomers were aged 36 to 55 years and made up 29% of the population. In South Australia 29% of the population was also made up of baby boomers (441,300). Nearly one in



**Figure 2. Population pyramid of Australian states and territories.**

Source: 2003 ABS cat. no. 3201.0.<sup>10</sup>

three Queenslanders (29%) are baby boomers (1,039,000) and this percentage is set to grow dramatically over the coming years. Of all the baby boomers in 2001, 25%, 26% and 28% from Western Australia, South Australia and Queensland, respectively, were smokers. In Western Australia, two-thirds of baby boomers were inactive or undertaking low levels of exercise. In Queensland and South Australia, 71% and 73%, respectively, were sedentary or undertaking low levels of exercise. In Western Australia, Queensland and South Australia, more than 50% were overweight or obese. The percentage of baby boomers exhibiting risky or high-risk levels of alcohol consumption in Western Australia, Queensland and South Australia were 14%, 13.1%, and 11.5%, respectively. While in Western Australia (83%), Queensland (82%) and South Australia (79%) a high percentage of baby boomers reported a self-assessed health status of good, very good

or excellent, there were higher proportions reporting long-term health conditions. In both Queensland and Western Australia, high cholesterol and hypertensive disease were more frequently reported by older baby boomers than by younger baby boomers. In Queensland and Western Australia, high cholesterol in older baby boomers was 11% and 13.6%, respectively. In younger baby boomers it was 4% and 5.6%, respectively. In Queensland and Western Australia hypertensive disease was 15% and 13.9% in that order for older baby boomers; in younger baby boomers it was 4.2% and 4.6%, respectively. Using a non-parametric analysis of variance there were no significant differences between the three states and health risk factors as listed in Table 1 [Kruskal-Wallis statistic = 3.611, corrected for ties and approximated using  $\chi^2$ ,  $P=0.1644$ ]. Access Economics have collated incidence and prevalence data for domestic Australia and its states.<sup>14</sup> The

**Table 1. Health risk factors of baby boomers: Western Australia, South Australia and Queensland.\***

	Western Australia (2001)	South Australia (2001)	Queensland (2001)
Number of baby boomers	557,700	441,000	1,039,000
Younger (born 1956-65)	297,300	231,000	549,300
Older (born 1946-55)	260,400	210,000	489,500
Self assessed health status- excellent/very good	281,900	221,300	534,000
Younger (born 1956-65)	160,200	119,700	291,600
Self assessed health status- good	178,000	122,200	322,100
Younger (born 1956-65)	96,600	74,900	96,000
Older (born 1946-55)	81,400	47,300	104,700
Self assessed health status- fair/poor	81,100	91,400	182,900
Younger (born 1956-65)	29,100	31,200	28,500
Older (born 1946-55)	52,000	60,100	36,400
Current smoker	134,400	115,000	290,900
Younger (born 1956-65)	82,500	67,900	93,100
Older (born 1946-55)	51,900	47,100	66,900
Risky/high risk alcohol consumption	74,700	51,300	136,100
Younger (born 1956-65)	37,200	21,300	N/A
Older (born 1946-55)	37,500	30,000	N/A
Sedentary/low exercise	358,600	323,200	322,100 (Sedentary)
Younger (born 1956-65)	183,100	172,400	N/A
Older (born 1946-55)	175,500	150,800	N/A
Overweight/obese	276,700	221,800	561,100
Younger (born 1956-65)	142,000	109,900	279,400
Older (born 1946-55)	134,600	111,900	328,800
High cholesterol			
Younger (born 1956-65)	16,600	N/A	22,000
Older (born 1946-55)	35,400	N/A	53,800
Hypertensive disease			
Younger (born 1956-65)	12,500	N/A	25,300
Older (born 1946-55)	36,200	N/A	73,400

\* Non-parametric ANOVA = 3.611; P=0.1644.

prevalence and incidence data for Queensland, South Australia and Western Australia are shown in Tables 2 and 3, respectively. Using a non-parametric analysis of variance there are no statistically significant differences between these states of Australia and the prevalence and incidence of dementia [prevalence: Kruskal-Wallis = 3.567, P=0.1964; incidence Kruskal-Wallis = 5.333, P=0.0714].

## Discussion

### Dementia risk factors: the evidence base

High systolic blood pressure has been reported as a risk factor for dementia. The Kungsholmen Project<sup>15</sup> found that patients with high blood pressure greater than 180

mmHg had a 50% increase of developing AD and dementia (Table 4). A risk score for the prediction of dementia based on risk factors at mid-life found high systolic blood pressure to significantly predict dementia.<sup>16</sup> Low diastolic pressure less than 65 mmHg led to a 40% increased risk of developing AD or dementia.<sup>15</sup> The Kungsholmen Project found that heart failure was associated with an over 80% increased risk of dementia and AD.<sup>15</sup> Men with unrecognized myocardial infarction are at increased risk of dementia and cerebral small vessel disease.<sup>36</sup> This was not so in women. Results of the Whitehall II study suggest an association between coronary heart disease and cognitive performance in middle-aged adults.<sup>31</sup> As indicated in the Kungsholmen Project,<sup>15</sup> use of antihypertensive drugs may decrease risk of dementia and AD,<sup>33</sup> as they may counteract the combined effect on dementia due to the genetic risk factors APOE4 and

**Table 2. Prevalence of dementia in individuals aged under 65 ( $\times 10^3$ ).\***

Gender	Queensland	South Australia	Western Australia
Male	1.25	0.49	0.62
Female	0.71	0.29	0.34
Total	1.96	0.78	0.96

\* Non-parametric ANOVA = 3.467, P=0.1964.

**Table 3. Incidence of dementia in individuals aged under 65 ( $\times 10^3$ ).\***

Gender	Queensland	South Australia	Western Australia
Male	0.10	0.04	0.05
Female	0.10	0.04	0.05
Total	0.20	0.08	0.10

\* Non-parametric ANOVA = 5.333, P=0.0714.

**Table 4. Dementia risk factors: evidence-base.**

High blood pressure <sup>15-17</sup>
Obesity/high BMI <sup>16,18,19</sup>
Smoking <sup>15,20,21</sup>
Alcohol <sup>15,20</sup>
Head injury <sup>22,24</sup>
Low cognitive activity <sup>25-30</sup>
Low physical activity <sup>19</sup>
Non-steroidal anti-inflammatory drugs <sup>31</sup>
History of coronary heart disease <sup>15,32</sup>
Antihypertensive drugs <sup>15,17,33,34</sup>
Diabetes mellitus <sup>35</sup>
Cholesterol <sup>16</sup>
Genetic: APOE $\epsilon 4$ <sup>16,20</sup>

high systolic blood pressure.<sup>34</sup> A study using the Hypertension in the Very Elderly Trial cognitive function assessment (HYVET-COG) found that antihypertensive treatment in elderly patients does not statistically reduce the incidence of dementia; however, this may be due to early follow up. The authors indicate that the HYVET findings, when included in a meta-analysis, might support antihypertensive treatment to reduce incident dementia.<sup>17</sup> Some studies indicate that treatment of dementia might slow cognitive decline and prevent AD.<sup>37,38</sup> A study by Xu *et al.*<sup>35</sup> found that diabetes mellitus increases the risk of dementia in very old people even after adjusting for other confounders. There seems to be an association between type 2 diabetes and APOE4 allele, and increased risk of developing AD.<sup>39</sup> High Body Mass Index was found to be a significant predictor of dementia indicated by the risk score as per Kivipelto *et al.*<sup>16</sup> Whitmer *et al.*<sup>18</sup>

found that central obesity in mid-life increases risk of dementia independent of diabetes and cardiovascular co-morbidities. High cholesterol was found to be a significant predictor of dementia indicated by the risk score as per Kivipelto *et al.*<sup>16</sup> Use of statins has been associated with reduced risk of incident dementia and AD.<sup>40,41</sup> Heavy drinking and smoking were associated with reduced age of onset of Late Onset Alzheimer's Disease (LOAD), with data suggesting that the elimination of smoking and heavy drinking could substantially reduce the age-specific prevalence of LOAD.<sup>20</sup> Life habits such as smoking and alcohol were also found to be associated with an increased risk of dementia and AD in the Kungsholmen Project.<sup>15</sup> Current smoking was found to increase the risk of dementia which was more pronounced in persons without the APOE $\epsilon$ 4 allele than APOE $\epsilon$ 4 carriers.<sup>21</sup> More frequent participation in cognitive activity was associated with reduced incidence of AD. A cognitively inactive person was 2.6 times more likely to develop AD than a cognitively active person.<sup>25</sup> A number of other studies have also shown that greater cognitive activity is associated with reduced cognitive decline in mild cognitive impairment,<sup>25-27</sup> dementia or AD.<sup>28-30</sup> According to Andel *et al.*,<sup>19</sup> it was found that exercise at mid-life may reduce odds of dementia in older adulthood, suggesting that exercise interventions should be explored as a potential strategy for delaying disease onset.<sup>42</sup> Vlad *et al.*<sup>31</sup> highlighted new evidence on the controversial topic of whether non-steroidal anti-inflammatory drugs may protect against AD. It was found that there was a dose-response effect with the long-term use of non-steroidal anti-inflammatory drugs, specifically ibuprofen, for lowering the risk for AD. According to the study by Kivipelto *et al.*,<sup>16</sup> the APOE $\epsilon$ 4 allele was an independent risk factor for dementia/AD even after adjustments for socio-demographic, lifestyle and vascular factors. Among the APOE $\epsilon$ 4 carriers, physical activity, alcohol drinking and smoking increased the risk of dementia/AD. In APOE $\epsilon$ 4 carriers this increased risk of dementia was associated with low-moderate intake of polyunsaturated and moderate-high intake of saturated fats.<sup>16,43</sup> Additionally, a composite effect of lifestyle factors was seen among the  $\epsilon$ 4 carriers. Kivipelto *et al.*<sup>16</sup> concluded that APOE $\epsilon$ 4 carriers may be more vulnerable to environmental factors and thus lifestyle interventions might modify dementia risk, particularly among genetically susceptible individuals. This has been supported by studies which show that other genetic risk factors influence the vulnerability of the central nervous system to the development of AD and includes genes involved with cholesterol and amyloid metabolism, microtubular associated protein tau, inflammatory factors and others.<sup>43</sup> These risk factors for AD and

dementia are of particular importance for baby boomers in Australia. In Western Australia, 25% of baby boomers are currently smoking, 14% are consuming risky or high levels of alcohol, 67% are inactive or undertaking low levels of exercise, and 51% are overweight or obese, with a similar pattern in Queensland and South Australia. High rates of cholesterol and hypertensive disease are also present in Australian baby boomers. Our emphasis of the importance of lifestyle risk factors on the development of AD in younger adults is supported by other investigators.<sup>44</sup>

## Conclusions

There is limited data on the health of baby boomers at a national level in Australia. Important ABS data has been gathered in Western Australia, Queensland and South Australia; however, data for the most populated areas of Australia (New South Wales and Victoria, where the risk of dementia development is of greatest potential economic impact) are not available. We recommend that data be collected at a national level in order to better determine the level of risk of dementia of our baby boomers and to provide a foundation for prevention. We have not demonstrated statistically significant differences in risk factors or dementia prevalence and incidence for Western Australia, South Australia and Queensland. Further studies might help to address the role of genetic and lifestyle risk factors in those under 65 years in comparison with those over 65 years in the Australian states. This paper has shown that there are a myriad of factors which may impact on the risk of dementia, including genetic and non-genetic. Whilst associations with dementia have not been proven, we recommend that those variables which promote a healthy lifestyle should be adopted. Target populations include those baby boomers with mild cognitive impairment where stringent application of risk factor modification might prevent transformation to dementia.<sup>45</sup> However, in our experience mild cognitive impairment is found in only 4.9% of younger adults with the suspicion of dementia.<sup>46</sup> We propose that activities promoting a healthy heart will lead to a healthy brain. These might help to prevent dementia and are probably best incorporated into health promotion, prevention and early intervention programs in primary practice.<sup>47</sup>

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