Lifestyle factors and risk of dementia: Dubbo Study of the elderly

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ABSTRACT

Objective: To identify risk factors for dementia in an elderly Australian cohort.

Design and setting: A longitudinal cohort study conducted in Dubbo, NSW.

Participants: 2805 men and women aged 60 years and older living in the community and initially free of cognitive impairment, first assessed in 1988 and followed for 16 years.

Main outcome measure: Admission to hospital or nursing home with any kind of dementia.

Results: There were 115 cases of dementia in 1233 men (9.3/100) and 170 cases in 1572 women (10.8/100). In a proportional hazards model for dementia, any intake of alcohol predicted a 34% lower risk, and daily gardening a 36% lower risk. Daily walking predicted a 38% lower risk of dementia in men, but there was no significant prediction in women. The lowest tertile of peak expiratory flow predicted an 84% higher risk of dementia, the upper tertile of depression score predicted a 50% higher risk.

Conclusion: While excess alcohol intake is to be avoided, it appears safe and reasonable to recommend the continuation of moderate alcohol intake in those already imbibing, as well as the maintenance of physical activity, especially daily gardening, in the hope of reducing the incidence of dementia in future years.

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In a recent longitudinal evaluation of nursing home admission in Australia, 44% of placements were primarily related to dementia, while dementia was a secondary diagnosis in a further 20% of people admitted.[1] Given the increased incidence of dementia with advancing age,[2] and the anticipated ageing of the Australian population over the next 20–30 years,[3] research on risk factors for dementia is a national and international priority.

Although vascular dementia may be associated with traditional cardiovascular risk factors,[4-6] most cases of dementia are the result of Alzheimer's disease.[7] Cognitive impairment in late life is inversely related to educational attainment,[8,9] and also to the presence of the ε4 allele for apolipoprotein E.[10] Lifestyle factors such as leisure activity,[11] physical activity[9,12,13] or a modest alcohol intake[9,14-16] appear to be associated with a lower risk of dementia. Intervention to increase physical activity in older people might reduce the risk or degree of cognitive impairment.[17]

The longitudinal Dubbo Study of the elderly included citizens free of cognitive impairment at baseline, with a mean entry age of about 70 years.[18,19] This report examines risk factors for dementia over 16 years of follow-up in the cohort.

METHODS

The Dubbo Study is an ongoing prospective study of a cohort of elderly people first examined in 1988–1989.[18] All non-institutionalised residents of Dubbo, NSW, born before 1930 were eligible to participate. Methods and measures have been described in detail elsewhere.[19] Briefly, the baseline examinations comprised demographic, psychosocial and standard cardiovascular risk assessments. The medical examination included anthropometry; blood pressure (mean of two readings, phase V diastolic, after 10 minutes' seated rest); resting electrocardiography; peak expiratory flow (PEF) rate (best of two attempts, measured by a Wright peak flow meter); and 12-hour fasting levels of plasma lipids, lipoproteins and glucose. A questionnaire explored measures of social support; depression status; education level; cognitive function (Short Portable Mental Status Questionnaire);[20] alcohol and tobacco use; medications; medical history; myocardial infarction and chest pain; physical activity (walking, gardening and sporting activity, coded as daily, weekly or less often); self-rated health; and physical disability. The study population was broadly representative of the Australian population born before 1930.[18]

Hospitalisation, nursing home admission and death records were monitored continuously, with postal surveys conducted every 2 years to confirm vital status. The first recorded presentation of dementia over 16 years (September 1988 – September 2004) was included in the analysis. Participants who died without a diagnosis of dementia were censored at that point. Records were coded according to the *International classification of diseases, 9th revision, clinical modification* (ICD-9-CM) and the *10th revision, Australian modification* (ICD-10-AM). The dementia coding was taken at face value from the records. Most cases were diagnosed by a geriatric assessment team with access to computed tomography scanning. The medical record coding did not reliably distinguish between Alzheimer's Disease and vascular dementia, and we have analysed dementia as a single category. All participants gave informed, written consent.

Our study was approved by institutional ethics committees at St Vincent's Hospital (Sydney), the University of New South Wales and the University of Western Sydney.

Statistical analysis

The independent contribution of any factor to the onset of dementia was examined in a Cox proportional-hazards model. Point estimates and 95% confidence intervals for the relative hazard of dementia were calculated from the regression coefficients and are presented as hazard ratios (HRs), a measure of relative risk. A large number of variables were entered in a single block and a final model was recalculated, retaining only variables of statistical significance ($P < 0.05$) and potential confounders. Statistical analysis was conducted with SPSS version 12 (SPSS Inc, Chicago, Ill, USA).

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1 Age-adjusted and sex-adjusted hazard ratios for onset of dementia over 16 years' follow-up for selected baseline variables

Variable	Hazard ratio	95% CI
Married (currently v other)	0.88	0.67–1.14
Education (years)	0.89†	0.83–0.96
Alcohol intake (any v nil)	0.66*	0.52–0.85
Smoking (current v never)	1.15	0.76–1.72
Gardening (daily v rarely [weekly or less often])	0.56*	0.44–0.71
Walking (daily v rarely [weekly or less often])	0.93	0.74–1.18
Stroke (prior v none)	1.50	0.98–2.29
Coronary heart disease (prior v none)	1.35‡	1.03–1.76
Anti-hypertensive medication (yes v no)	1.12	0.89–1.42
Diabetes (yes v no)	1.30	0.84–2.02
Peak expiratory flow		
Tertile I v III	1.98*	1.42–2.75
Tertile II v III	1.58†	1.13–2.21
Total cholesterol		
Quartile II v I	1.16	0.82–1.64
Quartile III v I	1.10	0.78–1.55
Quartile IV v I	1.39	0.98–1.97
Self-rated health (fair–poor v excellent)	1.51†	1.13–2.02
Activities of daily living		
1 impaired v nil	1.26	0.94–1.68
> 1 impaired v nil	1.68*	1.25–2.26
Depression score		
Tertile II v I	1.53†	1.11–2.11
Tertile III v I	1.77*	1.29–2.42

Note: a separate proportional hazards model, including age and sex, was calculated for each individual variable. All variables were categorical except age and years of education.
* $P < 0.001$. † $P < 0.01$. ‡ $P < 0.05$. ◆

RESULTS

Characteristics of the cohort at baseline have been presented in previous reports.[19,21] Virtually none of the 2805 members of the Dubbo cohort showed evidence of significant cognitive impairment at baseline (more than three errors on Short Portable Mental Status Questionnaire). During 16 years of follow-up (involving 32 284 person-years) there were 115 initial presentations with dementia in men (9.3/100) and 170 presentations in women (10.8/100). On average, the men developing dementia were 3.5 years older at baseline than their peers without dementia. Similarly the women with dementia were 5.7 years older than their peers.

Box 1 shows age-adjusted and sex-adjusted HRs for the prediction of dementia for individual variables of potential interest. Using this "univariate" approach there was significant prediction of reduced risk of dementia by years of education, intake of alcohol and daily gardening activity. There was significant prediction of an increased risk of dementia by prior coronary heart disease, impaired peak expiratory flow (PEF), a poor self-rated health score, physical disability and depression score. Many potential predictors (including a number of additional health and psychosocial factors not shown in Box 1) failed to reach significance.

An abbreviated summary of the final multivariate Cox model for dementia is presented in Box 2. For the total cohort, any intake of alcohol or daily gardening at baseline predicted a reduced risk of dementia (34% lower risk for alcohol and 36% lower risk for gardening). Broadly similar findings were made in models separating men and women. Daily walking also predicted a 38% lower risk of dementia in men, but with no significant prediction in women. For the total cohort, impaired PEF and higher depression score at baseline predicted an increased future risk of dementia (84% higher risk for the most impaired PEF, and 50% higher risk for those with the highest depression scores).

The final model was recalculated with graded levels of alcohol intake and gardening activity in the total cohort. Compared with those drinking no alcohol, the risk of developing dementia (HR) for those taking:

2 Proportional hazards model for dementia

	Total cohort	Men	Women
Number of cases/number at risk	*285/2805 (10.2%)*	*115/1233 (9.3%)*	*170/1572 (10.8%)*
Age	1.13 (1.10–1.15)*	1.13 (1.09–1.16)*	1.13 (1.10–1.16)*
Alcohol intake (any v nil)	0.66 (0.51–0.86)†	0.64 (0.41–1.01)	0.67 (0.48–0.93)‡
Gardening (daily v rarely [weekly or less often])	0.64 (0.50–0.83)*	0.55 (0.37–0.82)†	0.70 (0.50–0.97)§
Walking (daily v rarely [weekly or less often])	1.00 (0.78–1.28)	0.62 (0.42–0.92)‡	1.35 (0.98–1.87)
Peak expiratory flow			
Tertile I v III	1.84 (1.30–2.61)*	1.92 (1.13–3.24)‡	1.90 (1.18–3.07)†
Tertile II v III	1.48 (1.05–2.10)§	1.39 (0.82–2.36)	1.60 (1.00–2.57)
Depression score			
Tertile II v I	1.36 (0.97–1.91)	1.43 (0.86–2.38)	1.33 (0.84–2.10)
Tertile III v I	1.50 (1.07–2.10)	1.26 (0.76–2.08)	1.69 (1.06–2.69)§

Note: This is the final model which also controlled for marital status, education, prior history of stroke and activities of daily living. Hazard ratios and 95% confidence intervals are shown. * $P < 0.001$. † $P < 0.01$. ‡ $P < 0.02$. § $P < 0.05$. ◆

1–7 standard drinks per week was 0.70 (95% CI, 0.52–0.93); for 8–14 drinks per week was 0.65 (95% CI, 0.45–0.96); and for 15–28 drinks per week 0.40 (95% CI, 0.21–0.79). Only 21% of men and 3% of women had more than 14 drinks per week. Compared with those not gardening, the HR for those gardening daily was 0.60 (95% CI, 0.44–0.82), and for those gardening weekly or less often, the HR was 0.89 (95% CI, 0.64–1.24). Fifty-six per cent of men and 41% of women gardened daily.

DISCUSSION

We have confirmed that increasing age and lower educational attainment are associated with increased risk of dementia (univariate analysis only). Among other factors that are potentially amenable to intervention, a modest intake of alcohol and/or daily gardening activity seem to offer substantial protection against the onset of dementia. Impaired respiratory function is also a strong and consistent predictor of dementia. In general, the above factors predicted onset of dementia in a graded relationship and this is suggestive of a genuine causal relationship. There are no proven mechanisms available to explain these effects.

The key strength of our study rests in this being a longitudinal follow-up of a well defined cohort who were initially free of cognitive impairment, as judged by the Short Portable Mental Status Questionnaire. It may be argued that some behavioural activity at baseline might have been influenced by a subtle degree of cognitive impairment ("reverse causation" effect). This mechanism appears unlikely, as only 52 of the 285 people with dementia presented during the first 5 years of follow-up (data not shown).

There are some weaknesses in our methods. We have no information on lifestyle behaviour in participants after baseline assessment. We have relied entirely on medical record linkage without further validation, but cases of dementia were diagnosed by a thorough and consistent process. We have not identified less severe cases managed in the community, thus indicating that we have probably underestimated the true incidence of dementia. Recent research from the Rotterdam Study has highlighted how difficult it is to assess the true incidence of dementia, either during short or longer term follow-up.[22] However, a potential misclassification of cases suggests that we must be reasonably conservative in drawing conclusions.

The apparently protective effect of moderate alcohol intake is consistent with previous reports.[9,14-16] High intakes of alcohol were not observed among the Dubbo senior citizens, while other studies have shown an adverse effect on cognitive function at higher intakes.[16] Physical activity has regularly been found to be protective against the onset of dementia.[9,12,13] While the protective effect of daily gardening is very strong, it may also be appropriate to consider daily gardening in a senior citizen as a leisure or mental activity.[11]

A recent epidemiological study from Sweden reported a significantly lower risk of dementia in people found in the top quartile of cholesterol distribution.[23] This contrasts with a pilot placebo-controlled trial suggesting that cholesterol reduction with atorvastatin slowed cognitive decline in patients with mild Alzheimer's disease.[24] Our data show no association between plasma cholesterol level and risk of dementia, and this is equally true for levels of low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, plasma triglycerides or lipoprotein(a) (data not presented).

Our findings suggest some public health messages for reducing the future incidence of dementia in our ageing society. Excess alcohol intake needs to be avoided, but it would appear safe and reasonable to recommend the *continuation* of moderate alcohol intake in those already imbibing, and the maintenance of physical, leisure and mental activity, especially daily gardening.

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COMPETING INTERESTS

None identified.

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