Physical activity, alcohol and tobacco use and associated cardiovascular morbidity and mortality in the Second Australian National Blood Pressure study cohort

SIR—Globally, ~17 million people die each year of cardiovascular disease (CVD) [1]. The incidence of CVD increases with age. Hypertension is an important modifiable risk factor for CVD and is the most significant risk factor for stroke [2–6]. Hypertension prevalence increases with age such that most people aged 60 years or more have it [4, 5]. The presence of other cardiovascular risk factors increases the risk of CVD from hypertension [2]. All hypertensive aged individuals therefore require attention to their behavioural risk factors for hypertension and CVD.

Physical inactivity and smoking are modifiable risk factors for CVD [7, 8]. High alcohol consumption and a sedentary lifestyle contribute to the risk of hypertension in the elderly and thus mortality from its associated disease outcomes [9–12].

We sought to ascertain the prevalence rate at baseline and the changes over time of alcohol intake, cigarette smoking and physical activity among 6,083 Australian hypertensive elderly who participated in the Second Australian National Blood Pressure study [13]. The risk of cardiovascular events or death from any cause as a result of these lifestyle factors was also assessed.

Method

Data on lifestyle habits were collected at study entry and at annual face-to-face reviews. Because recruitment occurred over an extended period, there was variation in the length of follow-up (3–7½ years). Change in lifestyle habits was calculated by the difference in response from baseline to the last available recording. Subjects were classified into the following categories for: alcohol consumption (average daily drinks defined as containing 10 g of alcohol) — A, non-drinkers; B, <3; C, 4; D, 5–8 or occasion excess; E, 9–12 or occasion excess; F, >12; tobacco use — never, current or ex-smoker; physical activity — walking/vigorous activity (using validated items from the 1989 Australian National Heart Foundation (NHF) risk factor survey) [14, 15].

Event analysis was measured with each of the lifestyle habits considered among these subjects, and the associated risk of event was reported. Lifestyle factors at baseline and last visit were compared using chi-square test and 95% Confidence Interval (CI) [16]. The Kaplan–Meier method was used to estimate CVD free survival.

Cox's proportional hazards regression was used to compare the CVD free survival between different levels of the lifestyles factors. Robust standard errors were used to take account of clustering within doctors [17–20]. Furthermore, Cox regression analyses were performed to determine the effects of the lifestyle factors after adjusting for the following a priori confounders: sex, age, diabetes, history of coronary heart disease (CHD), history of cerebrovascular disease, systolic and diastolic BP at randomisation, raised cholesterol and randomised treatment, as well as the other lifestyle factors. The effect of alcohol on other risk factors at baseline was examined using chi-square tests.

Results

Table 1 shows subject baseline characteristics.

Alcohol consumption

The prevalence at baseline of ‘binge’ drinking was 24% of those aged 65–69, decreasing to 10% in those aged 85+. Significant factors associated with alcohol consumption at baseline were male sex, younger age, diabetes, smoking (all \( P < 0.0001 \)), raised cholesterol \(( P = 0.02)\) and physical inactivity \(( P = 0.01)\). There was no significant relationship between alcohol consumption at baseline and coronary heart disease, CVD, systolic or diastolic BP. Category B drinking tended to increase over time \(( P < 0.0001)\), whereas categories C–F drinking tended to decrease \(( P < 0.0001)\). Alcohol status had no effect on CVD free survival and this remained after adjustment for a priori confounders. Analysis of alcohol intake and risk of cardiovascular events or deaths has shown category D–F drinkers to be at a greater risk HR = 1.53 (95% CI 1.17–2.00), whereas category B drinkers had a similar risk to non-drinkers. After adjusting for a priori confounders, heavy and binge drinkers were not at a significantly higher risk.

Smoking

The percentage of subjects smoking at baseline was 7.1% and at last visit was 5.6% (95% CI 0.13–2.07 \( P = 0.001\)). Current smokers were 1.75 (95% CI 1.40–2.20) times and ex-smokers were 1.38 (95% CI 1.21–1.58) times more likely to have a cardiovascular event or death from any cause than non-smokers (Figure 1). Smokers (but not ex-smokers) were still at a significantly higher risk HR = 1.68 (95% CI 1.33–2.12) after adjusting for a priori confounders.
Physical activity
Seventy-seven percent of the cohort was involved in vigorous activity or walking at study entry. There was no significant change in the proportion of exercising elderly over the duration of the study (95% CI 1.99–1.55, P = 0.60). Risk assessment showed physically active subjects to be 0.75 (95% CI 0.65–0.86) times less likely to have a cardiovascular event or die than inactive subjects (Figure 1) even after adjustment for a priori confounders.

Discussion
Alcohol problems in the older population are generally accepted to be lower than in younger people with estimates in community-based studies of about 2–6% [21–25]. The 4.3% prevalence rate of heavy alcohol intake in this study is comparable to other studies in the community setting. The lower prevalence in the elderly alcohol-related problems can be serious because alcohol-related health problems may be present at lower levels of alcohol consumption [25]. Alcohol problems may go unrecognised by primary health care workers or families because of their non-specific symptoms or masking by other illnesses or physical decline [21]. Our results showing that heavy alcohol drinking decreases with age, and that male gender and smoking, previously been associated with alcohol misuse, have also been shown to decrease in other studies [22–29].

Our finding that there was no difference in cardiovascular deaths after adjusting for a priori confounders between category A and B drinkers differs from other research. Al-
Alcohol abstention in the hypertensive and the elderly has previously been found to be associated with an increased mortality rate largely due to a higher risk of CVD [9, 10, 28]. The Dubbo Study showed that there is an association with longer survival between moderate alcohol intake in males aged between 60 and 74 years and all elderly women compared with non-drinkers [28].

Heavy drinkers and binge drinkers were not at increased risk of cardiovascular event or death after adjustment for a priori confounders. Palmer et al. observed that hypertensive male drinkers had a reduced risk of stroke mortality and the possibility of CHD mortality compared to non-drinkers [11]. Similar results were seen for women for stroke mortality but not for CHD mortality. The risk for dying of any cause in males and females was similar in drinkers and non-drinkers. The lowest risk of death from CHD was seen in those who consumed >21 units per week, but these men had a twofold higher risk of death from non-circulatory causes. Alcohol

**Figure 1.** Survival analysis by behaviour.
consumption of 1–10 units per week was associated with the lowest mortality in men [22]. A study by Klatsky et al. showed that heavier drinkers over 60 years of age had lower levels of alcohol-associated mortality risk than younger persons [10]. The Hisayama Study in Japan showed a synergistic effect between heavy alcohol consumption, hypertension and cerebral haemorrhage [29]. Moore et al. found at risk drinking (≥12 drinks a week or ≥4 drinks in a day) was associated with greater mortality rates in men HR = 1.20 (95% CI 1.01–1.41) [30]. Our small sample of heavy drinkers may explain the observed non-significant result.

Smoking
Previously reported prevalence rates of smoking are higher than the results reported here, especially among the men. An Australian study of smoking in participants aged 60 years or over reported the prevalence rate to be 20% in men and 11% in women [31]. The finding that current smoking and hypertension increase risk of all cause mortality in the elderly is well supported [31]. Most cardiovascular risk factors increase with age except cigarette smoking [32]. The latter is likely to be due to survival disadvantage of smokers and smoking cessation.

Physical activity
The prevalence of physical activity at baseline of this cohort was 77%. The high prevalence of physical activity in this cohort may be the result of volunteer bias and therefore can only serve as a rough guide to actual physical activity. Despite this, we were able to show significant inverse associations with reported activity and CVD or death.

Study limitations
Because of the long recruitment period, there are varying lengths of follow-up. Six thousand eighty-one out of 6,083 subjects had baseline data collected, but only 23% of participants had a 4-year post-randomisation visit at study close. Some of the missing data might have occurred randomly due to logistic issues for annual visit follow-up, but it could also be due to the health of the subjects. There is some evidence in the analysis that smoking and alcohol may not be missing completely at random and hence our results, especially the GEE analysis, may be biased.

Conclusion
This study revealed the prevalence of unhealthy lifestyle factors to be still prevalent among the hypertensive elderly attending Australian general practice. The significant increase in relative risk of CVD or death from any cause in these patients as a result of these lifestyle factors corroborated previous reports. Accordingly, minimising these risk factors is a beneficial approach to reducing BP non-pharmacologically and CVD events.

Key points
- Adverse lifestyle factors (especially physical inactivity) are prevalent in the hypertensive elderly.
- There was a significant increase in relative risk of CVD or death from any cause in these patients who continued to smoke or were physically inactive.
- Physicians need to identify and address such risk factors.

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Conflicts of interest
None.

Contributors
M.N. conceived the paper. A.A., M.N., K.W. and J.G. wrote the paper with revision and critical input from P.R. and C.R. M.N. is the guarantor.

References
Improving metamemory in ageing and Parkinson's disease

SIR—Older adults and patients with Parkinson's disease (PD) have significant but subtle deficits in memory and metamemory [1]. Metamemory refers to people's knowledge, awareness and control of their memory [2]. A common method for measuring people's knowledge of their memory abilities ('monitoring') is to ask individuals to predict how well they will remember items during an upcoming memory test. One such prediction method is the Feeling-of-Knowing (FOK), which consists in asking participants to predict the likelihood that they will subsequently recognise information they have failed to recall [3].

Coutler [4] and Ivory et al. [5] assessed the accuracy of FOK judgments on previously learnt material (semantic memory) indicating that FOK judgments remained accurate in PD. However, Souchay et al. [1], in a pioneering study assessing FOK on newly learnt information (episodic memory), revealed a deficit in PD. Patients were presented with cue-target noun pairs to learn and were asked to retrieve the target when presented with the cue at recall. FOK predictions were made on non-recalled targets. Results showed that PD patients were inaccurate at predicting their ability to retrieve forgotten targets.

These studies suggest a dissociation between impaired episodic FOK and preserved semantic FOK in PD, paralleling findings observed in ageing and in patients with frontal lobe lesions [6]. As a result, episodic FOK inaccuracy in PD was interpreted as resulting from dysfunction of the frontal lobes, highly involved in metamemory [6].