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Original Contribution

20/20—Alcohol and Age-related Macular Degeneration

The Melbourne Collaborative Cohort Study

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Little evidence exists regarding associations between age-related macular degeneration (AMD) and moderate alcohol consumption, patterns of consumption, or different types of alcoholic beverage. The authors examined associations between AMD prevalence and alcohol intake using 20,963 participants from the Melbourne Collaborative Cohort Study aged 40–69 years at baseline (1990–1994). Participants' alcohol consumption was determined from a structured interview at baseline. At follow-up from 2003 to 2007, digital macula photographs of both eyes were taken and evaluated for early and late AMD signs. Drinking more than 20 g of alcohol per day was associated with an approximate 20% increase in the odds of early AMD (odds ratio = 1.21, 95% confidence interval: 1.06, 1.38; $P = 0.004$) when compared with those who reported no alcohol intake at baseline, having adjusted for sex, age, smoking, country of birth, education, physical activity, and energy from food. This positive association was apparent for wine, beer, and spirits. The estimates were similar for both sexes. The odds ratio for those drinking more than 20 g of alcohol per day for late AMD was 1.44 (95% confidence interval: 0.85, 2.45; $P = 0.17$). These results show a modest association between alcohol consumption and increased AMD risk.

aging; alcohol drinking; macular degeneration

Abbreviations: AMD, age-related macular degeneration; MCCS, Melbourne Collaborative Cohort Study.

The per-capita consumption of alcohol in Australia is high by world standards; 83% of the population reported drinking in a survey from 2004 (1). Alcohol has been hypothesized to have both positive and negative effects on the development of age-related macular degeneration (AMD), the most important cause of irreversible visual loss in elderly populations of the developed world (2). AMD is considered a complex genetic disease whereby environmental factors interact with a genetic predisposition to the disease (3). Smoking is the most established modifiable risk factor for developing AMD, although other factors such as abdominal obesity (4) and diet (5, 6) have been implicated. Most studies have examined the risks from heavy alcohol consumption (7–9). A meta-analysis indicated that long-term heavy alcohol consumption, an average of more than 30 g a day, was associated with an increased risk of early AMD by 47%–67% in Western populations (10). Additionally, some evidence has suggested that not only the quantity but also the type of alcohol may be important; beer consumption has been reported to increase risk (11, 12), whereas a lower risk has been associated with wine consumption (9, 12, 13). There is currently little evidence regarding the associations between moderate alcohol consumption or different alcoholic beverages and AMD and for the influence of patterns of weekly consumption.

In Australia, the National Health and Medical Research Council guidelines recommend consuming no more than 20 g of alcohol per day (equivalent to 2 Australian standard drinks) (14, 15). Using data from the Melbourne Collaborative Cohort Study, we have determined the association

between alcohol use (quantity, type of alcohol, and pattern of consumption) and the prevalence of AMD. This large Australian cohort has recorded extensive data on lifestyle factors including diet and obesity, as well as detailed information on drinking habits.

MATERIALS AND METHODS

Study population

The Melbourne Collaborative Cohort Study (MCCS) is a volunteer-based prospective cohort study of 41,514 people of white European descent (16). Almost all (99.3%) participants were aged 40–69 years at baseline (1990–1994), with approximately equal proportions of participants across the 3 age decades. Follow-up of this cohort occurred during 2003–2007 when participants were aged 48–86 years. The MCCS was approved by the human research and ethics committees of the Cancer Council Victoria and Royal Victorian Eye and Ear Hospital, Australia.

Baseline assessment of alcohol consumption, smoking, and diet

Participants underwent a structured face-to-face interview where they were asked if they had ever drunk at least 12 alcoholic drinks in a year in their lifetime. Those who answered "no" were considered lifetime abstainers. Participants who answered "yes" were asked about their current average quantity (number of glasses of wine, cans or bottles of beer, nips of spirit) and frequency of alcohol intake. These are henceforth referred to as the "beverage-specific frequency-quantity questions." A can or bottle of regular beer constituted 15 g of alcohol, a glass of wine constituted 15 g of alcohol, and a nip (30 mL) of spirit constituted 10 g of alcohol (Australian food composition tables) (17). The total alcohol intake in grams per day from wine, beer, and spirits was then computed from this information. Participants who were not lifetime abstainers but did not consume alcohol at baseline were classified as former drinkers.

In addition, participants were asked about the intake of alcoholic beverages on each day during the week before the interview (this method will be referred to as the "diary"). All analyses except those for pattern of consumption are based on the beverage-specific frequency-quantity questions. Analyses of pattern of consumption are based upon the diary because the frequency-quantity questions did not ask about the frequency of consumption of all alcoholic beverages combined; that is, for example, if twice weekly wine consumption occurred on the same days as twice weekly beer consumption.

Comprehensive questionnaires regarding lifestyle, dietary intakes, and health conditions were completed at baseline. Participants were classified according to their smoking habits as never smokers, former smokers, and current smokers.

Food intake in the year before baseline was estimated by using a 121-item food frequency questionnaire specifically developed for the MCCS (18). The energy derived from food was calculated by using standard sex-specific portion sizes from Australian food composition tables (17).

AMD detection

Detection of age-related macular degeneration and other fundus pathology was conducted at follow-up by using digital photographs centered on the macula and optic disc, as described previously (19, 20). Grading and quality-control procedures of the photographs have been described in detail elsewhere (19). Early AMD was defined as the presence of from 63- to 125-μm drusen with the presence of hyper/hypopigmentation or ≥125-μm drusen, with or without the presence of hyper/hypopigmentation (21). Late AMD was defined as evidence of choroidal neovascularization, geographic atrophy (≥175 μm of hypopigmentation with visible choroidal vessels), or a disciform scar (21). The fundoscopic photos were interpreted blindly with respect to baseline traits.

Statistical analysis

Total alcohol intake was categorized into lifetime abstainers, former drinkers, current drinkers consuming 1–19 g/day, and current drinkers consuming 20 or more g/day. An additional variable consisting of the categories—lifetime abstainers, former drinkers, those consuming 1–19 g/day, 20–39 g/day, 40–59 g/day, and ≥60 g per day—was used to explore higher intakes of alcohol consumption.

Former drinkers may have changed their dietary habits and lifestyle (22). Therefore, they were included in the analysis as a distinct group (separate from lifetime abstainers). Wine, spirit, and beer consumptions were categorized similarly to total alcohol. Associations for each beverage were evaluated by including consumption of wine, beer, and spirits in separate models as they were highly collinear. The reference group in each analysis consisted of lifetime abstainers.

The total alcohol intake during the week before interview was highly correlated with the average daily intake from the frequency-quantity questions (Spearman's correlation coefficient = 0.87). Additionally, the pattern of consumption (number of days/week) was also highly correlated with the quantity of alcohol consumption (Spearman's correlation coefficient = 0.83), where those with higher intakes were also more likely to drink more frequently. Therefore, to examine weekly patterns of consumption, the participants were stratified into quantities of consumption of 1–139 g, 140–279 g, and ≥280 g/week, and the odds for those drinking on 1–3 days or 4–6 days a week were compared with those drinking every day within each stratum. Participants with no intake of alcohol during the week before baseline were excluded from the analysis of pattern of consumption.

Chi-squared, *t* tests, and multivariable logistic regression were used to compare baseline demographics and other factors associated with inclusion or exclusion from the analysis.

Multivariable logistic regression was also used to calculate odds ratios for alcohol consumption at baseline, with

the presence or absence of AMD at follow-up as the outcome. A directed acyclic graph was used to select variables to include in the models (23, 24). Under the assumptions made in this graph, to estimate the effect of alcohol intake on AMD, the following variables need to be included in the logistic regression model: age, sex, country of birth, physical activity, smoking status, and dietary energy intake. Although the waist/hip ratio is associated with AMD in this cohort (19), it was not included in the regression model as we consider it to be on the causal pathway between alcohol and AMD. Smoking was grouped into the categories current, past, or never, and country of birth was grouped into the countries Australia/United Kingdom, Italy, and Greece. Four ordered categories combining frequency and intensity were used to group physical activity.

Effect modification by sex, smoking, and country of birth was assessed by fitting interaction terms between each of these variables and alcohol intake, and it was tested by using the likelihood ratio test. Linear associations between alcohol intake and the odds of AMD were investigated by comparing regression models with alcohol intake as a categorical variable and a pseudo-continuous variable by using the likelihood ratio test. All statistical analyses were performed by using Stata, version 10, statistical software (StataCorp LP, College Station, Texas).

Study size

Participation at the MCCS follow-up (2003–2007) was 67.2% (Figure 1). A total of 13,612 participants did not participate in follow-up due to death, illness, refusal, leaving Victoria or Australia, or unknown reasons. A further 5,483 were unable to be photographed because of the lack of photographic facilities at some of the clinics. Ophthalmic data from 1,119 participants were excluded from the analysis because the photographs were not able to be graded (Figure 1). The mean time between baseline when dietary and alcohol data were collected and the time of eye photography was 11.5 years (standard deviation, 1.4 years; range, 8.6–16.4). Participants were excluded if they reported extreme energy intakes ($n = 324$), that is, less than the 1st percentile and more than the 99th percentile of the

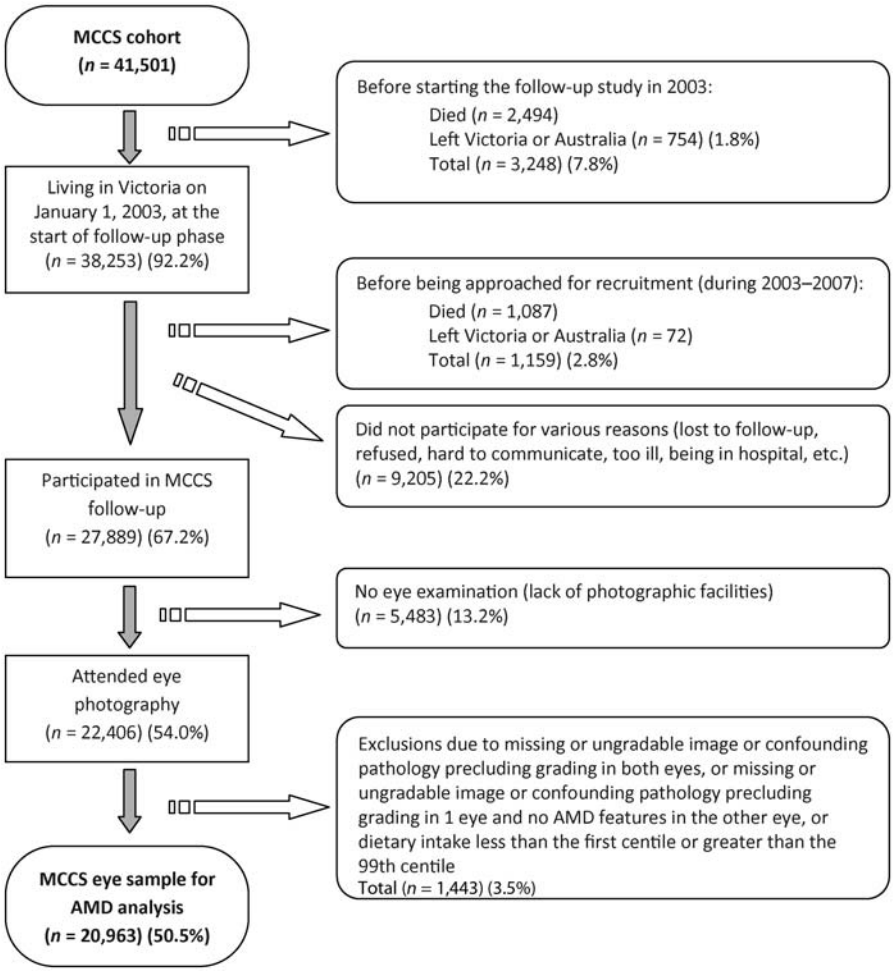

Figure 1. Flow chart of participants in the Melbourne Collaborative Cohort Study (MCCS), Australia, 1990–2007. AMD, age-related macular degeneration.

Table 1. Baseline Demographics, Melbourne Collaborative Cohort Study, Australia, 1990–2007

	Participants ($n = 20,963$)			Nonparticipants ($n = 20,538$)			*P* Value[a]
	No.	%	Mean (SD)	No.	%	Mean (SD)	
Age at baseline, years			54 (9)			57 (9)	<0.001
Age at follow-up, years			65 (9)				
Female	12,627	60		11,836	58		<0.001
Current smoker	1,764	8		2,920	14		<0.001
Past smoker	6,515	31		6,480	32		<0.001
High school education or above	11,039	53		6,562	32		<0.001
Country of birth							
Australia/United Kingdom	18,297	87		13,270	65		<0.001
Italy	1,779	8		3,630	18		<0.001
Greece	887	4		3,638	18		<0.001
Waist/hip ratio							
Men			0.92 (0.06)			0.93 (0.06)	<0.001
Women			0.77 (0.07)			0.8 (0.07)	<0.001
Does not exercise	4,031	19		5,190	25		<0.001
Alcohol use							
Lifetime abstainers	5,067	24		6,898	34		
Former drinkers	712	3		967	5		
Current drinkers	15,500	73		12,634	62		<0.001
Alcohol intake, g/day							
1–19	10,729	50		8,448	41		
≥ 20	4,779	22		4,225	20		<0.001

Abbreviation: SD, standard deviation.
[a] *P* value from the chi square or *t* test.

total MCCS cohort of 41,501. The total number of participants included in the final analysis was 20,963.

RESULTS

Baseline demographics and drinking habits of participants

Table 1 provides baseline demographics for participants included in the analysis and those not included for any reason. Those not included in the study were older, less educated, and more likely to have been born in Italy or Greece; additionally, those not included were more likely to have been current or previous smokers. They were also more likely to be lifetime abstainers and less likely to have been classified as current drinkers. However, when age was adjusted for, current drinking status was no longer associated with inclusion in the study (odds ratio = 0.94, 95% confidence interval: 0.84, 1.12; $P = 0.7$). The proportion of lifetime abstainers varied from 14% in those aged less than 55 years to 31% in those aged above 75 years.

Of the 20,963 eligible participants (52% of the original cohort), 8,336 (39.8%) were male, and 12,627 (60.2%) were female.

Compared with 11% of the men, 31% of the women were classified as lifetime abstainers. Half of all participants drank between 1 and 19 g/day; only 7.7% drank more than 40 g/day (Table 2). In both sexes, current drinking was of greater prevalence in the younger age groups (Figure 2). Wine was the most popular alcoholic beverage, with more than half of the cohort drinking wine (Table 3). Alcohol consumption and smoking were closely related: 81% of lifetime abstainers had never smoked, in contrast to 40% of those who consumed more than 20 g/day (chi-squared $P < 0.001$). Those who had never smoked were also more likely to be lifetime abstainers from alcohol, most markedly women (Appendix Table 1).

There were 2,663 cases of early AMD and 121 cases of late AMD; the prevalence was not materially different between the sexes (data not shown) (19).

Daily alcohol intake and AMD

Drinking more than 20 g of alcohol per day, equivalent to 2 Australian standard drinks, was associated with an approximate 20% increase in the odds of early AMD when compared with lifetime abstention, having adjusted for age, sex, smoking status, energy intake from food, physical activity, and country of birth (Table 4). Drinking less than 20 g/day was not associated with early AMD nor was being categorized as a former drinker (Table 4). The association between alcohol consumption of ≥20 g/day and late

Table 2. Prevalence of Consumption of Alcohol in the 20,963 Participants From the Melbourne Collaborative Cohort Study, Australia, 1990–2007

Alcohol, g/day	No. of Participants	%
Lifetime abstainers	4,970	23.7
Former drinkers	696	3.4
Current drinkers		
1–19	10,597	50.6
20–39	3,085	14.7
40–59	1,016	4.9
≥60	599	2.9

Table 3. Prevalence of Consumption of Alcohol Type in the 20,963 Participants From the Melbourne Collaborative Cohort Study, Australia, 1990–2007

	Wine		Beer		Spirits	
	No.	%	No.	%	No.	%
Male	5,867	70	5,849	70	3,348	40
Female	7,707	61	2,666	21	4,196	33
Total	13,574	65	8,515	41	7,544	36

AMD was of a similar magnitude as that for early AMD, although not statistically significant.

Odds ratios for categories of higher consumption of alcohol were of similar magnitude (Table 5).

Despite differences in alcohol consumption in terms of quantity and type between males and females, sex was not observed to modify the association between alcohol and AMD (likelihood ratio test, $P = 0.6$), and the estimates were similar for each sex. Age group and country of birth were also not found to modify associations for early or late AMD (data not shown). Comparing estimates of the alcohol and early AMD associations for never smokers and those with a previous or current smoking history suggested that the associations differed, where an association was not apparent for those with no smoking history (Table 4); however, there was only weak statistical evidence of effect modification (likelihood ratio test, $P = 0.07$). The 696 former drinkers were not found to have increased odds of AMD.

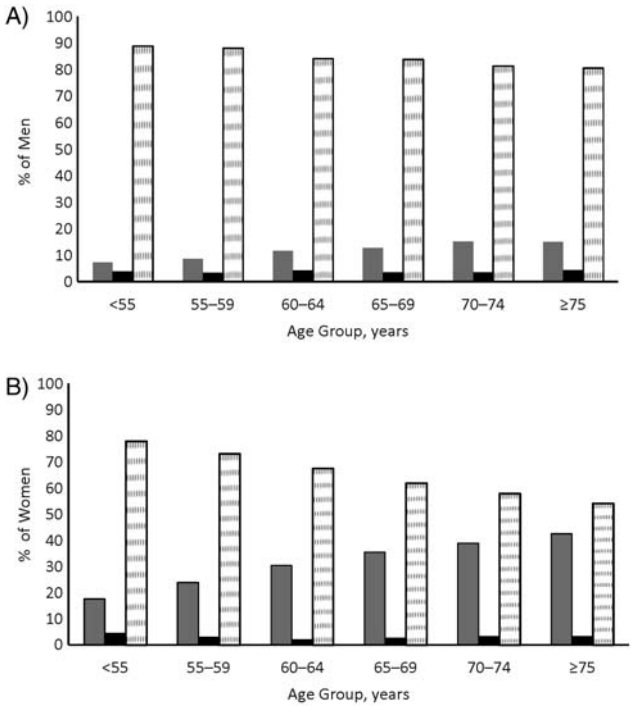

Figure 2. Age groups and drinking status, by percentage, for the 20,963 participants in the Melbourne Collaborative Cohort Study, Australia, 1990–2007. A, men; B, women. Striped bars, current drinkers; gray bars, lifetime abstainers; black bars, former drinkers.

Alcohol type and AMD

Consuming more than 20 g of wine per day was associated with a 24% increase in the odds of early AMD when compared with those consuming no wine (Table 6). Beer consumption was generally positively associated with early AMD, although it was not statistically significant. Daily consumption of 1–19 g of spirits had a weak positive association with early AMD; the odds ratio for greater than 20 g was less than 1.0, although the confidence intervals were wide and consistent with no association (Table 6).

Drinking pattern

In the week before baseline, 2,209 (26.5%) men and 5,883 (46.6%) women did not drink alcoholic beverages and, thus, were excluded from the analysis of pattern of consumption.

Within the categories of 1–139 g, 140–279 g, and ≥280 g/week, no significant change in the odds of early AMD was observed for those concentrating their drinking into 1–3 or 4–6 days compared with those drinking every day (Appendix Table 2).

DISCUSSION

Consuming more than 20 g of alcohol per day, the current Australian recommendations for maximum daily intake, was associated with an increase in the odds of early AMD of approximately 20% for both women and men. The odds for late AMD were also increased in those drinking more than 20 g/day. A similar relation was observed between different alcohol types and AMD. Unlike the protective associations of drinking reported for cardiovascular disease (14, 15), no protective effect was observed for AMD for low levels of intake or for drinking wine. There was no evidence that those who concentrated their consumption into fewer days had higher odds of early AMD than those who drank every day.

Table 4. Alcohol Consumption and Early Age-related Macular Degeneration, Stratified by Smoking, Melbourne Collaborative Cohort Study, Australia, 1990–2007[a]

Average Daily Intake[b]	Overall			Never Smokers			Former Smokers			Current Smokers			*P* Value[c]
	OR	95% CI	*P* Value	OR	95% CI	*P* Value	OR	95% CI	*P* Value	OR	95% CI	*P* Value	
Lifetime abstainers	1.00	Referent		1.00	Referent		1.00	Referent		1.00	Referent		
Former drinkers	1.00	0.79, 1.28		0.91	0.64, 1.30		1.35	0.89, 2.05		1.12	0.50, 2.50		
Current drinkers, g/day													
1–19	1.00	0.90, 1.12		0.98	0.86, 1.10		1.23	0.94, 1.61		1.18	0.76, 1.83		
≥20	1.21	1.06, 1.38	0.004	1.06	0.89, 1.27	0.7	1.65	1.25, 2.18	0.0003	1.25	0.78, 1.98	0.8	0.07

Abbreviations: CI, confidence interval; OR, odds ratio.

[a] *P* value from likelihood ratio test comparing multivariable logistic regression models with and without alcohol consumption. Both models adjusted for age, sex, country of birth, physical activity, and energy from food.

[b] Average daily intake estimated from beverage-specific questions about average quantity and frequency of consumption.

[c] *P* value from likelihood ratio test for effect modification from smoking.

Table 5. Higher Levels of Alcohol Consumption and Early Age-related Macular Degeneration, Melbourne Collaborative Cohort Study, Australia, 1990–2007[a]

Average Daily Intake[b]	OR	95% CI	*P* Value
Lifetime abstainers	1.00	Referent	
Former drinkers	1.00	0.78, 1.28	
Current drinkers, g/day			
1–19	1.00	0.90, 1.12	
20–39	1.24	1.08, 1.43	
40–59	1.10	0.89, 1.36	
≥60	1.26	0.98, 1.62	0.01

Abbreviations: CI, confidence interval; OR, odds ratio.

[a] *P* value from likelihood ratio test comparing multivariable logistic regression models with and without alcohol consumption. Both models adjusted for age, sex, country of birth, physical activity, and energy from food.

[b] Average daily intake estimated from beverage-specific questions about average quantity and frequency of consumption.

Most previous studies have reported an increased risk of late AMD associated with heavy drinking (>40 g daily) and positive associations of borderline significance between drinking and early AMD (8, 9, 25–28). Our results suggest that it is not only high levels of consumption that are deleterious to eye health; levels considered to be "social" or "moderate" increased the risk of early AMD. Although no universally accepted definition of "heavy drinking" exists, there is general agreement that it constitutes more than 3 drinks per day (10). "Moderate drinking" remains more loosely defined (29); definitions range from less than 15 g/day (30) to a daily intake of 40 g/day (31). The public's perception of moderate drinking is not uniform; what one person considers to be moderate, another might view as heavy drinking (32), with important implications for their interpretation of public health messages. An Australian national survey in 2005 indicated that 35.6% of men and 13% of women perceived that they could consume 3–4 standard drinks per day (30–40 g/day) before putting their long-term health at risk (1). Although older people tend to consume less alcohol during any one session than younger people, they are more likely to drink every day (1).

Previous studies reporting significant associations between alcohol consumption and early AMD simply compared those consuming more than 1 alcoholic drink per month with abstainers (7, 9). Moreover, a systematic misclassification error was committed by all except 1 study (33) by including as "abstainers" many people who had reduced or stopped drinking, a phenomenon associated with aging, ill health, and increased medication use (29). If these people are included in the abstainer category, then it might not be the absence of alcohol that elevates their risk for AMD but, rather, their compromised health (22, 29). In this study, however, former drinkers were not at higher risk of AMD.

The small proportion of heavy drinkers, especially among women, causes our results to be inapplicable to people with high levels of consumption. This may

Table 6. Alcohol Type Consumed and Early Age-related Macular Degeneration, Melbourne Collaborative Cohort Study, Australia, 1990–2007[a]

Alcohol Type[b]	OR	95% CI	*P* Value
Wine			
Lifetime abstainers	1.00	Referent	
Former drinkers	1	0.78, 1.28	
Current drinkers, g/day			
1–19	1.02	0.92, 1.14	
≥ 20	1.26	1.09, 1.46	0.008
Beer			
Lifetime abstainers	1.00	Referent	
Former drinkers	1.01	0.79, 1.29	
Current drinkers, g/day			
1–19	1.05	0.93, 1.19	
≥ 20	1.19	0.96, 1.48	0.5
Spirits			
Lifetime abstainers	1.00	Referent	
Former drinkers	1.02	0.8, 1.3	
Current drinkers, g/day			
1–19	1.13	1, 1.27	
≥ 20	0.72	0.36, 1.45	0.1

Abbreviations: CI, confidence interval; OR, odds ratio.

[a] *P* value from likelihood ratio test comparing multivariable logistic regression models with and without alcohol consumption. Both models adjusted for age, sex, country of birth, physical activity, and energy from food.

[b] Average daily intake at baseline of alcohol from each beverage type.

contribute to the absence of a dose-response curve with higher levels of intake. Additionally, it is logical that there would be an increasing survivorship effect with higher intakes of alcohol; those remaining in the study despite high levels of intake may be less susceptible to the adverse effects of alcohol, which would attenuate the estimates for higher intakes. The survivorship effect for AMD due to loss to follow-up is greater for AMD than for cancer and mortality. In the MCCS, data linkage exists with cancer and death registries. Therefore, outcomes are observed for all participants. AMD was determined at 9–11 years from baseline, and the AMD status of those who died or did not return to follow-up could not be determined. AMD is, of course, not a disease in isolation. In the MCCS cohort, a J-shaped mortality rate versus alcohol consumption curve was observed for both sexes, where light-moderate drinkers had a lower mortality than did lifetime abstainers. Only at high levels of consumption was there evidence of higher mortality (34), above 60 g/day for men and 45 g/day for women, excluding former drinkers. Such a relation has been described elsewhere (35–37); a comprehensive meta-analysis of 84 studies confirmed this (38). In higher intake groups, the positive association with AMD would be attenuated by the survivorship effect from competing risks resulting in excess mortality. A meta-analysis on alcohol consumption and the risk of 14 major alcohol-related neoplasms and nonneoplastic diseases, plus injuries, reported that the J-shaped relations were observed only for coronary heart disease with no evidence of a threshold effect for both neoplasms and several nonneoplastic diseases (39). We did not find a J-shaped curve of association with AMD either. In the MCCS mortality study, wine drinkers had a lower risk of dying; beer drinking was associated with increased mortality for males but not females, and no significant associations were observed with the consumption of spirits (34). We found wine to be the type of alcohol most strongly associated with AMD; this partly reflects the popularity of wine as a beverage, with a higher proportion reporting wine than any other type. Possibly, the stronger association between wine and AMD may to some degree arise from the protective relation of wine with mortality; individuals that drank wine were more likely to live long enough to develop AMD. As 60% of the sample was female, the results from pooling of the estimates of each sex are heavily weighted to the women. The association between alcohol intake and AMD varying by smoking status may reflect that of those women who had never smoked; very few drank more than 20 g/day (8.7%) (Appendix Table 1). Therefore, it appears that never-smokers are not at risk. In male never-smokers, the odds ratio was 1.26 (95% confidence interval: 0.92, 1.72), similar to the overall odds ratio.

Although we still do not fully understand the pathophysiology of AMD, some of the current theories on etiology could implicate alcohol in their mechanisms of action. Alcohol is a known neurotoxin that can cause oxidative brain damage and, hence, it is logical that the retina could be similarly affected (40, 41). One hypothesis of AMD etiology is that photo-oxidative damage to the retina is important. Thus, alcohol has been shown to increase oxidative stress or modify the mechanisms that protect against such oxidative stresses (41, 42). Alcohol has also been linked to enhanced angiogenesis or exacerbation of choroidal neovascularization in alcohol- versus water-fed rats (43).

Strengths of our study include its size and prospective design, where details of alcohol consumption were obtained by well-trained interviewers before the diagnosis of AMD, and the reliability and validity of the classification of AMD status. Lifetime abstainers of alcohol were differentiated from former drinkers, allowing us to explore if there was any difference between categorizing them together as nondrinkers or separately as another group. There are some limitations to our study. The primary limitation is the substantial loss to follow-up (49%), particularly the differential loss according to smoking; this partly reflects the natural attrition to competing risks of ill health and death to be expected in this age range. Those not included in the follow-up study did not appear to be more likely to drink alcohol than the participants who returned (Table 1). Common to most studies evaluating alcohol and AMD, participants with higher alcohol intakes may underreport their consumption; this has been reported as a greater problem in the elderly (44). Such differential misclassification would have most likely resulted in an underestimation of the point estimates, although an overestimation of the point estimate cannot be excluded.

Unmeasured changes in drinking habits in the period leading up to the follow-up assessment may be important if exposure exerts a rapid effect on AMD development. Patterns of alcohol intake may be associated with other behaviors not taken into account in this analysis, which could be confounding the observed association. AMD status was determined at a single visit during follow-up. Thus, no comment can be made about disease incidence or progression. Although AMD status at baseline was unknown, approximation by extrapolation of prevalence by age to the cohort at baseline indicates that the percentage with AMD would be low (early AMD, 8.8%; late AMD, 0.07%) (19). The study population was limited to the age range of 48–86 years at the time of the retinal photography, with only 718 aged above 80—a group that included 21% of the cases of late AMD. Furthermore, although there are many cases of early AMD, there are relatively few late AMD cases, and any inference from associations must be cautious.

These results suggest a modest association between alcohol intake and increased AMD risk and, thus, provide additional support for guidelines that advise moderation of consumption.

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(Appendix follows)

Appendix Table 1. Alcohol Consumption Categories, by Smoking Status, Melbourne Collaborative Cohort Study, Australia, 1990–2007

	Total, no.	Lifetime Abstainers		Former Drinkers		Current Drinkers, g/day			
						1–19		≥ 20	
		No.	%	No.	%	No.	%	No.	%
Women									
Never smoked	8,670	3,338	38.5	209	2.4	4,367	50.4	756	8.7
Formerly smoked	3,050	454	14.9	135	4.4	1,769	58	692	22.7
Currently smoke	907	188	20.7	37	4.1	473	52.2	209	23.0
Total	12,627	3,980	31.5	381	3.0	6,609	52.3	1,657	13.1
Men									
Never smoked	4,013	694	17.3	117	2.92	2,096	52.2	1,106	27.6
Formerly smoked	3,465	210	6.1	162	4.68	1,532	44.2	1,561	45.1
Currently smoke	857	86	10.0	36	4.2	360	42	375	43.8
Total	8,335	990	11.9	315	3.78	3,988	47.9	3,042	36.5

Appendix Table 2. Patterns of Alcohol Consumption and Early Age-related Macular Degeneration, Melbourne Collaborative Cohort Study, Australia, 1990–2007[a]

Alcohol Consumption and No. of Drinking Days[b]	Total, no.	OR	95% CI	*P* Value
1–139 g/week	8,909	1.00	Referent	
7				
4–6		0.98	0.78, 1.23	0.8
1–3		0.96	0.78, 1.16	0.7
140–279 g/week	2,661	1.00	Referent	
7				
4–6		0.91	0.71, 1.15	0.4
1–3		0.75	0.48, 1.17	0.2
≥280 g/week	1,301	1.00	Referent	
7				
4–6		1.32	0.92, 1.87	0.1
1–3		1.23	0.41, 3.70	0.7

Abbreviations: CI, confidence interval; OR, odds ratio.

[a] *P* value from logistic regression adjusting for the effects of age, sex, country of birth, physical activity, and energy from food.

[b] Total alcohol intake and number of drinking days during the week before interview were calculated from the diary.