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Light to Moderate Alcohol Consumption and Mortality in the Elderly

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Objective: To determine whether there is a relationship of low to moderate alcohol consumption with cardiovascular mortality in the elderly.

Design: Prospective cohort studies with 5-year mortality follow-up.

Setting: Three populations of community-dwelling elders.

Participants: Population-based cohorts of men and women, aged 65 or older, in three populations. Subjects with prior myocardial infarction, stroke, or cancer, as well as those lacking alcohol consumption data, were excluded from statistical analyses leaving 2,694 subjects in East Boston, Massachusetts, 2,293 subjects in Iowa, and 1,904 subjects in New Haven, Connecticut.

Main Outcome Measurements: Alcohol consumption, total mortality, cardiovascular mortality, and cancer mortality.

Results: Low to moderate alcohol consumption was associated with statistically significant lowered total as well as cardiovascular mortality in East Boston and New Haven. The relative risks of total mortality for low to moderate consumers of alcohol compared to those consuming no alcohol in the previous year were 0.7 (95% CI 0.6–0.8) in East Boston and 0.6 (95% CI 0.5–0.8) in New Haven. For cardiovascular mortality, the RRs were 0.6 in East Boston and 0.5 in New Haven (95% CI's exclude null). These results persisted after control for potential confounding variables. In Iowa, there were no significant differences in total or cardiovascular mortality according to alcohol consumption patterns. For cancer mortality, there were no significant associations with alcohol consumption in any of the three populations.

Conclusions: These data suggest that the relationship of low to moderate alcohol consumption with reduced total and cardiovascular mortality, which are well documented in middle age, also occur in older populations. **J Am Geriatr Soc 40:651–657, 1992**

The deleterious consequences of heavy alcohol drinking have been well established and include risks of traffic fatalities, cirrhosis, death from violent crime, suicide, industrial accident, and certain cancers.[1] These associations account for the fact that heavy alcohol consumption is the second leading avoidable cause of mortality in the US and other developed countries, after cigarettes. In contrast, a large body of evidence has accumulated that those who regularly consume small to moderate amounts of alcohol have lowered mortality from coronary heart disease,[1–17] the chief cause of death in the United States.[3]

The available data are derived almost exclusively from studies among middle-age individuals between 40 and 65 years of age. Whether or not such an association is present among older populations, however, has not been well described. In this report, we present prospective data on alcohol consumption and mortality from the Established Populations for Epidemiologic Studies of the Elderly (EPESE).[18]

MATERIALS AND METHODS

Baseline surveys were carried out between 1981 and 1983 in East Boston, Massachusetts (n = 3,808), two rural counties in Iowa (n = 3,673), and New Haven, Connecticut (n = 2,812). A fourth EPESE site, consisting of residents in five counties in the Piedmont area of North Carolina, was added in 1986–87, but data from this site were not included in these analyses. Follow-up telephone interviews were conducted in the first, second, fourth, and fifth years of follow-up, while in the third year, in-person interviews were done. At the baseline interview, information was collected on a wide range of questions concerning the health status of the elderly including information on cigarette smoking, alcohol intake, and history of major chronic conditions such as myocardial infarction, stroke, hypertension, cancer, diabetes, and hip fracture. A detailed description of the data collection instruments used at the initial interview and the characteristics of participants in EPESE has been published previously.[18]

To evaluate prospectively the relation of alcohol consumption to total, cardiovascular, and cancer mortality, participants were excluded if they reported at baseline a history of heart attack, stroke, or cancer

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(28.2% of subjects in East Boston, 30.6% in Iowa, and 31.2% in New Haven). In addition, subjects with missing information on alcohol consumption were excluded (1.1 per cent in East Boston, 7.0 per cent in Iowa, 1.1 per cent in New Haven). After exclusions, the final sample size for all statistical analyses was 2,694 in East Boston, 2,293 in Iowa, and 1,904 in New Haven.

Definition of Exposure and Health Characteristics Alcohol intake was ascertained from a series of questions concerning consumption of each of three main beverage types, namely beer (or ale), wine, and liquor. For each beverage, participants were first asked whether they had consumed that type of drink during the past year. If they had, they were then asked how often they had consumed it during the past month and how many drinks they usually had at one time.

The information from these questions was used to calculate an average daily intake of alcohol by assigning weights to each beverage type according to the Framingham classification.[4] The total daily ounces of alcohol equals the sum of 0.60 times the daily number of 12-ounce beers, 0.67 times the daily number of 4-ounce glasses of wine, and 1.00 times the daily number of mixed drinks or cocktails.[4]

Cigarette smoking was classified as never, former, and current. Three measures of functional disability were adapted from existing questionnaires[19–21] as previously described.[18] Limitation in one or more activities of daily living was defined as needing assistance with bathing, dressing, walking, grooming, transferring from bed to chair, using the toilet or eating.[19] The inability to perform an activity in the modified Rosow-Breslau scale was defined as being unable to walk a half mile without help, walk up and down stairs to the second floor without help, or do heavy work around the house without help.[20] Limitation in performing an activity on the Nagi scale was defined as difficulty in one or more of the following: extending arms above shoulder level, writing or handling small objects, pulling or pushing large objects, or stooping, crouching, or kneeling.[21] Mental status score was based on a nine-item version of the Short Portable Mental Status Questionnaire.[22] The question, "What place is this?" was excluded since the interviews were done in the participants' homes.

Mortality Surveillance Vital status was determined annually over 5 years as part of the regular follow-up cycle in each location, and was virtually complete in the three communities (100% in East Boston and Iowa and 99% in New Haven). For participants found to have died, death certificates were requested. All death certificates were reviewed by a single certified nosologist, who applied uniform criteria to code cause of death according to the Ninth International Classification of Diseases (ICD-9). Cardiovascular deaths were those with codes of 390–459, and 798; cancer death codes were 140–209.

Statistical Methods Prevalence rates at baseline of four categories of alcohol consumption (none in past year, none in past month, <1 ounce per day, and ≥1 ounce per day) were examined by sex and age. For each category of alcohol consumption, 5-year age-standardized mortality rates for each gender were calculated using the age strata of 65–69, 70–74, and ≥75 years and a standard population consisting of the sum of the East Boston, Iowa, and New Haven populations. Standardized relative risks, risk differences and corresponding 95% confidence intervals were also calculated using the group that had consumed no alcohol in the past year as the reference category.[23] Because the New Haven population was selected using a complex sampling scheme, those data were weighted according to the number of persons in the total population represented by each participant, and then multiplied by the overall sampling fraction of the entire population. Tests of significance and confidence intervals in the New Haven population were calculated after adjusting standard errors for effects of the complex survey design. Logistic regression was used to examine the relation of alcohol consumption with mortality after adjustment for the effects several potential confounders including smoking, limitations in activities of daily living, mental status score, history of hypertension, and history of diabetes.

TABLE 1. PERCENT PREVALENCE OF ALCOHOL CONSUMPTION AT BASELINE

	Age Group											
	East Boston				Iowa				New Haven			
	65–69	70–74	≥75	Total	65–69	70–74	≥75	Total	65–69	70–74	≥75	Total
Men												
Sample size	355	288	380	1023	252	229	270	751	266	200	306	772
Alcohol consumption (%)												
None in year	13.0	18.8	22.9	18.3	35.7	37.6	50.7	41.7	22.7	19.5	28.9	23.9
None in month	14.1	11.8	10.3	12.0	12.3	14.4	14.1	13.6	7.7	15.0	12.7	11.4
<1 ounce/day	42.8	44.1	44.7	43.9	36.1	32.3	30.7	33.0	43.9	43.7	44.0	43.9
≥1 ounce/day	30.1	25.4	22.1	25.8	15.9	15.7	4.4	11.7	25.8	21.8	14.4	20.9
Women												
Sample size	551	464	656	1671	406	416	720	1542	294	316	522	1132
Alcohol consumption (%)												
None in year	29.4	31.5	40.4	34.3	50.5	61.3	70.7	62.8	32.3	38.5	43.2	38.7
None in month	17.6	18.8	17.1	17.7	18.5	13.9	12.8	14.6	13.6	18.0	14.5	15.1
<1 ounce/day	49.7	46.6	39.2	44.7	28.1	22.8	15.0	20.6	48.0	41.1	37.7	41.7
≥1 ounce/day	3.3	3.2	3.4	3.3	3.0	1.9	1.5	2.0	6.1	2.4	4.7	4.5

RESULTS

The proportions of the cohort not consuming any alcohol in the last year differed by site, age group, and gender (Table 1). Women were more likely than men to have consumed no alcohol in the past year, as were older subjects regardless of gender. The proportions not consuming any alcohol in the past year were higher in Iowa men and women than in East Boston and New Haven men and women, for whom similar prevalence rates were observed. In men, the proportion of the population having an average of one or more ounces of alcohol per day was 25.8% in East Boston, 20.9% in New Haven, and 11.7% in Iowa. In all three cohorts, the prevalence of alcohol consumption of ≥1 ounce per day was low in women (less than 5%).

At baseline, current smoking was more common among alcohol consumers of ≥1 ounce per day (Table 2). The relation of alcohol consumption to other health characteristics at baseline differed among the three cohorts. In East Boston and New Haven, those consuming low to moderate amounts of alcohol (<1 ounce per day) had the lowest prevalence of limitations in activities of daily living and the lowest prevalence of inability to perform a Rosow-Breslau activity. Alcohol consumption was not related to disability in the Iowa cohort. The prevalence of ≥2 errors on the Short Portable Mental Status Questionnaire was lowest among low to moderate alcohol consumers in all three populations. In East Boston and New Haven, a history of hypertension or diabetes was less common among current alcohol consumers, while no such relationships were observed in Iowa. Hip fracture was not consistently related to alcohol consumption.

Sex and age-adjusted 5-year total mortality rates were lowest in the Iowa cohort (15.3 per 100), as were cardiovascular (8.9 per 100) and cancer (3.2 per 100) mortality rates (Table 3). The New Haven cohort experienced the highest overall mortality rate (22.4 per 100) as well as the highest rates of cardiovascular and cancer mortality.

The relation of alcohol consumption to sex and age-adjusted rates of 5-year total mortality also differed in the three communities (Figure 1). In East Boston and New Haven, low to moderate alcohol consumers had significantly lower rates of total mortality than those consuming no alcohol in the past year; the relative risk was 0.7 (95% confidence interval, 0.6–0.8) in East Boston and 0.6 (95% confidence interval, 0.5–0.8) in New Haven. In East Boston, alcohol consumers of ≥1 ounce per day had slightly (but not significantly) lower mortality rates than those not consuming in the past year. In New Haven, those consuming ≥1 ounce per day had rates of total mortality similar to those who had not consumed alcohol in the past year, suggesting a U-shaped relationship between alcohol consumption and total mortality. For those who had consumed alcohol in the past year but not the past month, total mortality rates were similar to those of non-consumers in East Boston and similar to those of lower to moderate consumers in New Haven. In Iowa, total mortality rates among alcohol consumers were as high or higher than among those consuming no alcohol in the past year;

TABLE 2. THE RELATION OF HEALTH CHARACTERISTICS TO ALCOHOL CONSUMPTION AT BASELINE

Alcohol Consumption at Baseline	East Boston				Iowa				New Haven			
Health characteristic†	None in Year	None in Month	<1 oz/Day	≥1 oz/Day	None in Year	None in Month	<1 oz/Day	≥1 oz/Day	None in Year	None in Month	<1 oz/Day	≥1 oz/Day
Current smoking (%)	19.3	21.5	18.0	30.6*	5.3	11.1*	10.8*	28.6*	15.6	19.5	19.7	37.6*
Limitation in activities of daily living (%)	17.8	14.7	12.7*	11.1	4.7	4.0	5.0	7.0	13.7	13.9	7.7*	12.2
Unable to perform Rosow-Breslau activity (%)	50.9	52.5	41.3*	46.7	31.2	34.6	29.4	34.6	40.2	37.7	31.6*	41.3
Difficulty in performing Nagi activity (%)	53.5	50.9	52.7	50.3	49.1	45.1	47.9	53.5	41.4	47.4	43.5	60.7*
Mental status score (% with 2 or more errors)	51.6	51.0	45.7*	48.3	30.7	23.9*	20.8*	28.9	42.7	38.4	30.1*	31.5
History of diabetes (%)	19.2	16.3	11.4*	11.8*	10.2	10.9	10.3	8.8	19.6	12.9*	9.4*	19.3
History of hypertension (%)	45.2	40.9	39.7*	35.1*	40.5	44.9	42.9	40.8	47.2	48.7	42.0	36.9
History of hip fracture (%)	4.7	3.7	3.0	3.3	3.3	4.0	3.2	6.5	4.5	1.4	3.7	0.9*

† *Adjusted for sex and age.*
* *Significant difference from subjects consuming no alcohol in past year ($P < 0.05$).*

however, these differences were not statistically significant.

The pattern for cardiovascular mortality was quite similar to that for total mortality (Table 4). In East Boston and New Haven, rates of cardiovascular mortality were lowest in low to moderate alcohol consumers (<1 ounce per day) with relative risks compared to non-drinkers in the past year of 0.6 in East Boston and 0.5 in New Haven (95% confidence intervals exlude 1.0). In Iowa, rates were similar among those consuming alcohol and non-drinkers in the past year. Also in Iowa, rates of cardiovascular mortality were significantly higher for those who had consumed alcohol in the past year, but not in the past month, compared to non-drinkers in the past year.

For all types of cancer, no consistent association in any of the three cohorts between alcohol use and death was observed (Table 4).

Logistic regression models were constructed to control for the health characteristics previously found to be related to alcohol consumption (Table 5). Terms for sex and age were included in all models. Because measures of disability are highly correlated, only limitations in activities of daily living were included in these models. Adjustment for sex, age, current smoking, one or more limitations in activities of daily living, two or more errors on the mental status questionnaire, history of hypertension, and history of diabetes did not substantially alter the results for total and cardiovascular mortality. In East Boston and New Haven, alcohol consumption (regardless of quantity) was associated

TABLE 3. SEX AND AGE-ADJUSTED FIVE-YEAR MORTALITY RATES

	East Boston	Iowa	New Haven
	(Mortality Rate per 100 (number of deaths))		
Total mortality	20.4 (540)	15.3 (353)	22.4 (459)
Cardiovascular disease mortality	9.4 (246)	8.9 (206)	11.8 (225)
Cancer mortality	4.6 (123)	3.2 (74)	5.0 (106)

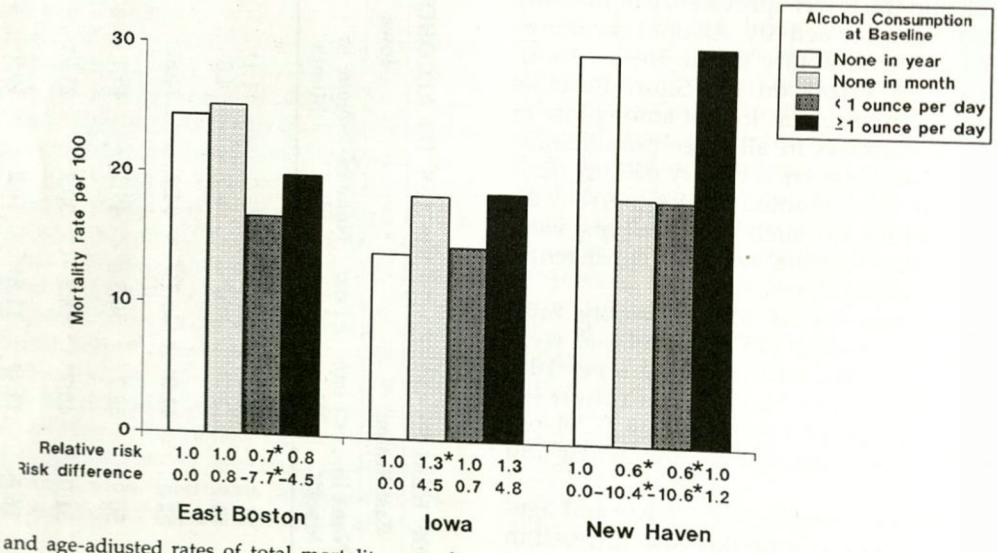

FIGURE 1. Sex and age-adjusted rates of total mortality according to alcohol consumption at baseline; *95 percent confidence interval excludes the null value: 1.0 for relative risk. 0.0 for risk difference.

TABLE 4. SEX AND AGE-ADJUSTED FIVE-YEAR CARDIOVASCULAR AND CANCER MORTALITY RATES ACCORDING TO ALCOHOL CONSUMPTION AT BASELINE

Alcohol Consumption	East Boston			Iowa			New Haven		
	Rate†	RR	RD	Rate	RR	RD	Rate	RR	RD
				(Cardiovascular Disease)					
None in year	12.1	1.0	0.0	8.1	1.0	0.0	15.6	1.0	0.0
None in month	10.0	0.8	−2.1	12.2	1.5*	4.1*	10.5	0.7	−5.0
<1 ounce/day	7.7	0.6*	−4.4*	8.2	1.0	0.1	8.2	0.5*	−7.4*
≥1 ounce/day	9.0	0.7	−3.1	8.5	1.1	0.4	22.6	1.5	7.0
				(Malignant Cancers)					
None in year	4.7	1.0	0.0	2.7	1.0	0.0	5.3	1.0	0.0
None in month	6.2	1.3	1.5	2.6	1.0	−0.1	3.6	0.7	−1.7
<1 ounce/day	3.6	0.8	−1.1	4.2	1.6	1.6	5.8	1.1	0.5
≥1 ounce/day	4.6	1.0	−0.1	8.0	3.0*	5.3	1.7	0.3*	−3.6*

† *Rate per 100; RR = relative risk; RD = risk difference.*

* *95 percent confidence intervals exclude the null value: 1.0 for relative risk; 0.0 for risk difference.*

TABLE 5. MULTIVARIATE-ADJUSTED† RELATIVE RISKS RELATING ALCOHOL CONSUMPTION TO 5-YEAR TOTAL AND CARDIOVASCULAR MORTALITY

	East Boston	Iowa	New Haven
	(Relative Risk (95 percent confidence interval))		
	(Total Mortality)		
Alcohol consumption at baseline			
None in year	1.0	1.0	1.0
None in month	1.1 (0.8–1.5)	1.4 (1.0–2.0)	0.5 (0.3–0.7)
<1 ounce/day	0.6 (0.5–0.8)	1.0 (0.8–1.4)	0.5 (0.4–0.8)
≥1 ounce/day	0.6 (0.4–0.9)	1.6 (1.0–2.8)	0.6 (0.4–0.9)
	(Cardiovascular Mortality)		
None in year	1.0	1.0	1.0
None in month	0.8 (0.5–1.2)	1.6 (1.1–2.5)	0.6 (0.4–1.0)
<1 ounce/day	0.6 (0.5–0.9)	1.0 (0.7–1.5)	0.5 (0.3–0.7)
≥1 ounce/day	0.5 (0.3–0.9)	1.3 (0.6–2.7)	0.9 (0.4–1.8)

†*Adjusted for sex, age, current smoking, one or more limitations in activities of daily living, mental status score (2 or more errors), history of hypertension, and history of diabetes.*

with a statistically significant 40%–50% decreased risk of total mortality. In Iowa, alcohol consumption of ≥1 ounce per day was associated with an increased risk of total mortality. Similar patterns showing a protective effect for low to moderate alcohol consumption were observed for cardiovascular mortality; a U-shaped relationship was suggested in New Haven, but not elsewhere. In general, the variables controlled were strong predictors of total and cardiovascular mortality in all three cohorts. Thus, the protective association of low to moderate alcohol consumption in East Boston and New Haven was independent of these indicators of health status. Further, the differences between these two sites and Iowa was not explained by these health characteristics.

To determine whether the elevated rates of total and cardiovascular mortality in subjects who consumed no alcohol in the past year was due to poorer health among former alcohol drinkers in that group, the logistic models described above were repeated after excluding subjects who reported that they had in the past "drank quite a bit more" alcohol than they did currently at baseline. The results in each community were not changed by this exclusion.

In addition, the relation of alcohol consumption to rates of total, cardiovascular, and cancer mortality was re-examined in each cohort for the total population including subjects with a history of myocardial infarction, stroke, or cancer at the initial interview. The results were unchanged from those presented.

DISCUSSION

Among persons aged 65 years and older, those consuming alcohol during the month of the baseline interview had a statistically significant decrease in risk of total mortality in two of three cohorts (East Boston and New Haven) compared to those consuming no alcohol in the past year. No relationship was observed in the third cohort (Iowa). For cardiovascular mortality as well, there was a significant protective effect of low to moderate alcohol consumption in East Boston and New Haven, but not in Iowa. The decreased risk of total and cardiovascular mortality associated with low to moderate alcohol consumption in East Boston and New Haven was independent of sex, age, current smoking, functional impairment, mental status score, history of hypertension and history of diabetes.

Overall, these findings suggest a protective effect of low to moderate alcohol intake in two of the three study populations. These two study populations (from East Boston and New Haven) had a larger fraction of the population using alcohol and higher mortality rates than the third study population from rural Iowa. While, the findings were not uniform for all three cohorts, studies of middle-aged populations also show some inconsistencies. A large number of case-control and cohort investigations have reported significant reductions in risk of cardiovascular mortality among moderate drinkers[1–2] while other studies have failed to confirm this association.[5–8] A J- or U-shaped curve, with non-drinkers having a risk of mortality higher than that of moderate drinkers but lower than that of heavy drinkers, has been seen in some studies.[9–10] Among the elderly, two previous reports[11–12] found no association between alcohol consumption and total mortality, while another found a significant inverse relation of moderate drinking with both total and cardiovascular mortality.[13]

Several considerations may affect the interpretation of these findings for total and cardiovascular mortality. First, pertaining to the lack of association between alcohol consumption and mortality in Iowa, it is not clear whether the apparent absence of an effect is due to differences in the behavioral and cultural determinants of alcohol consumption or the inability to test the hypothesis adequately because of lower rates of both alcohol consumption and mortality in this cohort.

Second, these data must be viewed in the context that levels of alcohol consumption tend to be lower in these and other older populations. Further, the cut-points utilized to categorize alcohol consumption have not been standard in previous studies. Definitions of "moderate" consumption in studies of middle-aged individuals have ranged from 30+ ounces per month,[14] to four to five drinks per day.[15] Thus, the highest alcohol consumption groups in the present study would lie within the moderate consumption groups used in studies of middle-aged populations. Finally,

due to the distribution of alcohol consumption in the three cohorts, we were unable to evaluate the effects of heavier alcohol consumption in these older populations.

Third, the present study has information only on current alcohol consumption at the time of the initial interview. Current levels of alcohol consumption may not be representative of middle-age life experience of these older individuals. In view of possible pathophysiological relations, such previous exposure could be important.

Fourth, it is possible that individuals in declining health are more likely to stop drinking alcohol. If this were so, then an apparent protective effect could result from current alcohol consumption being a marker of good health. It is not possible with available data to distinguish between those abstaining for health reasons and those not drinking for reasons unrelated to health. However, we attempted to control for such potential confounding in several ways: (1) by excluding subjects with a history of myocardial infarction, stroke or cancer at the initial interview; (2) by further excluding subjects who reported past greater alcohol consumption; and (3) by controlling for the effects of functional limitations, mental status score, history of hypertension, and history of diabetes in multivariate analyses. Our multivariate findings suggest that the protective association of low to moderate alcohol intake with total and cardiovascular mortality in two cohorts is independent of health status, as least for those health characteristics that we were able to take into consideration. These findings also argue against the possibility that former drinkers in poor health account for the higher mortality rates observed in the non-drinkers.

The results were also not affected by restricting the cohort to subjects with stable drinking habits (eg, excluding those who reported a history of greater alcohol consumption in the past). Furthermore, when the analyses were repeated on the total population, including those with a history of myocardial infarction, stroke or cancer at the initial interview, the results were unchanged. This supports the conclusion that the findings presented are generalizable to the entire study population in each of the three communities and that the results were not substantially influenced by differences in alcohol consumption patterns among persons with these chronic diseases.

Finally, it is possible that the association of low to moderate alcohol consumption with lower mortality rates is the result of some unmeasured personal or social characteristic, that is related to better health and lower risk of death, of those who drank small amounts of alcohol. While such speculations cannot be ruled out in epidemiologic studies, the biologic plausibility of a direct effect of alcohol on risk of cardiovascular mortality is supported by past studies linking moderate alcohol consumption to increased levels of high density lipoprotein cholesterol levels.[24] In addition, alcohol consumption may reduce thrombosis and thus lower risk of cardiovascular death.[24]

The lack of any association between alcohol consumption and cancer mortality in the present study may also reflect lower intakes among the elderly.[25] A positive relationship with cancer mortality might have been observed if a large number of details had occurred for malignancies related to alcohol consumption or perhaps in the presence of a promoting effect that would be general to all tumors. There is no evidence for either effect in this study.

Despite the limitations noted above, the findings from this investigation suggest that consumption of small to moderate amounts of alcohol may confer a protective effect on both total and cardiovascular mortality among the elderly in some populations. We could not evaluate potentially detrimental physiologic effects of small amounts of alcohol on, for example, brain function or the altered metabolism of drugs in the elderly. The complexity of alcohol's metabolic, physiologic, and psychological effects may preclude its use as a prescribable means to lower risk of cardiovascular disease. At present, in view of the well-documented detrimental effects of heavy alcohol consumption, the evidence is compelling for heavy drinkers to limit their consumption.

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