

Wine Consumption and 20-Year Mortality Among Late-Life Moderate Drinkers

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ABSTRACT. Objective: This study examined level of wine consumption and total mortality among 802 older adults ages 55–65 at baseline, controlling for key sociodemographic, behavioral, and health status factors. Despite a growing consensus that moderate alcohol consumption is associated with reduced total mortality, whether wine consumption provides an additional, unique protective effect is unresolved. **Method:** Participants were categorized in three subsamples: abstainers, high-wine-consumption moderate drinkers, and low-wine-consumption moderate drinkers. Alcohol consumption, sociodemographic factors, health behavior, and health problems were assessed at baseline; total mortality was indexed across an ensuing 20-year period. **Results:** After adjusting for all covariates, both high-wine-consumption and low-wine-consumption moderate drinkers showed reduced mortality risks compared with abstainers. Further, compared with moderate drinkers for whom a high

proportion of ethanol came from wine, those for whom a low proportion of ethanol came from wine were older, were more likely to be male, reported more health problems, were more likely to be tobacco smokers, scored lower on socioeconomic status, and (statistical trend) reported engaging in less physical activity. Controlling only for overall ethanol consumption, compared with moderate drinkers for whom a high proportion of ethanol came from wine, those for whom a low proportion of ethanol came from wine showed a substantially increased 20-year mortality risk of 85%. However, after controlling for all covariates, the initial mortality difference associated with wine consumption was no longer significant. **Conclusions:** Among older adults who are moderate drinkers, the apparent unique effects of wine on longevity may be explained by confounding factors correlated with wine consumption. (*J. Stud. Alcohol Drugs*, 73, 80–88, 2012)

A CONSENSUS IS EMERGING THAT MODERATE alcohol consumption is associated with reduced total mortality (Di Castelnuovo et al., 2006). However, the issue of whether wine consumption may provide benefits to longevity beyond those attributable to ethanol per se remains an open question, with findings on both sides of the issue. Initially, analyses across countries suggested a link between wine consumption and reduced cardiac mortality (Renaud and de Lorgeril, 1992; St Leger et al., 1979). Several subsequent studies indexing wine consumption and total mortality at the individual level provided additional support for the hypothesis that wine may provide unique protective effects. For example, prospective studies of men and women in Denmark (Grønbaek et al., 1995, 2000) and the United States (Klatsky et al., 2003) and men in France (Renaud et al., 1999) and the Netherlands (Streppel et al., 2009) reported that, in contrast

to consumption of other alcoholic beverages, only wine consumption was associated with lower total mortality.

Despite these findings, investigators have been concerned about possible confounding factors associated with the apparent unique protective effects of wine on total mortality (Goldberg et al., 2001; Vogel, 2002). For example, several studies have raised cautions about findings with Danish samples because of concerns about a lack of adequate controls for socioeconomic and lifestyle factors (Grønbaek, 2001, 2003; Mortensen et al., 2001; Nielsen et al., 2004). Similarly, although Theobald et al. (2000) found a unique association between moderate wine consumption and reduced total mortality among Swedish adults, they concluded that their findings most likely reflected confounding factors correlated with wine consumption. In addition, Grønbaek (2001) noted that, in some studies, the effort to disentangle the mortality effect attributable to wine from that attributable to ethanol may have been incomplete.

In this vein, some research has suggested that ethanol consumption per se is associated with mortality and has underscored the substantial connection between wine consumption and socioeconomic and lifestyle factors. In fact, preference for wine consumption, compared with preference for other alcoholic beverages, is strongly associated with higher socioeconomic status, a healthier lifestyle, and better health status indicators (Barefoot et al., 2002; Klatsky et

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al., 1990; McCann et al., 2003; Paschall and Lipton, 2005). Moreover, studies in the United States, controlling for key sociodemographic, behavioral, and health status factors, reported associations between moderate alcohol consumption and reduced total mortality among older adults (Paganini-Hill et al., 2007) and reduced risk of myocardial infarction among men (Mukamal et al., 2003) that were independent of the type of alcoholic beverage consumed.

Present study

The purpose of the current study was to examine level of wine consumption and total mortality among older adults, controlling for confounding factors correlated with wine consumption. We examined this issue among 802 adults ages 55–65 at baseline. Alcohol consumption was assessed at baseline, and total mortality was indexed across an ensuing 20-year period. The present study extends our research examining alcohol consumption and all-cause mortality among older adults in the larger database from which the current sample was drawn (Holahan et al., 2010). The earlier study demonstrated that, even after adjusting for a wide range of sociodemographic, behavioral, and health status factors, abstainers showed an increased mortality risk compared with moderate drinkers. However, the earlier study did not consider the role of beverage type.

First, we examined whether the previously reported mortality advantage for moderate drinkers versus abstainers is evident for both high-wine-consumption moderate drinkers and low-wine-consumption moderate drinkers. Then, we examined three interrelated questions pertaining to high wine consumption versus low wine consumption among moderate drinkers: (a) Are there significant confounding factors associated with level of wine consumption? (b) Is there an apparent mortality advantage associated with level of wine consumption before controlling for potential confounding factors? (c) Is any mortality advantage associated with level of wine consumption independent of confounding factors?

Method

Sample selection and characteristics

The present study is part of a longitudinal project that has examined late-life patterns of alcohol consumption and drinking problems (Moos et al., 2004, 2009, 2010; Schutte et al., 2006) and stress and coping processes (Holahan et al., 1997, 2005) among late-middle-aged adults. The sample at baseline included individuals between the ages of 55 and 65 who had had outpatient contact with a health care facility in the previous 3 years. Based on the aims of the parent project, lifetime nondrinkers were excluded. However, the sample was comparable to similarly aged community samples with respect to health characteristics, such as prevalence of chron-

ic illness and hospitalization (for additional information on sample recruitment, see Brennan and Moos, 1990; Moos et al., 1991). Predictive data were obtained from self-report inventories at baseline. Of eligible respondents contacted at baseline, 92% agreed to participate in the survey, and 89% (1,884) of these individuals provided complete data at baseline. The present study focused on three subsamples ($N_{\text{total}} = 802$) from the parent project: participants who were abstainers, high-wine-consumption moderate drinkers, and low-wine-consumption moderate drinkers at baseline, as defined below (see Table 1 for subsample characteristics). The study was approved by the Stanford University Medical School Panel on Human Subjects; after the project was fully explained, participants provided signed informed consent.

Measures

The baseline data included information on alcohol consumption, sociodemographic factors, health behavior, and health problems. Death across the 20-year follow-up period was confirmed primarily by death certificate. Descriptive and psychometric information on the measures is available in the Health and Daily Living Form Manual (Moos et al., 1992) for the measures of alcohol consumption, tobacco smoking, and physical activity and in the Life Stressors and Social Resources Inventory Manual (Moos and Moos, 1994) for the measure of health problems.

Alcohol consumption groups. Average daily ethanol consumption was assessed with a quantity–frequency index using items adapted from the Health and Daily Living Form (Moos et al., 1992). The quantity of alcohol consumed was assessed by items that measured amounts of wine, beer, and distilled spirits participants had consumed on the days they drank in the last month. Responses to these items were converted to reflect the ethanol content of the beverages consumed. The frequency of alcohol consumption was assessed by responses to questions asking how often per week (never, less than once, once or twice, three to four times, nearly every day) participants had consumed wine, beer, and distilled spirits in the last month. From this information, quantity–frequency values were calculated to provide indices of participants' average daily ethanol consumption from each beverage type. Summing average daily ethanol consumption

TABLE 1. Descriptive characteristics for the three subsamples

Variable	Abstainers (<i>n</i> = 345)	Low wine consumption (<i>n</i> = 281)	High wine consumption (<i>n</i> = 176)
Age, in years, <i>M</i> (<i>SD</i>)	61.29 (3.08)	61.67 (3.06)	60.99 (3.29)
Gender, %			
Female	29.3	32.7	52.8
Male	70.7	67.3	47.2
White, %	88.4	91.8	96.6
Married, %	57.4	75.4	80.7

from the three beverage types provided a composite index of participants' overall average daily ethanol consumption. There is support for the validity of self-report measures of alcohol consumption for mixed-age and older adults (Babor et al., 1987; Stacy et al., 1985; Tucker et al., 1991; Werch, 1989).

Groups of abstainers and high-wine-consumption versus low-wine-consumption moderate drinkers were identified in two steps. First, following Holahan et al. (2010), we defined groups of abstainers and moderate drinkers. Abstainers were individuals who, at baseline, had consumed no alcohol in the past month. Based on the approximation that 5 oz. of wine, 12 oz. of beer, and 1 shot (1.5 oz.) of distilled spirits contain an average of 0.6 oz. (approximately 14 g) of pure, 100% alcohol (National Institute on Alcohol Abuse and Alcoholism, 2007), we defined moderate drinkers as individuals who, at baseline, consumed from one to less than three drinks per day in the last month (14 g to less than 42 g/day). This definition of moderate drinking is similar to that used in prior studies (Camacho et al., 1987; De Labry et al., 1992; Di Castelnuovo et al., 2006; Ferreira and Weems, 2008; Mertens et al., 1996) and resulted in 345 abstainers and 560 moderate drinkers.

Then, among moderate drinkers, we operationalized level of wine consumption in two steps. First, an index of percentage daily ethanol consumption from wine was calculated as the average daily ethanol consumption from wine divided by the overall average daily ethanol consumption. Next, similar to Grønbaek et al. (2000), the low-wine-consumption group was defined as moderate drinkers who consumed less than or equal to one third of their daily ethanol consumption from wine ($n = 281$, 50% of 560 moderate drinkers). Correspondingly, the high-wine-consumption group was defined as moderate drinkers who consumed two thirds or more of their daily ethanol consumption from wine ($n = 176$, 31% of 560 moderate drinkers). Because individuals tend to prefer particular beverages, this breakdown encompassed more than 81% of moderate drinkers. Based on follow-up data 1 year later, consistency in low-wine-consumption versus high-wine-consumption group membership was very high ($r = .90$, $p < .01$, $n = 360$).

Sociodemographic factors. Sociodemographic factors included age, gender (0 = female, 1 = male), and socioeconomic status. Respondents were asked at baseline about their total annual family income and years of education. Following Holahan et al. (2010), we indexed socioeconomic status as the average of participants' family income and years of education, using standard scores for both measures to equate their scales. Marital status was assessed by a dichotomous index (0 = not married, 1 = married).

Health problems. Following Holahan et al. (2010) and Mertens et al. (1996), health problems at baseline were indexed as a count of nine self-reported physician-diagnosed medical conditions experienced in the past 12 months (can-

cer, diabetes, heart problems, stroke, high blood pressure, anemia, bronchitis, kidney problems, and ulcers) and seven physical ailments experienced in the past 12 months (pain in the heart or tightness or heaviness in the chest, trouble breathing or shortness of breath, constant coughing or frequent heavy chest colds, frequent cramps in the leg, swollen ankles, getting very tired in a short time, and trouble climbing stairs or getting outdoors).

Health behaviors. We evaluated tobacco smoking and physical activity at baseline. Tobacco smoking was indexed by an item asking participants whether they currently smoked tobacco (0 = no, 1 = yes), specifying either cigarettes, cigars, or pipe. Following Harris et al. (2006) and Holahan et al. (2010), level of physical activity was indexed by summing four items asking participants whether they engaged in any of the following activities during the last month (0 = no, 1 = yes): (a) swimming or tennis with friends, (b) swimming or tennis with family, (c) long hikes or walks with friends, and (d) long hikes or walks with family. The total score ranged from 0 (no activity) to 4 (high activity).

Mortality. The outcome variable was death (0 = surviving, 1 = death) during the 20-year follow-up. A total of 435 (54%) of the 802 participants died during the 20-year follow-up. Based on coding in the full data set, the fact of death was confirmed by death certificate for 92% of cases, by another official source (primarily the Social Security Death Index) for 7% of cases, and verbally by telephone by an individual at the participant's former residence (primarily the spouse) for 1% of cases.

Analytic plan. First, we contrasted both high-wine-consumption and low-wine-consumption moderate drinkers with abstainers in predicting mortality risk across the 20-year follow-up in a Cox proportional hazards regression analysis. We controlled for the sociodemographic, behavioral, and health status factors that made significant unique contributions in our earlier research (Holahan et al., 2010): age, gender, socioeconomic status, health problems, tobacco smoking, and physical activity. In fact, the results are unchanged if the nonsignificant covariates in our earlier research (marital status, former problem drinking, obesity, depressive symptoms, avoidance coping, number of close friends, and quality of friend support) are also included.

Next, among moderate drinkers, we examined the association of each of the above covariates with (a) 20-year mortality in logistic regression analyses and (b) level of wine consumption, using analyses of variance for continuous variables and chi-square analyses for categorical variables. Finally, we examined level of wine consumption in predicting mortality risk across the 20-year follow-up in two Cox proportional hazards regression analyses. Initially, we examined a model controlling only for average overall daily ethanol consumption. Then, we examined a model controlling for all covariates identified in the covariate analyses as well as for average overall daily ethanol consumption.

Earlier studies have not found gender differences in the association between wine and longevity (Grønbaek et al., 2000; Klatsky et al., 2003; Paganini-Hill et al., 2007). However, because the physiological effects of alcohol differ for women and men (National Institute on Alcohol Abuse and Alcoholism, 2008), we examined the potential role of gender as a moderator of the relationships between predictive factors and 20-year mortality. Continuous variables were centered at the mean and then multiplied to create each interaction term.

Results

Descriptive information on sample mortality

The mortality rate was highest among abstainers (239 of 345, or 69%), intermediate among low-wine-consumption moderate drinkers (140 of 281, or 50%), and lowest among high-wine-consumption moderate drinkers (56 of 176, or 32%).

High-wine-consumption and low-wine-consumption moderate drinkers versus abstainers

We contrasted both high-wine-consumption moderate drinkers and low-wine-consumption moderate drinkers with abstainers in predicting mortality risk across the 20-year follow-up period in a Cox proportional hazards regression analysis. Alcohol consumption groups were dummy coded with abstainers as the reference group. Based on Holahan et al. (2010), we controlled for age, gender, socioeconomic status, health problems, tobacco smoking, and physical activity. One covariate, physical activity, did not meet the proportional hazards assumption that the hazards ratio for any two observations was constant over time. Preliminary tests indicated that the strength of baseline physical activity in predicting mortality risk decreased over time. Thus, following convention (Singer and Willett, 2003, pp. 562–570), an interaction term reflecting the Physical Activity \times Time

interaction was included in the model. After adjusting for all covariates, high-wine-consumption moderate drinkers (odds ratio [OR] = 0.59, 95% CI [0.43, 0.82], $p < .01$) and low-wine-consumption moderate drinkers (OR = 0.67, 95% CI [0.54, 0.84], $p < .01$) showed reduced mortality risks of 41% and 33%, respectively, compared with abstainers.

Level of wine consumption among moderate drinkers

Tests of covariates. Next, we turned to the question of whether level of wine consumption is related to longevity among moderate drinkers. We began by examining the significant covariates identified in our previous research (Holahan et al., 2010) for possible inclusion in the predictive model. First, we examined each covariate as a predictor of 20-year mortality in separate logistic regression analyses. All six covariates significantly ($p < .05$) predicted mortality (Table 2). No gender interactions were statistically significant ($p > .05$).

We also examined the association of high wine consumption versus low wine consumption with each of the above covariates. Continuous variables were examined in one-factor analysis of variance. Categorical variables were examined in chi-square analyses. Baseline level of wine consumption was significantly ($p < .05$) associated with five of the six covariates and showed a statistical trend ($p = .09$) for physical activity (Table 3). Based on these results, all six covariates were retained. Compared with the high-wine-consumption moderate drinkers, the low-wine-consumption moderate drinkers were older, were more likely to be male, reported more health problems, were more likely to be tobacco smokers, scored lower on socioeconomic status, and reported engaging in less physical activity. The high-wine-consumption and low-wine-consumption groups of moderate drinkers did not differ significantly ($p > .05$) on any of the variables that were nonsignificant in our earlier research (Holahan et al., 2010).

TABLE 2. Results of logistic regression analyses for each baseline covariate examined separately as a predictor of 20-year mortality among moderate drinkers ($n = 457$)

Covariate	Odds ratio	[95% CI]
Age, in years	1.10**	[1.04, 1.17]
Gender (0 = female, 1 = male)	1.86**	[1.31, 2.64]
Socioeconomic status ^a	0.62**	[0.51, 0.76]
Health problems	1.30**	[1.20, 1.41]
Tobacco smoking (0 = no, 1 = yes)	2.72**	[1.83, 4.05]
Physical activity	0.84*	[0.73, 0.98]

^aStandardized scale.
* $p < .05$; ** $p < .01$.

TABLE 3. Means and standard deviations (in parentheses) for baseline covariates by baseline level of wine consumption among high-wine consumption and low-wine consumption moderate drinkers. Results of F and chi-square tests are shown in the last column ($n = 457$)

Covariate	High wine consumption	Low wine consumption	Overall test ^b
	M (SD)	M (SD)	
Age, in years	60.99 (3.29)	61.67 (3.06)	$F = 5.06^*$
Gender, 0 = female, 1 = male	0.47 (0.50)	0.67 (0.47)	$\chi^2 = 18.15^{**}$
Socioeconomic status ^a	0.24 (0.75)	-0.19 (0.87)	$F = 29.73^{**}$
Health problems	1.35 (1.61)	2.35 (2.51)	$F = 22.37^{**}$
Tobacco smoking, 0 = no, 1 = yes	0.08 (0.27)	0.37 (0.48)	$\chi^2 = 47.70^{**}$
Physical activity	1.38 (1.18)	1.19 (1.16)	$F = 2.90^\dagger$

^aStandardized scale; ^b $df = 1, 455$ for F ; $df = 1$ for chi-square.
[†] $p = .09$; * $p < .05$; ** $p < .01$.

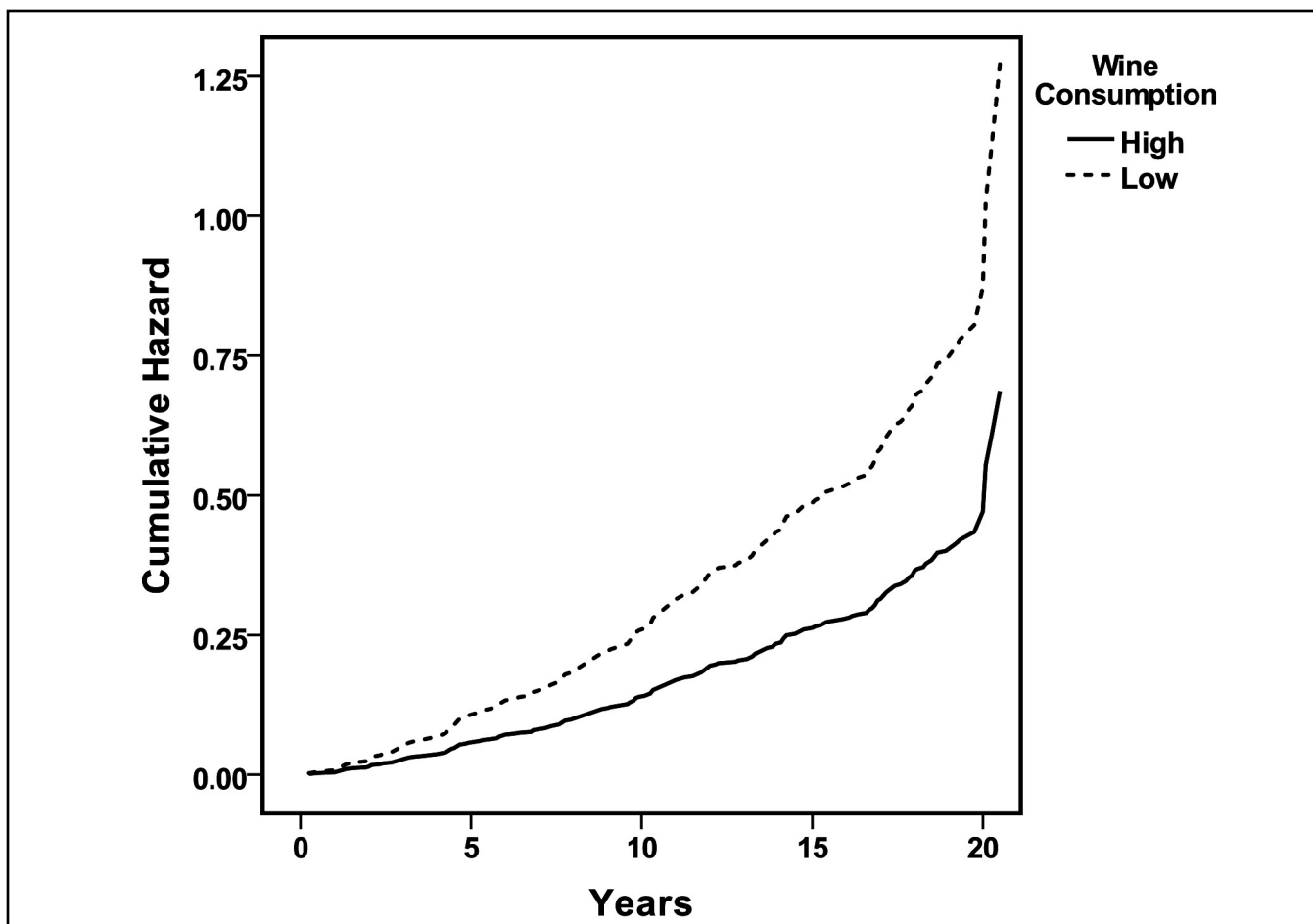


FIGURE 1. Cumulative hazard of mortality across 20 years among moderate drinkers by proportion of ethanol from wine consumption for an initial model controlling only for overall daily ethanol consumption ($n = 457$)

Initial model controlling only for overall ethanol consumption

Next, we examined whether there is an apparent mortality advantage associated with level of wine consumption among moderate drinkers before controlling for potential demographic and lifestyle confounding factors. Specifically, we examined the association between high-wine-consumption and low-wine-consumption moderate drinkers and mortality risk across the 20-year follow-up period in a Cox proportional hazards regression analysis. Although the high-wine-consumption and low-wine-consumption groups did not differ significantly ($p > .05$) in overall average daily ethanol consumption, to be conservative we controlled for overall average daily ethanol consumption. Compared with high wine consumption, low wine consumption among moderate drinkers was associated with an increased mortality risk of 85% (OR = 1.85, 95% CI [1.36, 2.53], $p < .01$). The association between level of wine consumption and mortality risk among moderate drinkers did not differ for women and men (OR = 0.86, 95% CI [0.44, 1.67], $p = .66$).

Figure 1 plots the cumulative hazard of mortality across the 20-year follow-up by level of wine consumption for the initial model. The figure shows the total accumulated risk of mortality for an individual in each alcohol group from baseline until the respective time point across the 20-year period (Singer and Willett, 2003). The plot shows that, among moderate drinkers, controlling only for overall average daily ethanol consumption, accumulated mortality risk is consistently greater for the low-wine-consumption group than for the high-wine-consumption group.

Full model controlling for all covariates

Finally, we examined the association between high wine consumption versus low wine consumption among moderate drinkers and mortality risk across the 20-year follow-up period in a Cox proportional hazards regression, controlling for all covariates identified in the covariate analyses, as well as for overall average daily ethanol consumption. As in the preliminary model, physical activity did not meet the proportional hazards assumption. Thus, an interaction term

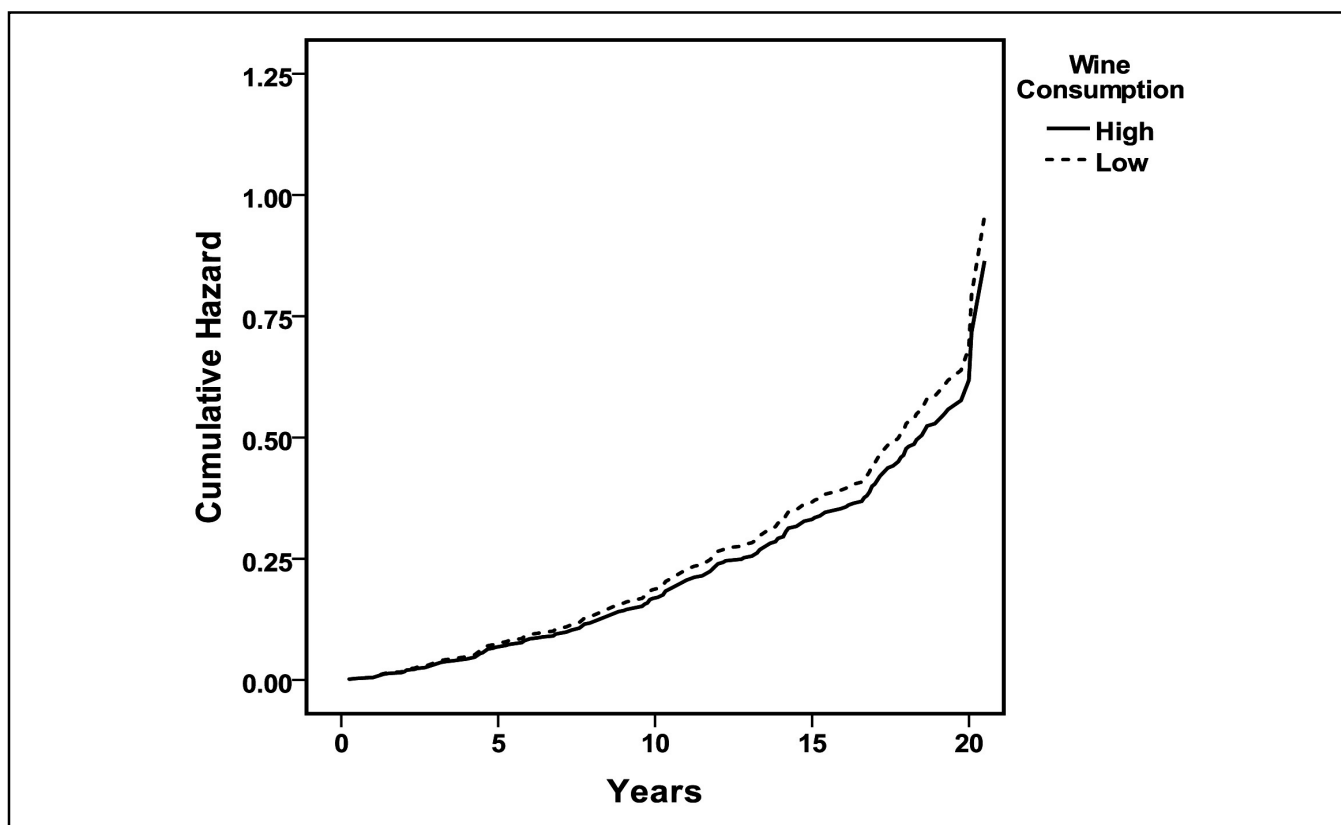


FIGURE 2. Cumulative hazard of mortality across 20 years among moderate drinkers by proportion of ethanol from wine consumption for a full model controlling for sociodemographic, behavioral, and health status factors, as well as for overall daily ethanol consumption ($n = 457$)

reflecting the Physical Activity \times Time interaction was again included in the model.

After adjusting for the full set of covariates as well as overall average daily ethanol consumption, the initial mortality difference between high-wine-consumption and low-wine-consumption moderate drinkers was no longer

significant (Table 4). The association between level of wine consumption and mortality risk among moderate drinkers in the full model did not differ for women and men (OR = 0.70, 95% CI [0.37, 1.40], $p = .30$). Figure 2 plots the cumulative hazard across the 20-year follow-up by level of wine consumption for the full model controlling for all covariates. Comparing Figures 1 and 2 demonstrates the effect of including all covariates on cumulative hazard.

TABLE 4. Results of a Cox proportional hazards regression analysis predicting 20-year mortality risk from level of wine consumption at baseline among moderate drinkers in a full model controlling for sociodemographic, behavioral, and health status factors, as well as for overall daily ethanol consumption ($n = 457$)

Covariate	Hazard ratio	[95% CI]
Overall ethanol consumption, in ounces	0.87	[0.55, 1.37]
Age, in years	1.06*	[1.01, 1.11]
Gender, 0 = female, 1 = male	1.61**	[1.16, 2.22]
Socioeconomic status ^a	0.85 ^b	[0.71, 1.01]
Health problems	1.15**	[1.08, 1.21]
Tobacco smoking, 0 = no, 1 = yes	1.49*	[1.09, 2.04]
Physical activity	0.69*	[0.51, 0.94]
Physical Activity \times Time	1.03*	[1.01, 1.06]
Level of wine consumption, 0 = high, 1 = low	1.13 ^c	[0.80, 1.61]

^aStandardized scale; ^b $p = .06$; ^c $p = .48$.

* $p < .05$; ** $p < .01$.

Discussion

We have examined the predictive association between level of wine consumption at baseline and total mortality among older adults across a 20-year period. In an extension of our own and other investigators' earlier findings that moderate alcohol consumption is associated with reduced total mortality (Di Castelnuovo et al., 2006; Holahan et al., 2010), initial analyses showed that the mortality advantage of moderate drinkers over abstainers does not appear to be solely because of their consumption of wine. We then turned our attention to whether level of wine consumption may be related to longevity among moderate drinkers.

In a model controlling only for overall average ethanol consumption, we found that, compared with moderate

drinkers who consumed primarily wine, moderate drinkers who consumed primarily other alcoholic beverages had a substantially increased mortality risk. This difference is consistent with prior studies that have reported that wine, compared with other alcoholic beverages, is uniquely predictive of reduced total mortality (Grønbaek et al., 1995, 2000; Klatsky et al., 2003; Renaud et al., 1999; Streppel et al., 2009). However, these prior studies did not adequately control for potential confounding factors, leading to the concern that the apparent unique effects of wine might be explained by factors associated with both level of wine consumption and mortality (Barefoot et al., 2002; McCann et al., 2003; Paschall and Lipton, 2005). Consistent with this concern, we found strong evidence of confounding sociodemographic, behavioral, and health status factors associated with level of wine consumption among moderate drinkers. Moreover, among these moderate drinkers, all of these factors were significantly linked to increased mortality.

More important, we found that these confounding factors played a pivotal role in assessing the apparent effect of wine consumption on mortality among moderate drinkers. When we controlled for sociodemographic, behavioral, and health status factors in addition to overall average ethanol consumption, the initial mortality difference associated with wine consumption among moderate drinkers was no longer significant. This finding is reinforced by the fact that moderate drinkers who consumed both high and low proportions of wine had a mortality advantage compared with abstainers and supports studies that have not found unique mortality effects for wine (Mukamal et al., 2003; Paganini-Hill et al., 2007).

Several limitations should be kept in mind in interpreting the present findings. Most important, as with other research on alcohol consumption and mortality in humans, these are not experimental findings and do not provide evidence of causality. In addition, although mortality was indexed objectively, our measures of alcohol consumption were based on self-reports. However, we identified substantial consistency over time in reports of level of wine consumption. There also is consistency in self-reported beverage type across in-depth dietary interviews and short food-frequency questionnaires (Grønbaek, 2001), and there is support for the validity of self-report measures of alcohol consumption for mixed-age and older adults (Babor et al., 1987; Stacy et al., 1985; Tucker et al., 1991; Werch, 1989). Nevertheless, future research would be strengthened by including objective indices or collateral information on alcohol consumption. Also, our measure of physical activity was limited to a narrow range of activities with family or friends. Moreover, the social nature of the physical activity measure might have contributed to its association with longevity.

Further, as with most studies on wine and mortality, we were unable to differentiate between types of wine. However, Klatsky et al. (2003), who reported wine effects on reduced

mortality in a U.S. sample, noted that the risk reduction was nearly identical for red and white wine. We also did not have information on whether individuals were engaged in hazardous patterns of drinking, which may differ for wine and other alcoholic beverages (Grønbaek et al., 2000). In addition, our sample of older adults is primarily White; thus, we do not know whether the present findings would generalize to a more ethnically diverse population of older adults. Also, although a unique strength of our study is the use of baseline information to predict 20-year mortality, we did not consider changes in alcohol consumption or covariates. Finally, total mortality is a global measure that reflects the interplay of many risk and protective factors, including regional beverage choice and drinking habits.

Several cautions are also appropriate in interpreting these findings. Although there appears to be a mortality advantage of moderate drinking of up to less than three drinks a day, consuming more than two drinks a day exceeds recommended alcohol consumption guidelines in the United States and is associated with increased falls (Mukamal et al., 2003), a higher risk of alcohol use problems (Moos et al., 2004, 2009), and potential adverse interactions with medications (Moore et al., 2006) in older adults. In addition, our results do not address or endorse initiation of drinking among nondrinkers. Some people should not consume alcohol, including those who cannot restrict their drinking to moderate levels, who have medical conditions that would be worsened by drinking alcohol, or who take medications that interact adversely with alcohol (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010).

In sum, we found that failure to control for confounding factors produced a spurious effect of a mortality advantage for older moderate drinkers who preferred wine compared with those who preferred other alcoholic beverages. Even among moderate drinkers, who have a general longevity advantage over abstainers, we identified sociodemographic, behavioral, and health status differences linked to both level of wine consumption and increased mortality. Controlling for these confounding factors eliminated the apparent beneficial mortality effect associated with level of wine consumption among moderate consumers of alcohol. These results were consistent with evidence that the mortality advantage for moderate drinkers compared with abstainers was consistent across level of wine consumption.

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