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Alcohol Consumption and Health Among Elders

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Purpose: This article estimates the effects of alcohol consumption on self-reported overall health status, injuries, heart problems, emergency room use, and hospitalizations among persons older than the age of 65. ***Design and Methods:*** We analyzed data from the first wave of the National Epidemiologic Survey on Alcohol and Related Conditions, a nationally representative study. We used multivariate regression and instrumental variables methods to study the associations between alcohol consumption (current drinking, binge drinking, and average number of drinks consumed) and several indicators of health status and health care utilization. ***Results:*** Alcohol consumption by women was associated with better self-perceived health status, improved cardiovascular health, and lower rates of hospitalizations. We detected no significant negative or positive associations for older men. ***Implications:*** These findings suggest that light to moderate alcohol use by older women may have beneficial health effects. Experimental trials, however, are needed to more rigorously assess the potential benefits of alcohol use by elders due to the inherent biases of observational studies.

Key Words: Alcohol consumption, Health care utilization, Self-perceived health status, Health benefits, Selection bias

In 2004, 35.3% of individuals older than the age of 65 reported having had one or more drinks in the past 30 days (Substance Abuse and Mental Health Services Administration [SAMHSA], 2005a). A comparison of the consumption patterns of older adults and those of younger individuals suggests that alcohol consumption decreases with age for a number of reasons (Moos, Brennan, Schutte, & Moos, 2005). (In this article, we use the term *older adults* to refer to individuals older than 65 years of age.) Life-long heavy drinkers may die earlier or be forced to stop drinking because of poor health (Moos et al., 2005). Even moderate drinkers may reduce their drinking or abstain because of harmful interactions of alcohol with health conditions or medications, or simply because they have fewer social opportunities to drink (Brennan & Moos, 1990; Moos et al., 2005). Some older adults, however, continue to drink heavily or even increase their consumption in response to lack of social support, health problems, and life transitions such as job loss or the death of a family member (Johnson, 2000; SAMHSA, 2005b). Drinking problems in older adults, who are more likely than younger populations to suffer from additional health problems, often go undetected or untreated by health care professionals (Johnson, 2000).

Moore and colleagues (2005) determined that the age-related decline in drinking was smaller in recent cohorts, perhaps because older adults today tend to be healthier and can continue to drink without any immediate adverse effects. If this is the case, as baby boomers age and older adults make up an increasing proportion of the population, the prevalence of alcohol consumption by older adults may increase as well. These demographic changes will place

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significant demands on the health care system and on Medicare. Consequently, experts must properly understand the expected health care needs and associated costs of this cohort to plan accordingly.

This study contributes to the health care planning process by evaluating the association between various measures of alcohol use among older adults and self-reported health status, injuries, heart problems, utilization of emergency room (ER) services, and hospitalizations. We analyzed data from the first wave of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a nationally representative data set with excellent measures for past and current alcohol use. The findings from this analysis have timely implications for health care management, public policy, and health promotion among elders.

Background

Research has demonstrated that moderate alcohol consumption can have positive health effects. Older adults who consume moderate levels of alcohol are at lower risk for cardiovascular disease (Abramson, Williams, Krumholz, & Vaccarino, 2001; Bryson et al., 2006; Klatsky, Armstrong, & Friedman, 1992), dementia (Coker et al., 2004; Mukamal, Kuller, & Fitzpatrick, 2003), ischemic stroke (Sacco et al., 1999), and mortality (Thun et al., 1997). Although the biological mechanisms for these relationships are not fully understood, a number of potential mechanisms support the apparent protective effect of alcohol on cardiovascular disease. Alcohol may decrease platelet aggregation, reduce rates of vascular smooth muscle proliferation and migration, and decrease inflammation involving monocytes and T lymphocytes (Abramson et al., 2001; Mann & Folts, 2004). Abnormalities in endothelial-mediated vascular function, which have been linked to reduced availability of nitrous oxide from endothelial cells, have been observed in patients with atherosclerosis. Experiments with isolated arterial rings demonstrated that flavonoids in red wine increased production of nitrous oxide in endothelial cells (Andriambeloson, Stoclet, & Andriantsitohaina, 1999). Demrow, Slane, and Folts (1995) suggested that two glasses of red wine significantly inhibit platelet activity and decrease rates of coronary thrombosis in animal models. Elevated low-density lipoprotein levels are a known risk factor for the development of coronary heart disease and may be partially related to production of free radicals. Alcoholic beverages, particularly those containing flavonoids, appear to protect low-density lipoproteins from oxidation (Rifici, Stephen, Schneider, & Khachadurian, 1999). Although several studies have highlighted the health benefits of wine, other types of alcoholic beverages also reduce the risk of heart failure (Abramson et al., 2001). Because atherosclerotic disease is a risk factor for dementia, the benefits of moderate alcohol use for the cardiovascular system may offer insight into why moderate drinkers may also be at lower risk for dementia (Mukamal et al., 2003). Older adults who drink moderately may also have more social interactions that are beneficial for cognitive functioning (Mukamal et al., 2003).

Heavy drinkers, however, have elevated risks of injuries, liver disease, cognitive changes, ischemic stroke, and behavioral problems (Beresford & Katsoyannis, 1995; Mukamal et al., 2005; Sacco et al., 1999; Thun et al., 1997), and both heavy and moderate drinkers alike face higher risks of certain types of cancers (Thun et al., 1997). Alcohol-related liver disease is associated with poor nutrition, comorbid infection with hepatitis C, and metabolic factors (Lieber et al., 2007). Cytochrome P450 2E1, one of the enzymes responsible for the metabolism of alcohol in the liver, has a very significant role in the generation of reactive oxygen species and can lead to oxidative stress in the tissues (Koop, 2006). Chronic excessive use of alcohol leads to induction of this enzyme in the liver and progressive liver damage. Chronic alcohol consumption also leads to oxidative stress and decreased mitochondrial reduced glutathione levels, a leading cause of mitochondrial damage (Fernandez-Checa, Garcia-Ruiz, Ookhtens, & Kaplowitz, 1991). The etiological factor behind the higher risk of throat, liver, colon, and breast cancers in heavy drinkers is not clear but may be related to comorbid factors such as tobacco use, environmental toxins, and alcohol metabolism. Acetaldehyde, the first and most toxic metabolite of alcohol metabolism, causes cancer in experimental animals and reacts with DNA to form cancer-promoting compounds. Certain variants of genes in some individuals may result in elevated acetaldehyde levels, contributing to an increased risk of certain cancers (Seitz & Becker, 2007).

Older adults are especially sensitive to the effects of alcohol as a result of the physiological changes associated with aging and a high prevalence of adverse health conditions (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 1998; O'Connell, Chin, Cunningham, & Lawlor, 2003; Pozzato et al., 1995). Older adults also experience higher blood alcohol concentration for a given amount of alcohol than younger adults due to changes in body mass that evolve with age (Lucey, Hill, Young, Demo-Dananberg, & Beresford, 1999; Rigler, 2000). Older adults with alcohol-related disease have a higher risk of fracturing a hip than those without alcohol-related disease, largely due to the increased risk of falling while intoxicated and the lower bone density found in older adults with alcoholism (Bikle, Stesin, Halloran, Steinbach, & Recker, 1993; Yuan et al., 2001). Gastrointestinal disease, liver disease, cognitive impairment, and sleep problems are also reported more frequently by older adults with alcohol disorders than by those without (Onen et al., 2005; Rigler, 2000; Thomas &

Rockwood, 2001). In addition, alcohol may have a more pronounced effect on disease because of adverse interactions with medication. The average older adult takes between two and seven prescription medications daily (Beresford & Katsoyannis, 1995). Even in moderate amounts, alcohol can negatively interact with medications, potentially reducing their effectiveness and increasing the risk of harmful side effects (Beresford & Katsoyannis, 1995; Onder et al., 2002). Finally, alcohol misuse tends to co-occur with depressive disorders, contributing to higher suicide rates among older adults, particularly men (McKeown, Cuffe, & Schulz, 2006; SAMHSA, 2005b). For these reasons, the NIAAA (1995) has issued specific recommendations for older adults, defining low-risk drinking as a maximum of one drink daily.

Much of the literature relating alcohol use and health among elderly adults has focused on measures of functionality and well-being. Studies assessing self-reported health among older adults typically use measures based on the Short Form–36 (Blow et al., 2000; Bridevaux, Bradley, Bryson, McDonell, & Fihn, 2004; Friedmann et al., 1999), whereas those focusing on health limitations consider the ability to perform activities of daily living or instrumental activities of daily living (Friedmann et al., 1999; Moore, Endo, & Kallin Carter, 2003). Analyses using the Short Form–36 instrument have suggested that low-risk elderly drinkers achieve the highest levels of self-perceived health (Blow et al., 2000; Bridevaux et al., 2004), whereas elderly former problem drinkers generally have the poorest self-perceptions of health (Bridevaux et al., 2004; Friedmann et al., 1999). Blow and colleagues found that elderly abstainers had the poorest scores for physical health compared to low-risk and at-risk drinkers, possibly because people tend to stop drinking when they develop health problems. In addition, at-risk drinkers had poorer mental health functioning than low-risk drinkers (Blow et al., 2000). Binge and heavy drinking were significantly associated with instrumental activity of daily living impairment in a study of 161 adults older than the age of 60 recruited from internal medicine and primary care practices (Moore et al., 2003).

Fewer studies have evaluated the implications of alcohol use for health care utilization by older adults. Based on claims data for Medicare enrollees in 1989, Adams, Yuan, Barboriak, and Rimm (1993) estimated that the national prevalence of alcohol-related hospitalizations was 48.2 per 10,000 individuals. Rates were higher for men (54.7 per 10,000 individuals) than for women (14.8 per 10,000 individuals) and decreased with age. The high prevalence rates, which were comparable to hospitalization rates for myocardial infraction, demonstrated that alcohol was a significant contributor to morbidity and health care costs among older adults. Callahan and Tierney (1995) screened 3,954 patients older than the age of 60 at a primary care group practice. The likelihood of hospitalization and mortality were greater for patients with symptoms of alcoholism than for those without symptoms, but the number of hospitalization or ER visits, use of preventive care, and length of stay did not differ significantly between these groups. Rice and Duncan (1995) analyzed the 1990 Health Interview Survey, including only those respondents older than the age of 60 who reported having had at least 12 drinks in the past year and controlling for gender and health status. They found a negative association between alcohol consumption and physician visits. Findings from subsequent studies of the relationship between alcohol use and health care utilization have produced mixed results (Brennan, 2005; Reid et al., 2000).

When studying the effects of alcohol consumption on health outcomes and health services utilization, it is important to recognize that hereditary influences may play an important role in these relationships. Twin and adoption studies have demonstrated that the prevalence of alcohol disorders is significantly higher among close relatives of people with alcoholism than among the general population (Kendler, 2001; Knopik et al., 2004; Schuckit, 2000). The risk of alcoholism may be related to the transmission of genes that control how individuals metabolize and respond to alcohol (Schuckit, 2000). The Swedish Twin Registry Study is a unique registry that has followed cohorts since the early 1900s (Lichtenstein, Faire, Floderus, Svartengren, & Svedberg, 2002). Genetic risk factors accounted for 54% of the likelihood of being registered with Sweden's temperance boards for individuals with alcohol offenses, whereas family and environmental factors explained only 14% (Lichtenstein et al., 2002). Other twin studies have indicated that genetics also accounts for a large proportion of the variance in other health behaviors such as seeking treatment for alcoholism (41% of the variance; True et al., 1996). Researchers have recently begun to focus on the heritability of assessments of health-related quality-of-life measures and self-perceived health (Romeis et al., 2000, 2005). In their study of male–male twin pairs, Romeis and colleagues (2000) found that genetics accounts for more than a third of the variance of self-reported health. Finally, the presence of a specific genotype in some individuals may increase the risk of certain health outcomes associated with alcohol use (Mukamal et al., 2005).

How much alcohol can an elderly adult consume without incurring harmful health effects? At what point does drinking shift from being a protective to a risky behavior? Are the strict drinking guidelines for older adults published by the NIAAA reasonable? Research is needed to improve experts' understanding of the effects of alcohol consumption by elders on elders' health status and use of medical care. First, it is not clear from prior investigations that alcohol consumption has unique consequences among elders

as compared to younger populations. Second, many of the previous studies focusing on the association between alcohol consumption and health among older adults have been based on convenience samples of primary care or hospital patients and nursing home residents, who are not representative of older adults in the general population. Estimates from these analyses may be biased because the criterion for inclusion is participation in some form of medical treatment (Stock & Watson, 2002). Third, previous research on older adults has generally failed to consider the problem of self-selection into drinking. Moos and colleagues (2005) found that health problems among older adults were associated with increased abstinence, although those with more health burdens were also at greater risk of having drinking problems than were healthier older adults. If unhealthy individuals are less likely to drink than healthy people, then researchers are likely to see better health outcomes and lower health care utilization among drinkers. This selection effect, known also as the ''sick quitter'' hypothesis (Shaper, Wannamethee, & Walker, 1988), could be of particular significance for elders given that prevalence of disease increases with age.

Rather than testing a theory-driven hypothesis, this article seeks to shed light on the interactions of alcohol consumption and the health care needs of older adults in order to plan health services accordingly. We not only considered various distinctive outcomes (self-perceived health, likelihood of injuries, heart problems, ER visits, and hospitalizations) but also analyzed a number of alcohol use behaviors. Based on the existing literature, we expected older adults who drink moderately and adhere to the NIAAA guidelines to use less health care and have better health outcomes than heavy drinkers. Methodologically, we have improved on previous research by addressing specifically the problem of self-selection into drinking and by using a nationally representative data set including a substantial number of individuals older than 65.

Data

NESARC

The NESARC is a nationally representative survey developed to study prevalence rates and problems associated with the use and abuse of alcohol in the United States. The U.S. Census Bureau conducted the fieldwork for this survey for the NIAAA. The NESARC was designed as a longitudinal survey. Data collection for Wave 1 began in August 2001 and was completed by May 2002 through computer-assisted personal interviewing. The second wave, conducted in 2005, has yet to be released.

The target population of the NESARC is the civilian, noninstitutionalized population, aged 18 years and older, residing in the 50 states and the District of Columbia. The sampling frame of the NESARC sample for housing units is the Census 2000/2001 Supplementary Survey, a national survey of approximately 78,300 households per month conducted in 2000 and 2001 by the U.S. Census Bureau. The NESARC also includes a group quarters frame. The sampling frame for group quarters derives from the Census 2000 Group Quarters Inventory.

The NESARC sample resulted in a total of 43,093 completed interviews, including an oversample of non-Hispanic Black and Hispanic households. For the current analysis, we restricted the analysis to the population aged 65 or older and enrolled in Medicare but not participating in Medicaid. (We excluded Medicaid enrollees to make medical care decisions related to health insurance more homogeneous across observations.) These criteria produced a total of 6,861 observations consisting of 2,587 men and 4,274 women.

Measures

Health Status and Health Care Utilization.—We selected three measures of health status that prior studies have found to be associated with alcohol use: self-reported health, injuries, and heart problems. The self-perceived health measure was set to 1 if the respondent reported ''very good'' or ''excellent'' health status (from among five options that also included ''good,'' ''fair,'' and ''poor'') at the time of the interview. We chose this cutoff to dichotomize the variable because it was a natural interval in the distribution: 33% of the sample reported excellent or very good health, 31% good health, and 35% fair or poor health. A second variable indicated whether the respondent reported having suffered any injuries in the 12 months prior to the interview that had caused him or her to seek medical help or limit usual activities for more than half a day. The measure for heart problems was set to 1 if the respondent had experienced chest pain, rapid heartbeat, hardened arteries, heart attack, or other heart disease in the past 12 months.

We defined two dichotomous dependent variables—any visits to the ER and any hospitalizations during the past 12 months—on the available measures of health care utilization in the NESARC. The lack of information about other health care services, such as primary care, constitutes a limitation of our study. Previous studies of middle-aged populations have found that although alcohol use is positively associated with ER visits and inpatient health services, it is negatively related to outpatient services (Anzai et al., 2005; Cherpitel et al., 2006).

Alcohol Use.—We first categorized the sample broadly into current drinkers (consumed at least 12 drinks in the past year), former drinkers (consumed less than 12 drinks in the past year but more than 12

drinks in a single previous year[s]), and lifetime abstainers (never consumed 12 or more drinks in a single year). Among drinkers, we constructed a number of measures that could characterize different drinking patterns during the past 12 months. We initially defined more than 20 specifications that described alternative alcohol use behaviors based on measures of frequency and intensity of drinking, *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*) diagnosis, and type of ethanol consumption (wine, spirits, and others). We estimated preliminary multivariate regressions associating each alcohol use measure with the different health outcomes and controlling for a full set of sociodemographic and regional variables. We used the Bayesian Information Criterion (BIC) test (Schwarz, 1978) to select those specifications that achieved the best fit of the data. The BIC is a statistical criterion for model selection that increases with the residual sum of squares from the estimated model and with the number of free parameters to be estimated (the number of regressors in a linear regression). In other words, both unexplained variation in the dependent variable and the number of explanatory variables increase the value of the BIC. Between two models with the same number of explanatory variables, the model with the lower BIC is a better fit.

We selected three specifications based on fit. The first one categorized the data as follows: lifetime abstainers (reference category), former drinkers, current drinkers who had not had a binge-drinking episode in the past 12 months, and current drinkers with at least one binge-drinking episode in the past 12 months. We defined *binge drinking* as having five or more drinks in a single episode in the case of men or four or more drinks in the case of women. The second specification distinguished again among lifetime abstainers, former drinkers, and current drinkers and divided current drinkers into drinkers with no *DSM* diagnosis of abuse or dependence in the past 12 months and drinkers with a *DSM* diagnosis of abuse or dependence in that period. The variable indicating abuse or dependence was internally defined in the NESARC following *DSM–IV* (4th ed.) guidelines for the diagnosis of these conditions. Finally, the third selected specification divided the sample into former drinkers and lifetime abstainers and included a linear and quadratic effect for the average number of drinks in the past 12 months (the number of drinks and its square). This variable was constructed as the frequency of alcohol intake (number of days the individual had consumed alcohol in the past 12 months) times the intensity (average number of drinks consumed in each drinking episode in the past 12 months).

Control Variables.—All specifications controlled for demographics (race, age, marital status), socioeconomic status (education, household income, health insurance), region of residency, current and former smoking status, and whether there had been a death in the family in the past year. (Note that although all participants in the analysis were Medicare beneficiaries, some had complementary private insurance as well.) In addition, we controlled for state-specific indicators of health behaviors (rates of flu shots and exercise per capita), health expenditures, and economic conditions (unemployment rate), because both alcohol consumption and use of health care services may be correlated with cultural attitudes and aggregate resources at the state level. Numerous studies have shown that drinking patterns, health status, and health care utilization differ significantly by gender (Robbins & Martin, 1993; Wilsnack, Vogeltanz, Wilsnack, & Harris, 2000). We therefore conducted the present analysis separately for men and women.

The main analysis did not control for preexisting serious health conditions because controlling for these conditions might have diluted the association between alcohol use and health care utilization. In a sensitivity analysis discussed later, we controlled for chronic health problems and mental health status.

Descriptive Statistics

Table 1 presents descriptive statistics for the alcohol use measures by gender. Approximately 37% of elderly women and 55% of elderly men were current drinkers in 2001. More than half of the nondrinking women were lifetime abstainers, whereas only a third of nondrinking men reported never having had a drink. On average, men drank alcohol 134 days of the year or around 2.5 days per week, whereas the average frequency for women was 87 days per year or 1.7 days per week. The average number of drinks per drinking day was 1.3 for women and 1.8 for men. Approximately 6% of women and 14% of men reported at least one binge-drinking episode in the previous 12 months. In terms of problematic drinking, 1.2% of elderly women and 4.8% of men were classified as having alcohol abuse or dependence according to the *DSM–IV* criterion. More than half of the female sample reported that wine was the drink they drank most, whereas men were more likely to report drinking beer or coolers. (*Coolers* are defined as wine, malt, or liquor-based coolers, or any prepackaged cocktails with alcohol and mixer already combined in the container.)

Table 2 shows the mean values for the dependent and explanatory variables by drinking status. Current drinkers in the NESARC were less likely to have health problems, used fewer health care services, and reported better health status than former drinkers and lifetime abstainers. For most of the health and health care variables in Table 1, former drinkers displayed the worst scores. Current

Table 1. Alcohol Consumption Among Elders

Variable	Women ($N = 4,274$)	Men ($N = 2,587$)
Drinking status		
Current drinker	0.368	0.547
Former drinker	0.275	0.312
Lifetime abstainer	0.357	0.142
Alcohol consumption among drinkers, past 12 months		
Frequency (no. of days drank)	86.6	134.2
Intensity (average no. of drinks per drinking day)	1.319	1.842
Average no. of drinks consumed daily (frequency × intensity/365)[a]	0.369	0.809
Prevalence of any binge drinking[b]	0.061	0.141
DSM–IV diagnosis of alcohol abuse and/or dependence	0.012	0.048
Wine drinkers (%)	0.544	0.298
Spirits drinkers (%)	0.241	0.221
Beer/coolers drinkers (%)	0.215	0.486
Alcohol consumption among former drinkers[c]		
Former heavy drinker (average daily no. of drinks > 2 if men, > 1 if women)	0.086	0.247
Former alcohol abuse and/or dependence	0.078	0.397
Other former drinkers	0.836	0.356

Notes: *DSM-IV = Diagnostic and Statistical Manual of Mental Disorders* (4th ed.).
[a]Computed as the sum of the product of frequency times intensity for each individual in the survey. The aggregate product need not be equal to the product of average frequency times average intensity.
[b]*Binge drinking* is defined as having five or more drinks in a single drinking episode for men, and having four or more drinks in a single episode for women.
[c]The categories here add up to 1.

drinkers were more likely to be White, married, college graduates, employed, and privately insured. They also were more likely to have higher incomes and to live in states with higher per capita alcohol consumption, per capita expenditures on health care, and rates of exercise in the population.

Methods

Multivariate Logistic Regressions

The primary equation of interest took the following form:

$$\Pr(Y_i = 1) = f(\alpha_0 + A_i'\alpha_1 + \alpha_2 F_i + X_i'\alpha_3), \quad (1)$$

where Y_i is one of the selected dichotomous outcomes representing health status or health care utilization; A_i is a set of variables indicating the respondent's current drinking pattern; F_i is an indicator for former drinking status among current abstainers; X_i is a vector of other covariates that accounted for the respondent's sociodemographics, household, and state characteristics; and the α_s are parameters to estimate.

As mentioned previously, we selected three specifications describing different alcohol consumption behaviors based on overall model fit according to the BIC. The first and second specifications sought to identify risky or problematic drinkers (the first one distinguishing binge drinkers from other drinkers and the second one identifying individuals with abuse or dependence). In the third specification, a continuous measure, average number of drinks per day, described alcohol use. To capture possible nonlinear effects in this specification, we added linear and quadratic terms to the model. This last specification allowed for the possibility of both positive and negative effects of alcohol use on health outcomes.

All of the initial specifications estimated the relationship between alcohol use and health status/health care use by using logistic regression. All regressions weighted observations using the sampling weights provided by the NESARC. (The NESARC-provided weights were the product of the NESARC base weight and other individual weighting factors. The base weight was the inverse of the probability of selection of a sample housing unit or housing unit equivalent for group quarters. Other weighting factors considered adjustment for households in which no information was obtained; adjustments for the oversampling of young adults within a household; and adjustment by region, age, gender, race, and ethnicity so that the final estimates agreed with independent estimates of the civilian noninstitutionalized population of the United States. Our analysis used the pweight command in Stata, which caused Stata to conduct the estimation using the sampling weight as the number of participants in the population that each observation represented. When working only with a subsample of the population, Stata automatically reconverted the weights to specify the number of participants in that subpopulation that each observation represented.) We corrected standard errors to account

Table 2. Mean Values for Dependent and Explanatory Variables, by Drinking Status

Variable	Women					Men				
	Full Sample	Lifetime Abstainer	Former Drinker	Current Drinker	p^a	Full Sample	Lifetime Abstainer	Former Drinker	Current Drinker	p^a
Dependent variables past year										
Self-perceived health Exc/VG	0.336	0.262	0.268	0.460	**	0.357	0.301	0.264	0.424	**
Any injury	0.141	0.128	0.139	0.154		0.114	0.111	0.109	0.118	
Any heart problem	0.261	0.282	0.314	0.202	**	0.250	0.232	0.298	0.227	**
Any ER visit	0.234	0.223	0.285	0.206	**	0.234	0.235	0.267	0.215	*
Any hospitalization	0.200	0.222	0.235	0.153	**	0.217	0.237	0.248	0.195	*
Controls										
Age	75.62	76.73	75.72	74.47	**	74.39	75.91	75.12	73.58	**
White	0.765	0.693	0.737	0.857	**	0.769	0.686	0.712	0.823	**
African American	0.149	0.193	0.202	0.066	**	0.130	0.172	0.191	0.085	**
Hispanic	0.086	0.115	0.060	0.078	**	0.101	0.142	0.097	0.093	*
Married	0.318	0.290	0.273	0.379	**	0.633	0.612	0.597	0.659	**
No high school graduation	0.287	0.384	0.340	0.153	**	0.292	0.358	0.402	0.213	**
High school graduate, no college	0.585	0.521	0.560	0.667	**	0.501	0.511	0.474	0.514	
College graduate	0.128	0.095	0.100	0.180	**	0.206	0.131	0.124	0.273	**
Employed	0.092	0.068	0.090	0.118	**	0.151	0.153	0.115	0.170	**
Household size	1.475	1.477	1.450	1.492	*	1.760	1.743	1.754	1.767	
Household income p/c (10,000)	1.817	1.461	1.692	2.256	**	2.569	2.710	1.983	2.867	**
Private health insurance	0.605	0.508	0.583	0.716	**	0.607	0.522	0.557	0.657	**
Central MSA	0.311	0.314	0.320	0.302		0.280	0.281	0.263	0.290	
Region: Midwest	0.221	0.193	0.258	0.221	**	0.224	0.194	0.226	0.231	
Region: South	0.385	0.517	0.349	0.285	**	0.372	0.473	0.416	0.321	**
Region: West	0.189	0.138	0.183	0.244	**	0.203	0.148	0.167	0.237	**
Region: East	0.204	0.153	0.210	0.250	**	0.201	0.186	0.191	0.211	
Current smoker	0.101	0.069	0.118	0.120	**	0.181	0.090	0.185	0.202	**
Former smoker	0.270	0.108	0.328	0.384	**	0.536	0.301	0.597	0.562	**
Family member died past 12 months	0.403	0.380	0.409	0.420		0.387	0.353	0.385	0.397	
State alcohol consumption p/c	2.179	2.121	2.180	2.233	**	2.204	2.131	2.172	2.241	**
State health care expenditure p/c	4,058	3,992	4,065	4,117	**	4,056	4,031	4,039	4,071	
State rate of unemployment (%)	3.995	3.991	3.967	4.020		3.998	3.982	4.004	3.999	
State rate of exercise (%)	72.28	71.43	72.49	72.96	**	72.41	72.02	72.09	72.68	**
State rate of flu shots (%)	30.26	30.26	30.31	30.23		30.23	30.01	30.30	30.25	

Notes: Exc/VG = excellent/very good; ER = emergency room; p/c = per capita; MSA = metropolitan statistical area.
[a]Kruskal–Wallis (1952) test of the hypothesis that lifetime abstainers, former drinkers, and current drinkers are from the same population.
*$p < .05$; **$p < .01$.

for the clustering of observations around states and adjusted them to account for unspecified heteroscedasticity.

Instrumental Variables (IV) Estimation

If elderly individuals choose to decrease or abstain from drinking as their health deteriorates, the estimates from simple multivariate regression may suffer from selection or endogeneity bias. Although alcohol consumption may have both positive and negative effects on health status and health care utilization, health status can also influence the likelihood of drinking and the amount of alcohol consumed. Failure to correct for the health status of the individuals prior to baseline may result in biased estimates for the drinking coefficients. In addition, as revealed in Table 2, drinking status is associated with higher socioeconomic status, which is positively related to health status and health care use. If empirical models do not completely account for socioeconomic indicators, then estimated associations between alcohol use and the dependent variables could actually be indicating an underlying relationship between alcohol use and socioeconomic status.

To address these potential problems, we reestimated the association between alcohol use and health status/health care utilization by using IV techniques. In the absence of a randomized controlled trial, the application of IV techniques simulates random assignment on the basis of one or more variables that are correlated with the endogenous or troublesome explanatory variable (viz., alcohol consumption in this case) but uncorrelated with the health status and health care utilization measures (Newhouse & McClellan, 1998). We chose to use an IV technique on the model measuring number of drinks per day and its square (Specification 3) because this model fit the data well and revealed more information about the relationship between alcohol use and

health status/health care utilization than the dichotomous measures of drinking. (We also conducted IV estimation on the dichotomous outcomes [using recursive bivariate probit models], and results were qualitatively similar to those identified in the continuous specification.) The IV estimation included the following equations:

$$A_i = h_1(Z_i, X_i) + \eta_{1i} \quad (2)$$

$$A_i^2 = h_2(Z_i, X_i) + \eta_{2i} \quad (3)$$

$$Y_i = \beta_0 + A_i^* \beta_1 + A_i^{*2} \beta_2 + F_i \beta_3 + X_i' \beta_4, \quad (4)$$

where Z_i is a vector of excluded IVs that identified the alcohol demand equations, A_i and A_i^2 are the average daily number of drinks consumed in the past year and its square, and A_i^* and A_i^{*2} are the predicted values of these measures from the first-stage reduced-form alcohol demand regressions. (When there are two endogenous variables [viz., alcohol consumption and its square], IV analysis requires at least two IVs for the identification of each endogenous measure in a first stage. The first stage in such a case consists of a prediction of the number of drinks and another prediction of the square of the number of drinks, each of which is conditional on the IVs available for identification and other covariates.) Equation 4 estimates the likelihood of being in a particular state of health or the probability of using a particular type of health care given the first-stage prediction of alcohol consumption.

We selected several IVs at the state level to address the potential endogeneity of drinking in the respondent's health status and health care utilization equations. IVs included a combination of alcohol and drug policies in 2000 (alcohol sales prohibited in gas stations, state bans on Sunday sales of alcohol, beer tax, merchandising prohibited in alcohol transactions, financial penalties for driving-under-the-influence violation, and penalties for consumption of cocaine) and other determinants of alcohol consumption at the state level, such as the ratio of wine and spirits to total alcohol consumption in the state, the state population density, and the average amount of precipitation by state in 2000. We used different IVs for the male and female samples to ensure the best fit and predictions possible. The Appendix shows sample statistics for the IVs.

State-level policies and other characteristics are commonly used IVs (Chatterji & Markowitz, 2001; French & Maclean, 2006). Alcohol policies are expected to influence alcohol consumption but are presumably uncorrelated with health events or individual decisions to use health care. Use of these instruments has occasionally been questioned due to the fact that governments use alcohol taxes to finance public expenditures, including health care. To account for this possibility, our analysis controlled for health care expenditure and unemployment rates by state. Others have criticized alcohol policy instruments because they may reflect state-level attitudes informed by individual perspectives on behavioral health (including alcohol use) and health care demand. To mitigate the confounding effect of this influence, we included state-level rates of flu shots, exercise, and alcohol consumption as controls. These corrections should enhance the validity of the instruments. Additional concerns regarding self-reported health status remain unresolved, given that this measure is more dependent upon personal beliefs and attitudes than the health care measures.

We conducted several tests to confirm the validity of the IVs. We used *F* tests to assess the predictive power of the instruments in the alcohol demand equations. We implemented the Hansen (1982) J test (a variation of the Sargan, 1958, test that corrects for the heteroscedasticity of the errors) to detect potential correlations between the IVs and the error terms in the main (health and health care) equation. We assessed the exogeneity of the alcohol use measures with a *C* test of orthogonality. All IVs used in the simultaneous-equation estimation achieved satisfactory levels of reliability and validity. Although IV estimation can correct for potential estimation biases, it is less efficient than single-equation procedures and may therefore fail to detect significant effects that would be identified with single-equation regression.

Results

Logistic Regression Results

Tables 3 (women) and 4 (men) display the results of the logistic regressions for the three alcohol use measures and the five health status/health care outcomes. Although all regressions adjusted for the explanatory variables listed in Table 2, to save space we report only the coefficient estimates for alcohol use.

Alcohol consumption by women was associated with better self-perceived health status and with lower use of health services (see Table 3). Relative to lifetime abstainers, female current drinkers were more likely to report excellent or very good overall health status, more likely to experience lower rates of heart problems, and less likely to be hospitalized. The positive effect of alcohol was even larger in magnitude among women who reported at least one binge episode in the 12 months prior to the interview, although a *t* test showed that the effect was not significantly different from that experienced by other current drinkers. Regardless of gender, we identified no adverse effects of alcohol for any of the alcohol measures or for any of the outcomes analyzed. Even in the case of women diagnosed with alcohol abuse and/or dependence, we found a protective effect of alcohol consumption on cardiovascular health.

According to the BIC, the nonlinear specification based on daily number of drinks and its square was

Table 3. Selected Estimation Results for Drinking Patterns With Measures of Health Status and Health Care Utilization (Women, $N = 4,150$)

Variable	Self-Perceived Health Exc/VG	Any Injury	Any Heart Problem	Any ER Visit	Any Hospitalization
Specification 1: Binge drinkers, other current drinkers, and former drinkers vs lifetime abstainers					
Current drinker, no binging	0.140** (0.019)	0.016 (0.017)	−0.085** (0.017)	−0.019 (0.016)	−0.069** (0.016)
Any binge episode past 12 months[a]	0.200** (0.055)	0.044 (0.046)	−0.124** (0.039)	0.031 (0.063)	−0.101** (0.031)
Former drinker	−0.003 (0.026)	0.002 (0.018)	0.008 (0.018)	0.041 (0.021)	0.002 (0.021)
Bayesian Information Criterion	5,318	3,569	4,839	4,611	4,116
Specification 2: Problematic drinkers, other current drinkers, and former drinkers vs lifetime abstainers					
Current drinker, no abuse/dependence	0.143** (0.018)	0.016 (0.017)	−0.089** (0.017)	−0.017 (0.016)	−0.074** (0.017)
Abuse/dependence past 12 months	0.060 (0.080)	0.076 (0.083)	−0.124** (0.043)	−0.006 (0.090)	0.012 (0.076)
Former drinker	−0.003 (0.026)	0.002 (0.018)	0.008 (0.018)	0.040* (0.020)	0.002 (0.021)
Bayesian Information Criterion	5,327	5,374	4,844	4,616	4,118
Specification 3: Nonlinear effect of alcohol consumption with lifetime abstainer as omitted category					
Average no. of drinks per day past 12 months[b]	0.247** (0.049)	−0.001 (0.020)	−0.113** (0.041)	−0.047* (0.024)	−0.076* (0.031
Average no. of drinks squared	−0.065** (0.019)	0.001 (0.005)	0.021* (0.010)	0.012** (0.006)	0.012* (0.006)
Former drinker	−0.053* (0.024)	−0.007 (0.012)	0.043** (0.015)	0.044* (0.019)	0.032 (0.021)
Joint significance of drinks (p)	(0.000)**	(0.989)	(0.021)*	(0.099)	(0.048)*
Inflection point (drinks per day)	1.9		2.7		3.2
Bayesian Information Criterion	5,307	3,557	4,839	4,593	4,108

Notes: Except where noted, data are b (SE). All specifications control for demographics, socioeconomic measures, and state-level indicators as indicated in Table 2. Exc/VG = excellent/very good; ER = emergency room.
[a]Binging for women is defined as having four or more drinks in a single drinking episode.
[b]Average number of drinks per day = frequency × intensity consumed in past 12 months/365.

the model that best fit the data. Results from this specification reinforced the findings described above. For women, alcohol use had an increasing protective effect on self-perceived health up to a rate of approximately two drinks, and consuming alcohol up to three drinks per day was associated with increasing levels of cardiovascular health and with lower rates of hospitalization (see Figure 1). After participants achieved the maximum protective effect at a range of two to three drinks, the benefits began to diminish with increasing alcohol consumption. Although the benefits actually turned negative when daily drinking exceeded a certain rate of heavy drinking, we do not report that value here because extrapolation would extend beyond the plausible range of our data. We detected no significant relationship between alcohol use by elderly women and injuries in any of the specifications. At 10% significance, moderate alcohol use (i.e., up to approximately two drinks per day) was associated with a decreasing probability of visiting an ER.

In all three specifications, female former drinkers were more likely to visit the ER than lifetime abstainers. This result suggests either that sick women are more likely to stop drinking or that a history of accumulated alcohol use has negatively affected their health. Female former drinkers were also more likely than lifetime abstainers and current drinkers to experience heart conditions and to have below-average self-reported health status, but this result was less robust to changes in specification.

Table 4 displays results for the male respondents. Very few associations between alcohol use and health status or health care utilization were statistically significant in the male sample, and none of these were robust to variations in model specification. A small number of the specifications suggested a protective effect of drinking for elderly men, and none of the results indicated adverse effects of alcohol use. We provide possible explanations for these results as well as the implications for health care professionals in ''Conclusion.''

Sensitivity Analysis: IV Regression

In this section, we report the results of our analysis to address self-selection into drinking through the use of IV regression. Table 5 compares the logit and IV estimations of Specification 3 for women, the best-fitting model according to the BIC. The C tests of orthogonality revealed that the alcohol use measures were correlated with the error terms in the equations analyzing self-reported health, injuries, and heart problems, suggesting potential selection biases in such cases. For these three outcomes, the IV results (which are bolded in Table 5) should provide more reliable estimates than the logit results. In the case of self-reported health status, IV estimates confirmed the concave relationship previously identified with the logit model. Alcohol use had an increasing effect on self-perceived health up to a threshold of 1.5 drinks per day and began

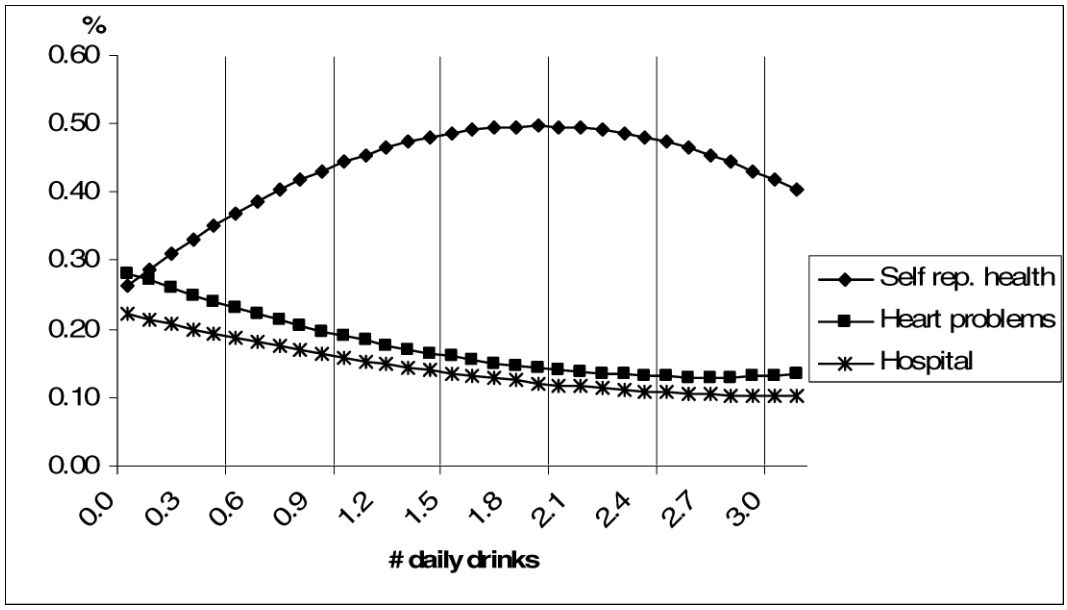

Figure 1. Nonlinear marginal effects of average daily number of drinks on selected health status/health care utilization measures for women: logit estimation. Self rep. health = self-perceived health.

decreasing thereafter. The only meaningful difference from the IV estimation relative to the logit estimation was an adverse effect of alcohol use on older women's probability of having an injury. (The linear and quadratic effects of an additional drink per day were jointly significant in the determination of the likelihood of an injury. The association was increasing in a range of up to three drinks per day and decreasing thereafter. The validity of the prediction for levels of consumption greater than three drinks per day must be taken with caution due to the few observations in the data that fell in that range [only 7]. IV estimates using only a first-order effect of alcohol use on injuries confirmed the findings from the quadratic specification; exogeneity was rejected at 5.6% significance, and the coefficient

Table 4. Selected Estimation Results for Drinking Patterns With Measures of Health Status and Health Care Utilization (Men, $N = 2,500$)

Variable	Self-Perceived Health Exc/VG	Any Injury	Any Heart Problem	Any ER Visit	Any Hospitalization
Specification 1: Binge drinkers, other current drinkers, and former drinkers vs lifetime abstainers					
Current drinker, no binging	0.056 (0.040)	0.016 (0.026)	−0.017 (0.034)	−0.047 (0.034)	−0.041 (0.032)
Any binge episode past 12 months[a]	0.036 (0.052)	−0.002 (0.029)	−0.027 (0.042)	−0.061 (0.040)	−0.061 (0.048)
Former drinker	−0.050 (0.038)	0.004 (0.030)	0.033 (0.037)	−0.022 (0.026)	−0.004 (0.032)
Bayesian Information Criterion	3,358	1,942	2,943	2,850	2,770
Specification 2: Problematic drinkers, other current drinkers, and former drinkers vs lifetime abstainers					
Current drinker, no abuse/dependence	0.053 (0.039)	0.016 (0.025)	−0.020 (0.034)	−0.049 (0.035)	−0.044 (0.035)
Abuse/dependence past 12 months	0.051 (0.083)	−0.042 (0.028)	0.041 (0.058)	−0.042 (0.048)	−0.027 (0.056)
Former drinker	−0.050 (0.038)	0.004 (0.030)	0.034 (0.037)	−0.021 (0.026)	−0.003 (0.032)
Bayesian Information Criterion	3,377	1,942	2,956	2,860	2,781
Specification 3: Nonlinear effect of alcohol consumption with lifetime abstainer as omitted category					
Average no. of drinks per day past 12 months[b]	0.048 (0.027)	−0.031* (0.012)	−0.016 (0.020)	−0.034* (0.016)	−0.033 (0.018)
Average no. of drinks squared	−0.007 (0.004)	0.003* (0.001)	−0.001 (0.004)	0.004 (0.002)	0.004 (0.003)
Former drinker	−0.072 (0.025)**	−0.020 (0.017)	0.036 (0.031)	0.003 (0.020)	0.016 (0.021)
Joint significance of drinks (p)	(0.207)	(0.033)*	(0.080)	(0.099)	(0.174)
Inflection point (drinks per day)		5.2			
Bayesian Information Criterion	3,347	1,934	2,937	2,841	2,763

Notes: Except where noted, data are b (*SE*). All specifications control for demographics, socioeconomic measures, and state-level indicators as indicated in Table 2. Exc/VG = excellent/very good; ER = emergency room.

[a]Binging for men is defined as having five or more drinks in a single drinking episode.

[b]Average number of drinks = frequency × intensity consumed in past 12 months/365.

Table 5. Nonlinear Association Between Number of Drinks Per Day and Health Status/Health Care Use for Older Women (Comparison Between Logit and IV Estimates)

Variable	Self-Perceived Health Exc/VG	Any Injury	Any Heart Problem	Any ER Visit	Any Hospitalization
			Logit estimation		
Average no. of drinks per day past 12 months	0.247** (0.049)	−0.001 (0.020)	−0.113** (0.041)	**−0.047* (0.024)**	**−0.076* (0.031)**
Average no. of drinks squared	−0.065** (0.019)	0.001 (0.005)	0.021* (0.010)	**0.012** (0.006)**	**0.012* (0.006)**
Joint significance (*p*)	(0.000)**	(0.967)	(0.022)**	**(0.109)**	**(0.035)***
Inflection point (drinks per day)	1.9		2.7		3.2
			IV estimation		
Average no. of drinks per day past 12 months	**1.781** (0.629)**	**0.678 (0.426)**	**−0.818 (0.621)**	−0.150 (0.498)	−0.404 (0.481)
Average no. of drinks squared	**−0.601 (0.336)**	**−0.114 (0.226)**	**0.597 (0.325)**	0.123 (0.303)	0.195 (0.238)
Joint significance (*p*)	**(0.004)****	**(0.039)***	**(0.160)**	(0.916)	(0.697)
Inflection point (drinks per day)	1.5	3.0			
			Tests supporting IV estimation		
F test for IV strength: Linear effect	11.75**	12.88**	12.64**	12.81**	12.79**
F test for IV strength: Quadratic effect	4.06**	4.65**	4.61**	4.62**	4.60**
Excl. restrictions (*p* Hansen J)	(0.954)	(0.438)	(0.955)	(0.114)	(0.747)
Independent equations (*p* C statistic)	(0.015)*	(0.089)	(0.032)*	(0.820)	(0.985)

Notes: Except where noted, data are *b* (*SE*). All regressions control for explanatory variables listed in Table 2. Instrumental variables include a combination of alcohol policies in 2000 (alcohol sales prohibited in pharmacies and gas stations, state bans on Sunday sales of alcohol, beer tax); the ratio of wine and spirits to total alcohol consumption in the state, jail penalties for consumption of cocaine; state population density; and average annual precipitation at the state level in 2000. Bolded results reflect the preferred estimates. IV estimates are bolded when results of C-statistic identified correlation between the alcohol measures and the error term in the second-stage regression. Logit estimates are bolded when exogeneity could not be rejected. IV = instrumental variable; Exc/VG = excellent/very good; ER = emergency room.

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

on "daily number of drinks" was positive and statistically significant at a level of 5%.) This finding suggests that logit estimates of the association between number of drinks and any injuries may have been biased by selection effects. We identified no significant IV effects of alcohol in the analysis of heart problems. Exogeneity of the alcohol measures could not be rejected for the health care utilization measures. This being the case, estimates for health care utilization produced through multivariate logit regression should be less biased and more efficient than those produced through IV techniques.

For men, we failed to reject the null hypothesis that the alcohol use measures were exogenous in all of the health status/health care use equations (see Table 6). We therefore have confidence in the reliability of the single-equation logit estimates, which are consistent under the hypothesis of no endogeneity and are more efficient than IVs.

Sensitivity Analysis: Inclusion of Controls for Health Conditions and Drinking Histories

To examine the stability of the findings, we reestimated the logit regressions relating alcohol use and health status/health care outcomes with different controls. First we added measures of historical patterns of drinking (number of years the individual experienced binge episodes and whether he or she had ever been diagnosed with alcohol abuse and/or dependence) to the demographic, socioeconomic, and state-level characteristics. Results remained qualitatively similar to those in Tables 3 and 4, although the magnitudes of the current drinking coefficients were slightly larger with the additional controls. Next we added to the core models dichotomous indicators for hypertension, liver problems, stomach problems, arthritis, and major depression and two scales for mental and physical health. Adding health controls did not alter the main results for the male sample. For women, the effects of being a current, non-problematic drinker on self-perceived health status, heart problems, and fewer hospitalizations were much smaller than before and sometimes not significant. Almost all of the significant effects for binge or problematic drinking disappeared except for a strong, protective effect of alcohol abuse and/or dependence on cardiovascular health. In addition, being a current, non-problematic drinker was now associated with a higher likelihood of suffering an injury. These analyses suggest that chronic health conditions and other health controls are related to drinking behavior, which can dampen

Table 6. Nonlinear Association Between Number of Drinks Per Day and Health Status/Health Care Use for Older Men (Comparison Between Logit and IV Estimates)

Variable	Self-Perceived Health Exc/VG	Any Injury	Any Heart Problem	Any ER Visit	Any Hospitalization
			Logit estimation		
Average no. of drinks per day past 12 months	**0.048 (0.027)**	**−0.031* (0.012)**	**−0.016 (0.020)**	**−0.034* (0.016)**	**−0.033 (0.018)**
Average no. of drinks squared	**−0.007 (0.004)**	**0.003* (0.001)**	**−0.001 (0.004)**	**0.004 (0.002)**	**0.004 (0.003)**
Joint significance (p)	**(0.120)**	**(0.041)***	**(0.022)***	**(0.100)**	**(0.190)**
Inflection point (drinks per day)		5.2			
			2SLS IV estimation		
Average no. of drinks 12 months	−0.780 (1.098)	−0.225 (0.334)	0.735 (0.544)	−0.170 (0.550)	0.049 (0.579)
Average no. of drinks 12 months squared	0.241 (0.265)	0.022 (0.067)	−0.151 (0.123)	0.043 (0.113)	0.003 (0.114)
Joint significance (p)	(0.507)	(0.473)	(0.385)	(0.901)	(0.857)
			Tests supporting IV estimation		
F test for IV strength: Linear effect	16.64**	14.97**	15.04**	14.81**	15.10**
F test for IV strength: Quadratic effect	5.61**	4.83**	4.87**	4.79**	4.83*
Excl. restrictions (p Hansen J)	(0.094)	(0.713)	(0.200)	(0.957)	(0.185)
Independent equations (p C statistic)	(0.121)	(0.503)	(0.461)	(0.832)	(0.708)

Notes: Except where noted, data are b (*SE*). All regressions control for explanatory variables listed in Table 2. Instrumental variables include a combination of alcohol policy variables for 2000 (i.e., state bans on Sunday sales of alcohol, merchandising prohibited in alcohol transactions at the state, and state penalties for driving-under-the-influence violation). Bolded results reflect the preferred estimates. IV estimates are bolded when results of *C*-statistic identified correlation between the alcohol measures and the error term in the second-stage regression. Logit estimates are bolded when exogeneity could not be rejected. IV = instrumental variable; Exc/VG = excellent/very good; ER = emergency room.

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

the positive associations between alcohol consumption and health status/health services utilization. However, it is important to point out that alcohol consumption was rarely negatively related to health outcomes, even with these additional controls.

Conclusion

This study reports new information on the relationships between various patterns of alcohol consumption and five health outcomes in older women and men. Prior observational studies have not been large enough to generate nationally representative associations for alcohol use and health status. We can summarize our analysis of the first wave of the NESARC into five primary findings. First, moderate alcohol use by older women was associated with a beneficial effect on overall health status, decreased hospitalization, and likelihood of heart disease. Second, alcohol use did not increase rates of ER use or hospital days in women or men. Third, unexpectedly, the presence of alcohol abuse or dependence did not increase health care utilization rates in older adults either. Fourth, there was a somewhat weak association between alcohol use and injury in women. And fifth, current drinkers were healthier than former drinkers.

Although the findings of this investigation generally coincide with those of studies of younger women (French & Zavala, 2007), the absence of any significant associations for men is surprising. Many young men and women report heavy episodic drinking in their early 20s prior to full-time employment, marriage, and family formation. With the exception of individuals who develop alcohol dependence, most adults significantly decrease their alcohol use with age, and many become abstinent. There is, however, a group of older adults who resume or initiate heavy alcohol use in their 50s and 60s. These varying patterns of consumption make it difficult to use point-in-time interviews with older adults to fully assess their alcohol use over the previous 40 to 50 years. One of the unique features of the NESARC data set is the categorization of alcohol use by current drinker, former drinker, or lifetime abstainer. It also collects detailed patterns of alcohol use over the past 12 months as well as symptoms of alcohol abuse and dependence. As a result, our study was able to at least partially control for some of these consumption patterns.

Our analysis suggests a modest positive health effect in elderly women who consume one to two drinks per day. The clinical implications support the current notion that it is acceptable to drink on a daily basis regardless of age as long as one does not exceed a threshold of two drinks. Nevertheless, these guidelines do not apply to all individuals (e.g., those with a genetic predisposition to problem drinking), and one should exercise caution in interpreting these results. A number of potential biases inherent in retrospective, self-reported observational studies temper any definitive statements that we can make about alcohol use and its potential health benefits. Rigorous experimental trials of low-dose alcohol use are critically needed to confirm the findings of this and other observational studies. Alcohol use by older

adults interacts in complex ways with a variety of cells, organ systems, and metabolic processes. The challenge of identifying a clear and causal link between alcohol and health status highlights the inherent weakness of observational studies.

Although these results are enlightening, we would advise clinicians to thoroughly evaluate the potential risks with their patients before recommending a modest amount of daily alcohol use for health promotion. Considerations include ongoing chronic illnesses that are likely to worsen with alcohol use (e.g., diabetes, lipid disorders), medication interactions, risk of fall or injuries in older adults who have problems with balance or arthritis, whether the patient lives alone, the social support of the patient's friends and family, and genetic issues such as familial problem drinking. Our study does suggest, however, that some women with no medical contraindications can use alcohol on a daily basis without serious sequelae or harm. The challenge for physicians is to carefully distinguish between those older patients who will benefit from daily alcohol use and those who could be harmed. This article provides some preliminary evidence on how best to make that distinction.

The primary statistical limitation of this research relates to the power of the IVs to detect causal effects. In particular, the IVs were rather weak in the case of men, and failure to detect significant effects of alcohol use in the IV estimation could have been tied to this problem. The analysis was also limited by the cross-sectional nature of the data and by the absence of measures of outpatient health care use in the NESARC.

This study has many strengths as well. The analysis employed a large, diverse, and nationally representative sample of older adults and included detailed information on current and past alcohol use and symptoms of alcohol abuse and dependence. The five primary outcomes selected for this analysis provided reliable and valid estimates of these measures. The analysis used state-of-the-art statistical procedures to estimate the associations between alcohol use, health status, and health care utilization.

The overall finding that light to moderate alcohol use by older adults does not appear to lead to greater utilization of health care services is timely and relevant for policy makers concerned with how to meet the health care needs of the aging baby boom generation. The benefits of moderate alcohol use also differ between older women and older men, and programs or recommendations should continue to take these gender differences into account. Given the important role of genetics in alcohol use, self-perceived health, and health care utilization, the relationships described here are complex, and risks may be higher for older adults with certain genotypes (Romeis et al., 2005). In future research, we intend to investigate these relationships further by using longitudinal data and a broader range of measures for alcohol use and health services utilization.

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Appendix

Variable	*M*	*SD*	Min	Max
Ratio of wine and spirits over total alcohol consumption	0.141	0.050	0.052	0.274
Maximum jail penalty for possession of cocaine (no. of years)	4.979	3.591	0.500	15.000
State population density per square mile (1,000)	208.249	161.778	1.000	816.000
Average annual precipitation (in)	36.778	14.957	3.940	70.930
Alcohol sales prohibited in gas stations	0.893	0.310	0.000	1.000
Bans on Sunday sales of alcohol	0.201	0.401	0.000	1.000
Merchandising prohibited in alcohol transactions	0.956	0.205	0.000	1.000
Beer tax ($ per gallon)	0.249	0.197	0.020	1.053
Maximum fine due for driving-under-the-influence violation ($)	1,497	1,383	300	5,625