Published in final edited form as:

Popul Res Policy Rev. 2013 June ; 32(3): 325–352. doi:10.1007/s11113-013-9268-7.

NONDRINKER MORTALITY RISK IN THE UNITED STATES

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Abstract

The literature has shown that people who do not drink alcohol are at greater risk for death than light to moderate drinkers, yet the reasons for this remain largely unexplained. We examine whether variation in people's *reasons* for nondrinking explains the increased mortality. Our data come from the 1988-2006 National Health Interview Survey Linked Mortality File (N= 41,076 individuals age 21 and above, of whom 10,421 died over the follow-up period). The results indicate that nondrinkers include several different groups that have unique mortality risks. Among abstainers and light drinkers the risk of mortality is the same as light drinkers for a subgroup who report that they do not drink because of their family upbringing, and moral/religious reasons. In contrast, the risk of mortality is higher than light drinkers for former drinkers who cite health problems or who report problematic drinking behaviors. Our findings address a notable gap in the literature and may inform social policies to reduce or prevent alcohol abuse, increase health, and lengthen life.

Keywords

alcohol; nondrinkers; abstainers; infrequent drinkers; mortality; survival; NHIS

Alcohol consumption is an important and extensively researched determinant of premature mortality in the United States. An estimated 85,000 deaths were attributed to alcohol consumption in the United States in 2000, a number that trailed deaths resulting from tobacco, physical inactivity, and poor diet, but was greater than deaths attributed to microbial agents, toxic agents, motor vehicle crashes, firearms, sexual behavior, and illicit drug use (Mokdad et al. 2004). Nondrinking is also associated with increased risks of death,

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although the reasons for this association are not fully understood. We examine heterogeneity in survival among nondrinkers based on their reasons for nondrinking, and then test multiple social and behavioral mechanisms that may explain the elevated risk of death among nondrinkers in a large nationally representative prospective data set of U.S. adults.

Alcohol consumption has a well-documented U-shaped relationship with mortality. The risk of death is lowest among light-to-moderate drinkers, slightly higher among abstainers and former drinkers, and much higher among heavy drinkers (Agarwal 2002; Pearl 1926). Several studies find that the lowest mortality risk occurs among current drinkers who consume on average one drink or less per day (Di Castelnuovo et al. 2006; Gmel et al. 2003). This U-shaped relationship suggests a perplexing question: why do nondrinkers have higher risks of death than light or moderate drinkers? If their elevated mortality results solely from not drinking, then public health policies and clinical guidelines could acknowledge the disadvantages of nondrinking and perhaps even recommend that nondrinkers begin drinking in moderation (in addition to suggesting that heavy drinkers curtail their excesses). Indeed, Doll and colleagues (1994:917) advocate that national guidelines should “not only stress the disadvantages in terms of total mortality of consistently exceeding the upper limit but also acknowledge the important health disadvantages, at least in middle or old age, of total abstinence.”

Nevertheless, public health and clinical groups rarely advise patients of the risks of nondrinking or recommend that they begin drinking. Their reticence may result in part because alcohol consumption is a nonessential part of a person's diet (Goldberg et al. 2001), and from the particular role that alcohol plays in the moral life of our society, as seen through the historical temperance movement and the prohibition of drinking by some religions, including Seventh Day Adventism, Mormonism, and Islam (Idler 2011). Even more importantly, many researchers remain skeptical that the benefits of alcohol consumption are as substantial as past studies have suggested (see Goldberg et al. 2001). Nondrinkers are a diverse group and differ in their attitudes toward drinking (Hilton 1986). They may also have heterogeneous mortality experiences based on their social circumstances and broader health behavior patterns—factors that past research has inadequately conceptualized and modeled.

Nondrinkers and the Risk of Death

Two hypotheses frame research about why nondrinking might elevate risks of death. First, the *healthy drinker hypothesis* predicts that light drinkers will have the lowest mortality relative to nondrinkers and heavy drinkers, because moderate alcohol consumption biologically reduces the risk of death. This protective effect results primarily from lower risk of coronary heart disease, the major cause of death in the United States, and persists even after adjustments for age, sex, race, marital status, education, body mass index (BMI), and cigarette consumption (Agarwal 2002; Goldberg et al. 1994; Kloner and Rezkalla 2007; Mukamal et al. 2010; Murray et al. 2002; National Institute on Alcohol Abuse and Alcoholism [NIAAA] 2003). Light to moderate drinking may lower the risk of coronary heart disease by increasing levels of high-density lipoprotein (HDL) cholesterol (“good” cholesterol), and decreasing levels of low-density lipoprotein (LDL) cholesterol (“bad”

cholesterol), blood pressure, inflammation, platelet aggregation, and blood clotting (Agarwal 2002; NIAAA 2003).

Alcohol consumption can also reduce stress and anxiety, and provide relaxation, pleasure, and enjoyment, which can contribute to improved health and reduced risk of death (Agarwal 2002; Bonneux 2011; Grønbaek 2009; Krueger and Chang 2008; Krueger, Saint Onge, and Chang 2011). Although some studies have touted the special benefits of red wine, which contains higher levels of resveratrol, epidemiological studies find survival benefits for consuming any type of alcohol, including beer, wine, or spirits (Marmot 2001; Mukamal et al. 2003; Paganini-Hill et al. 2007). The health benefits of alcohol appear to persist across cultures and in various countries (Marmot 1984). Yet while light to moderate drinking protects against some health problems, it may exacerbate others. Light drinking has been shown to protect against heart disease, but it may also increase the risk of cancer (Klatsky 2001; Rehm et al. 2010).

Second, the *heterogeneous nondrinker* hypothesis acknowledges that nondrinkers are a diverse group and predicts that some subgroups of nondrinkers will have a mortality risk that is equal to or even lower than that of light drinkers, whereas other subgroups will have substantially elevated mortality risks. Taking into account the stated reasons why people do not drink should illuminate the heterogeneous mortality experiences among nondrinkers, relative to light or moderate drinkers.

The reasons nondrinkers give for not drinking can offer insight into prosocial motivations, underlying health concerns, or lack of access to important resources—all of which might account for the elevated risk of death. Some nondrinkers invoke the importance of family responsibilities, religious and moral beliefs, or desires to control weight. Many adults who avoid drinking because of their upbringing or religion acquired their motives early in life, may have little to no exposure to alcohol consumption among family members, relatives, and friends, and may hold solid, consistent, and strongly-held views about alcohol abstinence (Epler et al. 2009). Moreover, prosocial reasons often imply membership in institutions (e.g., family, religion) that have been linked to better health and healthier behaviors (Broman 1993), and lower risks of death (Hummer et al. 1999; Rogers, Hummer, and Nam 2000; Waite 2006).

Other individuals cite personal problems with drinking, an inability to control drinking, or having a family member who is a problem drinker. Adults with family histories of alcohol problems are more likely to state that the reasons they abstain or drink infrequently is because they do not want to lose control, or they are concerned about becoming a problem drinker (Epler et al. 2009). These reasons define a group that would be ill-advised to begin drinking, even moderately, but may have elevated mortality even if they are currently nondrinkers.

A strong and pervasive reason for not drinking is that some individuals dislike the taste of alcohol. The taste for alcohol can be affected by social, psychological, physiological, and genetic factors. Investigators have demonstrated that 6-n-propylthiouracil (PROP) is a chemical marker for genetic differences in taste, with higher reports of bitterness associated

with lower levels of alcohol consumption. Individuals who find PROP bitter are more likely to taste bitterness in some types of beer, red wines, and ethanol; experience greater irritation and burn and fewer positive sensations (such as sweetness) from ethanol; dislike the taste; and therefore avoid drinking or reduce their consumption of alcohol. Additionally, individuals with higher numbers of fungiform papilla, which are located on the tip of the tongue and that can distinguish five tastes including bitterness, consumed less alcohol (Duffy et al. 2004a; Duffy, Peterson, and Bartoshuk 2004b). Of course, individuals who live in families and communities that abstain from drinking may never have an occasion to try alcohol and therefore would not have any basis for liking or disliking its taste. Finally, some nondrinkers cannot afford to drink.

Drinking history also offers important context for understanding the reasons that individuals give for not drinking. Some former drinkers who currently avoid drinking may have quit drinking because of health or social problems that resulted from their drinking, and their history of problems may drive their elevated risks of death (Bonneux 2011; Chikritzhs, Fillmore, and Stockwell 2009; Shaper et al. 1988; Shaper 1990; Fillmore et al. 2006; Liao et al. 2000). Some former drinkers who avoid drinking for moral or religious reasons may also report concerns over health or problem drinking, and may have sought out religious beliefs or communities to cope with their drinking. In fact, religious ideals are central to Alcoholics Anonymous programs (Michalak, Trocki, and Bond 2007). In contrast, lifetime abstainers who report that they avoid drinking for moral or religious reasons may participate in religious communities that discourage drinking.

Confounders of the Relationship between Nondrinking and Mortality

When evaluating our hypotheses, our models will take into account the potential confounders of health lifestyles, social characteristics, and drinking history. Health lifestyle theories suggest that individuals practice organized patterns of behaviors (Cockerham 2005). In other words, individuals do not decide to drink independently of their choices about smoking or other health behaviors. Studies that fail to adjust for other lifestyle characteristics may provide biased estimates of the relationship between alcohol consumption and mortality. We focus on smoking, body mass (an indicator of overweight or obesity that is correlated with nutritional and exercise practices), and general health.

Smoking and alcohol consumption are correlated because they are both addictive, share common meanings about relaxation and socializing, and emerge early in the life course (Donovan, Jessor, and Costa 1993). Many lifetime abstainers are never smokers (Fuller 2011). Current and former smokers are more likely to drink to excess and less likely to abstain, and the amount one drinks and smokes are correlated (Bien and Burge 1990; Dawson 2000b; Kozlowski and Ferrence 1990). Smokers are ten times more likely to be alcoholic than nonsmokers, and alcoholics are less likely to successfully quit smoking, and these effects persist beyond socioeconomic status and gender (DiFranza and Guerrero 1990). Because both drinking and smoking have established relationships with mortality (Krueger and Chang 2008; Krueger et al. 2011), it is important to control for smoking to distinguish the effects of alcohol consumption.

Body mass and, by implication, diet and exercise, are correlated with alcohol consumption. Alcohol can contribute to weight gain, and some individuals may refrain from drinking as a way to control their weight. Drinking to excess is correlated with poor diet quality and weight gain (Breslow et al. 2006; Sayon-Orea et al. 2011). Blood alcohol levels are directly related to the amount of alcohol consumed and a person's body weight and composition (Kozłowski and Ferrence 1990). Compared to nondrinkers, drinkers are more physically active, and increases in physical activity are associated with increases in alcohol consumption (Piazza-Gardner and Barry 2012). Moreover, there are confounding factors that may be associated with both higher body weight and heavier drinking, such as smoking (Williamson et al. 1987). Though the causal relationship between body mass and alcohol consumption is not clear (French et al. 2010; Sayon-Orea et al. 2011), both are associated with mortality, so it is important to adjust for body mass in our study (see Berrington de Gonzalez et al. 2010).

Alcohol consumption is also associated with general health status. Alcohol consumption can worsen some illnesses and interfere with help-seeking behaviors and treatment processes, some prescription drugs cannot be taken with alcohol, and some medications interact with alcohol to reduce the drug's therapeutic benefits and increase its adverse effects (Agarwal 2002; Costanzo et al. 2010; Rehm et al. 2010). Furthermore, some individuals reduce their level of consumption or quit drinking altogether because of health problems (Kerr et al. 2011; Sempos et al. 2003). Thus, "sick-quitters" may experience higher mortality risk because of their preexisting health conditions (Grønbaek 2009; Shaper et al. 1988). To control for sick-quitters, we estimate models that parse the effects of drinking from the potentially confounding effects of underlying illnesses.

Social characteristics including marital status and socioeconomic status have strong links to mortality and are also correlated with drinking. Compared to individuals with lower socioeconomic status, individuals with higher socioeconomic status (measured by education and income) are more likely to drink, but to consume light-to-moderate rather than heavy amounts of alcohol (Hansel et al. 2010; Himes 2011; Hummer and Lariscy 2011). Lower status individuals are more likely to drink to excess (Cutler and Lleras-Muney 2010), binge drink, become addicted to alcohol, drink low-quality home-produced alcohol (McKee 1999), and drink such nonbeverage liquids as after-shave, mouthwash, and antifreeze that contain alcohol but are unsuitable for human consumption (Anderson et al. 2009; Murphy 2011; Rehm et al. 2009).

Strong social relations reduce mortality by providing social support and integration, and by regulating and constraining risky behaviors (Broman 1993; Umberson 1987, 1992). The married experience lower mortality than the unmarried, and are less likely to drink to excess (Miller-Tutzauer et al. 1991; Power et al. 1999). While some of this effect may be due to selection, there are also independent effects of marriage, as it appears that the role transition to being married moderates drinking. Furthermore, excessive drinking can lead to divorce, as alcohol consumption may prevent couples from being able to communicate effectively or reconcile disagreements (Keller et al. 2009).

DATA AND METHODS

Data

Our data come from the 1988 National Health Interview Survey Linked Mortality File (NHISLMF; NCHS 2010). The NHIS is “the principal source of information on the health of the U.S. population” (NCHS 2012, p. 1). It is based on a complex multistage sampling frame that provides nationally representative data on the noninstitutionalized U.S. population (Schiller et al. 2012). The 1988 NHIS features an Alcohol Supplement, which includes 43,809 adults aged 18 and over who responded to an extensive set of questions on past and current alcohol use, including abstention, infrequent, and former drinking. We limit the analyses to individuals with valid survival status and who are aged 21 and above to exclude illegal underage drinking, which reduces the sample to 41,722.¹ We further exclude 646 respondents who are neither current drinkers nor provide reasons for not drinking, resulting in a final analytic sample of 41,076 respondents.

In 2010, the National Center for Health Statistics linked the 1988 NHIS respondents to death certificates through the year 2006, or up to 19 years, to determine whether individuals died within or survived the follow-up period. Over this period, 10,421 adults of the analysis sample died. This data set is especially well-suited for our proposed project because it is large and nationally representative; boasts a detailed and extensive set of questions about alcohol consumption, including reasons for nondrinking; allows us to separate nondrinkers into lifetime abstainers, lifetime infrequent drinkers, and former drinkers; and includes a large number of deaths that permit all-cause and cause-specific analyses. It is theoretically and practically fortuitous to have a long follow-up period because there is a lagged effect between alcohol consumption and some causes of death, including heart disease and cancer (Rehm et al. 2010).

Alcohol Consumption and Abstention Variables

Like most studies, we rely on self-reported alcohol consumption, which studies generally find reliable and valid (Del Boca and Darkes 2003).² Our final sample includes 7,780 abstainers, 4,845 lifetime infrequent drinkers, 7,703 former drinkers, and 20,748 current drinkers. Following convention, we calculated alcohol volume (that is alcohol quantity, or drinks per day on the days that individuals drink, multiplied by frequency, or number of days individuals drink per year, and divided by 365.25 to obtain a per day measure) among current drinkers and coded them into those who drink less than 1 drink (referent), 1 to less than 2, 2 to less than 3, and 3 or more drinks per day on average (for similar coding, see Breslow and Graubard 2008).³ “One drink is defined as 12 fluid ounces of regular beer (5% alcohol), 5 fluid ounces of wine (12% alcohol), or 1.5 fluid ounces of 80 proof (40% alcohol) distilled spirits” (USDA and USDHHS 2010, page 21). We also include a category for respondents who are current drinkers but whose frequency or quantity is unknown.

¹Underage drinking can contribute to increased risk of death through a number of specific causes including alcohol poisonings and external causes (accidents, suicides, and homicides), may set the stage for abuse in later years, and may impart additional mortality risks because it is illegal. Thus, we distinguish underage drinkers from those who are of legal drinking age.

²Some studies show that individuals underreport their drinking on surveys (Chikritzhs et al. 2009). Underreporting that is minor and that does not change the drinking category to which respondents are assigned will not affect our hazard ratios. But, if current drinkers report that they are abstainers, infrequent drinkers, or former drinkers, then the hazard ratios for nondrinkers will be upwardly biased.

Abstainers are defined as never having had more than 12 drinks in their lives, whereas lifetime infrequent drinkers have never had more than 12 drinks in any one year. Former drinkers have had 12 drinks in a year but not in the preceding year, and current drinkers have had at least 12 drinks in the last year. The 1988 NHIS asked detailed questions about “any reason” and “the most important reason” that abstainers, lifetime infrequent drinkers, and former drinkers do not currently drink. The survey provided 14 response categories, including that the respondent had drinking problems (e.g., was an alcoholic, was concerned about becoming an alcoholic, or couldn't control his/her drinking), was sickened by drinking, had an alcoholic family member, did not drink for moral or religious reasons, considered drinking too expensive or fattening, didn't socialize much, had a responsibility to his/her family, disliked it, or didn't drink for health or medical reasons (see Appendix A for the complete list of response categories provided to the respondents).

Latent Class Analysis

Of the 14 possible reasons for abstention, respondents could endorse multiple items, although they were also asked to indicate a single reason that they considered the most important. The resulting very complex response patterns lead to concerns about multicollinearity when each reason is included separately in regression models. Further, the meaning of certain items (e.g., don't drink due to religious or moral reasons) might depend on the other items a respondent endorses (e.g., don't drink due to prior problems with drinking). Therefore, we use Latent Class Analysis (LCA) to identify different types of nondrinkers. LCA is an inductive statistical technique that attempts to find latent (or unobserved) groups in the population that generate patterns in the observed variables (Clogg 1995; Magidson and Vermunt 2004). Like factor analysis, LCA identifies latent patterns among observed variables. But whereas factor analysis identifies a continuous latent variable, LCA identifies a nominal latent variable that indicates a respondent's membership in a latent group according to patterns in the observed variables. Because the reasons for nondrinking may mean different things for lifetime abstainers, lifetime infrequent drinkers, and former drinkers, we estimate our LCA models separately for each of these three groups (see Muthén 2006).

We code each of the 14 reasons for not drinking as 0 for those who did not endorse the particular reason, 1 for those who endorsed a particular reason, or 2 for those who endorsed a particular reason *and* ranked it most important. LCA uses ordered logistic regression models to predict each reason, and searches for the group membership that best predicts patterns among the 14 reasons. We use Bayesian Information Criteria and Akaike Information Criteria to identify the number of classes that best explains observed patterns in the reason variables (Muthén and Muthén, 2010).

³Separate analyses (not shown) that compare drinking quantity and drinking frequency as separate measures find similar results to those presented herein. Further, some studies have demonstrated that occasional binge drinking (usually defined as drinking 5 or more drinks on at least one occasion) is associated with higher risks of death, even among regular lower volume light drinkers (Chikritzhs et al. 2009). But controlling for binge drinking had a negligible effect on our results (not shown), which is consistent with findings from other studies (Fuller 2011; Mukamal et al. 2010). For parsimony and to follow standard practice, we do not show these additional models.

Control Variables

Control variables include sex (with female as the referent),⁴ race/ethnicity (with non-Hispanic white as the referent), socioeconomic status (education and income), marital status (with married as the referent), cigarette smoking status (with never smoked as the referent), BMI, and region. Education is represented in years of education attained and income is logged to account for diminishing returns for survival for each incremental increase in income. We use BMI as a continuous indicator, and include a squared term to account for the nonlinear relationship between BMI and mortality. Region is also included, with categories of Midwest, South, West, and Northeast (the referent).

We use self-rated health (SRH) to assess the potential confounding effect of health status—that is, healthy individuals may be more likely to drink and sick individuals may be more likely to quit (Kerr et al. 2011; Sempos et al. 2003; Shaper et al. 1988). To consider and control for a possible confounding effect of health we present models that first include and then exclude respondents who were in poor health at baseline, which we define as those with “poor” or “fair” self-reported health. Models restricted to healthy respondents at baseline have a sample size of 35,261.⁵

Multiple Imputation of Missing Values

Because multiple imputation methods rely on weaker (i.e., more plausible) assumptions than more commonly used methods, including listwise deletion, we use the mi commands in Stata 11 to deal with missing data on our covariates (Allison 2002; StataCorp 2009). Imputations filled in missing data on income, education, marital status, smoking status, and BMI. Data were imputed for 5,187 respondents for income, 128 for education, 41 for marital status, 16 for smoking, and 565 for BMI. Our estimates were similar when using multiple imputed values or listwise deletion, but our standard errors were smaller when using multiple imputation, due to our larger sample size.

Overall and Cause-Specific Mortality

Cause-specific mortality may vary across groups of nondrinkers (Rehm et al. 2010). Our cause-specific analyses separately examine heart disease (I00-I09, I11, I13, I20-I151), malignant neoplasms [cancer] (C00-C97), chronic lower respiratory diseases (J40-J47), external causes, defined as intentional self-harm (suicide), assault (homicide), and accidents (V01-X59, Y85-Y86, *U03, X60-X84, Y87.0, *U01-*U02, X85-Y09, Y87.1),⁶ and all other

⁴We tested for but did not find improved model fit (based on the Bayesian Information Criterion) when including interactions between sex and the drinking/nondrinking statuses in the all-cause and cause-specific models. Because our results were substantively identical for men and women, we do not stratify our models by sex (for similar results, see Fuller 2011).

⁵Our results for those who were in good or better health at the time of the interview were similar to results for those who were free of activity limitations at the time of the interview (results not shown). We used SRH rather than activity limitation because SRH is a better global measure of health status (Jylhä 2011), and is consistent with other studies (Fuller 2011).

The data also include information on whether the respondent ever had such health conditions as hypertension, heart disease, diabetes, diseases of the liver, cancer, or alcoholism (Adams and Hardy 1989). But these individual health conditions do not add any additional insight in our full models after we exclude those in fair or poor SRH. In addition, exercise may be associated with drinking and mortality, but the 1988 survey does not provide information on physical activity. However, the inclusion of BMI and SRH should capture some of the influence of exercise on mortality.

⁶Codes U01-U03 are preceded by an asterisk to indicate that they vary from the *International Classification of Diseases* because they include suicides and homicides due to acts of terrorism (Miniño et al. 2011).

causes, using the most current classification of causes of death, the tenth revision of the *International Classification of Diseases* (Miniño et al. 2011; WHO 2007).

We expect that nondrinkers will exhibit higher mortality due to heart disease, because of the purported benefits of light alcohol consumption for the cardiovascular system, similar risks for most causes, including respiratory diseases, but slightly lower mortality risk from external causes and cancer. The carcinogenic properties of alcohol may contribute to a variety of cancers, including cancers of the oral cavity, larynx, esophagus, stomach, colon, and liver (Rehm et al. 2010). Alcohol can contribute to external causes of death such as automobile accidents, poisonings, falls, drownings, suicides, and homicides (Rehm et al. 2010).

The cause-specific analyses right-censor individuals when they survive the follow-up period or die of other causes. Of the 7,206 total deaths in the subsample of healthy individuals who were in good or better health at baseline, 2,285 were due to heart disease, 1,800 to cancer, 308 to chronic lower respiratory diseases, 325 to external causes, and 2,488 to other causes.

We examine alcohol consumption and mortality through Cox proportional hazards models that use age at interview as the time variable, because age is a fundamental force that drives the risk of death (Allison 1984; Korn, Graubard, and Midthune 1997). We follow individuals from the time of the interview until the date of death or the end of the follow-up period, and adjust our descriptive and multivariate results for NHIS sample weights and the complex sampling frame through the Stata 11 “svy” commands (StataCorp 2009).⁷

RESULTS

We performed latent class analyses on each of the three nondrinker categories. Three classes emerged for former drinkers, two for infrequent drinkers, and two for lifetime abstainers. Figure 1, Panel A plots the means of the 14 reasons for nondrinking for the two classes that emerged among lifetime abstainers. Higher values mean that more respondents endorsed the item as one of many reasons for not drinking (=1) or as the primary reason for not drinking (=2). Members of both classes strongly endorse the idea that they dislike the taste of alcohol. Members of the “family prosocial” class (solid line) are a minority of lifetime abstainers (N=1,048) and cite their upbringing and moral/religious reasons for not drinking, but also note concerns that they may be alcoholic, have a problem drinker in the family, find drinking sickening, and are concerned about their health.⁸ Collectively, the items suggest that the family prosocial group embraces religion, their upbringing, and family responsibility. The “prosocial” group (dashed line) is a substantially larger share of lifetime

⁷We use Cox proportional hazard models because they do not require us to make an assumption about the shape of the baseline hazard function. Separate tests (not shown) find that our drinking and nondrinking variables—our key predictors—meet the proportional hazards assumption. But control variables including black and other race, current smoking, widowed, never married, education, income, body mass, and Midwest region do not meet the proportional hazards assumption in our full model. As a result, the hazard ratios for those control variables represent the average effect of each covariate on mortality, across respondents’ age (Allison 1984). We follow the recommendation of the National Center for Health Statistics (2010) and adjust for the complex survey design employed by the NHIS, and include the sample weights to ensure our results are representative of the U.S. population. Separate analyses (not shown) that exclude the sample weights find results that are virtually identical to those shown herein.

⁸Although the labels we devise for the latent class categories are ultimately arbitrary, we sought to describe the underlying orientations that might drive the patterns of reasons for nondrinking that emerge in our LCA categories.

abstainers (N=6,732) and endorses their upbringing and religious/moral reasons at somewhat lower levels, but notes little concern that they are at risk of falling into problem drinking patterns themselves. In contrast to the family prosocial group, this group does not report family responsibility as a reason for not drinking.

Figure 1, Panel B shows the means of the 14 items for the two classes that emerge among lifetime infrequent drinkers. Similar to lifetime abstainers, lifetime infrequent drinkers persistently note that they dislike drinking. The solid line plots the means for “family prosocial” class that comprises a minority of infrequent drinkers (N=590) and shows a group that endorses a similar constellation of reasons as the group of the same name among lifetime abstainers. Members of the family prosocial class cite upbringing and religious/moral reasons for not drinking, but also endorse concerns about having a problem drinker in the family, health reasons, and being sickened by alcohol consumption at relatively high levels. The dashed line shows that the majority of infrequent drinkers (N=4,255) ardently dislike the taste of alcohol—their mean on the dislike variable is higher than for any other latent class identified—and do not strongly endorse other reasons for not drinking.

Figure 1, Panel C shows the means of the 14 items for the three classes that emerge among former drinkers. Across all three classes, former drinkers report that they dislike the taste of alcohol less often than lifetime abstainers or lifetime infrequent drinkers. The solid line plots the means for the “health concerns” class, the largest class of former drinkers (N=6,469), who do not drink largely out of concerns for their health and mention few other reasons, with the exception of disliking the taste of alcohol.

The dashed line plots the item means for members of the relatively smaller (N=997) “family problem drinker” class, and shows respondents may have a tendency toward problem drinking and avoid drinking because they might be alcoholic, have a problem drinker in the family, find drinking sickening, and have health concerns. However, family problem drinkers also invoke family responsibility, upbringing, and religious/moral reasons for not drinking, suggesting that they use family and religion as means of coping with their own or their family's propensity toward problem drinking.

Finally, the dotted line shows the item means for members of the “problem drinker” class, the smallest group of former drinkers (N=237). Problem drinkers highly endorse reasons including their own alcoholism, concerns that they may be alcoholic, problems with drinking, inability to control their own drinking, responsibility to their family, and the cost of drinking as reasons for not drinking. Of all the classes examined, members of the problem drinker class are least likely to report that they dislike the taste of alcohol. Problem drinkers, as a group, clearly have a problematic relationship with alcohol.

Table 1 shows percentage distributions of drinking status by selected covariates. Males, whites, younger adults, current smokers, and never married or divorced/separated adults are more likely to be current drinkers than to be abstainers or infrequent drinkers. But former drinkers typically have characteristics that fall between those of current drinkers and abstainers or lifetime infrequent drinkers. For example, 12.7% of prosocial abstainers are current smokers, compared to 29.8% of former drinkers who note health concerns as their

reason for not drinking, and 32.0% of current drinkers who drink less than one drink per day. Further, higher levels of education, higher incomes, being normal weight or overweight, or living in the Northeast or the West are associated with a higher likelihood of being a current drinker rather than an abstainer or lifetime infrequent drinker.

Table 2 presents the relations between drinking status and the risk of death, adjusting for covariates. Panel A displays the reasons respondents provide for nondrinking. Panel B presents results for abstainers, infrequent drinkers, and former drinkers without reference to the reasons for nondrinking, and are presented to provide comparisons with previous studies. Thus, our discussion will focus on the results in Panel A.

We begin with a basic model that controls for sex and race/ethnicity, and then sequentially add covariates that might confound the relationship between nondrinking and mortality. Model 1 shows that compared to current light drinkers (those who consume less than 1 drink per day on average, the referent), family prosocial abstainers have similar mortality risk, other abstainers and infrequent drinkers have approximately 14% higher mortality risk, and former problem drinkers have 60% higher mortality risk over the follow-up period. Compared to current light drinkers, there is a near-monotonic relationship between mortality risk and numbers of drinks consumed, with 16% higher mortality risk for those who drink 1 to less than 2 drinks per day on average to 68% higher for those who drink 2 to less than 3 drinks, and an over twofold risk of death for those who drink 3 or more drinks per day over the follow-up period.

Model 2 shows that adjusting for smoking partially explains the elevated risks of death among current drinkers, but also results in apparently higher mortality for some nondrinkers. Thus, smoking suppresses the relationship between being an abstainer or a lifetime infrequent drinker and mortality, because smoking is highest among current drinkers and lowest among abstainers and lifetime infrequent drinkers (see Table 1). After accounting for the higher prevalence of never smokers among abstainers and infrequent drinkers, their risks of death, relative to light drinkers, appears larger in Model 2 than in Model 1.

Adjusting for marital status (Model 3), body mass (Model 6), or Census region (Model 7) does little to change the hazard ratios for nondrinkers. But adjusting for education (Model 4) and income (Model 5) modestly reduce the size of the hazard ratios for nondrinkers (compared to Model 2), and eliminates the statistical difference between light drinkers and family prosocial abstainers. Simultaneously controlling for all covariates in Model 8 further reduces the hazard ratios for the nondrinkers (compared to Model 2), and family prosocial abstainers and family prosocial infrequent drinkers are no longer significantly more likely to die than light drinkers.

To assess whether part of the association between drinking and mortality is due to health selectivity, we estimate Model 9 with a restricted sample that includes only those who were in good, very good, or excellent health at the time of the interview. This is a stringent test, as health at the time of interview may mediate rather than confound the relationship between nondrinking patterns and prospective mortality. Model 9 generally shows weaker relationships between nondrinkers and mortality than we observed in Model 8. Family

prosocial abstainers and family prosocial infrequent drinkers exhibit similar mortality risks as light drinkers in both Model 8 and Model 9. Model 9 also shows that the exclusion of the least healthy individuals at baseline results in a smaller hazard ratio for former drinkers who quit drinking due to health concerns, and explains the elevated risk of death among former drinkers who quit drinking because they were problem drinkers—results that are consistent with the sick-quitter hypothesis (Grønbaek 2009; Shaper et al. 1988).

Table 3 shows cause-specific mortality by drinking status, net of control variables and restricted to those who were in good or better health at the time of the interview.⁹ We focus on the results in Panel A that employ information about reasons for nondrinking. The results in Panel B are presented to facilitate comparisons with previous research.

As Panel A shows, compared to light drinkers, family prosocial abstainers do not have any statistically significant hazard ratios for any cause of death, except for cancer, where they have 34% lower risk of death over the follow-up period. Compared to light drinkers, prosocial abstainers have significantly lower risks of external causes of death, but have elevated risks of heart disease mortality. And compared to light drinkers, infrequent family prosocial and former drinkers who quit for health reasons exhibit higher heart disease mortality risk. The greater mortality risk for many causes of death among heavy drinkers stands out. Higher levels of alcohol consumption contributing to increasingly higher risks of death for mortality due to cancer; compared to light drinkers, those who drink 1 to less than 2 drinks per day on average have 34% higher risk, those who drink 2 to less than 3 drinks have 78% higher risk, and those who drink 3 or more drinks have almost 2-times the risk of death from cancer mortality, net of other covariates, over the follow-up period.

DISCUSSION

The commonly reported U-shaped relationship between alcohol consumption and mortality is an oversimplification. Among drinkers, there is a strong gradient: increasing alcohol consumption leads to concomitant increases in mortality risk (Britton and McKee 2000; Doll et al. 1994; Himes 2011; Rehm et al. 2007). But, in support of the heterogeneous nondrinker hypothesis, mortality risk varies across and within groups of nondrinkers. Family prosocial abstainers, family prosocial infrequent drinkers, and current light drinkers have similar risks of overall mortality in our final models.

The heterogeneous mortality experiences among nondrinkers also accounts for the elevated risks of death for former drinkers who quit drinking for health reasons (Grønbaek 2009; Shaper et al. 1988), because they have family members who have problematic drinking behaviors, or because they are problem drinkers. Thus, the nondrinkers who have the highest risks of death relative to light drinkers might have even higher risks of death if they resumed their drinking. Furthermore, some lifetime abstainers never drank because of previous problems with alcoholic family members, or due to religious and moral reasons and family

⁹Cause-specific analyses (not shown) for the full sample find similar results as those in Table 3 that include only those in good or better health. Models that use the full sample find more statistically significant results, both due to the larger sample size and because health may mediate the relationship between drinking status and mortality. However, the reduced risk for cancer mortality for family prosocial abstainers in Table 3 is not significant in the full sample.

upbringing. Healthcare professionals and policymakers should understand the diverse motives individuals hold for drinking or nondrinking, and provide individualized advice based on their health and drinking histories and social milieu (Anderson et al. 2009; Epler et al. 2009).

A high proportion of nondrinkers dislike the taste of alcohol. For many abstainers and infrequent drinkers, the distaste for alcohol may be a genetic predisposition, which makes alcohol taste unpleasant, bitter, and irritating, and elicits a burning sensation (Duffy et al. 2004a; et al. 2004b). Indeed, for one group of lifetime infrequent drinkers, dislike of the taste of drinking overwhelmed all other reasons for nondrinking. Former drinkers reported disliking the taste of alcohol far less often than abstainers or infrequent drinkers. In addition to genetic factors, there could be additional social, psychological, and physiological reasons to dislike the taste of alcohol, including changes in taste sensations with age, health conditions, and social relations. For example, we found subgroups of abstainers and infrequent drinkers who mentioned reasons for nondrinking that include religious and moral reasons, upbringing, family responsibility, family problem drinkers, and disliking the taste of alcohol. Those family prosocial nondrinkers may have had unpleasant social interactions surrounding alcohol or moral orientations that oppose alcohol, both of which might result in less enjoyment of the taste of alcohol.

Our finding of protective effects of light drinking is consistent with other research findings and with the mechanisms that should lower the risk of death, including ways to relax and to reduce hypertension and heart disease (Agarwal 2002; Ashley et al. 2000). But light drinkers are self-selected, and their risk of death is influenced in part by smoking status, education, and income. Adjusting for marital status, region, and BMI—a proxy for both nutrition and physical activity patterns (Piazza-Gardner and Barry 2012)—had almost no impact on the relationship between drinking and nondrinking behaviors and the risk of death.

Because smoking and drinking are interrelated (see also Bien and Burge 1990; Dawson 2000b; Sobell et al. 1990), it is crucial that studies that examine drinking control for smoking. Because risky behaviors often cluster (Cockerham 2005), one advantage of abstaining from drinking is that it can encourage individuals to engage in other healthy behaviors, including not smoking (compare Models 1 and 2 in Table 2).¹⁰ For example, compared to alcoholics who continued to smoke, those who had previously quit smoking were more likely to successfully quit drinking (Sobell et al. 1990). Because alcohol and tobacco consumption are two key forms of legal drug use in the United States (Kozlowski and Ferrence 1990), further research on the combined effects of these substances on morbidity and mortality risk is warranted.

Relatively low levels of education and income also partially explain the elevated mortality among nondrinkers. In addition, analyses restricted to individuals who were in good or

¹⁰We cannot parse out whether drinking and smoking are independent, which is what the hazard model assumes, or whether drinking precipitates or sustains smoking (see Kozlowski and Ferrence 1990). The mortality risk for current drinkers declines with controls for smoking (compare Models 1 and 2 in Table 2), which suggests that the mortality risk of current drinkers, including light drinkers, is overstated (if smoking and drinking are independent). On the other hand, if smoking triggers or encourages drinking, then controls for smoking may underestimate the true mortality effect of drinking. Notably, Table 1 shows that the highest rates of former smoking are among former drinkers, suggesting that adults may quit smoking and drinking at the same time or for similar reasons.

better health at the time of the interview dampen the hazard ratios of people in both abstainer groups, both infrequent drinker groups, and two of the three former drinker groups. Concerns about health or problem drinking behaviors may have led some nondrinkers to avoid alcohol, or, alternately, SRH may simply mediate the relationship between nondrinking statuses and the risk of death.

Our results also demonstrate heterogeneous mortality risks when examining detailed causes of death. Compared to light drinkers, family prosocial lifetime abstainers have similar mortality risk for most of the causes of death we examined but 34% lower risk from cancer mortality. Alcohol may provide some protection against heart disease mortality among light drinkers (Agarwal 2002; Mukamal et al. 2010; NIAAA 2003). But over time, risks of death from heart disease and cancer have converged, so that current age-adjusted rates are very similar (179.8 versus 173.6; NCHS 2011b), with a high likelihood that cancer will soon surpass heart disease as the major cause of death in the United States (NCHS 2011a). Thus, the lower risks of heart disease mortality from light alcohol consumption must be balanced against the greater potential risks of cancer mortality. There are multiple pathways to low risk of heart disease; light alcohol consumption is but one path. A similar low risk may be achieved among abstainers through other avenues, including healthy diets, regular exercise, strong social relations, and high socioeconomic status (Rogers and Crimmins 2011). Further research is warranted to further understand the association between drinking status and specific types of cancer mortality.

Perhaps most important, the oft-touted benefits of light alcohol consumption can easily vanish if consumption levels increase. Compared to light consumption, heavy consumption (3 or more drinks per day on average) contributes to 55% higher overall mortality risk over the follow-up period (Model 9, Table 2 as well as English et al. 1995; Ridolfo and Stevenson 2001) and to higher risk of mortality from cancer, external causes, and other residual causes (Table 3). Excessive drinkers have higher mortality risk than any other drinking-status group, though former drinkers who quit drinking for health reasons or who quit because they were problem drinkers also exhibit high risks (see Model 8, Table 2). Problem drinking contributes to problems at home, at work, and in the community, and vice versa (Schoenborn 1991). In instances where problem drinking results from other problems that have social origins, it may make sense to address problem drinking in tandem with work and family problems, and addiction to cigarettes.

The strengths of our analysis include a large, nationally representative sample of adults at baseline, detailed information on reasons for nondrinking, and a long follow-up period resulting in substantial numbers of all-cause and cause-specific deaths. Although some researchers demonstrate differential effects of alcohol consumption across age and sex (Agarwal 2002; Grønbaek 2009; Klatsky 2001; Thun et al. 1997), we did not find evidence that the relationship between alcohol consumption and the risk of death varied across ages (see Endnote 7) or by sex (see Endnote 4).

Three limitations of our analyses warrant discussion. First, we measure drinking status at one point in time, even though some individuals change their drinking status or their reasons for their drinking status over time (see Chikritzhs et al. 2009; Epler et al. 2009). Second, we

control for race/ethnicity, but due to small numbers of members of some race/ethnic groups across some categories of the alcohol consumption variables, we were unable to test for race/ethnic differences in the relationship between drinking and nondrinking statuses, and the risk of death. And last, we may not have controlled for other important covariates, such as religiosity and religious affiliation (Hummer et al. 1999; Nusbaumer 1981), which are not regularly included in the NHIS. We encourage researchers to build on our findings by collecting additional data, including rich covariates related to drinking status and mortality, and presenting results by detailed demographic subpopulations.

In summary, the risk that nondrinkers may miss slight potential benefits of drinking must be offset against the risk that light drinkers may increase their consumption levels and thus their overall and cause-specific mortality. Rose (2008) cautions that prevention strategies should consider both the middle and the extremes of distributions. At the population level, nudging abstainers and light drinkers to become light drinkers could reduce the number of drinking-related deaths, unless those individuals then go on to become heavier drinkers. Our results indicate that social policies aimed at reducing mortality can credibly point to the benefits of abstention. Substantial and diverse evidence demonstrates that many nondrinkers have quite positive mortality prospects, on par with those of light drinkers, if not better.

Acknowledgments

We thank the Eunice Kennedy Shriver NICHD-funded University of Colorado Population Center (grant R24 HD066613) for administrative and computing support; the National Center for Health Statistics (NCHS) for collecting the data and making the linked files available to the research public; and the anonymous reviewers for helpful comments and suggestions. Earlier versions of this manuscript were presented at the 2012 Population Association of America annual meetings in San Francisco, California, May 3-5, and to the Rice University Department of Sociology and Kinder Institute for Urban Research, and the University of Houston Center for Drug and Social Policy Research, September 21, 2011. The content of this manuscript is solely the responsibility of the authors and does not necessarily represent the official views of NIH, NICHD, or NCHS.

Appendix A

Response categories for any reason and primary reason for abstention, lifetime infrequency, or not having drank 12 drinks in the last year

Based on the previous responses, interviewers handed abstainers and infrequent drinkers a card before asking the reasons for not drinking (or not drinking very much, or not drinking in the previous year). First, the interviewer stated, "Please look at this list and tell me, what are your reasons for not drinking/not drinking very much/not drinking since (previous year)?" Once the interviewer obtained all of the responses, s/he asked "Of the reasons you have just told me, which of these is your MOST IMPORTANT reason for not drinking/not drinking very much/not drinking since previous year?" The reasons are listed verbatim below.

1. Don't socialize very much
2. Don't care for it or dislike it
3. Am an alcoholic
4. Thought I might become an alcoholic

5. Had problems with my drinking
6. Have a responsibility to my family
7. Family member an alcoholic or problem drinker
8. Medical or health reasons
9. Religious or moral reasons
10. Brought up not to drink
11. Makes me sick
12. Can't control my drinking
13. Costs too much or can't afford it
14. Dieting or too fattening
15. Other
16. DK

Source: NCHS 1989.

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Panel A: Types of Abstainers

Panel B: Types of Infrequent Drinkers

Figure 1.
 Means of Reasons for Abstaining, Infrequently Drinking, and Formerly Drinking, U.S.
 Adults Aged 21 and Above, 1988

Table 1
Percentage Distributions of Sample Covariates by Drinking Status, U.S. Adults Aged 21 and Above, 1988

Drinking Status	Abstainers			Infrequent Drinkers			Former Drinkers			Current Drinkers				
	Family	Prosocial	%	Family	Prosocial	%	Family	Problem	Health	Dislike	<1 drink per day	1 to <2 drinks per day	2 to <3 drinks per day	3 or more drinks per day
Sex	23.2		21.7	19.9		23.6	37.3		45.3		47.6	70.5	80.3	87.1
	Male		%	%		%	%		%		%	%	%	%
Race/Ethnicity	76.8		78.3	80.1		76.4	62.7		54.7		52.4	29.5	19.7	12.9
	Female		%	%		%	%		%		%	%	%	%
Age	73.0		62.4	74.1		69.0	78.3		71.9		80.8	85.0	87.2	84.3
	Non-Hispanic white		%	%		%	%		%		%	%	%	%
	18-24		15.0	10.0		12.8	6.6		9.8		7.9	7.3	5.8	8.5
	25-34		9.4	8.1		7.4	3.3		4.1		5.4	5.7	5.2	5.0
	35-44		5.2	0.7		2.0	0.5		0.8		1.1	0.5	0.8	0.8
	45-64		8.0	7.2		8.7	11.2		13.4		4.8	1.4	1.1	1.4
Smoking Status	46.5		38.7	56.5		41.6	60.9		44.2		66.8	64.7	61.4	60.5
	Never		%	%		%	%		%		%	%	%	%
	Former		23.8	25.4		28.3	25.9		29.9		22.2	23.7	27.7	28.7
	Current		37.5	18.1		30.1	13.2		25.9		11.0	11.6	10.8	10.7
Marital Status	82.7		77.3	62.5		56.7	38.9		35.6		41.7	27.7	20.7	17.1
	Married		%	%		%	%		%		%	%	%	%
	Widowed		10.0	14.6		20.5	33.1		34.6		26.3	29.9	27.8	21.4
	Divorced/separated		12.7	22.8		22.8	28.0		29.8		32.0	42.4	51.5	61.5
Education	58.4		50.6	65.9		55.1	69.6		61.8		58.6	52.6	50.9	51.2
	Married		%	%		%	%		%		%	%	%	%
	Widowed		25.1	9.3		19.5	6.9		13.0		5.7	4.7	5.6	5.0
	Divorced/separated		9.8	14.4		13.4	15.4		14.7		15.6	17.0	15.9	21.0
Never married	13.0		14.6	10.5		11.9	8.1		10.5		20.1	25.7	27.6	22.8
	Never married		%	%		%	%		%		%	%	%	%

Popul Res Policy Rep. Author manuscript; available in PMC 2014 July 1.

Notes: Adjusted for complex sampling frame. Other for race contains cases that reported race as missing. Percentages may not add exactly to 100% due to rounding. Source: 1988 National Health Interview Survey Alcohol Supplement Linked Mortality File

Table 2

Drinking Status and the Risk of Death (Hazard Ratios), U.S. Adults Aged 21 and Above, 1988-2006

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9 ^a
Panel A: Nondrinker Status and Reasons for Nondrinking									
Drinking Status (current drinker, <1 drink/day)									
Abstainers ^b									
Family prosocial	0.96	1.16 *	1.15 *	1.10	1.06	1.14 *	1.13 +	1.03	0.93
Prosocial	1.14 ***	1.32 ***	1.32 ***	1.25 ***	1.21 ***	1.31 ***	1.30 ***	1.17 ***	1.11 *
Infrequent Drinkers ^b									
Family prosocial	1.13	1.26 *	1.28 **	1.22 *	1.19 +	1.27 **	1.27 **	1.16	1.07
Dislike drinking	1.14 ***	1.22 ***	1.22 ***	1.17 ***	1.16 ***	1.21 ***	1.21 ***	1.14 ***	1.09 *
Former Drinkers ^b									
Health concerns	1.35 ***	1.35 ***	1.34 ***	1.30 ***	1.28 ***	1.34 ***	1.34 ***	1.26 ***	1.16 ***
Family problem drinker	1.29 ***	1.26 ***	1.28 ***	1.24 *	1.22 *	1.27 **	1.26 **	1.19 ***	1.21 ***
Problem drinker	1.60 **	1.46 **	1.45 **	1.40 *	1.40 *	1.45 **	1.44 **	1.38 *	1.14
Current Drinkers									
1 to less than 2 drinks per day	1.16 **	1.09 +	1.08	1.09	1.09 +	1.08	1.08	1.09 +	1.08
2 to less than 3 drinks per day	1.68 ***	1.49 ***	1.48 ***	1.48 ***	1.49 ***	1.48 ***	1.48 ***	1.49 ***	1.49 ***
3 or more drinks per day	2.08 ***	1.70 ***	1.66 ***	1.61 ***	1.60 ***	1.66 ***	1.66 ***	1.58 ***	1.55 ***
Unknown number or frequenc	1.43 ***	1.37 ***	1.34 ***	1.31 ***	1.31 ***	1.34 ***	1.34 ***	1.30 ***	1.20 *
Sex (male)	1.48 ***	1.45 ***	1.52 ***	1.50 ***	1.53 ***	1.52 ***	1.51 ***	1.52 ***	1.55 ***
Race/Ethnicity (non-Hispanic white)									
Non-Hispanic black	1.24 ***	1.19 ***	1.15 ***	1.08 *	1.06	1.13 **	1.14 **	1.02	1.06
Hispanic	0.90 +	0.89 *	0.88 *	0.81 ***	0.84 **	0.87 *	0.88 *	0.81 ***	0.81 **
Non-Hispanic Asian	0.55 **	0.56 **	0.56 **	0.54 **	0.57 **	0.57 **	0.58 **	0.57 **	0.68 +
Other	1.06	1.04	1.03	1.02	1.02	1.02	1.03	1.00	1.03
Smoking status (never smoked)									
Former		1.25 ***	1.26 ***	1.25 ***	1.25 ***	1.26 ***	1.26 ***	1.25 ***	1.20 ***
Current		2.17 ***	2.13 ***	2.10 ***	2.08 ***	2.14 ***	2.13 ***	2.07 ***	2.10 ***
Marital status (married)									
Widowed			1.19 ***	1.17 ***	1.07 *	1.18 ***	1.19 ***	1.07 *	1.09 **
Divorced/separated			1.31 ***	1.31 ***	1.17 ***	1.32 ***	1.32 ***	1.19 ***	1.25 ***
Never married			1.29 ***	1.31 ***	1.14 ***	1.29 ***	1.30 ***	1.18 ***	1.26 ***
Education				0.97 ***				0.99 ***	0.99 **
Logged Income					0.83 ***			0.85 ***	0.89 ***
BMI						0.99 +		0.98 *	0.99
BMI²						1.00 **		1.00 ***	1.00 **

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9 ^a
Panel A: Nondrinker Status and Reasons for Nondrinking									
Region (Northeast)									
Midwest							1.08 *	1.06 +	1.07
South							1.08 *	1.06 +	1.04
West							1.03	1.03	1.03
Panel B: Nondrinker Status^b									
Abstainers	1.12 **	1.30 ***	1.30 ***	1.23 ***	1.19 ***	1.29 ***	1.28 ***	1.16 ***	1.09 *
Infrequent Drinkers	1.14 ***	1.23 ***	1.22 ***	1.17 ***	1.16 ***	1.22 ***	1.22 ***	1.14 ***	1.09 *
Former Drinkers	1.35 ***	1.34 ***	1.34 ***	1.30 ***	1.28 ***	1.33 ***	1.33 ***	1.26 ***	1.17 ***

+ $p < .10$

Notes: referent is listed in parentheses. N=41,076 for Models 1-7.

Source: 1988 National Health Interview Survey Alcohol Supplement Linked Mortality File.

p < .001

**
p < .01

*
p < .05;

^aModel 9 is restricted to those who were in good, very good, or excellent health at the time of the interview (N=35,261).

^bHazard ratios in Panel B come from separate analyses that examine subgroups of nondrinkers, without reference to the reasons for nondrinking. All hazard ratios are compared to current drinkers drinking less than 1 drink per day (referent) and adjust for the same covariates as the corresponding models in Panel A.

Table 3

Hazard Ratios of Drinking Status by Cause of Death, U.S. Adults Aged 21 and Above and in Good or Better Health, 1988-2006

	Causes of Death					
	All cause	Heart	Cancer	Resp	External	Other
Panel A: Nondrinker Status and Reasons for Nondrinking						
Drinking Status (current drinker, <1 drink/day)						
Abstainers						
Family prosocial	0.93	1.04	0.66 *	0.34	0.97	1.06
Prosocial	1.11 *	1.27 **	1.03	1.09	0.70 +	1.08
Infrequent Drinkers						
Family prosocial	1.07	1.52 *	1.05	1.67	0.29	0.77
Dislike drinking	1.09 *	1.11	1.05	1.28	1.01	1.10
Former Drinkers						
Health reasons	1.16 ***	1.21 **	1.17 *	1.37 +	0.96	1.12 +
Family problem drinker	1.21 *	1.28	1.26	1.40	1.16	1.07
Problem drinker	1.14	1.64	0.97	0.76	0.46	1.12
Current Drinkers						
1 to less than 2 drinks per day	1.08	0.98	1.34 **	0.69	0.68	1.09
2 to less than 3 drinks per day	1.49 ***	1.32 +	1.78 ***	1.55	1.41	1.36 +
3 or more drinks per day	1.55 ***	1.13	1.96 ***	1.32	1.55 +	1.55 **
Unknown number or frequency	1.20 *	1.32 +	1.26	1.87	0.46	1.07
Sex (male)	1.55 ***	1.98 ***	1.32 ***	1.15	2.72 ***	1.36 ***
Race/Ethnicity (non-Hispanic white)						
Non-Hispanic black	1.06	0.99	1.20 *	0.55 +	0.82	1.14
Hispanic	0.81 **	0.68 **	0.84	0.45 +	0.81	0.96
Non-Hispanic Asian	0.68 +	0.79	0.79	omit	0.41	0.65 +
Other	1.03	1.07	1.10	1.15	0.65	0.99
Smoking status (never smoked)						
Former	1.20 ***	1.19 **	1.25 *	4.48 ***	1.19	1.06
Current	2.10 ***	1.79 ***	2.33 ***	12.30 ***	1.91 ***	1.79 ***
Marital status (married)						
Widowed	1.09 **	1.22 **	1.03	0.97	1.25	1.04
Divorced/separated	1.25 ***	1.29 ***	1.15	1.15	1.19	1.34 ***
Never married	1.26 ***	1.37 **	1.04	1.02	1.03	1.42 ***
Education	0.99 **	0.98 **	0.98 *	0.96 *	0.93 **	1.01
Logged Income	0.89 ***	0.91 *	0.90 **	0.86	0.76 ***	0.90 **
BMI	0.99	1.01	0.98 +	0.87 ***	0.98	1.00

		Causes of Death				
	All cause	Heart	Cancer	Resp	External	Other
Panel A: Nondrinker Status and Reasons for Nondrinking						
BMI ²	1.00 **	1.00	1.00 ***	1.00 ***	1.00 +	1.00 *
Region (Northeast)						
Midwest	1.07	0.95	1.10	1.19	1.85 ***	1.08
South	1.04	0.96	0.98	1.52 *	1.71 **	1.04
West	1.03	0.90	0.93	1.28	1.70 **	1.14 *
Panel B: Nondrinker Status ^a						
Abstainers	1.09 *	1.25 **	0.98	1.00	0.74	1.08
Infrequent Drinkers	1.09 *	1.144 +	1.051	1.30	0.93	1.991
Former Drinkers	1.17 ***	1.224 **	1.175 *	1.357 +	0.962	1.114 +

+ p < .10

Notes: Referent is listed in parentheses. N is 35,261 for all models.

p < .001

**
p < .01

*
p < .05

^a Hazard ratios in Panel B come from separate analyses that examine subgroups of nondrinkers, without reference to the reasons for nondrinking. All hazard ratios are compared to current drinkers drinking less than 1 drink per day (referent) and adjust for the same covariates as the corresponding models in Panel A. Source: 1988 National Health Interview Survey Alcohol Supplement Linked Mortality File.