

Effects of Alcohol Consumption on Disability among the Near Elderly: A Longitudinal Analysis

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THERE IS A LENGTHY HISTORICAL RECORD OF CONCERN about the impact of alcohol use on work patterns. In fact, the concern that excessive alcohol use would impair breadwinners' ability to provide adequate support for one's family was an important motivation underlying prohibition movements in the 19th-century United States and a reason for passage of the National Prohibition Act in the 20th century (Cherrington 1920; Krout 1925; Shipman 1940). In more recent years, given the increased public role in providing income support and medical coverage for disabled people, the issue of disability has taken on both efficiency and equity dimensions, as opposed to personal ethical dimensions.

Policy concerns about the relationship of excessive alcohol use to work disability illustrate the increasing emphasis on efficiency considerations (Scott 1992). In particular, there is widespread concern about the work-disincentive effects of public transfer programs for the disabled. During the 1990s, the U.S. Congress enacted two statutory changes affecting the coverage under income-transfer programs of people for whom manifestations of substance abuse were prominent. The Social Security Administrative Reform Act of 1994 placed restrictions on benefits for individuals for whom drug addiction and alcoholism (DAA) was

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material to the determination of eligibility for Social Security Disability Insurance (SSDI) and Supplemental Security Income (SSI) benefits. The restrictions limited the length of time such a person could be covered, and implemented treatment requirements as a prerequisite for benefits. Before the Social Security Administration could fully implement the 1994 Reform Act provisions, Congress passed the Contract with America Advancement Act of 1996, which required outright elimination of DAA as a basis for disability-benefit eligibility (Frisman and Rosenheck 1997; Kennedy 1999; Landry 1999; McKay, McClellan, Durell, et al. 1998). Since receipt of Medicare (under SSDI) and Medicaid (under SSI) is partially contingent on public disability-insurance coverage, public health-insurance coverage was also affected by these statutory changes in these income support programs (Swartz, Lugigio, and Goldstein 2000).

Our review of pertinent literature on the relationship between alcohol use, disability, and receipt of public income transfers revealed that there is relatively little empirical evidence on the topic. Given the lack of evidence, much of the argument for or against such statutory changes had to be conceptual, anecdotal, or ideological. More generally, we found very little information about the impact of high levels of alcohol use on disability and public-transfer receipt.

Using data from the first four waves of the Health and Retirement Study, spanning the years 1992 to 1998, we examined the effects of alcohol use on disability and income support for the disabled. We addressed these specific issues:

- How do different measures of disability compare with respect to the prevalence of measured disability in a near-elderly adult population?
- How often do transitions onto and off of disability occur among the near elderly?
- Holding other factors (including other health behaviors) constant, what was the cross-sectional association between heavy drinking and disability?
- From a longitudinal perspective, were heavy drinking and past problem drinking associated with the onset of disability for nondisabled people?

Answers to these questions are important. Although much is known about the potentially beneficial effects of moderate levels of alcohol

consumption on cardiovascular health, much less is known about the effects of alcohol consumption—especially heavy drinking and problem drinking—on other dimensions of health. Much disability first occurs after age 50 and before the traditional age of retirement, age 65. Disability represents a burden to the individuals involved, to their families, and to society more generally, in terms of reduced market productivity and increased demands for public assistance. At the same time, public concern about such demands has led to specific legislation designed to reduce the number of people with alcohol-related problems receiving public income support.

Our analysis sheds light on both the validity of the rationale for this legislation, and the extent to which it was successful in limiting SSDI/SSI receipt by heavy drinkers. In cross-sectional analysis, we examined whether heavy drinkers and problem drinkers were more likely than abstainers and moderate drinkers to be disabled and to rely on transfers from SSDI or SSI. In longitudinal analysis, we evaluated whether heavy drinkers were more or less likely to have experienced the onset of disability and SSDI/SSI receipt, and whether the 1996 policy changes have resulted in measurable changes.

The longitudinal feature of our data is a particular strength, as it enabled us to track the effect of drinking patterns measured at one point in time on subsequent receipt of SSDI or SSI. Although not perfect, having a panel makes it easier to infer causality from drinking to public-transfer receipt. In a single cross section, it is conceptually possible that income from transfer payments may be used to purchase alcoholic beverages. This is likely to have been a concern among proponents of legislation to restrict eligibility for such public transfers.

Alcohol Consumption, Disability, and Behavior

There is no one-to-one relationship between medical diagnoses and disability. For any given level of health or specific diagnosis, some people will be disabled and others will not (Verbrugge, Lepkowski, and Kontrol 1991; Verbrugge and Patrick 1995). Rather, disability depends on a much larger set of factors, including the setting and role in which the person worked before becoming disabled, accommodations made in the workplace for a person with a disabling physical or mental

impairment, and private and public sources of financial support contingent on whether the person works. Disability depends on a host of economic, sociological, and psychological factors in addition to underlying clinical conditions (e.g., Flippen and Tienda 2000).

The link between disability and a health behavior, such as excessive alcohol use, is even more subtle, because there are many potential pathways and because moderate drinking appears to have different effects from high levels of alcohol consumption (Mullahy and Sindelar 1993; 1996; 1998). Excessive consumption may reduce productivity in the workplace through complex mechanisms affecting cognitive, cardiac, and liver functioning (Heien 1996; Jones, Casswell, and Zhang 1995; Mullahy and Sindelar 1996; Harwood, Fountain, and Livermore 1998). High rates of use not only may directly affect a person's capacity to perform some tasks but also may exacerbate other underlying deficiencies (e.g., a learning disability) or make employers less willing to accommodate an employee's alcohol- and nonalcohol-related disability. Heavy drinking is also likely to reduce an individual's productivity in the household.

Excessive alcohol use may alter preferences between consumption of goods and consumption of leisure and therefore increase the likelihood of a person self-declaring disability (Becker 1996; Mullahy and Sindelar 1991). High alcohol use may be a marker for another unmeasured determinant of disability, such as other poor health habits, or even follow the onset of a disability. Excessive alcohol use may decrease or, under conditions of very high use, may increase access to health care providers, who in turn may facilitate access to sources of disability support. For example, a visit to an emergency room following an accident may lead to a search for methods to pay for the cost of treatment. High alcohol use may alter family dynamics and thus sources of financial support from family members. And availability of other sources of support, such as private employment-based disability coverage, may be related in part to an individual's alcohol consumption levels (Harwood, Fountain, and Livermore 1998).

Methods

The Health and Retirement Study (HRS) is a nationally representative sample of men and women born between 1931 and 1941 and their spouses or partners, who could be of any age (Juster and Suzman 1995).

At wave 1 (in 1992), 12,652 people from 7,607 households were asked detailed questions about labor-force participation, income and wealth, family structure, and health and health-relevant behaviors. The study also included detailed questions about respondents' alcohol consumption and the prevalence of disabilities or limitations. The HRS oversampled blacks, Hispanics, and residents of the state of Florida. As of 2001, four waves of the HRS (1992, 1994, 1996, and 1998) had been completed and released, at least in a preliminary form. We limited our study to people who were born between 1931 and 1941 ($N = 9,790$). At the baseline interview conducted in 1992, these individuals were at least 51 years of age; and by the end of the six-year follow-up period, the oldest person was 68.

The concept of disability is multifaceted. The number of people considered to be disabled plausibly depends on how the disability question is framed. We assessed the probability of disability based on two definitions. One was a broad definition of self-reported disability. The other referred to participation in transfer payment programs for disabled people.

1. *Any Kind of Limitation.* Respondents were considered to have a limitation if they answered "yes" to any of the following questions:

- Do you have any impairment or health problem that limits the kind or amount of paid work you can do?
- Does any impairment or health problem limit the kind or amount of work you can do around the house?
- Are you limited in any way in activities because of an impairment or problem?

This broad definition is particularly useful for the study's age group since it encompasses ability to work in household as well as employment settings. Thus, the measure is more neutral with respect to labor market participation than a measure based on being employed. At wave 1, 29 percent answered at least one of the questions affirmatively. The vast majority (71.1 percent) of respondents reporting any limitation answered affirmatively to the employment question, the first question above.

2. *SSDI/SSI Receipt.* Respondents who reported any permanent or recurring temporary impairment or health problem limiting the type or amount of paid work were asked whether or not they were currently receiving SSDI or SSI benefits, including any that were

ultimately approved after initial denial. Because of their strict eligibility restrictions, receipt of SSDI/SSI benefits allows for an analysis of a combination of a very narrow definition of disability (including the most severe types of disability) and a behavioral response to such disability—a decision on the part of a very disabled person to seek public assistance and a decision of a public agency to grant such assistance.

Six percent of respondents reported receiving SSDI or SSI benefits. Using additional questions in the income section of the HRS, we were able to distinguish between the two programs. Because of the low number of people who received SSDI or SSI, however, we analyzed these public programs together in this study.

At each wave, respondents were asked how much alcohol they consumed. In waves 1 (1992) and 2 (1994), respondents were asked questions about the number of drinks per day in five categories: zero, less than one, one to two, three to four, and five or more. In waves 3 (1996) and 4 (1998), respondents were asked separate questions about the number of days a week during which alcohol was consumed and, conditional on drinking on a particular day, how many drinks were consumed on average. We converted questions from each wave into a common format, in four mutually exclusive categories: zero, less than one, one to two, and three or more drinks per day.

On entry into the HRS, respondents were also asked about their past drinking history using the “CAGE” instrument for clinical assessment of alcohol disorders (Steinbauer, Cantor, Holzer, et al. 1998). The acronym *CAGE* reflects answers to four questions:

- Have you ever felt you should Cut (emphasis added) down on your drinking?
- Have people Annoyed you by criticizing your drinking?
- Have you ever felt bad or Guilty about your drinking?
- Have you ever had a drink first thing in the morning (*Eye-opener*) to steady your nerves or to get rid of a hangover?

Item responses are scored zero or one, with respondents' total scores ranging from a minimum of zero to a maximum of four. While the *CAGE* instrument does not provide a clinical (e.g., DSM-III-R) diagnosis of alcohol abuse or dependence (Grant, Harford, Chou, et al. 1991), it has been validated as an excellent clinical screening tool (Buchsbbaum, Buchanan, Centor, et al. 1991; Chan, Pristach, and Welte 1994; Girela,

Villanueva, Hernandez-Cuento, et al. 1994; Mayfield, McLeod, and Hall 1974; McIntosh, Leigh, and Baldwin 1994).

A recent review of screening methods for alcohol abuse and dependence found that the sensitivity of the CAGE screen in older populations ranged from 63 to 70 percent, and the specificity ranged from 82 to 91 percent, when a score of two or higher was used to define alcohol abuse or dependence (Fiellin, Reid, and O'Connor 2000). In these terms, the CAGE instrument compares well with other, generally lengthier screens for alcohol abuse and/or dependence, such as the Alcohol Use Disorders Test (AUDIT) and the Michigan Alcoholism Screening Test (MAST), suggesting that the CAGE screen is an appropriate indicator for alcohol problems among HRS respondents. To the extent that the CAGE screen is subject to measurement error, estimates of the disability effects of CAGE are likely to be lower-bound estimates of the true effect.

Our investigation into the effects of heavy alcohol consumption on disability was divided into two parts: a cross-sectional analysis of the association between current and past drinking behaviors and rates of disability, and a longitudinal analysis of the probability of two-year disability onset for nondisabled people. Although the primary strength of the HRS is in assessing life transitions, most of the people sampled who survived and were disabled at wave 4 (1998) were already disabled at wave 1 (1992). The cross-sectional analysis of disability at wave 4 allowed us to evaluate separately the effects of six-year-lagged heavy drinking (at wave 1), providing a more accurate picture of alcohol's role in the prevalence of disability.

For the cross-sectional analysis, based on data from wave 4, the dependent variables were the probability of having any limitation and the probability of transfer receipt. We measured current alcohol consumption with binary variables corresponding to the categories described above. A history of problem drinking was indicated by a binary variable for a CAGE score of two or more, and by its interactions with each of the current drinking categories. The model also included a binary variable for wave 1 heavy drinkers, which captured the effects of six-year-lagged heavy drinking on disability at wave 4. The reference group was composed of abstainers without a history of heavy or problem drinking.

Other covariates were smoking status (smoker, former smoker, never smoked), age, gender, race (white, nonwhite), ethnicity (Hispanic, non-Hispanic), education (less than high school education, college graduate [high school graduate was omitted]), marital status (married, unmarried),

and body-mass index (BMI; binary variables for <18.5, 25–29.9, 30–34.9, and 35+, with 18.5–24.9 [normal weight] the omitted reference group). We also included a binary variable in which 1 = respondent reported any of the following health conditions having ever been diagnosed by a physician: emotional or psychiatric problems, congestive heart failure, angina, chest pain, myocardial infarction, high blood pressure, stroke, chronic lung disease, arthritis, cancer, or diabetes.

In the analysis of SSDI/SSI receipt, we added two binary variables for ages 62–64 and 65+ in addition to the continuous age measure. After attaining age 62, individuals became eligible for Social Security retirement benefits. Therefore, they may have been more likely to rely on this source of support. Nevertheless, 20.3 percent of SSDI/SSI recipients who also reported a limitation at wave 4 were aged 65 and over.

We estimated the models by logistic regression. We calculated joint effects, and their statistical significance, for each combination of current drinking category and CAGE as the sum of the corresponding main effects and interactions; we calculated significance using the variance-covariance matrix of the estimates. We weighted our observations using the HRS sampling weights. The analysis accounted for error correlations among members of the same household.

In the longitudinal analysis, we assessed the probability that a person would become disabled or die within a two-year time interval (between two successive waves), given that the person was alive and not disabled at the beginning of the time interval. We measured all covariates, other than age, at the beginning of the respective two-year period, and the dependent variables and age at the end of this period. We used observations for waves 1, 2, and 3 for the explanatory variables, and waves 2, 3, and 4, respectively, for the dependent variables. In this specification, therefore, the drinking measures and other covariates always preceded the outcomes of interest. We measured age at the end of the two-year period, because the age at the interview date would have determined respondents' eligibility for Social Security retirement benefits. We used the same variables as in the cross-sectional analysis; however, we added two binary variables for observations of the dependent variable in waves 3 and 4, and a variable identifying wave 3 heavy drinkers. Wave 2 was the omitted reference group.

Each respondent was included in the sample up to three times (less frequently in the case of death or onset of disability prior to wave 4).

We weighted observations using HRS wave 1 person-level sampling weights. We estimated all longitudinal models as random-effects logistic regression models to account for repeat observations on the same individual. Presently, there is no estimation method that can account for the survey design as well as the panel structure of a longitudinal survey. It was more important to control for individual-level fixed effects and multiple observations on each individual than for error correlation within strata or primary sampling units, particularly since the former method also provides more accurate point estimates for the effects, at the cost of only a small understatement of the standard errors of the estimates.

The longitudinal estimation was done in two parts. The first part involved estimating the effects of drinking on mortality, with the probability of dying over the two-year period as the dependent variable. The second part consisted of estimating the effects of current and past alcohol consumption on disability for those who survived. For this purpose, three models were estimated: (1) onset of any limitation; (2) initiation of SSDI/SSI receipt; and (3), conditional upon onset of any limitations, initiation of SSDI/SSI receipt.

Results

Overview

The number of disabled people was highly dependent on the definition used (see table 1). Using the broader definition that included both work-related and home-related disabilities, 29 percent of people (all of whom were aged 51 to 62) reported having a disability at wave 1. Restricting the concept of disability to SSDI/SSI receipt, however, only 5.9 percent of people reported a disability at wave 1. The percentage of people reporting any limitation declined slightly between 1992 and 1998; however, the decline was more than offset by deaths occurring during this time period—that is, the number of people reporting no limitations declined between waves 1 and 4. While the percentage of people reporting SSDI/SSI receipt increased between waves 1 and 3, it dropped sharply between waves 3 and 4. Based on examination of table 1 alone, this may result from policy changes implemented after 1996 or from the transferring of respondents to Social Security retirement benefits

TABLE 1
Disabled Persons by Wave and Mortality by Wave 4

	Number and percentage of respondents reporting disability								Dead by wave 4	
	Wave 1		Wave 2		Wave 3		Wave 4		N	(%)
	N	(%)	N	(%)	N	(%)	N	(%)		
Any kind of limitation	2,906	(29.0)	2,892	(29.0)	2,785	(28.2)	2,716	(27.6)	332	(10.1)
Currently receiving SSDI or SSI	635	(5.9)	672	(6.4)	734	(7.1)	619	(5.9)	140	(19.7)
Currently receiving SSI	187	(1.6)	224	(1.9)	246	(2.3)	222	(2.0)	37	(17.8)
No limitation	6,884	(71.0)	6,718	(69.5)	6,618	(68.3)	6,490	(67.0)	252	(3.5)
Deaths	0	(0.0)	168	(1.5)	375	(3.5)	584	(5.4)		
Total	9,790	(100.0)	9,778	(100.0)	9,778	(100.0)	9,790	(100.0)		

Notes: Numbers in parentheses are weighted percentages; 12 people were lost to waves 2 and 3.

as they reached ages 62 to 65. We report further results on this issue below.

We found a correspondence between the breadth of the definition of disability at wave 1 (1992) and the probability of death between wave 1 and wave 4 (1998) (table 1). Mortality rates were higher for people who were disabled according to the narrower definition, supporting the notion that the more restrictive definition identified more severely health-impaired individuals, on average. Among people receiving SSDI/SSI at the 1992 interview, 19.7 percent had died by the fourth interview in 1998, a nearly identical rate as the subset of people who reported receiving SSI (17.8 percent). Of people with any limitations, 10.1 percent died, compared with 3.5 percent of those without any limitation.

There was appreciable movement onto and off disability over the six-year study period, irrespective of the measure used (not shown). For example, 71 percent of respondents had no limitation at wave 1 (using the less restrictive definition described above). Of these people, 13 percent developed a limitation by wave 2, and 0.4 percent died. Among the 87 percent who survived to wave 2 without a limitation, 10 percent developed a limitation by wave 3, 89 percent continued not to have a limitation, and 1 percent died. Almost 70 percent of people with a limitation at wave 1 also reported a limitation at wave 2. However, 30 percent were no longer limited. Clearly, for this broad definition of disability, a limitation was not necessarily an absorbing state.

Rates of disability at wave 4 were strongly associated with respondents' current drinking behavior and history of problem drinking as reported at wave 1 (see table 2). The relationship is complex, however, with problem drinking clearly leading to higher rates of disability, and the relationship between current drinking and disability being nonmonotonic. Moderate drinkers—those with current daily consumption levels of one to two drinks—were least likely report a limitation or SSDI/SSI receipt, whereas abstainers generally were most likely to be disabled using either definition. Problem drinkers had higher rates of any limitation and of SSDI/SSI receipt for all levels of wave 4 drinking. For the “any limitation” measure, the difference was statistically significant irrespective of the level of drinking. On average, problem drinkers were nearly 33 percent more likely to report any limitation, and more than 80 percent more likely to report SSDI or SSI receipt.

TABLE 2
Disability at Wave 4 by Current Alcohol Consumption and Lifetime Problem Drinking

Consumption category		No drinking problem	Drinking problem
0 Drinks/day	Number of respondents	3,565	536
	% reporting any kind of limitation	39.9 ^{ref,ref}	49.6 ^{***,ref}
	% reporting SSDI/SSI receipt	10.2 ^{ref,ref}	15.1 ^{***,ref}
0 < Drinks/day < 1	Number of respondents	2,685	287
	% reporting any kind of limitation	27.1 ^{ref,***}	40.8 ^{***,*}
	% reporting SSDI/SSI receipt	3.8 ^{ref,***}	14.6 ^{***,ns}
1–2 Drinks/day	Number of respondents	547	163
	% reporting any kind of limitation	20.3 ^{ref,***}	31.3 ^{***,**}
	% reporting SSDI/SSI receipt	3.1 ^{ref,***}	6.1 ^{ns,**}
3 + Drinks/day	Number of respondents	160	103
	% reporting any kind of limitation	28.8 ^{ref,**}	40.8 ^{*,ns}
	% reporting SSDI/SSI receipt	5.6 ^{ref,ns}	5.8 ^{ns,*}
All categories	Number of respondents	8,190	1,276
	% reporting any kind of limitation	28.3 ^{ref}	37.5 [*]
	% reporting SSDI/SSI receipt	6.0 ^{ref}	11.0 ^{**}

Notes: A drinking problem is defined as a CAGE score greater than or equal to two. All Categories includes missing values on wave 4 alcohol consumption. *, **, and *** denote significance at the 0.05, 0.01, and 0.001 levels, respectively. ns - denotes no significance. ref - denotes reference group. Asterisks before the comma denote significantly different disability rates compared with persons with a CAGE score of zero or one (horizontal comparison). Asterisks after the comma denote significantly different disability rates compared with abstainers with the same CAGE score (vertical comparison).

Logit Analysis of Disability at Wave 4

Among respondents without a history of problem drinking, drinkers were less likely to report any limitations or SSDI/SSI receipt than abstainers, regardless of their consumption levels, holding other factors constant (see table 3). The cross-sectional relationship between alcohol consumption and disability resembled the frequently observed U shape for both dependent variables, which is consistent with some protective effect of moderate alcohol consumption. Moderate drinkers generally had less than half the odds of disability that abstainers had.

The odds of reporting any limitation were always higher for problem drinkers than for non-problem drinkers, holding other covariates constant, including current consumption. SSDI/SSI receipt, by contrast, was 60 to 70 percent less likely among moderate and heavy drinkers with a drinking problem than among abstainers without a problem; however, only for moderate drinkers was the difference statistically significant.

In wave 4, both heavy and lifetime problem drinkers were *less* likely to receive public transfers than were abstainers without a problem, restricting the analysis of SSDI/SSI receipt to people reporting any limitations (panel C in table 3). Wave 4 drinkers without a history of problem drinking were only slightly more than half as likely, and moderate and heavy drinkers with a history of problem drinking were even less likely, to be on SSDI/SSI. Among respondents reporting any limitations, those with a history of problem drinking who reported consuming at least three drinks per day at the wave 4 interview were least likely to be receiving SSDI/SSI transfers—nearly 50 percent less likely than heavy drinkers without a problem drinking history and 70 percent less likely than abstainers.

The effects of heavy drinking at the wave 1 interview (six years before reporting disability) on the probability of disability at wave 4 were similar to the effects of problem drinking (see table 4). This finding confirms the validity of the CAGE instrument as a measure of problem drinking for HRS respondents. The two measures captured distinct but related aspects of the same underlying phenomenon. The CAGE-based variable measured drinking at ages prior to the HRS, and additional dimensions of *problem* drinking—especially an increased propensity of heavy drinking at times not captured by the HRS interviews. The heavy-drinking variable, by contrast, measured only heavy drinking at a specific point in time.

TABLE 3
Odds of Disability at Wave 4 by Alcohol Consumption at Wave 4 and Lifetime Problem Drinking

	0 Drinks	<1 Drinks	1–2 Drinks	3+ Drinks
A. Any kind of limitation ($N = 7,819$)				
Not problem drinker	1.00	0.64*** [0.57;0.73]	0.46*** [0.35;0.59]	0.57** [0.37;0.87]
Problem drinker	1.15 [0.93;1.44]	1.18 [0.89;1.58]	0.56** [0.37;0.85]	0.79 [0.49;1.28]
B. SSDI/SSI receipt ($N = 7,819$)				
Not problem drinker	1.00	0.46*** [0.35;0.60]	0.38** [0.22;0.68]	0.53 [0.23;1.19]
Problem drinker	0.94 [0.68;1.30]	1.41 [0.92;2.15]	0.34** [0.16;0.71]	0.39 [0.41;1.09]
C. SSD/SSI receipt given any limitation ($N = 2,694$)				
Not problem drinker	1.00	0.59*** [0.44;0.79]	0.64 [0.34;1.20]	0.57 [0.22;1.45]
Problem drinker	0.90 [0.63;1.29]	1.30 [0.79;2.14]	0.41* [0.18;0.95]	0.30 [0.09;1.04]

Notes: Estimates from logistic regressions with disability measures as dependent variables, controlling for age, gender, race, ethnicity, wave 1 heavy drinking, presence of a health condition, marital status, smoking, and bmi. Estimates for other covariates are displayed in Table 4. *, **, and *** denote significance at the 0.05, 0.01, and 0.001 levels, respectively.

TABLE 4
Effects of Other Covariates on Respondents' Odds of Disability at Wave 4

	Any limitation (Panel A)	SSDI/SSI receipt (Panel B)	SSDI/SSI receipt given any limitation (Panel C)
Wave 1 heavy drinker (3+ drinks/day)	1.21 [0.91;1.63]	1.06 [0.65;1.72]	0.82 [0.48;1.41]
Health condition	4.79*** [3.99;5.76]	7.57*** [4.50;12.75]	2.47** [1.40;4.36]
Smoker	1.58*** [1.35;1.85]	1.88*** [1.42;2.48]	1.63** [1.19;2.22]
Former smoker	1.32*** [1.15;1.50]	1.57*** [1.23;2.00]	1.43** [1.09;1.88]
Hispanic	0.90 [0.73;1.11]	0.83 [0.56;1.25]	0.84 [0.54;1.32]
White	1.17* [1.02;1.34]	0.81 [0.65;1.01]	0.72* [0.56;0.93]
Less than high school	1.58*** [1.39;1.80]	1.91*** [1.54;2.37]	1.49** [1.17;1.90]
College degree	0.87 [0.74;1.02]	0.51** [0.34;0.76]	0.58* [0.38;0.90]
Age (-57)	1.01 [0.99;1.02]		
Age 62-64		1.15 [0.92;1.43]	1.04 [0.82;1.34]
Age 65+		0.60*** [0.46;0.77]	0.48*** [0.36;0.65]
Male	1.04 [0.92;1.17]	1.35** [1.09;1.68]	1.37** [1.08;1.75]
Married	0.75*** [0.66;0.85]	0.43*** [0.35;0.53]	0.50*** [0.40;0.63]
BMI less than 18.5	2.13** [1.30;3.49]	1.62 [0.71;3.68]	1.09 [0.45;2.62]
BMI 25 to less than 30	1.05 [0.92;1.19]	0.95 [0.74;1.21]	0.90 [0.69;1.18]
BMI 30 to less than 35	1.31*** [1.12;1.54]	0.98 [0.73;1.32]	0.75 [0.55;1.04]
BMI greater or equal 35	2.51*** [2.00;3.15]	2.17*** [1.54;3.06]	1.33 [0.91;1.95]
N Total	7819	7819	2694
N Yes	2703	615	573

See notes for table 3. See table 3 for effects of current and problem drinking.

After controlling for current drinking as well as problem drinking, the odds of any limitation were more than 20 percent greater for wave 1 heavy drinkers than for all other respondents; however, because of the correlation between wave 1 heavy drinking and wave 4 heavy drinking ($\rho = 0.41$), and between wave 1 heavy drinking and lifetime problem drinking ($\rho = 0.21$), this effect was not independently significant at conventional levels ($p = 0.19$). As in the case of problem drinking, wave 1 heavy drinking had no effect on the probability of SSDI/SSI receipt at wave 4, and a small protective effect on SSDI/SSI receipt, given that the person reported any limitation at wave 4.

Smokers and former smokers were significantly more likely than those who never smoked to be disabled at wave 4, with odds ratios ranging from 1.32 to 1.88 for the three dependent variables. Respondents with a health condition, those with less than a high school degree, and those with a very high or a very low body mass index were also more likely to be disabled. Males, married individuals, respondents over the age of 65, and those with a college education were less likely to report any type of disability. The prevalence of disability varied by race. White respondents were more likely to report any limitation, while nonwhite respondents were more likely to report SSDI or SSI receipt. Conditional on having any limitation, the probability of SSDI/SSI receipt was higher for those with a health condition, for smokers, the less well educated, and males. White and married respondents had lower odds of receiving SSDI/SSI benefits if they reported any kind of disability.

Longitudinal Analysis of Two-year Disability Onset

The longitudinal analysis allowed us to determine the extent to which alcohol consumption preceded disability onset, and to evaluate the relationship between patterns of alcohol use and survival. Holding other factors constant, the odds of dying within a two-year span did not vary significantly with respondents' alcohol consumption at the beginning of the two-year period, or with a history of problem drinking as reported at wave 1 (table 5, panel A). However, we found some relationships between alcohol use and subsequent disability onset (panels B–D).

Conditional on having survived to the end of the two-year period, problem drinkers were between 12 percent and 83 percent more likely to have developed a limitation, compared to non-problem drinkers in the

TABLE 5
Odds of Two-year Mortality and Disability Onset for Non-Disabled Respondents

	0 Drinks	<1 Drink	1–2 Drinks	3+ Drinks
A. Death ($N = 7,756$)				
Not problem drinker	1.00	0.83	0.66	0.41
	.	[0.56;1.23]	[0.35;1.24]	[0.13;1.31]
Problem drinker	1.59	1.07	0.92	1.30
	[0.90;2.82]	[0.51;2.26]	[0.36;2.33]	[0.54;3.15]
B. Any kind of limitation ($N = 7,698$)				
Not problem drinker	1.00	0.82**	0.81	0.87
	.	[0.71;0.94]	[0.65;1.02]	[0.61;1.23]
Problem drinker	1.12	1.50*	1.00	1.11
	[0.83;1.51]	[1.10;2.06]	[0.69;1.46]	[0.71;1.74]
C. SSDI/SSI receipt ($N = 7,698$)				
Not problem drinker	1.00	0.43***	0.50	0.45
	.	[0.26;0.69]	[0.23;1.10]	[0.13;1.48]
Problem drinker	0.74	0.58	0.76	0.68
	[0.33;1.68]	[0.20;1.67]	[0.25;2.33]	[0.20;2.26]
D. SSDI/SSI receipt conditional upon any limitation ($N = 2,200$)				
Not problem drinker	1.00	0.50**	0.56	0.30
	.	[0.30;0.83]	[0.25;1.28]	[0.07;1.19]
Problem drinker	0.67	0.33	0.75	0.66
	[0.28;1.60]	[0.10;1.06]	[0.23;2.50]	[0.19;2.31]

Notes: Estimates from logistic regressions with disability measures as dependent variables, controlling for age, gender, race, ethnicity, presence of a health condition, marital status, smoking, bmi, and wave. Estimates for covariates displayed in Table 6. *, **, and *** denote significance at the 0.05, 0.01, and 0.001 levels, respectively.

same consumption category. Similarly, drinkers with a problem drinking history were between 34 and 51 percent more likely to initiate SSDI/SSI receipt than were drinkers without a problem. Abstainers without a history of problem drinking were *most* likely to have initiated SSDI/SSI receipt by the end of the two-year period. Light, moderate, and heavy drinkers without a history of problem drinking were least likely either to have experienced the onset of any limitation or to have initiated SSDI/SSI receipt. The finding that heavy alcohol consumption is protective of SSDI/SSI receipt was confirmed by our analysis that limited the pool to those people reporting any limitation.

The effects of other covariates in the longitudinal analysis (see table 6) were similar to those in the cross-sectional analysis. Smokers were significantly more likely to die or become disabled within two years than were those who never smoked. Former smokers also had greater odds of dying, but were no more likely than those who never smoked to develop a limitation or to receive income transfers from SSDI or SSI. Having less than a high school education was associated with 36 to 72 percent higher odds of death or disability on average. Older people, males, and those with a very low body-mass index (BMI) had higher odds of mortality; married individuals had lower odds. A higher or very low BMI at the beginning of the period led to a higher probability of developing a limitation within the next two years. People with a BMI above 35 (i.e., who are very obese) were almost three times as likely to report a limitation as the omitted reference group—individuals with a BMI between 18.5 and 25, which is generally considered to be optimal (U.S. National Institutes of Health 1998).

Compared with survey responses at the wave 2 interview, respondents were more likely to report a limitation at wave 3, but less likely to report a limitation at wave 4, holding other factors constant. The odds ratio of 0.31 on the wave 4 variable in the analysis of SSDI/SSI receipt suggests that the probability of beginning SSDI/SSI benefits was 69 percent lower between waves 3 and 4 than between waves 1 and 2. By contrast, there was no statistically significant difference between wave 1–2 and wave 2–3 probabilities of onset. This suggests a major decrease in the probability of transfer receipt immediately following the tightening of eligibility criteria in 1996.

Panels C and D in table 6 also show parameter estimates for a variable identifying wave 3 heavy drinkers. Significant coefficients on this variable would indicate changes in the probability that a wave 3 heavy

drinker started receiving SSDI/SSI payments within two years, compared with heavy drinkers in previous waves and controlling for overall changes in the probability of SSDI/SSI receipt across waves. The coefficients on wave 3 heavy drinkers were positive and not significant, indicating that relative to other respondents, heavy drinkers were no less likely to initiate public-transfer receipt between waves 3 and 4 than between previous waves. This finding suggests that the observed decline in the probability of SSDI/SSI onset after 1996 was across the board and not specific to heavy drinkers.

Sensitivity Analysis

Particularly in view of the complex relationship between alcohol use and disability, it was important to alter the specification and gauge the sensitivity of our findings to changes in equation specification. Our results were robust with respect to changes in equation specification, in the definition of drinking, and in the selection of the sample.

To analyze the sensitivity of the results to the inclusion of self-reported and objective health measures in the cross-sectional and longitudinal analyses, all models were estimated with and without variables for respondents' self-reported health status (continuous from 1 to 5 for excellent, very good, good, fair, poor), and a binary variable for the presence of any from a list of selected health conditions (see above for equation specification). Inclusion or omission of these explanatory variables in the models, or of specific conditions in the list, did not change our findings on the role of alcohol in death and disability. The HRS contains numerous other variables describing the respondent's mental health, functional status, and cognition. Another study based on HRS data found that heavy and problem drinking at wave 1 increased the probability of onset for many of these variables by wave 4 (Perreira and Sloan 2001). Since prior high alcohol use positively affected subsequent onset, these variables were not included as covariates in our study.

We reestimated all models of SSDI/SSI receipt, limiting the sample to respondents under the age of 65. The results were virtually unchanged. We also altered the definition of problem drinking and the specification of other drinking variables in the models. Our findings were very robust to changes in variable definition and model specification.

To evaluate whether the positive association between lagged heavy drinking and the presence of any limitations is the result of endogeneity

TABLE 6
Effects of Covariates on the Odds of Two-year Transitions

	Death (Panel A)	Any limitation (Panel B)	SSDI/SSI receipt (Panel C)	SSDI/SSI receipt given any limitation (Panel D)
Health condition	1.37 [0.96;1.96]	2.42*** [2.12;2.75]	2.13*** [1.37;3.34]	1.14 [0.70;1.88]
Smoker	4.51*** [2.80;7.29]	1.52*** [1.29;1.79]	2.2** [1.36;3.54]	1.95* [1.15;3.31]
Former smoker	2.28*** [1.41;3.68]	1.15 [1.00;1.34]	0.81 [0.47;1.40]	0.81 [0.45;1.44]
Hispanic	0.56 [0.24;1.32]	0.88 [0.67;1.16]	1.00 [0.48;2.09]	0.91 [0.40;2.09]
White	0.74 [0.49;1.12]	1.36** [1.12;1.65]	0.97 [0.58;1.61]	0.71 [0.41;1.25]
Less than high school	1.45* [1.00;2.09]	1.36*** [1.16;1.59]	1.72** [1.14;2.60]	1.65* [1.07;2.57]
College degree	0.96 [0.62;1.50]	0.91 [0.77;1.07]	0.33** [0.14;0.77]	0.40* [0.17;0.95]
Age at t+2	1.06* [1.01;1.11]	1.02 [1.00;1.04]	1.03 [0.93;1.13]	1.01 [0.91;1.12]
Age 62–64 at t+2			1.06 [0.55;2.05]	1.19 [0.60;2.37]
Age 65+ at t+2			0.45 [0.14;1.44]	0.26 [0.06;1.13]

Male	1.63** [1.14;2.31]	0.91 [0.80;1.04]	1.62* [1.06;2.47]	1.82* [1.15;2.88]
Married	0.76 [0.54;1.08]	0.80** [0.70;0.92]	0.45*** [0.30;0.67]	0.54** [0.35;0.84]
BMI less than 18.5	3.44* [1.18;10.07]	2.14* [1.15;3.97]	2.05 [0.54;7.83]	1.93 [0.45;8.31]
BMI 25 to less than 30	0.93 [0.59;1.46]	1.20* [1.03;1.41]	0.59* [0.35;0.99]	0.50* [0.29;0.86]
BMI 30 to less than 35	0.96 [0.52;1.78]	1.72*** [1.41;2.10]	0.68 [0.34;1.37]	0.47* [0.23;0.97]
BMI greater or equal 35	0.93 [0.35;2.46]	2.64*** [2.00;3.47]	1.60 [0.76;3.40]	0.90 [0.41;2.00]
Wave 3	1.62* [1.05;2.52]	1.83*** [1.57;2.13]	1.06 [0.64;1.75]	0.92 [0.53;1.60]
Wave 4	1.45 [0.53;3.96]	0.56*** [0.42;0.74]	0.31** [0.13;0.72]	0.44 [0.18;1.07]
Wave 3 heavy drinker			2.63 [0.52;13.16]	1.87 [0.23;14.91]
N Total	7,756	7,698	7,698	2,200
N Yes	165	2331	117	109

See notes for table 5. See table 5 for effects of current and problem drinking.

(i.e., an increase in drinking in anticipation of a future disability), we analyzed drinking frequencies among disabled respondents two, four, and six years prior to the onset of their limitations. The share of heavy drinkers among respondents who reported their first limitation in wave 4 decreased continuously between waves 1 and 3 by almost 25 percent, suggesting that anticipation of a disability, if anything, *decreases* heavy drinking.

Finally, we have assessed relationships between two important measures of disability and patterns of alcohol use. There are other measures of disability. In analyses not reported, we assessed purely employment-based measures of disability. In terms of prevalence, these measures fell between the two measures we analyzed. The results for alcohol use were generally similar to any limitation measure reported in this study, suggesting that our findings are robust to changes in the definition of disability.

Discussion

Synopsis of Findings

An appreciable fraction of people in this age 50+ cohort were disabled. To some extent, being disabled is a transitory phenomenon. Much disability occurs before age 50, and disability, especially when broadly defined, was associated with heavy alcohol use and a history of problem drinking. In cross-sectional analysis, the most distinct relationship was between a history of problem drinking and an increased probability of having some limitation in performing household and/or market tasks. By contrast, concurrent heavy drinking by people without a history of problem drinking reduced the probability of having such a limitation. For receipt of public transfers, heavy drinkers with a history of problem drinking were, if anything, less likely to receive SSDI or SSI than abstainers or moderate drinkers.

In the longitudinal analysis, which permitted inferences based on the temporal sequencing of events, alcohol consumption was not significantly related to mortality, but had significant effects on having any limitation and on the probability of SSDI/SSI receipt. Problem drinkers were more likely to develop a limitation during a two-year transition period, while moderate drinkers without a problem-drinking history were less likely to develop a limitation or to start receiving SSDI/SSI.

Compared with abstainers, problem drinkers and heavy drinkers were, if anything, less likely to start receiving SSDI or SSI. The 1996 statutory change designed to further restrict eligibility of people with drug and/or alcohol problems had no effect on public transfer receipt by heavy drinkers.

Our Results in Contrast to Previous Research

The concepts of problem- and heavy-drinking used in our empirical analysis do not correspond to the definitions of drug addiction and alcoholism (DAA) in the federal statutes (Landry 1999). The concepts we used were both broader and narrower than DAA—broader in that most heavy- and problem-drinkers would not have satisfied a clinical definition of alcoholism, but narrower in that we had no information on drug abuse. To the extent that drug abuse is correlated with heavy alcohol use, our results are potentially confounded; however, the age group we have considered in this study makes this unlikely. Data from the 1999 National Household Survey on Drug Abuse indicate that illicit drug use was about 2 percent among people aged 50 to 64 (U.S. Department of Health and Human Services 1999). By contrast, approximately 15 percent of those in this age group reported binge drinking.

A recent evaluation of the 1996 law found that DAA beneficiaries constituted only 2.6 percent of all SSDI and SSI disabled beneficiaries (Davies, Iams, and Rupp 2000), but their definition of problem drinking was appreciably narrower than ours. In one sense, the 2.6 percent figure implies that the rule change had virtually no effect on total SSDI/SSI enrollments. However, a change in eligibility criteria may have had a chilling effect on applications from a broader group of heavy users, or public officials could have interpreted the law more broadly. Thus, it was not clear, a priori, that the statutory change had no effect.

Our data did not permit analyses of why heavy and problem drinkers were relatively less numerous among SSDI/SSI recipients. One possibility is that heavy alcohol users were not eligible for SSDI: eligibility for this program depends on a fairly continuous work history before the onset of disability. However, a continuous work history has never been a condition for eligibility in SSI. In the Health and Retirement Study sample, SSI recipients were a distinct minority of the SSDI/SSI population. An analysis of disability that did not include measures of alcohol consumption

found that SSDI ineligibility, based on quarters during which Social Security payments were made before the onset of disability, only reduced the probability of becoming disabled by 0.016 (Benitez-Silva, Buchinsky, Chan, et al. 1999). A combination of factors—including reduced eligibility, lower application rates, and higher denial rates for benefits for heavy and problem drinkers—may contribute to lower rates of SSDI/SSI benefit receipt in this group.

As others have documented, the relationship between alcohol use and health is a complex one. Low levels of alcohol use may have protective effects, especially on cardiovascular health. Furthermore, people may curtail their drinking in response to poor health. Researchers have attributed the frequently described U and J shapes of the effects of alcohol consumption on morbidity and mortality to these reasons (e.g., Rehm and Sempos 1995; Poikolainen, Vartiainen, and Korhonen 1996; Thun, Peto, Lopez, et al. 1997). Past problem drinking, in our analysis, modified the relationship between alcohol consumption and disability. In both the cross-sectional and longitudinal analyses, it was apparent that predominantly non-problem drinkers benefited from the morbidity reduction associated with light or moderate alcohol consumption.

Study Limitations

There is a potential for imprecision in measurement, particularly of the drinking variables, which may affect the precision of the estimated effects on disability. As mentioned above, the sensitivity of the CAGE screen in detecting alcohol dependence especially is well below 100 percent. Also, the questions regarding respondents' drinking behaviors changed between waves 2 and 3. And it is possible that respondents with a positive CAGE score reported their alcohol consumption differently than respondents with a zero CAGE score. If measurement error is random, it results in a downward bias in the estimated effects, and a less precise estimate of the contribution of alcohol to disability.

Another potential source of bias may result from the failure to control for other, non-alcohol-related determinants of disability that may be correlated with alcohol consumption patterns. We included some major potential confounders, such as smoking and obesity. While there is a risk of bias due to confounding, there is also a risk of bias from overcontrolling for correlates of alcohol consumption, especially those health conditions for which a causal relationship has been documented or is suspected.

Previous empirical studies point to a significant potential for endogeneity of measures of disability to health and possibly, by extension, to alcohol consumption, as well. Especially in studies of retirement behavior, this endogeneity has been expressed in the form of the “justification hypothesis,” according to which reporting of disability is influenced by preferences for leisure over work, and disability is used to justify early retirement decisions (Chirikos and Nestel 1984; Anderson and Burkhauser 1985; and Bazzoli 1985; Haveman, Holden, Wolfe, et al. 1999). A recent study by Dwyer and Mitchell (1999) using the HRS, however, found little evidence for the justification hypothesis; the authors reported substantial correlations between objective and subjective measures of health status and disability. Self-reports of work-related disability are highly correlated with self-reports of clinical diagnoses (Bound, Schoenbaum, and Waidman 1996). In our analysis, any concern about justification was mitigated by the use of a broader measure of disability not directly based on employment.

In cross-sectional analysis, it has been difficult to distinguish the impact of a health behavior, such as alcohol consumption, on disability. Disability may be a cause as well as an effect of heavy alcohol use, although evidence on this point is conflicting (Dwyer and Mitchell 1999). In the HRS, alcohol consumption was measured concurrently in each wave. By contrast, data on problem drinking were obtained by HRS for any time period prior to the wave 1 survey date. While the temporal order of problem drinking and disability could not be established for respondents reporting a disability at wave 1, temporal sequencing could be established for respondents developing a disability between waves 1 and 4, permitting us to infer the direction of causality in the relationship between alcohol and disability. We found no evidence that people increased alcohol consumption in response to *anticipated* disability.

Since our study emphasized the role of heavy alcohol consumption on disability, we focused on results relating to alcohol use. Other results, such as those relating to the effects of smoking, age, and marital status on the prevalence and onset of disability, were consistent with the existing literature, however. Interestingly, in the case of tobacco, much of the disability onset occurs during late middle age (Peto, Darby, Deo, et al. 2000). For alcohol-induced disability, by contrast, much of the disability occurs earlier even though the harm from heavy drinking extends through late middle age. Plausible findings for other covariates strengthen our results on relationships between alcohol use and disability.

Conclusion

On balance, we found strong though complex associations between alcohol consumption and disability. A history of problem drinking, especially when combined with recent heavy drinking, is associated with a greater prevalence and incidence of limitations in home and/or work tasks in a near-elderly population. These alcohol-related higher rates of limitations do not, however, translate into a greater likelihood that heavy and problem drinkers receive income support from SSDI or SSI. To the extent that the general growth in disability levels and the rise in public income-transfer program caseloads are viewed as important problems, statutes restricting the eligibility of high alcohol users are not an effective solution.

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