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Age-Related Changes in Drinking Patterns From Mid- to Older Age: Results From the Wisconsin Longitudinal Study

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Abstract

Background: Drinking has generally been shown to decline with age in older adults. However, results vary depending on the measure of alcohol consumption used and the study population. The goals of this study were to (i) describe changes in drinking in a current cohort of older adults using a variety of measures of drinking and (ii) examine a number of different possible predictors of change.

Methods: This is a longitudinal study of a community-based sample surveyed at 2 time points, ages 53 and 64 years. We estimated a series of logistic regressions to predict change and stability in drinking categories of nondrinking, moderate drinking, and heavy drinking. Linear regressions were used to predict change in past-month drinking days, past-month average drinks per drinking day, and past-month total drinks.

Results: From age 53 to 64, average drinks per drinking day and heavy drinking decreased. Frequency of drinking increased for men and women, and total drinks per month increased for men. The most consistent predictors of drinking changes were gender, health, and education. Other factors predicted drinking change but were not consistent across drinking measures including: adolescent IQ, income, lifetime history of alcohol-related problems, religious service attendance, depression, debt, and changes in employment.

Conclusions: Heavy drinking decreases with age, but we may see more frequent moderate drinking with current and upcoming cohorts of older adults. Components of quantity and frequency of drinking change differently. Composite measures of total alcohol consumption may not be adequate for describing relevant changes in drinking over time. A number of factors predicted patterns of change in drinking and warrant further exploration.

Keywords

Alcohol; Aging; Longitudinal; Drinking Behavior

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ALCOHOL USE AMONG older adults is an important public health concern. Alcohol-related hospitalizations and medical complications for those over 65 years account for significant health care costs and represent a major preventable cause of morbidity and mortality (Adams et al., 1990). The balance of risk versus potential benefit of drinking shifts from middle to older age. Moderate drinking has been associated with cardiovascular benefits in middle-aged adults (Thun et al., 1997), but as people age, they become more sensitive to the effects of alcohol and are at higher risk of alcohol-related adverse health events (Adams et al., 1990; Dufour and Fuller, 1995). Although many studies suggest that heavy drinking decreases with age (Adams et al., 1990; Brennan et al., 1999; Clemens et al., 2007; Ekerdt et al., 1989; Glass et al., 1995; Karlamangla et al., 2005; Moos et al., 2004; Thundal et al., 2000), a significant proportion of older adults nonetheless continue to report exceeding low-risk drinking guidelines and drinking-related problems (Adams et al., 1996). As the percentage of the US population over age 65 reaches 16% in the next decade and 20% by 2040 (US Census Bureau, 2004), knowing how drinking patterns change from middle to older adulthood will help health and related professionals anticipate the public health impact of alcohol on the aging US population.

AGE-RELATED CHANGE IN DRINKING PATTERNS

Longitudinal studies of alcohol consumption generally find age-related decreases in drinking. Older adults are likely to transition to nondrinking (Adams et al., 1990; Eigenbrodt et al., 2001; Moore et al., 2005; Moos et al., 2004), and total alcohol consumption among those who continue to drink tends to decrease with age (Clemens et al., 2007; Eigenbrodt et al., 2001; Ekerdt et al., 1989; Fillmore et al., 1991; Gee et al., 2007; Moore et al., 2005). Average drinks per drinking day, frequency of drinking, heavy drinking, and alcohol-related problems also tend to decrease with age (Adams et al., 1990; Brennan et al., 1999; Clemens et al., 2007; Ekerdt et al., 1989; Fillmore et al., 1991; Ganguli et al., 2005; Glass et al., 1995; Johnstone et al., 1996; Karlamangla et al., 2005; Moos et al., 2004; Perreira and Sloan, 2001; Thundal et al., 2000).

While the literature generally indicates that older adults drink less (variously defined) and report fewer drinking problems as they age, a few studies exist that contradict this trend. That is, total alcohol consumption and drinking frequency may actually remain stable or increase among older adults (Benzies et al., 2008; Gordon and Kannel, 1983; Moos et al., 2004). Inconsistent findings may be the result of a number of factors. These include sample demographics, period effects, increased rates of abstention versus decreased consumption among continuous drinkers, and differentiation of heavy versus moderate drinkers who may have different patterns of change. Differences in the measure of alcohol consumption, and whether individual components or a composite calculation of total alcohol consumption is used, may also contribute to incongruent findings among studies.

PREDICTORS OF CHANGE IN DRINKING PATTERNS

Numerous predictors of age-related changes in drinking patterns have been examined. These include socio-demographics (e.g., gender, education), health-related stressors (e.g., hospitalization, illnesses), and non-health-related stressors (e.g., divorce, widowing, debt,

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retirement). Women are more likely to decrease or stop drinking as they aged (Brennan et al., 1999; Fillmore, 1987; Fillmore et al., 1991; Gee et al., 2007; Perreira and Sloan, 2001). Consistent abstention over time is associated with lower education levels, and higher education predicts greater alcohol consumption at baseline and slower age-related decline in drinking (Moore et al., 2005). No studies have examined baseline intellectual functioning in addition to education. Poor health and adverse health events (e.g. hospitalizations) are associated with decreased alcohol consumption over time in older adults (Brennan et al., 1999; Fillmore et al., 1991; Glass et al., 1995; Perreira and Sloan, 2001). Both divorce and widowing are associated with increased alcohol consumption (Perreira and Sloan, 2001; Romelsjo et al., 1991). While less is known about the transition into marriage for older adults, marriage is generally associated with health promoting behaviors, and becoming married may be expected to result in decreases or more moderate drinking patterns (Kiecolt-Glaser and Newton, 2001; Umberson, 1992). The relationship between alcohol consumption and employment pattern is unclear. Some studies find that retirement is associated with increased alcohol consumption, periodic heavy drinking, and alcohol-related problems (Bacharach et al., 2004; Ekerdt et al., 1989; Perreira and Sloan, 2001). Others show limited or no effect of retirement on drinking (Gallo et al., 2001; Midanik et al., 1995; Neve et al., 2000).

Previous studies are limited in a number of ways. First, many of the larger studies took place in the 1970s to 1980s, and these cohorts may not represent current middle-aged and older adults. Second, the ways drinking behaviors are measured and reported are inconsistent, and few studies include multiple measures of drinking. Third, few studies include a wide range of predictors, such that relationships among different factors can be examined.

To our knowledge, no US study has investigated these issues in a cohort that directly precedes the Baby Boomers, from which one could derive reasonable predictions about age-related changes in alcohol use in this large emerging older population. To address these limitations, we examine age-related changes in drinking patterns in a large community sample of older men and women to answer the following questions: (i) How do drinking patterns change from mid- to later life with respect to drinking versus nondrinking, frequency of drinking, drinks per drinking day, total consumption, and heavy drinking? and (ii) What factors predict the pattern of change in these drinking measures? Factors were selected as potential predictors based on our conceptual model which holds that a change in drinking pattern is affected by baseline characteristics and changes or stressors in the environment. For example, gender, education, or IQ might be considered relatively static baseline characteristics that affect how drinking changes throughout the life course, while a hospitalization, or a change in marital status are new events which may result in transient or sustained drinking changes.

MATERIALS AND METHODS

Sample

The WLS study design and history have been discussed in detail elsewhere (Hauser, 2005; Sewell et al., 2004). Briefly, the WLS sample was originally comprised of over 10,000 men and women who graduated from Wisconsin high schools in 1957. Data for these analyses are

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from the 1993 and 2004 telephone and mail interviews when the respondents were approximately 53 (M = 53.20, SD = 0.63) and 64 (M = 64.32, SD = 0.69) years old, respectively.

The WLS has enjoyed excellent response rates. In 1993, 8,493 completed the telephone interview (94% completion rate among living respondents who could be located). The alcohol behaviors section of the interview was randomly subsampled at just under 80%, and participants who completed this section constituted the baseline sample of 6,489. In the 2004 follow-up, 5,283 of the baseline respondents completed the telephone interview (81% of baseline participants). Both time points also included a supplemental mail interview with similarly high response rates.

Drinking Measures

During both survey waves (telephone interview) respondents were asked a series of alcohol-related questions that included (a) number of drinking days in the past month, (b) average number of drinks per drinking day in the past month, (c) number of binge drinking episodes (≥5 drinks) in the past month, and (d) *lifetime* history of drinking-related problems. Responses to (a) and (b) were multiplied to construct a measure of total alcohol consumption in the past month.

Responses to (a to c) were used to classify respondents into 3 drinking categories: past-month nondrinkers, past-month moderate drinkers, and past-month heavy drinkers. Those who did not drink in the past month were considered past-month nondrinkers (men and women). Criteria for heavy drinking were generally based on low-risk drinking guidelines for adults ≤65 from the National Institute on Alcohol Abuse and Alcoholism (NIAAA): *daily* limits of ≤4 drinks for men and ≤3 drinks for women, and *weekly* limits of ≤14 drinks for men, ≤7 drinks for women (Dawson, 2000; National Institute on Alcohol Abuse and Alcoholism, 2007). Based on these NIAAA guidelines, we developed the following heavy drinking criteria. For men, heavy drinkers were identified using 2 criteria: (i) reporting at least one past-month binge episode of ≥5 drinks (exceeding daily limits) or (ii) total past-month alcohol consumption >60 drinks (exceeding weekly limits, calculated from reported average drinks per drinking day and number of drinking days). For women, the NIAAA criteria did not match exactly with available data (the binge criterion in WLS response (c) was the same for men and women). This issue was partially addressed by using 3 criteria to identify heavy drinking women: (i) reporting any binge episodes (≥5 drinks) in the past month, (ii) reporting an average of ≥4 drinks per dinking day (1 and 2 exceed daily limits), or (iii) total past monthly alcohol consumption >30 drinks (exceeding weekly limits). All other respondents that drank in the previous month but who did not exceed these limits were considered moderate drinkers.

Predictors

Participants were asked a number of questions regarding education, employment, marriage, household income and debt, religious service attendance, health and health behaviors, and depression. In addition, these data were supplemented by administrative records that included high school intelligence tests.

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Education at baseline (1993) was measured through a series of questions regarding the highest level or degree of schooling completed. These were transformed into equivalent years of education. Completion of high school received a value of 12, while completion of college received a value of 16, etc. Adolescent IQ was measured by participant scores on the Henmon-Nelson test of mental ability, completed either their freshman or junior year of high school, or both (Henmon and Nelson, 1946, 1954). We used the age-normed score from the junior year, if available, or otherwise the age-normed freshman year score. These were transformed to standard normal metric for analysis ($M = 0$, $SD = 1$).

Employment and marital statuses were obtained at both time points. For employment, responses for both time points were used to create 4 groups based on employment history: (i) those employed at both times (employed–employed, reference group), (ii) those employed at baseline but unemployed at follow-up (employed–unemployed), (iii) those unemployed at baseline but employed at follow-up (unemployed–employed), and (iv) those unemployed at both times (unemployed–unemployed). A similar procedure was used to classify respondents according to marital status into 5 groups: (i) those married at baseline and still in that marriage at follow-up (married–married, reference group), (ii) those married at baseline but not in that marriage at follow-up and not in any other marriage (married–not married), (iii) those not married at baseline and married at follow-up but married only once during the survey interval (not married–married), (iv) those not married at baseline and not married at follow-up and no marriage between waves (not married–not married), and (v) those who experienced multiple marriage transitions between waves (multiple marriage transitions), such as being married, experiencing a divorce within the survey interval, and remarrying before follow-up.

Household income was ascertained at baseline, in thousands of dollars, and transformed to natural logarithm scale. Respondents were also asked at follow-up whether they had ever gone deeply into debt or suffered substantial financial loss. Respondents were classified into those who experienced debt within the survey interval and those who did not.

Respondents were asked a series of questions regarding religious service attendance and were classified at baseline into those who attended any religious services in the past year versus no religious service attendance.

Questions regarding health and health behaviors were asked at baseline and follow-up. General health was ascertained at baseline with a global self-reported health question. Respondents were dichotomized into those who reported excellent or good health versus fair, poor, or very poor health. At follow-up, respondents were asked about major medical events, including diagnosed diabetes, stroke, myocardial infarction, and cancer (other than minor skin). Respondents were classified into those who experienced at least one of these within the survey interval versus those who did not. At follow-up, respondents were asked about hospitalizations that lasted at least 1 night within the past year. These were dichotomized into any hospitalizations versus none. Finally, respondents were given the Center for Epidemiologic Studies Depression Scale (CES-D) at baseline. Scores on the scale were dichotomized according to the standard cutoff of 16 or more.

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Finally, respondents were asked a series of 5 questions regarding *lifetime history* of drinking-related problems. These included whether the respondent (i) had *ever* felt guilty about their drinking, (ii) had *ever* been annoyed by people criticizing their drinking, (iii) had *ever* experienced problems at work because of their drinking, (iv) had *ever* experienced problems with relatives because of their drinking, and (v) *ever* gone to anyone for help about their drinking. Respondents were dichotomized into those who reported experiencing any of these drinking-related problems up to baseline versus those who did not.

Analysis

We conducted a series of prospective regression analyses to investigate predictors of stability and change in drinking behaviors from ages 53 to 64 (1993 to 2004). For drinking category transitions, we estimated a series of binary logistic regressions. For the dimensions of drinking, we conducted standard linear regressions for simple change in number of drinking days in the past month, change in average drinks per drinking episode in the past month, and change total drinks in the past month. Previous literature and preliminary results suggested the possibility that predictors of drinking changes might interact with gender (i.e., predictors act on men and women differently to result in different patterns of change). All regressions in Tables 3–5 were estimated separately by gender (not shown) and inspected for significant gender interactions according to whether the 95% confidence intervals did not overlap for men and women. Candidate interactions were included in pooled analyses but were inconsistent, and only one interaction term achieved nominal statistical significance. In Tables 3–5, we only report models without gender interactions.

RESULTS

Descriptive Statistics

Table 1 shows descriptive statistics for predictor variables. With the exceptions of high school IQ and baseline good health, all variables showed significant gender differences.

The upper panel of Table 2 shows the number of respondents in each drinking category for baseline (1993) and follow-up (2004). At baseline, 33% of women (945/2,854) and 25% of men (612/2,429) were past-month nondrinkers, 56% of women (1,585/2,854) and 48% of men (1,173/2,429) were past-month moderate drinkers, and 11% of women (324/2,854) and 27% of men (644/2,429) were past-month heavy drinkers. At follow-up, 36% of women (1,015/2,854) and 25% of men (617/2,429) were past-month nondrinkers, 56% of women (1,586/2,854) and 56% of men (1,369/2,429) were past-month moderate drinkers, and 9% of women (253/2,854) and 18% of men (443/2,429) were past-month heavy drinkers.

We investigated the distributions of baseline and follow-up drinking category for men and women combined (results not shown in Table 2). Women were more likely to be nondrinkers at baseline and follow-up [$\chi^2(1) = 47.25$, $p < 0.001$; $\chi^2(1) = 63.48$, $p < 0.001$] and moderate drinkers at baseline [$\chi^2(1) = 28.79$, $p < 0.001$]. Men were more likely to be heavy drinkers at baseline and follow-up [$\chi^2(1) = 224.76$, $p < 0.001$; $\chi^2(1) = 100.79$, $p < 0.001$].

The general association between baseline and follow-up drinking category was highly significant [$\chi^2(4) = 1127.92$, $p < 0.001$ for women; $\chi^2(4) = 1202.33$, $p < 0.001$ for men],

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with weighted Kappa estimates of $\kappa = 0.48$ and $\kappa = 0.51$ for women and men, respectively (gender difference NS). At follow-up women and men were also equally likely to be in the same drinking category that they were in at baseline [cells along main diagonal, 69% = (672 + 1162 + 126)/2,854 for women and 70% = (481 + 913 + 303)/2,429 for men].

The lower panel of Table 2 shows descriptive statistics for the dimensions of drinking at baseline and follow-up by gender. Reported past-month drinking days increased from 1993 to 2004 for both women and men (4.57 to 5.51 and 7.98 to 9.13, respectively). Among those who drank at both baseline and follow-up, the reported past-month average drinks per drinking day significantly decreased for both women and men (1.80 to 1.55 and 2.31 to 2.11, respectively). While there was a trend for men to show slightly more of an increase in their drinking days, and slightly less of a decrease their drinks per drinking days, repeated measures analyses did not reveal a significant gender by time interaction for these dimensions. When these dimensions were combined in the composite measure of total drinks per month, there was a significant gender by time interaction. Specifically, total drinks per month was stable for women (8.16 vs. 8.52, NS) but significantly increased for men from 17.88 to 20.29 [$F(1,5260) = 12.04$, $p < 0.001$].

Drinking and Nondrinking

Table 3 shows odds ratios for binary logistic regressions predicting changes in drinker versus nondrinker status in 1993 and 2004. Recall that the distinction of drinker and nondrinker is based on reports of past-month drinking only. Fifteen percent of those who were drinkers in 1993 transitioned to nondrinkers at 2004 follow-up. Predictors of transition to nondrinker (Model 1) included unemployment at both time points (relative to employment at both waves), experiencing a major medical diagnosis, being hospitalized in the previous year, and exceeding the CES-D cutoff at baseline. Predictors of remaining a drinker (i.e. decreased likelihood to transition to nondrinker) included being male, having higher high school IQ, becoming employed, greater baseline household income, baseline religious service attendance, and baseline heavy drinking. Nearly 1/3 of those who were nondrinkers in 1993 transitioned to drinkers in 2004 (Model 2), but the only measure that predicted this transition was good health at baseline.

Change in Drinking Dimensions

Table 4 shows linear regressions predicting change in drinking days in the past month (Model 3), average drinks per drinking day in the past month (Model 4), and total drinks in the past month (Model 5) between baseline (1993) and follow-up (2004). Recall from Table 2 that reported past-month drinking days increased, and average drinks per drinking day decreased from 1993 to 2004. Predictors of increased drinking days included higher education, greater income at baseline, and good health at baseline. The only predictors of decreased drinking days were experiencing a major medical diagnosis and hospitalization in the year prior to follow-up. Decreases in average drinks per drinking day were predicted by good health at baseline, experiencing a major medical diagnosis, and hospitalization in the previous year. More education was associated with a small increase in average drinks per drinking day. Recall from Table 2 that total drinks per month, a composite of drinking days and average drinks per drinking day, was stable for women but increased for men. Greater

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total drinks per month was predicted by being male, having greater education, and transitioning to unemployment (relative to employment at both time points). Decreased total drinks per month was predicted by experiencing a major medical diagnosis and hospitalization in the year prior to follow-up.

Heavy Drinking

Table 5 shows odds ratios for binary logistic regressions predicting transitioning into (Model 6) and out of (Model 7) the heavy drinking category between surveys. Over half of baseline heavy drinkers transitioned to moderate or nondrinking by follow-up. Predictors of transitioning out of heavy drinking included experiencing debt or a major medical diagnosis, and predictors of remaining in the heavy drinking category included being male and reporting a history of alcohol-related problems at baseline. Only 6% of baseline nonheavy drinkers (composed of moderate and nondrinkers) transitioned to heavy drinking by follow-up. Predictors of transitioning to heavy drinking included being male and reporting a history of alcohol-related problems at baseline.[1] Attendance of religious services and hospitalization in the previous year decreased the likelihood of transitioning to heavy drinking.

DISCUSSION

This study examines drinking changes among older adults from age 53 to 64 in the Wisconsin Longitudinal Study. Overall, respondents adopted more moderate drinking with age. While drinking frequency and total drinks per month increased or were stable, average drinks per drinking day and heavy drinking decreased. Dimensions of frequency and quantity changed differently over time, raising the concern that composite measures of total alcohol consumption may not adequately describe relevant changes in drinking over time. A number of factors predicted changes in drinking and warrant further discussion.

Age-Related Change in Drinking Patterns

Previous longitudinal studies of older adults find that nondrinking increases with age (Adams et al., 1990; Eigenbrodt et al., 2001; Moore et al., 2005; Moos et al., 2004). Our study did not replicate these findings. We found that the overall proportion of nondrinkers remained stable, although there was considerable within-sample transitioning between drinking and nondrinking status. While we did not observe significant increases in nondrinking, consistent with other longitudinal studies we found that heavy drinking decreased with age (Adams et al., 1990; Brennan et al., 1999; Clemens et al., 2007; Ekerdt et al., 1989; Glass et al., 1995; Karlamangla et al., 2005; Moos et al., 2004; Thundal et al., 2000). In fact, over half of those who were heavy drinkers at baseline transitioned to either moderate or nondrinking.

The individual dimensions of drinking changed differently over time. Average drinks per drinking day decreased for men and women, consistent with other studies that use this measure (Fillmore et al., 1991; Perreira and Sloan, 2001). However, in contrast to some previous findings (Ganguli et al., 2005; Johnstone et al., 1996), the number of drinking days

[1]Note that approximately 1/3 of those that reported a history of alcohol-related problems at baseline were past-month nondrinkers at baseline.

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in the past month, i.e., frequency, *increased* for both men and women. Moos and colleagues (2004) showed a similar trend toward increased drinking frequency in their 10-year longitudinal study of a community sample aged 55 to 65 at baseline. For men in that study, frequency decreased in the Year 1 and Year 4 follow-up surveys, but by the 10-year survey, frequency of drinking returned to baseline levels, making drinking frequency over 10 years appears stable. A longitudinal study of middle-aged women found that the rate of "drinking frequently" increased between ages 43 and 47 from 10 to 14% (Benzies et al., 2008). While our results are not directly comparable because of differences in sample age and definition of "drinking frequently," the trend toward more frequent drinking in a middle-aged population is similar. Increased drinking frequency and a relatively high rate of change from nondrinking to moderate drinking in the WLS may reflect increased media attention on the potential health benefits of daily moderate drinking (Thun et al., 1997).

Unlike many existing longitudinal studies of older adults (Clemens et al., 2007; Eigenbrodt et al., 2001; Ekerdt et al., 1989; Fillmore et al., 1991; Gee et al., 2007; Moore et al., 2005), past-month total drinks in this sample was stable for women and increased for men. However, this composite measure of total drinks masks differential changes in the individual dimensions of drinking days (frequency) and average drinks per drinking day (quantity). For women, the increases in drinking days were offset by decreases in average drinks per drinking day, such that total drinks per month remained stable. For men, the increase in total monthly drinks is a reflection of increased frequency and a less robust decrease in average drinks per drinking day. The only other studies that show age-related increases in total alcohol consumption among older adults use the Framingham sample (Gordon and Kannel, 1983) and Normative Aging Study (Glynn et al., 1985). Others have hypothesized that this a period effect since both the Framingham Study (1952 to 1972) and the NAS (1973 to 1982) took place during periods of substantial change in drinking norms and overall increases in US alcohol consumption (Adams et al., 1990). Ours is the first study to demonstrate increases in total alcohol consumption in a *current* cohort of older adult men.

Predictors of Age-Related Change in Drinking Patterns

A number of baseline factors and change events predicted drinking changes, but these were not always consistent across drinking measures. In addition, many factors that predict drinking change in other studies (e.g., changes in marital or employment status) are not strong predictors in this study. We found that the most consistent predictors of drinking changes were gender, health-related factors, and education.

Our findings are consistent with existing studies showing that women exhibit greater age-related decreases in drinking (Breslow and Smothers, 2004; Clemens et al., 2007; Moore et al., 2005). A complete discussion of gender differences in drinking is beyond the scope of this study, but in general, age-related change in drinking may be different in men and women resulting from gender differences in alcohol metabolism and tolerance, social norms, and responsibilities (Clemens et al., 2007; Fillmore, 1987).

Similar to previous studies (Brennan et al., 1999; Fillmore et al., 2003; Moos et al., 2004; Perreira and Sloan, 2001), measures of poor physical health predict change to more moderate or nondrinking. We also included a measure of mental health, because baseline

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poor mental health may represent a vulnerability or risk factor for heavier drinking. However, we did not find that to be the case. Baseline depressive symptoms (high vs. low) did not significantly predict changes in frequency, quantity, or heavy drinking but did predict transitioning to nondrinking. This is somewhat inconsistent with studies finding that depression is associated with higher alcohol consumption and mood and alcohol disorders frequently co-occur (Grant et al., 2004; Hasin et al., 2007; Kessler et al., 1997; Marmorstein, 2008). It may be that the relationship between depression and alcohol occurs more closely in time and the 10-year gap between measures misses the effect. Additionally, CES-D is a relatively crude assessment of depression and does not confirm a diagnosis of a depressive disorder (Radloff, 1977).

Interestingly, education and IQ independently affected drinking. Higher education predicted increases in drinking dimensions, and higher IQ predicted transitioning from nondrinker to drinker. Only one other longitudinal study considers education as a predictor of drinking changes (Moore et al., 2005), and no other studies include IQ as a predictor. Similar to our study, Moore et al. found that higher education predicting slower age-related decline in drinking (Moore et al., 2005). Higher education and IQ may be markers for a number of other socio-demographic characteristics that could affect drinking, including income, occupation, and social networks. We also found that higher income predicted increased frequency and stability of drinker status. While the relationship between education, IQ, and income is complex, it appears that higher education, IQ, and income independently support continuous moderate drinking. This may be due in part to greater disposable income, social activity and leisure time, and access to health information suggesting that moderate drinking may have health benefits.

Becoming divorced or widowed has been associated with increased drinking, and remaining married associated with faster age-related declines in drinking (Moore et al., 2005; Perreira and Sloan, 2001; Romelsjo et al., 1991). Our findings suggest that changes in marital status may not be as influential on major shifts in drinking as has been observed in previous studies. It may also be that significant shifts in drinking are transient and are missed with our 10-year follow-up. Other studies have suggested that changes in marital status are associated with changes in drinking that may be delayed and/or transient (Perreira and Sloan, 2001).

We looked at changes in employment status but were not able to clearly identify becoming unemployed as a retirement event in this study. We found that transitioning from being employed to unemployed was only associated with greater increases in total alcohol consumption relative to those who remained employed. Perreira et al. examine changes in employment status as well as “true” retirement on drinking patterns in the Health and Retirement Study, finding that retirement is associated with increased drinking (as measured by mean drinks per day), but transitioning into or out of employment does not significantly affect drinking (Perreira and Sloan, 2001). Other studies find more limited effects of retirement on drinking. Some find increases in periodic heavy drinking after retirement but no major shifts in overall average quantity or frequency of drinking (Bacharach et al., 2004; Ekerdt et al., 1989), and others find no effects on alcohol consumption or associated problems (Gallo et al., 2001; Midanik et al., 1995; Neve et al., 2000). Differences in results from retirement studies may be attributed to differences in retiree samples (e.g., blue vs.

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white collar workers), various definitions of retirement, and use of different measures of drinking. Our results do not specifically address the issue of retirement, but they do suggest that changes in employment status do not strongly affect drinking change. Similar to marital status changes, it is also possible that changes in employment were associated with transient drinking changes that were missed in the 10 years between surveys. Additionally, it may be that by looking at the transition unemployment as a whole, we are masking individual effects of retirement versus unintentional job loss (the effects of which may be opposite for this sample).

Some studies find that regular church attendance and greater subjective religiousness are associated with less drinking and higher rates of abstention in later life (Krause, 1991; Musick et al., 2000). We found that attendance of religious service may be a protective factor against transitioning to heavy drinking. Religion and religious participation are complex phenomena with multiple domains, like service attendance, prayer, community, and meaning. Our measure of religiousness is admittedly limited and quite general. It may be that religious service attendance is a marker for more positive coping skills, greater social connection, improved functional status, and decreased risky behavior, all of which may confer decreased likelihood of heavy drinking.

Baseline report of a history of alcohol-related problems predicted maintenance of heavy drinking and transition to heavy drinking. The structure of the WLS questions on alcohol-related questions does not specify whether problems are current or remote. But approximately 1/3 of respondents who reported a baseline history of alcohol-related problems were baseline past-month nondrinkers, and 1/3 were moderate drinkers. This finding suggests that a history of alcohol-related problems, even among past-month nondrinkers, is a potential risk factor for heavy drinking. Assessments limited to the current drinking pattern, without regard for past drinking problems, may not accurately characterize risk for future heavy drinking.

Strengths and Limitations

Strengths of this study include the large sample size, longitudinal design, and high response rates. Additionally, the inclusion of several measures of drinking allowed for more nuanced analyses than have been reported elsewhere. Lastly, this study examines a broad set of possible predictors. Such an approach clarifies potential confounding among predictors and allows for comparisons of the relative importance of different factors.

This study has a number of limitations. First, the WLS drinking data are self-reported with potential recall and reporting biases. There were some illogical response patterns that were not included in these analyses. For example, a small number of respondents reported current drinking at age 53 and then identified as a lifetime abstainer at age 64. Second, there was significant attrition between survey time points because of either death or refusal. The only predictor of attrition related to drinking was that men with a history of alcohol-related problems at age 53 were more likely to refuse follow-up. Consistent with what is known about survey response in general, women and respondents that are more educated showed higher participation at both time points. Third, as described previously, we are limited by information about drinking in the past month only, which may not reflect a consistent

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drinking pattern. Fourth, in our analysis of respondents who identified a history of alcohol-related problems, we do not differentiate among problems or severity, and the list of problems is not exhaustive. Fifth, the application of categorical thresholds on continuous data (splitting drinkers into moderate and heavy drinker status) may result in some systemic error for respondents who are at the perimeter of each of these categories. Sixth, follow-up period was relatively long, and we may have missed transient changes in drinking and events that could affect drinking, that would be identified if there were multiple and more frequent surveys. Seventh, for women, the NIAAA criteria did not match exactly with available data, which we partially addressed (see methods). Lastly, there are several unique demographic features of this sample that may limit generalizability. The WLS sample is almost entirely non-Hispanic white, all respondents are at least high-school educated, and two-thirds lived in Wisconsin at each survey date.

Summary

While measures of drinking frequency and total drinks per month increased or were stable, WLS respondents generally adopted a healthier drinking pattern characterized by decreased heavy drinking and more frequent, moderate daily drinking. A number of baseline characteristics and change events predicted drinking change, but the effects were not consistent across all drinking measures. The strongest and most consistent predictors of drinking changes were gender, education, and health-related factors. There are number of implications of our study findings. First, the expectation that drinking decreases with aging may reflect patterns of past generations, and we may see less of a decline in drinking with current and upcoming cohorts of older adults-including the baby boomer generation. Second, quantity and frequency of drinking change differently over time, suggesting that each dimension should be examined individually rather than using a calculated or reported measure of total alcohol consumption. Lastly, we need more information about the potential health implications of increased frequency of drinking in older age. These concerns are validated by a recent study that found that frequent drinking was associated with a significantly increased risk of cancer in women (Breslow and Graubard, 2008). Furthermore, recommendations for moderate drinking may not apply to older people because of age-related changes in metabolism, medication interactions, advancing ill health, and increased sensitivity to the effects of alcohol (Adams et al., 1990; Dufour and Fuller, 1995).

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Table 1.

Descriptive Statistics of Predictor and Control Measures by Gender

	Females		Males		
Baseline sample size	*N* = 3,469		*N* = 3,020		
Follow-up sample size	*N* = 2,854		*N* = 2,429		
Total sample loss (percent of baseline)	*N* = 615 (18%)		*N* = 591 (20%)		
Death	*N* = 183 (5%)		*N* = 239 (8%)		
Refusal[a]	*N* = 432 (12%)		*N* = 352 (12%)		
	Mean	SD	Mean	SD	Gender difference
High school IQ (normalized)	−0.01	0.98	0.01	1.02	NS
Baseline years of education[b]	13.30	1.99	14.01	2.53	$t(5711) = 12.40^{***}$
Employment status					
Employed–employed (reference)	36%		48%		$\chi^2(3) = 271.14^{***}$
Unemployed–unemployed	17%		5%		
Employed–unemployed	43%		46%		
Unemployed–employed	4%		1%		
Marital status					
Married–married (reference)	66%		78%		$\chi^2(4) = 156.63^{***}$
Married–not married	10%		4%		
Not married–not married	17%		10%		
Not married–married	2%		3%		
Multiple marriage transitions	4%		5%		
Baseline income (1000's) logged[b]	3.43	1.45	3.91	1.20	$t(6472) = 14.38^{***}$
Experienced debt	6%		9%		$\chi^2(1) = 15.94^{***}$
Baseline attended religious services	88%		82%		$\chi^2(1) = 38.83^{***}$
Baseline good health	89%		89%		NS
Experienced major medical diagnosis	21%		27%		$\chi^2(1) = 24.58^{***}$
Hospitalized year prior to follow-up	11%		15%		$\chi^2(1) = 12.64^{***}$

Alcohol Clin Exp Res. Author manuscript; available in PMC 2019 January 14.

		Females	Males
Baseline exceeded CES-D cutoff	15%	10%	$\chi^2(1) = 28.22^{***}$
Baseline history of lifetime alcohol-related problems	20%	32%	$\chi^2(1) = 111.85^{***}$

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

[a] Includes cases with incomplete data.

[b] Satterthwaite estimated degrees of freedom for unequal variances.

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Table 2.

Longitudinal Descriptive Statistics, Drinking Categories, and Drinking Components

Drinking Categories and Transitions

Females								**Males**							
	2004								**2004**						
1993	**None**	**Moderate**	**Heavy**	**Subtotal**	**Death**	**Refusal**	**Total**	**1993**	**None**	**Moderate**	**Heavy**	**Subtotal**	**Death**	**Refusal**	**Total**
None	672	264	9	945	78	166	1,189	None	481	173	21	612	75	110	797
Moderate	305	1,162	118	1,585	76	204	1,865	Moderate	141	913	119	1,173	92	157	1,422
Heavy	38	160	126	324	29	62	415	Heavy	58	283	303	644	72	85	801
Total	1,015	1,586	253	2,854	183	432	3,469	Total	617	1,369	443	2,429	239	352	3,020
General association[a]				$\chi^2(4) = 1127.92^{***}$				General association[a]				$\chi^2(4) = 1202.33^{***}$			
Agreement (weighted)[a]				$\kappa = 0.48$ 95% CI = (0.45,0.51)				Agreement (weighted)[a]				$\kappa = 0.51$ 95% CI = (0.48,0.54)			

Drinking Components (Past Month)[d]

Females	**1993 Mean (SD)**	**2004 Mean (SD)**	**Diff**	**Males**	**1993 Mean (SD)**	**2004 Mean (SD)**	**Diff**
Drinking days per month[e] (n = 2,854)	4.57 (7.09)	5.51 (8.26)	0.94	Drinking days per month[e] (n = 2,429)	7.98 (9.55)	9.13 (10.37)	1.14
Average drinks per drinking day[f] (n = 1,560)	1.80 (1.35)	1.55 (0.84)	−0.25	Average drinks per drinking day[f] (n = 1,606)	2.31 (1.58)	2.11 (1.24)	−0.19
Total drinks per month[e] (n = 2,846)	8.16 (16.32)	8.52 (15.85)	0.36	Total drinks per month[e] (n = 2,416)	17.88	20.29 (26.00)	2.41 (31.41)

	Repeated measures analyses (females and males combined)		
	Drinking days per month	Average drinks per drinking day	Total drinks per month
Gender difference effect[b]	$F(1,5281) = 254.71^{***}$	$F(1,3164) = 196.49^{***}$	$F(1,5260) = 370.58^{***}$
Time difference (1993 vs. 2004) effect[c]	$F(1,5281) = 102.06^{***}$	$F(1,3164) = 78.25^{***}$	$F(1,5260) = 21.82^{***}$
Gender × Time interaction effect[c]	$F(1,5281) = 0.96$	$F(1,3164) = 1.31$	$F(1,5260) = 12.04^{***}$

$^{*}p < 0.05$,

$^{**}p < 0.01$,

$^{***}p < 0.001$.

[a]Computed for unshaded portion of table.

[b]Between-subjects effect.

[c]Within-subjects effect.

[d]Among those who participated in both survey waves (1993 and 2004).

[e]Includes values of 0 for nondrinkers.

[f]Among those who reported drinking in the past month in both survey waves (1993 and 2004).

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Table 3.

Logistic Regressions Predicting 2004 Nondrinking and Drinking

	Model 1: past-month drinker to past-month nondrinker		**Model 2: past-month nondrinker to past-month drinker**	
N	3,726		1,557	
N transitioned (%)	540 (15%)		467 (30%)	
−2LL	−30763.40		−13913.40	
	OR	95% CI	OR	95% CI
Male	**0.65**	**(0.52, 0.79)**	1.07	(0.84, 1.37)
High school IQ (normalized)	**0.81**	**(0.72, 0.91)**	1.05	(0.93, 1.19)
Baseline years of education	0.95	(0.91, 1.00)	1.04	(0.99, 1.10)
Employment status				
Employed–employed (reference)	1.00	–	1.00	–
Unemployed–unemployed	**1.45**	**(1.07, 1.96)**	0.85	(0.59, 1.24)
Employed–unemployed	1.10	(0.89, 1.35)	1.05	(0.82, 1.35)
Unemployed–employed	**0.39**	**(0.16, 0.95)**	0.57	(0.28, 1.13)
Marital status				
Married–married (reference)	1.00	–	1.00	–
Married–not married	1.11	(0.77, 1.59)	1.03	(0.71, 1.51)
Not married–not married	1.28	(0.97, 1.68)	0.82	(0.60, 1.12)
Not married–married	0.92	(0.47, 1.77)	0.78	(0.34, 1.79)
Multiple marriage transitions	0.88	(0.35, 2.26)	2.14	(0.85, 5.39)
Baseline income (1000's) logged	**0.87**	**(0.81, 0.93)**	1.08	(0.98, 1.19)
Experienced debt	0.85	(0.52, 1.37)	0.69	(0.44, 1.09)
Baseline attended religious services	**0.76**	**(0.59, 1.00)**	1.40	(1.00, 1.95)
Baseline good health	0.79	(0.56, 1.11)	**1.56**	**(1.04, 2.34)**
Experienced major medical diagnosis	**1.74**	**(1.41, 2.15)**	0.78	(0.60, 1.01)
Hospitalized year prior to follow-up	**1.88**	**(1.41, 2.50)**	0.83	(0.58, 1.19)
Baseline exceeded CES-D cutoff	**1.38**	**(1.01, 1.90)**	1.19	(0.82, 1.71)
Baseline heavy drinker	**0.56**	**(0.44, 0.72)**		
Baseline history of lifetime alcohol-related problems	0.89	(0.70, 1.11)	0.99	(0.75, 1.29)

Alcohol Clin Exp Res. Author manuscript; available in PMC 2019 January 14.

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Table 4.

Linear Regressions Predicting Change in Drinking Days, Drinks Per Day, and Total Drinks

	Model 3: Change in past-month drinking days		**Model 4: Change in past-month drinks per drinking day**		**Model 5: Change in past-month total drinks**	
N	5,283		3,184		5,283	
−2LL	−58841.70		−28453.30		−64327.60	
	b	95% CI	b	95% CI	b	95% CI
Male	0.05	(−0.39, 0.48)	0.03	(−0.07, 0.14)	**1.84**	**(0.59, 3.08)**
High school IQ (normalized)	−0.09	(−0.32, 0.14)	0.01	(−0.05, 0.07)	−0.40	(−1.06, 0.26)
Baseline years of education	**0.25**	**(0.15, 0.35)**	**0.03**	**(0.00, 0.05)**	**0.53**	**(0.24, 0.82)**
Employment status						
Employed–employed (reference)	0.00	–	0.00	–	0.00	–
Unemployed–unemployed	0.34	(−0.36, 1.04)	−0.12	(−0.30, 0.07)	−0.10	(−2.11, 1.91)
Employed–unemployed	0.42	(−0.02, 0.85)	0.03	(−0.07, 0.13)	**1.51**	**(0.25, 2.76)**
Unemployed–employed	−0.31	(−1.56, 0.94)	−0.12	(−0.43, 0.19)	−0.07	(−3.66, 3.53)
Marital status						
Married–married (reference)	0.00	–	0.00	–	0.00	–
Married–not married	−0.11	(−0.88, 0.66)	−0.09	(−0.29, 0.11)	1.55	(−0.65, 3.76)
Not married–not married	−0.33	(−0.94, 0.28)	0.14	(−0.02, 0.30)	0.82	(−0.93, 2.57)
Not married–married	−1.11	(−2.44, 0.23)	0.17	(−0.14, 0.47)	−1.72	(−5.56, 2.13)
Multiple marriage transitions	−0.12	(−1.94, 1.70)	0.03	(−0.41, 0.46)	−0.65	(−5.93, 4.62)
Baseline income (1000's) logged	**0.19**	**(0.03, 0.36)**	0.01	(−0.03, 0.05)	0.18	(−0.31, 0.66)
Experienced debt	−0.77	(−1.62, 0.07)	−0.02	(−0.23, 0.20)	−0.63	(−3.18, 1.92)
Baseline attended religious services	0.55	(−0.03, 1.12)	−0.12	(−0.26, 0.03)	−0.29	(−1.95, 1.38)
Baseline good health	**1.00**	**(0.26, 1.74)**	**−0.21**	**(−0.42, −0.01)**	−0.07	(−2.37, 2.23)
Experienced major medical diagnosis	**−0.97**	**(−1.45, −0.49)**	**−0.18**	**(−0.30, −0.06)**	**−2.68**	**(−4.06, −1.29)**
Hospitalized year prior to follow-up	**−0.70**	**(−1.35, −0.05)**	**−0.26**	**(−0.43, −0.08)**	**−2.81**	**(−4.80, −0.83)**
Baseline exceeded CES-D cutoff	−0.22	(−0.92, 0.48)	−0.10	(−0.29, 0.09)	−1.32	(−3.46, 0.83)
Baseline history of lifetime alcohol-related problems	0.03	(−0.44, 0.49)	0.00	(−0.11, 0.11)	0.65	(−0.69, 2.00)

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Table 5.

Logistic Regressions Predicting 2004 Heavy and Not Heavy Drinking

	Model 6: Past-month not heavy to past-month heavy		**Model 7: Past-month heavy to past-month not heavy**	
N	4,315		968	
N transitioned (%)	268 (6%)		539 (56%)	
−2LL	−33782.10		−8197.12	
	OR	95% CI	OR	95% CI
Male	**1.51**	**(1.15, 1.99)**	**0.73**	**(0.54, 0.99)**
High school IQ (normalized)	1.12	(0.96, 1.31)	0.94	(0.80, 1.10)
Baseline years of education	0.95	(0.89, 1.01)	1.00	(0.93, 1.08)
Employment status				
Employed–employed (reference)	1.00	–	1.00	–
Unemployed–unemployed	0.69	(0.40, 1.17)	1.03	(0.63, 1.68)
Employed–unemployed	1.29	(0.99, 1.68)	0.87	(0.65, 1.15)
Unemployed–employed	1.26	(0.57, 2.80)	1.32	(0.61, 2.89)
Marital status				
Married–married (reference)	1.00	–	1.00	–
Married–not married	1.13	(0.70, 1.83)	1.10	(0.66, 1.83)
Not married–not married	0.84	(0.56, 1.27)	0.72	(0.47, 1.10)
Not married–married	1.42	(0.66, 3.04)	0.72	(0.35, 1.49)
Multiple marriage transitions	1.33	(0.53, 3.35)	1.22	(0.36, 4.12)
Baseline income (1000's) logged	1.08	(0.96, 1.22)	0.88	(0.77, 1.01)
Experienced debt	1.02	(0.62, 1.68)	**1.84**	**(1.05, 3.24)**
Baseline attended religious services	**0.65**	**(0.47, 0.91)**	1.27	(0.89, 1.80)
Baseline good health	1.16	(0.68, 1.96)	1.54	(0.96, 2.49)
Experienced major medical diagnosis	0.87	(0.64, 1.18)	**2.01**	**(1.45, 2.78)**
Hospitalized year prior to follow-up	**0.58**	**(0.34, 0.96)**	1.43	(0.93, 2.18)
Baseline exceeded CES-D cutoff	0.95	(0.59, 1.54)	1.55	(0.98, 2.47)
Baseline history of lifetime alcohol-related problems	**1.37**	**(1.04, 1.81)**	**0.64**	**(0.48, 0.86)**

Alcohol Clin Exp Res. Author manuscript; available in PMC 2019 January 14.