

Changes in Alcohol Intake and Their Relationship with Health Status over a 24-Year Follow-Up Period in Community-Dwelling Older Adults

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OBJECTIVES: To determine whether alcohol use changes over time in older adults and whether alcohol intake is associated with common chronic diseases.

DESIGN: Twenty-four-year longitudinal study.

SETTING: Southern California community.

PARTICIPANTS: One thousand seventy-six members of the Rancho Bernardo cohort aged 50 to 89 at baseline.

MEASUREMENTS: Participants completed two to six research visits at approximately 4-year intervals between 1984 and 2009. At each visit, participants completed standard questionnaires on alcohol use, chronic diseases, and behaviors. Mixed-effects linear models were used to examine changes in average weekly alcohol intake over time and in relationship to health status.

RESULTS: Prevalence and frequency of alcohol use was high throughout the study, with more than 60% of participants reporting weekly alcohol intake. The average amount consumed declined with advancing age, regardless of the presence of any of the eight most common chronic diseases. Prevalence of drinking in excess of age- and sex-specific low-risk guidelines was high across all visits and did not vary according to disease burden. At the final visit, 29% of participants drank in excess of low-risk drinking guidelines, including 28% of those with hypertension and 31% with diabetes mellitus.

CONCLUSION: Prevalence and frequency of alcohol intake remained stable over a 24 year follow-up in this cohort of educated, white, middle-class, older adults, although average amount consumed decreased with advancing age. Despite this decrease, a high proportion of older adults, including those with common chronic health conditions, drank in excess of current guidelines. Clinicians should provide more education on the importance of

older adults moderating alcohol intake. *J Am Geriatr Soc* 61:1303–1308, 2013.

Key words: aging; alcohol trajectory; drinking; hypertension; diabetes mellitus

Alcohol use is prevalent in older adults in the United States.^{1–4} Although light to moderate regular alcohol consumption appears to have cardioprotective effects even in older adults,^{5–7} older adults are at higher risk than younger adults of harmful effects from alcohol.⁸ Physiological changes in alcohol metabolism with age result in higher blood alcohol concentration in older than younger adults for the same amount of alcohol intake,^{9–11} and prevalence of diseases that alcohol use may exacerbate increase with age.⁸ Interactions between alcohol and medications are also a concern because even small amounts of alcohol may interact negatively with medications commonly used to treat age-related diseases.⁸

Although alcohol use in older adults has been recognized as an important public health concern,¹² patterns of alcohol use in older adults, particularly in the oldest-old, are not well understood. It is often assumed that adults decrease alcohol intake with advancing age, particularly in the presence of illness. Cross-sectional studies uniformly find that older adults drink less than younger adults,^{13–15} but multiple factors can account for age differences in cross-sectional studies,¹⁶ and longitudinal studies have not consistently found a decrease in alcohol intake with age.^{2,14,15,17,18} Few longitudinal studies have examined changes in alcohol intake over prolonged periods in older adults or have examined alcohol intake in relation to health status.^{2,14,15,17,18} With the aging of the population, a better understanding of alcohol use in older adults is necessary to anticipate the effect of alcohol use on public health in the coming years. The current study examined

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self-reported alcohol intake over a 24-year period in a well-characterized cohort of community-dwelling older adults. Frequency and amount of alcohol use over time were examined, and the relationship of alcohol use with age, sex, and reported morbidity was assessed.

METHODS

Participants

Data were obtained from 1,076 participants of the Rancho Bernardo Study (RBS), a longitudinal study of healthy aging. Of the 2,211 participants aged 50 or older at baseline, 49% (1,076) completed at least one subsequent research visit. These 614 women and 462 men, aged 50 to 89 at baseline, are the focus of this study. The University of California at San Diego institutional review board approved this study; all participants provided written informed consent before participation in each visit.

Data Collection

The baseline visit for this study occurred from 1984 to 1987. Follow-up research clinic visits occurred at approximately 4-year intervals; the last occurred from 2007 to 2009.

Health Status

At each clinic visit, a standardized questionnaire was used to obtain information on medical history and lifestyle. Participants completed a checklist of common chronic medical conditions that a physician had diagnosed. Chronic conditions with at least 5% prevalence at baseline in the cohort were assessed: osteoporosis, arthritis, cancer (including melanoma but excluding other skin cancers), diabetes mellitus, pulmonary disease, myocardial infarction, angina pectoris, and hypertension. Once a condition was reported, it was recorded as present for all subsequent follow-up visits for that participant. Chronic disease burden was computed as the total number of these diseases present at each visit.

Self-Reported Alcohol Intake

A standard set of questions was used to ask about alcohol use. Participants were asked whether they ever consumed an alcoholic beverage, and if so, whether they drank in the past year and the frequency of alcohol consumption (daily or almost daily, 3–4 times/wk, 1–2 times/wk, 1–2 times/month, <1 time/month). Participants were asked about the number of bottles or cans of beer, glasses of wine, mixed drinks, and liqueurs or other drinks consumed during an average week.

Average weekly alcohol consumption was calculated using the formula: grams of ethanol = ((number of bottles or cans of beer)(12 oz) (0.045 oz ethanol/oz beer) + (number of glasses of wine)(3.5 oz) (0.122 oz ethanol/oz. wine) + (number of mixed drinks)(1.5 oz) (0.41 oz ethanol/oz spirits) + (number of liqueurs)(1 oz) (0.362 oz ethanol/oz liqueurs) × (29.6 mL/oz)) × 0.7893 g/mL.¹⁹ One drink is equivalent to 12 g of ethanol. This formula may underestimate amount consumed because assumed serving sizes may be smaller than actual serving sizes.²⁰ For example, the formula assumes that a glass of wine is 3.5 oz.

Current standard serving size for wine is 5.0 oz, and actual servings may contain more than that.

Participants were categorized into consistent nondrinkers, those reporting no past-year alcohol use at each visit; consistent drinkers, those reporting some past-year alcohol use at each visit; inconsistent drinkers, those reporting past-year alcohol use at some visits but not at others; and quitters, those who stopped drinking at some point during follow-up. The proportion of individuals at each visit and with each disease who drank in excess of the National Institute on Alcohol Abuse and Alcoholism age- and sex-specific low-risk guidelines, which recommend no more than one drink/d for women of any age, no more than two drinks/d for men younger than 65, and no more than one drink/d for men aged 65 and older, was determined.²¹

Statistical Analyses

Differences between groups (men and women, participants and nonparticipants, study completers and noncompleters) were assessed using univariate analyses of variance for continuous measures and chi-square analyses for categorical measures.

Changes in average weekly alcohol intake over time were examined using mixed-effects models (SAS, PROC-MIXED, SAS Institute, Inc., Cary, NC). Sex and baseline age were entered as fixed effects; follow-up time, measured in years since baseline, was included as a random effect; and interaction terms with time were included to allow the influence of sex and age to change over time. Separate models examined whether education (some college, yes/no, included as a fixed effect) and marital status (married, yes/no, included as a time-varying effect) were associated with alcohol intake or change in intake over time, including the interaction terms of each covariate with time to allow the influence of each covariate to change over time. In separate analyses, adjusted for age, sex, and education, whether each chronic disease or the chronic disease burden was associated with alcohol intake or change in intake over time was examined, with disease status and burden included as time-varying covariates.

All statistical tests were two-tailed; $P \leq .05$ was considered statistically significant. Data were analyzed using SAS version 9.1 (SAS Institute, Inc.) and SPSS version 15.0 (SPSS, Inc., Chicago, IL).

RESULTS

All participants had at least two visits, 18.3% had three, 16.4% had four, 11.9% had five, and 18.3% had six. Mean follow-up time was 15.1 ± 5.6 years (range 5.9–24.3 years). Men and women did not differ in number of clinic visits or years of follow-up.

Characteristics of the cohort at baseline and at the final visit are shown in Table 1. Prevalence of drinking was high across all visits; 76% of women and 83% of men were consistent drinkers, 3% of women and 4% of men were inconsistent drinkers, 6% of women and 5% of men were consistent nondrinkers, and 14% of women and 16% of men quit drinking. The majority of participants at all visits reported drinking at least weekly. Prevalence of drinking in excess of age- and sex-specific guidelines was

Table 1. Cohort Characteristics at Baseline and Final Visit

Characteristic	1984–1988, n = 1,076	2007–2009, n = 288
Age, mean \pm SD	66.4 \pm 8.7	81.6 \pm 5.5
Male, %	42.9	47.2
White, %	100.0	100.0
Some college, %	71.3	73.9
Married, %	79.1	66.7
Nondrinker, %	7.5	16.7
Weekly alcohol intake, %	68.4	65.2
Near daily alcohol intake, %	46.7	42.7
Alcohol, g/wk, mean \pm SD	93.0 \pm 110.2	62.9 \pm 75.2
Drinking in excess of guidelines, %	38.2	29.2
Body mass index, kg/m ² , mean \pm SD	25.0 \pm 3.6	26.1 \pm 4.3
Waist-to-hip ratio, mean \pm SD	0.84 \pm 0.09	0.89 \pm 0.09
Engaged in strenuous physical activity \geq 3 times/wk, %	83.8	65.0
Smoker, %		
Never	42	47
Former	47	50
Current	12	3

SD = standard deviation.

Drinking in excess of guidelines was defined according to sex- and age-specific guidelines of \leq 1 drinks/d for women of any age and men aged \geq 65 and \leq 2 drinks/d for men $<$ 65.²¹

high across visits, with 40% of men and 37% of women drinking in excess guidelines at baseline and 35% of men and 24% of women drinking in excess of guidelines at the final visit (Table 1).

Participants were relatively healthy at baseline, with a low prevalence of common chronic diseases. Prevalence of all diseases increased over time (Figure 1). Prevalence of high-risk drinking did not vary substantially according to disease status. For example, at baseline, 38% of the cohort drank in excess of guidelines, with 33% to 46% of those with each chronic disease drinking in excess of guidelines. At the final visit, 29% of the full cohort reported drinking in excess of guidelines, including 31% of those with diabetes mellitus, 28% of those with hypertension, and 28% of those with three or more chronic diseases.

Analysis of average weekly consumption showed that, controlling for age, education, and marital status, men consumed an average of 36 g/wk more alcohol than women ($P < .001$). Amount of alcohol consumed per week decreased over time in participants who were older at baseline (significant baseline age by time interaction, $P < .001$; Figure 2). Men had a slightly steeper decline in alcohol intake over time than women (sex by time interaction, $P = .047$). Alcohol intake did not vary according to education or marital status.

Average weekly alcohol intake varied according to disease status, individuals with angina pectoris, myocardial infarction, or diabetes mellitus drank, on average 21.0, 19.2, and 20.6 g/wk less, respectively, than individuals without these conditions ($P < .05$). The associations between angina pectoris and myocardial infarction with alcohol intake did not vary over time, but there was a significant disease by time interaction with diabetes mellitus ($P < .05$). Although individuals with diabetes mellitus

drank less overall than those without, their alcohol consumption increased on average by 1 g/wk per year. None of the other individual diseases, or the disease burden, was associated with any significant differences in average weekly alcohol intake or rate of change in weekly alcohol intake over time.

Nonparticipant and Noncompleter Characteristics

Nonparticipants, defined as those who completed the baseline visit but did not return for any follow-up visits were older (75.1 vs 66.4, $P < .001$), more likely to be male (48% vs 43%, $P = .01$) and to report higher rates of common chronic diseases than participants, but after controlling for sex and age, participants and nonparticipants did not differ in average weekly alcohol intake (93 vs 80 g/wk) or in prevalence of drinking in excess of guidelines (38% of participants, 37% of nonparticipants).

Participants who did not complete all visits were older than those who did (baseline age 69 vs 59; $P < .001$) and reported higher rates of common diseases, but after controlling for sex and age, study completers and noncompleters did not differ in baseline average weekly alcohol intake (94 vs 93 g/wk) or prevalence of drinking in excess of guidelines (40% of completers, 34% of noncompleters).

DISCUSSION

In this community-dwelling cohort of older, educated, middle-class, white adults, patterns of alcohol consumption remained stable as the cohort transitioned from late middle age into late older age. Prevalence and frequency of alcohol intake were high across the 24-year follow-up period, with the majority of the cohort consuming alcohol at least weekly. Although the average amount of alcohol consumed per week decreased with advancing age regardless of health status, a substantial proportion of the cohort drank in excess of age- and sex-specific low-risk guidelines at each follow-up visit. This proportion did not differ between those with and without one or more common chronic diseases.

These results extend prior observations that drinking patterns remain stable during the transition from middle to older age,^{2,17,22} showing that stability in drinking patterns persists into advanced age. The decline in average amount consumed over time in older members of the cohort was consistent with cross-sectional studies showing lower levels of alcohol intake in older than younger adults^{13–15,23} and with a recent 20-year follow-up study that reported stable alcohol consumption in early older age, with steeper decline in later older age.¹⁸ The current finding that men consumed more alcohol than women and showed greater decline in alcohol intake over time is also consistent with prior reports.^{17,18}

The findings that the decrease in alcohol intake over time in older adults occurred regardless of disease status or disease burden and that the prevalence of drinking in excess of guidelines did not differ in the presence of common chronic diseases conflicts with prior findings that older adults decrease alcohol intake in response to decreases in health.^{18,24,25} The current study found that the presence of some diseases (myocardial infarction,

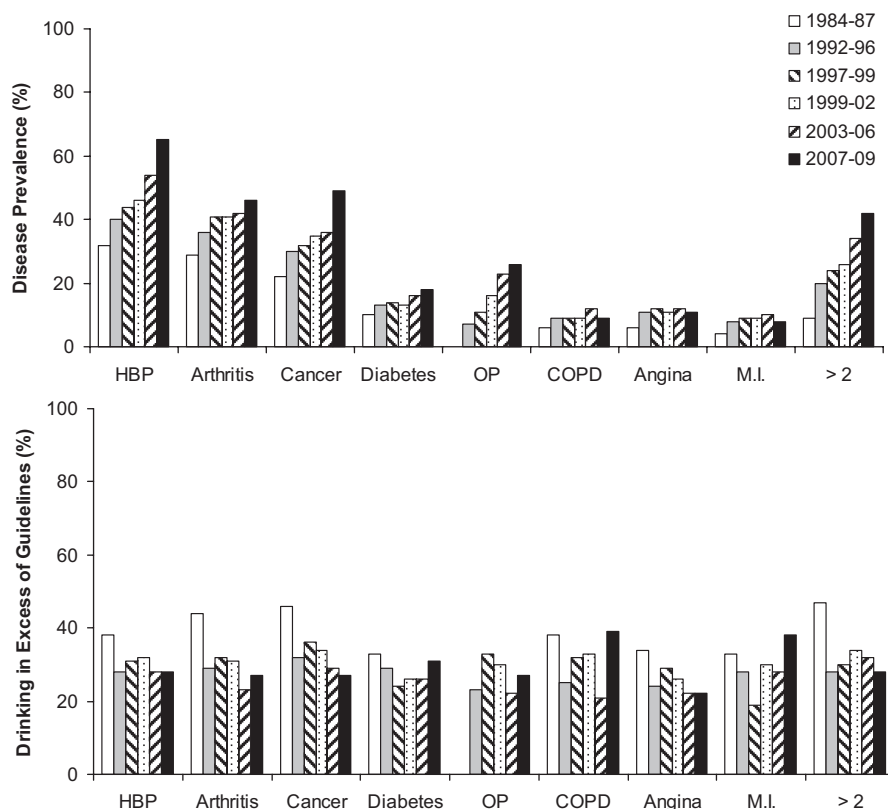


Figure 1. Prevalence of common chronic diseases at each visit (top) and prevalence of high-risk drinking according to disease at each visit (bottom). HBP, high blood pressure; OP, osteoporosis; COPD, chronic obstructive pulmonary disorder; MI, myocardial infarction; >2 = presence of ≥ 3 common chronic diseases.

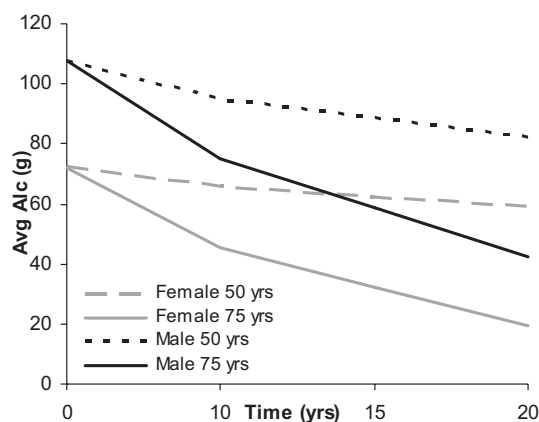


Figure 2. Change in average weekly alcohol intake over time. Predicted change in alcohol intake for men and women aged 50 and 75 from the mixed-effects linear model (age by time interaction, $P < .001$; sex by time interaction; $P = .047$). Avg Alc (g) = average weekly alcohol intake in grams.

angina pectoris, diabetes mellitus) was associated with lower average weekly alcohol intake, but the proportion of individuals with these diseases who drank in excess of guidelines was similar to that of individuals without these diseases. Another longitudinal study²⁴ reported that decline in alcohol consumption with poor health was modest and that the relationship between alcohol intake and health was complex. The authors noted that, although

some individuals appeared to drink more to counteract the effects of illness, the directionality of the relationship between illness and alcohol intake is uncertain.²⁴ Here, prevalence of drinking in excess of guidelines was high in all of the common diseases examined. This is of concern because guidelines for preventing and managing some of these diseases (e.g., diabetes mellitus, hypertension) stress the importance of adhering to low-risk drinking guidelines.^{26,27}

The prevalence of alcohol use in this cohort was higher than that in the general U.S. population, as previously reported.²⁸ For example, in the 2000 National Health Interview Survey, 49% of men and 63% of women aged 65 and older reported not drinking.¹ The nondrinking rate in the current study was less than 7%. In nationally representative samples of older adults, 10% of men and 2% of women reported drinking in excess of low-risk guidelines.¹ Here, 40% of men and 37% of women drank in excess of guidelines at baseline, and 35% of men and 24% of women drank in excess of guidelines at the final visit, in 2007 to 2009.

The higher levels of alcohol use in RBS than in nationally representative samples are consistent with the demographic characteristics of the cohort. The RBS cohort is white, well educated, and middle class. Results from the National Health and Nutrition Examination Survey have shown that whites consume more alcohol than other races and that education and socioeconomic status are positively associated with alcohol intake.¹⁷ The prevalence and

amount of alcohol intake in RBS is similar to that reported for a community sample of older adults in the western United States with similar demographic characteristics.³

In addition to the nonrepresentativeness of the study cohort, other limitations of the study are its reliance on self-reported alcohol intake and health status and potential survivor bias. Self-reported measures of alcohol use have been shown to have reasonable levels of reliability and validity,^{29,30} but as mentioned, estimated weekly average alcohol intake is likely to underestimate actual intake. Self-reported health status in RBS has been validated for most of the diseases considered here for subsets of the cohort using medical records or by clinical or laboratory assessment in the research clinic. Survivor bias might have influenced the results, although those who completed all visits did not differ in baseline average alcohol intake or in prevalence of drinking in excess of guidelines from nonparticipants or noncompleters. Strengths of the study include the broad upper age range, length of follow-up, frequent and detailed assessments of alcohol intake, health and lifestyle variables, and the resulting ability to describe the relationship between changes in alcohol intake and changes in health status over time.

In conclusion, this study shows that alcohol use remains high with advanced age in some segments of the population and that drinking in excess of low-risk guidelines is prevalent even in a cohort with good health care, including those with diseases for which drinking in excess of guidelines poses health hazards. This suggests that primary care physicians should monitor alcohol intake in patients and provide regular education on the importance of limiting alcohol intake, particularly for individuals with medical conditions that excess alcohol consumption may exacerbate.

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