

Primary care-based intervention to reduce at-risk drinking in older adults: a randomized controlled trial

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ABSTRACT

Aims To examine whether a multi-faceted intervention among older at-risk drinking primary care patients reduced at-risk drinking and alcohol consumption at 3 and 12 months. **Design** Randomized controlled trial. **Setting** Three primary care sites in southern California. **Participants** Six hundred and thirty-one adults aged ≥ 55 years who were at-risk drinkers identified by the Comorbidity Alcohol Risk Evaluation Tool (CARET) were assigned randomly between October 2004 and April 2007 during an office visit to receive a booklet on healthy behaviors or an intervention including a personalized report, booklet on alcohol and aging, drinking diary, advice from the primary care provider and telephone counseling from a health educator at 2, 4 and 8 weeks. **Measurements** The primary outcome was the proportion of participants meeting at-risk criteria, and secondary outcomes were number of drinks in past 7 days, heavy drinking (four or more drinks in a day) in the past 7 days and risk score. **Findings** At 3 months, relative to controls, fewer intervention group participants were at-risk drinkers [odds ratio (OR) 0.41; 95% confidence interval (CI) 0.22–0.75]; they reported drinking fewer drinks in the past 7 days [rate ratio (RR) 0.79; 95% CI 0.70–0.90], less heavy drinking (OR 0.46; 95% CI 0.22–0.99) and had lower risk scores (RR 0.77 95% CI 0.63–0.94). At 12 months, only the difference in number of drinks remained statistically significant (RR 0.87; 95% CI 0.76–0.99). **Conclusions** A multi-faceted intervention among older at-risk drinkers in primary care does not reduce the proportions of at-risk or heavy drinkers, but does reduce amount of drinking at 12 months.

Keywords Aged, alcohol, comorbidity, intervention, primary care, screening.

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INTRODUCTION

At-risk drinking falls within the spectrum of unhealthy alcohol use [1] and is defined typically as exceeding particular drinking limits [2–4]. One definition of at-risk drinking is consuming > 14 standard drinks per week or more than four drinks per occasion for men less than 65 years of age and more than seven drinks per week or more than three drinks per occasion for women and

people aged 65 years and older [5]. Using this definition, between 2 and 3% of women and 9–10% of men aged 65 years and older engage in at-risk drinking [2,6,7].

Older adults have risks associated with drinking that differ somewhat from younger people because of age-related physiological changes that increase blood alcohol levels for a given dose, increased brain sensitivity to alcohol and increases in morbidity and medication use [8–10]. A definition of at-risk drinking more relevant to

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older adults is the use of alcohol that increases risk for harm, due both to the amount consumed and concurrent use of alcohol with medications and comorbidities [11].

Using a definition of at-risk drinking that includes alcohol use and comorbidity, 18% of men and 5% of women aged 60 years and older were at-risk drinkers in a population-based sample of US adults [12]. At-risk male drinkers had a 20% higher mortality rate than not at-risk drinkers.

Randomized controlled trials of brief alcohol interventions have been proven to reduce unhealthy alcohol use in primary care populations [13], but few have focused on older adults [14,15]. No randomized controlled trial has tested interventions to reduce risks associated with alcohol, comorbidity and medication use in older adults.

The Comorbidity Alcohol Risk Evaluation Tool (CARET), whose precursor is the short Alcohol-Related Problems Survey [16], is a measure to identify at-risk drinking older adults. The CARET takes 2–5 minutes to self-administer and uses information on amount of alcohol use, comorbidity, symptoms and medications to assess drinking risks [16–20]. One study used a related instrument to identify older adults as harmful, hazardous or non-hazardous drinkers in three sites within a primary care practice [15]. At site 1, reports outlining patients' drinking risks were sent to both physicians and patients; at site 2, reports were sent only to patients; and at site 3, no reports were sent. Patients receiving reports had reduced drinking risks and those at site 1 also reduced drinking amount compared to site 3 at 12 months.

While these data were promising, we conducted a more rigorous trial by randomizing older at-risk drinkers to intervention or control groups, including multiple primary care practices in three separate organizations, and utilizing an intervention containing components proven effective to change behavior [13,14,21]. We hypothesized that, compared to the control group, the intervention would cause greater reductions in both at-risk drinking and alcohol consumption among older adults in primary care settings.

METHODS

Study design

The Healthy Living As You Age (HLAYA) study is a randomized clinical trial testing the effectiveness of a screening and multi-component intervention among older at-risk drinkers in community-based primary care settings. The primary aims of the study were to reduce at-risk drinking and alcohol use at 12 months. The Institutional Review Boards from the University of California

at Los Angeles and Kaiser Permanente Southern California approved this study. All enrolled participants provided written informed consent.

Setting and primary care providers (PCP)

Study sites included three organizations in Southern California: an independent provider organization, Desert Oasis Healthcare (DOHC); a large group model health maintenance organization: Kaiser Permanente Southern California (KPSC); and a university-affiliated ambulatory care system, UCLA Healthcare. Primary care providers (PCP) practising at the study sites were recruited in 2004 through announcements and e-mails sent by study authors (M.H., S.W., A.M.). The 145 participating PCPs (48.6% of those eligible) received 30 minutes' instruction by an investigator (A.M.) in the study procedures and how to provide brief advice (1–5 minutes) to reduce drinking modeled after the National Institute on Alcohol Abuse and Alcoholism publication *Helping Patients Who Drink Too Much: A Clinician's Guide* [5].

Participants

Participants were recruited from October 2004 to April 2007 and identified from a list of patients scheduled to see a participating PCP in the following week. To be eligible for screening, participants had to be aged 55 years or older, speak English or Spanish, see participating clinicians and report having consumed at least one alcoholic drink in the past week. Those who could not hear the screening questions, were too ill to participate or had received treatment for an alcohol use disorder in the prior 3 months were ineligible. Clinical staff and volunteers telephoned 7478 patients who met the age eligibility criterion to introduce the study as one focusing on healthy behaviors in older adults and to screen for eligibility. Of those contacted, 2138 (29%) were eligible to be screened further for study enrollment (Fig. 1).

Identification of at-risk drinkers

Those agreeing to participate in the secondary screening were administered the CARET over the telephone. The CARET includes questions assessing past 12-month (i) quantity and frequency of drinking, (ii) episodic heavy drinking (four or more drinks on an occasion), (iii) driving within 2 hours of drinking three or more drinks, (iv) others being concerned about the respondent's drinking, (v) medical and psychiatric conditions, (vi) symptoms that could be caused or worsened by alcohol and (vii) medications that could interact negatively with or whose efficacy could be diminished by alcohol.

Responses were scored to designate a participant as either an at-risk (score 1–7) or not at-risk drinker (score

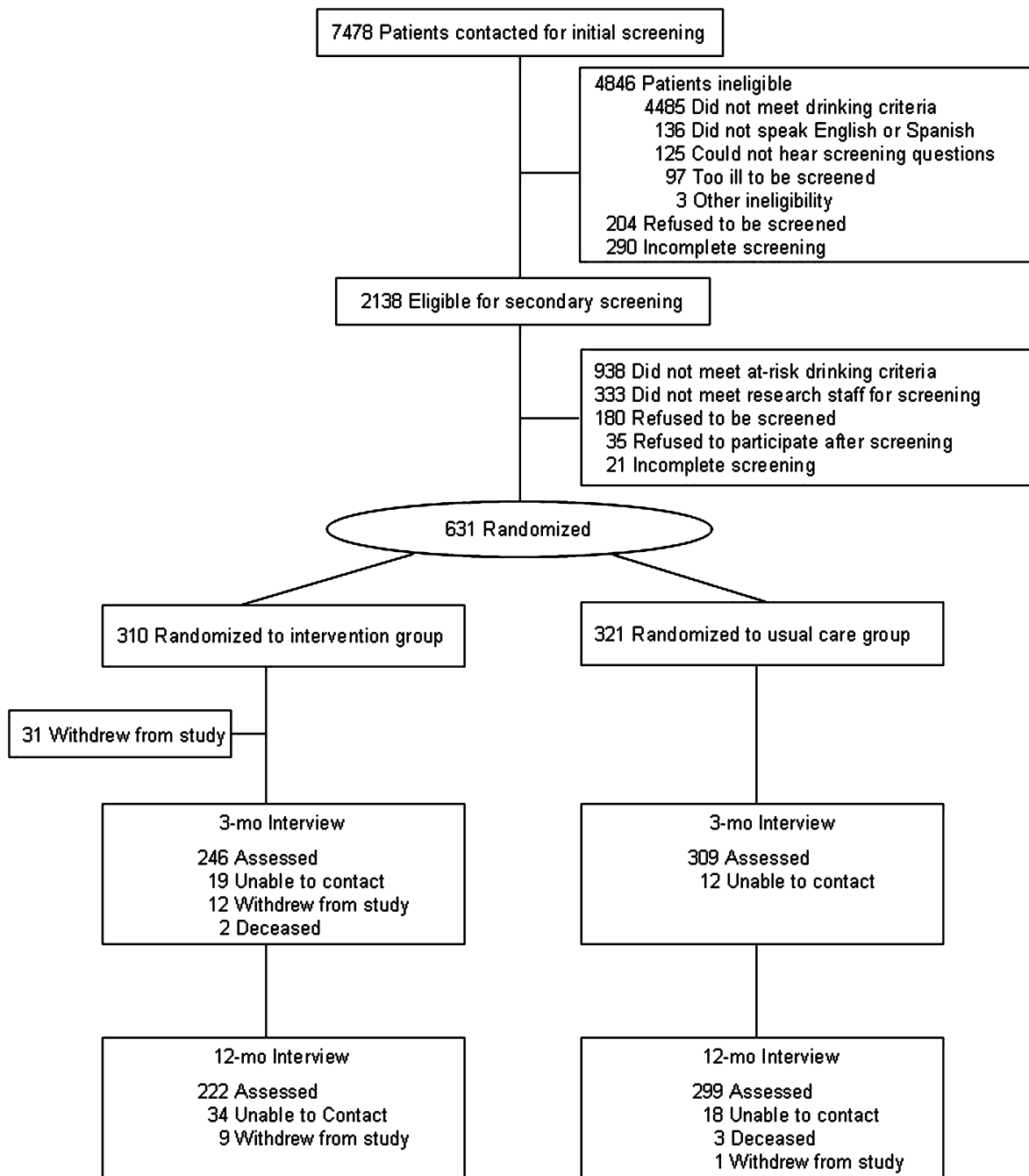


Figure 1 Flow of individuals in the Healthy Living As You Age (HLAYA) trial

0). Some examples of at-risk drinkers include people who report (i) drinking three drinks four or more times a week, or (ii) drinking two or more drinks at least twice a week and often having heartburn, or (iii) drinking two drinks daily and taking alprazolam at least three to four times a week. Of the 2138 individuals eligible for secondary screening, 631 (30%) were at-risk drinkers and agreed to participate in the trial. Approximately 1 week later, at the time of a regular visit with their PCPs (i.e. baseline visit), these participants were assigned randomly to the

intervention group (310 individuals) or control group (321 individuals).

Randomization and blinding

Research assistants used consecutively numbered, sealed opaque envelopes containing assignment information prepared at the study coordinating center using a computer-generated set of random numbers. Randomization of participants was stratified by site and gender;

within each stratum randomly sized blocks of 8, 10 or 12 were used. Within each block, equal numbers were assigned to intervention or control groups. PCPs could see patients in both groups, but they were alerted only when seeing intervention group subjects. Research assistants, blinded to treatment allocation, conducted all baseline and follow-up outcome assessments. To legitimize alcohol use as a health issue [22], and to mask the true purpose of the study to potential participants before randomization occurred, questions on seat belt use, exercise, diet and smoking were asked.

Control group

At the baseline visit control group participants received a booklet outlining recommended behaviors for alcohol use, nutrition, exercise, medication use and smoking. Research assistants encouraged participants to read the booklet and discuss it with their PCPs.

Intervention group

At the baseline visit the research assistant informed intervention group participants that the study focused on healthy drinking behaviors and they were asked to sign a second informed consent form describing additional procedures. Before seeing the PCP, the research assistant handed each participant a personalized report and drinking diary to keep track of alcohol use. A similar version of the report was given to the PCP. The reports outlined participants' alcohol-associated risks identified by the CARET (e.g. drinking two drinks daily and taking a sedative) and potential consequences (e.g. increased sedation and falls). The PCP gave the participant oral and written advice (in prescription-style format on an alcohol education booklet). At 2, 4 and 8 weeks after the baseline visit, a health educator called participants to provide additional feedback and counseling using motivational interviewing techniques [23] to help reduce alcohol consumption. We have reported previously on this component of the intervention [24].

Outcomes and follow-up

Baseline questionnaires assessing demographic, health-related and alcohol consumption characteristics were completed before randomization. Health-related characteristics included: self-rated health status (excellent, very good, good, fair and poor), ability to perform strenuous activities and heavy work [25] and overall quality of life (0, as bad as dying, to 10, perfect health). Alcohol consumption was assessed using the CARET and the 7-day alcohol time-line follow-back (TLFB) [26].

Follow-up assessments were made by telephone at 3 and 12 months after baseline. The CARET was adminis-

tered using the time-frame since the prior assessment (e.g. at 3 months, questions were framed using 'During the past 3 months' as the question stem). The 7-day alcohol TLFB, questions on self-rated health status, ability to perform strenuous activities and heavy work and quality of life were re-administered. Participant follow-up concluded in July 2008. The amount of time spent conducting each assessment was 15–20 minutes for baseline, 10–15 minutes for the 3 month and 15–20 minutes for the 12-month assessment.

Statistical analysis

As there were no available data on changes in CARET-defined at-risk drinking, we based the sample size estimates on two trials of brief advice in primary care [14,27] using number of drinks per week as the outcome. We anticipated that our enrolled sample would be drinking less than in other trials, as participants could be identified as at-risk drinkers while drinking one to two drinks per day depending on their comorbidities and medications used. The power calculations were based on expecting an average difference of 1.8–2.0 drinks per week between groups at 12 months and a standard deviation of 9.0–10.0. With 250 individuals per group, 80% power was projected to detect the effect size of 0.2 with alpha level of 0.05 (two-sided). Enrolling 313 individuals per group allowed up to 20% attrition rate.

Analyses of outcome data were based on the intention-to-treat method and measured at the 3- and 12-month follow-up periods. The outcomes were the: (1) percentage of participants meeting at-risk criteria on the CARET (yes or no); (2) number of risks identified on the CARET (range 0–7); (3) number of drinks consumed per week as measured by the 7-day alcohol TLFB; and (4) heavy drinking (four or more drinks in a day) in the past 7 days (yes or no) using the TLFB.

Baseline characteristics were reported for the total sample and by group. Categorical data were reported as frequencies (percentages) and count data were reported as means and standard deviations (SD).

Among the 631 participants, 555 (88%) completed the 3-month follow-up and 521 (83%) completed the 12-month follow-up (Fig. 1). Of those in the intervention arm, 249 (80.3%) completed at least one call with the health educator [24]. At 3 months, 246 (79%) of the intervention group and 309 (96%) of the control group completed the assessments; at 12 months, 222 (72%) of the intervention group and 299 (93%) of the control group completed the assessments ($P < 0.05$ for both follow-ups).

Using data from the 3- and 12-month follow-ups, we conducted longitudinal data analyses using the Stata version 11.0 xt series of commands (StataCorp, College

Station, TX, USA). The number of drinks consumed in the past 7 days was analyzed with a negative binomial model using the *xtenbreg* procedure; the number of risks was analyzed by Poisson models with the *xtpoisson* procedure [28]. Logistic regression models were fitted for the dichotomous outcomes: heavy drinking in past 7 days and at-risk drinking status. All models included a random intercept to account for clustering within participant [29] and examined the fixed effects for group, follow-up assessment and their interaction with regression adjustment for age, gender, baseline measure for the same outcome and study site. The results of the negative binomial regression and Poisson model analyses are presented as rate ratios (RR) and the logistic regression models as odds ratios (OR).

Because of differences in the magnitude of missing data between treatment groups, multiple imputation [30,31] was used to address missing data for participants who did not complete the 3- or 12-month follow-up assessments using a multivariate normal model separately for each group. The model included outcome variables assessed at baseline, 3 and 12 months, and baseline covariates using the MI procedure in SAS version 9.2 (SAS Institute, Cary, NC, USA). We reported results from unimputed data along with multiple imputation as sensitivity analyses.

RESULTS

Baseline sample characteristics

In the sample, 63% were recruited from DOHC ($n = 399$), 21% from UCLA ($n = 133$) and 16% from KPSC ($n = 99$). They ranged in age from 55 to 89 years (Table 1). Most were men, non-Hispanic white, highly educated, retired, married and living with someone. Most reported their health as good or better, being able to perform both strenuous activities and heavy work, and good quality of life.

On average, in the past 7 days, participants reported drinking >14 drinks and more than a third drank more than four drinks in a day (Table 1). Participants had an average of three risks; 28% had just one risk, and 19%, 14%, 18% and 21% had two, three, four or five or more risks, respectively. Most were identified as at-risk drinkers because of alcohol use with medications (73%), followed by alcohol use with particular symptoms (60%), alcohol use with comorbidities (50%), amount of alcohol use alone (47%), binge drinking (24%), driving after drinking (24%) and others being concerned about participant's drinking (17%).

Among those identified as at-risk due to amount of alcohol consumption with comorbidity, most had hypertension, followed by depression, gout and diabetes

(Table 2). Among those identified as at-risk due to amount of alcohol consumption with particular symptoms, most were identified due to problems sleeping, gastrointestinal symptoms or memory problems. Among those identified as at-risk due to amount of alcohol consumption with medications, most were taking antihypertensives, followed by ulcer medications, non-steroidal anti-inflammatory drugs and antiplatelet drugs.

Outcomes

The percentage of at-risk drinkers declined steeply from baseline to 3 months in both groups, and was generally sustained at 12 months (Fig. 2). Amount of drinking and prevalence of heavy drinking days dropped precipitously from baseline to 3 months for both groups and these reductions were generally sustained at 12 months (Figs 3 and 4). The summary outcome data at 3 and 12 months are presented in Table 3. The between group difference of 1.3 drinks in the past 7 days observed at 12 months is smaller than the 1.8–2.0 drink difference that we expected when designing the study, and may not be clinically meaningful.

Table 4 presents treatment effects on the outcomes at 3 and 12 months, with and without imputation for missing values. At 3 months, relative to controls, fewer participants receiving the intervention were at-risk drinkers (OR 0.41; 95% CI 0.22–0.75); they had lower risk scores (RR 0.77 95% CI 0.63–0.94), reported drinking fewer drinks (RR 0.79; 95% CI 0.70–0.90) and less heavy drinking (OR 0.46; 95% CI 0.22–0.99). At 12 months, the group differences in number of drinks in the past 7 days remained (RR 0.87; 95% CI 0.76–0.99). Multiple imputation produced similar results as those without imputation (Table 4).

DISCUSSION

This randomized trial demonstrated that, compared to receiving an educational booklet, a multi-component intervention among older adults in primary care did not reduce at-risk drinking but did reduce alcohol consumption. In both intervention and control groups, prevalence of at-risk drinking declined by 50–60%, amount of drinking declined by 30–40% and prevalence of heavy drinking days declined by 30–70% from baseline to 3 months, and largely persisted at 12 months. In addition, those in the intervention group receiving personalized feedback about alcohol-associated risks had greater reductions in at-risk drinking, number of risks, amount of drinking and prevalence of heavy drinking days compared to the control group at 3 months; these differences continued to favor the intervention group but remained statistically significant only for amount of drinking at 12 months.

Table 1 Baseline patient characteristics.^a

Characteristic	Total (n = 631)	Intervention (n = 310)	Control (n = 321)
Age, mean (SD)	68.4 (6.9)	68.7 (6.8)	68.1 (6.9)
Male gender	448 (71)	222 (72)	226 (70)
Race			
White, non-Hispanic	551 (87)	272 (88)	279 (87)
Hispanic/Latino	58 (9)	27 (9)	31 (10)
Other	21 (3)	10 (3)	11 (3)
Education			
High school or less	144 (23)	72 (23)	72 (23)
Some college	194 (31)	99 (32)	95 (30)
College degree or more	289 (46)	138 (45)	151 (47)
Marital status			
Married	311 (50)	153 (50)	158 (50)
Widowed, divorced, separated	170 (27)	78 (25)	92 (29)
Never married	145 (23)	76 (25)	69 (22)
Living arrangement			
Living with spouse, partner or others	464 (74)	228 (74)	236 (74)
Living alone	165 (26)	81 (26)	84 (26)
Employment status			
Retired or homemaker	463 (74)	228 (74)	253 (73)
Working full- or part-time	166 (26)	80 (26)	86 (27)
Self-rated health status			
Excellent or very good	328 (52)	156 (50)	172 (54)
Good	233 (37)	123 (40)	110 (34)
Fair or poor	69 (11)	31 (10)	38 (12)
Able to do			
Strenuous activities	471 (75)	226 (73)	245 (77)
Heavy work	525 (83)	256 (83)	269 (84)
Self-rated quality of life (range -10), mean (SD)	7.9 (1.6)	7.9 (1.6)	7.9 (1.7)
Number of drinks in past 7 days, mean (SD)	15.2 (7.3)	15.1 (7.2)	15.2 (7.4)
Had a heavy drinking day in past 7 days ^b	216 (34)	106 (34)	110 (34)
Risk score (range 0-7), mean (SD)	2.9 (1.7)	2.9 (1.7)	3.0 (1.7)
Type of risk			
Quantity and frequency of drinking ^c	295 (47)	147 (47)	148 (46)
Binge (four or more drinks per occasion) drinking	149 (24)	79 (25)	70 (22)
Driving after drinking	154 (24)	73 (24)	81 (25)
Others being concerned	106 (17)	50 (16)	56 (17)
Alcohol use with medical, psychiatric condition	315 (50)	154 (50)	161 (50)
Alcohol use with symptoms	378 (60)	185 (60)	193 (60)
Alcohol use with medications	462 (73)	222 (72)	240 (75)

SD: standard deviation. ^aData are presented as no. (%) unless indicated otherwise. ^bHeavy drinking day is defined as drinking four or more drinks in a day. ^cThose meeting criterion for this risk drink three or more drinks per occasion at least four times a week, four or more drinks per occasion at least twice monthly or five or more drinks per occasion at any frequency.

In Project GOAL [14], the number of drinks consumed in the past 7 days for both study arms at baseline was similar to our sample, but alcohol consumption did not decline from baseline in the control group. This finding contrasts with our study and most others employing brief interventions [13,32]. Project GOAL's intervention was more intensive than ours, as physicians used a work-book to give advice to patients and the study included a second reinforcement visit with the physician, and included two follow-up calls from a clinic nurse 2 weeks after each physician visit. These features probably contributed to its

success in reducing both 7-day alcohol use and binge drinking in the intervention group at 3, 6 and 12 months.

In the study by Fink *et al.* [15], respondents were classified as harmful, hazardous or non-hazardous drinkers using a scoring method similar to the CARET. At 12 months both groups receiving reports had overall lower-risk classifications compared to the group not receiving a report. Our study did not have statistically significant differences in the proportions of those at-risk in the two study arms at 12 months possibly because those in the control arm received information on healthy drinking

(similar to Project GOAL), and therefore received minimal intervention, while the study by Fink *et al.* gave no information on healthy drinking to the no report group.

The trial's data illustrate the unique risks of this sample of older adults who drink alcohol. They frequently used medications whose efficacy may be diminished by alcohol or may interact negatively with alcohol, such as antihypertensives, ulcer medications, non-steroidal anti-inflammatory drugs and antiplatelet drugs. They also frequently had conditions or symptoms that may be

caused or worsened by alcohol such as hypertension, depression, insomnia, memory problems and gastrointestinal symptoms such as heartburn.

Regression towards the mean, social desirability bias and assessment effects may have influenced our study's findings. Because the intervention group was told the study focused on drinking it is possible that, relative to the blinded control group, they may have under-reported their alcohol consumption on follow-up assessments. We aimed to minimize this bias by designing other aspects of the study to reduce such bias (e.g. confidential reporting, non-judgmental nature of assessments). Both study groups completed three separate assessments and this may have reduced the effect of the intervention relative to the control condition [33,34].

One of the study's limitations, common among studies of brief alcohol interventions, was the differential attrition rate between the two study arms [13]. Although we aimed to reduce dropout in the intervention arm by offering those participants who seemed unwilling to receive health educator calls the option of no further health educator calls, there was a 17% and 21% difference in follow-up rates between the two study arms at 3 and 12 months, respectively. It could be that older adults who are identified as at-risk drinkers are wary of talking about a sensitive topic with someone they do not know. Counseling delivered by health professionals known to the older adult, as in Project GOAL, may be more successful in changing behavior. Also, the sample was primarily white, male, highly educated and in good health, and the study findings may not be generalizable to other populations. However, the sample is typical of older adults in community-based primary care who participate in brief alcohol interventions [14,15], and the general population of older adults who drink alcohol [11,35,36]. Some clinical staff conducted pre-screening and administered the baseline assessments for the project. Although some practices use clinical staff for such health behavior assessments, it is not standard of care and could be challenging for many primary care practices to implement. Another

Table 2 Baseline comorbidities, symptoms and medications that increase risk with alcohol consumption.

Type of risk	n (%)
Alcohol consumption with comorbidity	
Hypertension	193 (30.6)
Depression	78 (12.4)
Gout	48 (7.6)
Diabetes	33 (5.2)
Ulcer disease	26 (4.1)
Liver condition	22 (3.5)
Pancreatitis	4 (0.6)
Alcohol consumption with symptoms	
Problems sleeping	243 (38.5)
Gastrointestinal symptoms	152 (24.1)
Memory problems	142 (22.5)
Feeling sad or blue	106 (16.8)
Tripping, falling or having accidents	112 (17.8)
Alcohol consumption with medications	
Antihypertensives	200 (31.7)
Ulcer medications	115 (18.2)
Non-steroidal anti-inflammatory drugs	113 (17.9)
Antiplatelet drugs	109 (17.3)
Non-prescription medications for allergies or sleep	80 (12.7)
Antidepressants	75 (11.9)
Sedatives	64 (10.1)
Opioids	42 (6.7)
Nitrates	27 (4.3)
Warfarin	28 (4.4)
Seizure medications	4 (0.6)

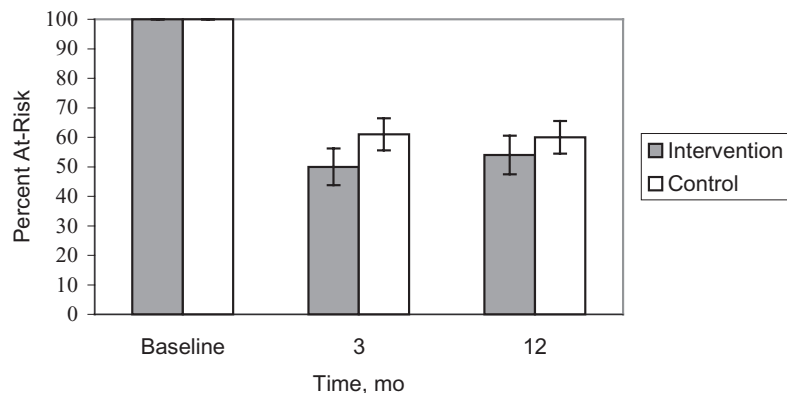


Figure 2 Percentage of at-risk drinkers. Error bars indicate 95% confidence intervals

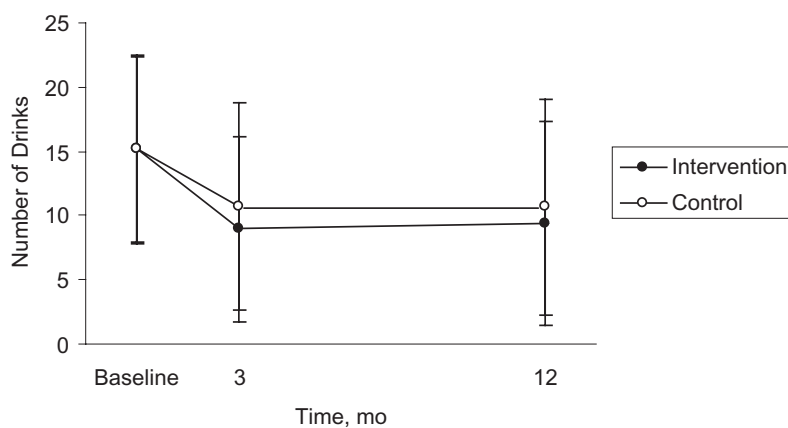


Figure 3 Mean number of drinks in the past 7 days. Error bars indicate standard deviations

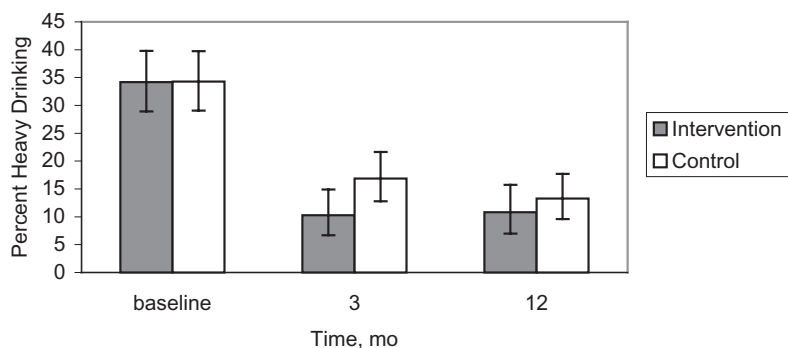


Figure 4 Prevalence of heavy drinking episodes in the past 7 days. Error bars indicate 95% confidence intervals

Table 3 Summary outcome data at 3 and 12 months.

Variable	Intervention group	Control group
	Percentage	
At-risk drinker, %		
3 months (control group, <i>n</i> = 309, intervention group, <i>n</i> = 246)	49.6	61.2
12 months (control group, <i>n</i> = 299, intervention group, <i>n</i> = 222)	54.1	59.9
One or more heavy drinking days in past 7 days		
3 months (control group, <i>n</i> = 296, intervention group, <i>n</i> = 234)	10.3	16.9
12 months (control group, <i>n</i> = 294, intervention group, <i>n</i> = 213)	10.8	13.3
	Mean (SD)	
Risk score (range 0–7)		
3 months	1.30 (1.8)	1.66 (1.9)
12 months	1.38 (1.8)	1.63 (1.9)
Number of drinks in past 7 days		
3 months	8.93 (7.3)	10.73 (8.0)
12 months	9.39 (8.0)	10.70 (8.4)

SD: standard deviation.

potential limitation is that PCPs could see participants in both the treatment and control arms of the study and could 'contaminate' the control arm by providing advice to reduce drinking. Similar to the control arm in Project GOAL, at the 3-month follow up 47 (15%) control participants reported discussing alcohol use with their PCPs. Also, as all study participants received information on low-risk drinking limits, all received some type of intervention. Both these design characteristics may have

reduced the observed differences between intervention and control groups. Finally, because we powered our study to detect differences in amount of drinking, it may have been underpowered to detect a difference in the prevalence of at-risk drinking. We did not assess whether participants met DSM criteria for alcohol abuse and/or dependence, but the relatively brief intervention conducted in this study may be unlikely to address the needs of those who have such alcohol use disorders.

Table 4 Intervention effects on at-risk drinking and amount of alcohol consumption based on random-effects models with and without imputation for missing values.

Variable	Adjusted analysis ^a	
	Without multiple imputation for missing values	With multiple imputation for missing values
	OR ^b (95% CI)	
At-risk drinker		
3 months (control group, <i>n</i> = 309, intervention group, <i>n</i> = 246)	0.41 (0.22–0.75)**	0.45 (0.25–0.81)**
12 months (control group, <i>n</i> = 299, intervention group, <i>n</i> = 222)	0.68 (0.36–1.26)	0.75 (0.42–1.36)
One or more heavy drinking days in past 7 days		
3 months (control group, <i>n</i> = 296, intervention group, <i>n</i> = 234)	0.46 (0.22–0.99)*	0.45 (0.21–0.96)*
12 months (control group, <i>n</i> = 294, intervention group, <i>n</i> = 213)	0.89 (0.4–1.97)	0.88 (0.41–1.90)
	RR ^c (95%) intervention/control	
Risk score (range 0–7)		
3 months	0.77 (0.63–0.94)**	0.82 (0.68–0.99)*
12 months	0.89 (0.73–1.09)	0.94 (0.78–1.13)
Number of drinks in past 7 days		
3 months	0.79 (0.70–0.90)***	0.79 (0.70–0.90)***
12 months	0.87 (0.76–0.99)*	0.86 (0.76–0.98)*

CI: confidence interval; RR: rate ratio; OR: odds ratio. **P* < 0.05; ***P* < 0.01; ****P* < 0.001. ^aAdjusted for baseline measure of the same dependent variable, study site, age and gender. ^bLogistic regression mixed model with the Stata xtlogit procedure. ^cNegative binomial mixed model for 'number of drinks in past 7 days' with the Stata xtnbreg procedure and Poisson mixed model for 'risk score' with the Stata xtpoisson procedure.

Despite these limitations, the HLAYA study is one of the first to show that asking about health behaviors and providing information and feedback about alcohol use is associated with reductions in at-risk drinking and amount of drinking in an older population in primary care settings. Even simply providing information on recommended drinking limits targeted to older adults may be enough to cause large reductions in both at-risk drinking and amount of alcohol use. This study also found that older at-risk drinkers typically had multiple risks, most because of combined use of alcohol and medications and/or use of alcohol in the presence of comorbidity. Further evaluation of approaches to reduce risks associated with alcohol consumption in older adults who take multiple medications and have comorbidities is still needed, particularly in primary care settings where most of this growing population receives health care.

Trial registration

clinicaltrials.gov; Identifier: NCT00379093 <http://www.clinicaltrials.gov/>

Declarations of interest

None.

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