Title

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The effect of a patient–provider educational intervention to reduce at-risk drinking on changes in health and health-related quality of life among older adults: the Project SHARE study

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ABSTRACT

Background: At-risk drinking, defined as alcohol use that is excessive or potentially harmful in combination with select comorbidities or medications, affects about 10% of older adults in the United States and is associated with higher mortality. The Project SHARE intervention, which uses patient and provider educational materials, physician counseling, and health educator support, was designed to reduce at-risk drinking among this vulnerable population. Although an earlier study showed that this intervention was successful in reducing rates of at-risk drinking, it is unknown whether these reductions translate into improved health and health-related quality of life (HRQL).
Objective: The aim of this study was to examine changes in health and HRQL of older adult at-risk drinkers resulting from a patient–provider educational intervention.
Research design: A randomized controlled trial to compare the health and HRQL outcomes of patients assigned to the Project SHARE intervention vs. care as usual at baseline, 6- and 12-months post assignment. Control patients received usual care, which may or may not have included alcohol counseling. Intervention group patients received a personalized patient report, educational materials on alcohol and aging, a brief provider intervention, and a telephone health educator intervention.
Subjects: Current drinkers 60 years and older accessing primary care clinics around Santa Barbara, California ($N = 1049$).
Measurements: Data were collected from patients using baseline, 6- and 12-month mail surveys. Health and HRQL measures included mental and physical component scores (MCS and PCS) based on the Short Form-12v2 (SF-12v2), the SF-6D, which is also based on the SF-12, and the Geriatric Depression Scale (GDS). Adjusted associations of treatment assignment with these outcomes were estimated using generalized least squares regressions with random provider effects. Regressions controlled for age group, sex, race/ethnicity, marital status, education, household income, home ownership and the baseline value of the dependent variable.
Results: After regression adjustment, the intervention was associated with a 0.58 point (95% CI: −0.06, 1.21) increase in 6-month MCS and a 0.14 point (95% CI: 0.01, 0.26) improvement in 12-month GDS score, compared to the control group. The intervention also increased adjusted SF-6D scores by 0.01 points at both 6 and 12 months (6-month 95% CI: 0.01, 0.02; 12-month 95% CI: 0.01, 0.01).
Conclusions: Despite the previously shown effectiveness of the Project SHARE intervention to reduce at-risk drinking among older adults, this effect translated into effects on health and HRQL that were statistically but not necessarily clinically significant. Effects were most prominent for patients who received physician discussions, suggesting that provider counseling may be a critical component of primary care-based interventions targeting at-risk alcohol use.

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1. Introduction

At-risk drinking, or drinking that puts individuals at high risk for developing alcohol use disorder, is currently defined by the National Institute on Alcohol Abuse and Alcoholism for women as consuming more than 3 drinks on any single day and more than 7 drinks per week. For men, it is defined as consuming more than 4 drinks on any single day and more than 14 drinks per week (National Institute on Alcohol Abuse and Alcoholism (NIAAA), 2015). According to this threshold, approximately 3% of female and 10% of male older adults are defined as at-risk drinkers (Breslow, Faden, & Smothers, 2003; Kirchner et al., 2007; Merrick et al., 2008). However, older adults face additional risks associated with drinking 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 (Linnoila, Erwin, Cleveland, Logue, & Gentry, 1978; Moore, Whiteman, & Ward, 2007; Vestal et al., 1977). Using a definition of at-risk drinking that includes alcohol use that is excessive or potentially harmful in combination with select comorbidities or medications, 3% of women and 18% of men 60 years and older have been defined at-risk drinkers in a population-based sample of U.S. adults (Moore et al., 2006). Further, it affects 35% of older adults who use alcohol, and is associated with higher mortality (Barnes et al., 2010; Moore et al., 2006).

At-risk drinking among older adults is also associated with health problems like hypertension, accidental injury, dementia and depression (Bakhshi & While, 2014). However, alcohol use has mixed effects on health and health-related quality of life (HRQL), which are self-reported measures of physical, social and mental well-being (Centers for Disease Control and Prevention, 2011). Some of the extant literature finds that alcohol consumption—in some cases, even heavy drinking— is associated with improved physical HRQL compared to no alcohol consumption (Valencia-Martín, Galán, Guallar-Castillón, & Rodríguez-Artalejo, 2013), while others indicate no (Martinez, Lien, Landheim, Kowal, & Clausen, 2014) or negative association between alcohol use and HRQL (Chen & Storr, 2006; Okoro et al., 2004; Wen et al., 2012). There is disagreement on how drinking patterns relate to HRQL status, although in general it seems that low-quantity is better than high-quantity drinking for HRQL outcomes (Volk, Cantor, Steinbauer, & Cass, 1997).

Older age can affect both alcohol use patterns (Bakhshi & While, 2014) and health and HRQL (De Luca d'Alessandro, Bonacci, & Giraldi, 2011), but the relationship between the two is unclear. Conflicting results find that older adults report lower HRQL than younger adults at intake to inpatient alcohol treatment, but report higher HRQL than younger patients after treatment (Donovan, Mattson, Cisler, Longabaugh, & Zweben, 2005). Further, few studies focus on older populations in the community (Byles, Young, Furuya, & Parkinson, 2006; Strandberg et al., 2007); those that do note that older women who drink moderately have lower HRQL (Byles et al., 2006) and that older men who prefer wine to other types of alcoholic beverages have higher HRQL (Strandberg et al., 2007). In middle-aged and older adults, regular moderate consumption was associated with the highest initial HRQL, although all types of drinkers and abstainers declined in HRQL over time (Kaplan et al., 2012).

Interventions to reduce alcohol use can improve health and HRQL. One review found that reductions in alcohol use markedly increase HRQL for alcoholics (Donovan et al., 2005), even if the HRQL for those reducing alcohol intake is still lower than HRQL for normative or abstaining populations (Donovan et al., 2005; Saarni et al., 2008). Alcohol abuse treatment programs also improve HRQL (Srivastava & Bhatia, 2013; Ugochukwu et al., 2013). Further, simple interventions like motivational aid or advice can help reduce alcohol use among heavy drinkers, which improves HRQL (Kraemer et al., 2002). Yet, whether these health and HRQL gains extend to older adults is unknown. Such evidence is essential to knowing how best to integrate behavioral health and medical treatment among at-risk drinking older adults in order to reduce harmful alcohol use and to improve health, HRQL and longevity.

The Project Senior Health and Alcohol Risk Education (SHARE) intervention, which uses patient and provider educational materials, physician counseling, and health educator support, was designed to reduce at-risk drinking among adults 60 and older. Although an earlier study showed that this intervention was successful in reducing rates of at-risk drinking and health care utilization (Ettner et al., 2014), it is unknown whether this translates into improved health and HRQL.

2. Methods

2.1. Setting

The study population was drawn from Sansum Clinic, a community-based group practice with seven clinics in the Santa Barbara, California area. The practice has a strong primary care base, with service lines representing all major specialties and sub-specialties appropriate for elder care (e.g., cardiology, diabetes, geriatrics, urology).

2.2. Recruitment

A detailed figure of participant flow through Project SHARE can be found in Appendix 1. Of the 42 primary care physicians approached, 31 agreed to participate in the study ($n = 20$ male, 11 female, 17 internal medicine, 14 family practice). The percentages of physicians who were internal medicine vs. family practice looked almost identical among participating and non-participating physicians. However, female physicians were more likely than male physicians to participate in the study, as were younger physicians. The mean age of participating physicians was 48.3 for physicians in the intervention group and 44.4 for the control physicians, compared with a mean age of 52.5 years for non-participating physicians.

Clinic information technology personnel identified all adults 60 and older who were current patients of these providers ($n = 12{,}573$). Providers initially screened out 2159 patients who had severe cognitive impairment, were terminally ill or deceased, were moving to a skilled nursing facility or out of the area within the next year, did not speak English, were no longer a patient of the physician, or other (e.g., physician preference, personal reasons). Of the remaining patients, 9476 were mailed recruitment letters. Of these, 2557 were not screened either because they actively refused, never responded to a call (passively refused), or staff had the incorrect contact information. Among the 6919 who were screened, 4217 patients agreed to participate, met the inclusion criteria (i.e., consumed at least one drink containing alcohol in the past 3 months, planning to live in the area for 12 months, not cognitively impaired, spoke English, not deceased, not too ill), and were mailed a baseline survey. Of the 3529 subjects who returned baseline surveys, 1186 were identified as at-risk drinkers and eligible for the intervention phase of the study.

At-risk patients were assigned to the intervention or control group based on the random assignment of their primary care physician. Of the 546 patients assigned to the intervention group and completing the baseline survey, 79 did not complete either the 6- or 12-month survey, 28 completed only the 6-month survey, 14 completed only the 12-month survey, and 425 completed both the 6- and 12-month surveys. The control group was composed of 640 patients. Among patients assigned to the control group and completing the baseline survey, 15 did not complete either the 6- or 12-month survey, 15 completed only the 6-month survey, 5 completed only the 12-month survey, and 605 completed both the 6- and 12-month surveys. Patients who screened as likely dependent drinkers at baseline (7 or more drinks daily) were excluded from the study and their physicians were notified. Patients who met this criterion at follow-up were not dropped from the study but their physicians were notified, regardless of whether the patient was in the experimental or control group (further information on enrollment and retention can be found in Ettner et al. (2014)).

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2.3. Intervention

Older participants' risk status was ascertained using the Comorbidity Alcohol Risk Evaluation Tool, or CARET (Barnes et al., 2010). The CARET, an updated and revised version of the short Alcohol-Related Problems Survey (Fink et al., 2002), uses information on amount of alcohol use, comorbidity, symptoms and medications to assess drinking risks among older adults. The face, content, and criterion validity for the CARET have been previously established (Moore, Beck, Babor, Hays, & Reuben, 2002; Moore, Hays, Reuben, & Beck, 2000; Oishi et al., 2001).

Control patients received usual care, which may or may not have included alcohol counseling. All intervention group patients received a personalized Patient Report that included educational information on alcohol and aging, a drinking diary, and tips based on the patient's alcohol risks identified in the CARET at baseline and 6 months. Provider reports at baseline and 6 months based on results from an intervention patient's CARET were also generated. Providers were given the reports immediately before each upcoming visit throughout the 12-month follow-up and asked to discuss the risk factors identified in the report with their patients. Among the intervention patients, 300 received at least one provider discussion (Duru et al., 2015). In addition, telephone health educators contacted intervention patients 2 weeks after sending the baseline patient report, 3 months after sending the baseline patient report and 2 weeks after sending the 6-month patient report (more details on the intervention can be found in Ettner et al. (2014)).

The SHARE intervention used PRECEDE-PROCEED, a coordinated approach to program development and evaluation (Gielen & McDonald, 1997), as the conceptual framework for evaluating the effectiveness of our intervention. PRECEDE (*P*redisposing, *R*einforcing, and *E*nabling *C*onstructs in *E*ducational *D*iagnosis and *E*valuation) is an educational diagnosis model developed in the 1970s. PROCEED (*P*olicy, *R*egulatory, and *O*rganizational *C*onstructs in *E*ducational and *E*nvironmental *D*evelopment) was added in 1991. Although not a theory itself, PRECEDE-PROCEED provides a framework for applying theories to program development and evaluation (Gielen & McDonald, 1997; Glanz, Lewis, & Rimer 1997). The theories adapted in this research are diffusion of innovations theory, with its focus on characteristics of innovations (Green & Lewis, 1986; Green, Gottlieb, & Parcel, 1987), and the Behavioral Model for Vulnerable Populations (Gelberg, Andersen, & Leake, 2000). The PRECEDE-PROCEED framework has proven to be useful and effective over a relatively long time in a variety of studies to change risky health behavior (Howat, Jones, Hall, Cross, & Stevenson, 1997; Keith & Doyle, 1998).

2.4. Measures

Health and HRQL outcomes included those measuring mental and physical health, as well as a global measure of HRQL. Mental and physical component scores (MCS and PCS) were based on the Short Form-12v2 (SF-12v2) (Ware, Kosinski, Turner-Bowker, & Gandek, 2002), as was the measure of overall HRQL, the SF-6D (Makai, Brouwer, Koopmanschap, Stolk, & Nieboer, 2014). The SF-12 is a validated metric in which higher scores represent better HRQL (Ware, Kosinski, & Keller, 1996). MCS and PCS scores range from 0, the worst possible health state, to 100, the best possible health state. Unlike the MCS and PCS, the SF-6D represents preference-weighted HRQL (i.e., utility scores) and ranges from 0 to 1 where 0 represents the utility associated with death and 1 represents the utility associated with perfect health. Also included was the Geriatric Depression Scale (GDS) (Yesavage et al., 1982–1983). The GDS assesses how participants have been feeling recently and was included in the 12 month follow up. The GDS was reverse coded, and ranged from 0 to 5 with higher scores indicating fewer depressive symptoms.

2.5. Data analysis

Descriptive and bivariate analyses were based on data from patients participating in the intervention phase of the study and completing the baseline, 3-, 6-, and 9-month follow-up surveys ($N = 1049$). Adjusted associations of treatment assignment with health and HRQL outcomes were estimated using generalized least squares regressions with random provider effects. Regressions controlled either for baseline health and HRQL only or for age group, sex, race/ethnicity, marital status, education, household income, home ownership and the baseline value of the dependent variable, except for the 12-month GDS regression, which controlled instead for baseline MCS. Our analytic sample in our adjusted analyses ranges from 953 to 1015 depending on the completeness of the outcome data. Multiple imputation was used to test the sensitivity of our main results to missing data. All statistical analyses were computed using Stata Version 10.1 (StataCorp, 2007).

3. Results

3.1. Sample characteristics

Just under half (46.0%) of the participants were in the intervention group (Table 1). Similar proportions of participants were at risk due to alcohol behaviors (61.2%), alcohol plus medications (60.7%), and alcohol plus symptoms (61.3%). Our sample was nearly two-thirds male (65.7%), predominantly non-Latino (94.1%) and white (97.3%). Most owned their homes (88.3%) and were married (76.2%). More than half completed college or graduate school (59.4%), 50.0% were 60–69 years old, and nearly half (47.1%) had household incomes of $80,000 or more per year.

Significant baseline differences between treatment groups were found only for gender ($p = 0.03$), marital status ($p = 0.01$) and income ($p = 0.02$). No significant differences were found between intervention and comparison groups for alcohol risk factors, race, ethnicity, education, age, or home ownership. Importantly, the baseline values of the outcome measures also did not vary significantly between the intervention and control groups.

Among participants, the average baseline PCS score was 48.9 (standard deviation 9.5) (Table 2). The mean MCS scores for this group at baseline was 44.4 (6.7). PCS and MCS scores for the general U.S. adult population have a mean at 50 and a standard deviation of 10 (Barnes, Robert, & Bradley, 2014), so these scores among our sample of older at-risk drinkers are not atypical. The average SF-6D score at baseline was 0.66 (0.11), suggesting our sample was below the U.S. average score of approximately 0.77 for adults over age 65 (Fryback et al., 2007). Participants scored a 4.4 (1.1) out of 5 on the GDS returned with the 12-month survey indicating that the average participant had few, if any, depressive symptoms. We found no unadjusted differences between the intervention and control group in measures of health and HRQL at baseline.

3.2. Associations of the at-risk drinking intervention with the outcomes controlling for baseline health and HRQL only

After adjusting for the baseline value of the outcome variable only, the Project SHARE intervention was not significantly associated with 6-month PCS scores (Table 3). The at-risk drinking intervention was associated with a 0.56 point (95% CI: 0.06, 1.06) increase in 6-month MCS scores and a 0.01 point increase in 6-month SF-6D scores (95% CI: 0.01, 0.01). No significant associations were found between the Project SHARE intervention and changes in health and HRQL between baseline and the 12-month follow-up.

3.3. Associations of the at-risk drinking intervention with the outcomes controlling for risk factors, demographics and baseline health and HRQL

After adding controls for risk factors and demographics, the intervention remained unassociated with changes in 6- or 12-month PCS scores (Table 3). However, receiving the at-risk drinking intervention was associated with modest improvements in MCS scores. Specifically,

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Table 1
Baseline characteristics of older at-risk drinkers in the Project SHARE study.

	Overall ($N = 1049$)	Intervention ($n = 439$)	Control ($n = 610$)	
	%	%	%	*p*-Value
Intervention group				
Intervention	46.0	100	0	NA
Control	54.0	0	100	
Risk factors				
Alcohol and medications	60.7	60.6	60.8	0.95
Alcohol and symptoms	61.3	59.7	62.7	0.30
Alcohol behaviors	61.2	61.5	64.5	0.29
Demographics				
Male	65.7	62.5	68.4	0.03
Race/ethnicity				
Latino	5.9	5.4	6.3	0.50
White	97.3	96.9	97.6	0.34
Black	0.3	0.4	0.3	
American Indian	1.5	1.3	1.6	
Asian	0.9	1.5	0.5	
Marital status				
Married	76.2	72.2	79.7	0.01
Widowed	11.4	13.5	9.6	
Divorced/separated	10.1	12.2	8.2	
Never married	2.3	2.0	2.5	
Education				
Less than HS	3.2	3.2	3.2	0.28
HS grad	10.5	11.6	9.6	
Some college	27.0	28.9	25.4	
College grad	24.8	25.0	24.7	
Graduate school	34.6	31.5	37.2	
Household income ($)				
Less than 30,000	10.8	13.5	8.4	0.02
30,000–40,000	8.4	9.4	7.6	
40,001–60,000	16.8	16.2	17.3	
60,001–80,000	16.9	18.8	15.2	
80,001–100,000	16.1	13.9	18.0	
100,001–200,000	21.1	19.2	22.7	
over 200,000	9.9	9.0	10.7	
Age (years)				
60 to 64	21.6	19.6	23.3	0.08
65 to 69	28.4	29.3	27.7	
70 to 74	19.1	16.9	20.9	
75 to 79	16.2	18.3	14.4	
80 and older	14.8	15.9	13.8	
Own home	88.3	88.6	88.1	0.77

assignment to treatment group was associated with a 0.58 point (95% CI: −0.06, 1.21) increase in 6-month MCS, although this association was only marginally significant ($p < 0.10$).

Intervention effects on global HRQL and measures of geriatric depression were more robust. Compared to those receiving usual care, older adults in the treatment group reported a 0.01 point increase in SF-6D scores at both 6 and 12 months (6-month 95% CI: 0.01, 0.02; 12-month 95% CI: 0.01, 0.01). Older adults receiving the Project Share intervention also had a 0.14 point (95% CI: 0.01, 0.26) improvement in their 12-month GDS score, compared to those receiving usual care, suggesting they endorsed fewer depressive symptoms.

Table 2
Baseline, 6- and 12-month outcomes of older at-risk drinkers in the Project SHARE study.

	Overall	Intervention	Control	
Outcomes	Mean (SD)	Mean (SD)	Mean (SD)	*p*-Value
Physical component score				
Baseline	48.9 (9.5)	48.9 (9.7)	48.8 (9.3)	0.93
6 month	50.1 (8.7)	50.3 (9.0)	50.0 (8.4)	0.54
12 month	49.8 (8.8)	49.8 (8.8)	49.9 (8.8)	0.88
Mental component score				
Baseline	44.4 (6.7)	44.5 (6.8)	44.3 (6.7)	0.68
6 month	43.9 (6.9)	44.2 (7.2)	43.6 (6.6)	0.14
12 month	43.9 (6.8)	44.0 (6.7)	43.8 (6.9)	0.61
SF-6D				
Baseline	0.66 (0.11)	0.66 (0.11)	0.66 (0.11)	0.35
6 month	0.66 (0.11)	0.66 (0.11)	0.66 (0.11)	0.15
12 month	0.66 (0.11)	0.66 (0.11)	0.66 (0.11)	0.45
Geriatric Depression Scale				
12 month	4.4 (1.1)	4.4 (1.0)	4.3 (1.1)	0.36

Table 3
Adjusted intervention effects on older at-risk drinkers' health and health-related quality of life (HRQL).

Health and HRQL outcomes	6 months	12 months
	Intervention effect (95% CI)	Intervention effect (95% CI)
Physical component score (PCS)		
Control for baseline PCS only	0.25 (−0.67, 1.17)	−0.13 (−0.94,0.68)
n	1066	1042
Control for baseline PCS, risk factors, and demographics	0.33 (−0.51, 1.17)	0.06 (−0.61, 0.72)
n	1011	990
Mental component score (MCS)		
Control for baseline MCS only	0.56** (0.06, 1.06)	0.15 (−0.60, 0.90)
n	1066	1042
Control for baseline MCS, risk factors, and demographics	0.58* (−0.06, 1.21)	0.16 (−0.56, 0.88)
n	1011	990
SF-6D		
Control for baseline SF-6D only	0.01*** (0.01, 0.01)	0.01 (−0.01, 0.01)
n	1070	1047
Control for baseline SF-6D, risk factors, and demographics	0.01*** (0.01, 0.02)	0.01** (0.01, 0.01)
n	1015	995
Geriatric Depression Scale (GDS)[1]		
Control for baseline MCS only		0.07 (−0.05, 0.20)
n		1002
Control for baseline MCS, risk factors, and demographics		0.14** (0.01, 0.26)
n		953

Notes: [1]The Geriatric Depression Scale was reverse coded so that higher values indicated fewer depressive symptoms. Regression models controlled for either: (1) only the baseline value of the outcome, or (2) risk factors and demographic covariates listed in Table 1, as well as the baseline value of the dependent variable (with the exception of the Geriatric Depression Scale regression, which controlled for baseline MCS score instead).
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

Importantly, our previous work has found the effectiveness of Project SHARE on reducing at-risk drinking among older adults varies by the intervention components received (Duru et al., 2015). Additional analyses of the association of the intervention components with health and HRQL (not shown) find evidence consistent with the earlier results for at-risk drinking; improvements in SF-6D scores associated with the intervention were primarily driven by whether patients engaged in an alcohol-related discussion with their physician at any time during the 12-month follow-up period rather than the health educator component of the intervention. However, changes in MCS and GDS associated with the Project SHARE intervention did not differ by receipt of a physician discussion. The physician component of the intervention may have been more important than the health educator component because it began at each subject's baseline and continued for the full 12-month follow-up period. The health educators, as noted earlier, spoke to patients via telephone on three occasions between receiving the baseline patient report and the 6-month follow-up Patient Report.

4. Discussion

Despite the previously shown effectiveness of the Project SHARE intervention in reducing at-risk drinking and health services use among older adults (Ettner et al., 2014), effects on health and HRQL were statistically but not necessarily clinically significant. These null findings may

have arisen from at least two characteristics of our study. First, the patients participating in the study were in good health generally and thus there may have been little room for the intervention to improve some measures of health and HRQL outcomes. Additionally, it is likely a 12-month follow-up is too brief a duration for some of the health and HRQL outcomes of interest to be influenced by the at-risk drinking intervention.

The significant intervention effects found for the global measure of health-related quality of life were driven by receiving a physician discussion, suggesting that access to physicians who can provide alcohol counseling may be an important component of the intervention. This is consistent with other research suggesting that brief interventions in primary care are effective in reducing alcohol use, (Bertholet, Daeppen, Wietlisbach, Fleming, & Burnand, 2005), especially among older adults (Fleming, Manwell, Barry, Adams, & Stauffacher, 1999; Gordon et al., 2003). However, the size and type of the effects vary widely among these primary care interventions (Fleming et al., 1999; Moore et al., 2011) and may depend on factors like ethnicity, gender, education, baseline risk (Lin, Karno, Tang et al., 2010), and perception of physician advice (Lin, Karno, Barry et al., 2010).

We experienced several initial barriers/facilitators to implementation of the Project SHARE intervention. First, when asked to participate, the physicians expressed concerns about the time it would take to go over the personalized patient report with patients in the treatment group. However, after incorporating the patient report into the appointment, participating physicians found the report valuable and felt that it did not noticeably constrain their ability to discuss other medical concerns during a patient's visit.

Second, the research staff at the collaborating clinic also had some initial concerns about the training time and effort that would be required in order to use the online patient recruitment and tracking system. After becoming more familiar with the system and its advantages, however, they concurred that the online system was more efficient and training with the new system proceeded relatively quickly. The online tracking system facilitated implementation of the intervention and research evaluation by making recruitment, retention and tracking of the intervention and survey data collection activities easier and more reliable than would otherwise have been possible, for example if Excel spreadsheets and Outlook calendars had been used for patient tracking. The online system also enabled the project director to monitor the research staff and health educators long-distance, saving project resources.

Finally, our initial recruitment plan targeted patients with an upcoming physician visit within the next month to enroll; furthermore, we only had enough resources to recruit a subsample of the total eligible patient population. An increase in the resources for data collection enabled us to change the recruitment strategy so that we were able to attempt data collection on the entire eligible population, randomly selecting a subsample each month. The advantage of the new recruitment strategy was that it allowed us to avoid sample selection bias (e.g., recruiting only individuals who were frequent/high utilizers).

When interpreting our findings, several limitations to our study are worth noting. First, our estimates may not generalize beyond our sample. Compared to the U.S. Census population over 60, our sample was more likely to be white, married, well-educated, and higher-income (U.S. Census Bureau, 2006). However, increased access to primary care resulting from recent coverage expansions among lower-socioeconomic populations may result in larger provider-based alcohol intervention effects if individuals with previously poor access to providers benefit more from additional care than patients who already had good healthcare. While we do not have any information about the reasons for withdrawal, we suspect from anecdotal reports that participants dropped out because they did not want to talk about their alcohol use. We empirically examined the correlates of dropping out between baseline and 12 months by estimating a regression of the predictors of dropout, including treatment assignment and all of the covariates listed in Table 1 of the manuscript. We find that the only indicator that is significantly correlated with dropout is assignment to the intervention group.

Further, selection bias based on unobservable differences in the intervention and control groups that may be correlated with participation in the intervention and in health and HRQL is a potential threat to the validity of our estimates. To assess this bias, we conducted a "worst-case" analysis similar to Ettner et al. (2014), by "imputing" a conservative value for 12-month HRQL outcomes to individuals who drop out of the sample in order to include them in the analysis. For each individual who dropped out of the sample, we took the baseline value of that individual's HRQL and adjusted it by the average percent change between baseline and follow-up HRQL among control group participants. This adjusted value was then assigned as the follow-up HRQL value. (If t-tests showed that changes over time among the control group were non-significant, we instead assigned the baseline value without any adjustments.) Estimates from these analyses were quantitatively similar to the original estimates, suggesting that potential bias due to unobservables correlated with intervention participation and health and HRQL outcomes was not a major threat to the consistency of our estimates.

Additionally, our study period may have been too short to allow improvements in health and HRQL to develop. The changes in at-risk drinking resulting from the Project SHARE intervention may require a longer time horizon to translate into improved health and HRQL. Studies of HRQL improvements after alcohol dependence treatment show gains after long (e.g. 12 months) and short time horizons, but these studies also used an alcohol-dependent population (Donovan et al., 2005; Kraemer et al., 2002). Few studies appear to follow seniors past 12 months; this is an important area for future research.

In summary, our results suggest that interventions to reduce at-risk drinking among older adults that include a provider component are modestly effective at improving health and HRQL. Given the limited evidence on how best to integrate behavioral health treatment with primary care to improve the physical and mental health of older adults, our findings offer an important contribution. One "take-home message" is that it may take longer than the typical timeline of most intervention studies to see changes in behaviors (in our case, at-risk drinking) translate into changes in health and health-related quality of life; in turn, this suggests that intervention studies may miss important effects if the evaluation does not include intermediate outcome measures. With the expansion of coverage for behavioral health conditions resulting from recent U.S. health reforms such as the Affordable Care Act and the Mental Health Parity and Addiction Equity Act, future inquiry assessing the effectiveness of provider-based behavioral health interventions is needed.

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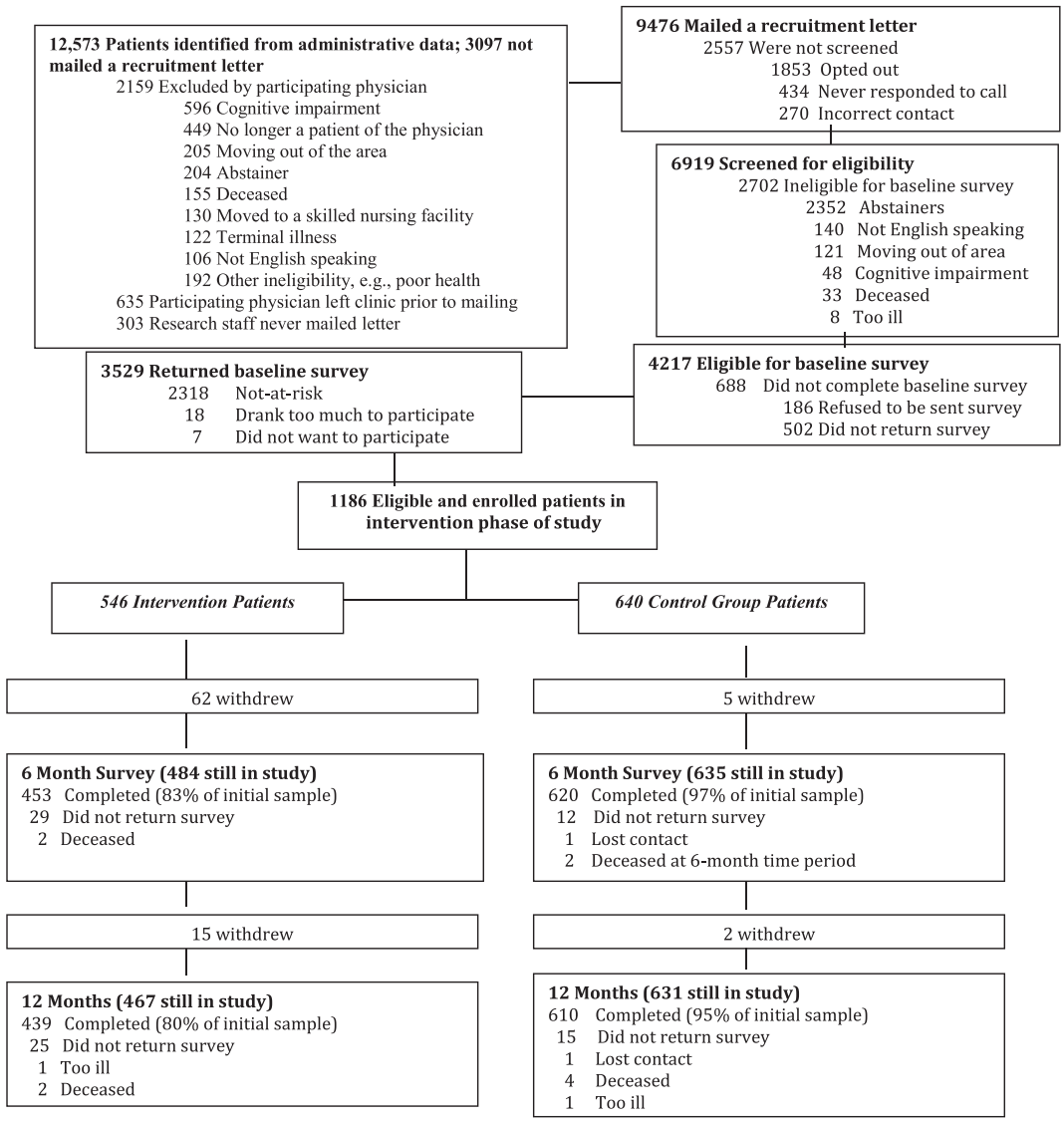
Appendix 1. Participant Flow through Project SHARE



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