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The Association between Unhealthy Alcohol Use and Acute Care Expenditures in the 30 Days Following Hospital Discharge Among Older Veterans Affairs Patients with a Medical Condition

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Abstract

Hospital readmissions and emergency department (ED) visits within 30 days of discharge are costly. Heavy alcohol use could predict increased risk for post-discharge acute care. This study assessed 30-day acute care utilization and expenditures for different categories of alcohol use. Veterans Affairs (VA) patients age ≥ 65 years with past-year alcohol screening, hospitalized for a medical condition, were included. VA and Medicare health care utilization data were used. Two-part models adjusted for patient demographics. Among 416,050 hospitalized patients, 25% had 30-day acute care use. Nondrinking patients (n=267,746) had increased probability of acute care use, mean utilization days, and expenditures (difference of \$345; 95% CI \$268–\$423), relative to low-risk drinkers (n=105,023). High-risk drinking patients (n=5,300) had increased probability of acute care use and mean utilization days, but not expenditures. Although these patients did not have greater acute care expenditures than low-risk drinking patients, they may nevertheless be vulnerable to poor post-discharge outcomes.

Views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs or the University of Washington.

Conflicts of Interest Statement

The authors do not have any conflicts of interest to disclose.

Keywords

30-day Readmission; Emergency Department; Health Care Expenditures; Unhealthy Alcohol Use

Introduction

Readmissions and emergency department (ED) visits within 30 days of hospital discharge are common and costly.^{1,2} Medicare's Hospital Readmissions Reductions Program³ and shared savings programs for Accountable Care Organizations (ACOs)⁴ have created new incentives for health care systems to reduce readmissions and potentially avoidable health care expenditures for acute care following hospital discharge. Post-discharge care interventions have been found to be effective for reducing readmissions^{5,6} and are increasingly implemented in hospital settings.^{7,8} However, these interventions can be expensive^{9,10} and health care systems might use limited resources more efficiently by targeting high utilizers of care. Yet, average expenditures for readmissions and ED visits following discharge among general samples of inpatients are seldom reported.¹¹

Older adult medical inpatients with unhealthy alcohol use may have greater acute care utilization and higher health care expenditures following hospitalizations than patients who do not drink at unhealthy levels. Unhealthy alcohol use includes a spectrum that ranges from hazardous drinking (i.e. drinking above recommended limits) to meeting criteria for alcohol use disorders (AUD).¹² Unhealthy alcohol use is a particular concern for older adults, many of whom have chronic conditions that could be worsened due to drinking¹³ and could be at risk for medication interactions.¹⁴ Unhealthy alcohol use is associated with poorer medication adherence^{15,16} and self-care for chronic conditions,^{17,18} hospital acquired infections,¹⁹ and increased risk for injuries.^{20,21} Alcohol consumption after hospital discharge could put patients at risk for readmission due to injuries or trauma resulting from acute intoxication²² or interactions with medications.²³ Although alcohol use disorders (AUD) are a known risk factor for readmissions among inpatients with psychiatric conditions^{24,25} and substance use disorders,²⁶ no previous study has evaluated the association of unhealthy alcohol use, based on alcohol screening results, with 30-day readmissions in a sample of general medical inpatients. In addition, the acute care utilization and expenditures in the 30 days following hospital discharge for older adults with unhealthy alcohol use have not been previously evaluated. If unhealthy alcohol use is associated with increased acute care expenditures, this could suggest that this patient subgroup merits focused attention of health care systems interested in targeting intervention resources.

Routine outpatient alcohol screening²⁷ and results are increasingly available in electronic medical records (EMR) due to increasing implementation of routine alcohol screening.^{28,29} Alcohol screening is recommended by the U.S. Preventive Services Task Force,^{30,31} is considered an essential benefit under the Affordable Care Act,³² and alcohol screening with the 3-item AUDIT-C has been proposed as a criterion for electronic medical records to meet meaningful use requirements.³³ In a previous study, older Veterans Affairs (VA) patients with severe unhealthy alcohol use based on alcohol screening documented in their VA EMR who were hospitalized for a medical condition, but not surgical condition, had increased risk

of 30-day readmission (1% absolute difference), relative to low-risk drinking patients.³⁴ Patients with severe unhealthy alcohol use also had longer lengths of stay during their initial hospitalization. Another prior VA study among surgical inpatients did not observe an association between high-risk drinking and 30-day readmissions, but post-operative length of stay and days in the intensive care unit were significantly longer for patients with high-risk drinking relative to low-risk drinking.³⁵ However, this prior study did not focus on older adults and surgical inpatients are known to have lower readmission rates than medical inpatients.² Thus, it is not known whether utilization and expenditures for acute care, in the 30 days after discharge, would be increased among older adult medical inpatients with alcohol screening results indicating high-risk drinking.

The present study had two aims. The first aim was to evaluate acute care utilization in older VA patients with unhealthy alcohol use in the 30 days after discharge from a medical hospitalization, including the number of readmission hospital days, ED visits, and combined acute care visit days. The second aim was to examine the acute care expenditures of these older VA patients with unhealthy alcohol use in the 30 days after hospital discharge, including expenditures for readmissions, ED visits, and total combined acute care utilization.

Methods

Data Sources and Study Sample

Data for VA inpatient and outpatient utilization were obtained from the VA's Corporate Data Warehouse (CDW). Data on patient demographic information, dates of birth and death, and AUDIT-C alcohol screening scores were also obtained from the CDW. Estimated VA expenditures were obtained from the VA Health Economics Resource Center (HERC)'s average costs datasets. Non-VA inpatient and outpatient utilization data, including Medicare payments for services, were from Medicare Inpatient, Outpatient, and Carrier standard analytic files obtained from the VA Information Resource Center (VIREC).

The study sample included all VA outpatients who were at least 65 years of age and were hospitalized for a medical condition at a VA or non-VA hospital from 2/1/2009–12/31/2011. Study eligibility criteria required that patients had at least one alcohol screening result documented in the VA EMR 1–365 days prior to hospitalization (2/1/2008–12/31/2011). On average, patients had 3.5 screens during the study period and when more than one was available, the screen preceding and closest to the index hospitalization was used. Additional eligibility criteria were adapted from the CMS criteria used to assess all-cause readmissions³⁶ and included the following: 1) surviving the initial (“index”) hospital stay, 2) length of stay <30 days, 3) primary diagnosis at the index hospitalization not for a psychiatric condition, cancer, or physical rehabilitation, 4) index admission from the community, 5) index discharge not to another facility, 6) index discharge not against medical advice, 7) index discharge before 10/1/2011 (to allow adequate follow-up) (Figure 1). These criteria were selected in order to include only patients who lived in the community both before and after hospitalization because it was hypothesized that drinking before or after hospitalization may increase risk for post-discharge acute care. Moreover, drinking might not be allowed in nursing homes or other institutional care settings. This study focused on

patients with an index hospitalization for *medical* conditions because prior work found no associations between unhealthy alcohol use and 30-day readmissions or ED visits among surgical inpatients.³⁴ Patients whose index hospitalization had a Diagnosis Related Group (DRG) code for a surgical condition or was missing a DRG code were excluded. Finally, patients were excluded if they were enrolled in a Medicare managed care plan in the year before hospitalization or 30 days after discharge because information on comorbidities and readmissions would be incomplete due to lack of Medicare fee-for-service claims. Consistent with CMS analyses of readmission rates, patients who died during the 30 days following discharge were not excluded. For patients with multiple eligible index hospitalizations, only the first index hospitalization was used to assess study outcomes in the 30 days post discharge. This study received human subjects approval, including waivers of informed consent and HIPAA authorization, from the University of Washington and VA Puget Sound Institutional Review Boards.

Outcomes

Health care utilization—Several acute care utilization outcomes were assessed: total hospital days for unplanned readmissions, total ED visits, and total days of acute unplanned care. A binary indicator was created to reflect any health care use for each acute care utilization type in the 30 days after hospital discharge. The algorithm for determining whether readmissions were unplanned was based on methods used for the CMS all-cause readmission measure (Appendix 1).³⁶ This algorithm categorized readmissions as either unplanned or planned based on the primary conditions and DRG codes for the readmission stay and only unplanned readmissions were included in the outcome. For example, a readmission stay for physical rehabilitation was excluded because these hospitalizations were considered likely to be planned following discharge from the index medical hospitalization and thus did not reflect undesirable over-utilization of hospital services. Next, count variables were created to reflect the total number of readmission hospital days, total ED visits, and total acute care utilization days (combining both unplanned readmission days and ED visits) in the 30 days following hospital discharge. Total number of hospital days was based on the total length of stay(s) for all VA or non-VA unplanned readmissions (Appendix 1). Total ED visits were defined as the total number of all “treat-and-release” VA or non-VA ED visits in the 30 days after hospital discharge. ED visits were considered treat-and-release if the patient was not admitted to the hospital on the same day or the day immediately following the ED visit. ED visits were identified based on clinic stop codes in HERC outpatient files and revenue center codes in Medicare inpatient standard analytic files. Finally, both hospital days and ED visit days were combined to obtain total acute care utilization days within 30 days of discharge.

Health care expenditures—The VA’s HERC average costs datasets provided VA inpatient and outpatient expenditure data. VA does not routinely bill patients for services, and as a result, HERC uses a “pseudo-bill” approach whereby hypothetical Medicare payments are assigned to VA inpatient and outpatient visits based on Medicare’s reimbursement rates.³⁷ For outpatient visits, HERC generates payment values based on reimbursement rates for Common Procedure Terminology (CPT) codes, which are adjusted to reflect aggregate costs of providing services in the VA.³⁸ For inpatient visits, HERC

generates payment values based on hospitalization characteristics such as DRG weights and length of stay.³⁹

The expenditure outcomes of interest in the present study were based on the three different categories of acute care utilization in the 30 days after discharge: total unplanned readmission expenditures (hereafter “readmission expenditures”), total treat and release ED expenditures (hereafter “ED expenditures”), and total unplanned acute care expenditures, which were the sum of expenditures for readmissions and treat and release ED visits (hereafter “acute care expenditures”). Readmission expenditures for each patient were defined as the sum of all VA or non-VA inpatient expenditures for unplanned readmissions within 30 days of hospital discharge. Any expenditures for outpatient services received on the same day or during a readmission stay were also included with readmission expenditures. In addition, any expenditures for services received during an ED visit that occurred the day before a readmission were included with readmission expenditures, due to the possibility that many of these ED visits were for observational stays linked to a subsequent hospital stay. ED visit expenditures were defined as the sum of all VA or non-VA expenditures for ED visits not occurring on the same day or day prior to an unplanned readmission. Acute care visit expenditures were the total expenditures for any readmissions and ED visits.

Alcohol risk group—Each patient was assigned to an alcohol risk group based on their most recent AUDIT-C alcohol screening score documented in their EMR (1–365 days prior to hospitalization). Since 2004, the VA has required annual alcohol screening with the AUDIT-C screening questionnaire.²⁹ This 3-item, brief screen has been validated for identifying hazardous drinking and alcohol use disorders (AUD) in the past year,²⁷ and increasing scores (0–12 points) are associated with increasing alcohol consumption and probability of AUD.^{40,41} Alcohol risk was classified into four groups, including the following: *nondrinking* (0 points), *low-risk drinking* (1–2 for women, 1–3 for men), *moderate-risk drinking* (3–7 for women, 4–7 for men), and *high-risk drinking* (8–12). This classification was based on gender-specific thresholds for positive screens for alcohol misuse (3 points for women, 4 points for men)^{27,42} and prior research documenting increased risk for scores ≥ 8 points hospitalizations for trauma,⁴³ gastrointestinal conditions,⁴⁴ and fractures.⁴⁵ Patients reporting nondrinking on the AUDIT-C are known to have poorer health status,⁴⁶ increased hospitalizations,⁴⁷ and increased mortality,⁴⁸ and as a result were also expected to have increased acute care utilization after hospital discharge.

Covariates

Patient-level characteristics were considered for inclusion in analyses that have known associations with both alcohol use and health care utilization. Demographic characteristics included patient age at index hospitalization, gender, race, and year of index hospital discharge. Year of index hospital discharge was included to account for known time trends, with hospital readmissions decreasing over time.^{49,50} Patient-level comorbidities were described using a validated comorbidity index⁵¹ and a binary indicator was constructed of any past-year diagnoses (including during index hospitalization) for each condition included in the comorbidity index (Appendix 2). Additional comorbid condition indicators were

constructed for past-year diagnosis of post-traumatic stress disorder (PTSD) or tobacco use disorders. The hospital length of stay was obtained for each index stay as an indicator of level of health care need. In addition, other measures of health care utilization in the year prior to the index hospitalization included the following: the number of hospitalizations, number of ED visits, inpatient costs, ED visit costs, and any discharge against medical advice. Elapsed time from AUDIT-C screen to the index hospitalization (0–3, 3–6, 6–12 months) was included to account for potential changes in alcohol use over time. VA copayment status due to disability or low income (copayment exempt vs. copayment required) was used as a proxy for socioeconomic status (SES) and lower health status.⁵² Marital status (married vs. not married/unknown) was used as an indicator of social support.

Analyses

Descriptive statistics were used to characterize the study sample and results are presented across alcohol risk groups. A large proportion of the sample did not have any acute care utilization in the 30 days following hospital discharge. Several modeling approaches were evaluated to account for disproportionate number of zeroes for acute care visit days and expenditures, including both single-equation and two-part models.^{53,54} Model fit was assessed using Pearson correlation coefficients between y-scale residuals and predicted mean values ($p>0.05$), modified Hosmer-Lemeshow tests (F-statistic $p>0.05$), and Pregobin's link test (t-statistic $p>0.05$). Two-part models appeared to perform adequately based on model fit tests and were used for modeling study outcomes.

The first part of the two-part model approach used a logit regression to predict the probability of any readmission, any ED use, or any acute care use in the 30 days following discharge. The second part used a Generalized Linear Model with a log-link and Gamma distribution to predict utilization days or expenditures among the subset of individuals who had any use. This model estimated the mean utilization among those who used acute care services (hospital, ED, or either). The unconditional expected expenditures, hereafter "mean expenditures for total sample," for each alcohol risk group were estimated for the combined two-part model using a method which holds covariates constant and allows alcohol risk group to vary.⁵⁵ This model estimates the mean utilization across the total sample, irrespective of utilization. A 95% confidence interval was obtained for each estimate through bootstrapping (1000 replications).

Three separate multivariable models were estimated for each outcome using a stepped approach. The primary model was selected *a priori* and included demographic covariates (age, gender, race, year of discharge). This model did not adjust for comorbidity because DRG-based systems for assigning payments are intended to allow payments to reflect average condition-specific resource use as well as condition complexity.⁵⁶ Moreover, the primary model was selected in order to provide health systems with information about expected expenditures for different categories of alcohol consumption before further adjustment for health conditions, which vary depending on alcohol use.³⁴ However, to assess the influence of differences in conditions treated, a second model additionally adjusted for patient-level comorbid conditions and prior utilization, including comorbid condition indicators, time from past-year AUDIT-C screen to index hospitalization, index length of

stay, any past-year discharge AMA, past-year expenditures (or utilization days). This model was chosen *a priori* as a secondary model because it included demographic and clinical characteristics more often included in readmission models⁵⁷ and would demonstrate whether expenditures varied after adjusting for comorbidity and prior utilization. Finally, a third model added indicators of SES (VA copay exempt status) and social support (marital status), as well as all other covariates, which are often missing from readmission adjustment models,⁵⁸ to see if these factors accounted for any observed associations between unhealthy alcohol use and study outcomes. In each model, the referent alcohol risk category was low-risk drinking because these patients generally have better health outcomes, whereas nondrinking patients are known to have poorer outcomes.^{46–48}

After exploring the distribution of readmission hospital days, a small minority of readmission records (<1%) had lengths of readmission stay that were longer than 90 days and the majority of these outliers were VA hospital admissions. It was anticipated that VA hospitalizations would have longer lengths of stay than non-VA hospitalizations⁵⁹ due to differences in discharge practices across health care systems. In order to ensure that VA outliers did not have undue influence on analytic results, readmission hospital days were truncated at 90 days.

Results

The study sample included 416,050 older adults who were hospitalized for a medical condition and met all study eligibility criteria (Figure 1). The majority of patients reported no past-year alcohol use (64.4%), and smaller proportions reported low-risk drinking (25.2%), moderate-risk drinking (9.1%), and high-risk drinking (1.3%). Overall, patients in the study sample were mostly male, White, married, and VA copayment exempt (Table 1). Relative to low-risk drinking, patients reporting high-risk drinking were younger (mean age 71 vs. 77 years) and a higher proportion was unmarried, nonwhite, and VA copay exempt (Table 1). In addition, a higher proportion of patients with high-risk drinking had a past-year diagnosis of AUD, PTSD, tobacco use disorders, and psychosis, but a lower proportion had a diagnosis of congestive heart failure (CHF), and complicated diabetes (Table 1; Appendix 2). A higher proportion of patients who reported no past-year alcohol use was nonwhite and copay exempt, had a past-year diagnosis of PTSD, CHF, complicated diabetes, and renal failure, compared to patients with low-risk drinking, but a lower proportion had a past-year AUD diagnosis. In the overall sample, 15% of patients were readmitted, 12% visited an ED (“treat and release”), and 25% were readmitted or had an ED visit within 30 days of hospital discharge. Overall, the mean total readmission hospital days were 1.3 hospital days, the mean number of ED visits per patient was 0.1 visits, and the mean total number of acute care days was 1.4 days. The mean readmission expenditures were \$2,528, mean ED visit expenditures were \$105, and mean total acute care expenditures were \$2,634 in the overall sample.

Acute care utilization in the 30 days post discharge

Relative to low-risk drinking, high-risk drinking patients had a 3% greater risk for readmission (part 1 of two-part models for readmission hospital days or expenditures) after

adjusting for demographics: 16.7% (95% CI 15.7%, 17.7%) compared to 13.7% (95% CI 13.4%, 13.9%) (Table 2). High-risk drinking patients also had significantly greater risk for any ED visit (12.4% vs. 10.8%) and any acute care use (26.1% vs. 22.3%), but results were no longer significant after adjusting for comorbidity and prior use (Tables 3 & 4, respectively). Among high-risk drinking patients who had any readmission, any ED visit, or any acute care use (part 2 of two-part models), mean hospital days, mean ED visits, and mean acute care visit days did not differ significantly from that for low-risk drinking patients (Tables 2–4). However, when estimated for the total sample irrespective of acute care use, mean hospital days, mean ED visits, and mean acute care visit days were significantly greater, after adjustment for demographics (Tables 2–4). High-risk drinking patients had an additional 0.32 days of acute care use (95% CI 0.18, 0.45) relative to low-risk drinking patients (Appendix 3).

Nondrinking patients also had increased risk for any readmission, any ED visit, and any acute care visit, relative to low-risk drinking patients and results were significant in all adjusted models (Tables 2–4). In the total sample, nondrinking patients had a mean number of readmission hospital days that was 0.22 (95% CI 0.19, 0.25) greater than that for low-risk drinking patients, after adjusting for demographics (Appendix 3). In addition, the mean number of acute care visit days for nondrinking patients in the total sample was also greater and remained significantly higher than that of low-risk drinking patients in all adjusted models.

Acute Care Expenditures in the 30 days post discharge

Average adjusted expenditures for high-risk drinking patients who were readmitted (part two of two-part model) were consistently lower than expenditures for low-risk drinking patients who were readmitted across all adjusted models (Table 2). When mean expenditures were estimated for the total sample, irrespective of readmission or acute care use, mean per person 30-day readmission expenditures and acute care expenditures did not differ significantly between high-risk and low-risk drinking patients in adjusted models. However, high-risk drinking patients had greater mean ED expenditures in the total sample, with a difference of \$16 per patient (95% CI \$3, \$29), after adjusting for demographics (Table 3; Appendix 4).

There were no significant differences in average adjusted expenditures, when estimated among nondrinking patients who were readmitted, who visited an ED, or who had any acute care visit days, compared to those with low risk drinking (part two of two-part models) (Tables 2–4). However, when estimated for the total sample, the mean readmission expenditures of nondrinking patients were significantly higher than that of low-risk drinking patients, with an adjusted difference of \$325 (95% CI \$247, \$404) after adjusting for demographics (Table 2; Appendix 4). Nondrinking patients also had significantly increased mean ED expenditures (\$19; 95% CI \$16, \$22) and acute care expenditures (\$346, 95% CI \$266, \$425), adjusted for demographics (Tables 3–4; Appendix 4).

Discussion

In this study of older adults hospitalized for a medical condition and followed for 30 days to assess total acute care utilization and expenditures, high-risk drinking, based on routinely

collected alcohol screening results, was associated with increased acute care utilization, adjusted for demographics. However, high-risk drinking was not associated with increased acute care expenditures. In fact, among high-risk drinking patients who had any readmission, average adjusted readmission expenditures were significantly lower than for readmitted low-risk drinking patients. Only mean ED visit expenditures were increased among high-risk drinking patients relative to low-risk drinking patients when estimated in the total sample, irrespective of ED visits. However, nondrinking was consistently associated with increased acute care utilization and expenditures.

The results of this study have important implications for health care systems seeking to address readmissions or post discharge ED use through the implementation of post-discharge interventions. Alcohol-specific post-discharge interventions implemented in some health care systems have been found to reduce readmissions.⁶⁰ However, routinely collected AUDIT-C screens for unhealthy alcohol used in the present study did not appear to identify high-risk drinking patients with increased expenditures in the 30 days following discharge. Even if the modestly increased post-discharge acute care utilization of older adults with high-risk drinking could be reduced to that of low-risk drinking patients, the lack of differences in acute care expenditures between these groups suggests that the cost offset potential for post-discharge interventions targeting alcohol use may be minimal. Both hospital readmission and total acute care utilization (including EDs use) appeared to be equally costly, based on expenditures, for all inpatients irrespective of the severity of unhealthy alcohol use. However, hospitals may nevertheless be motivated to implement post-discharge interventions in order to provide quality care for patients with high-risk drinking that satisfies Joint Commission metrics for discharged patients with alcohol use disorders.⁶¹

The lack of differences in health care expenditures for high-risk drinking patients relative to low-risk drinking patients, despite increased acute care utilization, was largely driven by the lower readmission expenditures among high-risk drinking patients who were readmitted. Inpatient expenditures are based on a DRG system for assigning payments, which is intended to take into account the costs of resources used to care for patients with specific conditions, based on both diagnoses and procedures during a hospital stay.⁵⁶ Patients with high-risk drinking may be treated for conditions considered less costly to care for, based on DRGs, than patients with low-risk drinking. The most common condition at readmission for high-risk drinking patients hospitalized for a medical condition during their index stay was alcohol-related conditions (12% of readmissions), while congestive heart failure (CHF) was the most common condition for low-risk drinking patients (8%).³⁴ However, even though there were no significant differences in expenditures, if alcohol-related readmissions are more preventable than readmissions for conditions like CHF, health care systems may still be interested in targeting high-risk drinking patients at greater risk for readmissions related to their alcohol use. The 30-day readmission measures used by CMS have received strong criticism because numerous studies have found that only a minority of readmissions are judged preventable, based on thorough chart reviews from clinical experts.^{62,63} Future research would be needed to determine whether readmissions for alcohol-related conditions could be prevented if hospitals provide higher quality care during index hospital stays, or if patients receive alcohol-related follow-up care after discharge.

The results of this study support some previous research that found greater hospital and ED utilization for individuals who report nondrinking than for current drinkers.^{34,64–66} In the present study, nondrinking patients had a higher burden of comorbidity, relative to low-risk drinking patients, consistent with prior studies showing lower health-related quality of life for nondrinkers.^{67–69} Patients who reported nondrinking in the present study's sample had consistently higher probability of acute care utilization, acute care utilization days, and expected 30-day acute care expenditures, relative to low-risk drinking patients. Although there was no difference in average expenditures among nondrinking patients relative to low-risk drinking patients among the subgroup of patients who had any readmission, the higher probability of readmission overall translated to higher expected 30-day expenditures, and similar results were observed for both ED use and total acute care use. Nondrinking patients made up the largest proportion of the study sample (64%) and given the large size of this subgroup, hospitals may not be able to feasibly target such patients at hospital discharge. Nevertheless, the majority of nondrinkers (74%) as well as patients overall (75%) did not have any acute care utilization or associated expenditures in the 30 days after discharge. However, nondrinking appeared to explain the slightly increased utilization and expenditures relative to low-risk drinking, over and above all comorbid conditions, prior utilization, and SES and social support indicators included in adjusted two-part models. Patient report of nondrinking may be one of many factors that could identify patients in need of post-discharge support.

There are several limitations to the present study. First, the associations between alcohol risk groups and expenditures are observational and cannot be interpreted as causal. Second, the present study utilized available, prior year AUDIT-C screening results, which use a past-year time frame, but an alcohol screen collected at the time of hospitalization with a past-month timeframe might have been more predictive of outcomes. Alcohol consumption could have changed following screening, potentially in response to brief interventions prompted in the EMR for patients who screen positive for unhealthy alcohol use.⁷⁰ However, in routine practice in the VA, documented brief interventions were not associated with resolution of unhealthy alcohol use.⁷¹ Third, patient reported unhealthy alcohol use may be underestimated in the sample and patients with high-risk drinking may be misclassified as low-risk drinking when alcohol consumption is assessed in clinical practice.⁷² Fourth, this study focused on medical inpatients and excluded patients hospitalized for an index psychiatric condition or physical rehabilitation. In addition, a prior study indicated that substance use disorders, but not alcohol use disorders alone, were predictive of 30-day readmissions.²⁶ However, the present study could not assess other substance use disorders based on self-reported drug screening. As a result, study findings may not generalize to inpatients with psychiatric conditions, physical rehabilitation, and other substance use disorders, and future research is needed to determine whether alcohol screening results are predictive of post-discharge outcomes in these inpatients. Fifth, the VA estimated expenditures may not be comparable to Medicare expenditures because salaried VA providers may not have the same incentives for coding patient diagnoses and procedures that are used to assign DRG.^{73,74} However, VA expenditures estimated through DRG-based relative value weights, as used in this study, would be the best available expenditure estimate for combining with Medicare expenditures. Sixth, the probability of any readmission within

30 days for alcohol risk groups (part one of two-part models) was estimated based on a single index hospitalization per patient and may differ from a readmission rate estimated if multiple index stays were included per patient. Finally, it is unknown whether the associations observed in this study of older VA patients screened with the AUDIT-C would be generalizable to other populations of older adults. Patients who were excluded from the study sample because they did not have an alcohol screen had a lower average number of past-year outpatient visits and lower prevalence of some conditions, such as chronic pulmonary disease.³⁴ Results of the present study may be most generalizable to patient samples with a higher burden of comorbidity.

Implications for Behavioral Health

The present study finds that high-risk drinking, based on alcohol screening results, was not associated with increased acute care expenditures, including readmissions and ED visits, in the 30-days following discharge from a hospitalization for a medical condition. These results suggest that older VA patients with high-risk drinking may not have the highest post-discharge cost burden, from the perspective of payers such as Medicare. Nevertheless, these high-risk drinking patients had greater acute care utilization than low-risk drinking patients and some health care systems may still consider targeting such patients with appropriate behavioral health resources in an effort to decrease potentially avoidable acute care utilization and improve quality of care. However, future research would be needed to determine whether post-discharge behavioral health interventions could reduce utilization, and therefore acute care expenditures, for older patients with high-risk drinking.

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Appendix 1

Algorithm for Identifying Unplanned Readmissions

^aReadmissions within 30 days of discharge that occur after the first readmission are not considered

^bDRG codes for potentially planned procedures are based on Jencks et al. 2009 and updated to be consistent with MS-DRG v25

^cBased on list of acute conditions that are excluded from CMS Hospital-Wide All Cause Unplanned Readmission Measure (version 2.0).

Appendix 2

Clinical Characteristics Based on Diagnoses in Past-Year and Including Index Stay for Study Sample, by AUDIT-C Groups

	Nondrinker n=267,746	Low-risk Drinking n=105,023	Moderate-Risk Drinking n=37,981	High-Risk Drinking n=5,300	Total n=416,050
Deficiency Anemias, n (%)	108,214 (40.4%)	38,511 (36.7%)	13,672 (36.0%)	1,651 (31.2%)	162,048 (38.9%)
Cardiac Arrhythmias, n (%)	126,948 (47.4%)	50,338 (47.9%)	18,387 (48.4%)	1,827 (34.5%)	197,500 (47.5%)
Congestive Heart Failure, n (%)	117,095 (43.7%)	41,163 (39.2%)	14,036 (37.0%)	1,463 (27.6%)	173,757 (41.8%)
Coagulopathy, n (%)	28,825 (10.8%)	11,358 (10.8%)	4,219 (11.1%)	527 (9.9%)	44,929 (10.8%)
Complicated Diabetes, n (%)	58,993 (22.0%)	17,744 (16.9%)	4,149 (10.9%)	450 (8.5%)	81,336 (19.5%)
Dementia, n (%)	25,533 (9.5%)	5,872 (5.6%)	1,823 (4.8%)	182 (3.4%)	33,410 (8.0%)
Fluid and Electrolyte Disorders, n (%)	102,720 (38.4%)	36,378 (34.6%)	13,787 (36.3%)	2,286 (43.1%)	155,171 (37.3%)
Hemiplegia, n (%)	8,023 (3.0%)	2,487 (2.4%)	777 (2.0%)	100 (1.9%)	11,387 (2.7%)
HIV/AIDS, n (%)	499 (0.2%)	237 (0.2%)	56 (0.1%)	9 (0.2%)	801 (0.2%)
Hypertension, n (%)	243,536 (91.0%)	94,775 (90.2%)	34,158 (89.9%)	4,607 (86.9%)	377,076 (90.6%)
Liver Disease, n (%)	10,010 (3.7%)	3,729 (3.6%)	1,730 (4.6%)	670 (12.6%)	16,139 (3.9%)
Metastatic cancer, n (%)	11,531 (4.3%)	4,686 (4.5%)	1,699 (4.5%)	194 (3.7%)	18,110 (4.4%)
Psychosis, n (%)	36,086 (13.5%)	9,770 (9.3%)	3,212 (8.5%)	831 (15.7%)	49,899 (12.0%)
Pulmonary circulation disorders, n (%)	18,874 (7.0%)	7,345 (7.0%)	2,695 (7.1%)	275 (5.2%)	29,189 (7.0%)
Chronic pulmonary disease, n (%)	119,015 (44.5%)	43,362 (41.3%)	16,886 (44.5%)	2,683 (50.6%)	181,946 (43.7%)
Peripheral vascular disorder, n (%)	87,792 (32.8%)	33,049 (31.5%)	11,798 (31.1%)	1,202 (22.7%)	133,841 (32.2%)
Renal Failure, n (%)	88,179 (32.9%)	29,815 (28.4%)	8,511 (22.4%)	681 (12.8%)	127,186 (30.6%)
Tumor, n (%)	75,534 (28.2%)	31,245 (29.8%)	11,193 (29.5%)	1,216 (22.9%)	119,188 (28.6%)
Weight loss, n (%)	10,789 (4.0%)	3,195 (3.0%)	1,381 (3.6%)	316 (6.0%)	15,681 (3.8%)
Myocardial infarction, n (%)	50,725 (18.9%)	18,911 (18.0%)	5,943 (15.6%)	631 (11.9%)	76,210 (18.3%)
Cerebrovascular disease, n (%)	21,349 (8.0%)	6,036 (5.7%)	2,066 (5.4%)	218 (4.1%)	29,669 (7.1%)
Rheumatoid Arthritis, n (%)	24,540 (9.2%)	10,139 (9.7%)	3,478 (9.2%)	236 (4.5%)	38,393 (9.2%)
Ulcer disease, n (%)	12,582 (4.7%)	4,900 (4.7%)	1,845 (4.9%)	259 (4.9%)	19,586 (4.7%)
Uncomplicated diabetes, n (%)	128,333 (47.9%)	43,073 (41.0%)	11,655 (30.7%)	1,426 (26.9%)	184,487 (44.3%)
Valvular disease, n (%)	61,759 (23.1%)	25,969 (24.7%)	9,293 (24.5%)	703 (13.3%)	97,724 (23.5%)
Paralysis, n (%)	14,024 (5.2%)	3,759 (3.6%)	1,206 (3.2%)	143 (2.7%)	19,132 (4.6%)
Hypothyroidism, n (%)	49,834 (18.6%)	17,736 (16.9%)	5,902 (15.5%)	518 (9.8%)	73,990 (17.8%)
Obesity, n (%)	41,895 (15.6%)	17,267 (16.4%)	4,695 (12.4%)	757 (14.3%)	64,614 (15.5%)

	Nondrinker n=267,746	Low-risk Drinking n=105,023	Moderate-Risk Drinking n=37,981	High-Risk Drinking n=5,300	Total n=416,050
Blood loss anemia, n (%)	9,353 (3.5%)	3,543 (3.4%)	1,330 (3.5%)	160 (3.0%)	14,386 (3.5%)
Drug use disorders, n (%)	4,423 (1.7%)	1,688 (1.6%)	783 (2.1%)	578 (10.9%)	7,472 (1.8%)
Depression, n (%)	14,349 (5.4%)	4,640 (4.4%)	1,591 (4.2%)	361 (6.8%)	20,941 (5.0%)
Neurodegenerative disorders, n (%)	70,142 (26.2%)	20,780 (19.8%)	7,185 (18.9%)	1,047 (19.8%)	99,154 (23.8%)

Appendix 3

Adjusted Differences in Acute Care Utilization Relative to Low-Risk Drinking

	Nondrinker (n=267,746)		Low-risk Drinking (n=105,023)		Moderate-Risk Drinking (n=37,981)		High-Risk Drinking (n=5,300)	
	Difference	(95% CI)	Difference	(95% CI)	Difference	(95% CI)	Difference	(95% CI)
Total 30-Day Readmission Hospital Days								
Adjusted for Demographics ^a	0.22	(0.19, 0.25)	--	--	-0.02	(-0.06, 0.03)	0.29	(0.16, 0.42)
Adjusted for Comorbidity and Prior Use ^b	0.12	(0.09, 0.15)	--	--	-0.02	(-0.08, 0.03)	0.04	(-0.08, 0.16)
Adjusted for SES and Social Support ^c	0.10	(0.07, 0.14)	--	--	-0.02	(-0.07, 0.04)	0.03	(-0.09, 0.15)
Total 30-day ED Visits								
Adjusted for Demographics ^a	0.03	(0.02, 0.03)	--	--	0.00	(-0.01, 0.00)	0.03	(0.01, 0.04)
Adjusted for Comorbidity and Prior Use ^b	0.01	(0.01, 0.02)	--	--	0.00	(-0.01, 0.00)	0.00	(-0.02, 0.01)
Adjusted for SES and Social Support ^c	0.01	(0.01, 0.01)	--	--	0.00	(-0.01, 0.01)	-0.01	(-0.02, 0.01)
Total 30-day Acute Care Days								
Adjusted for Demographics ^a	0.25	(0.21, 0.28)	--	--	-0.02	(-0.07, 0.03)	0.32	(0.18, 0.45)
Adjusted for Comorbidity and Prior Use ^b	0.18	(0.15, 0.21)	--	--	-0.04	(-0.09, 0.01)	0.12	(-0.01, 0.25)
Adjusted for SES and Social Support ^c	0.10	(0.06, 0.13)	--	--	-0.01	(-0.07, 0.04)	0.03	(-0.08, 0.15)

Note: Bolded estimates indicate adjusted difference in mean from referent group (low-risk drinking) is significantly different from zero (p<0.05).

^a Adjusted for age, gender, race, year of discharge

^b Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year inpatient/ED visits, past-year discharge AMA, index LOS

^c Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year inpatient/ED visits, past-year discharge AMA, index LOS, VA copay exempt status, marital status

Appendix 4

Adjusted Differences in Average expenditures Relative to Low-Risk Drinking Group

	Nondrinker (n=267,746)		Low-risk Drinking (n=105,023)		Moderate-Risk Drinking (n=37,981)		High-Risk Drinking (n=5,300)	
	Diff	(95% CI)	Diff	(95% CI)	Diff	(95% CI)	Diff	(95% CI)
Total 30-Day Readmission Hospital Days								
Adjusted for Demographics ^a	\$325	(\$247, \$404)	--	--	-\$26	(-\$148, \$97)	\$168	(\$97, \$433)
Adjusted for Comorbidity and Prior Use ^b	\$166	(\$87, \$244)	--	--	-\$34	(-\$156, \$88)	-\$159	(-\$404, \$86)
Adjusted for SES and Social Support ^c	\$128	(\$50, \$206)	--	--	-\$15	(-\$140, \$109)	-\$188	(-\$434, \$60)
Total 30-day ED Visits								
Adjusted for Demographics ^a	\$19	(\$16, \$22)	--	--	-\$5	(-\$9, \$0)	\$16	(\$3, \$29)
Adjusted for Comorbidity and Prior Use ^b	\$10	(\$6, \$14)	--	--	-\$6	(-\$13, \$1)	-\$1	(-\$16, \$14)
Adjusted for SES and Social Support ^c	\$8	(\$4, \$12)	--	--	-\$6	(-\$13, \$1)	-\$2	(-\$17, \$13)
Total 30-day Acute Care Days								
Adjusted for Demographics ^a	\$346	(\$266, \$425)	--	--	-\$37	(-\$157, \$84)	\$184	(-\$78, \$445)
Adjusted for Comorbidity and Prior Use ^b	\$176	(\$95, \$258)	--	--	-\$40	(-\$167, \$88)	-\$141	(-\$404, \$122)
Adjusted for SES and Social Support ^c	\$137	(\$56, \$218)	--	--	-\$20	(-\$149, \$109)	-\$172	(-\$435, \$90)

Note: Bolded estimates indicate adjusted difference in mean from referent group (low-risk drinking) is significantly different from zero (p<0.05).

^a Adjusted for age, gender, race, year of discharge

^b Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year inpatient/ER expenditures, past-year discharge AMA, index LOS

^c Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year inpatient/ER expenditures, past-year discharge AMA, index LOS, VA copay exempt status, marital status

Figure 1.
Sample Eligibility Criteria

Table 1

Sample Characteristics of Medical Inpatients, By AUDIT-C Group.

	Nondrinker n=267,746	Low-risk Drinking n=105,023	Moderate-Risk Drinking n=37,981	High-Risk Drinking n=5,300	Total n=416,050
Age, mean (SD)	77.4 (7.4)	76.6 (7.3)	76.6 (7.3)	71.1 (6.0)	77.0 (7.4)
Male, n (%)	262,188 (97.9%)	103,548 (98.6%)	37,362 (98.4%)	5,287 (99.8%)	408,385 (98.2%)
Nonwhite Race, n (%)	45,393 (17.0%)	12,944 (12.3%)	3,340 (8.8%)	945 (17.8%)	62,622 (15.1%)
Married, n (%)	169,296 (63.2%)	67,816 (64.6%)	23,940 (63.0%)	2,193 (41.4%)	263,245 (63.3%)
VA Copay Exempt, n (%)	196,806 (73.5%)	65,470 (62.3%)	22,424 (59.0%)	4,177 (78.8%)	288,877 (69.4%)
Tobacco, n (%)	35,411 (13.2%)	15,612 (14.9%)	7,499 (19.7%)	2,470 (46.6%)	60,992 (14.7%)
PTSD, n (%)	15,053 (5.6%)	4,926 (4.7%)	1,531 (4.0%)	545 (10.3%)	22,055 (5.3%)
AUD, n (%)	8,344 (3.1%)	5,955 (5.7%)	7,230 (19.0%)	3,566 (67.3%)	25,095 (6.0%)
Comorbidity Index, mean (SD) ^a	4.1 (3.0)	3.6 (3.0)	3.6 (2.9)	3.6 (2.7)	3.9 (3.0)
PY hospitalizations, mean (SD)	0.5 (1.1)	0.4 (0.9)	0.4 (0.8)	0.6 (1.2)	0.5 (1.0)
PY ED visits, mean (SD)	1.3 (2.1)	1.0 (1.7)	0.9 (1.7)	1.5 (2.6)	1.2 (2.0)
PY hospital expenditures, mean (SD)	\$6,482 (\$21,023)	\$4,562 (\$16,565)	\$4,103 (\$15,105)	\$8,378 (\$26,231)	\$6,518 (\$20,945)
PY ED expenditures, mean (SD)	\$785 (\$1,585)	\$558 (\$1,235)	\$508 (\$1,157)	\$890 (\$1,813)	\$790 (\$1,583)
Index Length of Stay, mean (SD)	3.9 (3.4)	3.6 (3.1)	3.6 (3.2)	4.3 (4.0)	3.8 (3.3)
Any AMA, n (%)	1,811 (0.7%)	614 (0.6%)	238 (0.6%)	135 (2.5%)	2,798 (0.7%)

^aCondition Indicators for Conditions in the Comorbidity Index available in Appendix 2^bPY = Past year

Mean Hospital Days and Expenditures for 30-day Readmissions, Across AUDIT-C Groups

Table 2

	Nondrinker (n=267,746)		Low-risk Drinking (n=105,023)		Moderate-Risk Drinking (n=37,981)		High-Risk Drinking (n=5,300)	
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
Total 30-Day Readmission Days								
Unadjusted								
Probability of Any Readmission	0.16	(0.16, 0.16)	0.14	(0.13, 0.14)	0.14	(0.13, 0.14)	0.16	(0.15, 0.17)
Mean Hospital Days if Any Readmission	8.41	(8.33, 8.49)	8.15	(8.00, 8.30)	7.91	(7.69, 8.13)	8.59	(8.04, 9.14)
Mean Hospital Days in Total Sample	1.34	(1.32, 1.34)	1.11	(1.08, 1.11)	1.08	(1.04, 1.08)	1.39	(1.27, 1.39)
Demographic Adjusted^a								
Probability of Any Readmission	0.16	(0.16, 0.16)	0.14	(0.13, 0.14)	0.14	(0.13, 0.14)	0.17	(0.16, 0.18)
Mean Hospital Days if Any Readmission	8.40	(8.32, 8.48)	8.17	(8.03, 8.32)	7.97	(7.74, 8.19)	8.42	(7.89, 8.94)
Mean Hospital Days in Total Sample	1.34	(1.32, 1.35)	1.12	(1.09, 1.14)	1.10	(1.06, 1.14)	1.40	(1.28, 1.52)
Comorbidity and Prior Use Adjusted^b								
Probability of Any Readmission	0.16	(0.16, 0.16)	0.14	(0.14, 0.14)	0.14	(0.14, 0.15)	0.15	(0.14, 0.16)
Mean Hospital Days if Any Readmission	8.03	(7.95, 8.11)	8.00	(7.85, 8.14)	7.78	(7.55, 8.00)	7.74	(7.22, 8.27)
Mean Hospital Days in Total Sample	1.30	(1.29, 1.32)	1.19	(1.16, 1.21)	1.16	(1.12, 1.21)	1.23	(1.12, 1.35)
SES and Social Support Adjusted^c								
Probability of Any Readmission	0.16	(0.15, 0.16)	0.14	(0.14, 0.14)	0.14	(0.14, 0.15)	0.15	(0.14, 0.16)
Mean Hospital Days if Any Readmission	8.01	(7.93, 8.09)	7.99	(7.84, 8.13)	7.77	(7.55, 8.00)	7.72	(7.20, 8.24)
Mean Hospital Days in Total Sample	1.30	(1.28, 1.32)	1.20	(1.17, 1.22)	1.18	(1.13, 1.22)	1.23	(1.11, 1.34)
Total 30-Day Readmission Expenditures								
Unadjusted								
Mean Expenditures if Any Readmission	\$16,617	(\$16,390, \$16,844)	\$16,998	(\$16,585, \$17,411)	\$16,489	(\$15,892, \$17,086)	\$16,088	(\$14,762, \$17,414)
Mean Expenditures in Total Sample	\$2,652	(\$2,609, \$2,641)	\$2,307	(\$2,241, \$2,307)	\$2,261	(\$2,161, \$2,261)	\$2,608	(\$2,340, \$2,608)
Demographics Adjusted^d								
Mean Expenditures if Any Readmission	\$16,696	(\$16,465, \$16,928)	\$17,066	(\$16,670, \$17,462)	\$16,699	(\$16,146, \$17,252)	\$14,986	(\$13,795, \$16,178)
Mean Expenditures in Total Sample	\$2,645	(\$2,601, \$2,689)	\$2,320	(\$2,255, \$2,385)	\$2,294	(\$2,197, \$2,391)	\$2,488	(\$2,243, \$2,733)
Comorbidity and Prior Use Adjusted^b								
Mean Expenditures if Any Readmission	\$16,286	(\$16,054, \$16,518)	\$16,818	(\$16,438, \$17,198)	\$16,516	(\$15,953, \$17,079)	\$14,582	(\$13,373, \$15,792)

	Nondrinker (n=267,746)		Low-risk Drinking (n=105,023)		Moderate-Risk Drinking (n=37,981)		High-Risk Drinking (n=5,300)	
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
Mean Expenditures in Total Sample	\$2,600	(\$2,556, \$2,644)	\$2,434	(\$2,367, \$2,501)	\$2,400	(\$2,297, \$2,503)	\$2,275	(\$2,043, \$2,509)
SES and Social Support Adjusted^c								
Mean Expenditures if Any Readmission	\$16,220	(\$15,990, \$16,450)	\$16,809	(\$16,429, \$17,189)	\$16,543	(\$15,981, \$17,105)	\$14,528	(\$13,330, \$15,726)
Mean Expenditures in Total Sample	\$2,584	(\$2,541, \$2,628)	\$2,456	(\$2,388, \$2,524)	\$2,441	(\$2,337, \$2,545)	\$2,268	(\$2,037, \$2,499)

Note: Bolded estimates indicate adjusted difference in mean from referent group (low-risk drinking) is significantly different from zero (p<0.05).

^a Adjusted for age, gender, race, year of discharge

^b Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year inpatient stays, past-year discharge AMA, index LOS

^c Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year inpatient stays, past-year discharge AMA, index LOS, VA copay exempt status, marital status

Table 3
Mean ED Visit Days and Expenditures for 30-day ED Visits, Across AUDIT-C Groups

	Nondrinker (n=267,746)		Low-risk Drinking (n=105,023)		Moderate-Risk Drinking (n=37,981)		High-Risk Drinking (n=5,300)	
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
Total 30-day ED Visits								
Unadjusted								
Probability of Any ED Visit	0.13	(0.13, 0.13)	0.11	(0.11, 0.11)	0.11	(0.10, 0.11)	0.13	(0.12, 0.14)
Mean ED Visits if Any ED Visit	1.25	(1.24, 1.26)	1.23	(1.22, 1.25)	1.23	(1.21, 1.25)	1.32	(1.25, 1.38)
Mean ED Visits in Total Sample	0.16	(0.16, 0.16)	0.13	(0.13, 0.13)	0.13	(0.13, 0.13)	0.17	(0.15, 0.17)
Demographics Adjusted^a								
Probability of Any	0.13	(0.13, 0.13)	0.11	(0.11, 0.11)	0.11	(0.10, 0.11)	0.12	(0.12, 0.13)
Mean ED Visits if Any ED Visit	1.25	(1.24, 1.25)	1.23	(1.22, 1.24)	1.23	(1.21, 1.25)	1.29	(1.23, 1.35)
Mean ED Visits in Total Sample	0.16	(0.16, 0.16)	0.13	(0.13, 0.14)	0.13	(0.13, 0.14)	0.16	(0.15, 0.17)
Comorbidity and Prior Use Adjusted^b								
Probability of Any ED Visit	0.12	(0.12, 0.13)	0.11	(0.11, 0.11)	0.11	(0.11, 0.11)	0.11	(0.10, 0.12)
Mean ED Visits if Any ED Visit	1.22	(1.20, 1.24)	1.22	(1.19, 1.25)	1.22	(1.19, 1.25)	1.21	(1.16, 1.27)
Mean ED Days in Total Sample	0.17	(0.15, 0.19)	0.16	(0.13, 0.18)	0.16	(0.13, 0.18)	0.15	(0.13, 0.18)
SES and Social Support Adjusted^c								
Probability of Any ED Visit	0.12	(0.12, 0.12)	0.11	(0.11, 0.12)	0.11	(0.11, 0.12)	0.11	(0.10, 0.12)
Mean ED Visits if Any ED Visit	1.22	(1.19, 1.24)	1.22	(1.19, 1.24)	1.22	(1.19, 1.24)	1.21	(1.16, 1.27)
Mean ED Visits in Total Sample	0.17	(0.15, 0.19)	0.16	(0.14, 0.18)	0.16	(0.14, 0.18)	0.15	(0.13, 0.17)
Total 30-day ED Expenditures								
Unadjusted								
Mean Expenditures if Any ED Visit	\$891	(\$880, \$901)	\$867	(\$849, \$885)	\$832	(\$804, \$859)	\$873	(\$799, \$946)
Mean Expenditures in Total Sample	\$113	(\$111, \$113)	\$93	(\$90, \$93)	\$87	(\$84, \$87)	\$112	(\$100, \$112)
Demographic Adjusted^a								
Mean Expenditures if Any ED Visit	\$890	(\$880, \$901)	\$868	(\$850, \$885)	\$833	(\$806, \$860)	\$882	(\$807, \$958)
Mean Expenditures in Total Sample	\$113	(\$111, \$114)	\$94	(\$91, \$96)	\$89	(\$85, \$93)	\$109	(\$98, \$121)
Comorbidity and Prior Use Adjusted^b								
Mean Expenditures if Any ED Visit	\$888	(\$804, \$971)	\$893	(\$807, \$980)	\$861	(\$774, \$947)	\$902	(\$783, \$1,020)

	Nondrinker (n=267,746)		Low-risk Drinking (n=105,023)		Moderate-Risk Drinking (n=37,981)		High-Risk Drinking (n=5,300)	
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
Mean Expenditures in Total Sample	\$146	(\$62, \$230)	\$136	(\$52, \$221)	\$130	(\$49, \$212)	\$135	(\$49, \$222)
SES and Social Support Adjusted^c								
Mean Expenditures if Any ED Visit	\$895	(\$798, \$992)	\$899	(\$799, \$999)	\$865	(\$766, \$964)	\$908	(\$778, \$1,038)
Mean Expenditures in Total Sample	\$151	(\$53, \$249)	\$143	(\$45, \$241)	\$137	(\$42, \$232)	\$141	(\$40, \$242)

Note: Bolded estimates indicate adjusted difference in mean from referent group (low-risk drinking) is significantly different from zero ($p < 0.05$).

^a Adjusted for age, gender, race, year of discharge

^b Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year ED Visits, past-year discharge AMA, index LOS

^c Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year ED Visits, past-year discharge AMA, index LOS, VA copay exempt status, marital status

Table 4
Mean Acute Care Days and Expenditures for 30-day Acute Care Use, Across AUDIT-C Groups

	Nondrinker (n=267,746)		Low-risk Drinking (n=105,023)		Moderate-Risk Drinking (n=37,981)		High-Risk Drinking (n=5,300)	
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
Total 30-day Acute Care Days								
Unadjusted								
Probability of Any Acute Care Use	0.26	(0.26, 0.26)	0.22	(0.22, 0.22)	0.22	(0.22, 0.23)	0.26	(0.25, 0.27)
Mean Acute Days if Any Acute Care	5.80	(5.75, 5.86)	5.58	(5.48, 5.68)	5.49	(5.33, 5.64)	6.00	(5.61, 6.40)
Mean Acute Days in Total Sample	1.50	(1.48, 1.50)	1.24	(1.21, 1.24)	1.21	(1.17, 1.21)	1.56	(1.44, 1.56)
Demographic Adjusted^a								
Probability of Any Acute Care Use	0.26	(0.26, 0.26)	0.22	(0.22, 0.23)	0.22	(0.22, 0.23)	0.26	(0.25, 0.27)
Mean Acute Days if Any Acute Care	5.79	(5.74, 5.85)	5.58	(5.48, 5.68)	5.49	(5.34, 5.65)	5.99	(5.60, 6.37)
Mean Acute Days in Total Sample	1.49	(1.48, 1.51)	1.25	(1.22, 1.27)	1.23	(1.19, 1.27)	1.56	(1.44, 1.69)
Comorbidity and Prior Use Adjusted^b								
Probability of Any Acute Care Use	0.25	(0.25, 0.26)	0.23	(0.23, 0.23)	0.23	(0.22, 0.23)	0.24	(0.23, 0.25)
Mean Acute Days if Any Acute Care	5.61	(5.56, 5.67)	5.51	(5.41, 5.60)	5.41	(5.25, 5.56)	5.69	(5.30, 6.09)
Mean Acute Days in Total Sample	1.47	(1.46, 1.49)	1.29	(1.27, 1.32)	1.26	(1.21, 1.30)	1.42	(1.30, 1.54)
SES and Social Support Adjusted^c								
Probability of Any Acute Care Use	0.25	(0.25, 0.25)	0.23	(0.23, 0.24)	0.23	(0.23, 0.24)	0.24	(0.23, 0.25)
Mean Acute Days if Any Acute Care	5.50	(5.45, 5.56)	5.44	(5.35, 5.54)	5.34	(5.19, 5.50)	5.50	(5.11, 5.88)
Mean Acute Days in Total Sample	1.45	(1.43, 1.47)	1.35	(1.32, 1.38)	1.34	(1.29, 1.39)	1.39	(1.27, 1.50)
Total 30-day Acute Care Expenditures								
Unadjusted								
Mean Expenditures if Any Acute Care	\$10,693	(\$10,541, \$10,844)	\$10,809	(\$10,537, \$11,081)	\$10,614	(\$10,209, \$11,019)	\$10,453	(\$9,537, \$11,369)
Mean Expenditures in Total Sample	\$2,766	(\$2,722, \$2,754)	\$2,400	(\$2,334, \$2,400)	\$2,348	(\$2,248, \$2,348)	\$2,720	(\$2,451, \$2,720)
Demographic Adjusted^a								
Mean Expenditures if Any Acute Care	\$10,702	(\$10,545, \$10,858)	\$10,796	(\$10,536, \$11,057)	\$10,632	(\$10,251, \$11,012)	\$9,953	(\$9,105, \$10,801)
Mean Expenditures in Total Sample	\$2,759	(\$2,715, \$2,802)	\$2,413	(\$2,348, \$2,478)	\$2,377	(\$2,279, \$2,474)	\$2,597	(\$2,348, \$2,845)
Comorbidity and Prior Use Adjusted^b								
Mean Expenditures if Any Acute Care	\$10,201	(\$10,049, \$10,352)	\$10,520	(\$10,269, \$10,771)	\$10,432	(\$10,046, \$10,818)	\$9,639	(\$8,755, \$10,522)

	Nondrinker (n=267,746)	Low-risk Drinking (n=105,023)	Moderate-Risk Drinking (n=37,981)	High-Risk Drinking (n=5,300)
	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)
Mean Expenditures in Total Sample	\$2,721 (\$2,676, \$2,766)	\$2,544 (\$2,475, \$2,614)	\$2,504 (\$2,399, \$2,610)	\$2,403 (\$2,157, \$2,649)
SES and Social Support Adjusted^c				
Mean Expenditures if Any Acute Care	\$10,188 (\$10,036, \$10,340)	\$10,505 (\$10,254, \$10,756)	\$10,425 (\$10,040, \$10,811)	\$9,610 (\$8,734, \$10,486)
Mean Expenditures in Total Sample	\$2,705 (\$2,660, \$2,749)	\$2,567 (\$2,498, \$2,638)	\$2,548 (\$2,441, \$2,655)	\$2,396 (\$2,151, \$2,639)

Note: Bolded estimates indicate adjusted difference in mean from referent group (low-risk drinking) is significantly different from zero ($p < 0.05$).

^a Adjusted for age, gender, race, year of discharge

^b Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year acute care visits, past-year discharge AMA, index LOS

^c Adjusted for age, gender, race, year of discharge, past-year comorbid condition indicators, days from AUDIT-C screen to index stay, past-year acute care visits, past-year discharge AMA, index LOS, VA copay exempt status, marital status