



Association of Alcohol Screening Scores With Adverse Mental Health Conditions and Substance Use Among US Adults

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Abstract

IMPORTANCE Alcohol screening may be associated with health outcomes that cluster with alcohol use (ie, alcohol-clustering conditions), including depression, anxiety, and use of tobacco, marijuana, and illicit drugs.

OBJECTIVE To quantify the extent to which alcohol screening provides additional information regarding alcohol-clustering conditions and to compare 2 alcohol use screening tools commonly used for this purpose.

DESIGN, SETTING, AND PARTICIPANTS This longitudinal cohort study used data from the Veterans Aging Cohort Study. Data were collected at 8 Veterans Health Administration facilities from 2003 through 2012. A total of 7510 participants were enrolled, completed a baseline survey, and were followed up. Veterans with HIV were matched with controls without HIV by age, race, sex, and site of care. Data were analyzed from January 2019 to December 2019.

EXPOSURES The Alcohol Use Disorders Identification Test (AUDIT) and Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) were used to assess alcohol use, with 4 risk groups delineated for each test: score 0 to 7 (reference), score 8 to 15, score 16 to 19, and score 20 to 40 (maximum score) for the full AUDIT and score 0 to 3 (reference), score 4 to 5, score 6 to 7, and score 8 to 12 (maximum score) for the AUDIT-C.

MAIN OUTCOMES AND MEASURES Alcohol-clustering conditions, including self-reported symptoms of depression and anxiety and use of tobacco, marijuana, cocaine, other stimulants, opioids, and injection drugs.

RESULTS A total of 6431 US patients (6104 [95%] men; median age during survey years 2003-2004, 50 years [range, 28-86 years; interquartile range, 44-55 years]) receiving care in the Veterans Health Administration completed 1 or more follow-up surveys when the AUDIT was administered and were included in the present analyses. Of the male participants, 4271 (66%) were African American, 1498 (24%) were white, and 590 (9%) were Hispanic. The AUDIT and AUDIT-C scores were associated with each alcohol-clustering condition. In particular, an AUDIT score of 20 or higher (vs <8, the reference) was associated with symptoms of depression (odds ratio [OR], 8.37; 95% CI, 6.20-11.29) and anxiety (OR, 8.98; 95% CI, 6.39-12.60) and with self-reported use of tobacco (OR, 14.64; 95% CI, 8.94-23.98), marijuana (OR, 12.41; 95% CI, 8.61-17.90), crack or cocaine (OR, 39.47; 95% CI, 27.38-56.90), other stimulants (OR, 21.31; 95% CI, 12.73-35.67), and injection drugs (OR, 8.67; 95% CI, 5.32-14.13). An AUDIT score of 20 or higher yielded likelihood ratio (sensitivity / 1 - specificity) values greater than 3.5 for depression, anxiety, crack or cocaine use, and other stimulant use. Associations between AUDIT-C scores and alcohol-clustering conditions were more modest.

(continued)

Key Points

Question Can alcohol use screening scores provide clinically meaningful information and facilitate identification of adverse mental health conditions and other substance use?

Findings This cohort study using data from 6431 US patients collected from 2003 to 2012 found that high alcohol use scores (Alcohol Use Disorders Identification Test score ≥ 20) were associated with depression, anxiety, crack or cocaine use, and other stimulant use, with likelihood ratios greater than 3.5.

Meaning These findings suggest that alcohol screening can inform decisions about further screening and diagnostic assessment for depression, anxiety, and some drug use outcomes.

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Abstract (continued)

CONCLUSIONS AND RELEVANCE Alcohol screening can inform decisions about further screening and diagnostic assessment for alcohol-clustering conditions, particularly for depression, anxiety, crack or cocaine use, and other stimulant use. Future studies using clinical diagnoses rather than screening tools to assess alcohol-clustering conditions may be warranted.

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Introduction

The health consequences of alcohol use are substantial, with rates of alcohol use having increased dramatically in the most recent reporting periods.^{1,2} Unhealthy alcohol use encompasses a range of alcohol use patterns, from risky use, which is defined as exceeding the recommended daily drinking limits (ie, >3 drinks per day for women and >4 drinks per day for men),³ to harmful use, which is accompanied by alcohol-related consequences (eg, failure to fulfill obligations or interpersonal problems), and dependence, which is accompanied by substantial impairment (eg, tolerance, withdrawal, or inability to reduce alcohol consumption).⁴ In the US, the most recent estimates suggest that 13% of adults exceed recommended daily drinking limits on a weekly basis, representing a 30% increase over a 10-year period, and an additional 13% have alcohol use disorder,¹ representing a 50% increase over the course of 10 years.¹ Globally, alcohol use disorder is the most common substance use disorder, with estimates indicating a worldwide population of 100 million individuals with alcohol use disorder.² Current guidelines suggest annual screening and treatment or referral for unhealthy alcohol use in adult primary care settings in an effort to reduce alcohol use-related morbidity and mortality.^{5,6} In many health care systems, alcohol screening is integrated into routine primary care.^{7,8}

Depression, anxiety, and the use of substances other than alcohol are highly prevalent in the US.⁹⁻¹¹ The US Preventive Services Task Force recommends screening for depression and tobacco use but does not currently recommend illicit drug use screening (although recent guidelines have been drafted) and does not recommend screening for anxiety.¹² Screening for recommended conditions may not be feasible for some practitioners because of resource constraints.^{13,14} Given that unhealthy alcohol use is associated with mood and anxiety disorders,^{15,16} as well as use of other substances including tobacco,^{17,18} marijuana,¹⁷ prescription opioid misuse,¹⁹ heroin,²⁰ crack or cocaine, and other stimulants,²¹⁻²⁴ information obtained from alcohol screening may provide clinically meaningful information regarding some or all of these conditions, potentially facilitating their identification and treatment.

Even though alcohol screening has been widely integrated into primary care and could provide insight into risk for other conditions in these settings, research on the association between alcohol use screening scores and other conditions is limited.^{25,26} Although the 10-item Alcohol Use Disorders Identification Test (AUDIT)²⁷ is commonly used for alcohol use screening, the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C), an abbreviated 3-item version of the full AUDIT, also reliably identifies unhealthy alcohol use and alcohol use disorder.²⁸⁻³⁰ Given the time constraints on primary care physicians,³¹ brief screeners such as the AUDIT-C are useful and practical tools for unhealthy alcohol use screening. However, the more-comprehensive AUDIT may more accurately screen individuals at high risk of alcohol-clustering conditions compared with the AUDIT-C.

The purpose of this study was to evaluate to what extent currently used alcohol screening measures provide information regarding the presence of conditions that are likely alcohol-clustering according to the literature (henceforth referred to as "alcohol-clustering conditions"). Specifically, we used data from the Veterans Aging Cohort Study (VACS), a cohort of veterans with HIV matched to HIV-negative controls, and used the AUDIT and AUDIT-C to measure associations between alcohol use severity and conditions such as depression and anxiety, as well as substance use, including tobacco, marijuana, illicit opioids, stimulants, and injection drugs.

Methods

Sample and Data Sources

The VACS survey sample includes US veterans receiving health care in 8 Veterans Health Administration centers: Atlanta, Georgia; Baltimore, Maryland; Bronx, New York; Houston, Texas; Los Angeles, California; Manhattan and Brooklyn, New York; Pittsburgh, Pennsylvania; and Washington, DC. The VACS is composed of approximately 3500 veterans with HIV and 3500 controls without HIV, frequency-matched by age, race/ethnicity, sex, and site of care.³² Patients of the Veterans Health Administration self-report their race/ethnicity; these data were used by the VACS study team during matching to ensure comparability of the HIV-positive and HIV-negative cohorts. Enrollment in VACS began in 2002 and is ongoing. The VACS participants provide written informed consent for participation in baseline and follow-up surveys that assess information about a range of health outcomes and health-related sociodemographic and behavioral factors. Participant survey data are matched to clinical and administrative data. Institutional review boards at each participating Veterans Health Administration medical center and affiliated academic institutions approved all parent study activities. The institutional review board of the New York University School of Medicine approved all study activities for the present secondary data analysis study focused on alcohol use screening for the identification of comorbid conditions. We used data from 6 annual surveys that administered the full AUDIT and the AUDIT-C. These surveys were administered from 2003 to 2012 in Atlanta, Bronx, Houston, Los Angeles, Manhattan and Brooklyn, and Pittsburgh and from 2004 to 2012 in Baltimore and Washington, DC. The present study describes results of analysis performed from January 2019 to December 2019. This study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

Measures

The current analysis considers patterns of alcohol use, defined by specific ranges of scores on the AUDIT and AUDIT-C, as well as symptoms of anxiety and depression and the use of substances other than alcohol. All instruments and thresholds used in our analyses are described in the following subsections.

Alcohol Use Patterns Measured by the AUDIT Questionnaire

The AUDIT is a 10-item questionnaire that was designed to detect hazardous or harmful drinking across settings and subgroups.³³⁻³⁵ The AUDIT assesses 3 domains of alcohol use: past-year consumption based on frequency, quantity, and heavy drinking; past-year dependence symptoms, including impaired control, increased salience of drinking, and morning drinking; and consequences of use (eg, guilt, blackouts, alcohol-related injury, and others' concern about one's use). Each item is scored from 0 to 4 for a maximum score of 40. Those reporting no alcohol use in the past year are given a score of 0 on all items with the exception of items 9 and 10, which are not restricted to the past year. On the basis of World Health Organization guidelines,²⁷ we categorized AUDIT scores into 4 risk groups (scores 0-7 [reference], 8-15, 16-19, and 20-40). Participants were categorized in the lowest category if they reported never drinking or not drinking in the past year even if missing AUDIT items 9 and/or 10, or if they were missing 1 AUDIT item but the sum of the remaining 9 AUDIT items was less than or equal to 3. Participants were categorized in the highest category if they were missing 1 or more AUDIT items but the remaining items when summed yielded a score of 20 to 40.

Alcohol Use Patterns Measured by the AUDIT-C Questionnaire

The AUDIT-C, the first 3 items of the full AUDIT, measures past year consumption patterns according to frequency, quantity, and heavy drinking. The score ranges from 0 to 12. We categorized AUDIT-C scores into 4 risk groups (scores 0-3 [reference], 4-5, 6-7, and 8-12). Our prior studies of the VACS sample,³⁶ which used group-based mixture modeling methods to categorize the sample on alcohol use, suggest that 4 distinct alcohol use patterns (abstainer, low risk, moderate risk, and high risk)

characterize the sample and that increasing alcohol risk is associated with a dose-response increase in mortality risk. A score of 4 or higher is the standard AUDIT-C cut point indicative of unhealthy alcohol use,³⁷ whereas a score of approximately 8 is associated with exposure to biologically confirmed alcohol use, a mortality risk indicator, and trauma-related hospitalizations.^{36,38}

Alcohol-Clustering Conditions: Psychiatric Disorder Symptoms

Depressive symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9), a 9-item screening instrument that assesses the frequency of experiencing depression-related problems (eg, "little interest or pleasure in doing things" or "feeling down") with response options rated on a 4-point scale ranging from 0 ("not at all") to 3 ("nearly every day").³⁹ In accordance with Kroenke et al,⁴⁰ we used a PHQ-9 score of 10 or more to identify cases of current depressive symptoms.⁴¹ Anxiety symptoms were assessed by a single survey item that asked whether the participant had "felt nervous or anxious" in the 4 weeks before the survey and, if they had this symptom, the degree to which they were bothered on a 4-point Likert scale.^{42,43} Single-item screening tools for anxiety have shown robust test performance in detection of validated measures of anxiety symptoms.⁴⁴ We coded a dichotomous variable indicating any endorsement of the symptom.

Alcohol-Clustering Conditions: Other Substance Use

We examined dichotomous indicators (yes vs no) of current substantial tobacco use (≥ 10 cigarettes per day) and past-year use of marijuana, crack or cocaine, other stimulants (eg, amphetamine), and illicit opioids, including heroin and/or prescription opioids (eg, Oxycontin, Vicodin, or Percocet; prescription opioids were not assessed during the 2005-2007 survey wave).

Screening Using the AUDIT vs Commonly Used Evidence-Based Screening Tools

We compared the test performance of the AUDIT with the following evidence-based tools used commonly in clinical practice: the Patient Health Questionnaire-2 (PHQ-2; first 2 items of the PHQ-9) for indication of depression,⁴¹ the Generalized Anxiety Disorder 7-item (GAD-7) scale for indication of anxiety,^{45,46} and the Drug Abuse Screen Test-10 (DAST-10) for indication of crack or cocaine use.^{47,48}

Statistical Analysis

All analyses were conducted using Stata statistical software version 15.0 (StataCorp). Bivariable analyses were conducted to describe across-time levels of alcohol use patterns and alcohol-clustering conditions. Using the 6 VACS survey waves (survey wave 2003-2004 to wave 2011-2012), we estimated cross-sectional logistic regression models to estimate unadjusted odds ratios (ORs) and 95% CIs for associations between categories of alcohol use severity and alcohol-clustering conditions, using random effects to account for within-individual clustering across follow-up periods.⁴⁹⁻⁵² We included an alcohol use pattern by HIV status interaction term in each model to test for statistically significant differences in the association between AUDIT or AUDIT-C category and alcohol-clustering condition by HIV status. We assessed the test performance of the AUDIT or AUDIT-C as screening tools for association with alcohol-clustering conditions and evaluated these tools when using different thresholds to define a positive test. Specifically, we calculated the sensitivity, specificity, likelihood ratio (sensitivity / 1 – specificity), positive predictive value (PPV), and the percentage of individuals correctly classified when using alcohol screening for indication of depression, anxiety, and other substance use. Finally, we compared the likelihood ratios obtained when using the AUDIT for indication of depressive symptoms, anxiety symptoms, and crack or cocaine use with likelihood ratios obtained from the PHQ-2 for depressive symptoms,⁴¹ GAD-7 for anxiety symptoms,⁴⁶ and DAST-10 for crack or cocaine use.⁴⁷ All models used complete case analysis.

Results

A total of 7510 participants were enrolled, completed a baseline survey, and were followed up. The median age in survey years 2003 to 2004 was 50 years (range, 28-86 years; interquartile range, 44-55 years). Of the participants, 6104 (95%) were men, and 327 (5%) were women. Of the male participants, 4271 (66%) were black, 1498 (24%) were white, 590 (9%) were Hispanic, and 2747 (45%) had an annual income of less than \$12 000. The AUDIT was not administered at baseline. A total of 6431 participants (86%) completed 1 or more follow-up surveys, for a total of 22 473 surveys across follow-up, when the AUDIT was administered and, hence, were included in the current analyses. The median number of completed follow-up surveys that included the AUDIT was 4 surveys (range, 1-6 surveys; interquartile range, 2-5 surveys).

Over the 6-year survey period, according to the full AUDIT, 18 577 participants (82.7%) were abstinent or had a score of less than 8, 1909 participants (8.5%) had a score of 8 to 15, 363 participants (1.6%) had a score of 16 to 19, and 671 participants (3.0%) had a score of 20 to 40 (Table 1). On the basis of the AUDIT-C, 17 321 participants (77.1%) had a score of less than 4, 2659 participants (11.8%) had a score of 4 to 5, 1234 participants (5.5%) had a score of 6 to 7, and 1009 participants (4.5%) had a score of 8 or higher. The percentage in each risk category of the AUDIT or AUDIT-C remained generally stable over time.

Table 1. Across-Time Prevalence of Alcohol Use Severity, Psychiatric Disorder Symptoms, and Substance Use Among Veterans Aging Cohort Study Participants, 2003 to 2012^a

Alcohol-Clustering Condition	Participants, No. (%)						Overall (N = 6431) ^b
	Survey Wave						
	2003-2004 (n = 2883)	2004-2005 (n = 3997)	2005-2007 (n = 4112)	2008-2009 (n = 4252)	2009-2011 (n = 3764)	2011-2012 (n = 3515)	
Alcohol Use Disorders Identification Test score							
<8	2380 (84.0)	2989 (74.8)	3412 (83.0)	3565 (83.8)	3203 (85.1)	3028 (86.2)	18 577 (82.7)
8-15	214 (7.6)	333 (8.3)	411 (10.0)	394 (9.3)	290 (7.7)	267 (7.6)	1909 (8.5)
16-19	46 (1.6)	70 (1.8)	66 (1.6)	71 (1.7)	64 (1.7)	46 (1.3)	363 (1.6)
20-40	74 (2.6)	138 (3.5)	146 (3.6)	122 (2.9)	104 (2.8)	87 (2.5)	671 (3.0)
Alcohol Use Disorders Identification Test-Consumption score							
<4	2129 (75.2)	3086 (77.2)	3126 (76.0)	3274 (77.0)	2896 (76.9)	2810 (79.9)	17 321 (77.1)
4-5	382 (13.5)	477 (11.9)	482 (11.7)	491 (11.6)	462 (12.3)	365 (10.4)	2659 (11.8)
6-7	151 (5.3)	233 (5.8)	240 (5.8)	240 (5.6)	206 (5.5)	164 (4.7)	1234 (5.5)
≥8	124 (4.4)	183 (4.6)	231 (5.6)	194 (4.6)	147 (3.9)	130 (3.7)	1009 (4.5)
Psychiatric symptoms							
Depression	553 (20.3)	917 (23.1)	1035 (25.4)	851 (20.2)	755 (20.3)	752 (21.6)	4863 (21.9)
Anxiety	1196 (45.2)	1832 (46.7)	1856 (46.1)	1937 (46.5)	NA ^c	1464 (42.8)	8285 (45.6)
Drug use							
Tobacco	NA ^c	1118 (32.1)	NA ^c	1113 (26.6)	896 (24.2)	815 (23.4)	3942 (26.5)
Marijuana	549 (20.3)	826 (20.7)	816 (20.7)	770 (18.8)	716 (19.6)	667 (19.5)	4344 (19.9)
Crack or cocaine	287 (10.6)	633 (15.8)	616 (15.7)	551 (13.5)	470 (13.0)	370 (10.9)	2927 (13.5)
Stimulants other than crack or cocaine ^d	57 (2.1)	120 (3.0)	99 (2.5)	87 (2.1)	66 (1.8)	61 (1.8)	490 (2.3)
Illicit opioids ^e	449 (16.4)	621 (20.1)	187 (4.8)	707 (17.2)	607 (16.6)	652 (19.0)	3223 (15.4)
Injection drugs	56 (2.0)	113 (2.8)	118 (2.9)	120 (2.9)	96 (2.6)	95 (2.7)	598 (2.7)

Abbreviation: NA, not applicable.

^c Data were not assessed at this survey wave.

^a Totals may not sum to the number participating in each survey wave because of missing values.

^d Past-year use of stimulants, defined as amphetamines, uppers, speed, crank, crystal meth, or bam.

^b Prevalence values are based on responses of 6431 Veterans Aging Cohort Study respondents who participated in at least 1 survey over the follow-up period (22 473 surveys total).

^e Includes use of prescription opioids or painkillers (eg, oxycodone or hydrocodone) or heroin use. Prescription opioids were not assessed during the 2005 to 2007 survey wave.

Over the follow-up period, 4863 respondents (21.9%) reported depressive symptoms and 8285 (45.6%) had anxiety symptoms. In the past year, more than one-quarter of the sample had substantial tobacco use (3942 participants [26.5%]), 4344 participants (19.9%) reported using marijuana, 2927 participants (13.5%) reported crack or cocaine use, and 3223 participants (15.4%) reported illicit opioid use. A minority of the sample reported using stimulants other than crack or cocaine (490 participants [2.3%]) and injection drugs (598 participants [2.7%]). The prevalence of psychiatric disorder symptoms and substance use varied over time.

The analytical sample of 6431 participants was comparable with the 1079 individuals who were omitted from the analysis, including with regard to age (median age, 50 years in both groups), sex (95% male in both groups), black and Hispanic race/ethnicity (approximately 75% in both groups), and having an annual income of less than \$12 000 (48% baseline only; 48% follow-up sample), as well as with regard to unhealthy alcohol use defined as an AUDIT-C score of 4 or higher (39% baseline only; 37% follow-up sample), depression (22% baseline only; 20% follow-up sample), anxiety (44% baseline only; 45% follow-up sample), marijuana use (21% baseline only; 23% follow-up sample), and cocaine use (19% in both groups).

Alcohol Use Patterns and Alcohol-Clustering Conditions

We observed a general dose-response association between alcohol use severity category and clustering condition when using the AUDIT or the AUDIT-C to assess alcohol use. The ORs for the associations between AUDIT scores of 8 to 15, 16 to 19, and 20 to 40 vs 0 to 7, the reference, ranged from 1.90 (95% CI, 1.58-2.29) to 8.37 (95% CI, 6.20-11.29) for depression and 2.07 (95% CI, 1.73-2.49) to 8.98 (95% CI, 6.39-12.60) for anxiety symptoms (Table 2). The ORs were larger when alcohol use was assessed using the AUDIT vs the AUDIT-C. The highest category of the AUDIT (≥ 20 vs < 8 , the reference) was associated with greater than 10 times odds of using tobacco (OR, 14.64, 95% CI, 8.94-23.98), crack or cocaine (OR, 39.47, 95% CI, 27.38-56.90), stimulants other than crack or cocaine (OR, 21.31, 95% CI, 12.73-35.67), marijuana (OR, 12.41; 95% CI, 8.61-17.90), and injection drugs (OR, 8.67; 95% CI, 5.32-14.13). An AUDIT score of 20 or higher yielded likelihood ratio values greater than 3.5 for depression, anxiety, crack or cocaine use, and other stimulant use. Associations did not vary significantly by HIV status (results not shown); hence, the findings are presented for the full sample.

Table 2. Associations Between Alcohol Use Severity, Psychiatric Disorder Symptoms, and Substance Use Among Veterans Aging Cohort Study Participants

Alcohol-Clustering Condition	Unadjusted OR (95% CI)					
	Alcohol Use Disorders Identification Test ^a			Alcohol Use Disorders Identification Test-Consumption ^b		
	Score ≥ 8	Score ≥ 16	Score ≥ 20	Score ≥ 4	Score ≥ 6	Score ≥ 8
Depression	1.90 (1.58-2.29)	3.71 (2.58-5.35)	8.37 (6.20-11.29)	1.29 (1.10-1.53)	1.55 (1.24-1.94)	2.78 (2.18-3.55)
Anxiety	2.07 (1.73-2.49)	2.42 (1.66-3.52)	8.98 (6.39-12.60)	1.42 (1.22-1.66)	1.50 (1.21-1.87)	2.06 (1.60-2.64)
Tobacco ^c	4.60 (3.44-6.16)	3.38 (1.90-6.02)	14.64 (8.94-23.98)	2.66 (2.07-3.41)	5.48 (3.89-7.72)	12.71 (8.39-19.24)
Marijuana	3.37 (2.70-4.22)	6.48 (4.22-9.93)	12.41 (8.61-17.90)	3.77 (3.09-4.58)	4.50 (3.47-5.84)	6.78 (5.01-9.16)
Crack or cocaine	6.55 (5.23-8.20)	12.07 (7.86-18.54)	39.47 (27.38-56.90)	4.00 (3.25-4.93)	9.66 (7.40-12.60)	13.51 (10.01-18.24)
Stimulants other than crack or cocaine ^d	3.98 (2.62-6.04)	4.39 (2.00-9.62)	21.31 (12.73-35.67)	2.14 (1.47-3.13)	2.77 (1.69-4.54)	8.14 (5.00-13.25)
Illicit opioid ^e	1.24 (1.03-1.50)	2.35 (1.64-3.36)	2.35 (1.76-3.15)	1.00 (0.85-1.19)	1.03 (0.82-1.30)	1.49 (1.16-1.92)
Injection drugs	2.44 (1.69-3.52)	2.53 (1.25-5.12)	8.67 (5.32-14.13)	2.07 (1.46-2.93)	2.61 (1.65-4.12)	2.95 (1.79-4.86)

Abbreviation: OR, odds ratio.

^a Alcohol Use Disorders Identification Test scores range from 0 to 40, with a score of 40 indicating the highest severity level of alcohol use. These analyses used a score of less than 8 as the reference group.

^b Alcohol Use Disorders Identification Test-Consumption scores range from 0 to 12, with a score of 12 indicating the highest level of alcohol use. These analyses used a score of less than 4 as the reference group.

^c Defined as 10 or more cigarettes per day.

^d Includes amphetamines, uppers, speed, crank, crystal methamphetamine, and bam.

^e Includes use of prescription opioids or painkillers (eg, oxycodone or hydrocodone) or heroin use. Prescription opioids were not assessed during the 2005 to 2007 survey wave.

Test Performance of Alcohol Use Screening for Indication of Alcohol-Clustering Conditions

Alcohol Use to Identify Cases of Depression and Anxiety

An AUDIT score of 8 or above was 21.4% sensitive and 85.5% specific for depressive symptoms, with a PPV of 34.2% and likelihood ratio of 1.86; for anxiety symptoms, an AUDIT score of 8 or higher was 18.7% sensitive and 90.0% specific, with a PPV of 61.1% and a likelihood ratio of 1.87 (Table 3). An AUDIT score of 16 or higher was 10.0% sensitive and 96.7% specific for depressive symptoms, with a PPV of 45.7% and likelihood ratio of 3.00; for anxiety symptoms, an AUDIT score of 16 or higher was 7.5% sensitive and 97.4% specific, with a PPV of 70.5% and a likelihood ratio of 2.84 (Table 3). An AUDIT score of 20 or higher was 7.2% sensitive and 98.0% specific for depressive symptoms, with a PPV of 50.4% and a likelihood ratio of 3.63; for anxiety symptoms, an AUDIT score of 20 or higher was 5.3% sensitive and 98.6% specific, with a PPV of 76.6% and a likelihood ratio of 3.90. When using an AUDIT score cut point of 20 or greater, the likelihood ratios for detection of depression approached that of the PHQ-2 (AUDIT, 3.63; PHQ-2, 4.0) and those for anxiety approached that of the GAD-7 (AUDIT, 3.90; GAD-7, 5.1) (Figure). Categorization of alcohol use severity based on the AUDIT-C yielded slight increases in sensitivity but reduced specificity and PPVs.

Alcohol Use to Identify Cases of Other Substance Use

An AUDIT score of 8 or higher yielded sensitivity levels of 17.3% for indication of illicit opioid use, 22.6% for substantial tobacco use, 23.5% for marijuana use, 30.4% for injection drugs, 36.0% for crack or cocaine use, and 32.7% for use of other stimulants, with specificities of 86.7% or higher for indication of each substance use outcome (Table 3). The PPVs were greatest for indication of marijuana (34.2%), crack or cocaine (35.1%), and substantial tobacco use (43.9%) and were much lower for illicit opioid use (19.1%), other stimulant use (5.6%), and injection drug use (5.9%). Likelihood ratios ranged from 1.30 (illicit opioid use) to 3.51 (crack or cocaine). When a positive screen was defined using AUDIT score thresholds of 16 or higher and 20 or higher, sensitivity decreased, whereas specificity, PPVs, and likelihood ratios increased. The AUDIT appeared to yield much higher likelihood ratio values for the detection of crack or cocaine use than those estimated for the DAST-10 (likelihood ratios: AUDIT score ≥ 8 , 3.51; AUDIT score ≥ 16 , 5.56; AUDIT score ≥ 20 , 6.27 vs DAST-10, 2.8). For an AUDIT score of 20 or higher, the PPV for the detection of crack or cocaine use was 49.2%.

Screening based on the AUDIT-C vs the AUDIT resulted in slight increases in sensitivity, reductions in specificity, and decreases in PPV and likelihood ratios. The likelihood ratios for the detection of crack or cocaine use when using the AUDIT-C approached or exceeded the likelihood ratios when using the DAST-10 (likelihood ratios: AUDIT-C score ≥ 4 , 2.25; AUDIT score ≥ 6 , 3.23; AUDIT score ≥ 8 , 3.52 vs DAST-10, 2.8) (Figure).

Discussion

This study is the first, to our knowledge, to assess the value of using the AUDIT and AUDIT-C for the potential identification of conditions that commonly cluster with alcohol use. Our results raise the question of whether using the AUDIT or AUDIT-C to screen for unhealthy alcohol use in primary care contains enough incidental information about the likelihood of alcohol-clustering conditions to affect screening decisions for these other conditions. For example, an AUDIT score of 20 or higher yielded likelihood ratio values greater than 3.5 for depression, anxiety, and crack or cocaine and other stimulant use. In a sufficiently high prevalence population, these likelihood ratios may confer a PPV sufficiently high to merit a diagnostic assessment for anxiety. Even in lower prevalence populations, these likelihood ratios may be sufficiently high to cause a clinically meaningful elevation of the PPV of anxiety screening, potentially making anxiety screening more clinically useful. Although the AUDIT and the AUDIT-C had low-to-moderate sensitivity for detecting alcohol-clustering conditions, their moderate-to-high likelihood ratio values and PPVs show they convey substantial information regarding the likely presence of these conditions. As long as the AUDIT or AUDIT-C are being

Table 3. Test Performance of Alcohol Use Severity Indicators for Indication of Psychiatric Disorder Symptoms and Substance Use Among Veterans Aging Cohort Study Participants

Alcohol-Clustering Condition	Percentage					
	Alcohol Use Disorders Identification Test			Alcohol Use Disorders Identification Test-Consumption		
	Score ≥ 8	Score ≥ 16	Score ≥ 20	Score ≥ 4	Score ≥ 6	Score ≥ 8
Depression						
Sensitivity	21.4	10.0	7.2	26.1	13.8	7.4
Specificity	85.5	96.7	98.0	79.1	91.2	96.3
Positive predictive value	34.2	45.7	50.4	25.9	30.0	36.0
Likelihood ratio	1.86	3.00	3.63	1.24	1.53	2.00
Correctly classified	73.8	77.7	78.2	67.4	74.2	76.8
Anxiety						
Sensitivity	18.7	7.5	5.3	24.7	12.1	5.9
Specificity	90.0	97.4	98.6	80.2	91.4	96.4
Positive predictive value	61.1	70.5	76.6	51.1	54.0	57.7
Likelihood ratio	1.87	2.84	3.90	1.25	1.40	1.63
Correctly classified	57.5	56.4	56.1	54.9	55.2	55.1
Tobacco use (≥ 10 cigarettes/d)						
Sensitivity	22.6	9.0	6.1	30.9	17.2	8.2
Specificity	89.7	96.8	98.1	81.6	92.7	97.1
Positive predictive value	43.9	49.8	52.9	37.8	46.0	50.6
Likelihood ratio	2.18	2.76	3.13	1.69	2.42	2.84
Correctly classified	72.0	73.6	73.8	68.2	72.7	73.6
Marijuana use						
Sensitivity	23.5	9.3	6.3	35.4	17.2	7.8
Specificity	88.8	96.4	98.7	81.2	91.7	96.3
Positive predictive value	34.2	38.9	40.1	32.0	34.2	34.6
Likelihood ratio	2.10	2.56	2.70	1.89	2.08	2.12
Correctly classified	75.8	79.1	79.5	72.1	76.9	78.7
Crack or cocaine use						
Sensitivity	36.0	16.6	11.5	42.6	25.1	11.9
Specificity	89.7	97.0	98.2	81.1	92.3	96.6
Positive predictive value	35.1	46.1	49.2	25.9	33.5	35.4
Likelihood ratio	3.51	5.56	6.27	2.25	3.23	3.52
Correctly classified	82.6	86.3	86.6	75.9	83.4	85.2
Stimulants other than crack or cocaine^a						
Sensitivity	32.7	17.6	14.4	38.0	21.4	12.7
Specificity	86.9	95.6	97.2	78.4	90.3	95.7
Positive predictive value	5.6	8.4	10.6	3.9	4.9	6.5
Likelihood ratio	2.57	3.99	5.16	1.76	2.20	2.99
Correctly classified	85.7	93.8	95.4	77.5	88.7	93.9
Illicit opioids^b						
Sensitivity	17.3	7.4	4.7	23.5	11.3	5.6
Specificity	86.7	95.6	97.1	77.7	89.9	95.6
Positive predictive value	19.1	23.2	23.0	16.1	17.0	19.0
Likelihood ratio	1.30	1.66	1.65	1.05	1.12	1.28
Correctly classified	76.1	82.1	83.0	69.4	77.8	81.7
Injection drugs						
Sensitivity	30.4	14.0	10.6	34.3	17.5	8.4
Specificity	86.8	95.4	97.1	78.3	90.1	95.6
Positive predictive value	5.9	7.8	9.0	4.2	4.7	5.0
Likelihood ratio	2.30	3.07	3.59	1.58	1.77	1.89
Correctly classified	85.2	93.3	94.8	77.1	88.1	93.2

^a Includes amphetamines, uppers, speed, crank, crystal methamphetamine, or bam.

^b Includes use of prescription opioids or painkillers (eg, oxycodone or hydrocodone) or heroin use. Prescription opioids were not assessed during the 2005 to 2007 survey wave.

administered anyway for alcohol screening, this additional information may be sufficient to newly motivate screening or definitive diagnostic efforts for alcohol-clustering conditions.

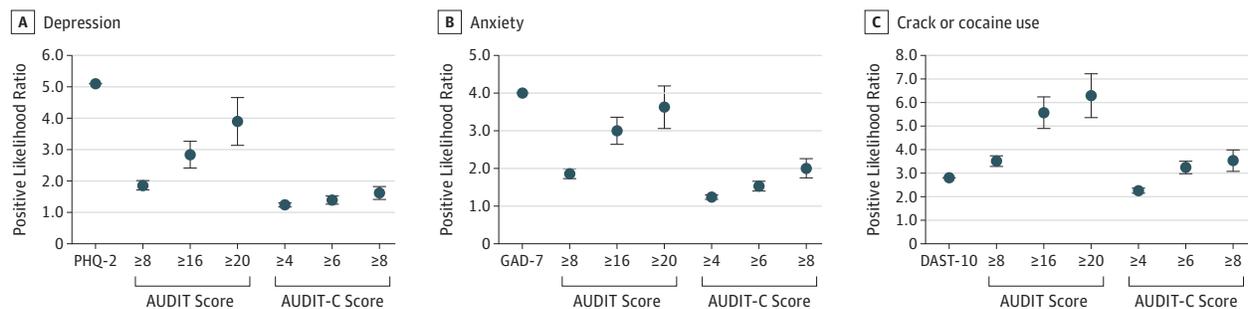
For example, among VACS enrollees scoring in the highest AUDIT category (AUDIT score, 20-40), 76.6% would screen positive for anxiety symptoms, 50.4% would screen positive for depressive symptoms, and 49.2% would screen positive for crack or cocaine use. The AUDIT and AUDIT-C also had high-to-excellent levels of specificity, which yielded high percentages of individuals correctly classified and likelihood ratio values that are comparable with those of dedicated screeners. Alcohol screening had likelihood ratio values that approached those of the GAD-7⁴⁶ for indication of anxiety and better likelihood ratio values than the DAST-10⁴⁷ for indication of crack or cocaine use.

These findings suggest a need for decision analytic modeling to systematically weigh the advantages vs the disadvantages of using the AUDIT to guide use of screeners for other conditions. Our results also reinvigorate the question of whether use of the full AUDIT compared with the AUDIT-C contains sufficient additional information to be worth the added response burden and imposition on clinical workflow.

Our findings that scores on 2 widely used alcohol screening tools are associated with anxiety symptoms depressive symptoms and other substance use corroborate those from prior studies^{17-24,53-61} and are consistent with neuroscientific findings regarding reward circuitry pathways in the brain and what is known about the genetics of alcohol, substance use, and mental health conditions. No guidelines currently recommend that identification of unhealthy alcohol use should prompt screening for alcohol-clustering conditions. If corroborated by future studies, our results suggest that guideline panels should consider whether an expanded scope for the AUDIT and AUDIT-C is warranted given their utility in informing the index of suspicion for other alcohol-clustering conditions. There is precedent for using screening for a particular condition to improve case finding for related and/or clustering conditions. For example, in the context of clinical management of sexually transmitted infection, identification and treatment of gonorrhea would lead to treatment of chlamydia even in the absence of biological confirmation of chlamydial infection.⁶² Furthermore, our findings reinforce the importance of promoting evidence-based screening in routine medical settings, which currently are not used consistently.⁶³⁻⁶⁵

The full AUDIT demonstrated better overall test performance indicated by greater likelihood ratio values and slightly higher percentages of individuals correctly classified compared with the AUDIT-C. Accordingly, the full AUDIT, despite its greater length, may be preferable to the AUDIT-C as a tool in clinical practice, given the additional benefit of identifying those at high risk of psychiatric disorders and other substance use in addition to identifying those with unhealthy alcohol use.

Figure. Test Performance of Alcohol Screening Scores for Identification of Depression, Anxiety, and Crack or Cocaine Use



A, Values are shown for the Patient Health Questionnaire-2 (PHQ-2) vs Alcohol Use Disorders Identification Test (AUDIT) and Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) for detection of depression. B, Values are shown for the

Generalized Anxiety Disorder 7-Item Scale (GAD-7) vs AUDIT and AUDIT-C for detection of anxiety. C, Values are shown for the Drug Abuse Screen Test (DAST-10) vs AUDIT and AUDIT-C for detection of crack or cocaine use. Error bars denote 95% CIs.

Limitations

This study has some limitations that should be noted. Most importantly, we assessed the presence of alcohol-clustering conditions using brief screening tools (ie, PHQ) or self-reported endorsement (eg, anxiety symptoms or drug use) rather than diagnoses using a formal instrument. It is possible the AUDIT or the AUDIT-C would have different associations with clinically diagnosed conditions; hence, our findings on test performance of these tools for identification of conditions would be affected. Another important limitation is that study findings are only generalizable to veterans receiving care in the Veterans Health Administration. It is possible that associations between unhealthy alcohol use and other conditions may differ among veterans compared with nonveterans. Additional studies are hence needed to assess alcohol use screening as an indicator of associated conditions across diverse samples. A goal of the present study was to assess whether evidence-based cut points indicating unhealthy alcohol use may also serve to guide screening for comorbid conditions. Future studies should explore continuous alcohol use indicators, in which a range of alcohol score values are assessed for indication of clustering conditions.

Conclusions

Our findings underscore the potential for alcohol screening, which is recommended as a standard practice in most primary care settings, to provide an additional benefit of identifying patients with a high risk of other clinical conditions. Using information from alcohol screening to trigger assessment of conditions expected to cluster with alcohol use appears to be a promising way to improve case finding and, by extension, treatment of depression, anxiety, and drug use disorder. Additional studies in other populations will provide insight into the degree to which alcohol screening is useful for identification of alcohol-clustering conditions across populations. In addition, assessment of the degree to which other conditions or behaviors that are commonly assessed in clinical practice (eg, tobacco use) can help improve case finding and treatment of important health concerns is warranted.

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