

Three Brief Alcohol Screens for Detecting Hazardous Drinking in Incarcerated Women*

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ABSTRACT. Objective: Screening methods for hazardous drinking have not been evaluated in a population of incarcerated women. This study examines abbreviated versions of the Alcohol Use Disorders Identification Test (AUDIT) and the National Institute on Alcohol Abuse and Alcoholism (NIAAA) heavy episodic drinking criterion in a sample of female detainees. **Method:** A total of 2,079 women at the Adult Correctional Institute in Rhode Island were approached for screening between February 2004 and June 2007. The AUDIT-consumption (AUDIT-C), AUDIT-3, and the NIAAA heavy episodic drinking criterion (four or more drinks on one occasion for women) were compared with the full AUDIT at different cut points. **Results:** More than 55% of the sample endorsed an AUDIT score of 4 or greater—the NIAAA recommended

threshold for detecting hazardous drinking. The three-item AUDIT-C with a cut score of 3 yielded a classification most consistent with the AUDIT score of 4 or more; sensitivity and specificity exceeded .9, and 91.5% of participants were correctly classified. The AUDIT-3 and NIAAA episodic drinking criteria were less sensitive measures. We found no evidence of interactions between the screening instruments and age or ethnicity. **Conclusions:** The three-item AUDIT-C has robust test characteristics for detecting hazardous drinking in female inmates. Universal screening for hazardous drinking is recommended for incarcerated women, given their high rates of alcohol misuse. (*J. Stud. Alcohol Drugs* 70: 50-54, 2009)

MORE THAN 3 MILLION WOMEN are arrested and taken to jail each year (Greenfeld and Snell, 1999; Harrison and Beck, 2005). The number of women incarcerated in prisons in the United States has increased 53% since 1995 (Harrison and Beck, 2005).

High levels of alcohol abuse and dependence are common among incarcerated women; 25% of state female inmates and nearly 30% of jail inmates in a New York City jail reported being daily drinkers (Freudenberg et al., 2007; Greenfeld and Snell, 1999). Mullings et al. (2004) found that, in the 30 days before arrest, women who were diagnosed as alcohol dependent drank a mean of 8.4 drinks per drinking day, and those with no diagnosis consumed on average 4.2 drinks per drinking day. Rates of alcohol abuse are approximately five times higher than those found in a sample of women in the community (Kessler et al., 1994; Weisner and Schmidt, 1993).

Hazardous drinking, defined as four or more drinks in a day or more than seven drinks per week for women (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2007), is not limited to women arrested for driving while intoxicated or public order offenses. Women awaiting trial or who have been sentenced at the Women's Facility of the Rhode Island Department of Corrections most often have

charges of shoplifting, obstructing a police officer, or felony drug counts; 46% reported alcohol problems in the past year (Rhode Island Department of Corrections, 2007; Derrick, 2007).

Lapham (2004/2005) recommends screening inmates for alcohol problems as soon as possible after their offense to take advantage of the "teachable moment." Yet despite high rates of hazardous drinking among incarcerated women, routine screening for alcohol use is not part of standard care in jails. To detect hazardous drinking among incarcerated female populations, very brief validated screening measures will be critical. Even the full 10-item Alcohol Use Disorders Identification Test (AUDIT), validated for use in other clinical settings, may add undue burden to the inmate intake process (Bohn et al., 1995; Reinert and Allen, 2007).

Although a standard cut point of 8 is used in many populations, the NIAAA (2007) has recommended the threshold for a positive AUDIT be lowered to 4 for women to increase detection of hazardous drinkers. Sensitivity decreases dramatically when a cut score of greater than 4 is used in women (Bradley et al., 2007).

The purpose of this study was to evaluate the sensitivity and specificity of three very brief, clinically popular screening instruments commonly cited in the literature (a 3-item AUDIT-C assessing consumption and two single-item measures of heavy episodic drinking) in detecting hazardous drinking as classified by the full 10-item AUDIT and to determine optimal cut points in this population (Bradley et al., 2003; Dawson et al., 2005; Gordon et al., 2001). Finally, we assessed the influence of age and ethnicity on measure scores.

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Method

Study site, population, and procedure

The Women's Facility at the Rhode Island Department of Corrections' Adult Correctional Institute is a combined prison and jail, with inmates at all levels of security. However, it functions like jails throughout the nation, with the majority of detained women returning to the community within 30 days of commitment. Fewer than 25% of commitments result in sentences, and 45% of sentences are less than 6 months in duration.

All women incarcerated between February 2004 and June 2007 were eligible for screening for recruitment to a larger randomized clinical trial of a brief intervention to reduce alcohol use and HIV risk (see Hebert et al., 2007, 2008). The Miriam Hospital Institutional Review Board approved the trial protocol.

The 5-minute screening was conducted without compensation, beginning with informed verbal consent, which stressed that refusal would not affect discipline status, medical care, or other services routinely provided at the facility. Women were excluded from screening because of poor English language comprehension or mental incompetence (as judged by the research assistant).

Measures

The measures used were the AUDIT, three-item AUDIT-C, single-item AUDIT-3, and single-item NIAAA heavy episodic drinking question. The full 10-item AUDIT was initially developed to detect hazardous levels of alcohol consumption (Saunders et al., 1993). The AUDIT was completed with score ranges from 0 to 40 (Bradley et al., 2007; Gordon et al., 2001; NIAAA, 2005; Saunders et al., 1993). The first three AUDIT items are consumption questions; summed scores range from 0 to 12 (three-item AUDIT-C). Heavy episodic drinking was evaluated in two ways. First, using the NIAAA recommended criterion, participants were asked, "Since this time in (three months prior) have you had at least 4 drinks on one occasion? If yes, has that happened more or less than once a month?" Answers were coded as positive (four or more drinks at least once a month) or negative. Second, a single item from the AUDIT (AUDIT-3) was used to assess the frequency of six or more drinks on one occasion (0-4 points possible).

Analytic methods

The predictive efficacy of brief instruments (three-item AUDIT-C, single-item AUDIT-3, NIAAA heavy episodic drinking measure) was described using the rate of sensitivity (true positives) and specificity (true negatives). The AUDIT score used to detect hazardous drinking has been ≥ 8 (Kypri

et al., 2008) in some studies; however, ≥ 4 has been recommended for women (Bradley et al., 1998; NIAAA, 2007). Here we tested both cut points for the three brief drinking screens. We also present the overall percentage correctly classified and the area under the receiver operating characteristic curve (AUC) as indicators of overall predictive efficacy. We used a nonparametric test (DeLong et al., 1988) to compare multiple AUCs to assess the predictive efficacy across cut points. We also determined if predictive efficacy was conditioned on age (<45 years vs ≥ 45 years of age; Grant et al., 2004) or ethnicity (white vs black vs Hispanic).

Results

During the course of the 3.5-year study period, 4,131 unique women entered the Adult Correctional Institute. Of those women, 2,079 (50.3%) were approached for screening. Women screened were not significantly different from the women who were not screened in terms of age or race (Hebert et al., 2008). One hundred sixty-one refused screening, and 1,918 (92.3%) women were screened, of whom 167 were eliminated from the analysis owing to incomplete AUDIT items, leaving a final sample size of 1,751. Their ages ranged from 18 to 62 (mean [SD] = 33.7 [9.5]) years. The majority of participants were white (65.5%); 20.2% were black, 10.8% were Hispanic, and 3.5% identified other ethnic origins.

The mean 10-item AUDIT score was 9.2 (10.7); 968 (55.3%) had scores of 4 or higher on the 10-item AUDIT and 677 (38.7%) had scores of 8 or higher. Participants' average score on the three-item AUDIT-C was 4.2 (4.0). More than half (64.4%) of the participants had AUDIT-C scores of 2 or higher, 54.5% had scores of 3 or higher, 46.8% had scores of 4 or higher, and 39.7% had scores of 5 or higher. On the AUDIT-3 (frequency of consuming six or more drinks), 51.2% reported never, 14.2% reported less than once per month, and 34.6% reported at least monthly. The product-moment correlation between the 10-item AUDIT and the AUDIT-C was .88. The correlation of AUDIT Item 3 was .85 and .95 with the 10-item AUDIT and AUDIT-C, respectively. Seven hundred seventeen (41.0%) participants met the NIAAA criterion for heavy episodic drinking (four or more drinks at a time for women).

The AUDIT-C with a cut score of 3 or higher yielded a classification most consistent with the 10-item AUDIT at a cut score of ≥ 4 (Table 1); sensitivity and specificity both exceeded .9 and 91.5% of participants were correctly classified, the positive predictive value was .93, and the negative predictive value was .90. The NIAAA heavy episodic drinking criterion had high specificity (.96) in predicting 10-item AUDIT scores of 4 or higher, although sensitivity (.71) was markedly lower. Use of the single AUDIT-3 (frequency of six or more drinks) cut point at greater than "never" exhibited good sensitivity (.84) and very good specificity (.95) and

TABLE 1. Performance of screening questionnaires for determining 10-item AUDIT scores of 4 or higher and 8 or higher ($n = 1,751$)

Variable	% Correct	Sensitivity	Specificity	AUC (95% CI)
AUDIT score of ≥ 4 ($n = 968, 55.3\%$)				
Heavy episodic drinking, yes = ≥ 4 drinks	81.9	.707	.958	.832 (.814-.849)
Three-item AUDIT-C				.961 (.950-.969)
Cut @ ≥ 2	85.6	.953	.737	.845 (.827-.861)
Cut @ ≥ 3	91.5	.916	.915	.915 (.901-.928)
Single-item AUDIT Item 3				.910 (.895-.923)
Cut @ ≥ 1	88.9	.841	.949	.845 (.827-.861)
Cut @ ≥ 2	78.8	.621	.995	.808 (.789-.826)
AUDIT score of ≥ 8 ($n = 677, 38.7\%$)				
Heavy episodic drinking, yes = ≥ 4 drinks	87.0	.861	.875	.868 (.851-.884)
Three-item AUDIT-C				.970 (.961-.978)
Cut @ ≥ 2	73.8	.994	.576	.785 (.765-.804)
Cut @ ≥ 3	82.9	.984	.732	.858 (.841-.874)
Cut @ ≥ 4	87.9	.948	.835	.892 (.876-.906)
Cut @ ≥ 5	91.1	.898	.919	.906 (.894-.912)
Cut @ ≥ 6	90.1	.811	.959	.885 (.869-.900)
Single-item AUDIT Item 3				.937 (.925-.948)
Cut @ ≥ 1	84.9	.937	.795	.866 (.849-.881)
Cut @ ≥ 2	88.7	.801	.941	.871 (.854-.886)
Cut @ ≥ 3	85.6	.641	.991	.816 (.797-.834)

Notes: AUDIT = Alcohol Use Disorders Identification Test; AUC = area under the receiver operating characteristic curve; CI = confidence interval; AUDIT-C = AUDIT-consumption.

correctly classified 88.9% of the participants; the sensitivity of the single-item screener dropped sharply at higher cut scores. AUCs indicated that the AUDIT-C with a cut score of 3 performed significantly better than either the NIAAA heavy episodic drinking criterion ($\chi^2 = 96.9, 1 \text{ df}, p < .001$) or the AUDIT-3 used alone ($\chi^2 = 8.59, 1 \text{ df}, p < .01$). In addition, the AUDIT-3 (cut score ≥ 1) performed significantly ($\chi^2 = 49.39, 1 \text{ df}, p < .001$) better than the NIAAA heavy episodic drinking criterion.

At a cut score of 5 or higher, the AUDIT-C had good sensitivity (.90) and specificity (.92) in predicting 10-item AUDIT scores of ≥ 8 and correctly classified 91.1% of participants (Table 1). The NIAAA heavy episodic drinking criterion had good sensitivity (.86) and specificity (.88) identifying participants with 10-item AUDIT scores of 8 or higher (Table 1). Overall, this screening criterion correctly classified 87.0% of participants. The AUDIT-C performed well at cut scores of ≥ 4 , ≥ 5 , and ≥ 6 . The AUDIT-3 correctly classified 88.7% of participants, and the AUC statistic (.871) favored a cut score of ≥ 2 , which corresponded to monthly or more frequent heavy episodic drinking. Statistical comparisons of AUC statistics indicated that the AUDIT-C with a cut score of ≥ 5 performed significantly better than either the NIAAA heavy episodic drinking criterion ($\chi^2 = 22.21, 1 \text{ df}, p < .001$) or the AUDIT-3 (with a cut score of ≥ 2) used alone ($\chi^2 = 30.61, 1 \text{ df}, p < .001$). Differences between the single-item AUDIT-3 (cut score ≥ 2) and the NIAAA heavy episodic drinking standard were not statistically significant ($\chi^2 = 0.09, 1 \text{ df}, p = .768$).

We conducted additional analyses to determine if the predictive efficacy of these instruments was varied by age or ethnicity. We ran analyses testing the interaction of all three instruments (NIAAA heavy episodic drinking, AUDIT-C, and AUDIT-3) by age (< 45 years vs ≥ 45 years of age) and ethnicity (white, black, Hispanic) across the range of cut points presented in Table 1. There was no evidence of substantively meaningful or statistically significant interactions.

Discussion

To our knowledge, this is the first study evaluating the performance of brief screening instruments to detect hazardous drinking in incarcerated women. The AUDIT-C has been validated in male and female Veterans Affairs patients (Bradley et al., 2003; Bush et al., 1998), primary care patients (Bradley et al., 2007; Gordon et al., 2001), including an ethnic/racially diverse sample (Frank et al., 2008), and a U.S. general population sample (Dawson et al., 2005). Our results were consistent with these studies, finding the AUDIT-C to be a valid tool to detect hazardous drinking among incarcerated women. A score of 3 or greater on the AUDIT-C showed excellent consistency with the full 10-item AUDIT at the cut point of ≥ 4 recommended for women by the NIAAA. Identifying hazardous drinkers using higher AUDIT-C scores could be supported, depending on the costs of false positives or false negatives.

As in previous studies (Bradley et al., 2003; Bush et al., 1998), the AUDIT-C proved to be more effective at screening

for hazardous drinking than a single heavy episodic drinking question. In addition, the AUDIT-C validity did not differ based on ethnicity, a finding similar to that of Frank et al. (2008). Despite lower sensitivity and specificity, the AUDIT-3 or NIAAA single-item screener could prove to be effective tools for identifying women in need of further evaluation.

Although hazardous drinking places women at health risk, it may also be a contributing factor in criminal offenses. Among inmates, 22%-29% had consumed alcohol before the time of their offense (Greenfeld and Snell, 1999; Karberg and James, 2005; Martin and Bryant, 2001). In addition, alcohol use at the time of offense was a threefold better predictor of violent crime among women than among men (Martin and Bryant, 2001). Phillips et al. (2002) found that a group of violent female offenders often failed to recognize the consequences of heavy alcohol use, decreasing the chances of independent treatment-seeking behavior. Clearly the consequences of hazardous drinking extend beyond the single incarceration event for an individual woman.

This study had important strengths. All inmates were eligible and the low refusal rate (8%) suggest limited bias. Women were missed most often because of rapid release. Approximately 65% of those released before they were approached left the Adult Correctional Institute within 24 hours of arrest (Hebert et al., 2008). This problem would be eliminated if screening was done routinely at intake. In addition, this study looked at incarcerated women, an understudied population.

Several limitations also deserve mention. First, this study did not validate the brief screens against gold standard diagnostic interviews for alcohol abuse and/or dependence. Because the brief screener questions derive from the full AUDIT, the measures tested are not independent. Our study assumes that the 10-item AUDIT is a validated and widely used measure of hazardous drinking, and therefore we used it as the "gold standard" in our attempt to evaluate even briefer screening measures. Second, we used a version of the full AUDIT, and by extension the AUDIT-C and AUDIT-3, which asked about the frequency of consuming six or more drinks on one occasion, instead of the current NIAAA recommended four or more drinks at a time for women. This threshold might have underestimated the prevalence of heavy episodic drinking among women. In addition, differences in the length of time (1 year vs 3 months past) in the question frame might have caused more women to respond affirmatively to the six-drink heavy episodic drinking question than the question based on four or more drinks.

Brief, easily administered alcohol screening questionnaires provided good sensitivity and specificity in identifying hazardous alcohol use among incarcerated women. Standard screening using the AUDIT-C is feasible even in correctional settings with constrained time and resources. Such screening would identify women in need of further evaluation and treatment and could be done as part of the intake process.

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