

# Screening for Problem Drinking: Does a Single Question Work?

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**BACKGROUND.** Brief interventions with problem drinkers have been shown to be effective, but physicians often do not ask about alcohol use. If a single question could effectively screen for problem drinking, it might facilitate intervention with problem drinkers.

**METHODS.** A cross-sectional study was undertaken to address the clinical utility of the question, "On any single occasion during the past 3 months, have you had more than 5 drinks containing alcohol?" Placing it between questions about tobacco and seat-belt use, we presented the three questions in writing to 1435 patients; 95.3% answered them. With a systematic sample of 101 patients who answered yes and 99 who answered no, we administered the Alcohol Use Disorders Identification Test in writing followed by two gold-standard interview instruments: (1) a calendar-based review of drinking, with at-risk drinking defined as drinking more than 4 drinks on one occasion or more than 14 drinks per week for men, and more than 3 drinks on one occasion or 7 per week for women; and (2) the alcohol questions in the Composite International Diagnostic Interview, with alcohol-use disorders defined by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) criteria. We defined problem drinking as either at-risk drinking in the previous month or an alcohol-use disorder in the past 12 months.

**RESULTS.** The single question had a positive predictive value of 74% and negative predictive value of 88% for problem drinking, with a sensitivity of 62% and a specificity of 93%. The question's utility was similar for detecting at-risk drinking and current alcohol-use disorders; it correctly identified all 29 patients who had both.

**CONCLUSIONS.** A single question about alcohol can detect at-risk drinking and current alcohol-use disorders with clinically useful positive and negative predictive values.

**KEY WORDS.** Screening; predictive value of tests; alcohol drinking; alcoholism; physicians, family. (*J Fam Pract* 1998; 46:328-335)

**P**roblem drinking is a major cause of morbidity<sup>1</sup> and mortality.<sup>2,3</sup> Several randomized clinical trials have shown that brief physician interventions with at-risk drinkers can significantly reduce alcohol consumption and, by some measures, alcohol-related harm.<sup>4,6</sup> Consistent with these observations, the 1996 *Guide to Clinical Preventive Services*<sup>7</sup> recommends screening all adolescent and adult patients for problem drinking. However, in the 1991 National Health Interview Survey of Health Promotion and Disease Prevention, only 39% of respondents who had visited a health professional in the pre-

vious 2 years reported being asked by their physician about alcohol use.<sup>8</sup>

Effective screening instruments to detect alcohol problems in primary care practice are available<sup>9,11</sup>; but physicians may be kept from asking about alcohol because of time constraints, lack of knowledge that intervention helps, and a reluctance to intervene.<sup>12-15</sup> Studies of smoking-cessation interventions<sup>16-18</sup> and some evidence from a study involving problem drinkers,<sup>19</sup> however, suggest that a systematic approach to screening can increase the rate at which primary care physicians discuss health behaviors with their patients. If a simple screening tool for problem drinking can be incorporated into

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routine assessment of vital signs with every patient, the probability of identifying and intervening with problem drinkers may improve.

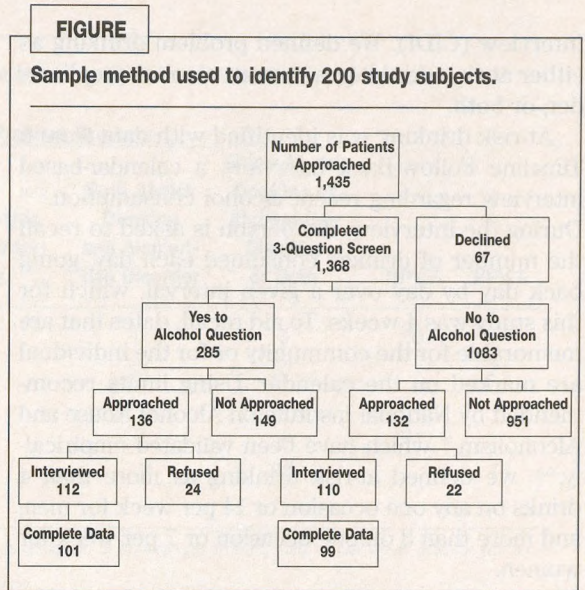
To facilitate systematic screening for problem drinking, we explored whether a single screening question can effectively identify problem drinkers, including both at-risk drinkers (those who drink more than safe limits<sup>20</sup> but without major recurrent consequences) and those with an alcohol-use disorder (alcohol abuse or dependence). Only questions about the quantity and frequency of drinking can detect at-risk drinkers; and in post hoc analyses of several questions about drinking quantity and frequency, Dawson<sup>21</sup> found that a question about binge drinking (5 or more drinks on one occasion in the past year) was the most sensitive single question. Therefore, we designed this study to determine the clinical utility of the question, "On any single occasion during the past 3 months, have you had more than 5 drinks containing alcohol?"

## METHODS

The study was cross-sectional (Figure). A convenience sample of adult patients was screened, then a systematic subsample was interviewed with a written screening test (the Alcohol Use Disorders Identification Test) and two gold-standard interviews. To set the alcohol-screening question in a context of general health concerns, we presented it printed between two other questions for which screening is also recommended: "In the past 3 months, have you used tobacco?" and "Do you regularly wear your seat belt when riding in the car?" We approached adult patients in the waiting rooms of a university-based family practice clinic and administered the three questions in written form to those who gave oral informed consent.

Most patients in family practice are not problem drinkers. Therefore, to interview as many problem drinkers as patients who were not, we systematically sampled equal numbers of patients who answered the alcohol question affirmatively or negatively. Because we sampled on the basis of screening response, we can calculate positive and negative predictive values directly, but sensitivity and specificity only indirectly.

Because the prevalence of problem drinking varies substantially by sex,<sup>22</sup> we matched on this variable. To facilitate this matching and to main-



tain balance in the temporal distribution of affirmative and negative answers, we identified a person with an affirmative answer first, then a person of the same sex with a negative answer. If several patients with the desired answer were found at the same time, the patient with the longest wait to see the physician was interviewed, if written informed consent was obtained. Patients unable to understand English, known to be pregnant, or with evident cognitive impairment were excluded.

In the interview, we administered three instruments in a fixed order. The first was the Alcohol Use Disorders Identification Test (AUDIT), a 10-item, written, multiple-choice questionnaire designed to identify patients with at-risk drinking or an alcohol-use disorder.<sup>11,23-25</sup> When initially tested in primary care settings, the AUDIT had a sensitivity of 92% and specificity of 94%.<sup>11</sup> Others, however, have found lower values (sensitivity 61% to 68%, specificity 85%).<sup>23,24</sup>

The term "problem drinking" covers the range from at-risk drinking to alcohol dependence. Furthermore, studies of brief intervention have shown benefit primarily with at-risk drinkers.<sup>4-6,26</sup> Therefore, screening for problem drinking in primary care should identify at-risk drinkers as well as those with more severe problems. To assess alcohol involvement throughout the range, we administered two gold-standard interviews: the Timeline Follow-Back and the alcohol-use questions of the Composite International Diagnostic



Interview (CIDI). We defined problem drinking as either at-risk drinking, a current alcohol-use disorder, or both.

At-risk drinking was identified with data from a Timeline Follow-Back interview, a calendar-based interview regarding recent alcohol consumption.<sup>27-31</sup> During the interview, the person is asked to recall the number of drinks<sup>32</sup> consumed each day, going back day by day over a given interval, which for this study was 4 weeks. To aid recall, dates that are memorable for the community or for the individual are marked on the calendar. Using limits recommended by National Institute on Alcohol Abuse and Alcoholism,<sup>20</sup> which have been validated empirically,<sup>33,34</sup> we defined at-risk drinking as more than 4 drinks on any one occasion or 14 per week for men, and more than 3 on one occasion or 7 per week for women.

Alcohol-use disorders were identified with the Composite International Diagnostic Interview (CIDI).<sup>35,36</sup> The alcohol section addresses the diagnostic criteria for alcohol-use disorders in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV).<sup>37</sup> We considered only those who met DSM-IV criteria for alcohol abuse or dependence within the past 12 months as having a current alcohol-use disorder.

Data were entered using the *Statistical Package for Social Sciences*<sup>38</sup> and analyzed with descriptive statistics, two-by-two tables with hand calculations of measures of clinical utility, non-parametric comparison of means for nonnormally distributed variables, and logistic regression for multivariate adjustment. Confidence intervals were calculated using *Confidence Interval Analysis*.<sup>39</sup>

## RESULTS

We approached 1435 patients; 1368 (95.3%) completed the initial three-question screen (Figure). Of those, 20.8% answered the alcohol question affirmatively, 31.3% of the men and 10.3% of the

women. Of the 285 who answered affirmatively, 136 patients were asked to participate in the interview portion of the study. Of those, 24 refused, one was pregnant (and, therefore, excluded), and 10 were unable to wait to complete the interview and could not be contacted at a scheduled time by telephone. We approached 132 who answered negatively; 22 refused and 11 were unable to wait and could not be contacted later. Of the 200 patients who provided complete data, only 3 drank more than 5 drinks per day (on average), and only 23 drank more than 5 drinks per drinking day (Table 1). Only 12 men and 12 women had alcohol tolerance or withdrawal symptoms in the previous 12 months. Of the 200, 36 met DSM-IV criteria for a current alcohol-use disorder, 80 were at-risk drinkers, and 87 met either criterion for problem drinking; 29 met both criteria (Table 2).

The single question on alcohol use had a positive predictive value of 74% (95% confidence interval [CI], 66% to 83%) and a negative predictive value of 88% (95% CI, 80% to 94%) (Table 2). All 29 of those with both at-risk drinking and a diagnosis of a past-year alcohol-use disorder answered the single question affirmatively.

The sampling procedure precludes direct calculation of sensitivity and specificity from Table 2. However, using the positive and negative predictive values and the total numbers of patients

TABLE 1

Quantity of Alcohol Consumption from Timeline Follow-Back Interview Data, by Sex and Response to Single-Question Screening Instrument

Variable	Negative Answer to Single Question*		Positive Answer to Single Question*	
	Mean (SD)	Median	Mean (SD)	Median
<b>Women</b>				
Drinks per day	0.1 (0.3)	0.0	0.7 (1.0)	0.3
Drinks per occasion	0.8 (1.1)	0.0	3.9 (3.9)	3.0
Maximum drinks on one day	1.0 (1.4)	0.0	6.3 (7.1)	5.0
<b>Men</b>				
Drinks per day	0.3 (0.9)	0.0	1.5 (1.4)	1.1
Drinks per occasion	1.0 (1.2)	1.0	4.5 (2.8)	3.4
Maximum drinks on one day	1.6 (2.4)	1.0	7.6 (5.3)	6.0

\*"On any single occasion during the past 3 months, have you had more than 5 drinks containing alcohol?" All numbers are expressed in standard drinks as defined in Miller et al.<sup>32</sup>



TABLE 2

Answer to the Single-Question Screening Instrument for Problem Drinking, by Criterion Standards and by Sex

Answer to Single Question	Not a Problem Drinker	Problem Drinkers				NPV,%	PPV,%
		At-risk Drinking*	Alcohol-Use Disorder†	Both At-risk Drinking and Alcohol-Use Disorder	Either At-risk Drinking or Alcohol-Use Disorder or Both		
Women	No	45	5	3	0	85	71
	Yes	15	24	2	11		
Men	No	42	3	1	0	91	78
	Yes	11	19	1	18		

\*At-risk drinking is defined for men as drinking more than 4 drinks on any single occasion or an average of more than 14 per week, and for women as drinking more than 3 drinks on one occasion or more than 7 per week.

†Alcohol-use disorders (abuse and dependence) were defined by DSM-IV criteria.

NPV denotes negative predictive value; PPV, positive predictive value.

screened, prevalence (25%), sensitivity (62%), and specificity (93%) can be calculated (Table 3). From these values, likelihood ratios<sup>40</sup> can be calculated: 8.9 for a positive answer, 0.4 for a negative answer.\* Because of the difference in prevalence of problem drinking, the sensitivity and specificity of the single question differ in men (80% and 90%, respectively) and women (35% and 96%, respectively) (Table 3).

Although we matched subjects with affirmative and negative answers by sex, we did not match by age. Mean ages were 33 years for affirmative answers and 40 years for negative answers ( $P < .001$  by Mann-Whitney  $U$  test). By logistic regression, the association between the screening question and problem drinking did not change when age was added as another independent variable.

With a higher threshold to define at-risk drinking (an average, not maximum, number of drinks per occasion above 4 for men or 3 for women), only 45 patients (22 men, 23 women) were identified as at-risk drinkers; 64 patients were problem drinkers, having either at-risk drinking by the revised definition or a past-year alcohol-use disorder or both. With this higher threshold definition,

the single screening question had a positive predictive value of 56% and a negative predictive value of 93% for problem drinking. Notably, all but one patient (a man) met the original definition of at-risk drinking by exceeding the per-occasion limit. Omitting the per-week limits from the definition of at-risk drinking did not significantly change the utility of the single question.

Anticipating that the single alcohol question might be nonspecific, we designed the study to determine the clinical utility of a two-stage screening procedure, in which the AUDIT would be administered if the response to the alcohol question is positive. The positive predictive value of the two screening instruments in tandem (both positive) was 86% at a cutoff score for the AUDIT of  $\geq 5$ , 96% at a cutoff score of  $\geq 8$ . Given an affirmative answer to the single-question screen, the AUDIT had a negative predictive value of 42% at a cutoff score of  $\geq 5$ , 34% at  $\geq 8$ .

The CIDI asks whether the respondent has received treatment for alcohol problems (Alcoholics Anonymous or any alcohol-treatment program) or has ever discussed "any problem you had from drinking" with a health professional. Only 7 of the 87 problem drinkers reported either treatment or a discussion with a health professional in the past year. Another 6 reported treatment or a discussion more than a year before. Those 13 constitute only 15% of the current problem drinkers.

\*Assume a pretest probability of 25%. Pretest odds are 0.25 to 0.75, or 1 to 3, or 0.33. Multiplying this by the likelihood ratios, a positive answer to the screening question has posttest odds of 2.9 and a posttest probability of  $2.9 \div (2.9 + 1) = 74\%$ , and a negative answer has posttest odds of 0.13 and a posttest probability of  $0.13 \div (0.13 + 1) = 12\%$ .



TABLE 3

**Calculation of Sensitivity and Specificity of Single-Question Screening Tool**

Answer to Single Question*	Problem Drinking		Row Totals
	No	Yes	
No	952	131	1083
Yes	73	212	285

\*"On any single occasion during the past 3 months, have you had more than 5 drinks containing alcohol?"

NOTE: Assuming that the systematic subsample is representative of the larger sample of 1368, the number of true positives (212) and true negatives (952) can be calculated from row totals (1083 and 285) and positive (74.26%) and negative (87.88%) predictive values. Subtraction gives the number of false negatives (131) and false positives (73). Simple calculations then provide estimates of sensitivity (212 divided by 343 = 62%) and specificity (952 divided by 1,025 = 93%). Similar calculations for men (n = 686) and women (n = 682) give sensitivities of 80% and 35% and specificities of 90% and 96%, respectively.

Problem drinking is associated with other risky health behaviors, but using the questions about smoking and seat belts to screen for problem drinking was not effective. Positive and negative predictive values for problem drinking were 60% and 66% with the tobacco question, 38% and 34% with the seat belt question.

## DISCUSSION

In this primary care setting, a single question about the maximum quantity of drinking was a useful screening tool for problem drinking. A positive answer to the screening question almost tripled the probability of the condition (from 25% prevalence to a post-test probability of 74%). A negative answer reduced the probability by half, from 25% to 12%. In an office setting, 62% of problem drinkers could be identified, with only 21% (those who answered the screening question affirmatively) requiring more than a single question about alcohol.

The study avoids several potential sources of bias. First, we began with an a priori question to minimize possible bias from multiple comparisons between candidate questions and the criterion standard. Previous efforts to identify a very brief screening instrument for problem drinking have reported the most discriminating questions from among several that were asked<sup>41,42</sup> without confirmation in a separate validation sample.<sup>43</sup>

Other studies have explored the relationships between questions about the quantity and frequency of drinking and the presence of alcohol-use disorders,<sup>21,44,45</sup> but have again examined several questions in post hoc analyses. Of several quantity-frequency questions, Dawson<sup>21,44</sup> found that self-report of drinking 5 or more drinks on any one occasion in the past year was the most sensitive predictor of alcohol dependence (90% in men, 77% in women).

Second, spectrum bias can occur when a screening instrument is tested in a sample of extremes—nondrinkers and alcoholics entering a treatment program, for example. To avoid it, we conducted this study in a primary care setting where very heavy drinking was uncommon but present, and where less severe forms of problem drinking were common.

Third, to avoid misclassification bias, we defined problem drinking using a combination of two widely accepted criterion standards. These standards were applied in the same way to patients with affirmative as to patients with negative answers.

Several potential sources of bias remain, however. First, interviewers were aware of each subject's answer to the single screening question, possibly leading to expectation bias in the CIDI or Timeline interviews. Limiting that source of bias, the CIDI is a fully structured interview and the Timeline interview was completed in a systematic way.

Second, we did not approach half of the patients who answered the alcohol question affirmatively, nor the majority of those who answered negatively. Our criterion for selecting a patient for interview (the one with the longest apparent wait) would probably not be associated with patients' drinking patterns and therefore not a source of selection bias.

A third potential source of bias is the refusal rate. Approximately 25% of those we approached with either an affirmative (18%) or a negative answer (17%) declined to participate or could not be reached by telephone to complete the interview. These refusals could have biased the findings in either direction. But of greatest concern are the patients who answered the single question negatively who could have been problem drinkers not



wanting to discuss their alcohol use. If all 22 patients who answered negatively and declined participation were problem drinkers, the negative predictive value of the single question would have been only 72% (87/121 instead of 87/99), representing no change from the pretest probability that the person was not a problem drinker (75%). Problem drinkers who are not ready to discuss their drinking<sup>46</sup> would probably be difficult to identify by any screening method and unlikely to respond to a brief intervention.

Although binge drinking has been defined as drinking "5 or more" drinks on one occasion,<sup>21,22,44</sup> we set the threshold at "more than 5" to maintain specificity. First, we do not know how much effect changing that number would have on the question's clinical utility. Second, for simplicity we chose to use a single threshold for both men and women. Given the different levels that define at-risk drinking,<sup>20</sup> and the very different sensitivities for men and women, future work should explore sex-specific threshold values. Third, we do not know how rephrasing the question or presenting it orally would affect the question's utility or whether presentation of the question about alcohol between questions about smoking and use of seat belts facilitates or hinders candid responses.

Because we wanted to determine whether the AUDIT could serve as a second-level screening instrument, we kept the sequence of interview instruments (AUDIT, Timeline, and CIDI) constant and cannot examine order effects. Order effects are known to affect self-reports of drinking and its consequences,<sup>47-49</sup> but we have no evidence that reversing the order of the Timeline and the CIDI interviews would have materially altered the study's findings. Furthermore, because the order of administration was constant, any effect on responses would apply equally to all interviewed participants.

Given an affirmative answer to the single-question screening tool, the AUDIT questionnaire has a high positive predictive value (86% at a cutpoint of  $\geq 5$ , 96% at  $\geq 8$ ). But a patient with an affirmative answer to the single question about alcohol use and a negative score on the AUDIT is more likely to have a drinking problem than not, even at a cutoff score as low as 5. Moreover, at the standard cutoff score of  $\geq 8$ , the AUDIT would have missed 11 of the 29 patients with both at-risk drinking and an

alcohol-use disorder, all of whom answered the single question affirmatively. We did not administer the CAGE questions (though several are incorporated in AUDIT items) and do not know how useful it would have been as a follow-up to an affirmative answer to the single question.

The positive predictive value (74%) appears impressive for a screening test, but that is largely because of the high prevalence of problem drinking in this sample (25% of the 1368), far higher than most conditions we screen for in primary care. Data from the 1994-95 Behavioral Risk Factor Surveillance System<sup>22</sup> indicates a past-month prevalence of binge drinking (defined as 5 or more drinks on at least one occasion) of 13.9% in the United States (14.1% in Missouri). If this lower prevalence figure were applied to our findings, the positive predictive value of the single question about alcohol would be 59% and negative predictive value 94%.

A major limitation of the single question is its relatively low sensitivity. Although it correctly identified all 29 patients with both at-risk drinking and a current alcohol-use disorder, it failed to identify 38% of the patients who were problem drinkers. In practice, this might be partially overcome by rescreening at each office visit. However, considering that many problem drinkers are young men who as a group are less likely to see a physician for any reason, some problem drinkers will inevitably be missed. This problem is not unique to this screening method.

Further study is needed before the three-question screen is put into routine practice. About one fourth of those we approached did not participate, and our systematic sampling strategy may have also introduced bias. Replication of our findings should be sought. Studies could include other settings, such as emergency centers and nonacademic family practice offices, and other age groups, including adolescents. We do not know if incorporating the three questions as a part of the routine assessment of vital signs on every patient or using a computer to administer the questions<sup>50</sup> would increase the frequency with which primary care providers discuss alcohol with their patients. More important, we do not know if problem drinkers would change their drinking patterns as a result of those discussions, nor whether those changes would lead to improved health outcomes. Notably, the only major clinical trial in which screening and



intervention occurred in the same office visit was not successful.<sup>51</sup>

Our study confirmed what Deitz et al<sup>8</sup> have also found: Most problem drinkers, even those with a past-year alcohol-use disorder, have not discussed their alcohol problems with a health care provider. Our study demonstrates that a single question can be an effective screening instrument. If the question's positive and negative predictive values are maintained when the three questions are asked as part of office routine, it may be easier to develop an office system for screening all patients that may lead to improved health for problem drinkers.

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