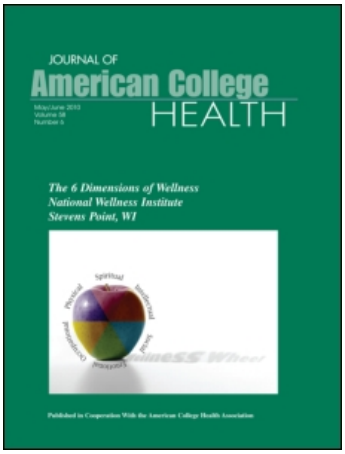

Journal of American College Health
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t914957632

Developing a Screening Questionnaire for Problem Drinking in College Students

Edward J. Heck[a]
[a] University of Kansas, Lawrence, USA

Online publication date: 09 July 2010

To cite this Article Heck, Edward J.(1991) 'Developing a Screening Questionnaire for Problem Drinking in College Students', Journal of American College Health, 39: 5, 227 — 231
To link to this Article: DOI: 10.1080/07448481.1991.9936239
URL: http://dx.doi.org/10.1080/07448481.1991.9936239

Developing a Screening Questionnaire for Problem Drinking in College Students

EDWARD J. HECK, PhD

The CAGE questionnaire is one of several brief screening instruments that has been successful in detecting alcoholism in a general population. There is evidence, however, indicating that none of these instruments has sufficient validity for detecting the less severe pattern of problem drinking that is more typical of college students. This study analyzed survey data, including CAGE questions, to identify items that would have sufficient test operating characteristics more valid for screening problem drinkers.

Problem and normal drinking patterns were defined by combining certain categories of quantity-frequency data with categories of alcohol-related problems. Problem and normal drinkers were identified as those students at the ends of the quantity-frequency/alcohol-problems continuum. Differences between the two groups in response frequencies to a 17-item alcohol-use survey were examined using chi-square analyses. Five items showing highly significant differences were identified, and sensitivity, specificity, and positive predictive values were calculated at possible cutoff points. These items were (1) a positive response to any 2 of the 4 CAGE items, (2) reporting rarely or never choosing nonalcoholic beverages at social events, (3) driving under the influence at least 6 to 10 times or more in the last year, and (4) having started regular use of alcohol before the college years. At the recommended cutoff score for a positive test, the items have a sensitivity of 88%, specificity of 87%, and positive predictive value of 52%. When used for screening in a population similar to this, it will fail to identify 12% of the problem drinkers and will falsely classify 13% of all normal drinkers as problem drinkers. These data represent a considerable improvement in basic screening capability for problem drinking over that demonstrated with the CAGE.

The ability to develop valid screening instruments for the detection of problem drinking in a college population is an important concern for college health professionals. Although several questionnaires for detecting alcoholism among the general population have been developed and validated, some authors have suggested that problem drinking in college students is different from the more severe clinical condition of alcohol abuse or alcoholism.[1,2] The term "problem drinking," when used in the research literature on college students, does not generally refer to the syndromes of "alcohol dependency" (alcoholism) or "alcohol abuse," conditions that have been defined by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III) criteria.[3] These two conditions are defined by criteria stipulating pathological patterns of use and abuse, serious impairments in social or occupational functioning, and, in the case of alcoholism, withdrawal effects. The concept of "problem drinking," when used to describe a pattern among college students, typically refers to less severe alcohol-related problems. The concept lacks a standardized criteria, but a problem-based conceptual framework similar to the framework in the DSM-III is usually adopted by many research studies. These criteria involve both a pattern of excessive alcohol use and physical, social, or psychological problems related to the drinking.

One instrument that has been demonstrated to be an efficient and effective screening for alcoholism is the brief, four-item CAGE questionnaire.[4-6] Introduced by Ewing and Rouse[7] in 1970, the CAGE was designed to correct such deficiencies of previous screening questionnaires as the need for brevity, sensitivity, and validity. The CAGE poses the following questions: (1) Have you ever felt the need to cut down on your drinking? (2) Have you become annoyed at criticism of your drinking? (3) Do you ever feel guilty about your drinking? (4) Do you ever need a drink first thing in the morning to get going?[2] It has been the practice to consider an affirmative response to two or more questions as the threshold score indicating a high likelihood of alcoholism. However, two studies[2,8] have provided evidence demonstrating that the CAGE does not have adequate test

Edward J. Heck is a professor of counseling psychology and staff member of the University Counseling Center at the University of Kansas, Lawrence.

characteristics[9] to serve as a screening instrument for problem drinking in college students. Both of these studies, using highly similar definitions of and criteria for problem drinking, found essentially the same sensitivity, specificity, and positive predictive values for all CAGE cutoff points.

Because the CAGE has been successful in screening for alcoholism but not for the college student problem drinker, this study reanalyzed the CAGE and other survey item data from a previous survey study[10] to identify items that have adequate test characteristics and could serve as an efficient screening instrument for problem drinking in college students.

METHOD

Study Population and Questionnaire Design

During the 1988 spring semester, a random sample of 1,000 students at the University of Kansas was sent a 17-item survey containing demographic items, weekly quantity and frequency items based on Hickenbottom et al,[11] items surveying negative effects of drinking from Smith et al,[2] and the 4 items of the CAGE. The quantity-frequency (QF) categories, negative effects, and CAGE items used are shown in Table 1.

A total of 582 questionnaires were returned (58.2%) with the sample not significantly differing from the campus population proportions in either class standing ($\chi^2 = 5.74$, $df = 4$) or sex ($\chi^2 = .001$, $df = 1$). The sample consisted of 300 men (51.3%) and 282 women (48.2%); in the university as a whole, the sex ratio was 51.6% men to 48.4% women. Because the sample proportions did not differ significantly from the population figures, I made no effort to increase the response rate. Of the 582 students, 60 students (10.3%) reported being nondrinkers, leaving 522 students who reported the regular use of alcohol in varying degrees. Five hundred eight of the 522 surveys from students reporting regular use of alcohol had complete data.

Identification of Problem Drinkers

Because no standardized definition of problem drinking exists in the literature, I adopted a problem-based definition similar to the definition used by Smith et al.[2] The definition and criteria adopted were based on combining certain quantity-frequency (QF) categories of drinking with ranges of negative effects. Problem drinkers were defined as individuals in QF categories 5 and 6 with a range of negative effects of 3 to 8. Normal drinkers were defined as those in QF categories 1 and 2 with a negative effects range of 0 to 2. Using these criteria, I identified 69 problem drinkers (13.6%) and 204 normal drinkers (40.2%). In the problem-drinking group, 50 were men and 19 were women. The normal-drinking group had 85 men and 119 women. These figures indicate estimated problem-drinking rates of 13.6% (total population), 19% men, and 7% women.

TABLE 1
Alcohol-Use Quantity-Frequency Categories, Negative Effects, and CAGE Items

Quantity-frequency categories†

QF1. Occasional drinking (1–2 drinks less than once/week)
QF2. Light drinking (3–4 drinks less than once/week or 1–2 drinks 1–2 times/week)
QF3. Light-moderate (5–6 drinks less than once/week, 3–4 drinks 1–2 times/week, or 1–2 drinks more than twice/week)
QF4. Moderate (7+ drinks less than once/week, 5–6 drinks 1–2 times/week, or 3–4 drinks more than twice/week)
QF5. Moderate-heavy (7+ drinks 1–2 times/week or 5–6 drinks more than twice/week)
QF6. Heavy drinking (7+ drinks more than twice/week)

Negative effect items‡	*CAGE items‡*
Missed school	Feeling the need to cut down on your drinking
Blacking out	Becoming annoyed at criticism of your drinking
Arguments with close friend	Feeling guilty about your drinking
Arguments with boy/girlfriend	Needing a drink first thing in the morning to get going
Fights while intoxicated	
Acts of stolen or damaged property	
Indiscriminate sexual activity	
Physical injuries	

†QF criteria based on Hickenbottom et al.[11]
‡Negative effect and CAGE items taken from Smith et al.[2] Both items are scored on the number of affirmative responses.

Identification of Screening Items and Cutoff Scores

To discover whether certain items would show adequate test characteristics, I examined differences on each of the survey items between the problem- and normal-drinking groups, using chi-square analyses. Items showing the most significant difference between the two groups were identified to form a brief screening questionnaire that had a range of scores equal to the number of items. Test characteristic indices were calculated at each score level to determine the optimal threshold or cutoff score for detecting problem drinking.

Following procedures proposed by Griner et al,[9] I calculated the test characteristics of sensitivity, specificity, and positive predictive values at each potential cutoff score. Sensitivity refers to the true positive rate or the instrument's ability to identify problem drinkers. Specificity refers to the true negative rate or the ability of the instrument to identify normal drinkers. These two indices are basic test characteristics whose values indicate what proportion of students, classified as either normal or problem drinkers, will have a positive or negative test. Since few tests have perfect sensitivity and specificity (ie, 100%), the actual values of these two factors are combined with prior estimates of the extent of a problem to determine the predictive value of a positive test result. The positive predictive value refers to the probability that problem drinking is present when the test is positive. Calculation of these indices was made for both the total sample and for each sex, using the problem-drinking percentages found for each group.

Although sensitivity is considered a more important factor than specificity in determining the optimal cutoff score for a screening test, the ideal situation is one in which both test characteristics are high.[9] The strategy used to determine the optimal cutoff score was that of trying to maximize both sensitivity and specificity values, assuming that both values were sufficiently high. Once the cutoff score was determined, individuals scoring at or above the cutoff score were said to have a positive test, those scoring below were said to have a negative test. Students identified as problem drinkers showing a positive test were classified as true positives. Conversely, students identified as normal drinkers showing a negative test were classified as true negatives.

RESULTS

Differences between the two groups were highly significant ($p < .001$) in response proportions on five survey items. The five items, with the item format and chi-square values, are shown in Table 2.

Examining the distribution of responses across the five items indicated the directions of a positive test for problem drinking. Specifically, items marked in the following ways were reflective of problem drinkers: (1) marking an affirmative response to any two CAGE items (ie, feeling a need to cut down on drinking, becoming annoyed at criticism of their drinking), (2) indicating having driven under the influence of alcohol 6 to 10 or 10+ times in the last year, (3) indicating that they rarely or never chose nonalcoholic beverages when these beverages were available, and (4) indicating the start of regular alcohol use before the college years.

TABLE 2
Five Discriminating Items Between Problem and Normal Drinkers

1. Have you ever felt the need to cut down on your drinking? (CAGE item with yes/no format; $\chi^2 = 41.3$, $df = 1$)
2. Have you become annoyed at criticism of your drinking? (CAGE item with yes/no format; $\chi^2 = 28.3$, $df = 1$)
3. How often, in the past 12 months, would you estimate that you have driven a motor vehicle under the influence of alcohol? (Never, 1–2 times, 3–5 times, 6–10 times, 10+ times; $\chi^2 = 141.3$, $df = 1$)
4. How frequently do you choose nonalcoholic beverages at social events when both are available? (Always, frequently, sometimes, rarely, never; $\chi^2 = 89.6$, $df = 1$)
5. When did you start drinking alcoholic beverages on a regular basis? (Elementary school, junior high, high school, university—freshman, sophomore, junior, senior, graduate; $\chi^2 = 31.8$, $df = 1$)

If these criteria for a positive test are used, the five items make up a screening questionnaire with a range of scores from 0 to 5. The test characteristics of sensitivity, specificity, and positive predictive values at each of the five cutoff scores for men, women, and the total group are shown in Table 3.

The optimal cutoff score for screening purposes, across all groups, is a score of > 2. At the cutoff score, the ability to identify problem drinkers (ie, sensitivity) and not mislabel normal drinkers as problem drinkers (ie, specificity) is greater. In the case of the total group, using a score of > 2 resulted in a sensitivity of 88% and specificity of 87%. This means that, at that score, the false-positive rate is 13% and the false-negative rate is 12%. Knowledge of these two test characteristics, however, only indicates what proportion of the students who are classified as normal and problem drinkers will have a positive and negative test. In the case of developing a screening instrument, the issue of determining the probability that problem drinking is present when a positive test occurs needs to be determined. This probability reflects the predictive value of a positive test (PPV) and requires combining test-characteristic information with prior estimates of the prevalence of the problem as it exists in the population. Calculating this value indicates, for example, that if these test characteristics are applied to a population with a 13.6% problem-drinking rate (as was found in this sample), the probability that problem drinking will be present when

TABLE 3
Sensitivity, Specificity, Positive Predictive Value (PPV), and False-Positive Rate (FPR) at Five Cutoff Scores for Total Group and Sex

Cutoff score	Sensitivity† (%)	Specificity‡ (%)	PPV§ (%)	FPR// (%)
		Total group		
>1	100	40	21	60
>2	88	87	52	13
>3	62	98	83	2
>4	30	99.5	91	.5
	8.7	100	100	0
		Men		
>1	100	44	30	56
>2	86	82	53	18
>3	58	95	73	5
>4	28	99	87	1
	10	100	100	0
		Women		
>1	100	38	11	62
>2	95	90	42	10
>3	74	99	85	1
>4	37	100	100	0
	5	100	100	0

†Sensitivity (true positive/true positive + false negative) = true positive rate.
‡Specificity (true negative/true negative + false positive) = true negative rate.
§Positive predictive value (true positive/true positive + false positive) = probability that problem drinking is present when test is positive. Prevalence of problem drinking is 13.6% (total group), 19% men, 7% women.
//False-positive rate = 100 specificity.

the test is positive is 52%. Finally, the results also indicate that the five-item questionnaire was slightly more sensitive for women (95%) than for men (86%).

DISCUSSION

One of the primary requirements of a screening test is that it should have high sensitivity, even at the expense of specificity; that is, it should identify a high proportion of genuine problem drinkers (ie, true positives), even though this may result in the inclusion of some false positives. Comparing the results of this study with the CAGE results from two other screening studies,[2,8] I calculated that the sensitivity value increased from 57% to 88%, specificity values remained about the same (85% *v* 87%), and the positive predictive value increased from 40% to 52%. Although there is only a 2% reduction in the false-positive rate, there is a 13% gain in the ability to identify true problem drinkers. Comparable increases in sensitivity and specificity are also found for both men and women, with the largest increase in the sensitivity index for women (ie, 50% to 95%).

There was a positive gain in all test characteristics, compared with data on the CAGE, but these results point to certain problems in distinguishing problem drinkers from normal drinkers. As noted earlier, the sensitivity score is generally considered most important for screening purposes, but that index must be viewed in relation to the positive predictive value. The data in Table 3 show that a perfect sensitivity index of 100% was achieved at a positive test criterion score of > 1. Thus, with this criterion, the test will accurately identify 100% of the problem drinkers. If this criterion is adopted in a population with a 13.6% problem-drinking rate, however, the number of false positives becomes very high (60%). This means that only 21% (ie, positive predictive value) of all positive test responders will be problem drinkers. If a score of > 2 is used as the criterion for a positive test, there is a 12% loss in sensitivity but a decrease in the false-positive rate from 60% to 13%. At this criterion, the predictive value of a positive test shows a substantial increase—from 21% to 52%. Changing the criterion to a score of 3 or higher will increase the predictive value of a positive test but will decrease the sensitivity to an unacceptable level for general or broad screening purposes.

It is assumed that once the operating characteristics of sensitivity, specificity, and predictive values are

known, they will remain relatively constant.[9] If the criteria used to define either a positive test or problem drinking are changed, however, these test characteristics will vary. For example, as the criteria become less stringent, sensitivity will increase at the expense of decreased specificity. A less stringent criteria, moreover, would increase the baseline estimate of problem drinking, thereby affecting the predictive value of the instrument. These issues are particularly problematic in the case of problem drinking because no firmly established or standardized criteria exist. Thus, the test indices found in this study need to be considered in the context of the problem-drinking criteria used in this study.

In addition to considering these questionnaire items in the context of the screening function of assessment, they may also be considered in regard to potential treatment usefulness.[12] From a practical perspective, it would be important to consider in what way or ways the items and test information help in assisting students who exhibit problem drinking. Examining both the content of the items and the direction of responses made by problem drinkers may provide some treatment suggestions. Four of the items may be particularly useful regarding treatment implications. Problem drinkers report the following to a much greater extent than normal drinkers: (1) feeling a need to cut down on their drinking, (2) becoming annoyed at being criticized for their drinking, (3) rarely choosing nonalcoholic beverages when the choice is available at social gatherings, and (4) driving more frequently under the influence of alcohol. Because these reactions reflect, in part, problems in establishing greater self-control, one approach is to use self-management training programs, perhaps along the guidelines suggested by Kanfer and Schefft,[13] that specifically focus on the issues of cutting down, handling criticism, exercising choice, and minimizing driving while drinking. Obviously, other ways of working with students on these topics are available, but one of the important considerations is that the items provide some structure for focusing intervention efforts.

Finally, in addition to the problem-drinking criteria used in this study, consideration should be given to other constraints inherent to this study. First, these five items were embedded in a larger survey and were not responded to as a separate five-item questionnaire. Compiling the items into a scale by themselves could influence responses to the items. Second, it is very important to cross validate these results in other college populations because some evidence suggests regional differences in drinking patterns among college students.[14] Even with these limitations, the results look promising as an attempt to develop a brief method for identifying and working with the problem drinker.

INDEX TERMS

college students, problem drinking, screening tests

NOTE

The author gratefully acknowledges the financial support of the Division of Student Affairs of the University of Kansas for the alcohol survey project of which this study was a part.

REFERENCES

1. Burns WD, Sloane DC. Commentary. *J Am Coll Health.* 1987;36:57–59.

2. Smith D, Collins M, Kreisberg J, Volpicelli J, Alterman A. Screening for problem drinking in college freshmen. *J Am Coll Health.* 1987;36:89–94.

3. *Diagnostic and Statistical Manual of Mental Disorders.* 3rd ed, rev. Washington, DC: American Psychiatric Association; 1987.

4. Ewing JA. Detecting alcoholism, the CAGE questionnaire. *JAMA.* 1984;252(14):1905–1907.

5. Bernadt MW, Taylor C, Mumford J, Smith B, Murray RM. Comparison of questionnaire and laboratory tests in the detection of excessive drinking and alcoholism. *Lancet.* 1982; 1:325–328.

6. Mayfield D, McLeod G, Hall P. The CAGE questionnaire: Validation of a new alcoholism screening instrument. *Am J Psychiatry.* 1974;131:1121–1123.

7. Ewing JA, Rouse BA. Identifying the hidden alcoholic. Presented at the 29th International Congress of Alcoholism and Drug Dependency; Feb. 1979: Sydney, Australia.

8. Heck E, Lichtenberg J. Validity of the CAGE in screening for problem drinking in college students. Unpublished manuscript; University of Kansas, 1989.

9. Griner P, Mayewski R, Mushlin A, Greenland P. Principles of test selection and use. *Ann Intern Med.* 1981;94: 559–592.

10. Heck E, Lichtenberg J, Bentley D. Drug use survey of University of Kansas students. Resources in Education 1989: ERIC Document Reproduction Service No. ED 298 379.

11. Hickenbottom JP, Bissonette R, O'Shea R. Preventive medicine and college alcohol abuse. *J Am Coll Health.* 1987;36:67–72.

12. Hayes S, Nelson R, Jarrett R. The treatment utility of assessment. *Am Psychol.* 1987;42:963–974.

13. Kanfer F, Schefft B. *Guiding the Process of Therapeutic Change.* Champaign, IL: Research Press; 1988.

14. Hughes SP, Dodder RA. Alcohol consumption patterns among college populations. *J Coll Stud Personnel.* 1983;24: 257–264.