Drinking Frequency as a Brief Screen for Adolescent Alcohol Problems

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KEY WORDS
adolescent, alcohol screen, alcohol use

ABBREVIATIONS
AUC—area under the curve
AUD—alcohol use disorder
AUDIT—Alcohol Use Disorder Identification Test
CI—confidence interval
DSM-IV—*Diagnostic and Statistical Manual, Fourth Edition*
HED—heavy episodic drinking (consuming ≥5 drinks per occasion)
NIAAA—National Institute on Alcohol Abuse and Alcoholism
NSDUH—National Survey on Drug Use and Health
ROC—receiver operating characteristic
Se—sensitivity
Sp—specificity

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WHAT'S KNOWN ON THIS SUBJECT: The American Academy of Pediatrics recommends routine alcohol screening for all adolescents. Problem-based substance use screens for adolescents exist, but have limitations. A consumption-based alcohol screen could provide an empirically validated, very brief method to screen youth for alcohol-related problems.

WHAT THIS STUDY ADDS: National sample data indicate that frequency of alcohol use has high sensitivity and specificity in identifying youth with alcohol-related problems. A range of age-specific frequency cut scores perform well; specific cut points can be selected based on the screening context.

abstract

OBJECTIVE: Routine alcohol screening of adolescents in pediatric settings is recommended, and could be facilitated by a very brief empirically validated alcohol screen based on alcohol consumption. This study used national sample data to test the screening performance of 3 alcohol consumption items (ie, frequency of use in the past year, quantity per occasion, frequency of heavy episodic drinking) in identifying youth with alcohol-related problems.

METHODS: Data were from youth aged 12 to 18 participating in the annual National Survey on Drug Use and Health from 2000 to 2007. The screening performance of 3 alcohol consumption items was tested, by age and gender, against 2 outcomes: any Diagnostic and Statistical Manual, Fourth Edition alcohol use disorder symptom ("moderate"-risk outcome), and a diagnosis of Diagnostic and Statistical Manual, Fourth Edition alcohol dependence ("high"-risk outcome).

RESULTS: Prevalence of the 2 outcomes increased with age: any alcohol use disorder symptom ranged from 1.4% to 29.2%; alcohol dependence ranged from 0.2% to 5.3%. Frequency of drinking had higher sensitivity and specificity in identifying both outcomes, compared with quantity per occasion and heavy episodic drinking frequency. For both outcomes, results indicate the utility of similar cut points for drinking frequency for males and females at each age. Age-specific frequency cut points, however, are recommended for both moderate- and high-risk outcomes to maximize screening performance.

CONCLUSIONS: Drinking frequency provides an empirically supported brief screen to efficiently identify youth with alcohol-related problems. *Pediatrics* 2012;129:205–212

Routine alcohol screening by health care providers, combined with appropriate intervention and referral, has potential to significantly reduce alcohol-related harm among youth.[1] More youth use alcohol than any other substance.[2–4] During adolescence, the prevalence of past-year alcohol use increases from 7% in 12-year-olds to almost 70% in 18-year-olds.[4] Harms related to adolescent alcohol use include greater risk for injury, violence, risky sexual behavior, suicidality, and academic and interpersonal problems.[5] Given the public health significance of alcohol-related harm among youth, the American Academy of Pediatrics recommends that adolescents be routinely screened for alcohol use and related problems.[5]

Questions on alcohol consumption (eg, frequency and quantity consumed per occasion) have been successfully used to screen adults for problem drinking (eg, National Institute on Alcohol Abuse and Alcoholism [NIAAA] Clinician's Guide[6]), and could likewise serve as clinically useful brief screens to identify risky and problem drinking in adolescents. Existing screening measures assess problems related to substance use that are not specific to alcohol (eg, CRAFFT[7]), and often they assume that questions on consumption level have already been asked.[7] Other screens, such as the Alcohol Use Disorder Identification Test (AUDIT),[8] were developed for use with adults, but demonstrate good performance in identifying youth with an alcohol use disorder (AUD).[9,10] The AUDIT includes 3 consumption questions, which have good ability to identify youth with an AUD.[11,12] One study found that an item on drinking frequency provided an efficient screen for adolescent AUDs.[13] However, no study to date has used population-based data to examine the screening performance of alcohol consumption questions for identifying youth with alcohol-related problems, or for determining whether there are age and/or gender differences in screening performance.

This study also addresses the need to identify risky drinking before the onset of AUD. Whereas most previous adolescent alcohol-screening studies have used AUD as the outcome of interest,[10] youth who report at least 1 alcohol-related symptom, but who fall short of meeting criteria for an AUD, report levels of consumption and problem severity similar to those with a diagnosis of alcohol abuse.[14] Thus, examining "any DSM-IV alcohol symptom" as an outcome permits earlier identification of symptomatic youth, and may thus help prevent further alcohol-related harm. This study examined a second outcome, *Diagnostic and Statistical Manual, Fourth Edition* (DSM-IV) alcohol dependence,[9] to help triage youth during screening who have relatively high alcohol problem severity, and who may benefit from more intensive evaluation and intervention.

This study used data from the National Survey on Drug Use and Health (NSDUH) to evaluate the performance of 3 alcohol consumption items (ie, frequency of drinking in the past year, quantity consumed per occasion, and heavy episodic drinking (HED) frequency in the past month) as very brief (ie, single item) screens to identify youth, aged 12 to 18, with alcohol-related problems. The 2 alcohol outcomes described above were used as standards against which the consumption items were tested. Based on previous research, the frequency of drinking in the past year ("frequency") was hypothesized to show better overall screening performance than either quantity consumed per occasion ("quantity") or frequency of HED ("HED frequency") in relation to both outcomes, across age, and within age for each gender. We predicted that frequency of drinking may provide a more efficient screen than quantity or frequency of binge drinking because any drinking behavior is associated with risk for harm among youth, and frequency may identify more children engaging in this risky behavior than do the other measures. Sensitivity and specificity of cut points were derived in relation to the 2 alcohol outcomes for each consumption item, by gender within each age.

METHODS

Study Sample

NSDUH is the largest epidemiologic survey in the United States that collects annual data on alcohol use and DSM-IV AUD symptoms in individuals aged 12 and older.[15] Sampling design and prevalence of DSM-IV AUD among youth (aged 12–18) were sufficiently similar from 2000 to 2007 to permit pooled analyses. Items on alcohol use and alcohol symptoms were administered by computer-assisted interview. The pooled sample size included 166 165 respondents aged 12 to 18. The sample was 48.6% female; 62.3% white, 14.7% black, 16.5% Hispanic, 3.9% Asian, and 2.6% other ethnicity (eg, multiethnic).

Measures

Alcohol Consumption

The frequency of alcohol use (frequency) item asked, "Think about the past 12 months. We want to know how many days you've had a drink of an alcoholic beverage in the past 12 months." The frequency item was coded as number of drinking days in the past year. The quantity per occasion (quantity) item asked, "On the days that you drank during the past 30 days, how many drinks did you usually have each day? Count as a drink a can or bottle of beer, a wine cooler or a glass of wine, champagne, or sherry; a shot of liquor or a mixed drink or cocktail." The frequency of heavy episodic drinking (HED frequency) item asked, "During the past

30 days, on how many days did you have 5 or more drinks on the same occasion? By 'occasion,' we mean at the same time or within a couple of hours of each other." Quantity and HED frequency items were only assessed if the respondent reported drinking in the past month. Past-year drinkers who reported no use in the past month had quantity coded "1" and HED frequency coded "0" (ie, median values for these variables among past-month drinkers).

DSM-IV Alcohol Diagnoses and Symptoms

Among those who reported past-year alcohol use, past-year symptoms of DSM-IV alcohol abuse (4 symptoms) and dependence (7 symptoms)[9] (see Table 1 for symptom descriptions) were assessed.[15] DSM-IV alcohol abuse requires the occurrence of at least 1 of 4 abuse symptoms; alcohol dependence requires the co-occurrence of at least 3 of 7 dependence symptoms in the past year. Endorsement of any of these 11 DSM-IV AUD symptoms represented a "moderate"-risk outcome. Past-year DSM-IV alcohol dependence represented a "high"-risk outcome.

Analysis Plan

Analyses used NSDUH public use data and accounted for sample weighting.[16] The relative performance of each of the 3 consumption items (ie, frequency, quantity, HED frequency) against the 2 outcomes* (ie, any past-year AUD symptom, past-year alcohol dependence) was examined by comparing the area under the curve (AUC; AUC = 0.5 indicates no better than chance performance; AUC = 1.0 indicates perfect discrimination of cases from noncases). AUC analyses were conducted separately for ages 12 to 18, and by gender within age. AUC analyses comparing the performance of consumption items within a sample used correlated sample analyses[17]; comparisons of AUC by gender within age used independent sample tests.[18] Receiver operating characteristic (ROC) analyses computed sensitivity (the proportion of those with the outcome who are correctly identified as having the outcome) and specificity (the proportion of those without the outcome who are correctly identified as not having the outcome) of cut points against each outcome.

*Similar analyses were performed for an outcome of ≥2 DSM-IV symptoms, and the results were very similar to those obtained with an outcome of ≥1 DSM-IV symptoms. Proposed criteria for DSM-5 define a single alcohol use disorder (www.dsm5.org) as 2 of 11 symptoms, including 10 of the DSM-IV AUD symptoms (all but Legal Problems) as well as a Craving symptom. Therefore, our analyses using a 2+ symptom outcome are probably similar to the proposed DSM-5 criteria.

RESULTS

Prevalence of Alcohol Use and Alcohol-Related Symptoms

Past-year prevalence of alcohol use increased with age (Table 1), from ~7% at age 12 to 66% to 67% at age 18, with similar prevalence by gender at each age. Likewise, prevalence of past-year DSM-IV AUD, and report of any past-year DSM-IV AUD symptom, the moderate-risk outcome, increased with age (Table 1). At each age, the prevalence of reporting any AUD symptom (1.4% at age 12 to 29.2% at age 18) was higher than the prevalence of DSM-IV alcohol abuse. Among youth who reported at least 1 AUD symptom in the past year, the most commonly reported symptom was Tolerance. Prevalence of past-year DSM-IV alcohol dependence, the high-risk outcome, ranged from 0.2% of 12-year-olds to 5.3% of 18-year-olds.

Relative Performance of the 3 Consumption Items

For both moderate- and high-risk outcomes, frequency had greater AUC (range = 0.89–0.99), relative to both quantity (range = 0.82–0.98) and HED frequency (range = 0.63–0.83) at each age ($P < .001$), except at age 12, when AUC for frequency did not differ significantly from quantity for any AUD symptom ($P = .08$). In addition, quantity generally had greater AUC relative to HED frequency (Table 2). This pattern of results, where AUC was greatest for frequency, followed by quantity, then HED frequency, generally held for both outcomes, across ages, and in male and female subgroups within age (exceptions: for females aged 12, and males aged 12 and 13, AUC for frequency and quantity did not differ). Analyses of AUC for each item indicated no differences by gender at each age for frequency. When detected, gender differences within age for quantity and HED frequency were generally small for both outcomes. The generally higher AUC for frequency, relative to the other 2 consumption items, suggests prioritizing assessment of frequency for brief alcohol screening.

Cut Points With Good Screening Performance for Any AUD Symptom and DSM-IV Alcohol Dependence

For both risk outcomes, frequency performed well (ie, high sensitivity and high specificity) across a range of cut scores, which were similar across gender at each age (Tables 3–6). The use of age-specific cut points, however, provides maximum sensitivity and specificity. Because maximum values for sensitivity and specificity were similar across a fairly wide range of frequency values, cut points that are the same for both genders and that correspond to easy-to-remember frequency values could be used for screening (bolded values in Tables 3–6). For any AUD symptom, easy-to-remember guidelines are: at ages 12 to 15, drinking ≥1 day in the past year (any drinking can signal

TABLE 1 NSDUH 2000 to 2007, Ages 12 to 18: Prevalence of Alcohol Use and DSM-IV Alcohol Use Disorders and Symptoms

	Age 12		Age 13		Age 14		Age 15		Age 16		Age 17		Age 18	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Total No.	11 478	11 822	12 164	12 796	12 135	12 696	12 161	12 590	11 942	12 481	11 554	11 966	10 069	10 311
Alcohol use (%) in the total sample (2000–2007)														
Past year	6.8	6.7	16.6	14.7	29.7	25.5	43.9	38.8	52.3	49.6	59.0	58.6	66.3	67.0
Past 30 days	2.5	2.2	6.9	5.3	13.3	10.8	21.2	19.0	27.7	26.9	32.8	35.9	42.0	46.8
DSM-IV AUD outcome prevalence (%) in the total sample (2000–2007)														
Any AUD	0.6	0.5	1.8	1.3	4.1	2.8	7.9	5.8	9.3	9.6	11.2	12.5	12.3	15.7
Abuse only	0.4	0.2	1.1	0.8	2.6	1.7	4.6	3.9	5.8	6.5	6.9	8.0	7.4	10.0
≥1 AUD sxs	1.5	1.3	4.4	3.4	8.5	6.8	15.3	12.8	19.7	19.3	22.9	25.0	26.1	32.0
Dependence	0.2	0.3	0.7	0.5	1.5	1.1	3.3	1.9	3.5	3.1	4.4	4.6	4.9	5.6
DSM-IV AUD symptom prevalence (%), among those with any past-year AUD symptom														
No.	175	153	565	432	1120	854	1887	1666	2415	2516	2754	3140	2701	3432
Four abuse symptoms														
Role obligations[a]	17.4	18.2	17.3	16.2	17.9	14.5	16.7	12.5	12.4	12.7	11.4	10.7	12.3	11.3
Hazard use[b]	17.0	11.2	20.2	19.8	24.6	22.6	27.5	28.9	32.2	31.6	31.4	33.6	29.9	33.8
Legal problems[c]	6.1	5.1	5.8	8.5	7.4	9.6	7.5	7.7	5.2	9.8	6.5	8.7	4.2	9.3
Social problems[d]	7.5	4.0	10.6	3.9	12.6	10.9	15.7	8.3	13.5	10.1	14.2	12.2	11.0	9.1
Seven dependence symptoms														
Tolerance[e]	60.7	70.4	65.4	64.9	64.7	64.4	65.0	66.3	61.9	66.9	61.0	68.6	61.0	67.8
Withdrawal[f]	17.2	17.1	13.7	10.3	11.8	12.6	12.0	9.2	8.1	8.5	6.5	7.9	7.3	8.0
Larger/longer[g]	2.1	9.6	5.2	5.8	8.6	6.8	10.8	7.2	9.4	7.5	9.3	9.1	11.4	8.9
Quit/reduce[h]	6.8	8.4	7.0	12.2	7.7	5.7	7.2	7.1	7.0	7.6	6.8	6.7	6.7	7.3
Much time[i]	40.5	35.4	41.5	35.8	44.3	42.9	52.8	45.3	54.7	49.4	56.1	54.3	58.4	55.5
Reduced activities[j]	14.2	20.6	14.2	13.9	12.9	15.2	14.7	13.1	13.3	12.4	14.6	13.1	14.5	13.4
Psychological/physical[k]	8.4	8.4	8.5	8.0	11.8	8.8	13.4	7.2	13.1	8.2	15.0	9.0	14.1	10.1

[a] Recurrent failure to meet major role obligations (eg, at school, home).
[b] Recurrent drinking in hazardous situations.
[c] Recurrent legal problems due to drinking.
[d] Recurrent interpersonal problems due to drinking (eg, physical fights when intoxicated).
[e] Need to drink much more to obtain the same effect, or much less effect at the same quantity.
[f] Recurrent alcohol-related withdrawal symptoms when stopping or cutting down on use.
[g] Recurrent episodes of drinking more or longer than intended.
[h] Strong desire and/or recurrent failed attempts to cut down or stop drinking.
[i] Extensive time spent obtaining, using, or recovering from the effects of alcohol.
[j] Reduced activities, gave up activities to drink.
[k] Continued drinking despite recurrent psychological or physical problems caused or exacerbated by alcohol use.

TABLE 2 Relative Performance of Consumption Items by Age: AUC (95% CI)

	Any Past-Year DSM-IV AUD Symptom			Past-Year Alcohol Dependence		
	Frequency[a]	Quantity[b]	HED Frequency[c]	Frequency[a]	Quantity[b]	HED Frequency[c]
Age 12	0.99 (0.98–0.99)	0.98 (0.98–0.98)	0.63 (0.60–0.66)	0.99 (0.99–0.99)	0.98 (0.98–0.99)	0.74 (0.65–0.83)
Age 13	0.98 (0.97–0.98)	0.96 (0.95–0.96)	0.64 (0.62–0.66)	0.98 (0.97–0.98)	0.95 (0.94–0.96)	0.71 (0.65–0.77)
Age 14	0.97 (0.96–0.97)	0.93 (0.93–0.94)	0.70 (0.69–0.72)	0.96 (0.95–0.97)	0.93 (0.92–0.94)	0.80 (0.76–0.83)
Age 15	0.96 (0.95–0.96)	0.91 (0.91–0.92)	0.74 (0.72–0.75)	0.94 (0.93–0.94)	0.89 (0.88–0.91)	0.80 (0.77–0.82)
Age 16	0.95 (0.94–0.95)	0.90 (0.89–0.90)	0.77 (0.76–0.78)	0.92 (0.91–0.93)	0.87 (0.86–0.88)	0.81 (0.79–0.83)
Age 17	0.93 (0.93–0.94)	0.88 (0.88–0.89)	0.79 (0.78–0.80)	0.90 (0.89–0.90)	0.84 (0.83–0.85)	0.81 (0.80–0.83)
Age 18	0.91 (0.91–0.92)	0.87 (0.86–0.88)	0.82 (0.81–0.82)	0.89 (0.88–0.90)	0.82 (0.81–0.84)	0.83 (0.81–0.85)

Results are presented at each age (rather than by gender within age) because results by gender within age were similar at each age.

[a] Number of drinking days in the past year.

[b] Quantity consumed per occasion.

[c] Heavy episodic drinking frequency (ie, number of days of 5+ drinks per occasion in the past year).

risky or potentially problematic use); at ages 16 to 17, drinking ≥6 days per year (eg, every other month), and at age 18, drinking ≥12 days per year (eg, once per month). For DSM-IV alcohol dependence, cut-points could be: at ages 12 to 15, drinking ≥6 days per year (eg, every other month); drinking at age 16, drinking ≥12 days per year; at age 17, drinking ≥24 days per year; and at age 18, drinking ≥52 days per year. Importantly, the bolded values in Tables 3–6 are general suggestions, and other frequency cut points with good screening efficiency could be used based on the screening context. The high sensitivity and specificity of frequency in relation to the outcomes makes it difficult to improve detection with additional consumption items (Supplemental Tables 7-10 present results for drinking quantity and HED frequency), particularly at younger ages.

DISCUSSION

This study used population-based data for youth aged 12 to 18 to identify a developmentally appropriate, consumption-based single-item alcohol screen with high sensitivity and specificity in identifying alcohol-related problems. Results indicate that self-reported frequency of alcohol use in the past year provides an empirically based brief 1-item screen that efficiently identifies youth with alcohol-related problems (ie, any DSM-IV AUD symptom or alcohol dependence), which had better overall screening performance than quantity or HED frequency. A range of cut points for the frequency item that have high sensitivity and specificity for a moderate-risk outcome (ie, any past-year DSM-IV AUD symptom) could be used for early detection of alcohol-related problems in youth (relative to AUD), whereas a range of cut points with good overall screening performance in relation to a high-risk outcome (ie, DSM-IV alcohol dependence) could facilitate triaging of youth with high problem severity to further evaluation and possible treatment referral (bolded values in Tables 3–6 indicate easy-to-remember cut scores). For both alcohol outcomes, age-specific cut points increase screening sensitivity and specificity, but within age, the same cut points can be used for males and females.

As predicted, frequency generally had better overall screening performance (ie, greater AUC) compared with quantity and HED frequency in relation to both outcomes, at ages 12 to 18, and by gender within age. Thus, frequency should be prioritized as a screen.[13] The high sensitivity and specificity of frequency suggests that additional consumption items would not provide much improvement in overall screening performance, especially at younger ages. It is noteworthy that AUC for frequency and quantity decreased slightly with age (but remained high, >0.80). In contrast, AUC for HED

TABLE 3 Performance of Frequency of Drinking to Identify Moderate Risk: Any Past-Year DSM-IV AUD Symptom (Females)

Cut Point	Age 12		Age 13		Age 14		Age 15		Age 16		Age 17		Age 18	
	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp
≥1 d	**1.00**	**0.95**	**1.00**	**0.87**	**1.00**	**0.77**	**1.00**	**0.66**	1.00	0.59	1.00	0.53	1.00	0.46
≥2 d	0.98	0.96	0.99	0.91	1.00	0.82	1.00	0.72	1.00	0.66	1.00	0.59	1.00	0.51
≥3 d	0.98	0.97	0.99	0.93	1.00	0.85	1.00	0.77	1.00	0.72	1.00	0.65	1.00	0.56
≥4 d	0.98	0.97	0.98	0.94	1.00	0.88	0.99	0.82	1.00	0.77	1.00	0.70	1.00	0.62
≥5 d	0.98	0.98	0.98	0.95	1.00	0.90	0.99	0.85	1.00	0.80	1.00	0.74	1.00	0.66
≥6 d	0.98	0.98	0.98	0.96	0.99	0.91	0.99	0.88	**1.00**	**0.83**	**1.00**	**0.78**	1.00	0.71
≥7 d	0.94	0.98	0.94	0.96	0.96	0.92	0.97	0.88	0.97	0.84	0.98	0.80	0.99	0.72
≥8 d	0.90	0.98	0.91	0.96	0.93	0.92	0.94	0.89	0.94	0.85	0.95	0.81	0.97	0.73
≥9 d	0.90	0.98	0.89	0.96	0.91	0.92	0.92	0.89	0.93	0.85	0.94	0.81	0.97	0.74
≥10 d	0.88	0.98	0.87	0.97	0.89	0.93	0.91	0.89	0.93	0.85	0.93	0.81	0.95	0.74
≥11 d	0.82	0.98	0.85	0.97	0.85	0.93	0.87	0.90	0.89	0.86	0.90	0.83	0.93	0.76
≥12 d	0.77	0.98	0.84	0.97	0.84	0.93	0.86	0.90	0.89	0.87	0.90	0.83	**0.93**	**0.77**
≥13 d	0.67	0.99	0.73	0.98	0.76	0.94	0.80	0.92	0.83	0.89	0.84	0.86	0.88	0.80
≥14 d	0.66	0.99	0.72	0.98	0.75	0.94	0.80	0.92	0.82	0.89	0.83	0.86	0.88	0.80
≥15 d	0.63	0.99	0.71	0.98	0.74	0.95	0.79	0.92	0.81	0.89	0.83	0.86	0.87	0.80

Bolded values indicate easy-to-remember cut points with good sensitivity and specificity. Se maximum value = 1.0; Sp maximum value = 1.0. d, day(s).

TABLE 4 Performance of Frequency of Drinking to Identify Moderate Risk: Any Past-Year DSM-IV AUD Symptom (Males)

Cut Point	Age 12		Age 13		Age 14		Age 15		Age 16		Age 17		Age 18	
	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp
≥1 d	**1.00**	**0.94**	**1.00**	**0.88**	**1.00**	**0.80**	**1.00**	**0.70**	1.00	0.62	1.00	0.55	1.00	0.48
≥2 d	1.00	0.96	1.00	0.91	1.00	0.85	1.00	0.76	1.00	0.68	1.00	0.60	1.00	0.53
≥3 d	0.99	0.97	0.98	0.94	0.99	0.88	1.00	0.80	1.00	0.73	1.00	0.65	1.00	0.57
≥4 d	0.99	0.97	0.98	0.95	0.99	0.90	0.99	0.83	1.00	0.77	1.00	0.70	1.00	0.62
≥5 d	0.99	0.98	0.98	0.95	0.99	0.91	0.99	0.86	0.99	0.80	1.00	0.73	0.99	0.65
≥6 d	0.99	0.98	0.97	0.96	0.99	0.92	0.99	0.88	**0.99**	**0.83**	**1.00**	**0.77**	0.99	0.69
≥7 d	0.97	0.98	0.94	0.96	0.96	0.93	0.97	0.88	0.97	0.84	0.98	0.78	0.99	0.71
≥8 d	0.93	0.98	0.92	0.96	0.94	0.93	0.95	0.89	0.96	0.84	0.97	0.79	0.97	0.71
≥9 d	0.89	0.98	0.91	0.96	0.93	0.93	0.93	0.89	0.95	0.85	0.96	0.79	0.96	0.72
≥10 d	0.86	0.98	0.89	0.97	0.90	0.93	0.91	0.89	0.93	0.85	0.95	0.79	0.96	0.72
≥11 d	0.83	0.98	0.86	0.97	0.87	0.94	0.88	0.90	0.90	0.86	0.93	0.81	0.94	0.74
≥12 d	0.81	0.98	0.85	0.97	0.86	0.94	0.88	0.90	0.90	0.86	0.92	0.81	**0.94**	**0.74**
≥13 d	0.70	0.99	0.74	0.98	0.77	0.95	0.80	0.92	0.83	0.89	0.87	0.84	0.91	0.77
≥14 d	0.69	0.99	0.73	0.98	0.77	0.95	0.80	0.92	0.83	0.89	0.87	0.84	0.90	0.77
≥15 d	0.68	0.99	0.72	0.98	0.76	0.95	0.79	0.92	0.83	0.89	0.87	0.84	0.90	0.77

Bolded values indicate easy-to-remember cut points with good sensitivity and specificity. Se maximum value = 1.0; Sp maximum value = 1.0. d, day(s).

frequency increased with age, suggesting that the frequency of consuming 5 or more drinks per occasion becomes more effective as a screener as a function of age. To improve the overall performance of the HED frequency measure at younger ages, lower HED quantity may be needed.[19] A caveat that needs to be considered in interpreting the relative performance of the 3 consumption items is that the time frame for the quantity and HED frequency items was "past 30 days," whereas the time frame for the frequency item and the 2 outcomes referred to "past year." The shorter time frame, particularly for HED frequency, might have limited its screening performance here.

Although optimal drinking frequency cut points to identify youth with moderate- and high-risk outcomes differed by age, differences by gender within age were small, in general. As shown in Tables 3–6, sensitivity and specificity across gender within age were similar across a range of values, suggesting that more general, easy-to-remember guidelines for cut points across gender could be used. At ages 12 to 15, the use of drinking at least once in the past year to identify risk may seem overly conservative (ie, potentially producing "false positives"); however, given that early onset of alcohol use predicts later AUD,[20] a conservative guideline at young ages may help to prevent future harm.

In applying developmentally appropriate screening cut points, use of a lower threshold incurs the "cost" of identifying possible false-positive cases, whereas the use of a higher threshold could increase the proportion of "false-negative" ("missed") cases that might benefit from further evaluation. In the context of adolescent alcohol screening, depending on the screening context and available resources, it may be preferable to favor high sensitivity relative to specificity, given the importance of prevention and early intervention. However, when resources to manage positive screens are scarce, specificity may be emphasized. It should be noted that any screen with less than perfect specificity will produce a substantial proportion of false-positive cases when base rates are sufficiently low.[21] Nevertheless, the current results show that both sensitivity and specificity are quite high across a range of cut points, especially in younger adolescents.

Advantages of a consumption-based, relative to a problem-based (eg, CRAFFT), screen are that even problem-based screens assume that the level of consumption has been assessed[7]; problem-based screens may "miss" specific

TABLE 5 Performance of Frequency of Drinking to Identify High Risk: Past-Year DSM-IV Alcohol Dependence (Females)

Cut Point	Age 12		Age 13		Age 14		Age 15		Age 16		Age 17		Age 18	
	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp
≥1 d	1.00	0.93	1.00	0.84	1.00	0.71	1.00	0.58	1.00	0.49	1.00	0.43	1.00	0.35
≥2 d	1.00	0.95	1.00	0.87	0.99	0.76	1.00	0.63	1.00	0.55	1.00	0.48	1.00	0.40
≥3 d	1.00	0.96	1.00	0.89	0.99	0.79	1.00	0.68	1.00	0.60	1.00	0.52	1.00	0.44
≥4 d	1.00	0.96	0.99	0.91	0.99	0.81	1.00	0.72	1.00	0.64	1.00	0.57	1.00	0.48
≥5 d	1.00	0.96	0.99	0.91	0.99	0.83	0.99	0.74	1.00	0.66	1.00	0.60	1.00	0.51
≥6 d	**1.00**	**0.97**	**0.99**	**0.92**	**0.99**	**0.85**	**0.99**	**0.77**	1.00	0.69	1.00	0.63	1.00	0.55
≥7 d	0.92	0.97	0.96	0.93	0.97	0.85	0.98	0.78	0.99	0.70	0.99	0.65	1.00	0.57
≥8 d	0.86	0.97	0.95	0.93	0.95	0.86	0.96	0.79	0.98	0.71	0.99	0.66	1.00	0.58
≥9 d	0.86	0.97	0.93	0.93	0.95	0.86	0.95	0.79	0.97	0.72	0.98	0.67	1.00	0.58
≥10 d	0.83	0.97	0.92	0.93	0.94	0.87	0.95	0.80	0.97	0.72	0.97	0.67	1.00	0.59
≥12 d[a]	0.83	0.97	0.90	0.94	0.92	0.88	0.92	0.81	**0.95**	**0.74**	0.94	0.69	0.98	0.62
≥18 d[a]	0.81	0.98	0.76	0.95	0.83	0.90	0.86	0.85	0.89	0.79	0.89	0.74	0.96	0.67
≥21 d[a]	0.81	0.98	0.73	0.96	0.80	0.91	0.85	0.85	0.89	0.79	0.88	0.75	0.94	0.68
≥24 d[a]	0.81	0.98	0.71	0.96	0.80	0.91	0.84	0.85	0.87	0.80	**0.87**	**0.75**	0.94	0.68
≥27 d[a]	0.77	0.99	0.60	0.96	0.73	0.93	0.78	0.88	0.82	0.83	0.82	0.80	0.91	0.74
≥29 d[a]	0.77	0.99	0.59	0.96	0.73	0.93	0.77	0.88	0.82	0.83	0.82	0.80	0.91	0.74
≥40 d[a]	0.77	0.99	0.52	0.97	0.63	0.94	0.69	0.90	0.74	0.86	0.72	0.84	0.86	0.78
≥48 d[a]	0.68	0.99	0.52	0.97	0.63	0.94	0.68	0.91	0.74	0.87	0.72	0.84	0.85	0.78
≥52 d[a]	0.68	0.99	0.51	0.97	0.56	0.95	0.60	0.92	0.69	0.88	0.64	0.86	**0.81**	**0.81**

Bolded values indicate easy-to-remember cut points with good sensitivity and specificity. d, day(s).

[a] Signals >1-d gap between previous cut point.

TABLE 6 Performance of Frequency of Drinking to Identify High Risk: Past Year DSM-IV Alcohol Dependence (Males)

Cut Point	Age 12		Age 13		Age 14		Age 15		Age 16		Age 17		Age 18	
	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp	Se	Sp
≥1 d	1.00	0.93	1.00	0.86	1.00	0.75	1.00	0.62	1.00	0.52	1.00	0.43	1.00	0.35
≥2 d	1.00	0.95	1.00	0.89	1.00	0.80	1.00	0.68	1.00	0.57	1.00	0.48	1.00	0.38
≥3 d	1.00	0.96	1.00	0.91	1.00	0.83	1.00	0.71	1.00	0.61	1.00	0.51	1.00	0.41
≥4 d	1.00	0.96	1.00	0.92	1.00	0.85	1.00	0.74	1.00	0.64	1.00	0.55	1.00	0.45
≥5 d	1.00	0.97	1.00	0.93	0.99	0.86	1.00	0.76	1.00	0.67	1.00	0.57	1.00	0.47
≥6 d	**1.00**	**0.97**	**1.00**	**0.93**	**0.99**	**0.87**	**1.00**	**0.78**	1.00	0.69	1.00	0.60	1.00	0.50
≥7 d	1.00	0.97	1.00	0.94	0.95	0.87	1.00	0.79	0.99	0.70	1.00	0.62	0.99	0.51
≥8 d	1.00	0.97	1.00	0.94	0.95	0.88	0.98	0.80	0.98	0.71	0.99	0.63	0.99	0.52
≥9 d	1.00	0.97	0.99	0.94	0.94	0.88	0.98	0.80	0.98	0.72	0.99	0.63	0.99	0.53
≥10 d	0.93	0.97	0.95	0.94	0.94	0.89	0.97	0.80	0.98	0.72	0.99	0.64	0.99	0.53
≥12 d[a]	0.93	0.98	0.92	0.94	0.92	0.89	0.94	0.81	**0.97**	**0.74**	0.97	0.66	0.98	0.55
≥18 d[a]	0.85	0.98	0.86	0.96	0.87	0.91	0.89	0.85	0.92	0.78	0.95	0.70	0.96	0.60
≥21 d[a]	0.80	0.98	0.86	0.96	0.84	0.92	0.88	0.86	0.91	0.79	0.94	0.71	0.96	0.61
≥24 d[a]	0.77	0.98	0.84	0.96	0.82	0.92	0.88	0.86	0.91	0.79	**0.94**	**0.71**	0.95	0.62
≥27 d[a]	0.45	0.99	0.80	0.97	0.77	0.93	0.80	0.88	0.88	0.82	0.91	0.75	0.93	0.66
≥29 d[a]	0.45	0.99	0.78	0.97	0.77	0.93	0.80	0.88	0.87	0.82	0.91	0.76	0.93	0.66
≥40 d[a]	0.44	0.99	0.67	0.97	0.73	0.94	0.73	0.90	0.80	0.85	0.82	0.79	0.89	0.71
≥48 d[a]	0.36	0.99	0.66	0.97	0.73	0.94	0.73	0.90	0.80	0.85	0.82	0.80	0.88	0.71
≥52 d[a]	0.36	0.99	0.61	0.97	0.66	0.95	0.67	0.92	0.75	0.87	0.76	0.82	**0.85**	**0.75**

Bolded values indicate easy-to-remember cut points with good sensitivity and specificity. d, day(s).
[a] Signals >1-d gap between previous cut point.

alcohol-related harm experienced by an adolescent; and assessing the pattern of alcohol use can identify potentially harmful use (eg, HED) that indicates the need for intervention. Because alcohol is the substance used most often by adolescents,[2] and youth who do not use alcohol are less likely to use other substances (NIAAA, unpublished analysis of 2000–2009 data from NSDUH),[22] a brief alcohol screen can help prioritize the need to screen for other substances and risk behaviors. Assessment of alcohol consumption can be complemented by problem-based screening (eg, CRAFFT[7]). Obtaining an honest report of drinking behavior from an adolescent can be facilitated by establishing rapport, ensuring that the adolescent understands the clinic's confidentiality policy, and discussing sensitive topics with the adolescent in private.[23]

DSM-based alcohol outcomes constitute an important standard used to evaluate screening performance. The higher prevalence of any AUD symptom in this study, relative to the alcohol abuse diagnosis, supports the use of this moderate-risk outcome for earlier detection of alcohol-related problems. The inclusion of a more severe outcome, DSM-IV alcohol dependence, provides an important advance in facilitating identification of youth who may benefit from more intensive evaluation and intervention. Despite the strengths of using DSM-based AUD outcomes, limitations of using DSM-based criteria with adolescents need to be considered.[24] As in many large-scale fully structured surveys of diagnostic criteria, there may be overendorsement of certain symptoms.[25] For example, hangover might be mistaken for withdrawal.[24] In addition, endorsement of Tolerance at early ages may reflect a developmental process, or acute (within session) tolerance, rather than a high level of tolerance typically associated with dependence.[26] Nevertheless, endorsement of any alcohol-related symptom by adolescents can signal a risky pattern of use that warrants further evaluation.

Other study limitations warrant comment. Youth self-reports of alcohol consumption were used without biochemical verification, and may have underestimated alcohol use, for example, because items did not specifically query use of alcohol energy drinks or sweetened alcoholic beverages. It is important to appreciate, however, that what predicted past-year AUD symptoms and alcohol dependence in this study was what the youth reported; the accuracy of those reports need not be presumed to use the item(s) as a screen. Although population-based data were analyzed, the context of responding to computerized survey items differs from that of clinic settings where consumption items might be asked in-person for the purpose of screening, and confidentiality concerns may compromise honest reporting. The performance of combinations of consumption items was not examined because of differences in item time frames. However, the high sensitivity and specificity of frequency in relation to the 2 outcomes, particularly at younger ages, suggests that a combination of consumption items would provide little incremental improvement. Ethnic differences in screening performance remain to be documented.

CONCLUSIONS

Routine alcohol screening of youth by health care providers, combined with appropriate intervention and follow-up, can help to reduce alcohol-related harm during adolescence.[1] Self-reported frequency of alcohol use in the past year provides an empirically validated, efficient screening tool to initially identify youth with alcohol-related problems, and can facilitate efforts to triage youth to moderate and high levels of alcohol-related risk. Results indicate that any drinking at ages 12 to 15 signals risk for alcohol-related problems, and emphasize the importance of routine alcohol screening and early intervention with adolescents.

Youth at moderate risk might benefit from brief motivational intervention to stop alcohol use[27] and follow-up, whereas high-risk youth might benefit not only from brief motivational intervention and follow-up, but also further evaluation and possible referral to treatment. Adolescents who report alcohol use that falls short of a moderate-risk threshold (ie, "lower" risk) may benefit from brief advice to stop drinking, which includes communication by the health care provider of concern regarding the risks of alcohol use, and follow-up. Youth who report no alcohol use can be praised for their healthy decision to avoid alcohol use. An alcohol frequency screening item, when used in combination with appropriate prevention and intervention, can provide a brief, powerful, and efficient tool that can help to reduce alcohol-related harm among youth.

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