

# Screening and Behavioral Counseling Interventions to Reduce Unhealthy Alcohol Use in Adolescents and Adults

## Updated Evidence Report and Systematic Review for the US Preventive Services Task Force

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**IMPORTANCE** Unhealthy alcohol use is common, increasing, and a leading cause of premature mortality.

**OBJECTIVE** To review literature on the effectiveness and harms of screening and counseling for unhealthy alcohol use to inform the US Preventive Services Task Force.

**DATA SOURCES** MEDLINE, PubMed, PsycINFO, and the Cochrane Central Register of Controlled Trials through October 12, 2017; literature surveillance through August 1, 2018.

**STUDY SELECTION** Test accuracy studies and randomized clinical trials of screening and counseling to reduce unhealthy alcohol use.

**DATA EXTRACTION AND SYNTHESIS** Independent critical appraisal and data abstraction by 2 reviewers. Counseling trials were pooled using random-effects meta-analyses.

**MAIN OUTCOMES AND MEASURES** Sensitivity, specificity, drinks per week, exceeding recommended limits, heavy use episodes, abstinence (for pregnant women), and other health, family, social, and legal outcomes.

**RESULTS** One hundred thirteen studies (N = 314 466) were included. No studies examined benefits or harms of screening programs to reduce unhealthy alcohol use. For adolescents (10 studies [n = 171 363]), 1 study (n = 225) reported a sensitivity of 0.73 (95% CI, 0.60 to 0.83) and specificity of 0.81 (95% CI, 0.74 to 0.86) using the AUDIT-C (Alcohol Use Disorders Identification Test–Consumption) to detect the full spectrum of unhealthy alcohol use. For adults (35 studies [n = 114 182]), brief screening instruments commonly reported sensitivity and specificity between 0.70 and 0.85. Two trials of the effects of interventions to reduce unhealthy alcohol use in adolescents (n = 588) found mixed results: one reported a benefit in high-risk but not moderate-risk drinkers, and the other reported a statistically significant reduction in drinking frequency for boys but not girls; neither reported health or related outcomes. Across all populations (68 studies [n = 36 528]), counseling interventions were associated with a decrease in drinks per week (weighted mean difference, -1.6 [95% CI, -2.2 to -1.0]; 32 studies [37 effects; n = 15 974]), the proportion exceeding recommended drinking limits (odds ratio [OR], 0.60 [95% CI, 0.53 to 0.67]; 15 studies [16 effects; n = 9760]), and the proportion reporting a heavy use episode (OR, 0.67 [95% CI, 0.58 to 0.77]; 12 studies [14 effects; n = 8108]), and an increase in the proportion of pregnant women reporting abstinence (OR, 2.26 [95% CI, 1.43 to 3.56]; 5 studies [n = 796]) after 6 to 12 months. Health outcomes were sparsely reported and generally did not demonstrate group differences in effect. There was no evidence that these interventions could be harmful.

**CONCLUSIONS AND RELEVANCE** Among adults, screening instruments feasible for use in primary care are available that can effectively identify people with unhealthy alcohol use, and counseling interventions in those who screen positive are associated with reductions in unhealthy alcohol use. There was no evidence that these interventions have unintended harmful effects.

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Unhealthy alcohol use (including use that exceeds recommended limits, use that is having negative effects on health, or alcohol use disorder) was estimated to be the third leading preventable cause of mortality in the United States in 2000,<sup>1</sup> with 9.8% of deaths attributable to alcohol consumption from 2006 to 2010.<sup>2</sup> Unhealthy alcohol use is relatively common; in 2016 in the United States, 26% of adults and 4.9% of adolescents reported heavy use episodes ( $\geq 5$  drinks on the same occasion on  $\geq 1$  day in the previous month, also referred to as binge episodes) and 6.6% of adults reported engaging in heavy drinking ( $\geq 5$  drinks on the same occasion on  $\geq 5$  days) in the previous month.<sup>3</sup> Alcohol use can exacerbate or cause a wide range of medical conditions commonly encountered in the primary care setting, including gastrointestinal, cardiopulmonary, dermatologic, reproductive, and neurologic conditions.<sup>4</sup> Alcohol also interacts dangerously with many commonly used prescription and over-the-counter medications.<sup>5</sup> Screening and counseling to reduce unhealthy alcohol use may prevent deleterious health effects and help prevent progression to more severe forms of unhealthy use.

In 2013, the US Preventive Services Task Force (USPSTF) recommended that clinicians screen adults 18 years or older for alcohol misuse and provide brief behavioral counseling interventions to those engaged in risky or hazardous drinking behaviors (B recommendation).<sup>6</sup> The USPSTF concluded, however, that the evidence in adolescents was insufficient to evaluate the balance of benefits and harms of screening and behavioral counseling interventions to reduce alcohol misuse (I statement). This review was prepared to inform an updated recommendation by the USPSTF on the evidence related to screening test accuracy and benefits and harms of screening and counseling for unhealthy alcohol use in populations and settings relevant to US primary care.

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## Methods

### Scope of Review

An analytic framework was developed with 5 key questions (KQs) (Figure 1) that examined the benefits (KQ1) and harms (KQ3) of screening for unhealthy alcohol use, screening test accuracy (KQ2), and benefits (KQ4) and harms (KQ5) of counseling interventions for unhealthy alcohol use. A draft of the analytic framework, review questions, and inclusion and exclusion criteria was posted on the USPSTF website from August 25, 2016, to September 21, 2016, for the purpose of gathering public input. Detailed methods (eg, more detailed information about inclusion and quality rating criteria, methods for grading the strength of evidence for key questions, expert review, and public comment process) are available in the full evidence report at <http://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/unhealthy-alcohol-use-in-adolescents-and-adults-screening-and-behavioral-counseling-interventions>.

### Data Sources and Searches

MEDLINE, PubMed (for publisher-supplied records only), PsycINFO, and the Cochrane Central Register of Controlled Trials were searched from January 1, 2011, to October 12, 2017, and

supplemented by checking reference lists from the prior 2013 review and other relevant reviews, covering literature published since January 1, 1985. ClinicalTrials.gov was searched for ongoing trials. From October 12, 2017, through August 1, 2018, surveillance was conducted through article alerts and targeted searches of journals with a high impact factor and journals relevant to the topic to identify major studies that might affect the conclusions or understanding of the evidence and therefore the related USPSTF recommendation. The last surveillance, conducted on August 1, 2018, identified no new studies. However, 1 recently published diagnostic accuracy study was subsequently identified that met the inclusion criteria; that study did not change the conclusions and therefore is cited in the Discussion section only.

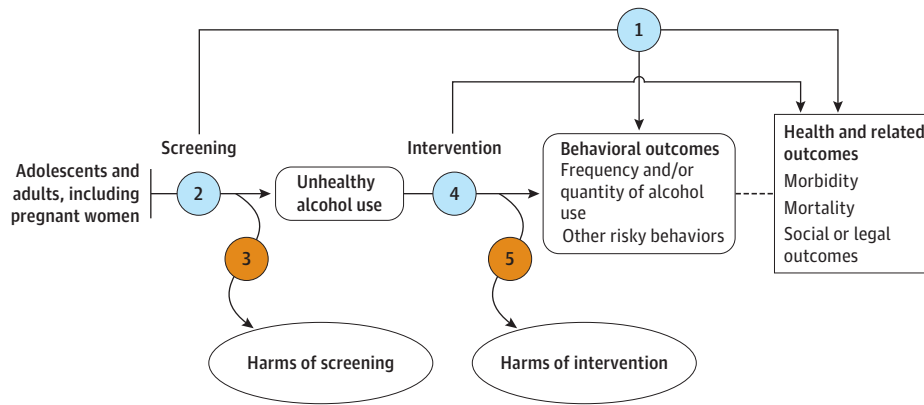
### Study Selection

Two reviewers, applying a priori inclusion criteria, independently reviewed 17 149 unique citations and 570 full-text articles (Figure 2; eTable 1 in the Supplement). The review included English-language fair- and good-quality studies conducted among adolescents (12 years or older) or adults in countries categorized as "very high" on the United Nations Human Development Index.<sup>8</sup> For benefits and harms of screening (KQ1 and KQ3) and interventions (KQ4 and KQ5), randomized clinical trials were included, as were nonrandomized controlled intervention studies with an eligible control group (eg, usual care, minimal intervention, attention control) that reported an alcohol use outcome. A minimum of 6 months of follow-up was required to assess intervention benefits (KQ1 and KQ4), but there was no minimum requirement for harms (KQ3 and KQ5). For screening test accuracy (KQ2), studies of test accuracy reporting sensitivity and specificity compared with a structured or semistructured clinical interview, or computer-based versions of structured assessments, were included.

For studies of benefits or harms of unhealthy alcohol screening (KQ1 and KQ3) and screening test accuracy (KQ2), studies that were restricted to participants with unhealthy alcohol use were excluded. For benefits or harms of unhealthy alcohol screening (KQ1 and KQ3), trials were sought that tested the effects of a screening program compared with usual care or a similar unscreened control group. Screening test accuracy (KQ2) evidence was limited to screening instruments named in national-level recommendations related to screening for unhealthy alcohol use or that had evidence to support their use based on the previous review (AUDIT [Alcohol Use Disorders Identification Test], AUDIT-C [AUDIT Consumption], SASQ [Single Alcohol Screening Question], and variations of these). Additionally, instruments were selected that target important subpopulations, ie, adolescents (National Institute on Alcohol Abuse and Alcoholism [NIAAA] 2-item screener, BSTAD [Brief Screener for Tobacco, Alcohol, and Other Drugs], and variations of these), pregnant women (TWEAK, T-ACE), or older adults (CARET [Comorbidity Alcohol Risk Evaluation Tool]), or that cover both drug and alcohol use (ASSIST [Alcohol, Smoking, and Substance Involvement Screening Test]). For benefits or harms of unhealthy alcohol screening (KQ1 and KQ3) and of counseling interventions to reduce unhealthy alcohol use (KQ4 and KQ5), studies using any screening instrument were eligible.

For evaluating counseling interventions to reduce unhealthy alcohol use (KQ4 and KQ5), trials of behavioral counseling—with or without referral—were included if they were conducted

Figure 1. Analytic Framework: Screening and Interventions to Reduce Unhealthy Alcohol Use



Key questions

- 1 a. Does primary care screening for unhealthy alcohol use in adolescents and adults, including pregnant women, reduce alcohol use or improve other risky behaviors?  
b. Does primary care screening for unhealthy alcohol use in adolescents and adults, including pregnant women, reduce morbidity or mortality or improve other health, social, or legal outcomes?
- 2 What is the accuracy of commonly used instruments to screen for unhealthy alcohol use?
- 3 What are the harms of screening for unhealthy alcohol use in adolescents and adults, including pregnant women?
- 4 a. Do counseling interventions to reduce unhealthy alcohol use, with or without referral, reduce alcohol use or improve other risky behaviors in screen-detected persons?  
b. Do counseling interventions to reduce unhealthy alcohol use, with or without referral, reduce morbidity or mortality or improve other health, social, or legal outcomes in screen-detected persons?
- 5 What are the harms of interventions to reduce unhealthy alcohol use in screen-detected persons?

Evidence reviews for the US Preventive Services Task Force (USPSTF) use an analytic framework to visually display the key questions that the review will address to allow the USPSTF to evaluate the effectiveness and safety of a preventive service. The questions are depicted by linkages that relate interventions and outcomes. A dashed line depicts a health outcome that follows an intermediate outcome. Refer to the USPSTF Procedure Manual for further details.<sup>7</sup>

in or recruited from primary care or a health care system or could feasibly be implemented in or referred from primary care. Since pharmacotherapy is primarily relevant to patients with moderate or severe alcohol use disorder (AUD), studies of pharmacotherapy treatment were excluded.

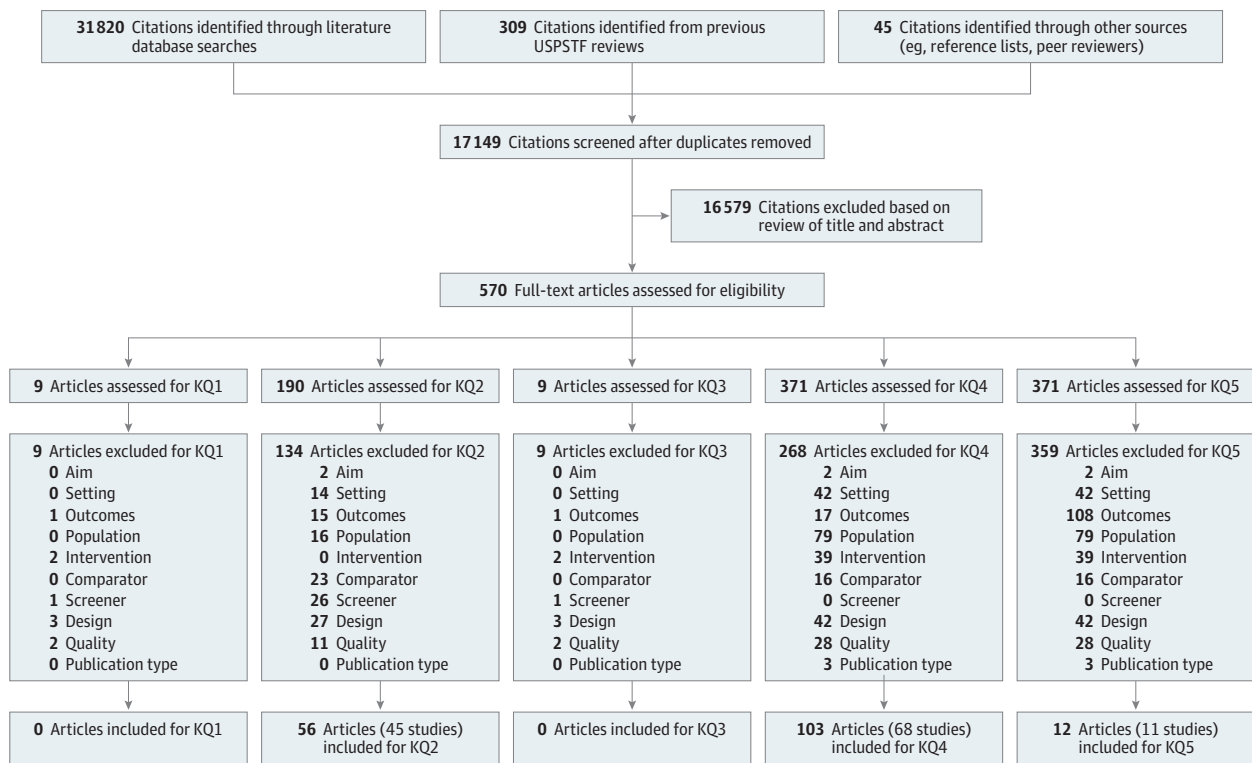
Trials were required to enroll participants through screening for unhealthy alcohol use for at least half of their sample. Screening had to take place in settings comparable or applicable to primary care with a defined population (eg, primary care clinic, Special Supplemental Nutrition Program for Women, Infants, and Children, college freshmen orientation). Trials that identified patients through behavioral or mental health clinics, substance abuse treatment centers, emergency department and trauma centers, work sites (including occupational screening), inpatient or residential facilities, or other institutions (eg, correctional facilities) were excluded. Studies of participants with alcohol dependence or severe AUD (or >50% of the enrolled sample having alcohol dependence or severe AUD) were excluded. Also excluded were studies limited to treatment-seeking individuals, those with concomitant psychotic disorders, those presenting in an emergency setting, and others not generalizable to primary care (eg, inpatients, those court-mandated to treatment, those who were incarcerated).

Data Extraction and Quality Assessment

Included trials were critically appraised by 2 independent reviewers using criteria defined by the USPSTF and for test accuracy studies, supplemented with criteria from the Quality Assessment of Diagnostic Accuracy Studies 2 (QUADAS-2) (eTable 2 in the Supplement).<sup>7,9</sup> Disagreements were resolved by a third reviewer.

Studies were rated as poor quality and excluded if there was an important limitation such as, among treatment trials, very high attrition (generally >40%); differential attrition between intervention groups (generally >20%); substantial lack of baseline comparability between groups without adjustment; or major concerns about the trial conduct, analysis, or reporting of results. For diagnostic accuracy studies, examples of important limitations warranting a "poor" quality rating included use of a reference standard that was not likely to categorize participants accurately, having the participant complete the screener after participating in an in-depth interview on his or her alcohol use, and/or lack of assurance that the study sample was representative of a relevant population. One reviewer abstracted descriptive and outcome data from fair- and good-quality studies into standardized evidence tables; a second checked for accuracy and completeness.

Figure 2. Literature Search Flow Diagram: Screening and Interventions to Reduce Unhealthy Alcohol Use



Articles could appear in more than 1 key question (KQ). Reasons for exclusion: Aim: Study aim was not relevant. Setting: Study was not conducted in a country relevant to United States practice or not conducted in, recruited from, or feasible for primary care or a health system. Outcomes: Study did not have relevant outcomes or had incomplete outcomes. Population: Study was not

conducted in an included population. Intervention: Intervention was out of scope. Comparator: Study did not have a comparison group. Screener: Study did not use an included screener. Design: Study did not use an included design. Quality: Study was poor quality. KQ indicates key question; USPSTF, United States Preventive Services Task Force.

### Data Synthesis and Analysis

Summary tables of study, population, and intervention characteristics were created, along with forest plots of outcomes, to examine the size, consistency, and precision of effects. Studies were grouped according to population: adolescents (≈12 to 18 years), young adults (≈18 to 25 years), general adult populations (≈18 years or older), older adults (≈65 years or older), and pregnant and postpartum (up to 1 year after childbirth) women.

For the analysis of screening test accuracy, data were not pooled because of variability in cutoffs, populations, and screening tests. Contingency tables were used to calculate confidence intervals for sensitivity and specificity. If contingency tables were not reported, they were estimated using the reported sensitivity, specificity, and prevalence. Positive and negative predictive values were estimated based on the population prevalence of unhealthy alcohol use<sup>3</sup> and 3 combinations of sensitivity and specificity. This article reports the test accuracy to screen for the full spectrum of unhealthy alcohol use (inclusive of exceeding limits and AUD). Test accuracy for other conditions (alcohol dependence, AUD, and exceeding limits) can be found in the full report.

For intervention effectiveness, meta-analysis was conducted for 4 alcohol use outcomes: drinks per week, drinking that exceeded recommended limits, heavy use episodes, and abstinence (for pregnant women). All related outcomes were converted to drinks per

week, such as when provided with other time frames (eg, drinks per month) or with grams of ethanol rather than drinks. The conversion factor of 14 g of ethanol was used for 1 standard drink, since this is the definition of a standard drink in the United States. To determine whether meta-analyses were appropriate, clinical and methodological heterogeneity were assessed. In general, when at least 5 similar studies were available or when there were fewer studies but statistical heterogeneity was very low, quantitative synthesis was conducted and reported. Few health outcomes were reported in enough trials to consider pooling; however, a meta-analysis of mortality and alcohol problems or consequences was conducted.

Random-effects models were performed using the DerSimonian and Laird method to estimate pooled effects.<sup>10</sup> For analyses that showed statistically significant pooled effects but that had fewer than 10 trials and *I*<sup>2</sup> values larger than 50%, a sensitivity analysis was performed that used a more conservative pooling method to determine whether statistical significance was sustained (profile likelihood model or, if the profile likelihood model did not converge, a restricted maximum likelihood analysis with the Knapp-Hartung correction for small samples). For outcomes with 10 or more trials in the meta-analysis (drinks per week, exceeding recommended limits, and heavy use episodes), funnel plots were generated and the Egger test was used to examine funnel plot asymmetry to explore small-study effects, which can be related to publication bias.<sup>11</sup>

Table 1. Summary Population Characteristics for Key Question 2

Population	Participants			Studies, No. (%)				Other Countries Represented	Other Settings
	No.	Age, Mean (SD), y <sup>a</sup>	% Female <sup>a</sup>	No. of Studies	Conducted in Primary Care	Good Quality <sup>b</sup>	Majority of Participants Nonwhite		
All populations	277 938	35.3 (13.1)	49.6	45 <sup>c</sup>	23 (51)	17 (38)	13 (29)	28 (62)	
Adolescents	171 363	15.5 (0.25)	48.8	10	7 (70)	5 (50)	5 (50)	8 (80)	High school (2) Community (1)
Adults (nonpregnant/postpartum)	114 182	38.1 (11.7)	53.1	35	16 (46)	14 (40)	7 (20)	21 (60)	
Young adults	6376	18.5 (1.1)	57.5	6	1 (17)	4 (67)	1 (17)	5 (83)	University (4) Other medical (1)
Adults	99 084	43.3 (4.1)	51.8	27	15 (56)	8 (30)	6 (22)	15 (56)	Australia, Finland, France, Germany, Great Britain, Italy, the Netherlands, Spain, Switzerland
Older adults	8722	69.0 (0)	49.7	2	0	2 (100)	0	1 (50)	Finland
Pregnant women	1105	25.3 (0.5)	100	3	1 (33)	1 (33)	2 (67)	2 (67)	Argentina Community (1) Hospital (1)

<sup>a</sup>Weighted by number randomized.  
<sup>b</sup>Assessed using criteria from Quality Assessment of Diagnostic Accuracy Studies.<sup>68,69</sup>  
<sup>c</sup>Three studies included subgroup analyses in young adults, older adults, and pregnant women, which are shown in the rows for these populations; therefore, the sum of the rows does not add up to the "all populations" totals.

Additionally, for the outcome drinks per week, which was the most commonly reported outcome, meta-regression and subgroup analyses were conducted to explore factors associated with effect size.

Stata version 13.1 (StataCorp) was used for all analyses. All significance testing was 2-tailed, and results were considered statistically significant if the P value was .05 or less.

## Results

Two reviewers independently assessed 17 149 unique abstracts and 570 full-text articles for inclusion (Figure 2). One hundred thirteen studies (N = 314 466) were included. Overall, 0 studies were included for KQ1, 45 studies (56 articles) for KQ2, 0 studies for KQ3, 68 studies (103 articles) for KQ4, and 11 studies (12 articles) for KQ5.

### Benefits of Screening

**Key Question 1a.** Does primary care screening for unhealthy alcohol use in adolescents and adults, including pregnant women, reduce alcohol use or improve other risky behaviors?

No eligible studies were identified.

**Key Question 1b.** Does primary care screening for unhealthy alcohol use in adolescents and adults, including pregnant women, reduce morbidity or mortality or improve other health, social, or legal outcomes?

No eligible studies were identified.

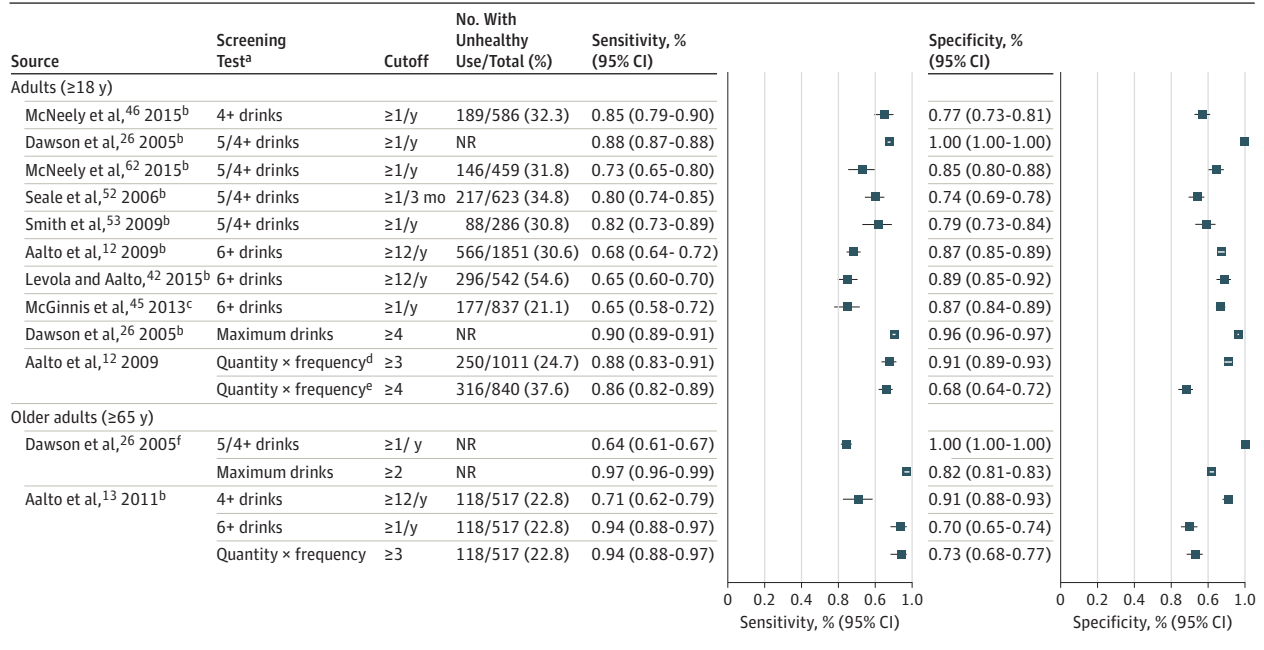
**Key Question 2.** What is the accuracy of commonly used instruments to screen for unhealthy alcohol use?

Forty-five studies<sup>12-56</sup> were included (reported in 56 publications<sup>12-67</sup>) (Table 1) that addressed the accuracy of screening instruments: 10 in adolescents,<sup>20,21,25,34,36,38,39,43,50,51</sup> 5 in young adults,<sup>14,23,29,40,47</sup> 27 in general adult populations,<sup>12,15-18,22,24,26-28,30-33,35,37,41,42,44-46,48,49,52-54,56</sup> 1 in older adults,<sup>13</sup> and 2 in pregnant<sup>19</sup> or postpartum<sup>55</sup> women. One study in a general adult population provided subgroup analyses of pregnant women and older adults,<sup>26,59</sup> and 1 study of participants aged 12 to 20 years provided subgroup analyses of young adults (18 to 20 years).<sup>21</sup> The majority of studies were conducted in the United States (28/45 [62%]) and recruited patients from primary care (23/45 [51%]) (Table 1). The number of study participants ranged from 95 to 166 165. A variety of 1- and 2-item screening tests were used in the included studies, as well as the AUDIT, AUDIT-C, and ASSIST. Reference standards used in the included studies were most commonly structured diagnostic interviews, and the interview sometimes was used in combination with other instruments (eg, Timeline Followback). Most studies were fair quality (28/45 [62%]).

For adolescents, just 1 study (n = 225) in a German high school reported on test accuracy for detecting the full spectrum of unhealthy alcohol use (eFigure 1 in the Supplement), finding a sensitivity of 0.73 (95% CI, 0.60 to 0.83) and specificity of 0.81 (95% CI, 0.74 to 0.86) for the optimal cutoff of 5 or higher on the AUDIT-C (male and female participants combined). The majority of the test accuracy evidence for adolescents was to detect AUD and is available in the full evidence report.

For adults, studies of the NIAAA-recommended single-item question (How many times in the past year have you had 5 or 4 [males

Figure 3. Test Accuracy of 1- and 2-Item Screening Tests at the Optimal Cutoff to Detect Unhealthy Alcohol Use



NR indicates not reported.

<sup>a</sup> 4+ drinks includes modified 3-Item Alcohol Use Disorders Identification Test (AUDIT-3; lower threshold for females and older adults) and the Substance Use Brief Screen (SUBS). 6+ drinks includes AUDIT-3. Quant × freq includes the first 2 items from the AUDIT (range, 0-8). Maximum drinks asks "During the last 12 months, what was the LARGEST number of drinks that you drank in a single day?" 6+, 5/4+, and 4+ drinks are variations of a screening test that quantifies the number of occasions

per year on which a certain amount of drinks (4-6, depending on the test) were consumed in 1 day.

<sup>b</sup> Screened group: all participants.

<sup>c</sup> Study enrolled male participants only.

<sup>d</sup> Female participants.

<sup>e</sup> Male participants.

<sup>f</sup> Screened group: participants aged 65 and older.

or females, respectively] or more drinks in a day?) reported sensitivity ranging from 0.73 to 0.88 (95% CI range, 0.65 to 0.89) and specificity ranging from 0.74 to 1.0 (95% CI range, 0.69 to 1.0) for detecting the full spectrum of unhealthy alcohol use (4 studies [n = 44 461]) (Figure 3, labeled "5/4+ drinks"). All of these studies were conducted in the United States, primarily in primary care settings. Other 1- and 2-item screening tests (8 studies [n = 48 211]) generally showed sensitivities of 0.70 or higher, although the standard of 6 or more drinks per occasion tended to have lower sensitivity than the 5/4 or more drinks standard, often with nonoverlapping confidence intervals. Other adult populations (young adults, older adults, pregnant women) had results in similar ranges.

For the AUDIT-C, sensitivity for detecting the full spectrum of unhealthy alcohol use in adults was similar to the 1- and 2-item screeners, excluding 1 Veterans Affairs-based study in HIV-positive patients and matched controls<sup>45</sup> that had substantially lower sensitivity. In most studies, the range of sensitivities was 0.73 to 0.97 for female participants (5 studies [n = 2714]; 95% CI range, 0.62 to 0.99) (eFigure 2 in the Supplement) and 0.82 to 1.0 for male participants (4 studies [n = 1038]; 95% CI range, 0.75 to 1.0) (eFigure 3 in the Supplement) at the standard score cutoffs of 3 or higher for female participants and 4 or higher for male participants, but the range of reported specificity was much wider (0.28 to 0.91 [95% CI range, 0.21 to 0.93] for female participants and 0.34 to 0.89 [95% CI range, 0.25 to 0.92] for male participants). Several studies reported sensitivities of 0.80 or higher at optimal cutoffs on the AUDIT-C, with

associated specificities generally in the range of mid-0.70s to mid-0.80s (eFigure 1 in the Supplement). Evidence on the use of the AUDIT-C was very sparse in the adult subpopulations of younger adults, older adults, and pregnant women.

For the AUDIT, when using the recommended score cutoff of 8 or higher, studies (7 studies [n = 8852]) reported a wide range of sensitivity for detecting the full spectrum of unhealthy alcohol use in general adult populations (range, 0.38 to 0.73 [95% CI range, 0.33 to 0.84]) but high specificity (range, 0.89 to 0.97 [95% CI range, 0.84 to 0.98]) (eFigure 4 in Supplement). Sensitivity was relatively high (0.82) in young adults at the standard score cutoff of 8 or higher, but data were sparse in this population (2 studies [n = 660]). In many studies, sensitivity improved at lower cutoffs. Studies conducted in US primary care settings generally showed a more optimal balance of sensitivity and specificity at cutoffs of 3, 4, or 5 (3 trials [n = 2782]; sensitivity range, 0.64 to 0.86 [95% CI range, 0.57 to 0.91]; specificity range, 0.74 to 0.94 [95% CI range, 0.68 to 0.95]) (eFigure 5 in the Supplement).

At a sensitivity of 0.80 and a specificity of 0.90, the positive predictive value was estimated at 74% and the negative predictive value was estimated at 93% among adults with heavy use episodes in the past month (eTable 4 in the Supplement), using prevalence estimates for the US general population. Among population groups with lower prevalence of unhealthy alcohol use—older adults, pregnant women, and adolescents—the estimated positive predictive value was much lower, ranging from 26% to 46%.

Table 2. Summary Intervention Characteristics for Key Questions 4 and 5 (All Intervention Conditions)

Population	Studies	Participants	Intervention Groups	No. (% of Intervention Groups)			Estimated Total Contact, Median (Range), min	Web- or Computer-Based Only	Personalized Normative Feedback	Motivational Intervening or Motivational Enhancement	Primary Care Team Involved	PCP Delivered Most/All of Intervention
				Single Session	Multiple Sessions	Other						
All populations	68	36 528	94	51 (54)	40 (43)	3 (3)	30 (1-600)	30 (32)	58 (62)	36 (38)	29 (31)	16 (17)
Adolescents	2	588	2	1 (50)	1 (50)		20 <sup>a</sup>	0	2 (100)	1 (50)	0	0
Adults (nonpregnant/postpartum)	55	33 662	80	44 (55)	33 (41)	3 (4)	30 (1-600)	27 (34)	53 (66)	29 (36)	29 (36)	16 (20)
Young adults	22	14 214	38	30 (79)	7 (18)	1 (mail only)	35 (1-600)	23 (61)	34 (89)	10 (26)	2 (5)	2 (5)
Adults	29	16 944	38	14 (37)	22 (58)	2 (not prescribed)	30 (3-555)	4 (11)	18 (47)	17 (45)	24 (63)	13 (34)
Older adults	4	2 504	4	0	4 (100)		80 (30-140)	0	1 (25)	2 (50)	3 (75)	1 (25)
Pregnant/postpartum	11	2 278	12	6 (50)	6 (50)		22 (10-80)	3 (25)	3 (25)	6 (50)	0	0
Pregnant	9	1 920	10	5 (50)	5 (50)		22 (10-80)	2 (20)	2 (20)	4 (40)	0	0
Postpartum	2	358	2	1 (50)	1 (50)		30 (20-40)	1 (50)	1 (50)	2 (100)	0	0

Abbreviation: PCP, primary care physician.

<sup>a</sup> Able to estimate total minutes for only 1 trial in adolescents.

### Harms of Screening

**Key Question 3.** What are the harms of screening for unhealthy alcohol use in adolescents and adults, including pregnant women?

No eligible studies were identified.

### Benefits of Interventions

**Key Question 4a.** Do counseling interventions to reduce unhealthy alcohol use, with or without referral, reduce unhealthy alcohol use or improve other risky behaviors in screen-detected persons?

Sixty-eight trials<sup>70-137</sup> (n = 36528) were included (reported in 100 publications<sup>70-169</sup>) that addressed the effect of a counseling intervention on alcohol use. Two of the trials targeted adolescents,<sup>92,109</sup> 22 targeted college-aged or young adults,<sup>71,75,79,83,87,96,98-101,103-105,107,108,111-113,125,129,133</sup> 29 addressed general adult populations,<sup>70,72-74,76,80-82,84,85,88,91,93-95,97,106,114,120,122,124,126-128,131,134,137</sup> 4 focused on older adults,<sup>86,90,110,136</sup> and 11 targeted pregnant<sup>77,78,115,116,118,119,123,130,132</sup> or postpartum<sup>89,117</sup> women. Details of the included trials are reported in eTable 3 in the Supplement. Most trials were conducted in the United States (41/68 [60%]) and in primary care settings (42/68 [62%]). Trials were typically limited to participants who reported a prespecified level of alcohol use (most commonly either more than 7 [female participants] or 14 [male participants] drinks per week on average, or 4 [female participants] or 5 [male participants] or more drinks on a single occasion) or scored above a predetermined cut-off on a screening instrument such as the AUDIT. Ten trials were rated as good quality<sup>71,86,88,91,92,100,123,129,133,136</sup> and the remaining were fair quality. Nineteen trials (28%) were included in the previous review.

Most interventions involved 1 to 2 sessions (90% involved 4 or fewer sessions), with a median of 30 minutes of contact time (88% involved 2 hours of contact or less) (Table 2). Almost all interventions involved at least basic education; general feedback, such as how the participant's drinking compared with recommended limits; and suggestions about how to reduce alcohol use. Many, particularly those in primary care settings, used a SBIRT (screening, brief intervention, and referral to treatment) approach, consistent with approaches recommended by several health organizations. The most commonly reported intervention element was the use of personalized normative feedback sessions, in which participants were shown how their alcohol use compared with that of others; this technique was used in 62% of the included interventions and 89% of the interventions in younger adults. Motivational techniques were also common, particularly in combination with personalized normative feedback.

Most trials in adolescents and young adults involved 1 or 2 in-person or web-based personalized normative feedback sessions in school or university settings. Counseling interventions targeting adults other than college students (including pregnant and postpartum women) were more likely to take place in primary care settings, have multiple sessions, and involve the primary care team in some way; 33% of the interventions were delivered by the primary care clinician in trials of general and older adult populations.

Six trials (in 7 intervention groups) incorporated feedback on how an individual's alcohol consumption was affecting his or her health, such as elevated liver enzyme levels, symptoms or medical conditions that could be exacerbated by alcohol use,

and potentially dangerous alcohol use with prescribed medications.<sup>73,86,93,110,132,134</sup>

The most commonly reported alcohol use outcome was drinks per week, reported in 45 trials. On average, individuals in intervention groups reduced their drinking by 1.6 drinks per week more than those in control groups after 6 to 12 months (32 trials and 37 analysis groups [n = 15 974]; weighted mean difference [WMD] between groups in change from baseline, -1.6 [95% CI, -2.2 to -1.0];  $I^2 = 63%$ ) (Figure 4, Table 3). This analysis included only 1 trial in adolescents, with separate entries for moderate- and high-risk users, and so is primarily reflective of adult unhealthy alcohol users. Baseline use levels were highly variable, with trial baseline means ranging from 3.8 to 59.3 drinks per week across all populations, and larger effects were typically seen with larger baseline use levels. The intervention group means changed from 20.5 drinks per week at baseline to 15.6 drinks per week at follow-up; control group means changed from 20.1 at baseline to 17.4 at follow-up. Excluding trials in adolescents and young adults, whose drinking patterns were generally typified by heavy use episodes rather than daily heavy drinking, the mean drinks per week in adult populations changed from 26.0 at baseline to 19.1 at follow-up in the intervention groups and from 25.6 at baseline to 21.6 in the control groups.

Trials that could not be included in the meta-analysis generally showed effects of a similar or slightly smaller size, favoring the intervention group (eg, between-group differences in change ranging from 0.9 to 1.8 drinks/wk, or posttest differences of 2.3 drinks/wk, or 10% to 20% relative reductions in use). The associations remained statistically significant when limited to trials conducted in primary care settings (21 trials [n = 7803]; WMD, -2.4 [95% CI, -3.4 to -1.3];  $I^2 = 70%$ ), in the United States (18 trials [n = 8766]; WMD, -1.3 [95% CI, -1.9 to -0.6];  $I^2 = 64%$ ), and in US-based primary care settings (9 trials [n=4989]; WMD, -1.8 [95% CI, -2.9 to -0.6];  $I^2 = 77%$ ) (Figure 5). For trials with multiple follow-up assessments, effects were typically maintained between 6 and 12 months of follow-up; however, in several trials of young adults, group differences at 6 months' follow-up were no longer statistically significant at 12 months' follow-up.<sup>75,87,99,125</sup> Seven trials<sup>70,88,90,95,102,107,114</sup> reported follow-up at 24 months or beyond, and group differences were maintained in 4 of these through 24 months<sup>90,107,112</sup> to 48 months.<sup>88</sup>

A small-studies effect was identified for drinks per week (Egger test bias coefficient, -1.04;  $P = .03$ ) (eFigure 6 in the Supplement), and earlier publication date, younger population age (young adults vs other adults), and higher baseline drinking levels were also associated with larger effect sizes (Figure 5). These factors were not independent of each other, however, and it could not be determined which had a causal association with effect size. Smaller trials were more likely to have been published before 2007 and to have been conducted among heavier drinkers. Older trials were also primarily conducted among general adult populations in primary care settings, whereas many of the newer trials were conducted among young adults in college settings, with baseline use levels that were considerably lower than those in trials targeting general adult populations. Associations between effect size and intervention elements or other populations or study characteristics were generally not found.

The intervention was associated with a reduction in the odds of exceeding recommended drinking limits at 6 to 12 months of

follow-up (15 trials [16 effects; n = 9760]; odds ratio [OR], 0.60 [95% CI, 0.53 to 0.67];  $I^2 = 24%$ ) (Table 3; eFigure 7 in the Supplement), although this outcome was reported in only 24% (16/68) of the included studies. Between 15% and 76% of participants exceeded recommended drinking limits at follow-up in the intervention groups, compared with 29% to 82% in the control groups. Similarly, there was a reduction in the pooled odds of reporting an episode of heavy use (12 trials [14 effects; n = 8108]; OR, 0.67 [95% CI, 0.58 to 0.77];  $I^2 = 24%$ ) (Table 3; eFigure 8 in the Supplement), which was also relatively sparsely reported. Between 10% and 76% of intervention participants reported heavy use episodes at follow-up, compared with 13% to 92% in control groups. Small-studies effects were not detected for either of these outcomes. The 9 trials in pregnant women were most likely to report the odds of abstinence rather than the aforementioned outcomes; abstinence was higher in the intervention groups compared with the control groups (5 trials [n = 796]; pooled OR, 2.26 [95% CI, 1.43 to 3.56];  $I^2 = 0%$ ) (Table 3; eFigure 9 in the Supplement). Among trials reporting abstinence before delivery, abstinence ranged from 72% to 90% among intervention participants and from 55% to 74% among control participants. Other alcohol use outcomes were very sparsely reported and generally showed no statistically significant differences between groups.

Few changes in other behavioral outcomes such as drug use, sex after alcohol use, and seeking help for unhealthy alcohol use were noted, and those outcomes were only rarely reported. One trial<sup>82</sup> in a general adult population found a reduction in self-reported drinking and driving, but 2 trials, in younger<sup>125</sup> and older<sup>86</sup> adults, did not. The latter trial in older adults also reported that participants reduced the likelihood of using alcohol in the face of symptoms or comorbidities that could be exacerbated by alcohol and with medication that could interact negatively with alcohol.<sup>86</sup>

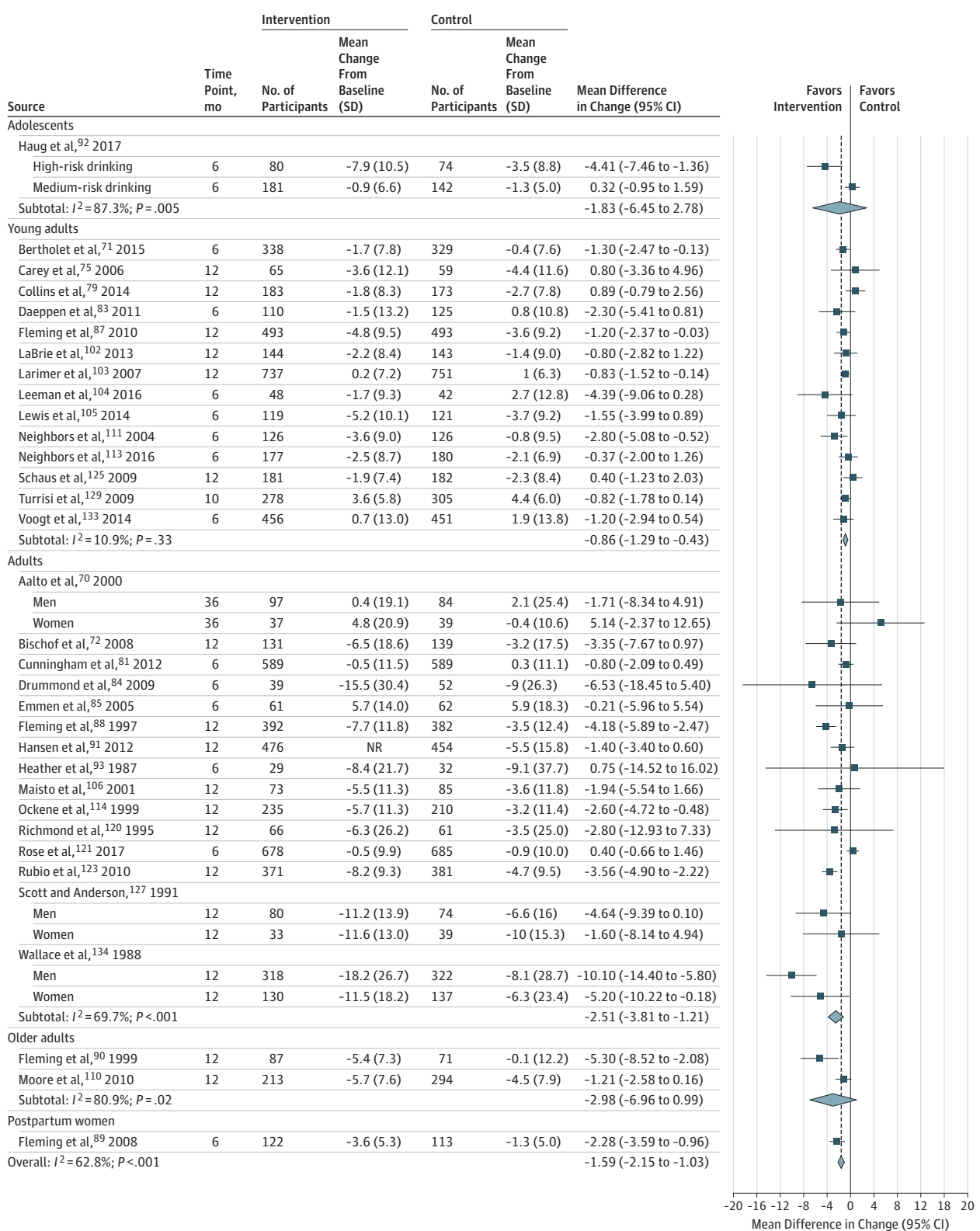
**Key Question 4b.** Do counseling interventions to reduce unhealthy alcohol use, with or without referral, reduce morbidity or mortality or improve other health, social, or legal outcomes in screen-detected persons?

The most commonly reported health outcome was alcohol-related problems or consequences, measured using a variety of instruments. A pooled analysis showed a statistically significant, but very small, standardized mean difference in change between groups of -0.04 (18 trials [n = 9894]; 95% CI, -0.09 to -0.01;  $I^2 = 3%$ ). This effect size (Hedges  $g$ ) can be interpreted as a Cohen  $d$ , where a small effect is typically considered to be 0.20 to 0.50.<sup>170</sup> Mortality was reported in 8 trials, primarily as part of the description of the participant retention. The pooled association was not statistically significant (9 trials [n = 4533]; OR, 0.64 [95% CI, 0.34 to 1.19];  $I^2 = 0%$ ) (eFigure 10 in the Supplement) and also may represent an overestimate of the true effect, since some trials that did not report deaths likely had no deaths, particularly trials among young adults. Trials were not powered for this outcome and many had very few events, resulting in imprecise results.

One trial, the Trial for Early Alcohol Treatment (TrEAT), described ascertainment methods.<sup>88</sup> The effect on mortality at 4 years, 0.8% (3/392) of intervention participants dying compared with 1.8% (7/382) of control participants, was not statistically significant. Differences in mortality between groups were statistically significant at 3 years of follow-up, when there had been only 1 death among intervention participants but 7 among



Figure 4. Drinks per Week (Key Question 4a), Mean Difference in Change Between Alcohol Counseling Interventions and Control Groups, by Population



Weights are from random-effects analysis.

Table 3. Summary of Meta-analysis Results, Primary Drinking Outcomes for Key Question 4a

Outcome (Effect Measure)	No. of Studies (No. of Effects Analyzed)	No. Participants Analyzed	Pooled Effect (95% CI)	I <sup>2</sup> , %	τ <sup>2</sup>
<b>Drinks/wk, Between-Group Difference in Change From Baseline (Weighted Mean Difference)</b>					
All populations	32 (37)	15 974	-1.59 (-2.15 to -1.03)	63	1.40
Adolescents	1 (2)	477	-1.83 (-6.45 to 2.78)	87	9.77
Young adults	14 (14)	6935	-0.86 (-1.29 to -0.43)	11	0.07
Adults	15 (18)	7662	-2.51 (-3.81 to -1.21)	70	3.73
Older adults	2 (2)	665	-2.98 (-6.96 to 0.99)	81	6.77
Pregnant women	0	0	NR		
Postpartum women	1 (1)	235	-2.28 (-3.59 to -0.96)	NA	NA
<b>% Exceeding Recommended Drinking Limits (OR)</b>					
All populations	15 (16)	9760	0.60 (0.53 to 0.67)	24	0.01
Adolescents	0	0	NR		
Young adults	2 (2)	3068	0.71 (0.60 to 0.86)	0	0.0
Adults	10 (11)	4964	0.56 (0.49 to 0.65)	14	0.01
Older adults	3 (3)	1728	0.58 (0.41 to 0.80)	24	0.02
Pregnant women	0	0	NR		
Postpartum women	0	0	NR		
<b>% With Heavy Use episodes (OR)</b>					
All populations	12 (14)	8108	0.67 (0.58 to 0.77)	24	0.01
Adolescents	1 (2)	477	0.55 (0.22 to 1.34)	52	0.24
Young adults	2 (2)	2247	0.81 (0.63 to 1.05)	0	0.0
Adults	6 (7)	3683	0.65 (0.53 to 0.81)	44	0.03
Older adults	3	1701	0.59 (0.44 to 0.80)	0	0.0
Pregnant women	0	0	NR		
Postpartum women	0	0	NR		
<b>% Abstinent From Alcohol (OR)</b>					
Pregnant women	5	796	2.26 (1.43 to 3.56)	0	0.0

Abbreviations: NA, not applicable; NR, not reported; OR, odds ratio.

controls. This trial also reported statistically significant reductions in days of hospitalization (420 in the intervention group vs 664 in the control group) and controlled substance or liquor violations (2 in the intervention group vs 11 in the control group) at 4 years of follow-up. Other trials reported a wide variety of health outcomes, generally at 6 to 12 months of follow-up, with few findings of benefit for intervention over control groups.

### Harms of Interventions

**Key Question 5.** What are the harms of interventions to reduce unhealthy alcohol use in screen-detected persons?

Only 6 of the included trials (n = 3650) of counseling interventions to reduce unhealthy alcohol use reported on harms.<sup>72,103,105,113,116,136</sup> In all cases, authors reported no harms in both groups. Further, no pattern of unexpected paradoxical increases in alcohol use was noted with these interventions.

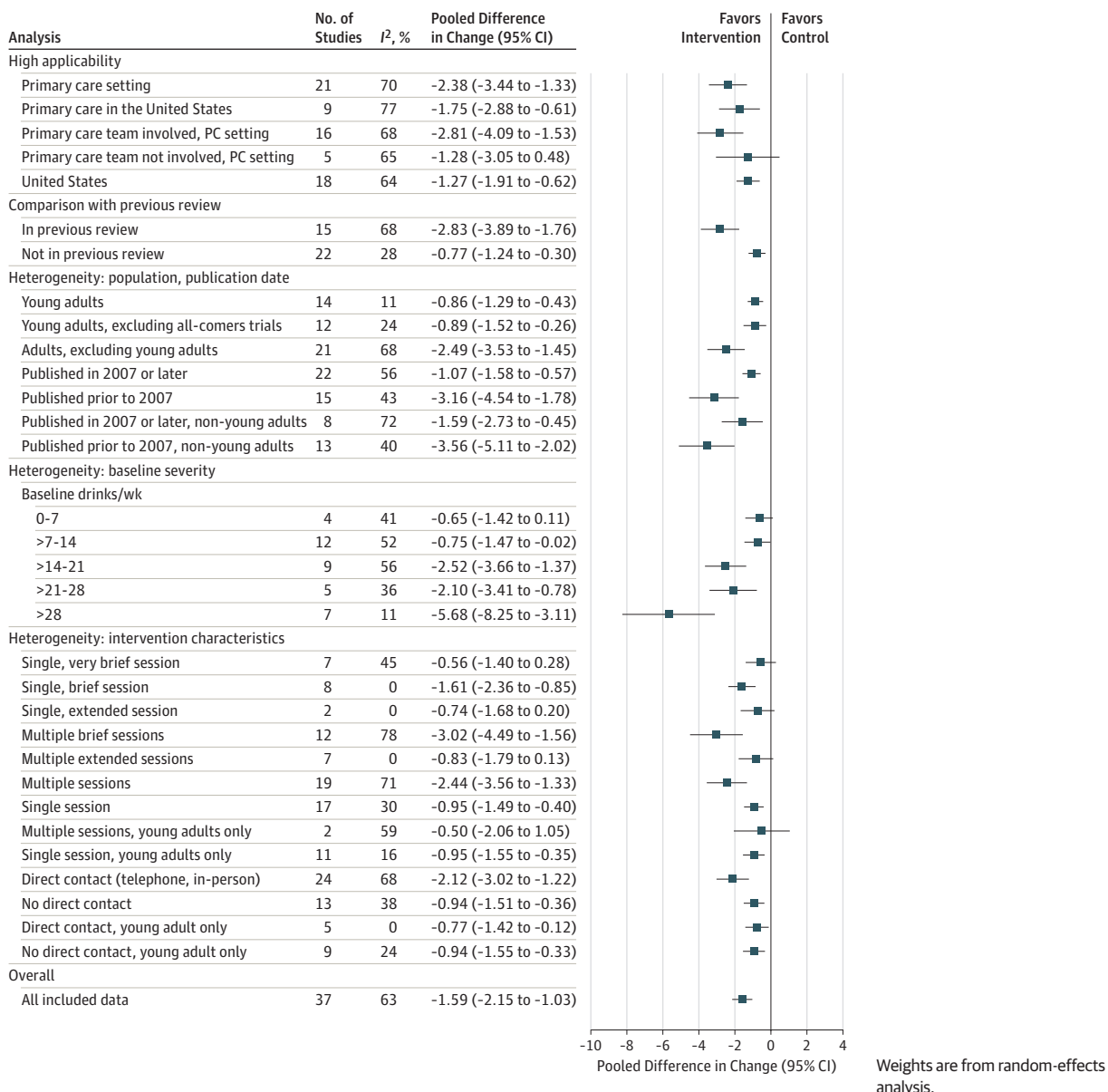
## Discussion

The evidence in this review is summarized in Table 4. No evidence was found for screening programs to reduce unhealthy alcohol use or improve health, compared with usual care without screening. Multiple screening instruments are available that can detect unhealthy alcohol use with reasonable accuracy and that require 1 or 2 minutes to administer. For example, studies of adults found that the

NIAAA-recommended single question had sensitivity ranging from 0.73 to 0.88 and specificity from 0.74 to 1.0 for detecting unhealthy alcohol use. For the AUDIT-C, sensitivity was similar, but the range of reported specificity was wider. For the full AUDIT, range of sensitivity was wide (0.38-0.73) using the recommended score cut-off of 8 or higher, but range of specificity was high (0.89-0.97). This pattern supports the use of a brief screener to identify excess use, followed by assessment with a more detailed instrument with greater specificity (eg, the AUDIT), as is currently done in some health care systems.<sup>171-173</sup> If used as an initial screening test, data for the AUDIT from US primary care settings suggests that lower cutoffs (eg, 3, 4, or 5) may be preferable to provide a more optimal balance of sensitivity and specificity for detecting the full spectrum of unhealthy alcohol use. Given the relatively brief time required for follow-up questions after a positive screen to confirm the presence of unhealthy alcohol use and determine its extent (if present), clinicians may prioritize sensitivity over specificity for the initial screening and may consider calibrating the optimal cutoff for their setting.

One limitation of the evidence on the accuracy of screening instruments is that studies sometimes used variations of the standard instruments and cutpoints, and the gold standard was also heterogeneous across studies (eg, the definition of "exceeding recommended limits" varied across countries). This likely increased the variability in results but also supports the robustness of these tools, even with modifications. Use of the USAUDIT and USAUDIT-C, designed to use the United States' standard drink size and to return

Figure 5. Subgroup and Sensitivity Analysis Results for Drinks per Week (Key Question 4a), Mean Difference in Change Between Alcohol Counseling Interventions and Control Groups, by Indicated Subgroup of Trials



results consistent with NIAAA recommendations, is likely to improve on the performance of the standard AUDIT and AUDIT-C.<sup>174</sup> No studies on the USAUDIT or USAUDIT-C were published during the search window; however, a newly published study conducted among college students confirms that the performance characteristics of these instruments are improved over those of the standard AUDIT and AUDIT-C for determining whether someone exceeds the NIAAA-recommended drinking limits.<sup>175</sup>

Among adults identified through screening, counseling interventions to reduce unhealthy alcohol use were associated with reductions in alcohol use (by a mean of 1.6 drinks/wk) and in the odds of exceeding recommended drinking limits (by 40%) and heavy use episodes (by 33%) at 6 to 12 months of follow-up. Based on these findings, among adult unhealthy alcohol users, and assuming 33% of control group participants were drinking within recommended

limits at follow-up (the median of the included trials), such interventions would result in an absolute increase of 14 percentage points in the likelihood of drinking within recommended limits, meaning 7 adults would need to be treated to achieve 1 drinking within recommended limits (number needed to treat [NNT], 7.2 [95% CI, 6.2 to 11.5]). Among pregnant women, counseling interventions were associated with an odds ratio of 2.26 for remaining abstinent from alcohol during pregnancy, for an NNT of 6.0 (95% CI, 4.3 to 12.5), assuming a baseline rate of 62% of women being abstinent from alcohol. Very limited data suggested that benefits from alcohol use counseling interventions can be maintained over 2 to 4 years.

Although many trials reported health, social, legal, and related outcomes, no specific outcomes were widely reported. Very limited information on harms of the included intervention was found, but the fact that most results favored the intervention groups across

**Table 4. Summary of Evidence**

No. Studies (Design), No. of Participants	Summary of Findings	Consistency and Precision	Limitations (Includes Reporting Bias)	Strength of Evidence	Applicability
<b>KQ1: Benefits of Screening</b>	NA	NA	NA	Insufficient	NA
<b>KQ2: Screening Accuracy</b>	<p>For adolescents, data supported the use of the NIAAA Youth Screen and other 1- or 2-item screeners to detect AUD; however, data were insufficient to determine whether brief (1-3 items) screeners or the AUDIT can detect unhealthy use</p> <p>Preliminary evidence suggests lower cutoffs than the standard <math>\geq 8</math> would be preferred for the AUDIT if used</p> <p>For adults, brief (1-3 items) screeners commonly reported sensitivity and specificity between 0.70 and 0.85, typically having better sensitivity than the full AUDIT for identifying the full spectrum of unhealthy use; however, the AUDIT tended to have higher specificity, particularly at the standard cutoff of <math>\geq 8</math></p> <p>Evidence supports the use of brief instruments as initial screeners, where high sensitivity and lower specificity would be desirable, followed by use of a longer instrument, such as the AUDIT, with greater specificity</p>	<p>Reasonably consistent, reasonably precise (to detect AUD)</p> <p>Consistency and precision NA (to predict unhealthy use)</p> <p>Reasonably consistent, reasonably precise</p>	<p>Information around the administration of the screening test and reference standard (order of tests, blinding of interviewer to the results of the index test while administering the reference standard) often not well reported</p> <p>No reporting bias suspected</p>	<p>Moderate (adolescents, to detect AUD)</p> <p>Insufficient (adolescents, to detect full spectrum of unhealthy alcohol use)</p> <p>High (adults)</p>	<p>Many in US primary care, including studies covering both general populations and targeted subgroup with comorbidities and in different types of settings (eg, including the VA and Indian Health Service)</p> <p>US-based studies outside of primary care included epidemiologic surveys with sampling to be representative of the US population, with oversampling of racial/ethnic minorities in some cases</p> <p>Young adult studies primarily in college settings</p>
<b>KQ3: Harms of Screening</b>	NA	NA	NA	Insufficient	NA
<b>KQ4a: Benefits of Interventions—Alcohol Use and Other Risky Behaviors</b>	<p>Interventions reduced drinks/wk (WMD, -1.59 [95% CI -2.15 to -1.03]), the proportion exceeding recommended drinking limits (OR, 0.60 [95% CI, 0.53 to 0.67]), and the proportion reporting a heavy use episode (OR, 0.67 [95% CI, 0.58 to 0.77]), and increased the proportion of pregnant women reporting abstinence (OR, 2.26 [95% CI, 1.43 to 3.56])</p> <p>Outcomes were generally reported at 6- to 12-mo follow-up or during the late pregnancy or early postpartum period for abstinence during pregnancy</p> <p>Benefits remained through 24 mo or beyond in 4 of 7 trials with longer-term outcomes</p> <p>Heterogeneity was high and effect size was associated with a number of study (but not intervention) characteristics</p> <p>Reduction in self-reported drinking after driving in 2 of 3 trials</p> <p>Only 2 trials included adolescents</p>	<p>Inconsistent and imprecise (adolescents)</p> <p>Reasonably consistent, reasonably precise (adults)</p>	<p>Inconsistency of outcomes reported and some important outcomes sparsely reported, such as proportion meeting or exceeding recommended drinking limits; risk of social desirability bias</p> <p>Reporting bias suspected, owing to detected small-studies bias</p>	<p>Low for benefit (adolescents)</p> <p>Moderate for benefit (adults)</p>	<p>Majority of trials conducted in the United States, in primary care, and in the past 10 y, with representation from a wide range of important subpopulations (eg, young adults, older adults, pregnant and postpartum women, low income, with comorbidities; racial/ethnic minorities)</p>

(continued)

Table 4. Summary of Evidence (continued)

No. Studies (Design), No. of Participants	Summary of Findings	Consistency and Precision	Limitations (Includes Reporting Bias)	Strength of Evidence	Applicability
<b>KQ4b: Benefits of Interventions—Health, Social, and Legal Outcomes</b> 41 (RCTs) n = 20 324	No evidence in adolescents In adults, studies reported a statistically nonsignificant reduction in all-cause mortality (OR, 0.64 [0.34 to 1.19]) but were underpowered, usually had unclear ascertainment methods, and likely overestimated effect, since many trials not reporting all-cause mortality likely had no deaths Reductions in emergency department visits or controlled substance or liquor violations at 4-y follow-up in 1 good-quality study Small reduction in alcohol-related consequences in trials of young adults (SMD, -0.06 [95% CI, -0.11 to 0.01]) Other health outcomes sparsely reported, usually not statistically significant, and did not consistently favor the intervention group 1 trial in pregnant women found higher birth weight among those in the intervention group, but other pregnancy and birth outcomes showed no between-group differences	Mortality, alcohol-related consequences: reasonably consistent, imprecise Other outcomes: inconsistent, imprecise	Wide range of outcomes reported with little replication and few studies reporting any particular outcome; mortality underpowered with ascertainment usually not described Possible reporting bias for mortality, since all studies reporting had at least 1 death	Insufficient (adolescents) Low for benefit (adults)	Majority of trials conducted in the United States, in primary care, and in the past 10 y, with representation from a wide range of important subpopulations (eg, young adults, older adults, pregnant and postpartum women, low income, individuals with comorbidities, racial/ethnic minorities)
<b>KQ5: Harms of Interventions</b> 6 (RCTs) n = 3650	All trials reporting on adverse effects had 0 adverse effects in both groups Across all included studies, no pattern of paradoxical effects suggesting risk of harm	Reasonably consistent, imprecise	Sparsely reported No reporting bias detected	Low for no harms	Majority of trials conducted in the United States, in primary care, and in the past 10 y

Abbreviations: AUD, alcohol use disorder; AUDIT, Alcohol Use Disorders Identification Test; KQ, key question; NA, not applicable; NIAAA, National Institute on Alcohol Abuse and Alcoholism; OR, odds ratio; RCT, randomized clinical trial; SMD, standardized mean difference; VA, US Department of Veterans Affairs; WMD, weighted mean difference.

a wide range of outcomes, even though differences were not always statistically significant, suggests very low risk of harm. Several studies reported on the acceptability of their interventions to participants and generally reported positive to very positive ratings.<sup>79,97,116,117,130</sup>

Findings in the current review were generally consistent with the findings of the previous USPSTF review.<sup>176</sup> For test accuracy, the previous reviewers concluded that a single-question screener, the AUDIT-C, and the AUDIT appeared to be the best overall instruments for screening adults for the full spectrum of unhealthy alcohol use in primary care, with ranges of sensitivities and specificities solidly in the range of the sensitivities and specificities seen in this review among studies of adults. In the current review, original studies were examined rather than existing systematic reviews, and at least 60% of the studies included in this review were newly published since the previous review. Among the newly included evidence are 10 studies in adolescents, who were not previously represented.

For counseling interventions, overall, the pooled effect size for drinks per week was larger in the previous review,<sup>176</sup> although results were quite similar for general and older adult populations and for other drinking outcomes. One of the main differences between the 2 reviews is the inclusion of studies conducted outside of primary care settings in the current review, which resulted in the inclusion of a substantial number of studies in college settings. Consistent with the previous review was the finding of a fairly large but statistically nonsignificant association between interventions and reduced all-cause mortality (OR, 0.64 [95% CI, 0.34 to 1.19] in the current review; relative risk, 0.52 [95% CI, 0.22 to 1.22] in the previous review).

Areas for future research include direct comparisons of screening programs with usual care (without universal screening); further evaluations of the versions of the AUDIT and AUDIT-C recently developed for the United States (USAUDIT and USAUDIT-C); interventions to reduce unhealthy alcohol use in populations of adolescents, young adults, and older adults in health care settings; and exploration of more intensive intervention approaches with young adults. One important limitation of evidence on the benefits and harms of alco-

hol counseling interventions is the lack of a consistently reported group of outcomes. It would be beneficial for trials to routinely report outcomes with the greatest clinical meaning, such as the proportion of participants drinking within recommended limits, and to report health (including alcohol-related medical conditions), social, and legal outcomes. It would also be useful for trials to commit a priori to reporting subgroup effects in important subpopulations, such as by age group, sex, race/ethnicity, and baseline severity.

### Limitations

This evidence review has several limitations. First, comparative effectiveness trials—which have the potential to identify important features or mechanisms of change—were not included; however, other reviews that have included comparative effectiveness reviews have had very limited success in identifying mechanisms of change. Second, evidence regarding use of medication in treatment of AUD was not included. While this is primarily relevant to individuals being treated for more severe disorders rather than to most people with unhealthy alcohol use in screen-detected samples, medication would likely be appropriate for some patients identified through screening. A previous review found that multiple medications were associated with reductions in drinking and maintenance of abstinence for people with moderate to severe AUD, with NNTs from 12 to 20.<sup>177</sup> Third, among adolescents, trials addressing prevention of unhealthy alcohol use were not included. This was outside the scope of the review but may be an important body of literature to consider when developing recommendations for adolescents.

### Conclusions

Among adults, screening instruments feasible for use in primary care are available that can effectively identify people with unhealthy alcohol use, and counseling interventions in those who screen positive are associated with reductions in unhealthy alcohol use. There was no evidence that these interventions have unintended harmful effects.

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**Concept and design:** O'Connor, Perdue, Patnode, Jonas.

**Acquisition, analysis, or interpretation of data:** O'Connor, Perdue, Senger, Rushkin, Bean, Jonas.

**Drafting of the manuscript:** O'Connor, Rushkin, Bean, Jonas.

**Critical revision of the manuscript for important intellectual content:** O'Connor, Perdue, Senger, Patnode, Jonas.

**Statistical analysis:** O'Connor, Perdue, Jonas.

**Administrative, technical, or material support:** Perdue, Senger, Rushkin, Patnode, Bean, Jonas.

**Supervision:** Jonas.

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and 9 federal partner reviewers from the National Institute of Alcohol Abuse and Alcoholism, National Institute of Mental Health, Office of Research on Women's Health, National Center of Birth Defects and Developmental Disabilities, and the National Institute of Dental and Craniofacial Research. Comments from reviewers were presented to the USPSTF during its deliberation of the evidence and were considered in preparing the final evidence review. Peer reviewers and those commenting on behalf of partner organizations did not receive financial compensation for their contributions.

**Editorial Disclaimer:** This evidence report is presented as a document in support of the accompanying USPSTF Recommendation Statement. It did not undergo additional peer review after submission to *JAMA*.

## REFERENCES

- Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *JAMA*. 2004;291(10):1238-1245. doi:10.1001/jama.291.10.1238
- Stahre M, Roeber J, Kanny D, Brewer RD, Zhang X. Contribution of excessive alcohol consumption to deaths and years of potential life lost in the United States. *Prev Chronic Dis*. 2014;11:E109. doi:10.5888/pcd11.130293
- Center for Behavioral Health Statistics and Quality. Results from the 2016 National Survey on Drug Use and Health: Detailed Tables. Substance Abuse and Mental Health Services Administration website. <https://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs-2016/NSDUH-DetTabs-2016.pdf>. 2017. Accessed October 2, 2017.
- Rehm J, Gmel GE Sr, Gmel G, et al. The relationship between different dimensions of alcohol use and the burden of disease—an update. *Addiction*. 2017;112(6):968-1001. doi:10.1111/add.13757
- National Institute on Alcohol Abuse and Alcoholism (NIAAA). Harmful Interactions: Mixing Alcohol With Medicines. NIAAA website. [https://pubs.niaaa.nih.gov/publications/Medicine/Harmful\\_Interactions.pdf](https://pubs.niaaa.nih.gov/publications/Medicine/Harmful_Interactions.pdf). Published 2014. Accessed August 2, 2018.
- Moyer VA; Preventive Services Task Force. Screening and behavioral counseling interventions in primary care to reduce alcohol misuse: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2013;159(3):210-218.
- U.S. Preventive Services Task Force. *U.S. Preventive Services Task Force Procedure Manual*. Rockville, MD: Agency for Healthcare Research and Quality; 2015.
- United Nations Development Programme (UNDP). Human Development Report 2015: Work for Human Development. UNDP website. [http://hdr.undp.org/sites/default/files/2015\\_human\\_development\\_report\\_1.pdf](http://hdr.undp.org/sites/default/files/2015_human_development_report_1.pdf). Published 2015. Accessed January, 2016.
- Whiting PF, Rutjes AW, Westwood ME, et al; QUADAS-2 Group. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. *Ann Intern Med*. 2011;155(8):529-536. doi:10.7326/0003-4819-155-8-201110180-00009
- DerSimonian R, Kacker R. Random-effects model for meta-analysis of clinical trials: an update. *Contemp Clin Trials*. 2007;28(2):105-114. doi:10.1016/j.cct.2006.04.004
- Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ*. 1997;315(7109):629-634. doi:10.1136/bmj.315.7109.629
- Aalto M, Alho H, Halme JT, Seppä K. AUDIT and its abbreviated versions in detecting heavy and binge drinking in a general population survey. *Drug Alcohol Depend*. 2009;103(1-2):25-29. doi:10.1016/j.drugalcdep.2009.02.013
- Aalto M, Alho H, Halme JT, Seppä K. The Alcohol Use Disorders Identification Test (AUDIT) and its derivatives in screening for heavy drinking among the elderly. *Int J Geriatr Psychiatry*. 2011;26(9):881-885. doi:10.1002/gps.2498
- Aertgeerts B, Buntinx F, Bande-Knops J, et al. The value of CAGE, CUGJE, and AUDIT in screening for alcohol abuse and dependence among college freshmen. *Alcohol Clin Exp Res*. 2000;24(1):53-57. doi:10.1111/j.1530-0277.2000.tb04553.x
- Bartoli F, Crocamo C, Biagi E, et al. Clinical utility of a single-item test for DSM-5 alcohol use disorder among outpatients with anxiety and depressive disorders. *Drug Alcohol Depend*. 2016;165:283-287. doi:10.1016/j.drugalcdep.2016.06.003
- Boschloo L, Vogelzangs N, Smit JH, et al. The performance of the Alcohol Use Disorder Identification Test (AUDIT) in detecting alcohol abuse and dependence in a population of depressed or anxious persons. *J Affect Disord*. 2010;126(3):441-446. doi:10.1016/j.jad.2010.04.019
- Bradley KA, Bush KR, Epler AJ, et al. Two brief alcohol-screening tests from the Alcohol Use Disorders Identification Test (AUDIT): validation in a female Veterans Affairs patient population. *Arch Intern Med*. 2003;163(7):821-829. doi:10.1001/archinte.163.7.821
- Buchsbaum DG, Welsh J, Buchanan RG, Elswick RK Jr. Screening for drinking problems by patient self-report: even "safe" levels may indicate a problem. *Arch Intern Med*. 1995;155(1):104-108. doi:10.1001/archinte.1995.00430010112015
- Bull LB, Kvigne VL, Leonardson GR, Lacina L, Welty TK. Validation of a self-administered questionnaire to screen for prenatal alcohol use in Northern Plains Indian women. *Am J Prev Med*. 1999;16(3):240-243. doi:10.1016/S0749-3797(98)00158-5
- Chung T, Smith GT, Donovan JE, et al. Drinking frequency as a brief screen for adolescent alcohol problems. *Pediatrics*. 2012;129(2):205-212. doi:10.1542/peds.2011-1828
- Clark DB, Martin CS, Chung T, et al. Screening for underage drinking and *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* alcohol use disorder in rural primary care practice. *J Pediatr*. 2016;173:214-220.
- Clements R. A critical evaluation of several alcohol screening instruments using the CIDI-SAM as a criterion measure. *Alcohol Clin Exp Res*. 1998;22(5):985-993. doi:10.1111/j.1530-0277.1998.tb03693.x
- Cook RL, Chung T, Kelly TM, Clark DB. Alcohol screening in young persons attending a sexually transmitted disease clinic: comparison of AUDIT, CRAFFT, and CAGE instruments. *J Gen Intern Med*. 2005;20(1):1-6. doi:10.1111/j.1525-1497.2005.40052.x
- Crawford EF, Fulton JJ, Swinkels CM, Beckham JC, Calhoun PS; VA Mid-Atlantic MIRECC OEF/OIF Registry Workgroup. Diagnostic efficiency of the AUDIT-C in U.S. veterans with military service since September 11, 2001. *Drug Alcohol Depend*. 2013;132(1-2):101-106. doi:10.1016/j.drugalcdep.2013.01.012
- D'Amico EJ, Parast L, Meredith LS, Ewing BA, Shadel WG, Stein BD. Screening in primary care: what is the best way to identify at-risk youth for substance use? *Pediatrics*. 2016;138(6):e20161717. doi:10.1542/peds.2016-1717
- Dawson DA, Grant BF, Stinson FS, Zhou Y. Effectiveness of the derived Alcohol Use Disorders Identification Test (AUDIT-C) in screening for alcohol use disorders and risk drinking in the US general population. *Alcohol Clin Exp Res*. 2005;29(5):844-854. doi:10.1097/01.ALC.0000164374.32229.A2
- Dawson DA, Smith SM, Saha TD, Rubinsky AD, Grant BF. Comparative performance of the AUDIT-C in screening for DSM-IV and DSM-5 alcohol use disorders. *Drug Alcohol Depend*. 2012;126(3):384-388. doi:10.1016/j.drugalcdep.2012.05.029
- Degenhardt LJ, Conigrave KM, Wutzke SE, Saunders JB. The validity of an Australian modification of the AUDIT questionnaire. *Drug Alcohol Rev*. 2001;20(2):143-154. doi:10.1080/O9595230124592
- Demartini KS, Carey KB. Optimizing the use of the AUDIT for alcohol screening in college students. *Psychol Assess*. 2012;24(4):954-963. doi:10.1037/a0028519
- Foxcroft DR, Smith LA, Thomas H, Howcutt S. Accuracy of Alcohol Use Disorders Identification Test for detecting problem drinking in 18-35 year-olds in England: method comparison study. *Alcohol Alcohol*. 2015;50(2):244-250. doi:10.1093/alcalc/agu095
- Gache P, Michaud P, Landry U, et al. The Alcohol Use Disorders Identification Test (AUDIT) as a screening tool for excessive drinking in primary care: reliability and validity of a French version. *Alcohol Clin Exp Res*. 2005;29(11):2001-2007. doi:10.1097/01.alc.0000187034.58955.64
- Gómez A, Conde A, Santana JM, Jorrín A. Diagnostic usefulness of brief versions of Alcohol Use Disorders Identification Test (AUDIT) for detecting hazardous drinkers in primary care settings. *J Stud Alcohol*. 2005;66(2):305-308. doi:10.15288/jsa.2005.66.305
- Gómez A, Conde A, Santana JM, Jorrín A, Serrano IM, Medina R. The diagnostic usefulness of AUDIT and AUDIT-C for detecting hazardous drinkers in the elderly. *Aging Ment Health*. 2006;10(5):558-561. doi:10.1080/13607860600637729
- Gryczynski J, Kelly SM, Mitchell SG, Kirk A, O'Grady KE, Schwartz RP. Validation and performance of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) among adolescent primary care patients. *Addiction*. 2015;110(2):240-247. doi:10.1111/add.12767
- Gual A, Segura L, Contel M, Heather N, Colom J. AUDIT-3 and AUDIT-4: effectiveness of two short forms of the Alcohol Use Disorders Identification Test. *Alcohol Alcohol*. 2002;37(6):591-596. doi:10.1093/alcalc/37.6.591
- Harris SK, Knight JR Jr, Van Hook S, et al. Adolescent substance use screening in primary care: validity of computer self-administered versus clinician-administered screening. *Subst Abuse*. 2016; 37(1):197-203. doi:10.1080/08897077.2015.1014615

37. Isaacson JH, Butler R, Zacharek M, Tzelepis A. Screening with the Alcohol Use Disorders Identification Test (AUDIT) in an inner-city population. *J Gen Intern Med*. 1994;9(10):550-553. doi:10.1007/BF02599279
38. Kelly SM, Gryczynski J, Mitchell SG, Kirk A, O'Grady KE, Schwartz RP. Validity of brief screening instrument for adolescent tobacco, alcohol, and drug use. *Pediatrics*. 2014;133(5):819-826. doi:10.1542/peds.2013-2346
39. Knight JR, Sherritt L, Harris SK, Gates EC, Chang G. Validity of brief alcohol screening tests among adolescents: a comparison of the AUDIT, POSIT, CAGE, and CRAFFT. *Alcohol Clin Exp Res*. 2003;27(1):67-73. doi:10.1111/j.1530-0277.2003.tb02723.x
40. Kokotailo PK, Egan J, Gangnon R, Brown D, Mundt M, Fleming M. Validity of the Alcohol Use Disorders Identification Test in college students. *Alcohol Clin Exp Res*. 2004;28(6):914-920. doi:10.1097/O1.ALC.0000128239.87611.F5
41. Kumar PC, Cleland CM, Gourevitch MN, et al. Accuracy of the Audio Computer Assisted Self Interview version of the Alcohol, Smoking and Substance Involvement Screening Test (ACASI ASSIST) for identifying unhealthy substance use and substance use disorders in primary care patients. *Drug Alcohol Depend*. 2016;165:38-44. doi:10.1016/j.drugalcdep.2016.05.030
42. Levala J, Aalto M. Screening for at-risk drinking in a population reporting symptoms of depression: a validation of the AUDIT, AUDIT-C, and AUDIT-3. *Alcohol Clin Exp Res*. 2015;39(7):1186-1192. doi:10.1111/acer.12763
43. Levy S, Dedeoglu F, Gaffin JM, et al. A screening tool for assessing alcohol use risk among medically vulnerable youth. *PLoS One*. 2016;11(5):e0156240. doi:10.1371/journal.pone.0156240
44. McCann BS, Simpson TL, Ries R, Roy-Byrne P. Reliability and validity of screening instruments for drug and alcohol abuse in adults seeking evaluation for attention-deficit/hyperactivity disorder. *Am J Addict*. 2000;9(1):1-9. doi:10.1080/10550490050172173
45. McGinnis KA, Justice AC, Kraemer KL, Saitz R, Bryant KJ, Fiellin DA. Comparing alcohol screening measures among HIV-infected and -uninfected men. *Alcohol Clin Exp Res*. 2013;37(3):435-442. doi:10.1111/j.1530-0277.2012.01937.x
46. McNeely J, Strauss SM, Saitz R, et al. A brief patient self-administered substance use screening tool for primary care: two-site validation study of the Substance Use Brief Screen (SUBS). *Am J Med*. 2015;128(7):784.e9-784.e19. doi:10.1016/j.amjmed.2015.02.007
47. Northrup TF, Malone PS, Follingstad D, Stotts AL. Using item response theory to improve alcohol dependence screening for African American and white male and female college students. *Addict Disord Their Treat*. 2013;12(2):99-109. doi:10.1097/ADT.0b013e3182627431
48. Piccinelli M, Tessari E, Bortolomasi M, et al. Efficacy of the Alcohol Use Disorders Identification Test as a screening tool for hazardous alcohol intake and related disorders in primary care: a validity study. *BMJ*. 1997;314(7078):420-424. doi:10.1136/bmj.314.7078.420
49. Rumpf HJ, Hapke U, Meyer C, John U. Screening for alcohol use disorders and at-risk drinking in the general population: psychometric performance of three questionnaires. *Alcohol Alcohol*. 2002;37(3):261-268. doi:10.1093/alcalc/37.3.261
50. Rumpf HJ, Wohler T, Freyer-Adam J, Grothues J, Bischof G. Screening questionnaires for problem drinking in adolescents: performance of AUDIT, AUDIT-C, CRAFFT and POSIT. *Eur Addict Res*. 2013;19(3):121-127. doi:10.1159/000342331
51. Santis R, Garmendia ML, Acuña G, Alvarado ME, Arteaga O. The Alcohol Use Disorders Identification Test (AUDIT) as a screening instrument for adolescents. *Drug Alcohol Depend*. 2009;103(3):155-158. doi:10.1016/j.drugalcdep.2009.01.017
52. Seale JP, Boltri JM, Shellenberger S, et al. Primary care validation of a single screening question for drinkers. *J Stud Alcohol*. 2006;67(5):778-784. doi:10.15288/jsa.2006.67.778
53. Smith PC, Schmidt SM, Allensworth-Davies D, Saitz R. Primary care validation of a single-question alcohol screening test [published correction appears in *J Gen Intern Med*. 2010;25(4):375]. *J Gen Intern Med*. 2009;24(7):783-788. doi:10.1007/s11606-009-0928-6
54. Volk RJ, Steinbauer JR, Cantor SB, Holzer CE III. The Alcohol Use Disorders Identification Test (AUDIT) as a screen for at-risk drinking in primary care patients of different racial/ethnic backgrounds. *Addiction*. 1997;92(2):197-206. doi:10.1111/j.1360-0443.1997.tb03652.x
55. López MB, Lichtenberger A, Conde K, Cremonese M. Psychometric properties of brief screening tests for alcohol use disorders during pregnancy in Argentina [in Portuguese]. *Rev Bras Ginecol Obstet*. 2017;39(7):322-329. doi:10.1055/s-0037-1603744
56. McNeely J, Wu LT, Subramaniam G, et al. Performance of the Tobacco, Alcohol, Prescription Medication, and Other Substance Use (TAPS) tool for substance use screening in primary care patients. *Ann Intern Med*. 2016;165(10):690-699. doi:10.7326/M16-0317
57. Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. *Alcohol Clin Exp Res*. 2007;31(7):1208-1217. doi:10.1111/j.1530-0277.2007.00403.x
58. Bush KR, Kivlahan DR, Davis TM, et al. The TWEAK is weak for alcohol screening among female Veterans Affairs outpatients. *Alcohol Clin Exp Res*. 2003;27(12):1971-1978. doi:10.1097/O1.ALC.0000099262.50094.98
59. Dawson DA, Pulay AJ, Grant BF. A comparison of two single-item screeners for hazardous drinking and alcohol use disorder. *Alcohol Clin Exp Res*. 2010;34(2):364-374. doi:10.1111/j.1530-0277.2009.01098.x
60. Frank D, DeBenedetti AF, Volk RJ, Williams EC, Kivlahan DR, Bradley KA. Effectiveness of the AUDIT-C as a screening test for alcohol misuse in three race/ethnic groups. *J Gen Intern Med*. 2008;23(6):781-787. doi:10.1007/s11606-008-0594-0
61. Johnson JA, Lee A, Vinson D, Seale JP. Use of AUDIT-based measures to identify unhealthy alcohol use and alcohol dependence in primary care: a validation study. *Alcohol Clin Exp Res*. 2013;37(suppl 1):E253-E259. doi:10.1111/j.1530-0277.2012.01898.x
62. McNeely J, Cleland CM, Strauss SM, Palamar JJ, Rotrosen J, Saitz R. Validation of self-administered Single-Item Screening Questions (SISQs) for unhealthy alcohol and drug use in primary care patients. *J Gen Intern Med*. 2015;30(12):1757-1764. doi:10.1007/s11606-015-3391-6
63. Northrup TF. Effective measurement of problematic drinking for college students: reducing differential item functioning across gender and race. *Diss Abstr Int B Sci Eng*. 2010;70(7-B):4492.
64. Saitz R, Cheng DM, Allensworth-Davies D, Winter MR, Smith PC. The ability of single screening questions for unhealthy alcohol and other drug use to identify substance dependence in primary care. *J Stud Alcohol Drugs*. 2014;75(1):153-157. doi:10.15288/jsad.2014.75.153
65. Steinbauer JR, Cantor SB, Holzer CE III, Volk RJ. Ethnic and sex bias in primary care screening tests for alcohol use disorders. *Ann Intern Med*. 1998;129(5):353-362. doi:10.7326/0003-4819-129-5-199809010-00002
66. Wu LT, McNeely J, Subramaniam GA, Sharma G, VanVeldhuisen P, Schwartz RP. Design of the NIDA clinical trials network validation study of Tobacco, Alcohol, Prescription medications, and Substance use/misuse (TAPS) tool. *Contemp Clin Trials*. 2016;50:90-97. doi:10.1016/j.cct.2016.07.013
67. Gryczynski J, McNeely J, Wu LT, et al. Validation of the TAPS-1: a four-item screening tool to identify unhealthy substance use in primary care. *J Gen Intern Med*. 2017;32(9):990-996. doi:10.1007/s11606-017-4079-x
68. Whiting P, Rutjes AW, Reitsma JB, Bossuyt PM, Kleijnen J. The development of QUADAS: a tool for the quality assessment of studies of diagnostic accuracy included in systematic reviews. *BMC Med Res Methodol*. 2003;3:25. doi:10.1186/1471-2288-3-25
69. Whiting P, Wolff R. Medical use of cannabinoids—reply. *JAMA*. 2015;314(16):1751-1752. doi:10.1001/jama.2015.11447
70. Aalto M, Saksanen R, Laine P, et al. Brief intervention for female heavy drinkers in routine general practice: a 3-year randomized, controlled study. *Alcohol Clin Exp Res*. 2000;24(11):1680-1686. doi:10.1111/j.1530-0277.2000.tb01969.x
71. Bertholet N, Cunningham JA, Fauzi M, et al. Internet-based brief intervention for young men with unhealthy alcohol use: a randomized controlled trial in a general population sample. *Addiction*. 2015;110(11):1735-1743. doi:10.1111/add.13051
72. Bischof G, Grothues JM, Reinhardt S, Meyer C, John U, Rumpf HJ. Evaluation of a telephone-based stepped care intervention for alcohol-related disorders: a randomized controlled trial. *Drug Alcohol Depend*. 2008;93(3):244-251. doi:10.1016/j.drugalcdep.2007.10.003
73. Burge SK, Amodei N, Elkin B, et al. An evaluation of two primary care interventions for alcohol abuse among Mexican-American patients. *Addiction*. 1997;92(12):1705-1716. doi:10.1111/j.1360-0443.1997.tb02891.x
74. Butler CC, Simpson SA, Hood K, et al. Training practitioners to deliver opportunistic multiple behaviour change counselling in primary care: a cluster randomised trial. *BMJ*. 2013;346:f1191. doi:10.1136/bmj.f1191
75. Carey KB, Carey MP, Maisto SA, Henson JM. Brief motivational interventions for heavy college drinkers: a randomized controlled trial. *J Consult*



- Clin Psychol.* 2006;74(5):943-954. doi:10.1037/0022-006X.74.5.943
- 76.** Chang G, Fisher ND, Hornstein MD, et al. Brief intervention for women with risky drinking and medical diagnoses: a randomized controlled trial. *J Subst Abuse Treat.* 2011;41(2):105-114. doi:10.1016/j.jsat.2011.02.011
- 77.** Chang G, McNamara TK, Orav EJ, et al. Brief intervention for prenatal alcohol use: a randomized trial. *Obstet Gynecol.* 2005;105(5, pt 1):991-998. doi:10.1097/01.AOG.0000157109.05453.84
- 78.** Chang G, Wilkins-Haug L, Berman S, Goetz MA. Brief intervention for alcohol use in pregnancy: a randomized trial. *Addiction.* 1999;94(10):1499-1508. doi:10.1046/j.1360-0443.1999.941014996.x
- 79.** Collins SE, Kirouac M, Lewis MA, Witkiewitz K, Carey KB. Randomized controlled trial of web-based decisional balance feedback and personalized normative feedback for college drinkers. *J Stud Alcohol Drugs.* 2014;75(6):982-992. doi:10.15288/jsad.2014.75.982
- 80.** Crawford MJ, Sanatinia R, Barrett B, et al. The clinical effectiveness and cost-effectiveness of brief intervention for excessive alcohol consumption among people attending sexual health clinics: a randomised controlled trial (SHEAR). *Health Technol Assess.* 2014;18(30):1-48. doi:10.3310/hta18300
- 81.** Cunningham JA, Neighbors C, Wild C, Humphreys K. Ultra-brief intervention for problem drinkers: results from a randomized controlled trial. *PLoS One.* 2012;7(10):e48003. doi:10.1371/journal.pone.0048003
- 82.** Curry SJ, Ludman EJ, Grothaus LC, Donovan D, Kim E. A randomized trial of a brief primary-care-based intervention for reducing at-risk drinking practices. *Health Psychol.* 2003;22(2):156-165. doi:10.1037/0278-6133.22.2.156
- 83.** Daepfen JB, Bertholet N, Gaume J, Fortini C, Faouzi M, Gmel G. Efficacy of brief motivational intervention in reducing binge drinking in young men: a randomized controlled trial. *Drug Alcohol Depend.* 2011;113(1):69-75. doi:10.1016/j.drugalcdep.2010.07.009
- 84.** Drummond C, Coulton S, James D, et al. Effectiveness and cost-effectiveness of a stepped care intervention for alcohol use disorders in primary care: pilot study. *Br J Psychiatry.* 2009;195(5):448-456. doi:10.1192/bjp.bp.108.056697
- 85.** Emmen MJ, Schippers GM, Wollersheim H, Bleijenberg G. Adding psychologist's intervention to physicians' advice to problem drinkers in the outpatient clinic. *Alcohol Alcohol.* 2005;40(3):219-226. doi:10.1093/alcac/agh137
- 86.** Etnner SL, Xu H, Duru OK, et al. The effect of an educational intervention on alcohol consumption, at-risk drinking, and health care utilization in older adults: the Project SHARE study. *J Stud Alcohol Drugs.* 2014;75(3):447-457. doi:10.15288/jsad.2014.75.447
- 87.** Fleming MF, Balousek SL, Grossberg PM, et al. Brief physician advice for heavy drinking college students: a randomized controlled trial in college health clinics. *J Stud Alcohol Drugs.* 2010;71(1):23-31. doi:10.15288/jsad.2010.71.23
- 88.** Fleming MF, Barry KL, Manwell LB, Johnson K, London R. Brief physician advice for problem alcohol drinkers: a randomized controlled trial in community-based primary care practices. *JAMA.* 1997;277(13):1039-1045. doi:10.1001/jama.1997.03540370029032
- 89.** Fleming MF, Lund MR, Wilton G, Landry M, Scheets D. The Healthy Moms Study: the efficacy of brief alcohol intervention in postpartum women. *Alcohol Clin Exp Res.* 2008;32(9):1600-1606. doi:10.1111/j.1530-0277.2008.00738.x
- 90.** Fleming MF, Manwell LB, Barry KL, Adams W, Stauffacher EA. Brief physician advice for alcohol problems in older adults: a randomized community-based trial. *J Fam Pract.* 1999;48(5):378-384.
- 91.** Hansen AB, Becker U, Nielsen AS, Grønbaek M, Tolstrup JS, Thygesen LC. Internet-based brief personalized feedback intervention in a non-treatment-seeking population of adult heavy drinkers: a randomized controlled trial. *J Med Internet Res.* 2012;14(4):e98. doi:10.2196/jmir.1883
- 92.** Haug S, Paz Castro R, Kowatsch T, Filler A, Dey M, Schaub MP. Efficacy of a web- and text messaging-based intervention to reduce problem drinking in adolescents: results of a cluster-randomized controlled trial. *J Consult Clin Psychol.* 2017;85(2):147-159. doi:10.1037/ccp0000138
- 93.** Heather N, Campion PD, Neville RG, Maccabe D. Evaluation of a controlled drinking minimal intervention for problem drinkers in general practice (the DRAMS scheme). *J R Coll Gen Pract.* 1987;37(301):358-363.
- 94.** Helstrom AW, Ingram E, Wang W, Small D, Klaus J, Oslin D. Treating heavy drinking in primary care practices: evaluation of a telephone-based intervention program. *Addict Disord Their Treat.* 2014;13(3):101-109. doi:10.1097/ADT.0b013e31827e206c
- 95.** Hilbink M, Voerman G, van Beurden I, Penninx B, Laurant M. A randomized controlled trial of a tailored primary care program to reverse excessive alcohol consumption. *J Am Board Fam Med.* 2012; 25(5):712-722. doi:10.3122/jabfm.2012.05.120070
- 96.** Johnsson KO, Berglund M. Comparison between a cognitive behavioural alcohol programme and post-mailed minimal intervention in high-risk drinking university freshmen: results from a randomized controlled trial. *Alcohol Alcohol.* 2006;41(2):174-180. doi:10.1093/alcac/agh243
- 97.** Kaner E, Bland M, Cassidy P, et al. Effectiveness of screening and brief alcohol intervention in primary care (SIPS trial): pragmatic cluster randomised controlled trial. *BMJ.* 2013;346:e8501. doi:10.1136/bmj.e8501
- 98.** Kypri K, Hallett J, Howat P, et al. Randomized controlled trial of proactive web-based alcohol screening and brief intervention for university students. *Arch Intern Med.* 2009;169(16):1508-1514. doi:10.1001/archinternmed.2009.249
- 99.** Kypri K, Langlely JD, Saunders JB, Cashell-Smith ML, Herbison P. Randomized controlled trial of web-based alcohol screening and brief intervention in primary care. *Arch Intern Med.* 2008;168(5):530-536. doi:10.1001/archinternmed.2007.109
- 100.** Kypri K, Saunders JB, Williams SM, et al. Web-based screening and brief intervention for hazardous drinking: a double-blind randomized controlled trial. *Addiction.* 2004;99(11):1410-1417. doi:10.1111/j.1360-0443.2004.00847.x
- 101.** LaBrie JW, Huchting KK, Lac A, Tawalbeh S, Thompson AD, Larimer ME. Preventing risky drinking in first-year college women: further validation of a female-specific motivational-enhancement group intervention. *J Stud Alcohol Drugs Suppl.* 2009;(16):77-85. doi:10.15288/jsads.2009.s16.77
- 102.** Labrie JW, Lewis MA, Atkins DC, et al. RCT of web-based personalized normative feedback for college drinking prevention: are typical student norms good enough? *J Consult Clin Psychol.* 2013;81(6):1074-1086. doi:10.1037/a0034087
- 103.** Larimer ME, Lee CM, Kilmer JR, et al. Personalized mailed feedback for college drinking prevention: a randomized clinical trial. *J Consult Clin Psychol.* 2007;75(2):285-293. doi:10.1037/0022-006X.75.2.285
- 104.** Leeman RF, DeMartini KS, Gueorguieva R, et al. Randomized controlled trial of a very brief, multicomponent web-based alcohol intervention for undergraduates with a focus on protective behavioral strategies. *J Consult Clin Psychol.* 2016; 84(11):1008-1015. doi:10.1037/ccp0000132
- 105.** Lewis MA, Patrick ME, Litt DM, et al. Randomized controlled trial of a web-delivered personalized normative feedback intervention to reduce alcohol-related risky sexual behavior among college students. *J Consult Clin Psychol.* 2014;82(3):429-440. doi:10.1037/a0035550
- 106.** Maisto SA, Conigliaro J, McNeil M, Kraemer K, Conigliaro RL, Kelley ME. Effects of two types of brief intervention and readiness to change on alcohol use in hazardous drinkers. *J Stud Alcohol.* 2001;62(5):605-614. doi:10.15288/jsa.2001.62.605
- 107.** Marlatt GA, Baer JS, Kivlahan DR, et al. Screening and brief intervention for high-risk college student drinkers: results from a 2-year follow-up assessment. *J Consult Clin Psychol.* 1998; 66(4):604-615. doi:10.1037/0022-006X.66.4.604
- 108.** Martens MP, Kilmer JR, Beck NC, Zamboanga BL. The efficacy of a targeted personalized drinking feedback intervention among intercollegiate athletes: a randomized controlled trial. *Psychol Addict Behav.* 2010;24(4):660-669. doi:10.1037/a0020299
- 109.** Mason M, Light J, Campbell L, et al. Peer network counseling with urban adolescents: a randomized controlled trial with moderate substance users. *J Subst Abuse Treat.* 2015;58:16-24. doi:10.1016/j.jsat.2015.06.013
- 110.** Moore AA, Blow FC, Hoffing M, et al. Primary care-based intervention to reduce at-risk drinking in older adults: a randomized controlled trial. *Addiction.* 2011;106(1):111-120. doi:10.1111/j.1360-0443.2010.03229.x
- 111.** Neighbors C, Larimer ME, Lewis MA. Targeting misperceptions of descriptive drinking norms: efficacy of a computer-delivered personalized normative feedback intervention. *J Consult Clin Psychol.* 2004;72(3):434-447. doi:10.1037/0022-006X.72.3.434
- 112.** Neighbors C, Lewis MA, Atkins DC, et al. Efficacy of web-based personalized normative feedback: a two-year randomized controlled trial. *J Consult Clin Psychol.* 2010;78(6):898-911. doi:10.1037/a0020766
- 113.** Neighbors C, Lewis MA, LaBrie J, et al. A multisite randomized trial of normative feedback for heavy drinking: social comparison versus social comparison plus correction of normative

- misperceptions. *J Consult Clin Psychol*. 2016;84(3):238-247. doi:10.1037/ccp0000067
- 114.** Ockene JK, Adams A, Hurlay TG, Wheeler EV, Hebert JR. Brief physician- and nurse practitioner-delivered counseling for high-risk drinkers: does it work? *Arch Intern Med*. 1999;159(18):2198-2205. doi:10.1001/archinte.159.18.2198
- 115.** O'Connor MJ, Whaley SE. Brief intervention for alcohol use by pregnant women. *Am J Public Health*. 2007;97(2):252-258. doi:10.2105/AJPH.2005.077222
- 116.** Ondersma SJ, Beatty JR, Svikis DS, et al. Computer-delivered screening and brief intervention for alcohol use in pregnancy: a pilot randomized trial. *Alcohol Clin Exp Res*. 2015;39(7):1219-1226. doi:10.1111/acer.12747
- 117.** Ondersma SJ, Svikis DS, Thacker LR, Beatty JR, Lockhart N. A randomized trial of a computer-delivered screening and brief intervention for postpartum alcohol use. *Drug Alcohol Rev*. 2016;35(6):710-718. doi:10.1111/dar.12389
- 118.** Osterman RL, Carle AC, Ammerman RT, Gates D. Single-session motivational intervention to decrease alcohol use during pregnancy. *J Subst Abuse Treat*. 2014;47(1):10-19. doi:10.1016/j.jsat.2014.01.009
- 119.** Reynolds KD, Coombs DW, Lowe JB, Peterson PL, Gayoso E. Evaluation of a self-help program to reduce alcohol consumption among pregnant women. *Int J Addict*. 1995;30(4):427-443. doi:10.3109/10826089509048735
- 120.** Richmond R, Heather N, Wodak A, Kehoe L, Webster I. Controlled evaluation of a general practice-based brief intervention for excessive drinking. *Addiction*. 1995;90(1):119-132. doi:10.1111/j.1360-0443.1995.tb01016.x
- 121.** Rose GL, Badger GJ, Skelly JM, MacLean CD, Ferraro TA, Helzer JE. A randomized controlled trial of brief intervention by interactive voice response. *Alcohol Alcohol*. 2017;52(3):335-343.
- 122.** Rubio DM, Day NL, Conigliaro J, et al. Brief motivational enhancement intervention to prevent or reduce postpartum alcohol use: a single-blinded, randomized controlled effectiveness trial. *J Subst Abuse Treat*. 2014;46(3):382-389. doi:10.1016/j.jsat.2013.10.009
- 123.** Rubio G, Jiménez-Arriero MA, Martínez I, Ponce G, Palomo T. Efficacy of physician-delivered brief counseling intervention for binge drinkers. *Am J Med*. 2010;123(1):72-78. doi:10.1016/j.amjmed.2009.08.012
- 124.** Saitz R, Horton NJ, Sullivan LM, Moskowitz MA, Samet JH. Addressing alcohol problems in primary care: a cluster randomized, controlled trial of a systems intervention: the screening and intervention in primary care (SIP) study. *Ann Intern Med*. 2003;138(5):372-382. doi:10.7326/0003-4819-138-5-200303040-00006
- 125.** Schaus JF, Sole ML, McCoy TP, Mullett N, O'Brien MC. Alcohol screening and brief intervention in a college student health center: a randomized controlled trial. *J Stud Alcohol Drugs Suppl*. 2009;(16):131-141. doi:10.15288/jsads.2009.s16.131
- 126.** Schulz DN, Candel MJ, Kremers SP, Reinwand DA, Jander A, de Vries H. Effects of a web-based tailored intervention to reduce alcohol consumption in adults: randomized controlled trial. *J Med Internet Res*. 2013;15(9):e206. doi:10.2196/jmir.2568
- 127.** Scott E, Anderson P. Randomized controlled trial of general practitioner intervention in women with excessive alcohol consumption. *Drug Alcohol Rev*. 1991;10(4):313-321. doi:10.1080/09595239100185371
- 128.** Senft RA, Polen MR, Freeborn DK, Hollis JF. Brief intervention in a primary care setting for hazardous drinkers. *Am J Prev Med*. 1997;13(6):464-470. doi:10.1016/S0749-3797(18)30143-0
- 129.** Turrissi R, Larimer ME, Mallett KA, et al. A randomized clinical trial evaluating a combined alcohol intervention for high-risk college students. *J Stud Alcohol Drugs*. 2009;70(4):555-567. doi:10.15288/jsad.2009.70.555
- 130.** Tzilios GK, Sokol RJ, Ondersma SJ. A randomized phase I trial of a brief computer-delivered intervention for alcohol use during pregnancy. *J Womens Health (Larchmt)*. 2011;20(10):1517-1524. doi:10.1089/jwh.2011.2732
- 131.** Upshur C, Weinreb L, Bharel M, Reed G, Frisard C. A randomized control trial of a chronic care intervention for homeless women with alcohol use problems. *J Subst Abuse Treat*. 2015;51:19-29. doi:10.1016/j.jsat.2014.11.001
- 132.** van der Wulp NY, Hoving C, Eijmael K, Candel MJ, van Dalen W, De Vries H. Reducing alcohol use during pregnancy via health counseling by midwives and internet-based computer-tailored feedback: a cluster randomized trial. *J Med Internet Res*. 2014;16(12):e274. doi:10.2196/jmir.3493
- 133.** Voogt CV, Kuntsche E, Kleinjan M, Engels RC. The effect of the "What Do You Drink" web-based brief alcohol intervention on self-efficacy to better understand changes in alcohol use over time: randomized controlled trial using ecological momentary assessment. *Drug Alcohol Depend*. 2014;138:89-97. doi:10.1016/j.drugalcdep.2014.02.009
- 134.** Wallace P, Cutler S, Haines A. Randomised controlled trial of general practitioner intervention in patients with excessive alcohol consumption. *BMJ*. 1988;297(6649):663-668. doi:10.1136/bmj.297.6649.663
- 135.** Watkins KE, Ober AJ, Lamp K, et al. Collaborative care for opioid and alcohol use disorders in primary care: the SUMMIT randomized clinical trial. *JAMA Intern Med*. 2017;177(10):1480-1488. doi:10.1001/jamainternmed.2017.3947
- 136.** Watson JM, Crosby H, Dale VM, et al; AESOPS Trial Team. AESOPS: a randomised controlled trial of the clinical effectiveness and cost-effectiveness of opportunistic screening and stepped care interventions for older hazardous alcohol users in primary care. *Health Technol Assess*. 2013;17(25):1-158. doi:10.3310/hta17250
- 137.** Wilson GB, Wray C, McGovern R, et al. Intervention to reduce excessive alcohol consumption and improve comorbidity outcomes in hypertensive or depressed primary care patients: two parallel cluster randomized feasibility trials. *Trials*. 2014;15:235. doi:10.1186/1745-6215-15-235
- 138.** Aalto M, Seppä K, Mattila P, et al. Brief intervention for male heavy drinkers in routine general practice: a three-year randomized controlled study. *Alcohol Alcohol*. 2001;36(3):224-230. doi:10.1093/alcac/36.3.224
- 139.** Anderson P, Scott E. The effect of general practitioners' advice to heavy drinking men. *Br J Addict*. 1992;87(6):891-900. doi:10.1111/j.1360-0443.1992.tb01984.x
- 140.** Baer JS, Kivlahan DR, Blume AW, McKnight P, Marlatt GA. Brief intervention for heavy-drinking college students: 4-year follow-up and natural history. *Am J Public Health*. 2001;91(8):1310-1316. doi:10.2105/AJPH.91.8.1310
- 141.** Barnes AJ, Xu H, Tseng CH, et al. The effect of a patient-provider educational intervention to reduce at-risk drinking on changes in health and health-related quality of life among older adults: the Project SHARE study. *J Subst Abuse Treat*. 2016; 60:14-20. doi:10.1016/j.jsat.2015.06.019
- 142.** Cleveland MJ, Lanza ST, Ray AE, Turrissi R, Mallett KA. Transitions in first-year college student drinking behaviors: does pre-college drinking moderate the effects of parent- and peer-based intervention components? *Psychol Addict Behav*. 2012;26(3):440-450. doi:10.1037/a0026130
- 143.** Coulton S, Bland M, Crosby H, et al. Effectiveness and cost-effectiveness of opportunistic screening and stepped-care interventions for older alcohol users in primary care. *Alcohol Alcohol*. 2017;52(6):655-664. doi:10.1093/alcac/axg065
- 144.** Coulton S, Dale V, Deluca P, et al. Screening for at-risk alcohol consumption in primary care: a randomized evaluation of screening approaches. *Alcohol Alcohol*. 2017;52(3):312-317. doi:10.1093/alcac/axg017
- 145.** Crawford MJ, Sanatinia R, Barrett B, et al. The clinical and cost-effectiveness of brief advice for excessive alcohol consumption among people attending sexual health clinics: a randomised controlled trial. *Sex Transm Infect*. 2015;91(1):37-43. doi:10.1136/sextrans-2014-051561
- 146.** Fleming MF, Mundt MP, French MT, Manwell LB, Stauffacher EA, Barry KL. Benefit-cost analysis of brief physician advice with problem drinkers in primary care settings. *Med Care*. 2000;38(1):7-18. doi:10.1097/00005650-200001000-00003
- 147.** Fleming MF, Mundt MP, French MT, Manwell LB, Stauffacher EA, Barry KL. Brief physician advice for problem drinkers: long-term efficacy and benefit-cost analysis. *Alcohol Clin Exp Res*. 2002;26(1):36-43. doi:10.1111/j.1530-0277.2002.tb02429.x
- 148.** Freeborn DK, Polen MR, Hollis JF, Senft RA. Screening and brief intervention for hazardous drinking in an HMO: effects on medical care utilization. *J Behav Health Serv Res*. 2000;27(4):446-453. doi:10.1007/BF02287826
- 149.** Gordon AJ, Conigliaro J, Maisto SA, McNeil M, Kraemer KL, Kelley ME. Comparison of consumption effects of brief interventions for hazardous drinking elderly. *Subst Use Misuse*. 2003; 38(8):1017-1035. doi:10.1081/JA-120017649
- 150.** Grossbard JR, Mastroleone NR, Geisner IM, et al. Drinking norms, readiness to change, and gender as moderators of a combined alcohol intervention for first-year college students. *Addict Behav*. 2016;52:75-82. doi:10.1016/j.addbeh.2015.07.028
- 151.** Grossbard JR, Mastroleone NR, Kilmer JR, et al. Substance use patterns among first-year college students: secondary effects of a combined alcohol intervention. *J Subst Abuse Treat*. 2010;39(4):384-390. doi:10.1016/j.jsat.2010.07.001

152. Grossberg PM, Brown DD, Fleming MF. Brief physician advice for high-risk drinking among young adults. *Ann Fam Med*. 2004;2(5):474-480. doi:10.1370/afm.122
153. Grothues JM, Bischof G, Reinhardt S, Meyer C, John U, Rumpf HJ. Effectiveness of brief alcohol interventions for general practice patients with problematic drinking behavior and comorbid anxiety or depressive disorders. *Drug Alcohol Depend*. 2008;94(1-3):214-220. doi:10.1016/j.drugalcdep.2007.11.015
154. Kaner E, Bland M, Cassidy P, et al. Screening and brief interventions for hazardous and harmful alcohol use in primary care: a cluster randomised controlled trial protocol. *BMC Public Health*. 2009; 9:287. doi:10.1186/1471-2458-9-287
155. Kypri K, Langley JD, Saunders JB, Cashell-Smith ML. Assessment may conceal therapeutic benefit: findings from a randomized controlled trial for hazardous drinking. *Addiction*. 2007;102(1):62-70. doi:10.1111/j.1360-0443.2006.01632.x
156. Lin JC, Karno MP, Tang L, et al. Do health educator telephone calls reduce at-risk drinking among older adults in primary care? *J Gen Intern Med*. 2010;25(4):334-339. doi:10.1007/s11606-009-1223-2
157. Maisto SA, Conigliaro J, McNeil M, Kraemer K, Kelley ME. The relationship between eligibility criteria for participation in alcohol brief intervention trials and other alcohol and health-related variables. *Am J Addict*. 2001;10(3):218-231. doi:10.1080/105504901750532102
158. Manwell LB, Fleming MF, Mundt MP, Stauffacher EA, Barry KL. Treatment of problem alcohol use in women of childbearing age: results of a brief intervention trial. *Alcohol Clin Exp Res*. 2000;24(10):1517-1524. doi:10.1111/j.1530-0277.2000.tb04570.x
159. Mundt MP, French MT, Roebuck MC, Manwell LB, Barry KL. Brief physician advice for problem drinking among older adults: an economic analysis of costs and benefits. *J Stud Alcohol*. 2005;66(3):389-394. doi:10.15288/jsa.2005.66.389
160. Ockene JK, Reed GW, Reiff-Hekking S. Brief patient-centered clinician-delivered counseling for high-risk drinking: 4-year results. *Ann Behav Med*. 2009;37(3):335-342. doi:10.1007/s12160-009-9108-5
161. Paz Castro R, Haug S, Kowatsch T, Filler A, Schaub MP. Moderators of outcome in a technology-based intervention to prevent and reduce problem drinking among adolescents. *Addict Behav*. 2017;72:64-71. doi:10.1016/j.addbeh.2017.03.013
162. Reiff-Hekking S, Ockene JK, Hurley TG, Reed GW. Brief physician and nurse practitioner-delivered counseling for high-risk drinking: results at 12-month follow-up. *J Gen Intern Med*. 2005;20(1):7-13. doi:10.1111/j.1525-1497.2005.21240.x
163. Reinhardt S, Bischof G, Grothues J, John U, Meyer C, Rumpf HJ. Gender differences in the efficacy of brief interventions with a stepped care approach in general practice patients with alcohol-related disorders. *Alcohol Alcohol*. 2008;43(3):334-340. doi:10.1093/alcac/agn004
164. Roberts LJ, Neal DJ, Kivlahan DR, Baer JS, Marlatt GA. Individual drinking changes following a brief intervention among college students: clinical significance in an indicated preventive context. *J Consult Clin Psychol*. 2000;68(3):500-505. doi:10.1037/0022-006X.68.3.500
165. Rossi BV, Chang G, Berry KF, Hornstein MD, Missmer SA. In vitro fertilization outcomes and alcohol consumption in at-risk drinkers: the effects of a randomized intervention. *Am J Addict*. 2013;22(5):481-485. doi:10.1111/j.1521-0391.2013.12019.x
166. Voogt CV, Poelen EA, Kleinjan M, Lemmers LA, Engels RC. The effectiveness of the "What Do You Drink" web-based brief alcohol intervention in reducing heavy drinking among students: a two-arm parallel group randomized controlled trial. *Alcohol Alcohol*. 2013;48(3):312-321. doi:10.1093/alcac/ags133
167. Voogt CV, Poelen EA, Kleinjan M, Lemmers LA, Engels RC. Targeting young drinkers online: the effectiveness of a web-based brief alcohol intervention in reducing heavy drinking among college students: study protocol of a two-arm parallel group randomized controlled trial. *BMC Public Health*. 2011;11:231. doi:10.1186/1471-2458-11-231
168. Wilton G, Moberg DP, Fleming MF. The effect of brief alcohol intervention on postpartum depression. *MCN Am J Matern Child Nurs*. 2009;34(5):297-302. doi:10.1097/01.NMC.0000360422.06486.c4
169. Young CM, Neighbors C, DiBello AM, Sharp C, Zvolensky MJ, Lewis MA. Coping motives moderate efficacy of personalized normative feedback among heavy drinking U.S. college students. *J Stud Alcohol Drugs*. 2016;77(3):495-499. doi:10.15288/jsad.2016.77.495
170. Cohen J. A power primer. *Psychol Bull*. 1992;112(1):155-159. doi:10.1037/0033-2909.112.1.155
171. U.S. Department of Veterans Affairs. QUERI—Quality Enhancement Research Initiative: AUDIT-C frequently asked questions. QUERI website. <https://www.queri.research.va.gov/tools/alcohol-misuse/alcohol-faqs.cfm>. 2014. Accessed September 26, 2017.
172. Williams EC, Rubinsky AD, Chavez LJ, et al. An early evaluation of implementation of brief intervention for unhealthy alcohol use in the US Veterans Health Administration. *Addiction*. 2014; 109(9):1472-1481. doi:10.1111/add.12600
173. Jonas DE, Miller T, Ratner S, et al. Implementation and quality improvement of a screening and counseling program for unhealthy alcohol use in an academic general internal medicine practice. *J Healthc Qual*. 2017;39(1):15-27. doi:10.1097/JHQ.000000000000069
174. Higgins-Biddle JC, Babor TF. A review of the Alcohol Use Disorders Identification Test (AUDIT), AUDIT-C, and USAUDIT for screening in the United States: past issues and future directions. *Am J Drug Alcohol Abuse*. 2018;1-9. doi:10.1080/00952990.2018.1456545
175. Madson MB, Schuttis JW, Jordan HR, et al. Identifying at-risk college student drinkers with the AUDIT-US: a receiver operating characteristic curve analysis [published online August 1, 2018]. *Assessment*. doi:10.1177/1073191118792091
176. Jonas DE, Garbutt JC, Amick HR, et al. Behavioral counseling after screening for alcohol misuse in primary care: a systematic review and meta-analysis for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2012;157(9):645-654. doi:10.7326/0003-4819-157-9-201211060-00544
177. Jonas DE, Amick HR, Feltner C, et al. Pharmacotherapy for adults with alcohol use disorders in outpatient settings: a systematic review and meta-analysis. *JAMA*. 2014;311(18):1889-1900. doi:10.1001/jama.2014.3628