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Face-to-Face Versus Computer-Delivered Alcohol Interventions for College Drinkers: A Meta-Analytic Review, 1998 to 2010

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Abstract

Alcohol misuse occurs commonly on college campuses, necessitating prevention programs to help college drinkers reduce consumption and minimize harmful consequences. Computer-delivered interventions (CDIs) have been widely used due to their low cost and ease of dissemination but whether CDIs are efficacious and whether they produce benefits equivalent to face-to-face interventions (FTFIs) remain unclear. Therefore, we identified controlled trials of both CDIs and FTFIs and used meta-analysis (a) to determine the relative efficacy of these two approaches and (b) to test predictors of intervention efficacy. We included studies examining FTFIs (N = 5,237; 56% female; 87% White) and CDIs (N = 32,243; 51% female; 81% White). Independent raters coded participant characteristics, design and methodological features, intervention content, and calculated weighted mean effect sizes using fixed and random-effects models. Analyses indicated that, compared to controls, FTFI participants drank less, drank less frequently, and reported fewer problems at short-term follow-up (d_+s = 0.15 – 0.19); they continued to consume lower quantities at intermediate (d_+ = 0.23) and long-term (d_+ = 0.14) follow-ups. Compared to controls, CDI participants reported lower quantities, frequency, and peak intoxication at short-term follow-up (d_+s = 0.13 – 0.29), but these effects were not maintained. Direct comparisons between FTFI and CDIs were infrequent, but these trials favored the FTFIs on both quantity and problems measures (d_+s = 0.12–0.20). Moderator analyses identified participant and intervention characteristics that influence intervention efficacy. Overall, we conclude that FTFIs provide the most effective and enduring effects.

Keywords

alcohol prevention; college students; meta-analysis; computer-delivered intervention; face-to-face intervention

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Alcohol use on college campuses is high, with four out of ten students engaging in “binge” drinking (defined as five or more drinks in a sitting) (Substance Abuse and Mental Health Services Administration, 2011). Many individuals who drink experience problems related to their alcohol use; 20% of college students report experiencing at least five different problems as a result of their alcohol use (Wechsler et al., 2002). College students also experience high rates of alcohol use disorders; 32% of college students meet alcohol abuse criteria, whereas 6% meet criteria for alcohol dependence (Knight et al., 2002).

Alcohol abuse prevention programs targeted at college drinkers effectively reduce risky drinking and consequences. A meta-analysis on the efficacy of individually-focused college drinking interventions suggested that interventions have small but reliable effects (Carey, Scott-Sheldon, Carey, & DeMartini, 2007). Larimer and Cronce’s (2004) narrative review notes that interventions with skills-building, motivational, and personalized normative feedback components are successful in reducing alcohol consumption. These interventions have been delivered in multiple formats, the most common being face-to-face and computer-facilitated administrations.

A face-to-face intervention (FTFI) allows the interventionist to tailor the intervention to the individual drinker, facilitates an interactive discussion, and provides an opportunity for the student to ask individualized questions. In the meta-analysis by Carey and colleagues (2007), method of administration moderated the effectiveness of interventions, with face-to-face interventions being more effective than alternative delivery modalities. Several individual, face-to-face interventions have received empirical support, and constitute the list created by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) of recommended Tier 1 interventions (National Institute on Alcohol Abuse and Alcoholism, 2002). Despite the empirical support enjoyed by FTFIs, this type of intervention requires individual counselor attention that can be costly and labor-intensive.

Computer-delivered interventions (CDIs) have become an increasingly popular alternative to FTFIs due to their ease of administration, potential for a wide reach, and for delivery of individually-tailored content. CDIs may be accessed via multiple user interfaces, but they involve interaction with a computer rather than a counselor. Evidence suggests that CDIs may be well-suited to the preferences and lifestyles of young adults (Escoffery et al., 2005; Kypri, Saunders, & Gallagher, 2003). A narrative review of research on CDIs for college alcohol use (Elliott, Carey, & Bolles, 2008) suggested that these interventions produce outcomes that are better than no intervention and that may be equivalent to other alcohol-focused interventions. A more recent meta-analysis clarified that effect sizes were small when CDIs were compared with wait-list, no-treatment, and assessment-only control conditions, and non-significant when compared with other active alcohol interventions (Carey, Scott-Sheldon, Elliott, Bolles, & Carey, 2009). Furthermore, not all CDIs demonstrate a benefit over a no-intervention control (Croom et al., 2009). Though CDIs have the potential to facilitate the widespread dissemination of alcohol abuse prevention interventions, they come with limitations as well. CDIs can be completed with minimal effort or investment in distracting environments that are not conducive to the thoughtful recall and contemplation associated with therapeutic intervention (Walters & Neighbors, 2011). Manipulations prompting more elaborative processing of computer-delivered drinking feedback improve outcomes (Jouriles et al., 2010).

Relative efficacy of FTFIs versus CDIs

In the broader field of health behavior change, CDIs are often compared against non-computerized interventions. Several meta-analyses examining a variety of health behaviors document improved health behaviors attributable to CDIs (Portnoy, Scott-Sheldon, Johnson,

& Carey, 2008; Rooke, Thorsteinsson, Karpin, Copeland, & Allsop, 2010; Wantland, Portillo, Holzemer, Slaughter, & McGhee, 2004). Such comparative efficacy studies are helpful to decision makers who must choose among alternatives.

Comparative efficacy data addressing FTFIs versus CDIs for college-aged drinkers are limited and the results have been mixed. In a study with mandated students, Barnett, Murphy, Colby, and Monti (2007) found the computerized Alcohol 101™ (The Century Council, 1997) program to be equivalent to a brief motivational interview at a 12-month follow-up. Donohue, Allen, Maurer, Ozols, and DeStefano (2004) also evaluated Alcohol 101™, and found that it performed similarly to a Cognitive Behavior Therapy (CBT)-based alcohol abuse prevention program, though CBT was more efficacious for high risk individuals. In contrast, two studies by Carey et al. (Carey, Carey, Henson, Maisto, & DeMartini, 2011; Carey, Scott-Sheldon, et al., 2009) found that a brief motivational intervention was more efficacious than a CDI in decreasing drinking and consequences of sanctioned students.

When a research literature contains a range of findings, meta-analysis can often illuminate systematic patterns in the results. Such information is valuable to administrators who must decide among various intervention programs. Therefore, for this review, we conducted a meta-analysis to address the relative efficacy of FTFIs and CDIs for college drinkers. Extending our previous qualitative (Elliott et al., 2008) and quantitative reviews (Carey, Scott-Sheldon, et al., 2009) that focused only on CDIs, we included studies that (a) randomized participants to either a FTFI or a CDI compared to an assessment-only control, (b) evaluated individually-delivered interventions, and (c) measured alcohol consumption or consequences in order to test the hypothesis that FTFIs produce more change on variables representing consumption and consequences than do CDIs. Because few studies have compared FTFI and CDI directly, we addressed the primary research question regarding comparative efficacy in three ways. First, we estimated between-groups effects of all eligible individual-level interventions compared to assessment-only controls, to ascertain the magnitude of effects of FTFIs and CDIs beyond the assessment reactivity effect (Walters, Vader, Harris, Field, & Jouriles, 2009). Second, we determined if intervention modality (FTFI or CDI) was associated with the magnitude of the effects across outcomes. Third, exploratory analyses examined between-groups effects among the few studies that allow direct comparisons of FTFI and CDI conditions.

Predictors of efficacy

Based on previous research, we hypothesize that two person variables would be related to the responsiveness of CDIs and FTFIs. First, we predict that the efficacy of CDIs will differ by gender. In the studies by Carey and colleagues (2011), female students responded better to a brief motivational interview than to a CDI (men did not respond differently). Therefore, we test the hypothesis that interventions sampling more women will be negatively related to effect sizes for CDIs. Gender distribution should not be related to response to FTFIs.

Second, we predict that the risk level of the student will predict response to CDIs and FTFIs. Minimal interventions produce self-initiated change in persons with milder alcohol problems (Miller & Munoz, 2005; Sobell & Sobell, 1993). By extension, minimal prevention interventions, such as CDIs, may be effective in producing risk reduction primarily among lower risk students. Thus, we hypothesize that the proportion of higher risk students in a sample (defined as heavy drinkers, students violating campus alcohol policy, and students experiencing alcohol-related problems) will correlate positively with stronger effects for the more intensive FTFIs, but correlate negatively with effects for the less intensive CDIs.

It should be noted that the FTFI and CDI labels distinguish method of administration, but within each are interventions of varying length, complexity, and content. Thus, we conduct exploratory analyses to determine which intervention components produce stronger effects.

Method

Sample of Studies

A comprehensive search strategy was used to obtain relevant studies. Studies were retrieved from (a) electronic databases (PsycInfo, PubMed, Dissertation Abstracts, ERIC, CINAHL, and The Cochrane Library) using a broad search strategy with the following terms: ((alcohol or drink* or binge) and (college or university) and (intervention or prevention)), (b) reference sections of relevant manuscripts, (c) electronic content of professional journals, (d) databases of alcohol-related interventions for college students held by the Substance Use Risk Education Meta-Analytic Team at Brown University, and (e) responses to listserv requests.

Selection Criteria

Studies were included if the author(s) (a) examined an individual-level alcohol intervention, (b) sampled college students, (c) used a randomized controlled trial (RCT) or a quasi-experimental design with an assessment-only/wait-list/no-treatment control condition, (d) measured alcohol behavior, and (e) provided information needed to calculate effect sizes (ES). Studies were excluded if they (a) did not focus on alcohol use (e.g., combined substance use interventions), (b) sampled non-college students, (c) used an active control condition (e.g., education-only), or (d) included a mass media or structural-level intervention component. When authors reported details and/or outcomes in multiple manuscripts, the studies were linked in the database and represented as a single study. When author(s) reported insufficient details, they were contacted for additional information. Of the 15 authors contacted, 87% responded resulting in the retention of 13 studies and the exclusion of 3 studies (a single author was contacted regarding two separate papers). Studies that fulfilled the selection criteria and were available by December 2010 were included. Thus, we included (a) 22 manuscripts comparing 33 FTFIs to a no-treatment control, (b) 26 manuscripts comparing 34 CDIs to a no-treatment control, and (c) 8 manuscripts directly comparing 15 FTFIs with CDIs (Figure 1).

Coding and Reliability

Two independent coders rated the study information, sample characteristics (e.g., gender), design and measurement specifics (e.g., number of follow-ups), and length and content of intervention (e.g., number of total minutes). Study quality was assessed using 12 items (e.g., random assignment) adapted from validated measures (Jadad et al., 1996; Miller et al., 1995); scores range from 0 to 17. A random selection of 20 studies was used to assess inter-rater reliability. For the categorical variables, raters agreed on 82% of the judgments. Reliability for the continuous variables (calculated using the intraclass correlation coefficient; ρ) yielded an average $\rho = 0.84$ across categories (median = 0.98). Disagreements between coders were resolved through discussion.

Study Outcomes

For each study, between-group effect size estimates were calculated for alcohol consumption and alcohol-related problems. *Alcohol consumption* outcomes included: (a) quantity consumed over a period of time (e.g., week, month) and (b) per drinking day; (c) frequency of heavy drinking, usually defined as 5 or more drinks for men and 4 or more drinks for women (Wechsler, Dowdall, Davenport, & Rimm, 1995); and (d) peak blood

alcohol concentration (BAC). *Alcohol-related problems* were typically operationalized using multi-item scales.

Effect Size Derivation

Because the majority of the studies reported continuous measures, ES were defined as the mean difference between the treatment and control groups divided by the pooled standard deviation (Cohen, 1988). When means and standard deviations were not provided, other information (e.g., *t*- or *F*-test) was used (Lipsey & Wilson, 2001). If a study reported dichotomous outcomes, we calculated an odds ratio and transformed it to *d* using the Cox transformation (Sanchez-Meca, Marin-Martinez, & Chacon-Moscoso, 2003). If no statistical information was available (and could not be obtained) and the author(s) reported a non-significant between-group difference, we estimated that effect size as zero (Lipsey & Wilson, 2001). In calculating *d*, we adjusted for baseline differences when pre-intervention measures were available (Morris & DeShon, 2002). All ES were corrected for sample size bias (Hedges, 1981). Positive ES indicate that participants receiving an intervention reported the intended effects (*lower* alcohol consumption and *fewer* alcohol-related problems compared to controls).

Multiple ES were calculated from individual studies when they reported more than one outcome variable, multiple FTFIs or CDIs, or when outcomes were separated by sample characteristics (e.g., gender). When a study reported multiple measures of the same outcome, the ES were averaged by assessment interval. ES calculated for each intervention and by sample characteristic were analyzed as a separate study (Lipsey & Wilson, 2001). Two coders independently calculated ES; ES were examined for consistency and discrepancies corrected.

Statistical Analysis

Weighted mean ES, d_+, stratified by assessment interval,[1] were calculated using fixed-and random-effects procedures (Lipsey & Wilson, 2001). To assess the extent to which outcomes were consistent across studies, the I^2 index and its corresponding 95% confidence intervals (*CI*s) were calculated (Higgins & Thompson, 2002; Huedo-Medina, Sanchez-Meca, Marin-Martinez, & Botella, 2006). I^2 varies between 0 (homogeneous) and 100% (heterogeneous) (Higgins, Thompson, Deeks, & Altman, 2003). If the *CI* around I^2 includes zero, the set of ES is considered homogeneous. To examine differences between FTFIs and CDIs, we calculated the between-groups-of-studies measure, $Q_{B,}$ which is the weighed sum of squares of group mean ES about the grand mean effect size (Hedges & Olkin, 1985). These analyses were calculated using a mixed-model approach, a more conservative approach to a fixed-effect model (Lipsey & Wilson, 2001).

To explain variability in ES, the association between sample, methodological, or intervention characteristics and the magnitude of the effects were examined using a modified weighted regression analysis with weights equivalent to the inverse of the variance for each effect size (Hedges, 1994; Lipsey & Wilson, 2001). For the mixed-effect regression models, the inverse variance for each effect size included error associated with within-study

[1]The timing and number of post-intervention assessments varied. For FTFIs, first (k = 32), second (k = 19), third (k = 12), and fourth (k = 3) assessments typically occurred at 8 weeks (range = 2 to 52 weeks), 26 weeks (range = 4 to 104 weeks), 52 weeks (range = 26 to 156 weeks), and 65 weeks (range = 52 to 208 weeks) post-intervention, respectively. Only a single study had a fifth assessment at 65 weeks post-intervention. Studies comparing CDIs to no-treatment controls had fewer assessment intervals than FTFI; first (k = 33), second, (k = 13), and third (k = 5) assessments typically occurred at 4 weeks (range = 0 to 13 weeks), 26 weeks (range = 4 to 52 weeks), and 52 weeks (range = 26 to 52 weeks), respectively. To avoid violating the assumption of independence, we stratified post-intervention follow-up time lapse into three assessment intervals: (a) short-term follow-up (assessments ≤ 13 weeks; k = 27 FTFIs, 34 CDIs), (b) intermediate follow-up (14 to 26 weeks; k = 17 FTFIs, 11 CDIs), and (c) long-term follow-up (≥ 27 weeks; k = 13 FTFIs, 5 CDIs).

level sampling error and additional between-study population variance; these models are more conservative than purely fixed-effects models (Lipsey & Wilson, 2001). Regression analyses examined *a priori* moderators. Sample characteristics (e.g., proportion women, targeted group), intervention content (e.g., feedback on consumption, normative comparisons), and intervention dose were examined. Significant moderators were entered simultaneously into multiple regression models to evaluate whether they explained unique variance. Continuous variables (e.g., proportion women) were mean-centered to reduce multicolinearity. To retain all studies in multiple moderator models, missing values of significant moderators were imputed from the mean of other studies that reported the information. All analyses were conducted in Stata 11 (StataCorp, 2009) using published macros (Lipsey & Wilson, 2001).

Results

Descriptive Outcomes

Table 1 summarizes study and participant characteristics, research design, and intervention details of the studies comparing FTFIs and CDIs to a no-treatment control. Of the 22 studies evaluating a FTFI vs. a no-treatment control, 20 (91%) were published in journals between 1998 and 2011. Studies were typically conducted at large public universities in the U. S. northeast or southeast and targeted heavy drinkers. The modal participant was a Caucasian first-year student (M age = 19, SD = 0.80) who volunteered for the study. FTFIs were typically delivered in a single session of 53 minutes (range = 5 to 120 minutes). Intervention content usually included alcohol education, feedback on consumption as well as alcohol-related risk factors and problems, and normative comparisons. Of the 26 studies comparing CDI to a no treatment control, 21 (81%) were published in journals between 2000 and 2011. Studies typically sampled first-year students and/or heavy drinkers attending large public universities across the U.S. Participants were typically Caucasian first-year students with a median age of 20. CDIs were typically delivered in a single session of 13 minutes (range = 1 to 150 minutes).

Several intervention components listed in Table 1 varied in the likelihood of being included in either the FTFI or CDI group. FTFIs were more likely to challenge alcohol-related expectancies (χ^2 [1] = 4.54, p = .03) and/or provide general alcohol-related materials (χ^2 [1] = 6.09, p = .01) whereas CDIs more consistently offered consumption feedback (χ^2 [1] = 4.16, p = .04) and/or normative comparisons (χ^2 [1] = 5.32, p = .02). No significant between-group differences were found for the other intervention components. Table 2 contains details of the interventions, number of sessions, and intervention length, as well as the nature of the sample, and length of assessment interval.

Impact of the Face-to-Face and Computer-Delivered Interventions Compared with Controls

Face-to-face interventions—Table 3 provides the weighted mean ES, d_+, for the 21 studies examining differences between FTFIs and no treatment controls. At short-term follow-ups, students participating in a FTFI reduced their quantity of alcohol consumed per week or month and per drinking day, frequency of heavy drinking, peak BAC, and alcohol-related problems relative to those in a control condition. All of the effects were homogeneous. At intermediate-length follow-ups, FTFI participants reduced their quantity of alcohol consumed per drinking day and their peak BAC relative to controls. At long-term follow-ups, FTFI participants maintained reductions in the quantity of alcohol consumed per drinking day relative to controls. The pattern of results was consistent using fixed- or random-effects assumptions. (Only results using random-effects models are reported in Table 3.)

Computer-delivered interventions—At short-term follow-ups, college students who received a CDI reduced the quantity of alcohol consumed per week/month, frequency of heavy drinking, and peak BAC (see Table 3). CDI recipients did not differ from controls on quantity of alcohol consumed per drinking day or alcohol-related problems at short-term follow-ups. These effects were consistent using either fixed- or random-effects assumptions. Examination of the I^2 index indicated that the studies lacked homogeneity. Moderator tests were conducted to examine whether study features related to the variability in effects (reported below). At the intermediate or long-term follow-ups, CDI recipients did not differ from non-treatment controls on alcohol consumption or alcohol-related problems.

Moderators of Intervention Impact on Alcohol Consumption and Alcohol-Related Problems

All of the ES for FTFIs were homogeneous with two exceptions: quantity of alcohol consumed per week/month at the intermediate assessment and the frequency of heavy drinking at long-term assessment. All ES for CDIs lacked homogeneity at short-term follow-up but were homogeneous at the intermediate and long-term assessment intervals. Because we had *a priori* moderation hypotheses, we conducted moderator tests to examine whether sample, methodological, or intervention characteristics related to the variability in ES.

Gender—Consistent with our hypothesis, the proportion women sampled moderated the quantity of alcohol consumed (per week/month) for CDIs. Compared to controls, CDIs were less successful in reducing alcohol use when they sampled more women at short-term, intermediate, and long-term assessments ($\beta = -0.37$, $p = .03$; $\beta = -0.84$, $p = .03$; $\beta = -0.98$, $p = .05$, respectively). The proportion of women sampled did not moderate the effect of FTFIs for any dependent variable at any assessment interval.

Targeted group—We examined three variables related to student risk level as potential moderators of intervention efficacy: whether or not the intervention targeted heavy drinkers, students who had violated campus alcohol policy, or students experiencing alcohol-related problems (typically measured as 2 or more problems on the Rutgers Alcohol Problem Index; White & Labouvie, 1989). Contrary to expectations, relative to samples that selected only heavy drinkers, students participating in FTFIs recruited from general student samples reported greater reductions in quantity of alcohol consumption (per week/month and drinking day) and alcohol-related problems at the long-term assessment ($\beta = -0.66$, $p = .03$; $\beta = -0.69$, $p = .03$; $\beta = -0.64$, $p = .04$, respectively). In contrast, participants given a CDI reduced heavy drinking frequency at the short-term assessment to a greater extent in heavy drinking samples than in samples that did not select for heavy drinkers ($\beta = 0.44$, $p = .03$). Consistent with our prediction, FTFIs were more successful at reducing the quantity of alcohol consumed (per week/month) at long-term assessment in samples of students who had violated campus alcohol policy than with non-mandated samples ($\beta = 0.72$, $p = .02$). Finally, targeting participants who were experiencing an alcohol-related problem was not a significant moderator of intervention effects for either alcohol consumption or problems.

Intervention components—Exploratory analyses revealed that several intervention components (see Table 1 for complete list) moderated the efficacy of the FTFIs and/or the CDIs. Within each intervention type, findings are presented for consumption across follow-up intervals, then for consequences.

At short-term assessments, FTFIs reduced the quantity of alcohol consumed (per week/month) *more* when the interventions provided alcohol/BAC education ($\beta = 0.55$, $p = .04$), feedback on alcohol risks ($\beta = 0.68$, $p = .01$) or alcohol-related problems ($\beta = 0.75$, $p < .01$), normative comparisons ($\beta = 0.68$, $p = .01$), and moderation strategies ($\beta = 0.66$, $p = .01$). At intermediate assessments, the reductions in quantity of alcohol consumption (per week/

month) were greater when FTFIs included feedback on consumption (β = 0.60, p =.04) but less when a decisional balance exercise (β = −0.60, p =.04) was included. Also at the intermediate assessment FTFIs reduced the frequency of heavy drinking to a greater extent when the intervention included feedback on alcohol risks (β = 0.60, p =.04), feedback on alcohol-related problems (β = 0.60, p =.04), or moderation strategies (β = 0.61, p =.04). Participants receiving FTFIs reported *fewer* alcohol-related problems at short-term when the intervention challenged expectancies (β = 0.58, p =.03) and at long-term when the interventions included feedback on consumption (β = 0.62, p =.05), risks (β = 0.62, p =.05), and alcohol-related problems (β = 0.62, p =.05); normative comparisons (β = 0.62, p =.05); and moderation strategies (β = 0.62, p =.05).

At the short-term assessment, CDI participants were *less* likely to reduce their alcohol consumption (per week/month) when the interventions identified high-risk situations (β = −0.46, p <.01), included a decisional balance exercise (β = −0.37, p =.03), and values clarification (β = −0.49, p <.01). Similarly, interventions were *less* successful at reducing the quantity of alcohol consumed per drinking day when content included identification of high-risk situations (β = −0.60, p =.03), decisional balance exercises (β = −0.29, p =.03), or values clarification (β = −0.59, p =.03). Finally, CDIs were *less* successful at reducing alcohol-related problems when the content included moderation strategies (β = −0.72, p =.04) and identified high-risk situations (β = −0.71, p =.05).

Intervention dose—Dose measured in number of minutes ranged from 5 to 120 minutes for FTFIs; most FTFIs ranged between 30 to 60 minutes, with a cluster at 50 to 60 minutes. In contrast, dose for CDIs ranged from 1 to 150 minutes most were less than 30 minutes with the largest cluster under 15 minutes. Duration of the intervention did not moderate alcohol consumption or alcohol-related problems at any assessment interval.

Multiple moderator models—Significant moderators were simultaneously entered into a regression models for each dependent variable by assessment interval. None of the moderators of FTFI remained significant in multiple moderator models. With respect to CDI, two of the multiple moderator models emerged as significant. First, to predict the quantity of alcohol consumed per week/month at the short-term assessment interval, significant moderators (proportion women, identification of high-risk situations, decisional balance exercise, and values clarification) were simultaneously entered into a multiple moderator model. Only proportion women (β = −0.37, p = .03) remained a significant moderator of the quantity of alcohol consumed and accounted for 46% of the variance. Second, to the frequency of heavy drinking at short-term assessment, significant moderators (targeting heavy drinkers and identification of high-risk situations) were simultaneously entered into a multiple moderator model. Neither remained significant when entered into the regression model.

Comparisons between Face-to-Face and Computer-Delivered Interventions—To examine differences between FTFIs and CDIs, we calculated the between-groups-of-studies measure, Q_B, using a mixed-model approach. There were no differences between modalities on quantity of alcohol consumed (per week/month or drinking day) or alcohol-related problems at any assessment interval (see Table 3). FTFIs and CDIs differed significantly on peak BAC at the intermediate assessment, Q_B (1) = 6.74, p < .01. Participants who received a FTFI (M = 0.27, SE = .06) reduced their peak BAC at the intermediate assessment more than those who had received a CDI (M = 0.04, SE = .07). At long-term assessment, FTFIs and CDIs differed significantly on the frequency of heavy drinking, Q_B (1) = 6.65, p = .01. Participants receiving a CDI (M = 0.12, SE = .09) reduced their frequency of heavy drinking at long-term assessment more than those receiving a FTFI (M = −0.19, SE = .08).

Supplemental Analyses of Studies Directly Comparing FTFIs with CDIs—Four manuscript (consisting of five studies) included both a FTFI and a CDI (Butler & Correia, 2009; Carey et al., 2011; Murphy, Dennhardt, Skidmore, Martens, & McDevitt-Murphy, 2010; Walters et al., 2009). In addition, three additional manuscripts not included in the previous analyses made direct comparisons between a FTFI and a CDI (Barnett et al., 2007; Carey, Henson, Carey, & Maisto, 2009; Donohue et al., 2004); see Table 2 for study descriptions. From these eight studies, ES were calculated for 15 intervention comparisons. Because few studies were available, we used the last assessment from each study in the analyses. As shown in Table 4, participants who received the FTFI reduced alcohol consumption (per week/month *and* per drinking day) as well as peak BAC, and reported fewer alcohol-related problems at follow-up compared with those who received a CDI. There were no differences between participants who received a FTFI or a CDI on frequency of heavy drinking at last assessment. All of the ES were homogeneous.

Discussion

CDIs arrived recently to the alcohol prevention field but the literature has grown rapidly. As evidence of this trend, in the four years since an earlier review was published (Elliott et al., 2008), the literature evaluating CDIs for college drinkers has increased from 17 to 30 trials. Further, with the burgeoning interest in mobile health and e-health applications (Fortney, Burgess, Bosworth, Booth, & Kaboli, 2011), use of CDIs is likely to continue because of benefits such as lower cost, easier access and availability, and replicability. The concurrent commitment to the use of empirically-supported and evidence-based interventions requires that CDIs undergo the same scrutiny expected of FTFIs (Chambless & Hollon, 1998).

For this review, we assembled evidence of the comparative efficacy of FTFIs and CDIs using three approaches: (a) evaluating effect size magnitude for each delivery format compared to assessment-only controls, (b) making direct comparisons between the magnitude of effects for FTFI and CDIs, and (c) summarizing the effects of the limited number of studies that directly compared FTFIs and CDIs. The comparative efficacy analyses (i.e., approaches “a” and “b”) revealed no consistent pattern of differences in the magnitude of effects (relative to controls) across most variables. However, studies that compared CDIs with FTFIs directly (i.e., approach “c”) favored FTFIs with respect to quantity, peak BAC, and alcohol-related problems. Overall, these findings provide support for FTFIs and limited support for CDIs for alcohol abuse prevention among college students.

FTFIs produced reliable risk reduction across multiple outcome measures at short-term follow-ups, and reductions in measures of quantity consumed and intoxication at follow-ups extending over a year. Despite the differences in content, intervention length, and type of facilitators within FTFIs, effects on alcohol use and consequences are homogeneous; thus, one can expect that FTFI will produce small but robust effects on college alcohol use even though they vary in content and style. Our findings also indicate that both male and female students respond positively to FTFIs, and the effects of FTFIs are particularly strong for mandated students. This is promising given resistance and/or defensiveness to risk reduction messages observed when participation in an intervention is mandated rather than voluntary (Palmer, Kilmer, Ball, & Larimer, 2010).

FTFIs that contain certain components are particularly effective at producing drinking reductions. Stronger effect sizes were associated with personalized feedback on consumption, risks and problems; normative comparisons; moderation strategies; challenging positive alcohol expectancies; and provision of BAC education. These components characterize the empirically supported interventions designated by the NIAAA

as Tier I interventions (National Institute on Alcohol Abuse and Alcoholism, 2002): cognitive-behavioral skills training with norms correction, feedback-based brief motivational interventions, and expectancy challenge interventions. The present findings address the need to identify components of effective interventions (Larimer & Cronce, 2007) in order to continue to enhance intervention efficacy.

The only component included in FTFIs that was associated with poorer outcomes was decisional balance (i.e., exercises used to decrease ambivalence, characteristic of the contemplation stage of change) (Prochaska, DiClemente, & Norcross, 1992). Strong inferences based on this result are not warranted, however, because this result was based on a limited number of studies and because the effect of decisional balance as a moderator of alcohol consumption (quantity per week/month) disappeared in multiple moderator analyses that controlled for other intervention components. Thus, future research on the impact of decisional balance exercises among college drinkers is needed before it is appropriate to conclude that such exercises are unhelpful.

The pattern of findings for CDIs revealed effects only on selected outcomes in the short-term. In contrast with the homogeneity of effects revealed for FTFIs, significant variability in efficacy was apparent within CDIs. Thus, as a group, the effect on student drinking is less reliable, and appears to vary as a function of the variability of content, tailoring, and method of access (e.g., logging on to a web-based CDI on home computer or smart phone versus interacting with a more structured, office-based CDI). Thus, the heterogeneity within the class of CDIs suggest greater attention be paid to isolating the content and components that can be incorporated in CDIs that produce change in drinking. Lustria, Cortese, Noar, and Glueckauf (2009) offer a components analysis of web-based computer-tailored health interventions that provides a useful framework for CDI design.

In this set of computer-delivered alcohol abuse prevention interventions, program length was unrelated to effect size, so more elaborate CDIs are not necessarily better. However, moderation analyses did identify components of CDIs that appeared to be associated with *poorer* outcomes. Specifically, identifying high-risk situations, inclusion of decisional balance, and values clarification were not effective components in CDIs targeted to college drinkers. At present, it is not clear if these components were implemented ineffectively in the CDIs that included them, or if they do not translate well to CDI format and should omitted from future CDI development.

The type of student receiving the CDI also influenced outcomes. Our analyses indicated that when more women were included, the efficacy of CDIs was reduced. It is important to note that gender moderated the effect of CDIs relative to controls (in contrast to CDIs relative to other type of intervention), so this finding represents a lessened response to CDI itself. One potential explanation relies on findings in other contexts that show differential gender responses to low intensity interventions. In general, women respond more positively than men to minimal alcohol interventions (Sanchez-Craig, Spivak, & Davila, 1991); this positive response to minimal or no-treatment control conditions presents challenges in detecting brief intervention effects on alcohol use (Chang, 2002). Although these findings suggest that the CDI effect may be muted for female students because of their positive response to assessment-only controls, they do not explain why a parallel moderation effect was not found with FTFIs. An alternative, albeit speculative, interpretation is that female students find alcohol abuse prevention CDIs less appealing than do male students. Future interventions developers might evaluate the gender-linked relevance and appeal of CDI content and consider gender-tailoring to avoid undermining intervention effects for women.

Also, CDIs targeting samples of heavier drinkers were more efficacious that CDIs targeting the broader student population, in the short-term. Heavy drinkers often do not perceive their drinking as a problem and are unlikely to seek help to reduce their alcohol consumption (Wechsler et al., 2002). Because CDIs typically provide personalized feedback, receiving an alcohol intervention via computer may increase students' risk awareness especially among those who have failed to acknowledge the severity of their behavior (Noar, Benac, & Harris, 2007). Computer-based interventions may also reduce heavy drinking college students' reactivity to the intervention as many CDIs are user-driven which may be perceived as less threatening (Pequegnat et al., 2007). Alternatively, smaller effects may be seen when lighter drinkers receive CDIs because personalized feedback reveals lower risk and thus fails to create a discrepancy to motivate behavior change.

Relatively few studies compared FTFIs and CDIs directly. The eight studies that provided such contrasts revealed small but significant effects in favor of the FTFIs on quantity and problems measures. Most of the FTFIs evaluated consist of brief motivational interventions (BMIs; single-session, feedback interventions conducted in motivational interviewing style), with the one exception being an individualized cognitive behavioral intervention emphasizing drink refusal training (Donohue et al., 2004). The comparison CDIs are dominated by Alcohol 101™, an interactive CD-ROM made available for free by the Century Council, or computer-delivered feedback matched to the feedback delivered in the FTFI. Thus a BMI, which is led by a facilitator and includes many of the components identified as predictors of good outcome, will lead to greater reductions in drinking quantities and problems than the specific CDIs that have been compared to it thus far. The literature includes only one dismantling design (Walters et al., 2009) and only one design that attempted to control for content while varying method of administration (Butler & Correia, 2009). Such designs allow better isolation of intervention differences accounting for outcome than the remaining studies that compared FTFIs and CDIs differing in both modality and content.

Overall, both FTFIs and CDIs reduce consumption in the short-term; FTFIs also significantly reduce problems in the short term and maintain suppression of quantity consumed over longer-term follow-ups. Direct comparisons favor FTFIs over CDIs although the incremental effect is small. In general, comparisons among active treatments tend to produce smaller effect sizes (Grissom, 1996). To put the effect sizes found in this study in context, we can look to other relevant meta-analytic studies for comparisons. CDIs that were designed for a broader range of substance users typically report small effects (d_+ = .24; Portnoy et al., 2008). CDIs for other health behaviors also reveal small initial effects (g = .17) that tend to decrease over time (Krebs, Prochaska, & Rossi, 2010). Furthermore, a synthesis of reviews across 6 health behavior domains reported small but significant effect for behavioral addictions treatments (d_+ = .21; Johnson, Scott-Sheldon, & Carey, 2010), equivalent to the effects of FTFIs and CDIs on college drinking. From a clinical perspective, both average volume of drinking and high-volume patterns of drinking demonstrate dose-response relationships with injury and other adverse health effects among drinkers, so even small reductions in average consumption are likely to reduce harms to individuals (Rehm et al., 2003). Thus, small changes in drinking patterns achieved by dissemination of alcohol abuse risk reduction interventions can have a public health impact by significantly reduce the harms associated with college drinking (cf. Rose, 1992).

Limitations

Several limitations of the extant research should be considered when interpreting these findings. First, identification of relevant studies may have been incomplete due to authors' use of keywords, publication source, and researchers' non-responses to requests for information (Matt & Cook, 1994). Although we undertook an exhaustive search process,

including searching all relevant databases on two separate occasions (June 2009 and May 2010), to ensure retrieval of all available studies through December 2010, relevant studies may have been inadvertently omitted. Second, all outcomes involve self-reports, which are vulnerable to cognitive (e.g., memory) and social (e.g., self-presentation) biases (Schroder, Carey, & Vanable, 2003; Weinhardt, Forsyth, Carey, Jaworski, & Durant, 1998). Self-report is imperfect, but most researchers employed methods designed to optimize data quality. Third, our operationalization of risk status relied on the information available in the studies; however, mandated status and the presence of alcohol-related problems may not be the optimal way to measure alcohol use severity or risk for negative outcomes. Fourth, the analyses identifying components associated with effect sizes are not independent, because components are nested within intervention protocols. Finally, the limited number of studies directly comparing FTFIs with CDIs precluded the evaluation of potentially important moderators of the finding that FTFIs reduce the quantity of alcohol consumed (per week/month and per drinking day) relative to CDIs.

Future Directions

This study suggests several directions for future research. In light of the small effects observed, future studies should develop and evaluate theoretically-based components in an effort to improve the magnitude of effect sizes. Further, research will need to go beyond simple efficacy evaluations and investigate whether intervention components, observed to be effective in FTFIs, can be demonstrated to be equivalently effective when delivered by computer. Also, researchers might identify what CDIs provide that might be more attractive and/or efficacious than FTFIs. Use of multi-media applications and the flexibility to pursue personally relevant content in an interactive way have been mentioned as benefits of CDIs (Budman, Portnoy, & Villapiano, 2003) but do such features help to change behavior? If so, do they facilitate deeper processing of the information (Jouriles et al., 2010) or might interactivity work by other mechanisms? Research is needed to determine how the conditions under which intervention content is delivered affect attention, depth of processing, and managing resistance. Increased research on gender differences in response to CDIs is warranted. Research might investigate whether female students simply prefer FTFIs, respond poorly to CDIs in general, or respond poorly to extant CDIs because they have not have been gender-tailored. Examination of CDIs targeted to men and women might evaluate the benefits (or weaknesses) of computer-delivery to reduce women's alcohol consumption.

Overall, the available evidence suggests that CDIs show promise in efforts to reduce harmful alcohol consumption among college students but they remain less efficacious than traditional FTFIs. Because of the many advantages of CDIs, increased research will be needed to align the benefits of this increasingly popular approach with the demonstrated need for alcohol use risk reduction among college students.

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Highlights

- a meta-analysis evaluates the efficacy of face-to-face vs computerized alcohol interventions
- both types of interventions are associated with less drinking in the short term
- face-to-face interventions produce risk reduction across a wider range of drinking outcomes
- effects of face-to-face (vs computerized) alcohol interventions last longer
- direct comparisons within studies favor face-to-face interventions

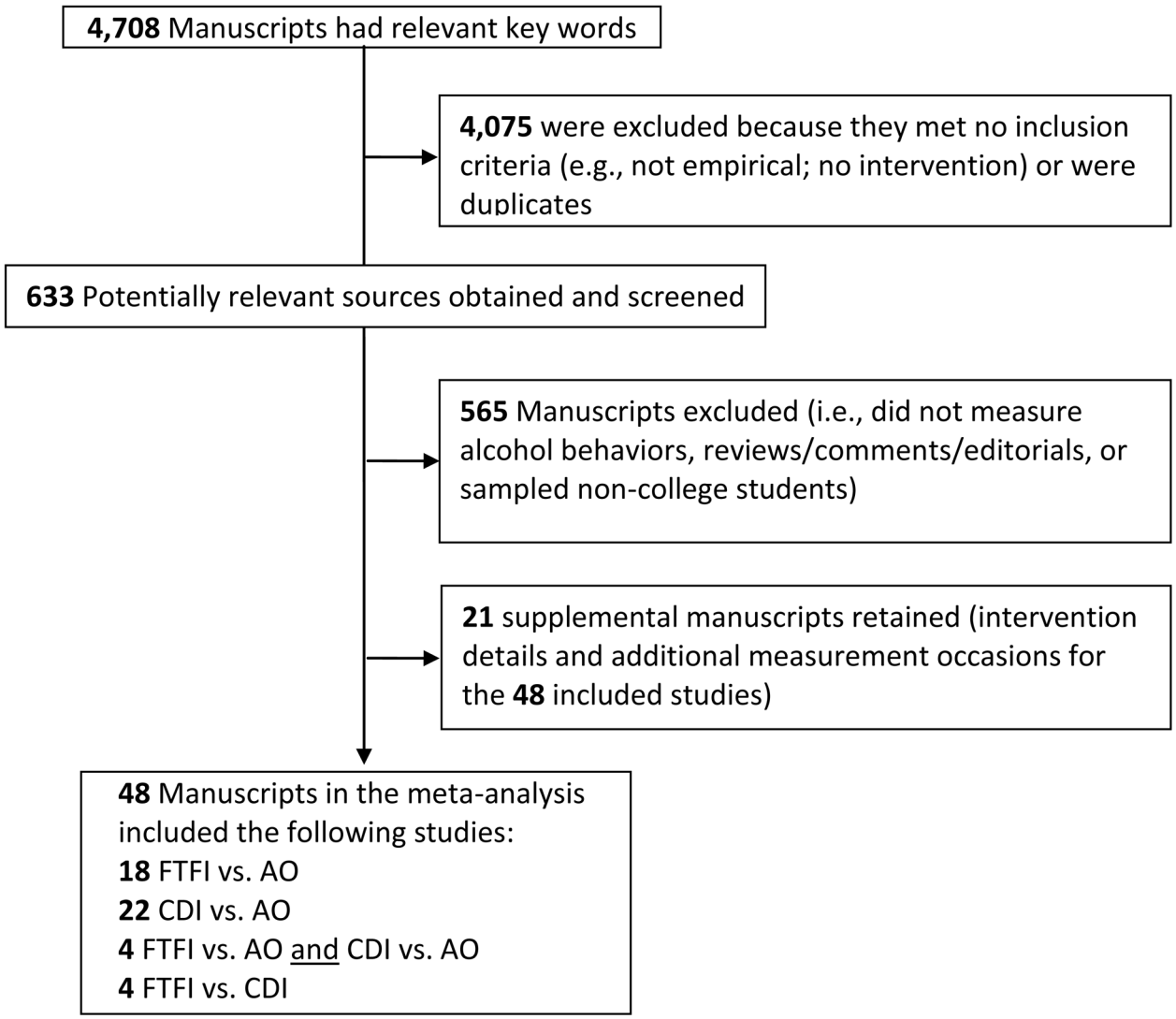

Figure 1.
Selection process for study inclusion in the meta-analysis. FTFI, face-to-face intervention; CDI, computer-delivered intervention; and AO, assessment only.

Table 1

Study, Sample, and Intervention Details by Intervention Modality

	FTFI	CDI
Study Characteristics		
Number of studies	22	26
Publication year, *Mdn* (Range)	2007 (1998–2011)	2009 (2000–2011)
Data collection year, *Mdn* (Range)	2005 (1990–2009)	2006 (1994–2009)
Region, no. (%)		
US Northeast	9 (41)	4 (15)
US Southeast	6 (27)	3 (12)
US Midwest	1 (5)	4 (15)
US Southwest	3 (14)	7 (27)
US Northwest	1 (5)	4 (15)
Non-US region	1 (5)	3 (12)
Multiple U.S. regions	1 (5)	1 (4)
*Type of Institution, no. (%)		
Public university	14 (74)	17 (68)
Private university	5 (26)	6 (24)
Community college	0 (0)	2 (8)
Institution Size, no. (%)		
<5,000 students	0 (0)	1 (5)
5,000 – 15,000 students	1 (5)	4 (18)
>15,000 students	18 (95)	17 (77)
Research Design and Implementation		
*Target Group, no.		
First-year students	7	6
Athletes	1	0
Students turning 21	0	1
Students violating alcohol policy	2	1
Current drinkers	2	1
At-risk drinkers	6	2
Heavy drinkers	12	9
Students experiencing alcohol-related problems	6	0
*Recruitment procedures, no. (%)		
Volunteered	15 (68)	13 (50)
Recruited	5 (23)	10 (38)
Mandated	2 (9)	3 (12)
Randomized Controlled Trial, no. (%)	22(100)	25 (96)
Provided incentives, no. (%)	19 (86)	15 (79)
Post-intervention assessments, *Mdn* (Range)	2 (1–5)	1 (1–3)

	FTFI	CDI
Methodological quality rating, *Mdn* (Range)	14 (8–16)	13 (8–15)
Sample Characteristics		
Sample size, initial/final	6,197/5,237	62,486/32,243
Age, *M* (*SD*)	19 (0.80)	20 (1.12)
Women, *M%* (*SD*)	56 (16)	51 (11)
Race/ethnic, *M*% (*SD*)		
White	83 (11)	81 (10)
Black	7 (12)	7 (9)
Hispanic/Latino	11 (11)	13 (15)
Asian	5 (4)	10 (9)
Year in school, *M*% (*SD*)		
Freshman	68 (28)	73 (34)
Sophomore	13 (14)	16 (17)
Junior	10 (12)	12 (12)
Senior	5 (07)	10 (11)
Proportion Greek members, *M%* (*SD*)	32 (14)	20 (16)
Prior alcohol use, *M*% (*SD*)	97 (10)	95 (14)
Intervention Characteristics		
No. of Intervention Conditions, *k*	33	34
Implemented a commercially available program, no. (%)	0 (0)	14 (41)
Intervention was guided by BASICS	25 (76)	17 (50)
Intervention was theory-driven	7 (21)	15 (44)
Intervention dose, *Mdn* (Range)		
No. sessions	1 (1–6)	1 (1–11)
No. minutes	53 (5–120)	13 (1–150)
* Facilitators		
Peers	3	0
Parent	1	0
Paraprofessionals	8	0
Professional-in-training	25	0
Professionals	7	0
None	0	34
Intervention content tailored, no. (%)	32 (97)	33 (97)
* Intervention content, no. (%)		
Alcohol/BAC education	25 (78)	23 (68)
Feedback on consumption	27 (82)	33 (97)
Feedback on risk factors	25 (76)	24 (71)
Feedback on problems	26 (79)	24 (71)
Normative comparisons	26 (79)	33 (97)
Moderation strategies	18 (55)	19 (56)

	FTFI	CDI
Goal-setting	19 (58)	12 (35)
Challenged expectancies	16 (48)	8 (24)
Focus on high-risk situations	10 (30)	10 (29)
Decisional balance exercise	7 (21)	4 (12)
Skills training	2 (6)	1 (3)
Values clarification	0 (0)	2 (6)
Provided general alcohol-related materials, no. (%)	11 (33)	3 (9)
Provided tailored alcohol-related materials, no. (%)	22 (67)	17 (50)

Note. N, number of studies; *k*, number of interventions; NR, not reported.

*Multiple categories were possible.

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Table 2

Study, sample, and intervention characteristics of the studies included in the meta-analysis.

	Included in Analyses								
Study	**FTFI**	**CDI**	**FTFI v. CDI**	**Sample**	**Description**	**Sessions**	**Dose[a]**	**MQS**	**Assessment Interval**
Barnett et al. (2007; 2004); Murphy, Barnett, and Colby (2006)			X	*N* = 227; 51% F; 76% W; *M* age = 19; 100% baseline ALC; Mandated	*BMI.* Alc Ed, PNF, AE, DB, PBS, and GS. Comparison group: Alcohol 101	1	60	15	ST, LT
					BMI and Booster. Alc Ed, PNF, AE, DB, PBS, and GS; boosters session reviewing baseline session, recent events that occurred, and goals. Comparison group: Alcohol 101				
Bingham et al. (2010)		X		*N* = 1200; 59% F; 80% W; *M* age = 18; 83.5% baseline ALC; Recruited	*C-PNF.* Web, Alc Ed, PNF, values clarification, DB, PBS, HS situations, and GS.	4	50	10	ST
Borsari and Carey (2003; 2005; 2009)	X			N = 60; 56% F; 90% W; *M* age = 19; 100% baseline ALC; Voluntary	*BMI.* Alc Ed, PNF, DB, AE, PBS, HR situations, and GS.	1	60	11	ST
Butler and Correia (2009)	X		X	N = 104; 65% F; 92% W; *M* age = 20; 100% baseline ALC; Voluntary	*BMI.* Alc Ed, PNF, and PBS.	1	41	10	ST
		X			*C-PNF.* Local computer, PNF, and PBS.	1	11.11	10	ST
Carey, Carey, Henson, Maisto, and DiMartini (2011)	X		X	N = 677; 36% F; 85% W; *M* age = 19; 100% baseline ALC; Mandated	*BMI.* Alc Ed, PNF, PBS, and GS.	1	62	14	ST, IT, LT
		X			*Alcohol 101+.* Local computer, Alc Ed, normative comparisons, AE, PBS, HR situations, and GS.	1	60		
		X			*AlcoholEdu for Sanctions.* Web, Alc Ed, PNF, AE, PBS, and GS.	2	120		
Carey, Carey, Maisto, and Henson (2006); Carey et al. (2007); Borsari et al. (2009)	X			N = 509; 65% F; 89% W; *M* age = 19; 100% baseline ALC; Voluntary	*TLFB.* Recall of alcohol behaviors.	1	45	14	ST, IT, LT
	X				*Basic BMI.* Alc Ed, PNF, AE, HR situations, and PBS.	1	60		
	X				*TLFB/basic BMI.* Alc Ed, PNF, AE, HR situations, and PBS; recall of alcohol behaviors.	2	105		
	X				*Enhanced BMI.* Alc Ed, PNF, DB, AE, HR situations, PBS, and GS.	1	60		
	X				*TLFB/enhanced BMI.* Alc Ed, PNF, DB, AE, HR situations, PBS, and GS; recall of alcohol behaviors.	2	105		
Carey, Henson, Carey, and Maisto (2009; 2010)			X	*N* = 198; 46% F; 91% W; *M* age = 19; 100% baseline ALC; Mandated	*BMI.* Alc Ed, PNF, PBS, and GS.	1	50	14	ST, IT, LT

	Included in Analyses								
Study	**FTFI**	**CDI**	**FTFI v. CDI**	**Sample**	**Description**	**Sessions**	**Dose[a]**	**MQS**	**Assessment Interval**
					Alcohol 101+. Local computer, Alc Ed, normative comparisons, AE, PBS, HR situations, and GS.				
Collins and Carey (2005); Collins (2003)	X			N = 131; 63% F; 92% W; *M* age = 19; 100% baseline ALC; Voluntary	*In-Person DB.* DB and GS.	1	30	15.8	ST, IT
Croom et al. (2009)		X		*N* = 3216; 49% F; 63% W; *M* age = 18; 40% baseline ALC; Recruited	*AlcoholEdu.* Web-Alc Ed, PNF, skills training, PBS, HR situations, and GS.	4	120	10	ST
Dermen and Thomas (2003)	X			N = 116; 59% F; *M* age = 21; 100% baseline ALC; Voluntary	*Alcohol and HIV BMI.* Alc Ed, HIV education, PNF, AE, PBS, HR situations, and GS.	2	105	13	ST, IT, LT
	X				*Alcohol BMI.* Alc Ed, PNF, AE, PBS, and GS.	2	75		
Dimeff and McNeely (2000); Dimeff (1997)		X		*N* = 46; 67% F; 72% W; *M* age = 22; 100% baseline ALC; Recruited	*C-PNF.* Local computer, Alc Ed, PNF, PBS, and HR situations; possibly tobacco feedback.	1	15	12	ST
Donohue, Allen, Maurer, Ozolos, and De Stefano (2004)			X	*N* = 113 (8%); 56% F; 63% W; *M* age = 21; 100% baseline ALC; Voluntary	*CBT.* Alc Ed, DB, HR situations, and skills training. Comparison group: Alcohol 101.	1	30	12.63	ST
Doumas and Andersen (2009)		X		*N* = 84; 41% F; 79% W; *M* age = 22; Voluntary	*e-Chug.* Web, Alc Ed, and PNF.	1	15	11	ST
Eggleston (2008)	X			N = 120; 58% F; 87% W; *M* age = 19; 100% baseline ALC; Voluntary	*Risk-Focused BMI.* Alc Ed, PNF, and AE.	1	67.09	11	IT
	X				*BMI.* Alc Ed and PNF.	1	51.17		
Feldstein and Forcehimes (2007); Feldstein (2007)	X			N = 65; 78% F; 64% W; *M* age = 19; 100% baseline ALC; Voluntary	*Substance Use BMI.* Alc Ed, marijuana education, tobacco education, and GS.	1	45	14	ST
Hester, Delaney, & Campbell (2012); *Study 1*		X		*N* = 144; 38% F; 88% W; *M* age = 20.39; 100% baseline ALC; Voluntary	*CDCU.* Local computer, Alc Ed, PNF, DB, exercised to resolve ambivalence to change, and GS.	1	37.5	13	ST, LT
Hester et al. (2012); *Study 2*		X		*N* = 82; 44% F; 86% W; *M* age = 20; 100% baseline ALC; Voluntary	*CDCU.* Local computer, Alc Ed, PNF, DB, exercised to resolve ambivalence to change, and GS.	1	37.5	11	ST
Hustad, Barnett, Borsari, and Jackson (2009)		X		*N* = 83; 51% F; 89% W; *M* age = 18; Recruited	*AlcoholEdu.* Web, Alc Ed, PNF, AE, skills training, PBS, and GS.	NR	180	15	ST
		X			*e-Chug.* Web, Alc Ed, PNF, and PBS.	1	20		
Juarez, Walters, Daugherty, and Radi (2006)	X			N = 122; 53% F; 57% W; *M* age = 19; 100% Baseline ALC; Voluntary	*BMI.* Alc Ed, PNF, DB, and AE.	1	70	10	ST
	X				*BMI without Feedback.* Alc Ed and DB.	1	50		

	Included in Analyses								
Study	**FTFI**	**CDI**	**FTFI v. CDI**	**Sample**	**Description**	**Sessions**	**Dose[a]**	**MQS**	**Assessment Interval**
Kypri et al. (2004; 2009; 2004); Hallett, Maycock, Kypri, Howat, and McManus (2009)		X		*N* = 2435; 45% F; *M* age = 19.7; 100% baseline ALC; Recruited	*C-PNF.* Web, Alc Ed, PNF, PBS, and smoking cessation.	1	10	14.74	ST, IT
Kypri and McAnally (2005)		X		*N* = 146; 51% F; 75% W; *M* age = 20; Recruited	*C-PNF.* Local computer, PNF, and PBS; personalized feedback and advice on fruit and vegetable consumption, physical activity, and smoking.	1	10	12.6	ST
Kypri et al. (2004)		X		*N* = 104; 50% F; *M* age = 20; 100% baseline ALC; Recruited	*C-PNF.* Web, Alc Ed pamphlet, and PNF.	1	7.8	14.7	ST, IT
Leffingwell et al. (2007)		X		*N* = 111; 39% F; *M* age = 19; 100% baseline ALC	*C-PNF.* Local computer, Alc Ed, PNF, and journaling.	1	35	14	ST; IT
Leffingwell, Leedy, and Lack (2005)		X		*N* = 78; 21% F; 90% W; *M* age = 20; 100% baseline ALC	*C-PNF.* Local computer, Alc Ed, PNF, and journaling.	1	35	14	ST; IT
Lewis and Neighbors (2006, 2007); Lewis (2006)		X		*N* = 185; 55% F; 97% W; *M* age = 20; 100% baseline ALC; Voluntary	*Gender-Specific C-PNF.* Local computer and PNF.	1	1.5	11.58	ST
		X			*Gender-Neutral C-PNF.* Local computer and PNF.				
Lovecchio, Wyatt, and DeJong (2010)		X		*N* = 1620; 54% F; 81% W; Mandated	*AlcoholEdu.* Web, Alc Ed, PNF, AE, PBS, HR situations, and GS.	1	105	13.68	ST
Lysaught, Wodarski, and Parris (2003)	X			N = 60; 53% F; 78% W; *M* age = 20; 100% baseline ALC; Voluntary	*BI.* Personalized feedback on risk factors; administered personalized feedback pamphlet.	1	5	12.63	ST
Marlatt et al. (1998)	X			N = 348; 54% F; 85% W; *M* age = 19; 100% baseline ALC; Recruited	*BMI.* PNF, AE, and PBS.	1	60	15	LT
Mastroleo (2008)	X			N = 238; 48% F; 92% W; *M* age = 18; 100% baseline ALC; Recruited	*Supervised Peer-Lead BMI.* Alc Ed, PNF, AE, and PBS; interventionist received supervision.	1	50	12	ST
	X				*Unsupervised Peer-Lead BMI.* Alc Ed, PNF, AE, and PBS.				
Murphy et al. (2001)	X			N = 99; 54% F; 94% W; *M* age = 20; 100% baseline ALC; Voluntary	*BMI.* Alc Ed, PNF, AE, PBS, and GS.	1	50	13	ST, IT
Murphy, Dennhardt, Skidmore, Martens, and McDevitt-Murphy (2010), *Study 1*			X	N = 74; 59% F; 73% W; *M* age = 21; 100% baseline ALC; Recruited	*BASICS.* PNF, AE, DB, skills training, PBS, HR situations, and GS. *Alcohol 101+.* Local computer, Alc Ed, normative comparisons, AE, PBS, HR situations, and GS.	1	55	13	ST

	Included in Analyses								
Study	**FTFI**	**CDI**	**FTFI v. CDI**	**Sample**	**Description**	**Sessions**	**Dose[a]**	**MQS**	**Assessment Interval**
Murphy, Dennhardt, Skidmore, Martens, and McDevitt-Murphy (2010), *Study 2*	X	X	X	N = 133; 50% F; 65% W; *M* age = 19; 100% baseline ALC; Voluntary	*BASICS.* PNF, AE, DB, skills training, PBS, HR situations, and GS.	1	55	13	ST
					e-Chug. Web (onsite), Alc Ed, PNF, and PBS.		36.5		
Neighbors, Larimer, and Lewis (2004)		X		*N* = 252; 59% F; 80% W; *M* age = 18.5; 100% baseline ALC; Voluntary	*C-PNF.* Local computer and PNF.	1	5	14.74	ST, IT
Neighbors, Lee, Lewis, Fossos, & Walters (2009)		X		*N* = 295; 58% F; 61% W; *M* age = 21; 100% baseline ALC; Recruited	*Event-Specific C-PNF.* Web, PNF, AE, PBS, and HR situations.	1	5	12.63	ST
Neighbors, Lewis, Bergstrom, and Larimer (2006)		X		*N* = 214; 56% F; 98% W; *M* age = 19.67; 100% baseline ALC; Voluntary	*C-PNF.* Local computer and PNF.	1	1.5	12.6	ST
Simao et al. (2008)	X			N = 266; 44% F; *M* age = 20; 100% baseline ALC; Recruited	*BMI.* Alc Ed, PNF, AE, skills training, PBS, and HR situations.	1	52.5	15	LT
Steiner, Woodall, and Yeagley (2005)		X		*N* = 159; 60% F; Voluntary	*e-Chug.* Web, Alc Ed, PNF, and PBS.	1	25	13.33	ST
Terlecki, Larimer, & Copeland (2010; under review)*; Study 1*	X			N = 45; 63% F; 78% W; *M* age = 20; 100% baseline ALC; Voluntary	*BMI.* Alc Ed, PNF, AE, PBS, HR situations, and GS; self-monitored alcohol consumption.	1	50	14	ST
Terlecki, Larimer, & Copeland (2010; under review); *Study 2*	X			N = 47; 14% F; 88% W; *M* age = 20; 100% baseline ALC; Mandated	*BMI.* Alc Ed, PNF, AE, PBS, HR situations, and GS; self-monitored alcohol consumption.	1	50	14	ST
Testa, Hoffman, Livingston, and Turrisi (2010)	X			N = 978; 100% F; 91% W; *M* age = 19; 53% baseline ALC; Recruited	*Parent-Based Intervention.* Parents discussed Alc Ed, communication strategies, and possibly college dating, sexual assertiveness, and partner selectivity with participant.	6	60	15	IT
Thombs et al. (2007)		X		*N* = 384; Voluntary	*Morning After C-PNF.* Web, Alc Ed, personalized breathalyzer reading, and normative comparisons.	1	10	11.58	ST
Turrisi et al. (2009); Mallett et al. (2010)	X			N = 1419; 56% F; 80% W; *M* age = 18; 85% baseline ALC; Recruited	*Parent-Based Intervention.* Parents discussed Alc Ed, normative comparisons, AE, skills training, PBS, and communication strategies with participant.	1	60	16	LT
	X				*Peer-Lead BMI.* Alc Ed, PNF, PBS, and GS.	1	52.5		
	X				*Combined Intervention.* Included intervention components of both the	2	112.5		

	Included in Analyses								
Study	**FTFI**	**CDI**	**FTFI v. CDI**	**Sample**	**Description**	**Sessions**	**Dose[a]**	**MQS**	**Assessment Interval**
					parent-based and peer-lead interventions.				
Wall (2005, 2006, 2007)		X		*N* = 50300; 53% F; 82% W; *M* age = 19; 80.7% baseline ALC; Voluntary, Recruited, and Mandated	*AlcoholEdu.* Web, Alc Ed, PNF, AE, PBS, HR situations, GS, and journaling.	1	150	8	ST
Walters (2000)	X			N = 46; 85% baseline ALC; Voluntary	*BMI.* Alc Ed, PNF, and money spent on alcohol.	1	120	8	ST
Walters, Vader, and Harris (2007)		X		*N* = 105; 48% F; 73% W; 100% baseline ALC; Recruited	*e-Chug.* Web, Alc Ed, PNF, and PBS.	1	5	13.68	ST, IT
Walters, Vader, Harris, Field, and Jouriles (2009)	X		X	N = 279; 64% F; 85% W; *M* age = 20; 100% baseline ALC; Voluntary	*BMI with Feedback.* PNF, money spent on alcohol, ambivalence about drinking, GS, and resources.	1	50	14	ST, IT
	X				*BMI without Feedback.* Personal drinking behaviors, ambivalence about drinking, GS, and resources.	1	40		
		X			*C-PNF.* Local computer, PNF, money spent on alcohol, and resources.	1	10	14	ST, IT
Weitzel, Bernhardt, Usdan, Mays, and Glanz (2007)		X		*N* = 50; 55% F; 80% W; *M* age = 19; 100% baseline ALC; Voluntary	*Feedback on Handheld Device.* Handheld computer-delivered, self-efficacy tailored feedback on alcohol-related consequences.	10.93	10.93	12.6	ST
Wood et al. (2007); Capone and Wood (2009)	X			N = 335; 53% F; 89.5% W; *M* age = 21; 100% baseline ALC; Voluntary	*BMI.* Alc Ed and PNF.	1	52.5	13	ST, IT

Note. Comparison condition was assessment only for all studies. *N*, number of consenting participants; F, proportion female; W, proportion White; ALC, alcohol users; MQS, methodological quality score; C-PNF, computer-delivered, personalized normative feedback; Alc Ed, alcohol-related education; PNF, personalized normative feedback; DB, decisional balance; PBS, protective behavioral strategies; HR situations, identification of high risk situations; GS, goal-setting; BASICS, Brief Alcohol Screening and Intervention for College Students; BMI, Brief Motivational Intervention; AE, alcohol expectancies; TLFB, Timeline Followback; BI, Brief Intervention; e-Chug, Electronic Check-Up to Go; CDCU, College Drinker's Check-up Program; ST, short-term assessment; IT, intermediate-term assessment; LT, long-term assessment.

[a]Estimated number of minutes of intervention content excluding measurement.

Table 3

Weighted mean effect sizes and homogeneity statistics for face-to-face (FTFI) and computer-delivered (CDI) alcohol interventions by follow-up interval

	FTFI vs. Controls			CDI vs. Controls			Comparisons Between Modalities	
Outcome	***k***	**d_+ (95% CI)**	**I^2 (95% CI)**	***k***	**d_+ (95% CI)**	**I^2 (95% CI)**	**Q_B**	***p***
Short-term Follow-up (≤13 weeks)								
Quantity, per week/month	21	**0.19 (0.11, 0.27)**	0	28	**0.14 (0.03, 0.24)**	80% (72, 86)	0.68	.410
Quantity, per drinking day	13	**0.17 (0.06, 0.27)**	0	14	0.08 (−0.13, 0.29)	78% (64, 87)	1.21	.272
Frequency of heavy drinking	18	**0.16 (0.07, 0.25)**	0	17	**0.13 (0.02, 0.24)**	67% (44, 80)	1.15	.284
Peak BAC	13	**0.18 (0.08, 0.28)**	0	11	**0.29 (0.12, 0.47)**	60% (23, 80)	0.99	.320
Problems	20	**0.15 (0.06, 0.23)**	0	21	0.11 (−0.00, 0.23)	85% (79, 90)	0.33	.563
Intermediate Follow-up (14–26 weeks)								
Quantity, per week/month	11	0.15 (−0.01, 0.30)	53% (6, 76)	8	0.13 (−0.01, 0.27)	0	0.09	.770
Quantity, per drinking day	11	**0.23 (0.12, 0.34)**	0	4	0.08 (−0.07, 0.22)	0	2.81	.094
Frequency of heavy drinking	13	0.07 (−0.03, 0.16)	0	4	0.17 (−0.05, 0.39)	0	1.21	.271
Peak BAC	9	**0.27 (0.16, 0.38)**	0	6	0.04 (−0.09, 0.17)	0	**6.74**	**.009**
Problems	13	0.09 (−0.01, 0.19)	0	9	0.01 (−0.10, 0.12)	0	1.10	.295
Long-term Follow-up (≥ 27 weeks)								
Quantity, per week/month	11	0.08 (−0.02, 0.19)	0	5	0.08 (−0.09, 0.26)	0	0.00	.977
Quantity, per drinking day	11	**0.16 (0.03, 0.30)**	0	4	0.07 (−0.08, 0.22)	0	1.07	.301
Frequency of heavy drinking	8	−0.20 (−0.40, 0.00)	61% (15, 82)	5	0.13 (−0.01, 0.26)	0	**6.65**	**.010**
Peak BAC	8	0.10 (−0.06, 0.26)	0	5	0.13 (−0.01, 0.27)	0	0.10	.758
Problems	11	−0.02 (−0.13, 0.09)	0	4	−0.07 (−0.22, 0.08)	0	0.54	.461

Note. Weighted mean effect sizes are based on random-effect models (MM). To be conservative, comparisons between modalities are based on a mixed model (full information ML). Using a random-effects (MM) model produced the same pattern of results.

Table 4

Weighted mean effect sizes and homogeneity statistics for face-to-face vs. computer-delivered alcohol interventions at last assessment”

				Sample Size		Weighted Effect Sizes (*d*)				
Source	**Group**	**Comparison**	**No. Weeks**	**FTFI**	**CDI**	$d_{quantity}$	$d_{quantity\ (DD)}$	d_{HD}	d_{pBAC}	$d_{problems}$
Barnett, Murphy, Colby and Monti (2007)		BMI (with booster) vs. Alcohol 101 (no booster)	52	58	55	--	0.45	−0.19	--	0.09
		BMI (no booster) vs. Alcohol 101 (no booster)		54	55	--	0.48	−0.23	--	0.01
Butler and Correia (2009)		BMI vs. FBO	3.92	28	30	−0.15	--	−0.23	--	0.17
Carey, Carey, Henson, Maisto, and DeMartini (2011)	Women	BMI vs. Alcohol 101+	52	58	62	0.39	0.27	−0.02	0.41	0.15
	Men		52	106	110	0.22	0.14	0.05	0.18	0.14
	Women	BMI vs. Alcohol EDU	52	58	63	0.31	0.19	−0.01	0.18	−0.06
	Men		52	106	104	0.21	0.28	0.08	0.16	0.12
Carey, Henson, Carey, and Maisto (2009)	Women	BMI vs. Alcohol 101	4.33	46	44	0.46	--	0.50	0.27	0.24
	Men		4.33	50	52	−0.05	--	−0.01	0.03	0.17
	Women and Men		26	71	71	--	−0.04	--	--	--
Donohue, Allen, Maurer, Ozols, and DeStefano (2004)	High-risk drinkers	CBT vs. Alcohol 101	4.27	18	25	0.46	−0.17	--	--	--
	Low-risk drinkers			21	15	−0.25	−0.25	--	--	--
Murphy, Dennhardt, Skidmore, Martens, and McDevitt-Murphy (2010), *Study 1*		BASICS vs. Alcohol 101+	4.33	37	32	0.20	--	0.32	--	--
Murphy, Dennhardt, Skidmore, Martens, and McDevitt-Murphy (2010), *Study 2*		BASICS vs. e-CHUG	4.33	41	38	0.07	--	0.08	--	--

Source	Group	Comparison	Sample Size			Weighted Effect Sizes (*d*)				
			No. Weeks	FTFI	CDI	$d_{quantity}$	$d_{quantity\ (DD)}$	d_{HD}	d_{pBAC}	$d_{problems}$
Walters, Vader, Harris, Field, and Jouriles (2009)		MIO vs. FBO	26	59	54	0.08	--	--	−0.08	−0.23
		BMI vs. FBO		67	54	0.34	--	--	0.37	0.00
Random-Effects	d_+ (95% CI)					**0.18 (0.08, 0.29)**	**0.20 (0.07, 0.33)**	0.04 (−0.10, 0.18)	**0.15 (0.04, 0.27)**	**0.12 (0.01, 0.22)**
	I^2 (95% CI)					0	0	0	0	0

Note. Positive ES indicate that participants receiving a FTFI reported the intended effects (*lower* alcohol consumption and *fewer* alcohol-related problems) compared to CDIs. BASICS, Brief Alcohol Screening and Interventions for College Students. BMI, brief motivational interviewing. CBT, cognitive-behavioral therapy. e-Chug, Electronic Check-Up to Go. MIO, motivational interviewing only. FBO, feedback only, delivered by computer.