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Computer-Based Interventions for College Drinking: A Qualitative Review

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Abstract

E-Interventions, or electronically based interventions, have become increasingly popular in recent years. College alcohol use has been one area in which such interventions have been implemented and evaluated. The purpose of this paper is to review the seventeen randomized controlled trials that have been published as of August 2007. These studies compared the effectiveness of e-interventions with other commonly used techniques, reading materials, and assessment-only control conditions. Overall, findings provide some support for such programs, especially in comparison with assessment-only control conditions. In addition, possible moderators (e.g. baseline drinking patterns) and mediators (e.g. corrected drinking norms) have emerged. Limitations and areas for future research are discussed.

Keywords

Alcohol; College drinking; Intervention; Computer; Internet

1. Introduction

1.1. E-Interventions

Advances in technology introduce new possibilities to the fields of health and mental health. The Internet allows for rapid and widespread distribution of information, and permits access to health education and intervention materials online. CD-ROMs and DVDs provide additional possibilities for widespread dissemination of health and mental health information.

The term eHealth interventions has been coined to describe this phenomenon, in which health and mental health services are provided through electronic media (Atkinson & Gold, 2002). Electronic interventions can incorporate many appealing design elements. First, eHealth interventions can be designed to maintain anonymity, creating an environment conducive to disclosing drug and alcohol related behavior. Second, multi-media effects, games, and virtual simulations can make eHealth interventions appealing and engaging. Third, some interventions collect demographic and/or health information about the users, and use this information to tailor content and provide personalized feedback. Additionally, such programs can be self-paced and self-directed with regard to content, allowing for a focus on the user's interests and priorities. Together, these features have the potential to make eHealth interventions both engaging and personally relevant.

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EHealth interventions also lend themselves well to research evaluation. Since every user receives the same program, the intervention serves as a standardized treatment condition (Atkinson & Gold, 2002). Also, due to the prevalence of computers and access to the Internet in the developed world, it is relatively easy to reach large numbers of people. This enhanced reach permits dissemination of interventions to individuals not readily available for face-to-face interventions, and expedient analysis of intervention effects.

EHealth interventions offer potential benefits over traditional face-to-face interventions. For example, they require less costly therapist time. In addition, the computerized nature of these interventions can lessen the stigma associated with revealing sensitive or unflattering personal information (Taylor & Luce, 2003). This type of environment may lead to more honest and thorough disclosure, which may in turn increase the validity of self-reports (Hester & Miller, 2006). Thus, concerns about social desirability bias and impression management are minimized with a computer-administered intervention. Yet, despite these advantages, eHealth interventions are also limited by the lack of face-to-face contact. For example, eHealth interventions cannot mobilize the therapeutic benefits of personal human contact, such as the facilitative effect of good rapport; nor can they make use of nonverbal communication (Taylor & Luce, 2003). In addition, it can be challenging to assess how well participants are engaging in and attending to intervention content when they do so in an uncontrolled environment. Nonetheless, the potential benefits of eHealth interventions justify scientific study.

E-interventions, as they will be referred to henceforth, may have particular value when used with individuals who are reluctant to identify behaviors as problems or to pursue potentially stigmatizing treatment, such as individuals with substance use disorders (Copeland & Martin, 2004). Accessing e-interventions via the Internet lowers the threshold for help-seeking, a strategy which may encourage more people to avail themselves of risk reduction interventions (e.g., Marlatt, 1996). Because they constitute low-intensity, low-threshold interventions, their use is consistent with stepped care models of substance abuse (Sobell & Sobell, 2000). In addition, e-interventions may also be particularly well-suited for prevention purposes, as cost-effective methods to reduce risky behaviors (Godin, 2005). Their capacity for broad dissemination is well-suited for universal prevention efforts, and the capacity for tailoring and personalization can facilitate selective prevention goals as well (Mrazek & Haggerty, 1994). If electronic forms of prevention are shown to be effective, and can be disseminated on a large scale, they could have significant public health impact.

1.2. E-Interventions and College Drinking

College drinkers are characterized by frequent high-risk behavior, as well as low levels of problem recognition and treatment seeking (Wechsler, Lee, Kuo, Seibring, Nelson & Lee, 2002). Many college alcohol interventions have emerged with the intent to aid in the reduction of drinking and associated negative consequences. Brief feedback-based alcohol interventions have been shown to be efficacious in this population (Larimer & Cronce, 2007; Neighbors, Lewis, Bergstrom, & Larimer, 2006; White, Morgan, Pugh, Celinsaka, LaBouvie, & Pandina, 2006). Although most feedback-based interventions evaluated to date have involved face-to-face interaction, a growing number have used mailed or computer-administered feedback (Larimer & Cronce, 2007; Walters & Neighbors, 2005). The dissemination of brief alcohol interventions, usually a barrier to their utilization, may be facilitated by eHealth methodologies (Moyer & Finney, 2004/5). One study found that 72.9% of undergraduate students sought out health related materials on the Internet (Escoffery, Miner, Adame, Butler, McCormick, & Mendell, 2005). Furthermore, college students prefer computer-based to practitioner-provided risk assessments, supporting their feasibility (Kypri, Saunders, & Gallagher, 2003).

Walters, Miller, and Chiauuzzi (2005) published a review of commercially available e-interventions for college drinkers. The programs discussed included Alcohol 101 Plus, Alcohol

Response-Ability, Electronic Check-Up to Go (e-CHUG), myStudentBody: Alcohol, and Under the Influence. All programs were brief (four hours or less), and focused on education, skill-building, and/or motivation enhancement. Only two of these commercially available programs had been evaluated in randomized control trials, limiting conclusions about efficacy. However, Walters et al. (2005) noted that common themes in the literature included the incorporation of educational material and personalized feedback into the programs, a continued reliance on personal interaction and mailed materials (despite the electronic nature of the intervention itself), and the apparent lack of effect of program length.

1.3. Purpose of Current Review

Since e-interventions have grown in popularity, both in practice and in research, an updated review of the literature is desirable. The purpose of this review is to examine the results of randomized controlled trials of e-interventions designed to reduce college drinking. In this review, we will evaluate the efficacy of these programs, and note promising moderators and mediators. We will also note the promises and caveats for e-interventions with college students, and discuss directions for future research.

2. Methods

The literature search was conducted using the PsycINFO and PubMed databases, using combinations of the following keywords: alcohol, college, education, intervention, computer (ized), Internet, randomized control. Also, several articles were obtained from reference lists of relevant papers. Studies were included if they were randomized controlled trials, targeted a college population, and evaluated some form of computerized alcohol intervention. All authors read the articles. Notes from each author were compared and conclusions were collectively drawn.

3. Results

As of August 2007, 17 randomized controlled trials regarding alcohol e-interventions with college students had been published. These studies evaluate a diverse selection of programs with varying formats. Some programs are Internet-based whereas others are available on CD-ROM. Though some interventions have been created strictly for research purposes at certain universities, both free (e.g., Alcohol 101) and proprietary (e.g., MyStudentBody: Alcohol, e-CHUG) programs are available to the public. The format of these interventions can vary widely ranging from brief feedback to extensive educational tutorials.

Students have been recruited in the context of universal prevention (i.e., all students recruited), selective interventions (e.g., screening for heavy drinkers), and indicated prevention (e.g., referred students). The relatively easy implementation of such products has allowed for medium to large samples (ranging from 40 to 2,194). However, the follow-ups have been relatively brief; both the median and the mode for follow-up length is one month, with only one study in the review reporting a 12-month follow-up (Barnett, Murphy, Colby, & Monti, 2007). Summary information on all studies reviewed appears in Table 1. The lengths of the interventions are noted if the information was available.

The reviewed studies evaluate the effects of e-interventions on multiple outcomes; most include alcohol consumption measures (16/17 studies), many assess alcohol problems (10/17 studies), and most (15/17) also report on interim psychological outcomes, including hypothesized mediators (e.g., knowledge, attitudes, intentions, perceived norms, readiness to change, satisfaction). In the text of this review, drinking outcomes are emphasized, rather than non-behavioral changes in knowledge, attitudes, or intentions, although the table contains

information on all reported outcomes. We note, however, that even these behavioral outcomes are based on self-report.

3.1 Summary of Findings

Overall, the published randomized controlled trials reveal that e-interventions are usually more effective than no treatment, and approximately equivalent to alternative intervention approaches. E-interventions appear to be superior to assessment-only (AO) control conditions on at least some measures of drinking behavior (Dimeff & McNeely, 2000; Lewis & Neighbors, 2007; Neighbors, Larimer, & Lewis, 2004; Neighbors et al. 2006; Bersamin, Paschall, Fearnow-Kenney, & Wyrick, 2007; Walters, Vader, & Harris, 2007; Weitzel, Bernhardt, Usdan, Mays, & Glanz, 2007), though two studies did not find any beneficial effects relative to AO controls (Kypri & McAnally, 2005; Sharmer, 2001). Findings are mixed regarding the efficacy of e-interventions in comparison with purely educational interventions (e.g. lectures or reading materials). Some support was found for e-interventions on non-behavioral outcomes at post-test (Reis, Riley, Lokman, & Baer, 2000) and on selected drinking outcomes (Chiauzzi, Green, Lord, Thum, & Goldstein, 2005; Kypri, Saunders, Williams, McGee, Langley, Cashell-Smith et al., 2004), whereas another study found no difference (Sharmer, 2001). When computer- and paper-based interventions of similar content were compared, they were roughly equivalent (Meier, 1988; Moore, Soderquist, & Werch, 2005). Finally, Alcohol 101, the only e-intervention compared to established treatment approaches, demonstrated efficacy equivalent to brief motivational interviews (Barnett et al., 2007) and cognitive-behavioral therapy (Donohue, Allen, Maurer, Ozols, and DeStefano, 2004) in samples of college drinkers. However, when the Donohue et al. (2004) sample was restricted to high-risk drinkers (defined by a mean split on drinks per month, such that high risk refers to 24 or more drinks in the last month), the cognitive-behavioral intervention outperformed Alcohol 101.

Little information is available on comparative efficacy among the e-interventions, because only two studies compared one e-intervention to another (Lewis & Neighbors, 2007; Saitz, Palfi, Freedner, Winter, MacDonald, Lu, et al. 2007). The Saitz et al. study compared e-interventions of differing lengths and found that length did not predict outcome. Indeed, several very brief e-interventions that provided assessment as well as personalized feedback or tailored messages garnered preliminary support (e.g., Kypri et al., 2004; Neighbors et al., 2004, 2006; Weitzel et al., 2007). Notably, however, an e-intervention that addressed alcohol along with other health behaviors had no effect on alcohol-related outcomes (Kypri & McAnally, 2005).

Although none of the e-interventions were significantly more efficacious than alternate, empirically-supported interventions, the available evidence provides encouragement for the use of e-interventions for the reduction of risky college drinking. Some of the specific programs cited in this review are available in the marketplace. Commercial programs achieving behavioral outcomes equivalent to alternate interventions include Alcohol 101 (Barnett et al., 2007; Donohue et al., 2004; Reis et al., 2000) and MyStudentBody (Chiauzzi et al., 2005). E-CHUG improved outcomes over assessment-only comparison among heavy drinkers (Walters et al., 2007), as did College Alc for drinking students only (Bersamin et al., 2007). However, conclusions regarding the efficacy of commercially available products must remain tentative until initial findings are replicated and outcomes are tracked over longer periods.

3.2. Moderating and Mediating Variables

Some studies provided additional analyses that suggest differential efficacy for subsets of participants. A small number tested mediators to help explain why e-interventions promoted behavior change. These findings will be highlighted, since they provide information regarding the conditions in which e-interventions work, and the possible mechanisms of action.

Paschall, Bersamin, Fearnow-Kenney, Wyrick, & Currey (2006) explored the effectiveness of an e-intervention, College Alc, with college freshman. This program addressed general alcohol knowledge, as well as risky behaviors and harm prevention strategies. Participants were randomized to either College Alc or assessment only control. Groups did not differ in self-reported drinking at the follow-up session (three months later), although students receiving College Alc demonstrated more alcohol-related knowledge and reported less positive attitudes toward alcohol. However, a reanalysis of the same data revealed that outcomes were moderated by previous drinking history (Bersamin et al., 2007). Students who had already initiated drinking reported greater decreases in heavy drinking, and marginal decreases in negative alcohol-related consequences in the College Alc condition, as compared to the drinkers in the control condition (who reported increases in these behaviors). In contrast, the students who were nondrinkers at baseline reported an increase in negative consequences in both experimental conditions. This pattern of findings suggests that College Alc did not prevent the onset of risky drinking, but it reduced risky drinking that already was taking place.

Donohue et al. (2004) compared a CD-ROM e-intervention (Alcohol 101) with a cognitive-behavioral therapy (CBT) session. Overall, students did not differ by condition in their reduction of alcohol consumption at the one-month follow-up appointment. However, students who took the Alcohol 101 course reported more awareness of alcohol consequences, and intentions to be more cautious. Risk status moderated the effect of e-intervention on outcome; high-risk students who received the CBT intervention decreased drinking quantity and frequency more than high-risk drinkers using Alcohol 101.

Chiauzzi et al. (2005) compared an e-intervention (My Student Body: Alcohol, or MSB:A) with an active control condition, in which students visited an informational Internet site (Alcohol and You). Those using MSB:A decreased the amount they were drinking on heavier drinking days at a faster rate, and experienced a delay in the increase of drinking (as indicated by a composite drinking score) at the one month follow-up appointment. Despite the more rapid decrease in these drinking variables reported at one month for MSB:A, both conditions reported equivalent drinking outcomes at a three month follow-up. However, three person variables were associated with response to MSB:A. First, drinking patterns moderated the intervention effect. Only persistent heavy drinkers (defined as still drinking heavily at follow-up) decreased average and peak consumption more quickly in the MSB:A group than in the control. Second, gender moderated intervention response. Women using MSB:A reported more significant reductions in drinking and heavy drinking episodes on special occasions, as well as fewer alcohol consequences, than women in the control group; these patterns were not present for men. Third, readiness to change (motivation) also moderated the effect of the e-intervention on average alcohol consumption. In particular, low motivation drinkers in the MSB:A group reduced weekly drinking faster than low motivation drinkers in the control group. The effect of the MSB:A intervention relative to the control condition did not differ by site of recruitment, race, or age.

Saitz et al. (2007) examined the effects of altering the intensity of a brief computerized alcohol intervention. All participants completed a minimal e-intervention that provided personalized consumption feedback with gender-specific norms and didactic information about risks related to drinking. A subset of problem drinkers were then randomly assigned to either a more extensive program (which provided additional personalized feedback on peak BAC, alcohol-related consequences, and money spent on alcohol), or no additional intervention. At the one-month follow-up appointment, some measures of alcohol consumption among the at-risk group decreased but did not differ by type of intervention, suggesting that brief feedback may be just as effective as the lengthier program. Gender showed interesting moderating effects. Men (but not women) receiving the extensive program expressed more willingness to seek help for their alcohol issues than those in the brief program. Women (but not men) receiving the more

extensive intervention reported more readiness to change their drinking than those in the brief program.

Neighbors and colleagues conducted a series of studies that addressed both moderators of outcome as well as potential mechanisms of change. Neighbors et al. (2004) assigned college students to either a computerized intervention featuring a single page of personalized normative feedback, or to no intervention (AO control). The intervention condition reduced alcohol consumption at both the 3-month and 6-month follow-ups. The strength of social reasons for drinking moderated the effect of intervention on alcohol consumption (i.e. those who drank for social reasons were more likely to reduce drinking if they received the intervention). This relationship held only for consumption at the 3-month follow-up, but not at the 6-month follow-up. Because the intervention was also associated with perceived norms at both follow-ups, these authors examined norms as mediators of the intervention effect. Perceived drinking norms at the 3-month follow-up mediated the effect of intervention on alcohol consumption at the 6-month follow-up (i.e. more accurate perceived drinking norms were associated with lower alcohol consumption 3 months later). In a second study with a similar design, Neighbors et al. (2006) reported that controlled orientation, a construct derived from self-determination theory addressing responsiveness to social pressure, moderated the effects of the feedback intervention on alcohol problems. Specifically, alcohol problems were reduced at the two-month follow-up only for those students who were higher in controlled orientation. The e-intervention effect on drinks per week was again mediated by changes in perceived norms. This finding was replicated independently by Walters et al. (2007), who reported that the effects of e-CHUG on drinks per week and peak BAC were fully mediated by changes in perceived norms.

Lewis and Neighbors (2007) evaluated the importance of including gender-relevant norms in an e-intervention consisting of personalized normative feedback. Students were randomized into three conditions: gender-neutral feedback, gender-specific feedback, or AO control. Following the intervention, the groups receiving any type of feedback differed in perceived norms from the control group. An intervention effect also emerged for typical weekly drinking and typical drinks per drinking occasion. Change in perceived gender-specific norms for alcohol consumption once again mediated the effect of the intervention type on alcohol consumption at the follow-up assessment, but only for women. This effect can be viewed as moderated mediation, since the mediation was specific to the female participants. Further analyses suggested that level of gender identity moderated the effect of the gender-specific norms on drinking for women; that is to say, women who identified more strongly with their gender reduced drinking more when gender-appropriate norms were used.

3.3. Summary of Moderating and Mediating Effects

3.3.1 Moderating Effects—The moderation findings suggest conditions under which e-interventions will be maximally effective. E-interventions have alcohol-related risk reduction effects only when participants were already regular drinkers before college (Bersamin et al., 2007), and may be most effective for heavier drinkers (Chiauzzi et al., 2005). These findings are consistent with the studies that show significant e-intervention effects in samples selected for heavy drinking (e.g., Lewis & Neighbors, 2007; Neighbors et al., 2004, 2006; Walters et al., 2007). However, one of the few studies comparing an e-intervention (Alcohol 101) to an empirically supported intervention (CBT) found that the heaviest drinkers responded better to CBT (Donohue et al., 2004). Thus, the pattern suggests that the most risky drinkers respond better to more intensive interpersonal interventions. For this subset, one can speculate that an e-intervention produces more risk reduction than no intervention, but less than a face-to-face intervention. This hypothesis can be tested in future research.

Furthermore, this literature suggests that e-interventions consisting of personalized feedback and normative comparisons are most effective (relative to no intervention) when participants are particularly sensitive to social context of their drinking (i.e., they endorse social motives for drinking, or higher controlled orientation; Neighbors et al., 2004, 2006). In addition, students with low motivation to change responded better to an e-intervention than to didactic material on the web (Chiauzzi et al., 2005). Yet, indirect evidence suggests that motivation, as manifested by more careful reading of feedback materials, facilitates change after an e-intervention that was supplemented by a physician discussion (Dimeff, 1997). Thus e-interventions may enhance motivation to change, and those who are more curious and interested in the e-intervention content benefit more than those who devote only cursory attention.

The role of gender in predicting response to e-interventions is difficult to characterize. In a sample selected for heavy drinking, women reduced drinking on special occasions more than men after completing MyStudentBody: Alcohol (Chiauzzi et al., 2005). In another study, Saitz and colleagues (2007) found that heavy drinking women reported more readiness to change their drinking a month after receiving an expanded e-intervention than did heavy drinking men (Saitz et al., 2007). However, in the Saitz study, the men expressed more willingness to seek help for drinking than did women, a slightly different indicator of motivation for change (cf. Carey, Purnine, Maisto, & Carey, 1999). Thus, future research should attend to gender patterns in response to e-interventions. In addition, Lewis and Neighbors (2007) demonstrated that women respond better to gender-specific normative feedback, whereas men respond equally well to generic feedback. This may be explained in part by the observation that the “average student drinker” tends to be interpreted as male by both genders (Lewis & Neighbors, 2006). The implication of this finding is that future research using normative feedback should provide gender-specific norms to enhance efficacy for women.

3.3.2 Mediating Effects—Studies of mediation suggest possible mechanisms for change, which may be incorporated into future intervention designs. Notably reductions in perceived drinking norms mediated the effects of a brief, feedback-based e-intervention in several studies (Lewis & Neighbors, 2007; Neighbors et al., 2004, 2006; Walters et al., 2007), consistent with mediation findings from face-to-face feedback interventions (e.g., Borsari & Carey, 2000). An additional mechanism of change may involve help-seeking intentions (Saitz et al., 2007), although this explanation awaits formal tests of mediation. Although other potential mediators have been explored (e.g., protective behavioral strategies, readiness to change; Barnett et al., 2007), they do not appear to account for the effectiveness of e-Interventions.

4. Discussion

The findings of this review lend cautious support to continued development and evaluation of e-interventions for college drinkers. It is likely that participation in an e-intervention will prompt more reduction in drinking than doing nothing. However, e-interventions rarely produce greater effects than alternative, alcohol risk reduction interventions. The data in Table 1 reveal that significant, short-term reductions in alcohol consumption can be prompted by very brief e-interventions, such as computerized screening and a single-page of personalized normative feedback. Thus, these brief forms of e-interventions are potentially cost-effective and require comparatively few resources to develop and administer.

4.1. Limitations

Despite the demonstrated support for e-interventions, caution is warranted due to the short-term nature of many of these effects. Longer-term effects would provide stronger support for the utility of such programs. Additionally, the studied populations were relatively homogeneous, including mostly volunteers; exceptions were three studies that sampled

freshmen (Paschall et al., 2006; Saitz et al., 2007; Walters et al., 2007) and one that recruited mandated students (Barnett et al., 2007). The efficacy of e-interventions with other at-risk college students (such as athletes, or members of the Greek system) has yet to be demonstrated. Finally, intervention effects were documented on isolated measures of consumption, and alcohol-related problems were not always assessed. This limits the ability to draw conclusions regarding the generalized effects of e-interventions on alcohol use and consequences.

4.2. Implications for Future Research

The findings of this review suggest promising areas for future development of e-intervention programs. Given that e-interventions appear to be most effective with students already engaging in risky drinking, future interventions may wish to target this group specifically. Providing e-interventions to college-aged abstainers may provide protection against initiation or increased drinking, but this goal requires content tailored for this target group.

More sophisticated research questions can now be posed regarding the effectiveness of e-interventions. The number and nature of the components included in the reviewed e-interventions varied widely. Most of the available studies compared e-interventions to traditional intervention packages (CBT, educational print or lectures), or to no program at all. With rare exceptions (i.e., Meier, 1988; Moore et al., 2005), comparisons were not made between e-interventions and an alternative method of administration of the same content. As a result, both modality and content differentiate experimental conditions. The one study that compared two e-interventions of differing intensity to each other (essentially a components analysis) found no differential effect (Saitz et al., 2007). Use of dismantling, constructive, and parametric designs may provide useful comparisons between two or more e-intervention conditions (Kazdin, 2002). In light of the significant risk reduction effects observed with very brief feedback, and the reliable demonstrations of mediation by changes in perceived norms, it is reasonable to expect empirical justification for more lengthy e-interventions. Systematic comparisons of e-interventions with differing components may permit stronger conclusions regarding which aspects of the e-interventions are most effective.

The current literature identifies several potential person factors that may moderate intervention response. At present, however, currently identified moderators (e.g. social motives, controlled orientation, gender identification for women) are more conceptually linked to receptivity to normative feedback, as opposed to receptivity to the e-intervention per se. Evidence suggests that some adolescents spontaneously seek help for mental health concerns through the Internet (Gould, Munfakh, Lubell, Kleinman, & Parker, 2002), and college students express a variety of preferences for accessing information about alcohol (DeMartini & Carey, 2006). It follows that e-interventions may be preferred modalities for a subset of at-risk drinkers. In future studies, it may be useful to study psychological factors that could be theoretically linked to response to e-interventions (e.g., personality dimensions such as introversion-extroversion, or learning styles that prefer visual versus auditory processing).

Finally, cost-effectiveness analyses may be useful in evaluating the programs' effects relative to costs (French & Drummond, 2005). These findings could be compared with the cost-effectiveness of other programs (or no program) to evaluate the feasibility of their implementation. Economic analysis of prevention programs is generally less developed than for treatment programs (French & Drummond, 2005), despite their potential to avert costly intensive interventions in the future. This information will help us to fully appreciate the role e-interventions play in a comprehensive program of prevention and intervention strategies for at-risk college drinking.

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Table 1

Authors	Conditions	Demographics	Follow-Ups	Outcome Measures ^a	Summary of Findings ^b
Barnett Murphy Colby Monti (2007)	E ₁ = Brief motivational intervention E ₂ = Alcohol 101 CD-ROM (45 minutes)	N = 225 mandated students 51% Female 76% White 15% Asian 13% Hispanic 4% African American 2% Native American 3% Other	Post-intervention 3 Months 12 Months	DD DDD BAC Binge ^c Problems Readiness to change Perceived norms Behavioral strategies for reducing drinking Help seeking	Post-intervention E ₁ = E ₂ : readiness to change 3 Month E ₁ > E ₂ : Help seeking, behavioral strategies to reduce drinking E ₁ = E ₂ : perceived norms, problems, binge, DD, DDD, BAC, readiness to change 12 Month E ₁ > E ₂ : DD, behavioral strategies to reduce drinking E ₁ < E ₂ : DDD E ₁ = E ₂ : perceived norms, problems, binge, BAC, readiness to change
Chiauzzi Green Lord Thum Goldstein (2005)	E = Web-based intervention called My Student Body: Alcohol (4 weekly 20-minute sessions) C = Alcohol and You, a web site that provided alcohol information (1 article assigned each of 4 weeks)	N = 265 heavy drinkers ^d 54% Female 73% White 11% Asian 3% Black 8% Latino/Hispanic 5% Other	1 Month 3 Months	Typical consumption (D, DD, DDD, Peak: Binge + Max) Composite score (D, Binge, Max) Drinks on special occasions Max on special occasions Problems Readiness to change Satisfaction	1 Month E < C: Max, D (especially for low motivation drinkers and binge drinkers), peak (only for binge drinkers), composite score (only for binge drinkers) E = C: Typical consumption, drinks on special occasions, readiness to change 3 Month E < C: Drinks on special occasions (especially for females), problems (only for females), D (only for low-motivation drinkers and binge drinkers), peak (only for binge drinkers) E > C: Overall satisfaction E = C: Composite score, typical consumption, drinks on special occasions, readiness to change
Dimeff (1997) also Dimeff & McNeely (2000)	E = Computer assessment with personalized feedback discussed with a physician (15 minutes for assessment and 3–5 minutes for discussion) C = AO	N = 41 high risk ^e visitors to health center 63% Female 75% European 4% African American 8% Asian/Pacific Islander 13% Other	1 Month	D DD DDD Binge Problems Readiness to change Satisfaction	E < C: Binge, problems (only students that received a lengthy brief intervention from their physician) E (careful reviewers ^f) < E (non-careful reviewers): D, DD, problems E = C: D, DD, DDD, problems, satisfaction
Donohue Allen Maurer Ozols DeStefano (2004)	E ₁ = Alcohol 101 CD-ROM (45 minutes) E ₂ = Cognitive Behavioral Therapy (30 minutes)	N = 113 drinkers 56% Female 63% White 13% Asian 12% Hispanic 8% African American >1% Native American 4% Other	1 Month	D DD DDD Awareness Intentions Satisfaction	E ₁ > E ₂ : D (high-risk students only), DD (high-risk students only), satisfaction, awareness, intentions E ₁ = E ₂ : D, DD, DDD
Kypri McAnally (2005)	E ₁ = Web-based assessment and personalized feedback E ₂ = AO C = Standard care – post-test only	N = 218 visitors to health center 75% European 8% Maori 17% Other	6 Weeks	Max Length of max episode Peak BAC Binge Fruit and vegetable consumption Physical activity D DD DDD Binge Problems	E ₁ < C: Fruit and vegetable consumption, physical activity E ₁ = E ₂ = C: Max, length of max episode, peak BAC, binge
Kypri Saunders Williams McGee Langley Cashell-Smith Gallagher (2004)	E = Electronic screening and brief intervention – e-SBI, web-based assessment and personalized feedback (10–15 minutes)	N = 104 visitors to health center with AUDIT ≥ 8 50% Female	6 Weeks 6 Months	D DD DDD Binge Problems	6 Weeks E < C: D, binge, problems E = C: DD, DDD 6 Month E < C: Problems

Authors	Conditions	Demographics	Follow-Ups	Outcome Measures ^d	Summary of Findings ^b
Lewis Neighbors(2007)	C = Alcohol Facts and Effects leaflet E ₁ = Gender-specific personalized normative feedback E ₂ = Gender-neutral personalized normative feedback C = AO	N = 185 students who have had a binge episode ^c 55% Female 97% White 3% Other	1 Month	D DDD Alcohol Consumption Inventory Gender Identity Perceived norms	E = C: D, DD, DDD, binge E ₁ & E ₂ < C: D, DDD, alcohol consumption inventory, perceived norms E ₁ < E ₂ & C: D, DDD, alcohol consumption inventory (women with high gender identity scores only)
Meier (1988)	E ₁ = If You Drink: A Guide to Alcohol Education (40 minutes) E ₂ = Read the script of If You Drink: A Guide to Alcohol (40 minutes) C = Read pamphlets on stress and anxiety E = e-mailed newsletter challenging alcohol-expectancy beliefs with online feedback Questionnaires (once a week for 4 weeks; 15 minutes for feedback) C = Identical newsletter was mailed and feedback questionnaires were mailed back (Once a week for 4 weeks) E = Web-based assessment and personalized normative feedback C = AO	N = 71 volunteers 72% Female	Post-test	Attitudes Knowledge Satisfaction	E ₁ & E ₂ < C: Attitudes E ₁ > C: Satisfaction E ₁ = E ₂ : Attitudes, satisfaction E ₁ = E ₂ = C: Knowledge
Moore Soderquist Werch (2005)	E = e-mailed newsletter challenging alcohol-expectancy beliefs with online feedback Questionnaires (once a week for 4 weeks; 15 minutes for feedback) C = Identical newsletter was mailed and feedback questionnaires were mailed back (Once a week for 4 weeks) E = Web-based assessment and personalized normative feedback C = AO	N = 106 volunteers 58% Female 70% White 10% Hispanic 9% Asian 8% African American	1 Month	D DD Max Binge Drinking days of getting drunk Drinks consumed while getting drunk Satisfaction	E > C: More likely to use web sites suggested in first 3 newsletters. E = C: Satisfaction, Binge, D, DD, Max, Drinking days of getting drunk, Drinks consumed while getting drunk
Neighbors Larimer Lewis (2004)	E = Web-based assessment and personalized normative feedback C = AO	N = 252 heavy drinkers ^d 59% Female 80% White 14% Asian/Asian-American 7% Other	3 Months 6 Months	Drinking composite (Alcohol Consumption Inventory, Peak, D, Problems) Problems Perceived norms Social reasons for drinking	3 Month E < C: Drinking composite (especially for students that reported social reasons for drinking), perceived norms 6 Month E < C: Drinking composite, perceived norms
Neighbors Lewis Bergstrom Larimer (2006)	E = Web-based assessment and personalized normative feedback C = AO	N = 214 heavy drinkers ^d 56% Female 98% White 2% Other	2 Months	D Perceived norms Problems Controlled orientation	E < C: D, perceived norms E = C: Problems (controlled orientation enhanced effects of intervention for problems)
Paschall Bersamin Fearnow-Kinney Wyrick Curry (2006) reanalysis with drinking status split: Bersamin Paschall Fearnow-Kinney Wyrick (2007)	E = College Alc (Web-based intervention) (3 hours) C = AO	N = 370 freshmen 52% Female 42% Asian 30% White 16% Hispanic 3% African American 8% Other	3 Months	DD Binge Getting drunk Problems Knowledge Positive/negative alcohol expectancies Perceived norms Positive attitudes Harm reduction intentions	E < C: Binge (for baseline drinkers only), positive alcohol attitudes E > C: Knowledge, harm reduction intentions E = C: DD, binge, problems, expectancies, perceived norms, getting drunk
Reis Riley Lokman Baer (2000)	E ₁ = Alcohol 101 CD-ROM E ₂ = Alternative education (lecture or facilitated group discussion) C = AO	N = 643 volunteers 61% Females 64% White 11% Asian 7% Hispanic 15% African American 3% Other	Post-test	D DD Perceived norms Knowledge Risk reduction intentions Satisfaction	E ₁ > C: Alcohol safety knowledge, risk reduction intentions, satisfaction E ₁ = E ₂ = C: D, DD

Authors	Conditions	Demographics	Follow-Ups	Outcome Measures ^d	Summary of Findings ^b Immediate post-intervention: E ₂ > E ₁ : Intentions to seek help (men only), readiness to change (females only) 1 Month E ₁ = E ₂ : D, AUDIT, max, binge 4 Weeks ^e C > E ₁ & E ₂ : Knowledge E ₁ =E ₂ =C: Attitudes, composite 8 Weeks C > E ₁ & E ₂ : Knowledge, attitude E ₁ =E ₂ =C: Composite 12 Weeks E ₁ = E ₂ = C: Attitude, knowledge, composite 8 Weeks E < C: D, peak BAC, perceived norms E=C: Problems 16 Weeks E=C: Problems E < C: DDD (daily report), expectancies E = C: Daily report: D, DD, problems. Retrospective reports: D, DD, DDD, problems, self-efficacy for avoiding alcohol related problems, satisfaction.
Saitz Palfai Freedner Winter MacDonald Lu Ozonoff Rosenbloom Dejong (2007)	E ₁ = web-based alcohol assessment and minimal brief intervention E ₂ = "More extensive" brief intervention E ₁ = Alcohol 101 CD-ROM (60 minutes) E ₂ = Motivational speaker (60 minutes) C = AO	N = 650 freshmen with AUDIT ≥ 8 60% Female 62% White 12% Asian 9% Hispanic/Other N = 360 volunteers 60% Female	1 Month	D AUDIT Max Binge Readiness to change Intention to seek help Composite (quantity, frequency, problems) Attitudes Knowledge	
Sharmer (2001)			4 Weeks 8 Weeks 12 Weeks		
Walters Vader Harris (2007)	E = Electronic-Check-Up to Go (e-CHUG), a web-based assessment plus personalized feedback print-out C = AO	N = 106 freshmen heavy drinkers ^d 48% Female 73% White	8 Weeks 16 Weeks	D Peak BAC Problems Perceived norms	
Weitzel Bernhardt Usdan Mays Glanz (2007)	E = Daily alcohol assessments completed on a handheld computer and personalized messages (≥ 40 words) based on survey responses (14 days) C = Daily alcohol assessments on handheld computers only (14 days)	N = 40 students reporting alcohol consumption more than once a week 55% Female 75% White 13% African American 5% Asian 3% Hispanic 3% Other	2 Weeks	Daily reports ^h D DD DDD Problems Retrospective reports D DD DDD Problems Expectancies Self-efficacy for avoiding alcohol related problems Satisfaction	

Note: AO= assessment only, BAC= blood alcohol concentration, D= total drinks, DD= drinking days, DDD= drinks per drinking day, Max= maximum amount of alcohol consumed in one sitting. BAC = blood alcohol concentration.

Greater than (>) and less than (<) signs indicate a significant difference between conditions following the intervention on the indicated outcome variable. For example, E<C: D indicates that the experimental group reported consuming significantly fewer drinks than the control group.

^a Studies used 1 week, 2 week, 4 week, or 12 week assessment intervals.

^b Only outcome measures reported in the results sections of the articles are present in the summary of findings.

^c Binge is defined as 4/5 or more drinks per occasion for women/men respectively.

^d Heavy drinkers are defined as one or more binge episodes in the last month.

^e High risk is defined as 4/5 or more drinks per occasion for women/men respectively in the previous two weeks. 3/5 typical drinks per occasion for women/men in the previous month, or any consumption against medical advice.

^f Careful reviewers took additional time to read their personalized feedback printouts. This might include sharing information with friends or referring back to the graphs at any point after their baseline assessment.

^g Author only reported that there was a significant difference across groups and not which groups were significantly different.

^h Since data was available every day throughout the study, there were two sets of outcome measures: those reported daily by the participant and those reported at the 2-week follow-up.