Understanding Mechanisms of Change for Brief Alcohol Interventions Among Youth: Examination of Within-Session Interactions

MAUREEN A. WALTON, M.P.H., PH.D.,^{a,b,*} QUYEN M. NGO, PH.D.,^{b,c,d} STEPHEN T. CHERMACK, PH.D.,^{a,e} FREDERIC C. BLOW, PH.D.,^{a,f,g} PETER F. EHRLICH, M.D.,^{b,h} ERIN E. BONAR, PH.D.,^a & REBECCA M. CUNNINGHAM, M.D.^{b,c,i}

^aAddiction Center, Department of Psychiatry, University of Michigan, Ann Arbor, Michigan

^bInjury Center, University of Michigan, Ann Arbor, Michigan

^cDepartment of Emergency Medicine, University of Michigan, Ann Arbor, Michigan

^dInstitute on Women and Gender Studies, University of Michigan, Ann Arbor, Michigan

^eMental Health Service, Veterans Affairs Ann Arbor Healthcare System, Ann Arbor, Michigan

^fCenter for Clinical Management Research, Veterans Affairs Ann Arbor Healthcare System, Ann Arbor, Michigan

^gMental Health Innovation, Services, and Outcomes Section, Department of Psychiatry, University of Michigan, Ann Arbor, Michigan

^hSection of Pediatric Surgery, Department of Surgery, C.S. Mott Children's Hospital, University of Michigan Health System, Ann Arbor, Michigan

ⁱSchool of Public Health, University of Michigan, Ann Arbor, Michigan

ABSTRACT. Objective: Alcohol brief interventions (BIs) for youth are efficacious, but effect sizes found have been modest. This article presents secondary data analyses from a randomized controlled trial of motivational interviewing–based (MI) alcohol BIs among youth in an emergency department, examining within-session predictors of alcohol outcomes at 3 months among those receiving BIs. **Method:** Risky drinkers (ages 14–20) received either a computer BI ($n = 277$) or therapist BI ($n = 278$). Within-session measures were obtained via computer metrics (therapist and computer BIs) and coding of audiotapes (therapist BI only). Parallel structural equation models examined direct and indirect effects of BI components on 3-month alcohol consumption and consequences, with posttest precursors of behavior change (e.g., importance, readiness, and intentions) as potential mediators. Components examined included reasons to avoid or reduce drinking, strengths, strategies for

change, benefits of change, and leisure activities (computer BI only), and MI global ratings and MI-adherent behaviors (therapist BI only). **Results:** For both BIs, greater number of strategies directly predicted greater posttest scores, with posttest scores mediating the relationship between strategies and alcohol consumption at 3 months. Greater number of strengths directly predicted fewer alcohol-related consequences at 3 months for both BIs; however, strengths also indirectly predicted greater consumption, mediated by posttest scores. Greater number of reasons to avoid or reduce drinking directly predicted greater alcohol consumption for the therapist BI only. **Conclusions:** These findings suggest ways to optimize the content and efficacy of alcohol BIs. Reviews of strategies such as refusal skills, protective behavioral strategies, and coping with negative affect may be particularly salient for reducing alcohol misuse. (*J. Stud. Alcohol Drugs*, 78, 725–734, 2017)

ALTHOUGH THE INITIATION of alcohol use occurs during early adolescence (Johnston et al., 2012), alcohol misuse increases across adolescent development. In 2013, 13.5% of 9th graders and 29.2% of 12th graders reported past-month heavy drinking (Kann et al., 2014). Therefore, the American Academy of Pediatrics (Committee on Substance Abuse, 2011), National Institute on Alcohol Abuse and Alcoholism (2015), and the Substance Abuse and Mental Health Services Administration (2008) recommend

alcohol screening, brief intervention, and referral to treatment (SBIRT) approaches to reduce alcohol misuse among youth in the emergency department.

The guiding framework for brief alcohol interventions is motivational interviewing (MI) (Miller & Rollnick, 2012; Miller & Rose, 2009). Conceptually, MI-based interventions initially focus on *why* change (e.g., increasing intrinsic motivation such as importance, readiness, behavioral intentions), which is followed by focusing on *how* to change (e.g., coping, protective behavioral strategies; Resnicow & Rollnick, 2011). Several meta-analyses conclude that single-session alcohol interventions for youth up to age 25 are efficacious in reducing alcohol misuse across settings (e.g., emergency departments, colleges) and delivery platforms (e.g., therapists, computers); however, effect sizes are modest, which limits public health impact (Carey et al., 2012; Foxcroft et al., 2014; Khadjesari et al., 2011; Tanner-Smith & Lipsey, 2015). Crucial gaps in the literature on alcohol brief interventions (BIs) identified in these reviews include the need

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*Correspondence may be sent to Maureen A. Walton at the Department of Psychiatry, University of Michigan, 2800 Plymouth Road, Bldg 16, Ann Arbor, MI 48109, or via email at: waltonma@med.umich.edu.

for studies identifying key intervention ingredients and examining fidelity to MI to optimize outcomes (Foxcroft et al., 2014; Tanner-Smith & Lipsey, 2015).

To address this gap, meta-analyses of alcohol BIs have examined content associated with more robust effects. For example, greater reduction in consumption was noted for therapist-delivered interventions that included some “why” change content, such as review of risks and problems and normative comparisons, whereas findings were mixed regarding the effects of decisional balance exercises on outcomes (Carey et al., 2012; Tanner-Smith & Lipsey, 2015). Regarding “how” to change, intervention content associated with greater reduction in consumption included harm-reduction components such as reviewing protective behavioral strategies (Carey et al., 2012; Ehret et al., 2013; Grazioli et al., 2015; Tanner-Smith & Lipsey, 2015). Notably, data are generally lacking regarding effective components of computer-delivered interventions (Carey et al., 2012).

Further, efficacy may also be affected by the manner in which BIs are delivered. For example, one study found that alcohol BIs in the emergency department that comprised only behavioral feedback were less efficacious than BIs that included MI components (e.g., discussion of goals, reasons for change, and strategies for change; Monti et al., 2007). Research also shows that MI adherence is positively related to better outcomes, whereas confrontation is related to worse outcomes (Apodaca & Longabaugh, 2008; Bertholet et al., 2014; Tollison et al., 2013). However, MI spirit, rapport building, use of empathy, and use of open versus closed questions has not been consistently related to better outcomes (Apodaca & Longabaugh, 2008; Bertholet et al., 2014; Tollison et al., 2013).

To fill an important gap in the literature regarding optimal content of BIs (Foxcroft et al., 2014), we describe findings from secondary data analyses of the U Connect study in order to identify key intervention components. The U Connect BIs were delivered by therapist or computer, with data demonstrating efficacy in decreasing alcohol consumption and consequences (Cunningham et al., 2015) and identifying BI components correlated with precursors of behavior change measured at posttest (e.g., importance of change; Walton et al., 2015). This article extends these prior findings by using structural equation modeling to examine within-session BI components as predictors of alcohol-related outcomes at 3 months (i.e., consumption and consequences). Separate models were conducted based on BI delivery method (i.e., therapist or computer), reflecting unique constructs measured in each condition. For the therapist BI, we hypothesized that better outcomes would be related to greater scores for (a) MI global ratings and MI adherent behaviors; (b) reasons to avoid or reduce drinking, strengths, and strategies (e.g., coping with negative affect, protective behavioral strategies, refusal skills); and, (c) psychological precursors of behavior change (e.g.,

importance, readiness, and intentions) at posttest. For the computer BI, we hypothesized that better outcomes would be related to greater scores for (a) reasons to avoid or reduce drinking, strengths, benefits of change, leisure activities, and strategies and (b) psychological precursors of behavior change at posttest. For both BIs, we also examined whether posttest scores mediated the relationship between the BI components and alcohol outcomes at 3 months. Findings provide clues to potential mechanisms of change in order to augment the efficacy of BIs.

Method

Design and setting

Project U Connect was a randomized controlled trial testing the efficacy of therapist and computer BIs among risky drinkers in the emergency department (Cunningham et al., 2015). Youth who screened positive for risky drinking were randomized to computer BI, therapist BI, or control. This study includes participants assigned to the therapist BI ($n = 277$) and computer BI ($n = 278$) only, with outcomes examined at posttest (91% completion) and 3 months (90% completion). Study procedures were approved by the University of Michigan's Institutional Review Board and a Certificate of Confidentiality was obtained.

Protocol

Research assistants obtained informed consent-assent from youth ages 14–20 during their emergency department visit (and parental consent from youth ages 14–17). Patients were ineligible for the study if they could not provide informed consent (e.g., severe medical condition, insufficient cognitive orientation, under age 18 without a parent or guardian present) or if they presented with acute suicidal ideation or sexual assault. Eligible participants self-administered a computerized screening survey and received a \$1.00 gift. Those screening positive for past-3-month risky drinking using the three-item Alcohol Use Disorders Identification Test–Consumption (AUDIT-C; ages 14–17: ≥ 3 ; ages 18–20: ≥ 4) (Chung et al., 2000; Knight et al., 2003) were eligible for the trial. During the emergency department visit, eligible youth provided consent or assent, self-administered a computerized baseline survey (\$20 compensation), received the assigned condition (therapist BI, computer BI, or control), and self-administered an immediate computerized posttest. Follow-ups were self-administered at 3 months (Cunningham et al., 2015).

U Connect brief interventions

A prior article describes in detail the therapist and computer BIs (Walton et al., 2015). Our BIs were guided by

self-determination and social cognitive theories (Bandura, 1986; Markland et al., 2005; Vansteenkiste et al., 2012), incorporating MI (Miller & Rollnick, 2002, 2012; Miller & Rose, 2009) and cognitive behavioral therapy (Kadden et al., 2003) to primarily address alcohol use. The BIs attempted to increase intrinsic motivation by increasing psychological precursors of behavior change (e.g., importance, readiness, behavioral intentions). Our study used a framework proposed by Resnicow and Rollnick (2011) for conceptualizing MI-based interventions, which focused on moving the client from “why” change to “how” to change, structured in three phases: explore, guide, and choose. During explore, therapists elicited youth’s goals, strengths, and behaviors, whereas during guide, therapists elicited reasons to avoid or reduce drinking and benefits of change (e.g., decisional balance); these phases focused on increasing psychological precursors of change (“why”). During choose, strategies for change (“how”) were elicited, such as alcohol refusal skills, protective behavioral strategies for drinking less, and coping skills. The choose phase also included identification of alternative leisure activities. Similarly, in the computer BI, computerized audio and visual prompts were designed to be consistent with these phases.

BIs were similarly structured, with some differences across delivery mechanisms. The BIs initially focused on “why” consider change (i.e., explore, guide), which was followed by “how” to potentially change (i.e., choose).

Therapist brief intervention. The therapist BI included a computerized workbook that contained prompts to structure the session and capture interactions. Sessions were audiotaped and coded using the Motivational Interviewing Treatment Integrity 3 (MITI-3; Moyers et al., 2007), with feedback and retraining provided during twice-monthly supervision with a master’s-level licensed psychologist, supervised by the investigators. Therapists met proficiency thresholds throughout the trial as indicated by ratings of MI spirit (Walton et al., 2015). During explore, the therapist reviewed participants’ goals, values, and strengths (e.g., responsible, not easily influenced by others) and tailored normative feedback. During guide, therapists elicited change talk by asking about reasons to avoid or reduce drinking (e.g., potential consequences) and benefits of change. During choose, the therapists collaboratively explored strategies for change (reducing drinking and/or avoiding negative consequences) either today or in the future, including protective behavioral strategies for drinking less (Borden et al., 2011), refusal skills, and coping with negative affect; they also reviewed alternative leisure activities.

Computer brief intervention. The stand-alone, interactive, self-directed computer BI included MI-consistent audio (open-ended questions, asking permission, affirmations, emphasizing autonomy, and reflections). It was designed as an offline, Facebook-style program in which youth chose a top “friend” to escort them through the program and six

“friends” to be incorporated into the BI. During explore, the program reviewed goals and values, strengths, and normative statistics for drinking. During guide, participants selected reasons to avoid or reduce drinking (potential consequences) and benefits of drinking less. During choose, participants selected alternative activities (e.g., sports, other leisure), reviewed risky situations, selected a drinking goal, and chose strategies (i.e., protective behavioral strategies to drink less, refusal skills, coping with negative affect) by interacting in virtual chat rooms.

Measures

In addition to demographic questions (Handelsman et al., 2005; Harris et al., 2009; Smith et al., 1996), the screen and baseline assessments (Time 0, T0) included measures of alcohol consumption, consequences, and precursors of behavior change, which were completed before the BI. Next, within-session BI components (Time 1, T1) were captured during the intervention. Precursors of behavior change were assessed again immediately after the intervention, at the posttest (Time 2, T2). The follow-up assessment measuring alcohol consumption and consequences occurred 3 months after the emergency-department visit (Time 3, T3).

Therapist brief intervention components (Time 1). During the BI, the therapist collaboratively showed the participants various screens and clicked on the participant’s choices. For each component, a summary count was created based on the number of items that the participant chose. Interactions captured included reasons to avoid or reduce drinking and drugs (e.g., hangovers; $M = 18.1$, $SD = 10.3$; range: 1–33); strengths (e.g., intelligent; overcome things in past; $M = 7.5$, $SD = 2.5$; range: 1–12); and strategies (e.g., coping; $M = 3.4$, $SD = 1.5$; range: 1–7; protective behavioral strategies: $M = 3.3$, $SD = 1.6$; range: 1–4; and refusal skills: $M = 2.3$, $SD = 1.0$; range: 1–7). Benefits and leisure activities were not captured by the computer to avoid interrupting the therapist session with too many screens requiring clicking on lists. The entire BI session was audiotaped (249/256; 97.3%) and coded using the MITI-3 (Moyers et al., 2007) using a single rater who was the clinical supervisor for the trial. Based on theory and prior literature, we examined MI global ratings including spirit [sum of evocation ($M = 4.6$, $SD = 0.6$, range: 3–5) + collaboration ($M = 4.7$, $SD = 0.6$, range: 2–5) + autonomy ($M = 4.6$, $SD = 0.7$, range: 2–5) / 3]; direction ($M = 4.6$, $SD = 0.7$, range: 2–5); and empathy ($M = 4.7$, $SD = 0.6$, range: 3–5). We also examined behavioral counts of MI highly skilled/adherent behaviors including open-ended questions ($M = 15.1$, $SD = 5.1$, range: 4–31); permission/affirm/control/support ($M = 6.4$, $SD = 2.7$, range: 1–15); complex reflections ($M = 12.7$, $SD = 4.5$, range: 0–30), and giving information ($M = 3.2$, $SD = 1.9$, range: 0–10). For descriptive purposes, other summary scores coded included reflection-to-question ratio ($M = 0.9$, $SD = 0.3$,

range: 0.3–2.6). All response choices in the therapist BI were selected by at least some participants, with the exception of the response option “paying fines and fees” as a legal reason to avoid drinking.

Computer brief intervention components (Time 1). The computer automatically recorded items that participants chose during sections containing interactive lists (e.g., visually displayed as album covers, decorative button pins, magnets on whiteboard). For each component, a summary count was created based on the number of items clicked on by the participant. Interactions captured included reasons to avoid or reduce drinking (e.g., hangovers, $M = 18.5$, $SD = 10.9$, range: 2–34); strengths (e.g., intelligent; overcome things in past, $M = 9.4$, $SD = 3.0$, range: 1–13); benefits of change (e.g., avoid getting sick, have more money, $M = 10.8$, $SD = 8.8$, range: 5–38); alternative activities (e.g., sports, such as soccer, $M = 3.4$, $SD = 2.4$, range: 1–16); other leisure activities (e.g., see a movie, $M = 5.7$, $SD = 2.6$, range: 1–16); and strategies (e.g., coping, $M = 4.0$, $SD = 1.0$, range: 1–5; protective behavioral strategies, $M = 4.4$, $SD = 1.4$, range: 1–6; and refusal skills, $M = 3.0$, $SD = 0.9$, range: 1–4). All response choices in the computer BI were selected by at least some participants.

Precursors of behavior change (Time 0, Time 2). Based on prior literature, we used single-item visual analog rulers to assess importance (Right now, how important is it to you to cut back your alcohol use?), readiness (Right now, how ready are you to stop using alcohol?), and intention (In the next 30 days, how likely are you to cut down on your alcohol use?), with responses ranging from 1 (*not at all*) to 10 (*very*); these items were assessed at baseline and posttest. Items were used to construct latent variables of precursors of behavior change at baseline (computer BI [T0: importance $M = 3.7$, $SD = 2.9$; readiness $M = 4.7$, $SD = 3.1$; intention $M = 4.7$, $SD = 3.2$]; therapist BI [T0: importance $M = 3.5$, $SD = 2.7$; readiness $M = 4.4$, $SD = 3.1$; intention $M = 4.5$, $SD = 3.3$]) and posttest (computer BI [T2: importance $M = 4.3$, $SD = 3.0$; readiness $M = 4.5$, $SD = 3.3$; intention $M = 4.3$, $SD = 3.3$]; therapist BI [T2: importance $M = 3.7$, $SD = 3.0$; readiness $M = 4.3$, $SD = 2.9$; intention $M = 4.3$, $SD = 2.9$]).

Past-3-month alcohol use (Time 0, Time 3). Based on the AUDIT-C (Bush et al., 1998; Saunders et al., 1993), alcohol consumption included three questions regarding frequency of drinking, average quantity, and binge (5 or more drinks per occasion) drinking (range: 0–4 per item); these items were assessed in the screening survey and 3-month follow-up. AUDIT-C items were used to construct latent variables for alcohol consumption at baseline (computer BI [T0: frequency $M = 2.3$, $SD = 0.8$; quantity $M = 2.6$, $SD = 0.8$; and binge $M = 1.8$, $SD = 0.9$]; therapist BI [T0: frequency $M = 2.3$, $SD = 0.8$; quantity $M = 2.5$, $SD = 0.8$; and binge $M = 1.8$, $SD = 0.9$]) and at 3-month follow-up (computer BI [T3: frequency $M = 2.1$, $SD = 0.9$; quantity $M = 2.4$, $SD = 1.1$;

and binge $M = 1.5$, $SD = 1.1$]; therapist BI [T3: frequency $M = 2.1$, $SD = 0.9$; quantity $M = 2.2$, $SD = 0.9$; and binge $M = 1.5$, $SD = 1.1$]).

Past-3-month consequences (Time 0, Time 3). The 18-item Rutgers Alcohol Problem Index (RAPI) was used to assess alcohol-related consequences at baseline and 3-month follow-up (Martens et al., 2007; Neal et al., 2006; White & Labouvie, 1989). Baseline (T0) consequences were not included in the models because they were conceptually confounded with the intervention components (e.g., reasons to avoid or reduce drinking contained lists of experienced or potential consequences). At 3-month follow-up, items were parceled into three groups to indicate the latent variable of alcohol consequences (T3: computer BI $M = 2.4$, $SD = 2.9$, range: 0–18; therapist BI $M = 2.2$, $SD = 3.0$, range: 0–18).

Data analysis

Data analyses were conducted using M-Plus Version 6.11 (Muthén & Muthén, 2010). Parallel structural equation models were used to examine markers of response separately within the computer ($n = 277$) and therapist BIs ($n = 278$). Missing data was addressed using full information maximum likelihood estimation (Enders, 2010). When constructing latent variables from multi-item constructs, a parceling approach was used. Items were summed into three groups of parcel scores and used as indicators for the latent variable for reasons of parsimony, and to reduce measurement error (Marsh et al., 2004).

For the therapist BI model, T1 latent variables included reasons to avoid or reduce alcohol use (parceled in three groups), strengths (parceled in three groups), strategies (i.e., coping with negative affect, protective behavioral strategies, refusal skills), MI global ratings (i.e., spirit, direction, and empathy), and MI adherent behaviors (i.e., complex reflections, open-ended questions, adherent behaviors, and giving information) (Little et al., 2002). Global ratings and MI adherent behaviors were included in the models (in lieu of MI nonadherent behaviors) given inability to include all three variables because of the sample size and greater conceptual interest in these variables.

For the computer BI model, T1 latent variables included reasons to avoid or reduce alcohol use (parceled in three groups), strengths (parceled in three groups), strategies (i.e., coping with negative affect, protective behavioral strategies, refusal skills), benefits (parceled in three groups), and leisure activities (i.e., sports, other leisure). T1 latent variables were allowed to covary. Precursors of behavior change measured at posttest (T2: importance, readiness, intention) were included as a latent variable, controlling for the latent variable of baseline precursors of behavior change (T0: importance, readiness, intention). T3 latent variables included alcohol consumption (T3: quantity, frequency, and heavy drinking), controlling for baseline alcohol consumption (T0: quantity, frequency, heavy drinking) as a latent variable, and alcohol consequences (RAPI; parceled in three groups); we

FIGURE 1. Significant prospective direct effects of components of the therapist brief intervention on alcohol outcomes. Model fit statistics: $\chi^2(393) = 648.04$, $p < .001$; root mean square error of approximation [90% CI] = .05 [.04, .06]; comparative fit index = .92; standardized root mean square residual = .06. Notes: Coefficients represent standardized betas. Model controls for T0 precursors of behavior change, and T0 alcohol consumption on T3 alcohol consumption. T = time; T1 = intervention; T2 = posttest; T3 = 3-month follow-up.

* $p < .05$; ** $p < .01$; *** $p < .001$.

allowed alcohol consumption and consequences to covary. We estimated direct paths for T1 to T2, T1 to T3, and T2 to T3 (shown in Figures 1 and 2). Mediation was examined by testing the significance of indirect effects from T1 to T3 through T2 (with direct and indirect effects shown in Tables 1 and 2). Model fit was considered acceptable when the root mean square error of approximation was < 0.06 (Hu & Bentler, 1999) and the comparative fit index was greater than .95 (Shevlin & Miles, 1998).

Results

Sample description

The sample was 51.5% male, with a M_{age} of 18.6 ($SD = 1.4$). The racial breakdown was 79.4% White, 9.5% African American, 0.6% Asian, 6.1% multiracial, 1.4% other race. Also, 5.6% were of Hispanic ethnicity.

Therapist brief intervention

Structural equation model. The therapist BI model displayed good model fit (Figure 1, Table 1). Greater number of strategies (T1) directly predicted a greater score at posttest (T2) on precursors of behavior change, which directly predicted less alcohol consumption (T3). Analyses of indirect effects indicate that posttest scores mediated the relationship between strategies and alcohol consumption. Next, greater number of strengths (T1) directly predicted fewer alcohol consequences (T3). Contrary to hypotheses, greater strengths (T1) directly predicted lower posttest scores and indirectly predicted greater alcohol consumption (T3), mediated by posttest scores. In addition, greater number of reasons to avoid drinking (T1) directly predicted greater alcohol consumption (T3). None of the other T1 variables (i.e., global ratings and MI adherence) were significant predictors of T2 posttest scores or T3 outcomes.

FIGURE 2. Significant prospective direct effects of components of the computer brief intervention on alcohol outcomes. Model fit statistics: $\chi^2(336) = 548.99$, $p < .001$; root mean square error of approximation [90% CI] = .05 [.04, .06]; comparative fit index = .93; standardized root mean square residual = .06. Notes: Coefficients represent standardized betas. Model controls for T0 precursors of behavior change on T2 precursors of behavior change, and T0 alcohol consumption on T3 alcohol consumption. T = time; T1 = Intervention; T2 = Posttest; T3 = 3-month follow-up.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Computer brief intervention

Structural equation model. The computer BI model indicated a good model fit (Figure 2, Table 2). Consistent with findings for the therapist BI, greater number of strategies (T1) directly predicted greater precursors of behavior change at posttest (T2), and greater precursors of behavior change (T2) predicted less alcohol consumption (T3). Strategies (T1) directly and indirectly predicted less alcohol consumption (T3), mediated by posttest scores (T2). Next, greater number of strengths (T1) directly predicted fewer alcohol-related consequences (T3). In addition, greater strengths (T1) directly predicted lower posttest scores and indirectly predicted greater alcohol consumption (T3), mediated by posttest scores. None of the other T1 variables (i.e., benefits of changes, reasons to avoid or reduce drinking, and leisure activities) were significant predictors of posttest scores (T2) or alcohol outcomes (T3).

Discussion

Our findings explore potential mechanisms of change during a BI, delivered by a computer or therapist, which may enhance the efficacy of these interventions. A key finding is that strategies appear to be important to include in BIs, with psychological constructs thought to be precursors of behavior change (e.g., readiness, importance, and intention) mediating the relationship between strategies and alcohol consumption. Further, strengths may also be important to include in BIs, although this finding varied somewhat by outcome examined (i.e., consumption, consequences).

As expected, greater strengths directly predicted fewer alcohol consequences at 3 months in both BI conditions. The notion of emphasizing personal strengths to enhance behavior change is rooted in strengths-based case management strategies (Siegal, 1998) as well as more recent MI literature (Miller & Rollnick, 2012). Conceptually, discus-

TABLE 1. Direct and indirect effects from structural equation model for the therapist brief intervention

Paths from independent variables to mediator	Precursors of behavior change			
Strategies	.25**			
Global ratings	.09			
Reasons to avoid/reduce	.10			
Motivational interviewing adherence	-.18			
Strengths	-.39***			
Paths from mediator to outcome variables	Alcohol consumption	Alcohol consequences		
Precursors of behavior change	-.30***	.12		
Direct and indirect effects	Alcohol consumption direct	Alcohol consumption indirect	Alcohol consequences direct	Alcohol consequences indirect
Strategies	-.08	-.08*	.16	.03
Global ratings	-.04	-.03	-.08	.01
Reasons to avoid/reduce	.17*	-.03	.10	.01
Motivational interviewing adherence	.10	.05	.24	-.02
Strengths	-.21	.11*	-.45***	-.05

Notes: Latent variables: 3-month alcohol consumption (i.e., Alcohol Use Disorders Identification Test–consumption: quantity, frequency, and heavy drinking) and 3-month alcohol consequences (Rutgers Alcohol Problem Index; parceled in three groups).

* $p < .05$; ** $p < .01$; *** $p < .001$.

sion of strengths may reduce the likelihood of discord or sustain talk and increase openness to considering change (e.g., conceptualized as a “why” change component in MI interventions; Resnicow & McMaster, 2012). However, greater strengths were also related to lower scores at posttest on precursors of behavior change. These findings may reflect that youth with greater strengths may perceive less need to change, which is consistent with their reports of experiencing fewer alcohol-related consequences. Surprisingly, greater strengths were also indirectly related to greater alcohol consumption, mediated by posttest scores, in both BIs. It may be that an overemphasis on current strengths during the “why” phase could paradoxically reinforce sustain talk among participants who are ambivalent about change, thereby reducing posttest scores on precursors of behavior change. For example, bolstering participants’ current strengths may reinforce their perception that they are doing well despite involvement in risky drinking, and as such, there is little need to change because alcohol may not be negatively affecting their life. Alternatively, these findings may reflect a harm-reduction approach, which involves focusing on avoiding consequences regardless of alcohol consumption levels. Further, in the therapist BI, greater reasons to avoid drinking were related to greater alcohol consumption, which is consistent with studies (Miller & Rose, 2015) suggesting that decisional balance components may be counterproductive for those ambivalent about change. Future studies are needed to verify these possible explanations.

Our findings regarding strategies are particularly interesting because they are consistent with literature supporting the benefits of harm-reduction approaches among college

students (e.g., protective behavioral strategies; Borden et al., 2011) but are extended to a noncollege sample of adolescents and emerging adults in the emergency department. Furthermore, psychological constructs, which are conceptualized as precursors of behavior change (e.g., readiness, intention, and importance), mediated the relationship between strategies and alcohol consumption, suggesting that these factors may be key mechanisms of change for BIs. It is important to note that following the “why” change section, our BIs proceeded with discussion of the “how” to change section for all youth, which was tailored to their readiness, importance, and intention to change. For example, among youth who were uncertain about change, the BIs proceeded with a discussion of how to change by focusing on harm reduction (e.g., avoiding consequences in the future), which may be particularly relevant for youth. Alternatively, it may be that youth with greater motivation to change may have spent more time on the strategies section of the intervention. Although our models controlled for baseline levels of precursors of behavior change, future studies testing individual intervention components among youth with low and high motivation for change are needed to test this explanation. In the meantime, consistent with the “how” component of MI interventions (Resnicow & McMaster, 2012), our data suggest that refusal skills, protective behavioral strategies, and coping with negative affect may be important to include in BIs. It is unclear the extent to which prior BIs in medical settings have included strategies; yet, these components are often included in alcohol interventions among college students (Carey et al., 2012).

Several of our hypothesized intervention components did not directly or indirectly predict alcohol consumption or

TABLE 2. Direct and indirect effects from structural equation model for the computer brief intervention

Paths from independent variables to mediator	Precursors of behavior change			
Strategies	.29**			
Benefits	.03			
Reasons to avoid/reduce	-.00			
Leisure activities	.17			
Strengths	-.26*			
Paths from mediator to outcome variables	Alcohol consumption	Alcohol consequences		
Precursors of behavior change	-.40***	.04		
Direct and indirect effects	Alcohol consumption direct	Alcohol consumption indirect	Alcohol consequences direct	Alcohol consequences indirect
Strategies	-.24*	-.12*	.02	.01
Benefits	.05	-.00	.13	.00
Reasons to avoid/reduce	-.02	.01	.04	.00
Leisure activities	-.14	-.07	.06	.01
Strengths	.10	.11*	-.27*	-.01

Notes: Latent variables: 3-month alcohol consumption (i.e., Alcohol Use Disorders Identification Test–consumption: quantity, frequency, and heavy drinking) and 3-month alcohol consequences (Rutgers Alcohol Problem Index; parceled in three groups).

* $p < .05$; ** $p < .01$; *** $p < .001$.

consequences. For example, benefits of change (in both BIs) and reasons to avoid or reduce drinking (in the computer BI) were not predictive of 3-month alcohol outcomes, despite the early conceptual emphasis on such decisional balance activities in MI. Current findings are consistent with the literature demonstrating that decisional balance may elicit sustain talk among those with ambivalence, so that evocation is the preferred strategy. In contrast, among those ready for change, decisional balance exercises may be beneficial (Miller & Rose, 2015). Next, identification of leisure activities was not predictive of alcohol outcomes, despite the conceptual relevance for how to change by identifying alternative, enhancement-based activities that do not involve alcohol. However, before eliminating these components from future interventions, it is important to note that these findings are exploratory; thus, replication is required.

Finally, in the therapist BI, ratings of audiotapes from sessions regarding global spirit and MI adherence were not predictive of precursors of behavior change or alcohol outcomes. Our null findings may reflect the proficiency of our therapists in MI (Apodaca & Longabaugh, 2008; Tollison et al., 2013), with some studies finding that MI non-adherent strategies (e.g., confrontation) are related to worse outcomes (Bertholet et al., 2013). On the other hand, our findings may reflect our intervention components, which used an MI framework, but also included cognitive behavioral elements. Notably, our question-to-reflection ratio was lower than recommended for proficiency in pure MI-based interventions. Further, our findings are limited by examination of therapist behaviors only, as opposed to coding client behaviors (Miller et al., 2008) and/or sequential therapist–client interactions (Dobber et al., 2015; Martin et al., 2005). Thus, we were

not able to measure important MI constructs such as change talk. Recent studies show that change talk mediates the effects of MI delivery on substance use outcomes (Apodaca et al., 2016; Barnett et al., 2014) potentially by activating brain regions involved with introspection (Feldstein Ewing et al., 2013). Future studies examining mechanisms of action of BIs should consider coding sequential client–therapist interactions as well as examining brain–behavior linkages for BI components.

Limitations

Although these findings provide novel data regarding potential salient components of alcohol BIs delivered by a computer or therapist among youth, results are limited by the exploratory nature of secondary analyses of data from a clinical trial. Replication is required with other samples, such as adults, and for BIs focusing on other drug use. Given sample size limitations, we were not able to examine some of the variables in our structural equation models using a finer-grained approach, such as examining strategies individually (i.e., refusal skills, protective behavioral strategies, and coping with negative affect). Although our computer BI was designed as an MI-consistent interaction, the virtual therapist audio was not coded and thus data verifying this assertion are lacking. Data regarding the therapist BI are limited by the use of a single rater to code sessions, who was the clinical supervisor. Future randomized controlled trials would benefit from double-coding intervention sessions. Also, the lower rates of question-to-reflection ratios may explain why session codes were not related to outcomes. Future studies are needed to capture similar components

across conditions as well as examine sequencing of therapist and participant interactions from recordings. Such studies would benefit from examining moderators of these pathways based on demographics (e.g., gender, race, and age) as well as other important potential psychosocial moderators (e.g., drinking motives, other drug use, parental influences, and peer influences). Findings are limited to 3-month outcomes, with examination over longer periods needed, which was not possible in this study given that half of the participants received an additional booster intervention after the 3-month follow-up (Cunningham et al., 2015).

Conclusions

Future BIs, regardless of delivery mode, should consider inclusion of strategies for change, specifically refusal skills, protective behavioral strategies, and coping with negative affect. Additional studies that prospectively test receipt of various therapeutic components (Klasnja et al., 2015; Nahum-Shani et al., 2016) would be helpful to understand mechanisms of change and enhance efficacy of MI-based early interventions for risky drinking.

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