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Brief Motivational Intervention for Underage Young Adult Drinkers: Results from a Randomized Clinical Trial

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Abstract

Background—While there is a substantial literature on the efficacy of brief motivational intervention (BMI) for college student drinkers, research has focused less on young adults who do not attend a four-year college, despite their elevated risk for excessive alcohol use and associated harmful consequences.

Methods—This randomized controlled trial (NCT01546025) compared the efficacy of BMI to a time-matched attention control intervention (Relaxation Training; REL) for reducing alcohol consumption and related negative consequences in an underage young adult sample. BMI was tailored to the developmental transition out of high school for young adults who were not immediately planning to enroll in a four-year college. Non-treatment-seeking underage drinkers who reported past-month heavy drinking (N=167; ages 17-20; 42% female; 59% non-Hispanic White) were randomly assigned to receive a single session of BMI or REL. Outcomes were evaluated 6 weeks and 3 months post-intervention via in-person assessments.

Results—Generalized Estimating Equation models provided strong support for the efficacy of BMI for reducing harmful drinking in these young adults. Compared to REL, and after controlling for baseline covariates including gender, those who received BMI subsequently reported significantly fewer average drinks per week, percent drinking days, percent heavy drinking days, lower peak and typical estimated blood alcohol content on drinking days, and fewer adverse consequences of drinking (all p s < .05). These between-group effects did not weaken over the course of the 3-month follow up period.

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Conclusions—These findings demonstrate an efficacious approach to tailoring BMI for non-college-attending young adults. Future research should replicate and extend these findings over a longer follow up period.

Keywords

alcohol; consequences; motivational; intervention; young adults

Introduction

Heavy alcohol use is a significant public health problem with widespread costs to individuals, families, and society (Bouchery et al., 2011). In the U.S., rates of alcohol use, high-risk drinking, and alcohol use disorders have increased dramatically between 2001-2002 and 2012-2013, particularly among certain vulnerable subpopulations such as racial/ethnic minorities and those with lower educational attainment and lower family income (Grant et al., 2017). Compared with individuals in all other age groups, young adults (ages 18-29) continue to have the highest prevalence of past-year alcohol use, high-risk drinking (4/5 drinks in one day for females/males respectively), and DSM-IV alcohol use disorders (Grant et al. 2017). High-risk drinking is associated with myriad acute negative consequences, including alcohol-related injuries, accidents, assaults, and arrests (Hingson et al., 2017b; Johnston et al., 2011) and can exert longer-term negative effects via interference with the developmental tasks of young adulthood, such as educational attainment, beginning a career, and establishing and maintaining intimate relationships (Dawson et al., 2008; Gotham et al., 2003).

Young adults who do not attend full-time college or university are at elevated risk for heavy drinking and associated harm over the life course (Hingson, et al., 2017a; 2017b; Johnston et al., 2015). In response, the National Institute on Alcohol Abuse and Alcoholism has prioritized the development of strategies to reduce alcohol misuse among these more difficult to reach young adults, including those in the military and the civilian workforce, acknowledging that most interventions for young adult heavy drinkers have been designed for college students and may not be effective for young adults who are not in school (NIAAA, 2017). In the current trial, our objective was to adapt an efficacious alcohol intervention and test its efficacy in a sample of young adult heavy drinkers who were not full-time college students.

We selected Brief Motivational Intervention (BMI) for adaptation due to its demonstrated efficacy for reducing heavy drinking and/or negative consequences in college student populations (Miller et al., 2013; Huh et al., 2015; Scott-Sheldon et al., 2014). BMI promotes behavior change among individuals who are ambivalent about changing, and as such is well-suited to young people who may be reluctant to decrease their alcohol use or commit to an abstinence goal. Further, BMI requires limited clinical contact and therefore has the potential for widespread and cost-effective application in a range of community settings (Neighbors et al., 2004). Our starting point was a BMI that involved the delivery of personalized drinking feedback (PDF) in the context of a single-session motivational

interview. BMI is a supportive and nonjudgmental therapeutic encounter focused on increasing motivation to change drinking (Miller and Rollnick, 2012).

The efficacy of BMI in community-dwelling young adults has not been adequately examined. It is plausible that these young adults will respond differently to alcohol intervention than full-time college students, in part based on differences in contextual drinking influences. For example, a direct transition from high school to the workforce can create risk for increased alcohol use, if workplaces have permissive norms toward drinking (Batts et al., 2005). Workplace stress may also play a role in increasing alcohol use (Bacharach et al., 2002). Leaving high school without graduating also creates risk, as it is associated with lower workforce skills, less perseverance, and lower wages, leading to poorer economic and social outcomes (Heckman and LaFontaine, 2010; Wickrama et al., 2005). Economic disadvantage is in turn associated with precocious transitions to adult roles (e.g., pregnancy; full-time employment; marriage or cohabiting), which have been shown to contribute to higher levels of distress (Wickrama et al., 2005). Non-college young adults are more likely than college students to drink to reduce distress (Barnett et al., 2003); thus, adult roles that are traditionally considered protective against heavy drinking may be less so among economically disadvantaged young adults.

Our implementation of BMI with young adults not attending four-year college was guided by the belief that salient goals during the transition to young adulthood could be effectively leveraged in the context of this intervention. In contrast, college students tend to downplay the seriousness of their drinking consequences (Colby et al., 2009; Mallett et al., 2008) (in part because protective campus environments may mitigate their impact), whereas drinking consequences are judged to be more serious when experienced by young people with “real world” responsibilities such as jobs and financial obligations (Colby et al., 2012). Thus, using BMI to highlight discrepancies between heavy drinking and salient emerging responsibilities and goals for community-dwelling young adults may help to promote behavior change in this group.

The current study tested the efficacy of a single session of BMI for reducing heavy drinking and related adverse consequences among underage young adult drinkers not attending a four-year college or university. We designed the intervention to be delivered proximal to the transition out of high school (with or without graduation), because such periods of transition and discontinuity in the life course present opportunities to positively alter developmental paths (Masten et al., 2009). Thus, interventions timed to co-occur with naturalistic transition points may have great potential for decreasing drinking trajectories or preventing harmful escalations in trajectories going forward. To increase the applicability of our findings to the heterogeneous population of community-dwelling young adults, our recruitment targeted a purposefully inclusive “non-four-year-college” population. We hypothesized that, compared to a time and attention-matched control condition (i.e., Relaxation Training; REL), BMI would result in significantly reduced heavy drinking and reduced adverse consequences of alcohol use at 6-week and 3-month follow up. This randomized control trial was registered in the Clinical Trials Registry (NCT01546025) with *a priori* outcome measures identified as: total number of standard drinks consumed; frequency of drinking; frequency of heavy drinking (greater than 4/5 drinks per occasion by females/males), estimated blood alcohol

content (BAC) associated with “typical” drinking occasion; estimated peak BAC (associated with heaviest drinking occasion), and total number of adverse alcohol consequences experienced. This set of outcomes was selected in order to comprehensively evaluate the consistency of intervention effects across a range of commonly assessed outcome variables, and for comparability to extant studies that have targeted these variables. In this manuscript, we report the effects of an adapted BMI on alcohol consumption and consequences, using the set of primary outcome variables and the data analytic plan as specified in the clinical trials registry.

Materials and Methods

Procedure

Participants—Participants were non-treatment-seeking volunteers ages 17 to 20 who reported > 1 occasion of past-month heavy drinking (4/5 drinks/occasion for females/males). Participants were not required to be motivated to reduce their drinking to participate. The project was described as “a research study focusing on young people’s transitions to adulthood and reducing the risks of alcohol during this period.” The period of eligibility began 3 months prior to leaving/graduating from HS and ended 12 months after leaving HS. Individuals enrolled as full-time 4-year college students, or who planned to enroll full-time within the next 12 months, were excluded. Other exclusions included: being in the military or plans to join the military within the next 12 months; and plans to move > 60 miles outside the geographic area within the next 3 months.

A priori power analysis and projections on study retention indicated that we would need to enroll 184 participants to retain 156 (85%) in the data analysis sample to conduct one-tailed hypothesis tests with adequate power (.70 to .80) to detect effects on our primary outcomes. We enrolled fewer participants (167) but retained them at higher than expected rates (94%), yielding a data analysis sample of 157. Recruitment was stopped at N=167 when we projected based on ongoing follow up rates that this would yield the required data analytic sample size that our power analysis had deemed necessary.

Recruitment—The study was promoted via posted flyers in the community; advertisements on buses, websites, and in newspapers; and recruitment events at high schools, community colleges, vocational/technical programs, social service agencies, and GED classes. Research staff described the study to groups/classes or at information booths set up in a lobby or cafeteria. Data collection took place in Rhode Island and Southeastern Massachusetts from June 2010 to October 2011.

Screening and Enrollment—A total of 675 individuals were screened and 39% met study criteria (flowchart in Figure 1). The most common reasons for ineligibility included not meeting minimum drinking criteria and having plans to enroll in a 4-year college within the next 12 months. We enrolled 167 participants (42% females; 59% non-Hispanic White). As shown in Table 1, the sample was heterogeneous and included those who had dropped out of high school and had not obtained a GED (15%), those who planned to graduate from high school within the next 3 months (26%), those who had recently graduated and were not involved in any kind of education/training (29%), and recent graduates participating in

technical, vocational, or community college education (31%). Of the 167 participants who enrolled, all (100%) completed baseline assessment (BL) and the intervention to which they had been randomly assigned.

Informed Consent—Adult participants (ages 18-20) provided written informed consent. Minors provided written assent and parental consent. Obtaining parental consent involved a research staff member contacting the parent by telephone, describing the study and answering any questions, acquiring verbal consent over the phone, mailing consent forms, and having the participant return the signed consent form at the baseline session. Participants were paid \$40 after BL (90-120 minutes), \$50 and \$60 for 6-week and 3-month follow up respectively (60 minutes each), and a \$10 bonus for completing all 3 sessions. A \$5 bonus gift certificate was provided for each session completed without rescheduling. All procedures were reviewed and approved by the university Institutional Review Board. No unexpected adverse effects of intervention were noted in either group. All sessions were conducted in-person and took place in a private office at Brown University or at a community setting (e.g., public library) based on the participant's preference.

Assessments—Assessments were administered via interactive computer program; most were self-administered, with research staff providing assistance as needed. For brevity, only measures relevant to the current manuscript are described. Interviewers were masked to intervention assignment during BL and follow-up assessments. BL preceded intervention assignment, so interviewers could not know assignment during BL assessment. At follow up, research assistants were only assigned to conduct interviews for participants with whom they had no contact at BL. The participant tracking database did not include a variable indicating intervention assignment.

Measures

Background and outcome measures—The **Demographics Questionnaire** assessed age, gender, race/ethnicity, school status, household characteristics, and income. The **Timeline Follow Back** (TLFB; Sobell and Sobell, 1992; 1995), a calendar-assisted interview for estimating daily drinking, provided a comprehensive assessment of alcohol consumption. The TLFB assessed the prior 4 weeks at BL and the prior 6 weeks at each follow up. Outcome variables derived from the TLFB included: total number of standard drinks consumed per week (DPW), frequency of drinking (percent drinking days [DD]), and frequency of heavy drinking (percent heavy drinking days [HDD]). Additional questions about the length of drinking episodes and the participant's weight and sex enabled us to estimate typical and peak blood alcohol concentration (BAC; Matthews and Miller, 1979). Respondents indicated on the **Brief Young Adult Alcohol Consequences Questionnaire** (BYAACQ; Kahler et al., 2005) whether they had experienced each of 24 adverse alcohol-related consequences in the prior 6 weeks; items are summed for a total score (Cronbach's $\alpha = .81$ at BL).

Measures used only for Personalized Drinking Feedback (PDF)—All participants completed these assessments but only those in BMI received feedback on them. **Money Allocation** (Murphy et al., 2009) queried past-month discretionary income and amount spent

on alcohol. **Time Allocation** (Murphy et al., 2012) queried past-week number of hours engaged in: paid work, volunteering, education/training, homework, exercise, hobby, time with family, religious activities, drinking/using drugs, socializing while not using alcohol/drugs. **Family History of Alcoholism** was assessed among first and second degree biological relatives following procedures used in Project Match (Miller et al., 1995). The **Drinking Norms Rating Form** (Borsari and Carey, 2000) recorded perceived weekly drinking norms for participants' close friends and for typical same-age same-gender peers.

Intervention acceptability measures—Post-intervention, participants completed a **Satisfaction Survey** (Borsari and Carey, 2000) to rate general satisfaction, engagement in the session, whether the intervention should continue to be offered, and whether they would recommend it to a friend. Ratings used 5-point Likert scales (1 = not at all/definitely not, 5 = very/definitely yes).

Randomization

Participants in this between-groups experimental design were allocated using a 1:1 ratio. Urn randomization was used to increase the odds that the two experimental groups would be balanced on key characteristics (Stout et al., 1994). After the BL assessment was completed, the interviewer entered participant values for the following variables into a computer-based program: 1) age (17 vs. 18-20); 2) gender (male vs. female); 3) education status (left HS without graduating vs. HS senior vs. HS graduate); and 4) past-month heavy drinking frequency (< 4 times vs. 4 times). The urn randomization program used these values to generate the condition assignment. There were no condition group differences in age, race, ethnicity, educational status, gender, or household income (less than vs. greater than \$20,000 annually) at baseline. Participants in REL were more likely than those in BMI to respond that they either did not know or preferred not to report their annual household income, $\chi^2(2, N = 164) = 9.77, p < .05$. Groups did not differ on any alcohol consumption variable at BL, but participants assigned to the BMI condition reported a greater number of adverse alcohol consequences at BL than participants assigned to REL, $t(164) = -2.14, p < .05$.

Intervention Conditions

Interventions were delivered after BL and lasted about 1 hour. All counselors were trained in and delivered both types of intervention, to avoid a counselor by intervention confound. Both interventions were manualized to standardize delivery of key intervention elements. Manuals are available from the corresponding author.

BMI—The session began with an **introduction** in which the counselor explained what the session would entail, emphasizing that the counselor was not there to tell the participant what to do about his/her alcohol use. The counselor built rapport while eliciting information about the developmental context of the participant's drinking behavior, discussing current experiences, goals, and plans for the next several years, within different life domains (e.g., education/training, work, financial independence, moving out of the parental home, social transitions, romantic relationships). The counselor explored how alcohol and drinking fit into the participant's life, and how the participant expected his/her drinking to change during this period of emerging adulthood. The counselor attended to information about important

influences, including risk and protective factors that could be incorporated into the discussion later in the session. **Assessing motivation** involved exploring the positive and negative aspects of drinking for participants, with the goal of identifying important influences and highlighting ambivalence about drinking. **Enhancing motivation** consisted of providing the computer-generated PDF report, which included: 1) comparison of past-month drinking to national norms; 2) estimated past-month typical and peak BAC, with information about effects of different BAC levels; 3) a summary of the participant's recent alcohol consequences; 4) a summary of participant risk factors including family history of alcohol problems; 5) a pie chart showing the proportion of discretionary income spent on alcohol and an estimate of annual alcohol expenditures; and 6) a bar graph depicting time spent in various activity categories, including alcohol use, intended to highlight the relative prominence of alcohol within the young adult's lifestyle (e.g., Murphy et al., 2012). The counselor presented each component, facilitating discussion and eliciting reactions. Participants were asked to envision themselves in the future if they decided to make a change, and again if they decided not to change. The counselor drew upon earlier discussion of participants' goals relevant to this developmental period (e.g., social, recreational, occupational, financial) to highlight discrepancies between drinking behavior and proximal life goals. Finally, for those interested, the counselor and participant collaboratively identified **goals for change** related to drinking. The PDF listed **strategies** for reducing heavy drinking, with spaces to indicate prior use and plans for future use of each. Participant strengths, protective factors, and autonomy/ability to make changes were elicited and supported. Throughout the session, counselors used MI principles and techniques, including respecting the participant's perspective on their alcohol use, using open-ended questions, employing reflective listening techniques, eliciting change talk, and supporting self-efficacy statements (Miller and Rollnick, 2012).

REL—REL was designed to control for nonspecific therapeutic effects by providing equivalent levels of attention from and rapport with a counselor. It was selected because it is a viable and theoretically distinct approach sometimes included in substance use intervention programs yet in this brief form has not been found to significantly affect substance use (Klajner et al., 1984; Murphy et al., 2012). REL began with an **introduction** to the intervention and general rapport building. The counselor asked about the participant's typical level of and experiences with daily stress, and reviewed the various strategies the participant had used to cope with stress. Past experiences with meditation and relaxation were explored. To **promote positive treatment expectancies** related to alcohol reduction, the counselor presented a rationale for the use of REL for alcohol reduction. Participants were told: 1) the transition to adulthood can be stressful, and stress can lead to increased alcohol use; and 2) alternative approaches to coping with stress, such as meditation and relaxation techniques, can reduce stress and thereby prevent excessive alcohol use. Next, **didactic information about stress** was presented, including descriptions of mental and physical stress, and mental and physical approaches to coping with stress. For the remainder of the session, two strategies for coping with stress were introduced and practiced: the first was a simple, guided **breathing meditation**, and the second was a full-body **progressive muscle relaxation**. Both exercises were scripted and read aloud by the counselor as the participant followed the counselor instructions. The session concluded with a review of the

participant's experiences during the two exercises, and a counselor recommendation to practice the techniques regularly. REL was implemented as a scripted control condition, it was not designed to include all the elements of mindfulness-based cognitive therapy; the latter approach, typically administered over a number of sessions, has gained empirical support for treating alcohol and substance use disorders (Chiesa and Serretti, 2014) and other aspects of psychological functioning (Keng et al., 2011).

Counselor Training and Supervision

The three counselors included a licensed clinical psychologist, a postdoctoral fellow with a PhD in clinical psychology, and a social worker with several years' counseling experience (the latter two conducted most sessions). Training on BMI included a detailed review of the manual and project protocol, readings on motivational interviewing, 40 hours of group didactic instruction with role playing of MI techniques, and homework assignments to build skills in open-ended questioning and reflective listening. REL training took about 8 hours and included a detailed review of the manual, protocol, and scripts, and practice with the breathing meditation and progressive muscle relaxation exercises via role-plays. In each condition, prescribed and proscribed behaviors were enumerated. To prevent drift over time, cases were reviewed in weekly supervision, and counselors received feedback on their recorded sessions.

Intervention Fidelity and Discriminability

Post-intervention, the participant and counselor independently completed **Adherence Assessments** (Magill et al., 2010), rating the participant-counselor interaction on ten items (e.g., "The counselor accepted that I might choose not to change"/"I believe that the participant felt that... I accepted that he/she might choose not to change") and indicating which prescribed intervention topics (11 for BMI and 4 for REL) had been discussed during the session. BMI and REL sessions were also coded using the Motivational Interviewing Skill Code (MISC) version 2.5 (Houck et al., 2010) so that the intervention conditions could be compared in terms of the counselors' MI Spirit, Empathy, and the extent to which the counselors engaged in MI-Consistent behaviors.

Data Analysis

Intervention groups were compared on demographic and key alcohol variables at BL, post-intervention assessments (counselor ratings, satisfaction), and session MISC scores using independent *t*-tests. Outcome variables were evaluated for distributional assumptions, and two (DPW and HDD) were log transformed to address moderate skew [2], and then standardized using a z-score transformation. Outcome analyses were conducted using Generalized Estimating Equations (GEE; Zeger and Liang, 1986) to account for clustering of observations given that participants were assessed at both 6 weeks and 3 months. To test the significance of intervention effects (BMI vs. REL) on the drinking and consequences outcomes, all of which had continuous distributions, analyses were conducted using normal GEE models. For each term in each of these models, the *model coefficient* can be interpreted as an effect size, presented in standardized units of the DV (i.e., effect size *d*); 95% confidence intervals are provided for each model coefficient. Intervention condition was

dummy-coded with REL as the reference group; thus *negative* coefficients for intervention effects indicate *lower* values on outcomes (drinking; harm) for BMI than for REL. Each model controlled for the standardized value of the respective outcome variable at BL, as well as gender, and included a term carrying the linear effect of time, centered so that 6 week had a value of -0.5 and 3 month had a value of 0.5. A significant effect of Time (Centered) would indicate that a particular outcome significantly increased or decreased over the follow up window. Gender was dummy-coded with male as the reference group; thus *negative* coefficients for gender indicate *lower* values on outcomes (drinking; harm) for females than for males. Models also included a time by treatment interaction, which tested whether the difference between those who received BMI versus REL increased or decreased over the follow up window.

Missing data and analytic sample—Analyses used all available data and were conducted using SPSS version 24. The analytic sample included all participants with valid data for at least one follow up. One participant who had no follow-up data was excluded from analyses of DPW, DD and HDD (resulting $N = 166$). One participant had incomplete data on the BYAACQ at baseline, and was excluded from analysis of this outcome. To facilitate interpretation of harm reduction effects, we evaluated estimated BAC and BYAACQ outcomes only among those who drank at follow up. This approach enabled us to test whether BMI reduced risk (BAC) and consequences (BYAACQ) among those who continued to drink. Two participants did not drink at either follow-up period, and so were excluded from the analytic sample for peak and typical BAC ($N = 164$) and BYAACQ ($N = 163$). The number of observations for the outcome variables across the follow-up periods ranged from 304 to 323. Attrition was minimal at both follow ups ($n = 5$ at 6 week, and $n = 6$ at 3 month), and about equal across groups, precluding meaningful analysis of factors associated with attrition.

Results

Intervention Fidelity and Discriminability

Analysis of post-session ratings demonstrated that counselors and participants agreed that a high percentage of prescribed intervention topics had been discussed in the sessions: In BMI, counselors and participants said they had discussed 99.7% ($SD = 2.73$) and 99.7% ($SD = 1.71$) of BMI topics, respectively. In REL, counselors and participants reported discussing 99.1% ($SD = 3.60$) and 99.7% ($SD = 2.73$) of REL topics, respectively. (Complete data are presented in a Supplemental Table online). Participant ratings on the Satisfaction Survey, and on interactions with the counselors, indicated high levels of satisfaction with the intervention and the counselors in both conditions (see Table 2). Comparison of MISC 2.5 ratings between BMI and REL confirmed that BMI sessions were highly distinguishable from REL sessions in terms of Empathy (BMI: $M = 3.83$, $SD = 0.67$; REL: $M = 2.65$, $SD = 0.63$, $t(166) = 11.87$, $p < .001$), MI Spirit (BMI: $M = 3.75$, $SD = 0.48$; REL: $M = 2.46$, $SD = 0.39$, $t(166) = 18.99$, $p < .001$), and percentage of MI Consistent behavior (BMI: $M = 0.99$, $SD = 0.02$; REL: $M = 0.25$, $SD = 0.13$), $t(166) = 52.80$, $p < .001$).

Intervention Effects on Alcohol Outcomes

Means and standard deviations for all outcome variables at all observations (non-transformed) between conditions are reported in Table 3. These descriptive data are presented to aid interpretability of the findings from the GEE models. Results of the GEE models are presented in Tables 4 and 5.

Percent drinking days—GEE analyses showed a significant effect of BMI on the standardized percent drinking days (DD) variable, with those in BMI reporting a lower percentage of drinking days (i.e., less frequent drinking) at follow up compared to those in REL ($d = -0.33$, 95% CI: -0.59 to -0.08 , $p = 0.011$). There was no significant effect of time, suggesting that DD did not vary across the two follow-up time intervals. The interaction between condition and time was not significant, suggesting that BMI's effect on reducing DD did not weaken over the course of the follow-up period.

Percent heavy drinking days—GEE analyses also showed a significant effect of BMI on the log-transformed standardized percent heavy drinking days (HDD) variable, with those in BMI reporting a lower percentage of heavy drinking days (i.e., less frequent heavy drinking) at follow up compared to those in REL ($d = -0.53$, 95% CI: -0.79 to -0.30 , $p < 0.001$). There was no significant effect of time (i.e., HDD did not vary across the two follow-up intervals) and the interaction between condition and time also was not significant, suggesting that BMI's effect on reducing HDD did not weaken over time.

Drinks per week—GEE analyses showed a significant effect of BMI on the log-transformed standardized drinks per week (DPW) variable, with those in BMI reporting consuming fewer total drinks per week at follow up compared to REL ($d = -0.52$, 95% CI: -0.79 to -0.33 , $p < 0.001$). There was no significant effect of time (i.e., DPW did not vary between the follow ups) and the interaction between condition and time also was not significant, suggesting that BMI's effect on reducing DPW did not weaken over time.

Estimated peak BAC—GEE analyses showed a significant effect of BMI on the standardized peak BAC variable. Among those who consumed alcohol at follow up, drinkers in BMI reached lower estimated peak BACs (i.e., lower BAC levels on their heaviest drinking occasion) than drinkers in REL ($d = -0.30$, 95% CI: -0.70 to -0.16 , $p = 0.002$). There was no significant effect of time, and no interaction between condition and time, suggesting that BMI's effect on reducing peak BAC levels did not weaken over the course of the follow up.

Estimated typical BAC—According to the GEE analysis, there was also a significant effect of BMI on the standardized typical BAC variable. Among those who consumed alcohol at follow up, drinkers in BMI reached lower estimated BAC levels on their typical drinking occasions compared to drinkers in REL ($d = -0.31$, 95% CI: -0.63 to -0.09 , $p = 0.010$). There was no significant time effect (i.e., typical BAC did not vary over the follow ups). The interaction between condition and time was also not significant, suggesting that BMI's effect on reducing typical BAC levels did not weaken over the follow up.

Number of adverse alcohol consequences. Finally, GEE analyses also showed a significant effect of BMI on the standardized number of adverse alcohol-related consequences (BYAACQ) variable. Specifically, among those who consumed alcohol at follow up, BMI participants reported having experienced fewer adverse consequences of drinking (i.e., less harm associated with drinking) than participants in REL ($d = -0.32$, 95% CI: -0.51 to -0.01 , $p = 0.043$). There was no significant effect of time (i.e., BYAACQ scores did not vary across follow ups). The interaction between condition and time was not significant, suggesting that BMI's effect on reducing alcohol-related harm did not weaken over time.

Discussion

Results from this randomized clinical trial provide strong support for the efficacy of a brief motivational intervention to reduce alcohol consumption, heavy drinking, and associated negative consequences, in a sample of underage heavy drinkers recruited from the community. Findings demonstrate a high level of acceptability and feasibility for e BMI, and a high level of discriminability between the content of the brief motivational intervention and the time- and attention-matched control condition. Young adults in both groups reported high levels of satisfaction with the intervention received and with their counselor. BMI sessions were distinguished by higher levels of empathy, MI spirit, and MI-consistent behaviors, all considered active ingredients of motivational interviewing. Although participants in both groups reported reductions in drinking frequency, quantity and adverse alcohol-related consequences following intervention, those who received BMI, compared to those who received the control condition, showed significantly better outcomes across all outcome variables evaluated. These included less frequent drinking and heavy drinking, fewer drinks per week, and among those who continued to drink, lower estimated BAC level for heaviest and typical drinking occasions, and fewer negative consequences experienced.

Our findings show that intervening with underage drinkers outside of a traditional four-year college setting can be impactful, at least over the 3-month follow-up period that this preliminary study involved. The majority of adults in the U.S. do not attain a four-year college degree, and these adults are at increased risk for persistent heavy drinking and alcohol use disorders (Grant et al., 2017; Hingson et al., 2017a). Given that few other studies have attempted to intervene specifically with this population of drinkers (NIAAA, 2017), the current findings are particularly promising. In similar brief intervention trials with college student drinkers, most reviews and meta-analyses have found effects to be inconsistent, and very small on average (Huh et al., 2015). Our BMI yielded medium-sized effects on heavy drinking frequency and total drinks per week ($d = 0.55$ to 0.56), and small-to-medium effects on all other outcomes examined ($d = 0.26$ to 0.43). Consistent with our original study rationale, the timing, context, and tailoring of our intervention, specifically for non-college-bound young adults, may have contributed to its success but this cannot be determined using the current study design.

The young adults who participated in this trial were recruited from a wide range of community settings (e.g., schools, social service agencies, job training programs) and from the broader community via advertisements on public transit and in print and online media. Following on this broad approach to recruitment, the applicability of our findings is not

limited to one specific service context. An important next step, however, would be to explore how to effectively disseminate this tailored BMI in community settings. There is a wide variety of community-based providers who could be trained to offer this intervention, such as student assistance counselors, case managers, and social workers. Applications might include interventions targeting heavy drinking among graduating non-college-bound high school seniors, or students entering community college or technical/job training programs. Although the current trial excluded young people planning to enter the military, promising findings from a trial of brief alcohol intervention in air force technical training (Klesges et al., 2013) suggest the military provides another promising venue for dissemination of BMI.

The study had a number of strengths, including the use of a rigorously controlled experimental design, high internal validity, and consistency of effects across a set of clinically meaningful outcome variables. The primary limitation of the study was the non-representative sampling approach, which precludes our ability to generalize findings to an identifiable population of underage young adult heavy drinkers. An important future direction is to replicate findings using a representative sample. Research with larger samples is needed, and Larimer and Cronce (2007) have indicated the need for longer follow-up periods (at least 6 months) to document the maintenance of treatment gains over time. Another limitation was our reliance on self-reported outcomes. However, alcohol self-reports have been demonstrated to be generally accurate in contexts such as these (Borsari and Muellerleile, 2009; Monti et al., 2007).

The REL condition was a credible control condition, matching BMI on nonspecific therapeutic factors like contact time, attention from a counselor, and perceived experimenter demand for reporting alcohol reductions at follow up. It did not contain all of the active ingredients of mindfulness-based cognitive therapy interventions, such as repeated practice in the nonjudgmental acceptance of thoughts and experiences, and training in separating thoughts from behavioral responses.

The premise of this BMI was that a proactive intervention with underage episodic heavy drinkers, timed to coincide with the developmental transition out of high school, might prevent harmful escalation in drinking trajectories. Our experimental intervention included both standard BMI elements included in most studies with college students (personalized drinking feedback on consumption, perceived norms, risks, and consequences) as well as relatively novel behavioral economic feedback material (e.g., time and money allocation) that situated participants' drinking patterns within an overall context of emerging adulthood and associated goals and values (Murphy et al., 2012). Future research should continue to examine treatment elements that might be most effective in motivating change among young adult drinkers. It would be important to learn whether the reductions in alcohol consumption and adverse consequences observed in this study persist over time and whether such changes translate benefit to other developmentally-relevant outcomes such as success in social, occupational, and academic/training domains.

There is growing evidence of health and mental health risks among young adults outside the traditional four-year college setting, including those who leave high school without graduating (Wickrama et al., 2005), technical and community college students (Eisenberg et

al., 2016; Simons-Morton et al., 2017), and other subgroups of young adults (Chartier et al., 2011). The primary contribution of this study is in demonstrating that BMI is a feasible, acceptable, and efficacious strategy for reducing heavy drinking and related adverse consequences in this understudied and relatively high-risk group.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. CONSORT Flow Diagram representing participant progress through the study

Table 1
Sample Demographic Characteristics by Condition and for the Full Sample

Characteristic	Condition		Full Sample
	BMI (<i>n</i> =83) <i>N</i> (%)	REL (<i>n</i> =84) <i>N</i> (%)	(<i>N</i> = 167) <i>N</i> (%)
Gender			
Male	49 (59.0%)	48 (57.1%)	97 (58.1%)
Female	34 (41.0%)	36 (42.9%)	70 (41.9%)
Ethnicity/Race			
Hispanic/Latino	10 (12.0%)	8 (9.5%)	18 (10.8%)
Non-Hispanic White	48 (57.8%)	51 (60.7%)	99 (59.3%)
Non-Hispanic Black/African American	9 (10.8%)	7 (8.3%)	16 (9.6%)
American Indian/Native American	1 (1.2%)	0 (0.0%)	1 (0.6%)
Asian/Pacific Islander	1 (1.2%)	6 (7.1%)	7 (4.2%)
More than one race endorsed	11 (13.3%)	12 (14.3%)	23 (13.8%)
Age (years)			
17	24 (28.9%)	22 (26.2%)	46 (27.5%)
18	29 (34.9%)	30 (35.7%)	59 (35.3%)
19	19 (22.9%)	24 (28.6%)	43 (25.7%)
20	11 (13.3%)	8 (9.5%)	19 (11.4%)
Family income			
< = \$20,000 per year	11 (13.3%)	22 (26.2%)	33 (19.8%)
> \$20,000 per year	24 (28.9%)	33 (39.3%)	57 (34.1%)
Don't Know/Prefer not to Answer	48 (57.8%)	29 (34.5%)	77 (46.1%)
Current Educational Status			
Not in HS, No Diploma or GED	14 (16.9%)	11 (13.1%)	25 (15.0%)
In HS, within 3 Months of Graduation	20 (24.1%)	23 (27.3%)	43 (25.7%)
HS Diploma or GED	23 (27.7%)	25 (29.8%)	48 (28.8%)
In Technical/Trade School or Community College	26 (31.3%)	25 (29.8%)	51 (30.5%)

Notes: BMI = Brief Motivational Interview; REL = Relaxation Training; HS = High School; GED = General Education Diploma (High School Equivalency Certificate). Groups did not differ significantly on any characteristic.

Table 2
Session Satisfaction and Counselor Evaluation by Condition (N = 167)

Characteristic	BMI <i>M</i> (<i>SD</i>)	REL <i>M</i> (<i>SD</i>)	<i>p</i>
Session Satisfaction ¹			
How satisfied are you with this session?	4.64 (0.53)	4.54 (0.63)	<i>ns</i>
How actively did you participate in this session?	4.65 (0.61)	4.61 (0.58)	<i>ns</i>
Do you think we should continue to offer these sessions?	4.76 (0.55)	4.74 (0.47)	<i>ns</i>
Would you recommend this session to a friend?	4.65 (0.63)	4.64 (0.53)	<i>ns</i>
The research counselor... ²			
Was easy to talk to	3.96 (0.19)	3.96 (0.19)	<i>ns</i>
Was concerned about me ³	3.43 (0.70)	3.29 (0.83)	<i>ns</i>
Understood me	3.77 (0.42)	3.81 (0.40)	<i>ns</i>
Asked about my ideas before presenting his/her own	3.82 (0.45)	3.77 (0.45)	<i>ns</i>
Helped me talk about my own reasons for change ^{3,4}	3.90 (0.30)	3.47 (0.67)	<.001
Treated me like an equal	3.90 (0.34)	3.94 (0.24)	<i>ns</i>
Respected my ideas about how change can occur ⁵	3.90 (0.30)	3.77 (0.45)	.029
Did not push me into something I wasn't ready for	3.87 (0.38)	3.94 (0.24)	<i>ns</i>
Accepted that I might choose not to change	3.73 (0.57)	3.80 (0.43)	<i>ns</i>
Made me feel I could change my alcohol use if I wanted to	3.92 (0.32)	3.81 (0.42)	<i>ns</i>

Note.

¹Rated from 1 to 5, with satisfaction ranging from "Not at all Satisfied" to "Very Satisfied", Participation rated from "Not at all Active" to "Very Active", and recommendation to continue sessions or recommend to a friend rated from "Definitely not" to "Definitely yes";

²Research counselor rated from 1 to 4, with responses ranging from "Strongly Disagree" to "Strongly Agree";

³*N* = 166;

⁴*t*(164) = 5.40, *p* < .001;

⁵*t*(165) = 2.02, *p* = .029.

Table 3
Descriptive Statistics for Alcohol Outcomes by Treatment Condition over Time (Non-Transformed Variables)

Outcome Group	Baseline		6-week		3-month	
	M	SD	M	SD	M	SD
Average Drinks Per Week (DPW)						
REL	12.14	9.85	11.00	10.69	8.93 ^{***}	10.00
BMI	14.85	14.41	7.06 ^{***}	8.04	5.56 ^{***}	5.91
Percent Drinking Days (DD)						
REL	26.74	18.89	23.63	18.66	19.52 ^{**}	17.92
BMI	30.34	19.40	19.17 ^{***}	16.33	14.32 ^{***}	12.23
Percent Heavy Drinking Days (HDD)						
REL	17.30	13.95	16.09	15.80	13.11 ^{**}	13.94
BMI	18.76	14.48	10.03 ^{***}	13.30	8.04 ^{***}	9.98
Estimated Typical Blood Alcohol Concentration (BAC) ^a						
REL	0.12	0.08	0.10	0.08	0.09 ^{**}	0.06
BMI	0.12	0.11	0.08 ^{***}	0.05	0.08 ^{***}	0.06
Estimated Peak Blood Alcohol Concentration (BAC) ^a						
REL	0.21	0.13	0.20	0.13	0.18	0.11
BMI	0.22	0.15	0.16 ^{***}	0.10	0.17 ^{***}	0.12
Number of Alcohol Consequences among Drinkers (BYAACQ) ^a						
REL	6.99	4.48	6.08	4.08	5.97 [*]	4.09
BMI	8.46	4.35	5.79 ^{***}	5.14	4.76 ^{***}	4.50

Notes: BMI = Brief Motivational Interview; REL = Relaxation Training; M = Mean; SD = Standard Deviation;

^a Among participants who reported one or more drinking days. Significant within-group change from baseline to 6-week and 3-month follow up indicated as

* $p < .05$;

** $p < .01$;

*** $p < .001$.

Table 4
GEE Models for Alcohol Consumption Outcomes at 6-Week and 3-Month Follow-ups (*N* = 166)

Outcome Predictor	Model coefficient	SE	95% CI	<i>p</i> value
Percent Drinking Days (DD)				
Female (vs. male)	-0.318	0.116	-0.545, -0.091	0.006
Baseline DD	0.460	0.089	0.285, 0.634	0.000
BMI (vs. REL)	-0.335	0.132	-0.594, -0.076	0.011
Time (Centered)	0.049	0.108	-0.162, 0.260	0.652
Time × BMI interaction	-0.042	0.134	-0.305, 0.221	0.757
Log, Percent Heavy Drinking Days (HDD)				
Female (vs. male)	-0.281	0.120	-0.517, 0.045	0.020
Baseline HDD	0.477	0.056	0.369, 0.586	0.000
BMI (vs. REL)	-0.547	0.125	-0.792, -0.302	0.000
Time (Centered)	-0.010	0.098	-0.202, 0.182	0.921
Time × BMI interaction	0.063	0.138	-0.208, 0.333	0.649
Log, Mean Drinks per Week (DPW)				
Female (vs. male)	-0.442	0.119	-0.675, -0.208	0.000
Baseline LDPW	0.494	0.064	0.369, 0.619	0.000
BMI (vs. REL)	-0.558	0.117	-0.787, -0.330	0.000
Time (Centered)	-0.042	0.097	-0.231, 0.148	0.666
Time × BMI interaction	0.133	0.131	-0.124, 0.391	0.310

Notes: Standardized variables; BMI = Brief Motivational Interview; REL = Relaxation Training; the Model Coefficient is presented in standardized units of the DV and can therefore be interpreted as effect size *d*.

Table 5
GEE Models for Estimated Blood Alcohol Concentration ($N = 164$) and Number of
Adverse Alcohol Consequences ($N = 163$) at 6-Week and 3-Month Follow-ups

Outcome Predictor	Model coefficient	SE	95% CI	<i>p</i> value
Adverse Alcohol Consequences (BYAACQ)				
Female (vs. male)	-0.132	0.119	-0.366, 0.101	0.267
Baseline BYAACQ	0.498	0.087	0.328, -0.668	0.000
BMI (vs. REL)	-0.258	0.128	-0.509, -0.008	0.043
Time (Centered)	0.070	0.083	-0.093, 0.233	0.400
Time $\times$ BMI interaction	-0.145	0.137	-0.413, 0.123	0.288
Estimated Typical Blood Alcohol Concentration (TYPBAC)				
Female (vs. male)	-0.137	0.119	-0.371, 0.096	0.249
Baseline TYPBAC	0.522	0.082	0.362, 0.682	0.000
BMI (vs. REL)	-0.364	0.140	-0.639, -0.089	0.010
Time (Centered)	-0.049	0.125	-0.295, 0.196	0.693
Time $\times$ BMI interaction	0.112	0.153	-0.189, 0.412	0.467
Estimated Peak Blood Alcohol Concentration (PKBAC)				
Female (vs. male)	-0.168	0.121	-0.405, 0.069	0.165
Baseline PKBAC	0.454	0.060	0.336, 0.572	0.000
BMI (vs. REL)	-0.428	0.137	-0.697, -0.159	0.002
Time (Centered)	0.114	0.110	-0.330, 0.101	0.298
Time $\times$ BMI interaction	0.237	0.157	-0.072, 0.545	0.132

Notes: Analyses were conducted only with participants who reported one or more drinking days. Standardized variables; BMI = Brief Motivational Interview; REL = Relaxation Training; the Model Coefficient is presented in standardized units of the DV and can therefore be interpreted as effect size *d*.