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A Pilot Randomized Trial of Motivational Interviewing Compared to Psycho-Education for Reducing and Preventing Underage Drinking in American Indian Adolescents

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Abstract

Underage drinking is an important public health issue for American Indian and Alaska Native (AI/AN) adolescents, as it is for U. S. teens of all ethnicities. One of the demonstrated risk factors for the development of alcohol use disorders in AI/AN is early age of initiation of drinking. To address this issue a randomized trial to assess the efficacy of Motivational Interviewing (MI) compared to Psycho-Education (PE) to reduce and prevent underage drinking in AI/AN youth was developed and implemented. Sixty-nine youth received MI or PE and 87% were assessed at follow-up. For teens who were already drinking, participating in the intervention (MI or PE) was associated, at follow-up, with lower quantity $\times$ frequency (qxf) of drinking ($p=0.011$), fewer maximum drinks per drinking occasion ($p=0.004$), and fewer problem behaviors ($p=0.009$). The MI intervention resulted in male drinkers reporting a lower qxf of drinking ($p=0.048$) and female drinkers reporting less depression ($p=0.011$). In teens who had not started drinking prior to the intervention, 17% had initiated drinking at follow-up. As a group they reported increased quantity $\times$ frequency of drinking ($p=0.008$) and maximum drinks ($p=0.047$), but no change in problem behaviors. These results suggest that intervening against underage drinking using either MI or PE in AI/AN youth can result in reduced drinking, prevention of initiation of drinking, and other

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positive behavioral outcomes. Brief interventions that enhance motivation to change as well as psycho-education may provide a successful approach to reducing the potential morbidity of underage drinking in this high-risk group.

Keywords

American Indian; Motivational Interviewing; Underage Drinking

1. Introduction

In 2007 the U.S. Surgeon General issued a call to action to engage a coordinated, multi-faceted effort to prevent and reduce underage drinking and its adverse consequences (U.S. Department of Health and Human Services, 2007). Of all ethnic groups, American Indian/Alaska Native (AI/AN) youth are at the highest risk for underage drinking and its associated morbidity and mortality (Bachman et al., 1991; Beals et al., 1997; Beauvais, Jumper-Thurman, & Burnside, 2008; Beauvais, Jumper-Thurman, Helm, Plested, & Burnside, 2004; Blum, Harmon, Harris, Bergeisen, & Resnick, 1992; Ehlers, Slutske, Gilder, Lau, & Wilhelmsen, 2006; Indian Health Service, 2009; Miller et al., 2008; National Institute on Alcohol Abuse and Alcoholism, 2009; Stanley, Harness, Swaim, & Beauvais, 2014; Substance Abuse and Mental Health Services Administration, 2013; Wallace, Brown, Bachman, & LaVeist, 2003; Wu, Woody, Yang, Pan, & Blazer, 2011). Early age of onset of drinking in adolescence has been associated with higher rates of lifetime alcohol use disorders (AUDs) in the general U.S. population (Grant & Dawson, 1997; Grant, Stinson, & Harford, 2001). Similar to what has been seen in these general population surveys, early onset of drinking in AI/AN youth is predictive of later alcohol problems and use disorders (Ehlers et al., 2006; Henry et al., 2011; Sung, Erkanli, Angold, & Costello, 2004; Whitesell et al., 2009). In addition, the onset of substance use in AI/AN youth appears to be *earlier* than all other U.S. ethnic groups (Clark, Nguyen, & Kropko, 2013). This earlier onset of drinking may be one important explanation for the high rates of morbidity and mortality associated with alcohol in some AI/AN communities and provides a compelling rationale for developing programs to address underage drinking in this high-risk ethnic group.

1.1. Motivational interviewing

One psychotherapeutic intervention that holds promise for reducing underage drinking in AI/AN is Motivational Interviewing (MI). MI is a psychotherapeutic intervention that assesses a person's readiness to change (or stage of change) and then implements a treatment program tailored for his or her stage of change (Miller & Rollnick, 2013). It has been demonstrated to be useful in the areas of treatment adherence and engagement (Dean, Britt, Bell, Stanley, & Collings, 2016), improving health behaviors (Kaar, Luberto, Campbell, & Huffman, 2017) and, in particular, in improving addictive behaviors in several studies (Arnaud et al., 2016; Hettema, Steele, & Miller, 2005; Lundahl et al., 2013; Romano & Peters, 2015). In adults, MI has had the highest effect sizes of all treatments for alcohol use disorders (Miller, 1996, 2000). MI has also been demonstrated to be effective in reducing substance use and use-related behaviors in adolescents and young adults (Barnett, Sussman, Smith, Rohrbach, & Spruijt-Metz, 2012; Brown et al., 2015; Grenard, Ames,

Pentz, & Sussman, 2006; Kohler & Hofmann, 2015; Li, Zhu, Tse, Tse, & Wong, 2016; Macgowan & Engle, 2010; P. M. Monti et al., 1999; Peter M. Monti, Suzanne M. Colby, & Tracy A. O’Leary, 2001; Spirito et al., 2004; Tevyaw & Monti, 2004; Vasilaki, Hosier, & Cox, 2006), although not in all analyses (Foxcroft et al., 2016; Li et al., 2016).

One advantage of MI is that it is a brief intervention and thus an alternative to longer term treatments with similar efficacy (P.M. Monti et al., 2007; P. M. Monti et al., 1999; P.M. Monti, S.M. Colby, & T.A. O’Leary, 2001; Spirito et al., 2004). In some studies, single session MI has been shown to be more effective than a control intervention (McCambridge & Strang, 2004); demonstrated to have effects persisting for 2 years and more post intervention (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001; Baer et al., 1992; Marlatt et al., 1998; P. M. Monti et al., 1999; Roberts, Neal, Kivlahan, Baer, & Marlatt, 2000); and show efficacy in high risk drinkers (Baer et al., 2001). In two studies, MI’s effects on alcohol-related problems persisted longer than its effects on drinking frequency and quantity (Baer et al., 2001; Roberts et al., 2000). MI is able to address the broad spectrum of patients who are using alcohol, not only those who have been using it for long periods of time, those who have developed major life problems, or those who meet criteria for alcohol dependence (Tevyaw & Monti, 2004). Although reduction in drinking is emphasized, MI also takes a harm reduction approach (Colby et al., 2005; P. M. Monti et al., 1999), something important for alcohol-related morbidity in underage drinkers. As such, MI may be particularly well-suited to adolescents and young adults who may respond poorly to more rigid authoritarian or confrontational approaches (Peter M. Monti et al., 2001).

There have been few studies that have specifically examined the efficacy of MI in women as opposed to men (Grella, 2008; Vasilaki et al., 2006). In one study, Intensive MI was found to be a particularly beneficial treatment for alcohol problems in women with methamphetamine dependence (Korcha, Polcin, Evans, Bond, & Galloway, 2014). Because of this paucity of studies, it has been suggested that more research is needed that specifically takes into account gender; particularly in relation to known differences in psychiatric comorbidities between men and women.

1.2. Motivational interviewing in American Indians/Alaska Natives (AI/AN)

Clinical trials analyzing the potential benefits of MI among AI/AN have been limited. Analysis of treatment response of 25 adult American Indians in the Project MATCH study found superiority of the MI as compared to cognitive-behavioral and 12-step facilitation interventions (Villanueva, Tonigan, & Miller, 2007). Woodall and colleagues (Woodall, Delaney, Kunitz, Westerberg, & Zhao, 2007) found that a treatment intervention incorporating MI principles for first time adult DUI offenders, in a primarily AI/AN sample, was associated with significantly greater reductions in alcohol consumption compared to no intervention. Importantly, “cultural relevance” can be built into MI and tailored for AI/AN populations. MI may be particularly useful in AI/AN populations when cultural adaptations are made to: use AI/AN therapists, emphasize respect for the study participant’s language and spirituality, their relationship with extended family and clan, as well as their tribes’ unique history and culture (Venner et al., 2016). Several groups have developed methodology to implement MI in AI/AN populations as well as demonstrate its acceptance

by AI/AN communities (Dickerson, Brown, Johnson, Schweigman, & D'Amico, 2016; Gilder et al., 2011; Venner, Feldstein, & Tafoya, 2008).

A recent review of evidence-based treatments in substance abuse treatment programs serving AI/AN communities found that only two treatments, MI and Relapse Prevention Therapy, were deemed culturally appropriate by the programs that had utilized them (Dickerson et al., 2016; Novins, Croy, Moore, & Rieckmann, 2016; Spillane, Greenfield, Venner, & Kahler, 2015). For this reason, there have been several groups that have begun to develop programs to incorporate MI within a framework of treatment for substance use disorders in AI/AN health care settings (Dickerson et al., 2016; Gilder et al., 2013; Venner et al., 2008). Few studies to date have been developed specifically for AI/AN youth. However, in one study, Dickerson and colleagues developed an alcohol and drug prevention intervention program specifically for AI/AN urban youth age 14–18 that integrates evidence based treatment with cultural integration.

1.3. The present study

The present study is part of a larger study to build the capacity of an AI community health center to assess and implement a comprehensive program to reduce underage drinking in a tribal group residing on AI reservations. The study was designed after research had documented, in a sample of this population, that the lifetime rates of alcohol use disorders among young adults in this population exceeded 50% (Ehlers, Stouffer, Corey, & Gilder, 2015; Ehlers, Wall, Betancourt, & Gilder, 2004) and that underage drinking (<13 years) is common and is associated, along with other variables, including male gender, with increased risk for the development of use disorders in this population (Ehlers et al., 2006). An outreach to this community in the form of focus groups with tribal leaders and elders was undertaken to determine if the community felt that an intervention for reducing underage drinking using MI would be generally well tolerated in this reservation community (Gilder et al., 2011). Specifically, the data from tribal leader and member participants supported the belief that youth in the community were in the “pre-contemplation” stage of readiness to change with respect to their drinking. Therefore, it was felt that an evidence-based randomized trial of MI would be an ideally suited intervention to reduce underage drinking in this community, particularly for drinking behaviors that others, but not necessarily the youth themselves, wanted to change.

The Institutional Review Board (IRB) required that we enroll participants who had not had a lifetime drink as well as those that had one or more lifetime drinks. The *a priori* hypotheses of this study were: 1) that MI would be more effective than PE in reducing and preventing under age drinking; 2) that MI would be more effective than PE in reducing drinking in participants who were drinking pre-intervention than in preventing drinking in those who were not drinking pre-intervention and 3) that MI would be more effective in boys than in girls because we anticipated that more boys would have begun drinking at pre-intervention than girls.

2. Methods

This study was conducted as part of an ongoing collaboration among an AI community health center, the Southern California Tribal Health Center (SCTHC), The Scripps Research Institute (TSRI), and the Pacific Institute for Research and Evaluation (PIRE).

2.1. Participants

To be included in the study, a potential participant had to be 13 – 20 years of age, be self-identified as AI/AN, eligible for health services from the SCTHC, and living on or near the eight Southwest California reservations served by the health clinic. The 8 reservations are contiguous, are in a rural area, and have approximately 4,000 AI/AN persons living on them. At the request of the tribal IRB, we have not disclosed the name of the SCTHC, the tribes, or their locations.

Additional inclusion criteria were ability and willingness to give formal written informed assent (ages 13 – 17 years) or consent (ages 18 – 20 years), and, in the case of prospective participants ages 13 – 17 years, a parent or legal guardian's ability and willingness to give formal written parental consent. Exclusion criteria included: not meeting study inclusion criteria, and inability or unwillingness to give informed assent/consent or parental consent. Participants came from all eight reservations, not from only one specific reservation. Participants were recruited from clinic waiting rooms, youth centers, and tribal gatherings. Recruitment was face-to-face. Prospective participants were given a brief explanation of the study and a flyer explaining the study and asked, if they were interested in participating, to take it home for a parent or legal guardian to read. The name and telephone number of the study coordinator was provided on the flyer if the teen or parent desired more information about the study. Youth and parents gave written formal assent and consent as described above. Prior to providing informed assent and consent, youth and their parents were informed of the nature of the study and its risks and benefits. Each participant and parent was also given contact information for the study coordinator in case they had any questions later. Prospective participants were told that after completion of the intervention they would be given a \$75 gift card. Prospective participants were also told that if at any point they felt uncomfortable they could discontinue their participation and they would still receive the gift card. Participants who completed the follow-up evaluation were given a \$25 gift card.

2.2. Measures

Information on age and gender was collected from each participant. The Adolescent Drinking Questionnaire (ADQ) (Jessor, Donovan, & Costa, 1989) and Student Self-Check Questionnaire, which was adapted from the Teen Check-up (Dishion & Kavanagh, 2003), were filled out by participants prior to the intervention and again at follow-up. The ADQ assesses frequency of drinking, frequency of getting drunk, quantity of drinking on a usual drinking occasion, and maximum quantity of drinks per occasion the past 3 months.

We adopted the Student Self-Check at the suggestion of the Peter Monti group at Brown University. A review of MI literature (see (Tevyaw & Monti, 2004)) concluded that the positive results seen with motivational enhancement interventions stem from both reductions

in drinking and alcohol-related problem behaviors, but more so from reductions in problem behaviors, at least in some studies. From previous work with adolescents and parents in this population, including focus groups exploring patterns of use and attitudes toward drinking alcohol in adolescents, we determined that for many youth alcohol use was normative, problems were not necessarily attributed to alcohol, even if parents or other adults felt they might be, and that most youth were in the pre-contemplation stage of behavior change with respect to drinking alcohol (Gilder et al., 2011). In addition, we knew we would be studying a group with no drinking at baseline because the IRB required us to include teens who were not drinking as well as those who were drinking at baseline. For these reasons, we wanted an initial assessment of problem behaviors not specifically linked to alcohol. This approach allowed us to assess the same problems at follow-up as we had assessed at baseline in those participants who were non-drinkers at baseline, and to make the assessment of behavior problems the same for those participants who were not drinking and those that were drinking at baseline.

The Student Self-Check asks the participant to rate how much of a problem he or she has had with fifteen behaviors: 1. underachieving in school; 2. lying, exaggerating, or withholding information; 3. stealing at home, school, or in the community; 4. defiance with parents; 5. defiance with teachers or other adults; 6. purposely destroying property; 7. spending time with people who smoke, drink or use other drugs; 8. spending unsupervised time with peers; 9. being jealous or demanding attention; 10. using alcohol; 11. using tobacco; 12. using other drugs; 13. “tagging,” wearing gang clothing or using gang talk; 14. spreading rumors or setting up conflicts with peer; and 15. being moody, withdrawn, sad, or depressed on a 10-point Likert scale from “Very Much a Problem” (1) to “Not a Problem at All” (10) in the past month.

In order to reduce multiple comparisons in the data analyses, and based on the literature that suggests that MI may affect problem behaviors associated with alcohol use more than quantity and frequency of drinking, two subscales of the Student Self-Check were constructed. An Externalizing Behaviors subscale, that consisted of problem behaviors (items 2, 3, 4, 5, 6, and 13) and a Substance Use Behaviors subscale (items 7, 10, 11, and 12). A split-half reliability test (Murphy & Davidshofer, 2005) was made on the Student Self-Check for the sum of the 15 items and on the Externalizing and Substance Use Behaviors subscales. Reliability was 93.9% for the sum of the 15 items, 80.7% for the Externalizing subscale, and 81.2% for the Substance Use subscale, indicating a high internal consistency for all three.

In previous studies with the reservation youth (Gilder et al., 2011; Lee et al., 2015; Moore et al., 2012), youth had indicated that drinking patterns were variable, particularly when comparing summer vacation drinking to drinking during the school year and in youth who were drinking at low levels. The ADQ and Student Self-Check questions were therefore modified to assess frequency and quantity and problem behaviors in the past 6 months. These changes were made to more accurately assess drinking in AI/AN teens who were drinking at irregular intervals or low frequencies.

A card illustrating standard drinks had been developed by and used successfully by the young adult AI/AN researchers to assess drinking frequency and quantity of standard drinks (Gilder et al., 2011). The standard drink frequency and quantity variables were assessed using 8-point Likert scales with higher numbers denoting lower drinking frequencies and quantities. For the purposes of analysis, these points were inverted so that higher numbers denoted higher drinking frequencies and quantities and lower numbers denoted lower frequencies and quantities. A single quantity $\times$ frequency of drinking variable was constructed by multiplying the frequency and quantity variables. The maximum drinks variable was a true continuous number.

2.3. Intervention

The intervention was administered by an AI/AN young adult research team member at the clinic who had received training in MI from a certified MI trainer, a workshop in MI for adolescents conducted by one of the authors (PM), and a workshop in interweaving American Indian and Western practices in MI for American Indian adolescents conducted by Kamilla Venner, PhD, utilizing her manual for Native American Motivational Interviewing (see (Venner, Feldstein, & Tafoya, 2006)). Youth were randomized to one of two interventions: MI and PE. Using a random sequence generator (Random.org, accessed at <https://www.random.org/> on July 28, 2017), a randomized series of all integers from 1 to 300 numbers was generated as a list. Starting at the first integer on the list, participants were assigned to successive integers on the list. Those participants assigned an even integer received MI, those assigned an odd integer received PE. All MI and PE intervention sessions were individual one-on-one with the therapist.

The MI intervention consisted of a brief introduction to the problem of underage drinking followed by a MI session in which the therapist endeavored to maintain a focus on underage drinking. After a quick assessment of the participant's stage of change, the therapist used the OARS approach (open ended questions, affirmations, reflections, and summaries) consistent with that stage of change to arrive at a description of a decisional balance concerning reducing drinking (for drinkers) or not beginning to drink (for non-drinkers). An effort was made to engage each participant using warmth, empathy, and affirmation of his or her autonomy. For youth who had already initiated drinking the therapist focused the session on drinking and its consequences. For youth who had not initiated drinking the therapist focused the session on the decision not to drink and its consequences. The PE intervention consisted of watching two DVDs, "Underage Drinking: Know the Facts, Know the Risks" (Human Relations Media, 2003) and "Too Much: The Extreme Dangers of Binge Drinking" (Human Relations Media, 2006). Watching the DVDs was followed by an open-ended discussion on the risks of underage drinking and binge drinking with the same young adult research team member. An open-ended discussion was not used in the MI intervention.

In both the MI and PE sessions an effort was made to include the teens' own experience and the experience of his or her family, friends, and tribal members with alcohol. An effort was also made to point out that alcohol was never used in the culture prior to colonialism and the strong tribal convention that intoxication excludes individuals from participating in dancing, drumming, and singing at cultural events. An MI approach was not used in the PE sessions,

which were informational only. Each intervention was 1.5 hours long. Single session MI or PE was chosen given the practical problems in achieving uniform second session intervention with participants who had completed the first intervention session, and because the literature had suggested that single session MI could be effective (McCambridge & Strang, 2004).

2.4. Adherence to MI

The Adherence Checklist (Spirito et al., 2004) was completed by each participant in the MI intervention at the end of the session.

2.5. Follow-up

To maximize participation in the follow-up assessment, several procedures were used. These procedures included use of contact information (phone numbers, email addresses) for the participant himself or herself and 2 other family members obtained at baseline; contact information in the Health Clinic roles; and personal knowledge of the AI study coordinator, who was a tribal member herself. The standard drink criteria used in the baseline assessment was reviewed at the time of the follow-up interview. The same ADQ and Student Self Check questionnaires used in the pre-intervention assessment were used to assess past 6 month drinking and behaviors at follow-up. The study protocol called for follow-up at 6 months or as soon thereafter as possible.

2.6. Analyses

Descriptive statistics of participants' ages, gender, intervention type (MI or PE), and time from intervention to follow-up for the entire sample, for boys and girls, and for the MI and PE groups separately were tabulated and compared using ANOVA. Likert scale variables were treated as continuous. Three variables were used in the main analyses: 1) Past 6-month quantity $\times$ frequency; 2) maximum drinks per occasion; and 3) the sum of 15 behavior problems. To correct for multiple comparisons for these three variables, in the main analyses, a Bonferroni correction was applied ($p < 0.017$). A repeated measures GLM analysis was performed for each variable with the following main independent variables in the analysis: gender, intervention type (MI vs. PE), and time (time 1 pre-intervention at baseline vs. time 2 post-intervention at follow-up). Main effects were assessed for gender, intervention, and time. Significant time interactions with gender, intervention type, and gender by intervention type were examined in post hoc analyses using ANOVA to assess the characteristics of those interactions. In a separate analysis, the group of 9 subjects who completed the baseline assessment but who did not complete the follow-up assessment were compared to the 60 subjects who did complete the follow-up assessment on the basis of age, gender, and each main and post-hoc exploratory variable in drinkers, non-drinkers, and the entire sample. Analyses were carried out using SPSS Version 20. In all exploratory post-hoc analyses the alpha level (2-tailed) was set at 0.05 and p-values were considered significant if < 0.05 .

3. Results

3.1. Recruitment and follow-up

Seventy-six prospective participants were approached and asked to consider participating in the study. Seven declined, usually citing not having enough time to participate. Sixty-nine youth agreed to participate and were randomly assigned to either a MI or PE session. Of these, 60 youth (24 boys, 36 girls) participated in a follow-up assessment. A comparison of those who did not follow-up to those that did follow-up revealed no differences on any main or exploratory post-hoc variable, age, or gender in drinkers, non-drinkers, and in the entire sample (results not shown). Of these 60 follow-ups, 18 had been recruited from clinic waiting rooms, 23 from the youth center, and 19 from tribal gatherings. The mean time to follow-up was longer than the initially intended 6 months (mean= 2.0 + S.E. = 0.16 years). Mean time to follow-up was compared between participants the MI and PE condition in the drinkers and non-drinkers and they were not found to be significantly different. Subsequent data analysis centered on the youth who participated in the follow-up assessment.

3.2. Comparison of subgroups at baseline and by time to follow-up

Ages of participants, drinking and behavior problem variables prior to intervention were compared in boys (n=24) vs. girls (n=36) and in the MI (n=33) vs. PE (n=27) interventions for drinkers (n=25), non-drinkers (n=35), and the entire sample (n=60). There were no differences. In the entire sample, mean time to follow-up was 2.0 years (S.E. = 0.20 years) in both the MI and the PE conditions (p=0.910 for the comparison). Mean time to follow-up was not different for boys vs. girls or in the MI vs. PE interventions in drinkers, non-drinkers, and in the entire sample.

3.3. Adherence to MI

Those participants who did the MI intervention filled out the 14 item Adherence Checklist at the end of the MI Session. Positive responses, which indicated adherence, were in the range of 90% to 100% for each of the 14 items.

3.4. Pre- and post-intervention variables in MI and PE

Pre- and post-intervention drinking and behavior problem variables are displayed for those who received MI in Table 1 and PE in Table 2. In drinkers and the entire sample, qxf of drinking, maximum drinks, and problem behaviors decreased from baseline to follow-up. In the non-drinkers, qxf of drinking, maximum drinks increased from zero to a measureable amount and problem behaviors showed no change.

3.5. Association of intervention with follow-up outcome variables

Results of the general linear model analysis of changes in drinking and behavior problem variables from baseline to follow-up (denoted as Time factor) are shown in Table 3. For drinkers, participation in the intervention (MI or PE) was associated at follow-up with a decrease in qxf of drinking (p=0.011), fewer maximum drinks (p=0.004), and fewer problem behaviors (p=0.009). In exploratory post-hoc comparisons, problems with underachieving in

school ($p=0.034$), externalizing behaviors ($p=0.008$), and substance use behaviors ($p=0.048$) were less at follow-up. For drinkers, in post-hoc analyses, males in the MI group reported less qxf of drinking ($p=0.048$) and females in the MI group reported less depression ($p=0.01$).

In the non-drinking group, 6 participants (17%) had initiated drinking at follow-up. In the non-drinking group as a whole, participation in the intervention (MI or PE) was associated with an increased qxf of drinking ($p=0.008$) and increased maximum drinks ($p=0.047$). There was no change in behavior problems. In exploratory post-hoc comparisons, no gender, MI vs. PE intervention, or gender $\times$ intervention effects were identified. In the entire group (drinkers + non-drinkers), qxf of drinking and behavior problems improved. In exploratory post-hoc comparisons, underachieving in school, externalizing behaviors, substance use behaviors, and being depressed improved. There were no gender, MI vs. PE intervention, or gender $\times$ intervention effects.

4.0 Discussion

4.1. Overall effects of the interventions on drinkers and non-drinkers

In the present study, a randomized control trial to assess the efficacy of MI compared to PE to prevent or reduce underage drinking in AI youth was implemented. For the most part, the effects of the interventions were not different for MI and PE in youth who were drinking at the time of the intervention as well as for those who were not. One possible reason that both MI and PE had successful effects was the fact that young adult AI/AN therapists had discussions following the MI and the PE sessions on the history of alcohol in the communities and pointing out that alcohol is not part of the tribal culture in the past – it was introduced from outside – and is not part of the tribal culture in the present and that all the tribes have forbidden drinking and being intoxicated at all tribal events, including tribal meetings, pow-wows, health fairs, youth gatherings, after school programs, and sports events. However, no measures were made of the potential effectiveness of such messages, and future studies should incorporate such measures.

4.2. Effects of the interventions on drinkers

For youth who were drinking at the time of the intervention, participation in MI or PE was associated at follow-up with significantly less quantity $\times$ frequency of alcohol use, less maximum drinks, and fewer behavioral problems. Improvement in behavior problems included improvements in achievements in school, externalizing behaviors, and substance use related behaviors. These findings are consistent with studies in non-AI teens that have demonstrated that brief interventions are generally effective in reducing alcohol and drug use and behavioral problems (Tanner-Smith & Lipsey, 2015; Winters, 2016). These findings also support previous studies employing MI in non-AI teens and young adults that have demonstrated significant improvement in substance use outcomes (Barnett et al., 2012; Brown et al., 2015; Jensen et al., 2011; Kohler & Hofmann, 2015; Macgowan & Engle, 2010; Stein et al., 2011). Additionally, these studies are consistent with the review of the literature by Tevyaw and Monti (2004) who found better evidence for the effectiveness of MI in reducing alcohol-related problems than in modifying drinking.

4.3. MI variables more effective than PE variables in drinkers

In this study, MI was more effective than PE in reducing quantity of drinking in boys who drank. Why MI should be more effective than PE in reducing quantity of consumption and why only in boys is unclear. In one recent study of young women in Sweden, although there was a significant decrease in risk and binge drinking from baseline to follow-up, there was no difference between control intervention and MI (Palm et al., 2016). In one study MI was found to be effective in reducing drinking in a subgroup of heavy drinkers (Spirito et al., 2004). Heavy drinking and bingeing is more common in boys, which might be one explanation for this effect. In our study, MI was found to be more effective than PE in reducing depression symptoms in girls who were drinkers at the initial interview. It may be that there are gender differences in the types of alcohol use and behavioral variables that improve with a motivational as opposed to a psycho-educational brief intervention. Other studies have demonstrated that depression can moderate the effects of MI treatment on risky behaviors (Clair-Michaud et al., 2016) and that MI can significantly enhance treatment compliance, as compared to an active control, in teens with anxiety and mood disorders (Dean et al., 2016). The moderating effects of depression, and possibly other psychiatric variables, on outcomes from an MI intervention are an important area for future study.

4.4. Effects of intervention on non-drinkers

In non-drinkers, over the course of participation in the intervention (MI or PE), a small but significant increase in quantity $\times$ frequency of drinking and maximum drinks occurred, which would be anticipated in teens in the 13 – 20 year old age range over the 2 year follow-up period. Individual participants who did begin to drink represented a small portion (17%) of the original non-drinking group and, when considered separately, were drinking at low levels at follow-up. In this group of non-drinkers, the intervention was not associated with changes in any behavior problem variable at follow-up.

5. Study Limitations

The results of this study should be viewed in the light of several limitations. Although the assignment to MI or PE was random, recruitment to the study was not conducted randomly and so the participants in the study may not be representative of the entire youth population served by the SCTHC. Another limitation in our data arises from the fact that the pre-intervention assessment was self-administered, whereas the follow-up assessment was conducted over the phone. Social desirability may have resulted in lower levels of self-reported drinking and problem behaviors during the follow-up phone assessment than would have been obtained with a self-administered assessment. Additionally, the follow-up occurred at a later time than originally intended. It is possible that the 2-year mean time to follow-up may have been too far out to capture some of the earlier effects of the interventions. The problem of multiple comparisons, and the sample size of this pilot study, also means that the superiority of MI over PE on some measures in this study should only be considered suggestive. Larger, more tightly controlled studies will be needed in order to accurately assess the relative effectiveness of MI and PE in AI/AN youth.

In accordance with the wishes of IRB, we did not have a true non-intervention control group in the sense that we did not have a group who was recruited, consented, assessed pre-intervention, randomly assigned to receive neither MI nor PE, and then assessed again at follow-up. Without a true non-intervention control group it is not possible to assess how effective MI or PE would have been relative to a group of drinkers and non-drinkers who received no intervention. Improvements in drinking indices and behavior problems in the drinking group and continued abstinence in the great majority of non-drinkers may have been due to factors other than the interventions, and thus renders our conclusions about the effectiveness of the MI and PE interventions tentative. Few studies have used an active control group to evaluate the efficacy of MI in adolescents, making it difficult to know whether observed changes are specific to MI or to additional contact time (Romano & Peters, 2015) or other, unmeasured factors. However, the teens who participated in this study were moving through a time in their lives of increased risk for substance use and behavior problems during the follow-up period. It is reasonable to think that a non-intervention group would have more dramatically shown the effectiveness of MI and PE. Other limitations are that assessment of drinking variables relied on self-report. Obtaining additional estimates of drinking from biomarkers might have added valuable additional information. Additionally, our results may not apply to other AI/AN youth populations served by rural clinics in other locations because of important differences in culture, history, socioeconomic status, degree of geographical remoteness, and availability of treatment resources.

6. Conclusions

The findings of this small pilot study represent an important contribution to identifying interventions that can relatively easily be implemented in youth served by the SCTHC and provide a population-specific and culturally appropriate platform for prevention efforts to reduce the morbidity and mortality associated with underage drinking. More broadly, this study suggests that intervening against underage drinking using MI or PE in AI youth can result in reduced drinking, prevention of drinking, as well as other positive behavioral outcomes. If larger studies confirm the effectiveness of PE on underage drinking in AI/AN youth then this would be a cost effective program that could be quite easily implemented in rural healthcare settings where access to trained therapists may be limited. However, the finding that MI may be superior to PE on some drinking and behavioral measures depending on the sex of the participant suggests that further research with this modality is still warranted. Given the scope of the problem, additional research is clearly needed to identify those brief interventions that are effective for substance use in both AI/AN and non-AI/AN youth.

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Highlights

1. Motivational Interviewing and Psycho-education are compared in American Indian youth.
2. Both interventions to reduce drinking and behavior problems are effective.
3. Motivational Interviewing is more effective than Psycho-education on some measures.
4. Gender and drinking status at baseline are covariates of intervention response.

Table 1

Drinking and behavioral problem variables at baseline and follow-up in the Motivational Interviewing (MI) intervention in drinkers, non-drinkers, and the entire sample

Variable	Baseline MI Mean (S.E.)	Follow-Up MI Mean (S.E.)
<u>Drinkers (n=17)</u>		
Items from questionnaire: During the past 6 months...		
-Quantity × frequency of alcohol use	9.12 (2.2)	5.12 (1.3)
-What is the highest number of drinks you can recall having on one occasion?	4.1 (0.7)	3.5 (0.8)
-Behavioral problems *	116.4 (6.4)	134.4 (3.4)
<u>Non-Drinkers (n=16)</u>	<u>Baseline MI</u>	<u>Follow-Up MI</u>
Items from questionnaire: During the past 6 months...		
-Quantity × frequency of alcohol use	0.0 (0.0)	0.2 (0.1)
-What is the highest number of drinks you can recall having on one occasion?	0.0 (0.0)	0.3 (0.2)
-Behavioral problems	128.3 (5.6)	129.8 (4.9)
<u>Entire Sample (n=33)</u>	<u>Baseline MI</u>	<u>Follow-Up MI</u>
Items from questionnaire: During the past 6 months...		
-Quantity × frequency of alcohol use	4.7 (1.4)	2.7 (0.8)
-What is the highest number of drinks you can recall having on one occasion?	2.1 (0.5)	2.0 (0.5)
-Behavioral problems	122.0 (4.4)	132.2 (2.9)

* Behavior problems (sum) scale: A higher value corresponds to less of a problem

Table 2

Drinking and behavioral problem variables at baseline and follow-up in the Psycho-Education (PE) intervention in drinkers, non-drinkers, and the entire sample

Variable	Baseline PE Mean (S.E.)	Follow-Up PE Mean (S.E.)
<i>Drinkers (n=8)</i>		
Items from questionnaire: During the past 6 months...		
-Quantity × frequency of alcohol use	14.1 (6.0)	10.1 (5.3)
-What is the highest number of drinks you can recall having on one occasion?	6.9 (2.5)	5.5 (2.4)
-Behavioral problems *	111.9 (7.8)	127.4 (10.2)
<i>Non-Drinkers (n=19)</i>	Baseline PE	Follow-Up PE
Items from questionnaire: During the past 6 months...		
-Quantity × frequency of alcohol use	0.0 (0.0)	0.2 (0.1)
-What is the highest number of drinks you can recall having on one occasion?	0.0 (0.0)	0.6 (0.5)
-Behavioral problems	137.2 (2.3)	139.6 (2.8)
<i>Entire Sample (n=27)</i>	Baseline PE	Follow-Up PE
Items from questionnaire: During the past 6 months...		
-Quantity × frequency of alcohol use	4.2 (2.1)	3.1 (1.7)
-What is the highest number of drinks you can recall having on one occasion?	2.0 (0.9)	2.1 (0.9)
-Behavioral problems	129.7 (3.6)	136.0 (3.7)

* Behavior problems (sum) scale: A higher value corresponds to less of a problem

Table 3

Results of general linear model analyses of primary and post-hoc drinking and behavioral problem variables showing significant changes in the drinkers and non-drinkers and in the entire sample

Variable significant for intervention effect/Significant interactions	F	p-value	Effect Size
Drinkers (n=25)			
Items from questionnaire: During the past 6 months...			
- Quantity $\times$ Frequency of alcohol use	7.9	0.011	0.273
<i>Timefactor*Gender</i>	4.0	0.058	0.161
<i>Timefactor*Intervention*Gender^a</i>	6.3	0.020	0.232
-What is the highest number of drinks you can recall having on one occasion?	10.1	0.004	0.326
<i>Timefactor*Intervention</i>	5.0	0.036	0.193
<i>Timefactor*Gender</i>	14.0	0.001	0.400
<i>Timefactor*Intervention*Gender</i>	10.9	0.003	0.342
-Have you had a problem with underachieving in school?	5.2	0.034	0.198
-Have you had a problem with being moody, withdrawn, sad or depressed?	1.6	0.221	0.070
<i>Timefactor*Intervention*Gender^b</i>	5.0	0.037	0.191
- Externalizing behaviors	8.5	0.008	0.288
- Substance use behaviors	4.4	0.048	0.174
- Sum of behavioral problems	8.2	0.009	0.282
Non-Drinkers (n=35)			
Items from questionnaire: During the past 6 months...			
- Quantity $\times$ Frequency of alcohol use	8.1	0.008	0.208
-What is the highest number of drinks you can recall having on one occasion?	4.3	0.047	0.121
Entire Sample (n=60)			
Items from questionnaire: During the past 6 months...			
- Quantity $\times$ Frequency of alcohol use	4.0	0.049	0.067
-Have you had a problem with underachieving in school?	6.8	0.011	0.109
-Have you had a problem with being moody, withdrawn, sad or depressed?	1.8	0.182	0.032
<i>Timefactor*Intervention*Gender</i>	4.3	0.042	0.072
- Externalizing behaviors	5.4	0.023	0.088
- Substance use behaviors	4.5	0.039	0.074
- Sum of behavioral problems	7.4	0.009	0.119

^a Male drinkers in the Motivational Interviewing group had lower quantity $\times$ frequency of alcohol use after the intervention

^b Female drinkers in the Motivational Interviewing group reported depression was less of a problem after the intervention