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## Randomized controlled trial of motivational interviewing for alcohol and cannabis use within a predominantly Hispanic adolescent sample

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### Abstract

Hispanic youth represent one of the fastest-growing minority groups. Yet, we know little about Hispanic adolescents' response to empirically-supported interventions for adolescent addiction, including motivational interviewing (MI). This randomized controlled trial compared MI to an active educational treatment for adolescent alcohol and cannabis use (alcohol and cannabis education; ACE). Adolescents who regularly use substances (N=448; n=347 Hispanic; n=101 non-Hispanic white; ages 13–18) were randomized to two 1-hour individual sessions of MI or ACE. We examined six-month outcomes and mechanisms of change across Hispanic and non-Hispanic white youth. Treatment response was comparable across ethnicities (Hispanic vs. Non-Hispanic white youth). Additionally, adolescents in the MI condition showed greater reductions in alcohol use compared to those in ACE, with support for motivation and self-efficacy as mechanisms of treatment response. Direct effects of MI on cannabis use were not observed; however, a significant indirect effect of motivation was observed for reductions in cannabis use. Data support the efficacy of MI in reducing adolescent alcohol use, through the vehicle of enhanced motivation and self-efficacy. While consistent treatment response was observed for adolescent alcohol use across ethnicities (Hispanic vs. non-Hispanic white), further exploration into potential underexplored

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**Data Sharing Statement:** Requests for deidentified individual participant data up to and including six month outcomes (including data dictionaries) can be made to researchers who provide a methodologically sound proposal for use in achieving the goals of the approved proposal. Proposals should be submitted to Sarah W. Feldstein Ewing, at feldsteinewing@uri.edu.

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mechanisms of Hispanic adolescents' treatment response is requisite to strengthening prevention and intervention programming for Hispanic adolescents' cannabis use.

## Keywords

RCT; Hispanic; adolescents; motivational interviewing; alcohol; cannabis

Hispanic individuals comprise one of the fastest growing populations in the United States (U.S.) According to the U.S. Census, the Hispanic population will increase from 55 million in 2014 to 119 million in 2060; Hispanic individuals will soon represent more than one quarter of the total U.S. population (Colby & Ortman, 2017). Despite comparable levels of substance use, Hispanic youth continue to show disproportionately elevated levels of substance-related consequences when compared with their non-Hispanic white peers; in other words, although Hispanic youth use substances in equivalent ways, the repercussions of substance use are much more deleterious for Hispanic, as compared with non-Hispanic white, adolescents (Salvador et al., 2015).

While great strides have been made in the dissemination of empirically supported treatments for adolescent substance use, including motivational interviewing (MI; Miller & Rollnick, 2013), most adolescents at high need for intervention still never receive needed substance use treatment (Silvers et al., 2019). This disparity is particularly pronounced for Hispanic youth (Feldstein Ewing, Gaume, et al., 2015; Feldstein Ewing et al., 2012). Further, even when Hispanic adolescents successfully arrive at treatment, we still do not know how to best approach treatment for Hispanic adolescents. This is likely due to the large absence of published empirical studies around the impact of MI with Hispanic youth - specifically.

MI is a collaborative youth-provider approach that bolsters youths' sense of their self-efficacy and autonomy in their journey toward behavior change; it has been integrated into school, hospital, and juvenile justice settings (D'Amico et al., 2015; D'Amico et al., 2018) and is widely used with Hispanic populations (D'Amico et al., 2019; Lee et al., 2019). Yet, while Hispanic youth represent a large cross-section of the population within many of these settings, we could find no published randomized controlled trials evaluating how effective this treatment approach is for Hispanic youth. Meaning, although *widely used* with adolescents, we still do not have a firm handle on whether or not MI works with Hispanic youth, and further, what mechanisms may drive its treatment effects in this community.

This is synchronous with the broader sphere of MI examinations, where the call for investigating mechanisms of MI continues to resound (Burke et al., 2003; Miller & Rose, 2009). To date, the mechanisms that drive this treatment are still very much under scrutiny. This is especially true for youth, for whom the effect sizes of MI have been comparatively lower than for adults (Cushing et al., 2014; Jensen et al., 2011). Further, the active ingredients of MI are even less well understood among race/ethnic minority youth (Austin et al., 2010; Feldstein Ewing et al., 2012). Knowing how and why MI works is critical for several reasons. Unveiling the underlying mechanisms of this common, widely-used treatment is critical to illuminating the mechanisms of MI and how they might operate differently between Hispanic and non-Hispanic white youth. This is requisite for informing

effective training and dissemination of MI, and represents one important step toward closing the gap in the current racial/ethnic disparities that exist for Hispanic adolescents in addictions treatment.

## Present Study

The goal of this study was to conduct a randomized controlled trial (RCT) to examine treatment response and its mechanisms among Hispanic adolescents. Specifically, this study aimed to examine the impact of MI on adolescent alcohol and cannabis use as compared to a common, traditionally used intervention in youth addiction settings (alcohol and cannabis education [ACE]; Reyna & Farley, 2006). Both interventions were carefully time-matched for session length and provider contact.

In terms of mechanisms, we posited that MI would have its effects via three factors posited to be important in adolescent treatment response (Hall et al., 2014): *motivation to change*, *self-efficacy*, and *peer norms*. One of the means through which MI may lead to change is through increasing motivation to change, operationalized by client's perception of the importance of making a change, their confidence that they could change, and their readiness to change (Miller & Rollnick, 2002). Even with high motivation, adolescents cannot successfully change their substance use behavior without situational self-efficacy, specifically feeling that they would be able to refuse substance use in a social situation. Finally, perception of peer use is a salient factor likely to influence adolescent substance use that is directly targeted in MI (D'Amico & Edelen, 2007; D'Amico & McCarthy, 2006; Kilmer et al., 2006). Hypothetically, an increase in motivation to change, an increase in refusal self-efficacy, and a decrease in perception of peer use would lead to decreased substance use, defined as lower levels of use, dependence, and substance-related problems. This model serves as the basis for our hypotheses regarding mediation, and for our analyses of differential mediators of MI effectiveness between Hispanic and non-Hispanic white adolescents.

We will also evaluate the contribution of specific cultural factors in adolescents' substance use outcomes (Venner & Feldstein, 2006; Venner et al., 2007; Venner & Miller, 2001). In previous studies, acculturation has yielded mixed results for alcohol use outcomes for Hispanic adolescents and adults (Arroyo et al., 2003; Delva et al., 2005; Fosados et al., 2007; Gil et al., 2004; Guilamo-Ramos et al., 2004). However, the adolescent published literature in this area is limited. Thus, in terms of the potential differential impact of the effectiveness of MI between Hispanic and non-Hispanic white adolescents, we proposed three possibilities. First, one could argue that MI may be less effective for Hispanic adolescents based on a discrepancy between aspects of Hispanic culture and central tenets of MI. For example, both the empirical and anecdotal literature indicate that many Hispanic individuals receiving substance abuse interventions prefer family-based versus individual interventions (e.g., Lopez Viets, 2007; Szapocznik et al., 2003; Waldron & Turner, 2008). These components are in direct contrast with the individual, non-expert, and egalitarian approach of MI.

Another possibility is that MI, in its original non-adapted form, may be highly effective among Hispanic adolescents. This argument is supported by the consistency of other aspects of MI with Hispanic culture. For example, the non-judgmental, empathic, and collaborative approach of MI may make it highly effective in cross-cultural applications (Hettema et al., 2005; Miller et al., 2007) as it allows the client's values, opinions, and arguments for change to be the most valued component of the discussion, yielding a collaborative spirit consistent with the concept of *simpatía* (Gloria & Peregoy, 1996). Based on the Hispanic treatment literature, which suggests the potential congruence of MI with several aspects of Hispanic culture (e.g., *simpatía*; Gloria & Peregoy, 1996) and the nascent Hispanic cultural MI literature in this area (Becker et al., 2012; Clair et al., 2013; Field et al., 2012; Hettema et al., 2005; Miller et al., 2007), MI could potentially generate greater reductions in alcohol and cannabis use as compared with education condition (ACE) for this sample.

Third, it is also possible that there might not be any global differences with respect to the effectiveness of MI with Hispanic adolescents. Rather, even if the intervention outcomes are the same across cultural groups, differences in the *mechanisms* of change (in the form of the mediators targeted herein), may emerge between Hispanic and non-Hispanic white adolescents. Based on the extant literature in this area (Gil et al., 2004; Wagner et al., 2015), it is hypothesized that perhaps the relatively more internal and "individualistic" mediator of motivation to change may be a stronger mechanisms of program efficacy for non-Hispanic white youth, while the relatively more communal and social situational mediators of peer norms and refusal self-efficacy may be stronger mechanisms of program efficacy for Hispanic youth.

Thus, we aimed to examine treatment response across Hispanic and non-Hispanic white adolescents by testing three factors proposed to be impactful in adolescent behavior change: motivation to change, self-efficacy, and peer norms (Hall et al., 2014). We posited that MI would enhance change in these three mechanisms compared to ACE, and that these mechanisms would mediate observed changes in alcohol and cannabis six months later among participants in the MI condition (Gil et al., 2004; Karoly et al., 2016; Mills & Caetano, 2012). Finally, we explored the possibility that the mechanisms of change might differ across Hispanic and non-Hispanic white youth, even if intervention outcomes were the same.

In sum, this was an *a priori* investigation of the primary 6-month treatment outcomes via a large, rigorous randomized controlled trial of MI and its theorized mechanisms with a sample of predominantly Hispanic youth who were regularly using substances. Knowing how and why MI works is critical for several reasons. Learning what the underlying mechanisms of this common, widely-used treatment – particularly among a sample of predominantly Hispanic youth – is critical to inform the training and dissemination of MI, particularly with Hispanic youth. Understanding the underlying mechanisms of MI and how they might operate differently between Hispanic and non-Hispanic adolescents also could begin to close the gap in the current racial/ethnic disparities that exist for Hispanic adolescents in addictions interventions (Lowman & Le Fauve, 2003).

## Methods

### Participants and Procedures

Research staff introduced this project at juvenile justice programs. Potential participants were informed that participation was voluntary and would not affect their justice status. Eligible youth were 13–18 years, involved with a juvenile justice program, and engaged in regular substance use (defined as use of alcohol and/or cannabis at least once a month for the past six months (Chung & Martin, 2001). Exclusion criteria included psychosis, significant cognitive impairment and/or severe medical illness. Youth age 18 provided consent, and parent consent/adolescent assent was obtained for youth under 18. The final sample was comprised of 448 youth (n=347 Hispanic; n=101 non-Hispanic white; Figure 1).

This study is part of a larger trial evaluating adolescent health disparities (1R01 AA017878–01A2; PI: Feldstein Ewing). All youth completed a baseline assessment and were randomized to receive time-matched individual sessions of MI or ACE (see details within Interventions). In line with the supporting R01, and our line of clinical research in this area (Feldstein Ewing, Gaume, et al., 2015; Feldstein Ewing, Houck, et al., 2016; Feldstein Ewing et al., 2013; Montanaro et al., 2015), all youth received two, 1-hour sessions, spaced 1 week apart to provide youth an opportunity to practice newly acquired skills in the intervening weekend. Youth completed measures prior to receiving treatment (baseline), immediately after completion of their second session (post-test), and at 3, 6, and 12 months following treatment completion. Data for the 3-month outcomes primarily focused on a test of treatment integrity and fidelity across the two interventions (Feldstein Ewing, Gaume, et al., 2015). In order to strike a balance between longer-term outcomes, and still seeing the influence of our mediators, to evaluate our specific aims herein, all analyses were focused on 6-month trial outcomes.

Youth received \$110 for completing all components of the study. All components of the study were conducted in private study space at the justice or research center. Procedures were conducted with University Human Subjects approval and a federal Certificate of Confidentiality.

### Measures

Assessments were completed on a laptop via audio computer-assisted self-interview (ACASI; Williams et al., 2000). In order to ensure that our primary outcome measures and mediators were invariant across the groups of interest (e.g., to demonstrate whether respondents from different ethnicities interpret the same measure in a conceptually similar way), we conducted a measurement invariance analysis. All measures successfully demonstrated measurement invariance in the target sample (Feldstein Ewing, Montanaro, et al., 2015). All descriptive and psychometric data presented herein are for the present sample.

**Demographics.**—Participants reported their preferred language, age, gender, highest completed grade, generational status, and number of lifetime arrests.

**Ethnicity and Acculturation.**—Participants reported their ethnicity and the culture they most identify with. Participants who endorsed Hispanic ethnic identity were administered

an abbreviated version of the Hispanic Acculturation Scale (Caetano, 1987), which queries frequency of items such as watching Spanish language television; proportion of friends, church congregation, and neighborhood that is Hispanic; and level of agreement with culturally-bound attitudes and beliefs.

**Substance Use and Related Problems.**—Throughout the past 15 years, clinical researchers in adolescent addiction have found that adult diagnostic criteria do not adequately capture the process and manifestation of adolescent substance use and addiction (Clark, 2004; Silvers et al., 2019). In line with recent calls for redefining adolescent addiction to be more developmentally appropriate (Silvers et al., 2019) measures implemented here aimed to capture aspects of addiction most frequently examined in this age group: use, problems, and dependence symptoms (Clark, 2004; Silvers et al., 2019).

**Alcohol.** Alcohol use was measured as the mean of 3 items assessing quantity and frequency (White et al., 1988); scores were standardized prior to calculating means ( $M=-0.00014$ ,  $SD=0.79$ ,  $\alpha=.71$ ). Alcohol problems were assessed with the 23-item Rutgers Alcohol Problems Index (RAPI; White & Labouvie, 1989); items were summed to a total score ( $M=10.69$ ,  $SD=11.34$ , range 0–65,  $\alpha=.88$ ). Alcohol dependence was measured with the 10-item Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 2001); items were summed to a total (sample  $M=6.88$ ,  $SD=5.49$ , range 0–31,  $\alpha=.81$ ).

**Cannabis.** Cannabis use was assessed using the Timeline FollowBack (Sobell & Sobell, 1992), evaluated here as the proportion of cannabis use days during prior 30 days ( $M=0.49$ ,  $SD=0.36$ , range 0–1.00). Cannabis problems was assessed with the 29 item Marijuana Problem Index (MPI; Johnson & White, 1995), which parallels the RAPI; items were summed to a total score ( $M=23.37$ ,  $SD=18.19$ , range 0–91,  $\alpha=.91$ ). Cannabis dependence was assessed with a 10-item cannabis use disorder scale (Stephens et al., 2000); items were summed to a total score ( $M=4.02$ ,  $SD=2.68$ , range 0–10,  $\alpha=.78$ ).

**Mechanisms of Treatment Response.**—Hypothesized mechanisms were measured at pre- and post-treatment. Each construct was measured separately for alcohol use and cannabis use, and scores were standardized prior to calculating means. Motivation to change was measured as the mean of 6 items assessing importance, readiness, and intentions to change (readiness rulers; Bryan et al., 1996). Internal consistency was high for alcohol ( $\alpha=.89$ ) and cannabis scales ( $\alpha=.92$ ). Self-efficacy was assessed with a 5-item subscale (Young et al., 2007). Scales were computed as the mean of 5 items, and internal consistency was high for alcohol ( $\alpha=.90$ ) and cannabis ( $\alpha=.96$ ) scales. Peer norms were measured via 3 item scale (Bryan et al., 2005). Internal consistency was adequate for alcohol ( $\alpha=.73$ ) and cannabis ( $\alpha=.80$ ).

## Interventions

Participants were randomized to MI or ACE via a gender-stratified random number generator. PhD-level therapists conducted both MI and ACE sessions; no therapist effects were observed (Feldstein Ewing, Gaume, et al., 2015). The first author is an established expert in MI with adolescents and trained all therapists in both interventions.

In the design of this study, we carefully weighed whether to adapt (“culturally-tailor”) the intervention prior to implementing it with this sample versus identifying how impactful the original intervention might be prior to cultural adaptation (Feldstein Ewing et al., 2012). Given the high level of dissemination of this intervention in its original form across existing community infrastructure serving US youth (e.g., schools, hospitals, juvenile justice settings), we ultimately decided to maintain the intervention in its original non-adapted form, in order to best inform the potential impact and generalizability of our study findings (Feldstein Ewing et al., 2012).

**Motivational Interviewing (MI).**—The goal of the MI intervention was to introduce, for the first time for many youth, a conversation about alcohol and cannabis use, and the personally-experienced consequences of substance use. Following the empirically-supported approach for MI with non-treatment-seeking adolescents (D’Amico et al., 2013; McCambridge & Strang, 2004), this manualized intervention explored youths’ stories around their substance use, the factors in youths’ lives that support substance use (e.g., enjoying the substance, having family members/friends who were using), and the consequences of using. Youth were provided personalized feedback about how their use compared to age-matched norms in the U.S. The ultimate goal was to engage youth in a thoughtful conversation about their alcohol and cannabis use, and the implications that their use may have on their lives, with an eye to bolstering and supporting behavior change.

**Alcohol and Cannabis Education (ACE).**—The ACE condition was designed to provide standard alcohol and drug education administered in standard adolescent care settings. The ACE intervention was matched for time and interventionist contact, and followed a manualized intervention. Across both ACE sessions, therapists were directed to utilize didactic approaches, as if they were providing a 1:1 tutoring session in these content areas. Importantly, throughout ACE sessions, therapists provided youth with material about alcohol and cannabis, and encouraged youth to ask questions about the presented information **only**. In contrast with MI, therapists did not reflect youth experiences and did not elicit youths’ perspectives. Further, youth were not provided with age-normed feedback regarding their drinking/cannabis use, and were not asked about their perceptions of their peers’ substance use. In ACE, youth were not invited to discuss how to reduce their alcohol and cannabis use, and did not discuss harm-reduction strategies.

**Treatment fidelity.** With participant permission, all sessions were audio-recorded to evaluate therapist fidelity and prevent therapist drift. Additionally, 20-minute segments from 15% of MI and ACE sessions were randomly selected for fidelity assessment by an expert third party using the Motivational Interviewing Treatment Integrity coding system (Moyers et al., 2005). These measurements reflected the integrity and fidelity of the MI intervention, and clinical distinction from the ACE condition (Feldstein Ewing, Gaume, et al., 2015). These data demonstrated that therapists utilized significantly greater MI-consistent behaviors in the MI condition [(M (SD) empathy = 4.29 (0.46); M (SD) MI spirit = 4.89 (0.46); M (SD) complex reflections = 23.36 (7.76); M (SD) give information = 0.71 (1.34); M (SD) closed questions = 1.00 (1.21)] and non-MI adherent behaviors in the ACE condition [(M (SD) empathy = 1.20, 0.47); M (SD) MI spirit = 1.74 (0.41); M (SD) complex reflections =



0.91 (1.63); M (SD) give information = 4.66 (4.73); M (SD) closed questions = 5.11 (4.26)] (Feldstein Ewing, Gaume, et al., 2015).

### Statistical Power

Power calculations assumed two-sided alpha of 0.05 and a minimum of 90% power. The study was powered for two distinct aims. First, we sought to detect an effect of condition on changes in alcohol use, problems, and dependence associated with a small effect size of Cohen's  $d=0.25$ , and to test differences in intervention effects by ethnicity based on intervention effects of Cohen's  $d=0.13$ ). For the first aim a total of 133 participants were required. Second, we planned to test mediation via path analysis to determine whether the mechanisms of treatment effects were different by ethnicity. Power analyses for this aim were conducted in Mplus and then in SAS following procedures outlined in Satorra and Saris (1985) for estimating the power of the likelihood ratio test of the significance of parameters in structural equation models (Muthén & Muthén, 2002). This second analysis, accounting for the possibility of differential mediated effects by race/ethnicity, suggested that a total of 350 participants were required.

### Data Analysis

SAS Version 9.4 and Mplus Version 8.2 were used for analyses. Full information maximum likelihood estimation was utilized for missing data (Schafer & Graham, 2002). Preliminary analyses examined baseline equivalence on demographic and outcome measures of 1) MI vs. ACE, 2) Hispanic vs. non-Hispanic white, and 3) their interaction term. The relationship of baseline values to later attrition was examined by testing the main effect of each characteristic, and its interaction with condition, on attrition at six months versus retention. Any demographic variables that differed by condition, ethnicity, and/or that were related to attrition were included as covariates in primary analyses after ensuring an absence of multicollinearity.

Primary analyses examined change from baseline to six months for substance use, and from baseline to immediate posttreatment for mechanisms. These analyses were carried out in a multilevel modeling framework (i.e., time nested within individual) using the two time points for each outcome. The primary interest in these models was the interaction term between condition and time, whereby a significant interaction signifies differences over time by condition. Interaction terms involving ethnicity and acculturation were initially included to test whether change over time by condition differed between Hispanic and non-Hispanic white youth and by level of acculturation, respectively; these factors did not generate significant differences, and thus were trimmed from models for parsimony.

Path analytic models were estimated within a structural equation modeling framework to test theoretical constructs as potential mediators between treatment and substance use outcomes. Separate models were tested for alcohol and cannabis. Substance use, problems, and dependence were considered outcomes in the same model, and theoretical constructs were assessed as co-equal mediators (i.e., no paths from one theoretical construct to another were predicted). Baseline scores of all mediators and outcomes were included as covariates of their respective construct. The models were initially tested in a multiple group framework

to examine model parameters within Hispanic and non-Hispanic white groups separately; however, because no differences by ethnicity were observed in model relationships, we reverted to single group models for simplicity. Indirect effects were estimated using the product of coefficients method with standard errors calculated using the Sobel method (Sobel, 1982), though results were confirmed via a sensitivity analysis conducted using bias-corrected bootstrapped standard errors (Preacher & Hayes, 2008).

## Results

### Pretest Equivalence and Attrition

Table 1 includes baseline demographics and behavior by condition and ethnicity. There were no differences by condition or ethnicity on age, gender, financial assistance, lifetime arrests, preferred language at home, or alcohol or cannabis use. There was a main effect of ethnicity on highest grade completed ( $p=.03$ ) and a significant interaction of ethnicity with condition on generational status ( $p=.01$ ). Baseline scores of theoretical constructs and substance use did not differ by condition (all  $p$ 's $>0.08$ ). Participants lost to follow-up reported more arrests compared to those retained ( $p=.045$ ); additionally, those lost to follow-up were older/in a higher grade at baseline than those retained, but only for ACE (both  $p$ 's $=.005$ ). Based on the pretest equivalence and attrition results, generational status, grade, and number of times arrested were included as covariates in repeated measures modeling. Age and grade were highly correlated ( $r=.67$ ), thus grade was chosen to represent developmental stage to avoid multicollinearity.

### Changes in Substance Use from Baseline to Six-Month Follow-up

Table 2 depicts effects of condition on change in substance use. Those in the MI condition significantly decreased their alcohol use and dependence from pretest to six-months relative to those in the ACE condition. There were significant decreases over time in alcohol problems and the three cannabis measures ( $p$ 's $<.01$  for all main effects), but these decreases did not differ by condition.

### Baseline to Posttreatment Changes in Putative Mediators

Table 3 depicts change from baseline to posttreatment in theoretical constructs by condition. Compared to participants receiving ACE, those receiving MI showed increases in motivation to change alcohol and cannabis use, and self-efficacy for changing alcohol and cannabis use. There were no effects of condition on peer norms for either substance.

### Mechanisms of Treatment Effects

**Alcohol.**—The final path model predicting alcohol use, problems, and dependence from condition through theoretical mediators is depicted in Figure 2a. The fit of this model was adequate, Santorra-Bentler  $\chi^2(30)=62.63$ ,  $p<.001$ ; comparative fit index (CFI) $=.96$ ; root mean square error of approximation (RMSEA) $=.05$  (90% CI .03-.07); standardized root mean square residual (SRMR) $=.04$ . There was an effect of MI on increased motivation and self-efficacy, such that higher motivation predicted lower alcohol dependence and higher self-efficacy predicted fewer alcohol-related problems. The specific indirect effects of condition on alcohol dependence through motivation and on alcohol problems through

self-efficacy were both significant ( $p=.025$  and  $p=.011$ ). Previously observed direct effects of condition on alcohol use and alcohol dependence were no longer significant over and above effects of the theoretical constructs.

**Cannabis.**—The fit of the cannabis use model (Figure 2b) was also adequate, Santorra-Bentler  $\chi^2(30)=62.22$ ,  $p<.001$ ; CFI=.96, RMSEA=.05 (90% CI .03-.07); SRMR=.04. There was an effect of MI on motivation, with greater motivation predicting less cannabis use. This indirect effect of condition on cannabis use via motivation was significant ( $p=.029$ ).

## Discussion

This study serves as a targeted examination of MI treatment outcomes and a set of theorized mechanisms with a sample of predominantly-Hispanic youth who were regularly using substances. The wide dissemination of this intervention, particularly within many settings that are increasingly serving Hispanic youth (e.g., schools, medical settings, justice settings), underscores the timeliness and relevance of unearthing the impact of this intervention with Hispanic adolescents, and the potential mechanisms that may be driving successful addiction treatment response.

### Differences between Hispanic and non-Hispanic white youth.

There were no clinically significant, conclusive differences observed between Hispanic and non-Hispanic white on treatment outcomes. This finding falls on the heels of the pattern of mixed findings for Hispanic individuals in MI, wherein some studies, but not others, have observed that Hispanic adults fare better in MI (Carroll et al., 2009; Field et al., 2012). Of relevance, this study's outcomes are also congruent with recent work by Wagner and colleagues (Wagner et al., 2015); like the pattern of findings observed here, Wagner's team observed no differences by race/ethnicity, or between their MI-related intervention compared with their control condition at six months (Wagner et al., 2015), but did find support for self-efficacy (measured in their study as "confidence") as a driver of their adolescents' positive treatment response.

One interesting element of the study is the geographic location; this area of the southwest has historically held the distinction for being one of the only majority-minority states, wherein Hispanic individuals have a strong history of being long-standing representatives of the majority culture (Colby & Ortman, 2015). Consequently, it is possible that the comparable outcomes by race/ethnicity for this sample might reflect the cultural homogeneity of this area of the southwest. Equally possible, Hispanic youth in this region might set the cultural norm for this adolescent community, such that non-Hispanic white youth might "acculturate" to cultural norms generated by the "mainstream" Hispanic youth in this community. In fact, New Mexico is a minority-majority state, and thus it may be that ethnic differences tend to be blurred, particularly among young people who interact regularly with other racial/ethnic groups in school and community settings; studies that have found effects of acculturation on MI efficacy tend to be in samples from Hispanic non-majority areas (Lee et al., 2019). One critical avenue for future work is to examine the nature and directionality of peer influence for youth in this geographic region, along with a more comprehensive set of cultural risk and protective factors.

Additionally, it is important to stay acutely aware that although often grouped together, and as represented by the numerous countries and cultures of origin in this sample, Hispanics are not a homogenous group. It is absolutely essential that future clinical research efforts take meticulous care to evaluate and detect cultural differences that may be obscured by the indelicate metrics that we have to assess cultural values and awareness for Hispanic youth globally, and within Hispanic subgroups specifically; a series of factors that is also dynamically in development during this age period (Schwartz et al., 2015).

### **Changes in Theoretical Constructs and Substance Use Outcomes**

MI outperformed the standard education treatment (ACE) for alcohol use. In terms of proposed mechanisms, changes in drinking observed in MI were driven by increased motivation to change and self-efficacy. While often presumed to be an inherent component of MI, the impact of motivation to change on MI outcomes has been supported in some (Cook et al., 2015; Wagner et al., 2014), but not all studies (Borsari et al., 2009). Further, despite the expectation that MI would modify peer norms, neither treatment moved participants on this mechanism. As peers increase in salience throughout the adolescent years and continue to gain support as one key risk factors in youths' transition to substance use and related health risk behaviors (Chassin et al., 2013; Ewing et al., 2015), future treatment development efforts may benefit from exploring how to better target and enhance peer factors in adolescent treatment.

MI did not directly impact cannabis use, though there was evidence of significant indirect effects of MI occurring through motivation to change. The absence of significant differences between the MI and ACE treatments was unexpected, as other studies have found clinically meaningful reductions in adolescent cannabis use following MI (Blevins et al., 2018; Feldstein Ewing et al., 2013). One reason for the absence of findings in the cannabis context is that we may still not be clear on what drives treatment response, particularly on a cognitive or neurocognitive level, for adolescents who regularly use substances (Feldstein Ewing, Tapert, et al., 2016). While treatment teams are increasingly examining the nature of adolescent brain in the context of cannabis treatment, and creating developmentally-relevant integrative brain-behavioral models for successful (and less successful treatment response; (Silvers et al., 2019), much work remains to continue to deconstruct the nature of the adolescent brain and ways in which it might be congruent with, but also divergent from, adult patterns of substance use and treatment-catalyzed behavior change.

A second reason for the potential absence of findings in the context of cannabis use is that treatment as usual, represented here as our ACE condition, increasingly represents "tough competition" in treatment examinations (Miller & Moyers, 2015). ACE might have been impactful here because it provided all adolescents two hours of individual attention with a caring adult. Anecdotally, most youth in this study reported that what they enjoyed most within this study was the opportunity to talk with someone about their substance use; a topic that they had not previously thought about. Thus, it is worthwhile to note that youth in both conditions received the foundation of a warm, supportive, therapeutic environment, and a novel conversation about substance use, conditions that, in this study, may have helped positively position youth, even in an otherwise-unlikely control condition, for change.

## Generalizability of our justice sample to the broader Hispanic and non-Hispanic white youth population

Finally, the generalizability of findings from samples of juvenile justice-involved youth may be questioned. This is often due to misconceptions about the nature of this population that rest on the assumption that these adolescents are a homogenous group fundamentally different from non-offending youth (Skeem et al., 2014), though there is almost no evidence to support this notion; in fact, data increasingly suggest that the nature of arrest in this age group is due to where a youth resides and conditions of their environment, rather than the presence of inherently greater problem behavior (Feldstein Ewing, Montanaro, et al., 2015). More specifically, it is worth noting that there is an extremely serious public health disparity in this geographic region (southwestern US), wherein non-Hispanic white youth who abuse substances get noticed by caring providers (often in the contexts of school and sports), and are redirected to substance abuse treatment, whereas youth of color who abuse substances – who in this region, are primarily Hispanic – are instead picked up by community police in their geographic regions, and funneled into the juvenile justice system (e.g., Feldstein Ewing et al., 2011). One of the unfortunate implications of this differential referral trajectory is that the juvenile justice system is an inadequate health services provider. Thus, in turn, Hispanic youth often face disproportionately more serious consequences for their substance use, overlaid with a critical absence of needed substance use intervention. In order to not conflate differences in community policing and treatment access with criminal tendencies, throughout the past 15 years, in line with other eminent research in this area (e.g., Moffitt, 1993), our work has taken the stance that juvenile justice involvement exists within the natural continuum of normative of juvenile behavior (e.g., Feldstein Ewing et al., 2011; Feldstein Ewing et al., 2012; Feldstein & Ginsburg, 2006; Feldstein & Miller, 2006; Salvador et al., 2016; Salvador et al., 2015), and we are extremely careful to tread the line where juvenile justice status is not conflated with very real treatment needs of this community of high-need, under-resourced, and underrepresented youth.

Thus, our recruitment source of juvenile justice merely represents here – and in our larger body of work – a setting wherein there are consistently elevated adolescent treatment needs (e.g., high rates of substance use), and an absence of any existing accessible substance-related social service/health services (e.g., including addiction treatment). One of the active public health/health disparity missions of our work has therefore been to specifically recruit high need but underserved youth into prevention/intervention treatment that they would otherwise not receive. Of note, this sample of youth represented a very low end of the justice risk continuum. They were not incarcerated in long-term facilities, which, of course, would represent a sample that likely would be more severe on all dimensions, and thus less generalizable to the broader population of youth.

Ultimately, we encourage caution about how juvenile justice youth are represented in the behavioral and cognitive literature, due to the implicit biases associated with juvenile justice-involved youth where youth of color, including Hispanic and African-American youth, are drastically overrepresented. It is important to keep in mind discrepancies in police presence across geographic sections of the metropolitan area that we recruited from. Ultimately, justice involvement was not a focus of the study; such settings simply

represented the best place for us to conduct timely prevention and intervention efforts with high-need, underserved youth, who would otherwise not receive any substance use intervention.

### Limitations

This study has several strengths, including an examination of treatment outcomes with a predominantly Hispanic adolescent sample and a focused examination of treatment differences by mechanisms. However, this novel RCT should be interpreted in light of some important limitations. First, only one of eight therapists was Hispanic; we were therefore unable to examine therapist matching, a factor which has shown differential addiction treatment outcomes (Field & Caetano, 2010). Second, higher-risk youth were more likely to be lost to follow-up, a consideration in generalizing interpretation of MI efficacy in this subgroup. Relatedly, a hallmark of adolescent substance use is that it is transient and infrequent (Silvers et al., 2019); thus, while rates of substance use and problems may “seem” low, they are the standard levels of problem use observed within this age group.

### Conclusions

In the face of this obvious health disparity, it is striking how little we know about Hispanic adolescents’ response to individual, flexible, and transportable brief interventions like MI. Through the first aim, this study provides critical data on the efficacy of this intervention in reducing substance use among a sample of Hispanic and non-Hispanic white adolescent substance users. Our second aim answers a pressing question regarding the potential differential efficacy of this intervention between Hispanic and non-Hispanic white youth. The third aim allows us to investigate what factors are driving this intervention, and whether those factors are different between Hispanic and non-Hispanic white youth. This information is integral to determining the efficacy of “empirically-supported” brief interventions across Hispanic and non-Hispanic white youth and to learning what factors may drive these interventions in different groups. The goal of determining efficacious adolescent substance use interventions for dissemination cannot occur without these steps.

This study offers an examination of treatment outcomes and mechanisms, carefully assessing how these factors operated for Hispanic compared to non-Hispanic white youth. More attention must be paid to three future efforts: (1) developing more sensitive metrics of cultural identity, to detect the nature of subtle changes throughout adolescence, (2) testing change in these constructs throughout adolescence (Lee et al., 2019), and most importantly (3) continued work must be done to learn how best to articulate treatments for this specific age group, to generate lasting changes across domains of adolescent substance use. Together, these data offer one important step towards improving adolescent treatment outcomes.

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### Public Significance Statement

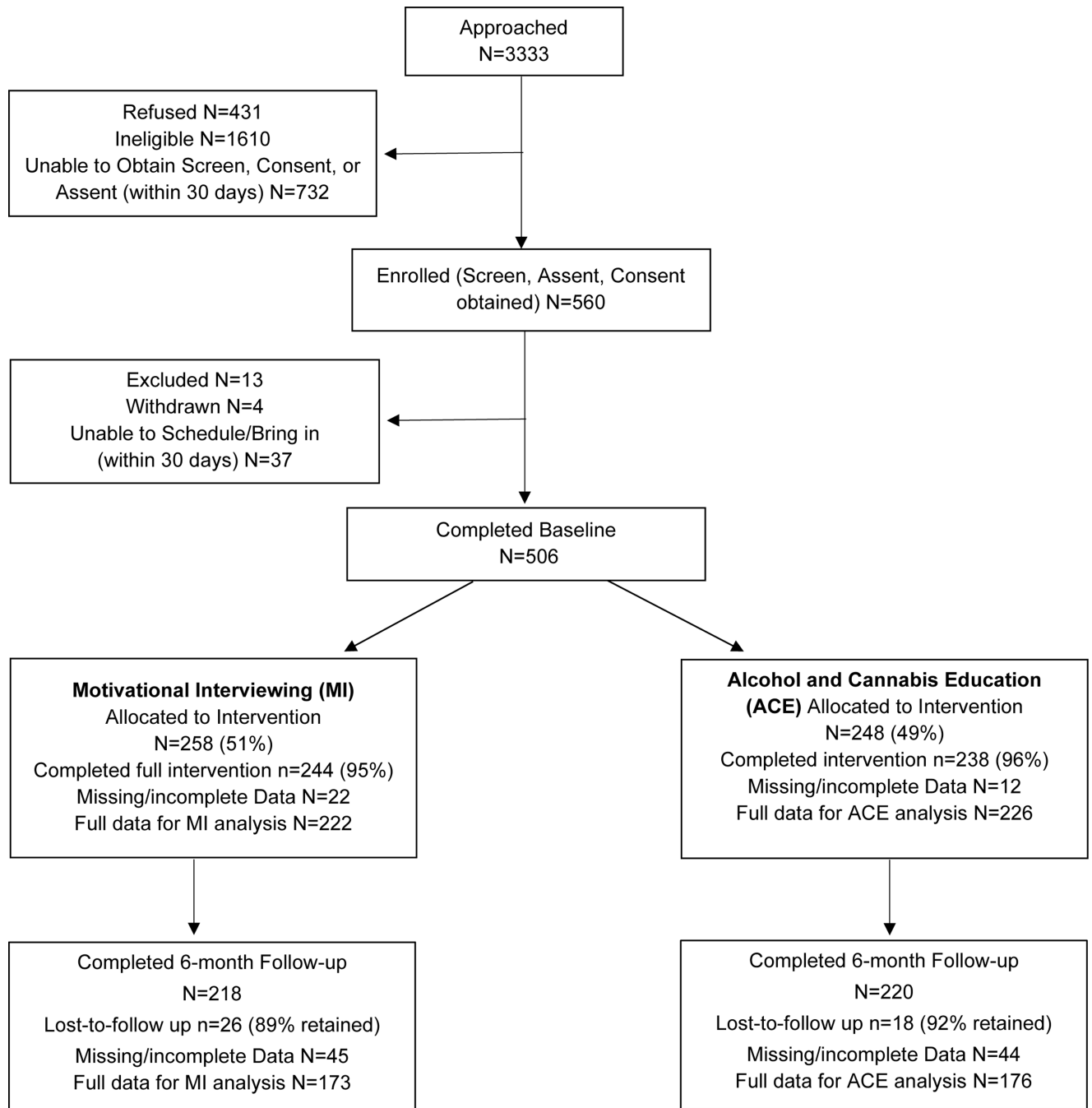
Hispanic adolescents represent one of the fastest-growing minority groups in the United States, yet little is known about their response to empirically-supported addiction interventions. This randomized controlled trial found that motivational interviewing (MI) was comparably effective for Hispanic and non-Hispanic white youth, and more effective than an educational control for reducing alcohol, but not cannabis, use at 6 months post-intervention. Motivation and self-efficacy appeared to underlie the efficacy of MI.

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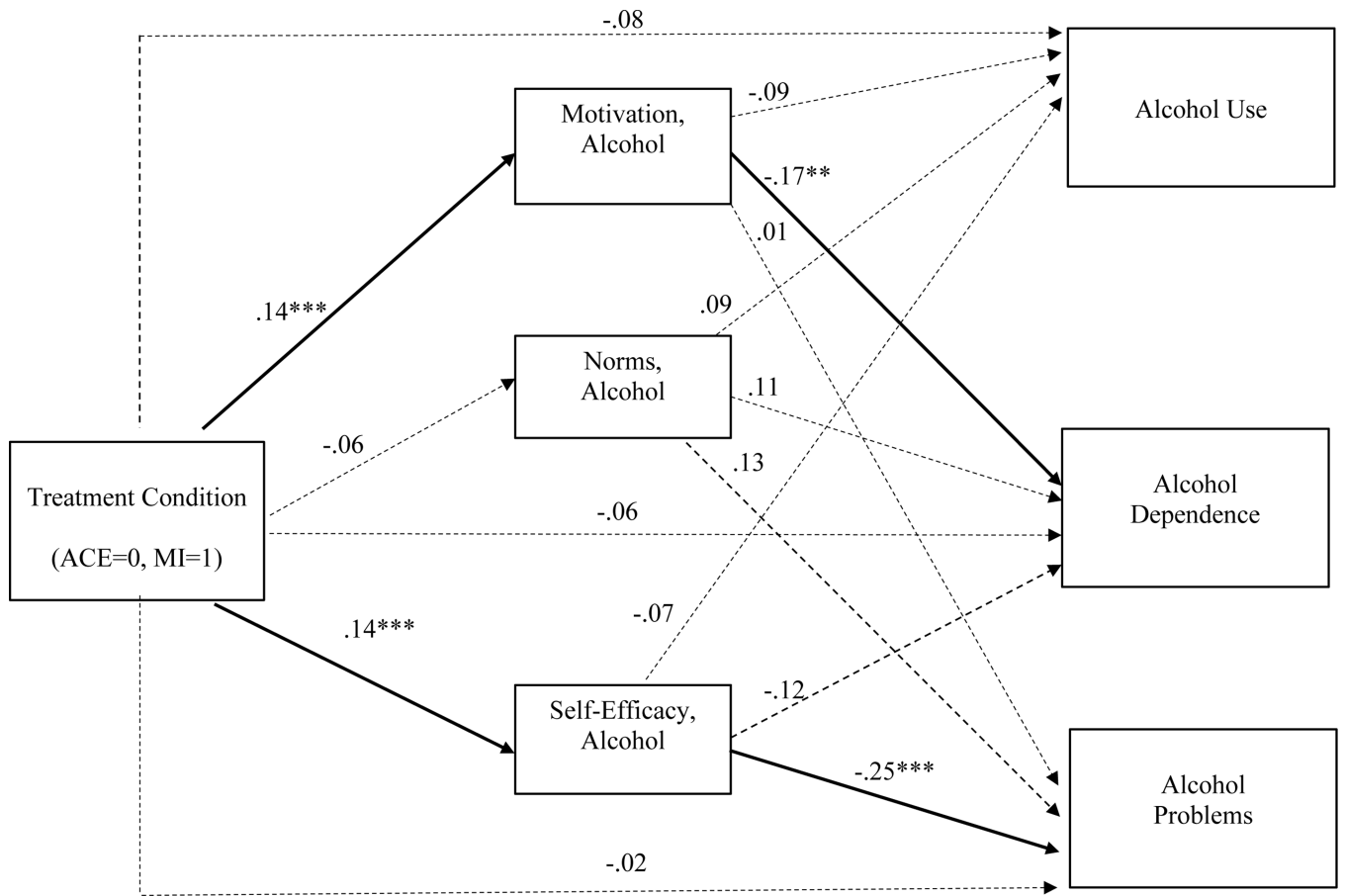
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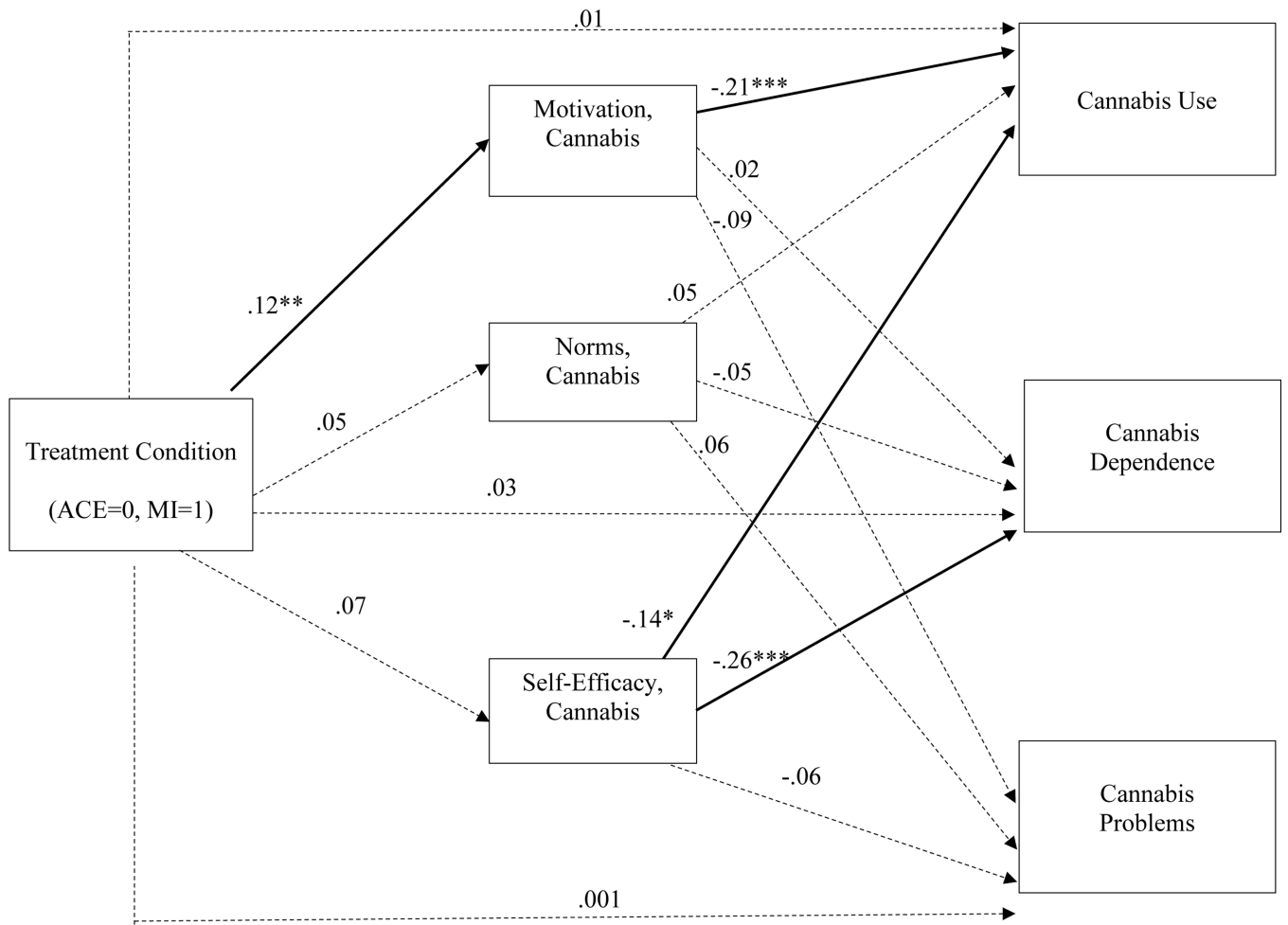
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**Figure 1.**  
Participant flowchart



**Figure 2a.**  
Model testing adolescent alcohol treatment response  
*Note.* Path estimates reflect standardized beta coefficients. \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.



**Figure 2b.**

Model testing adolescent cannabis treatment response

Note. Path estimates reflect standardized beta coefficients. \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.

**Table 1**  
Baseline demographic and behavioral characteristics by condition and ethnicity (N=448)

Sample Characteristics	Hispanic Youth		Non-Hispanic white Youth		Condition		Ethnicity		Condition × Ethnicity	
	MI (n=174)	ACE (n=173)	MI (n=48)	ACE (n=53)	Main Effect	F (df)	Main Effect	F (df)	Interaction	F (df)
Age	M±SE 15.98±1.27	M±SE 16.12±1.22	M±SE 16.13±1.35	M±SE 16.30±1.12	F (1, 444)=1.21	F (1, 444)=1.36	F (1, 444)=1.21	F (1, 444)=1.36	F (1, 444)=0.02	F (1, 444)=0.02
Highest Grade	M±SE 9.30±1.52	M±SE 9.52±1.39	M±SE 9.55±1.75	M±SE 9.98±1.26	F (1, 440)=3.84	F (1, 440)=4.57*	F (1, 440)=3.84	F (1, 440)=4.57*	F (1, 440)=0.36	F (1, 440)=0.36
Generational Status	M±SE 3.52±1.44	M±SE 3.26±1.43	M±SE 4.17±1.18	M±SE 4.72±0.61	F (1, 434)=0.89	F (1, 434)=46.27***	F (1, 434)=0.89	F (1, 434)=46.27***	F (1, 434)=6.62*	F (1, 434)=6.62*
Financial Assistance	M±SE 1.04±1.03	M±SE 0.90±0.91	M±SE 0.77±0.87	M±SE 0.79±0.74	F (1, 435)=0.29	F (1, 435)=3.24	F (1, 435)=0.29	F (1, 435)=3.24	F (1, 435)=0.62	F (1, 435)=0.62
Lifetime Arrests	M±SE 2.29±2.52	M±SE 2.22±2.46	M±SE 1.89±1.72	M±SE 1.68±2.20	F (1, 437)=0.26	F (1, 437)=2.95	F (1, 437)=0.26	F (1, 437)=2.95	F (1, 437)=0.07	F (1, 437)=0.07
	%	%	%	%	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Non-English Preferred	4.12	12.94	2.17	2.04	1.07 (.07, 17.57)	7.14 (.94, 54.34)	1.07 (.07, 17.57)	7.14 (.94, 54.34)	0.27 (.01, 5.10)	0.27 (.01, 5.10)
Female Gender	30.46	26.59	29.17	26.42	1.15 (.48, 2.74)	1.01 (.50, 2.03)	1.15 (.48, 2.74)	1.01 (.50, 2.03)	1.05 (.39, 2.84)	1.05 (.39, 2.84)
Past Six Month Alcohol Use	82.18	80.92	87.50	88.68	1.12 (.34, 3.74)	1.85 (.73, 4.68)	1.12 (.34, 3.74)	1.85 (.73, 4.68)	0.82 (.22, 3.08)	0.82 (.22, 3.08)
Past Six Month Cannabis use	97.70	96.53	91.67	96.23	2.32 (.41, 13.27)	0.92 (.18, 4.68)	2.32 (.41, 13.27)	0.92 (.18, 4.68)	0.28 (.03, 2.46)	0.28 (.03, 2.46)

Note.

\* p<.05

\*\* p<.001

OR=odds ratio with 95% confidence intervals.



Table 2

Changes in substance use measures from baseline to six-month follow-up

Outcome	Baseline			Six-Month Follow-up			Condition × Time		Cohen's d
	MI	ACE	MI	MI	ACE	MI	Interaction	Effect Size	
Alcohol Use <sup>a</sup>	0.05±0.76	-0.05±0.82	-0.04±0.86	0.10±0.89			F (1, 292)=5.22*	.22	
Alcohol Dependence <sup>b</sup>	7.32±5.28	6.98±5.39	5.90±5.56	6.97±5.80			F (1, 263)=3.95*	.21	
Alcohol Problems <sup>c</sup>	10.72±11.33	10.65±11.37	5.75±10.19	6.78±9.44			F (1, 283)=0.25	.05	
Cannabis Use <sup>d</sup>	0.52±0.36	0.47±0.37	0.37±0.41	0.36±0.40			F (1, 368)=0.88	.06	
Cannabis Dependence <sup>e</sup>	3.80±2.68	4.25±2.66	3.34±3.05	3.65±2.96			F (1, 262)=0.30	.15	
Cannabis Problems <sup>f</sup>	23.35±17.95	23.39±18.48	15.77±17.33	17.29±16.57			F (1, 262)=0.02	.08	

Note.

\* p&lt;.05

\*\* p&lt;.01

<sup>a</sup>Measured as the mean of quantity, frequency, and binge drinking scores all placed on a standardized scale (mean=0, standard deviation=1)<sup>b</sup>Range=0–40<sup>c</sup>Range=0–92<sup>d</sup>Percent of past valid 30 days (days not in detention or treatment) that cannabis was used<sup>e</sup>Range=0–10<sup>f</sup>Range=0–116.

Table 3

Theorized mechanisms of behavior change

Outcome	Baseline			Posttest			Condition × Time			Cohen's d
	MI	ACE	MI	MI	ACE	MI	Interaction	Effect Size		
Motivation, Alcohol <sup>a</sup>	0.02±0.80	-0.02±0.85	0.12±0.87	-0.12±0.83			F (1, 359)=10.27**	.30		
Norms, Alcohol <sup>b</sup>	0.02±0.76	0.03±0.83	0.02±0.83	0.03±0.80			F (1, 323)=0.11	.06		
Self-efficacy, Alcohol <sup>c</sup>	3.74±1.47	3.84±1.49	4.25±1.44	3.97±1.50			F (1, 410)=7.53**	.29		
Motivation, Cannabis <sup>a</sup>	-0.01±0.86	-0.03±0.83	0.12±0.93	-0.11±0.83			F (1, 328)=6.63*	.18		
Norms, Cannabis <sup>b</sup>	0.02±0.82	0.02±0.87	0.02±0.86	-0.03±0.92			F (1, 323)=0.92	.13		
Self-efficacy, Cannabis <sup>c</sup>	3.08±1.77	3.17±1.85	3.61±1.78	3.35±1.78			F (1, 410)=4.04*	.19		

Note.

\* p&lt;.05

\*\* p&lt;.01

<sup>a</sup>Measured as the mean of 6 items, all placed on a standardized scale ( $M=0$ ,  $SD=1$ ); higher scores indicate greater motivation<sup>b</sup>Measured as the mean of 3 items, all placed on a standardized scale ( $M=0$ ,  $SD=1$ ); higher scores indicate greater perception of peer norms<sup>c</sup>Measured using the mean of five items on a scale from 1–6; higher scores indicate greater self-efficacy.