From Counselor Skill to Decreased Marijuana Use: Does Change Talk Matter?

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Abstract

Client language about change, or change talk, is hypothesized to mediate the relationship between counselor fidelity in Motivational Interviewing (MI) and drug use outcomes. To investigate this causal chain, this study used data from a MI booster delivered to alternative high school students immediately after a universal classroom-based drug abuse prevention program. One hundred and seventy audio-recorded MI sessions about substance use were coded using the Motivational Interviewing Skill Code 2.5. Structural equation modeling showed that percentage of change talk on the part of the client mediated three of the four relationships between MI quality indicators and marijuana outcomes, while percentage of reflections of change talk showed a main effect of counselor skill on marijuana outcomes. Findings support change talk as an active ingredient of MI and provide new empirical support for the micro-skills of MI.

Keywords

Motivational Interviewing; Adolescent; Marijuana Use; Mediation; Mechanisms of Change

1. Introduction

Motivational Interviewing (MI), a client-centered counseling style used for the exploration of ambivalence about behavior change (Miller & Rollnick, 2002), has been identified as a promising intervention for adolescent substance use treatment (Macgowan & Engle, 2010) and appropriate for addressing a range of substances across a variety of settings (Barnett, Sussman, Smith, Rohrbach, & Spruijt-Metz, 2012). MI also has a well-specified technical model, whereby counselor behaviors or skills (X) are expected to promote client language predictive of change or "change talk" (M) and this language influences outcomes (Y; see Figure 1; adapted from Miller & Rose, 2009). A growing body of evidence exists to support

this hypothesized causal mechanism (Moyers, Martin, Houck, Christopher, & Tonigan, 2009; Pirlott, Kisbu-Sakarya, DeFrancesco, Elliot, & MacKinnon, 2012).

One issue in measuring causal models in MI concerns how this method is defined. The counselor skills within MI are commonly measured using objective behavioral rating schema designed to assess MI sessions (Houck, Moyers, Miller, Glynn & Hallgren, (2013). The instruments measure the micro-skills of MI by categorizing counselor statements as open or closed questions, complex or simple reflections. They further create composite measures of counselor speech that demonstrates adherence to the "way of being" prescribed in MI. MI consistent behaviors (MICO) include instances of asking permission before giving advice or making suggestions, offering support, affirming, emphasizing personal choice and control, and sometimes, depending upon the measurement instrument used, may include open questions and reflections. MI inconsistent behaviors (MIIN) include instances of confronting, warning, and giving advice without permission and sometimes closed questions.

To date much of the evidence for a causal path or mediation has been shown using MICO as the predictor (Moyers et al., 2009, Pirott et al., 2012; Vader et. al. 2010). Because MICO is a composite variable, none of the studies provide guidance as to which of the MI micro-skills is the most effective at eliciting change talk. Since counselors must decide which specific skill to employ as a session unfolds, and these choices theoretically influence the direction of the subsequent interactions between the client and counselor, empirical evidence to support choosing one skill over the other could increase both the efficiency and the efficacy of MI.

Current research has shown a relationship between some of these specific skills and treatment outcomes (path *c* in Figure 1). Gaume et al. (2009) modeled the unique MI counselor skills separately to predict alcohol use at 12-month follow-up in a study of alcohol-using adults in an emergency department. In so doing, they found significant relationships between complex reflection, the ratio of reflections to questions, and MIIN on outcomes when controlling for client ability language. Similarly, McCambridge, Day, Thomas, & Strang (2011) found a significant relationship between percentage complex reflection and marijuana cessation at 3-months in a sample of youth ages 14-19 attending Further Education Colleges in London.

Research has also been done to investigate the relationship between counselor skills and client language about change (i.e. change talk (CT) and counter change talk (CCT); path *a* in Figure 1). Sequential analyses have provided probabilistic support that MICO behaviors are more likely to be followed by CT, while MIIN behaviors are more likely to be followed by CCT (Gaume, Bertholet, Faouzi, Gmel, & Daeppen, 2010; Gaume, Gmel, Faouzi, & Daeppen, 2008; Moyers & Martin, 2006; Moyers, Martin, Houck, Christopher, & Tonigan, 2009). Regression analyses of non-sequential count data have similarly shown associations between MICO and the amount of CT (Catley et al., 2006) in MI sessions. Further, experimental manipulations of counselor attempts to elicit CT have resulted in higher levels of CT when counselors intend to evoke it (Glynn & Moyers, 2010). Morgenstern et al. (2012), in a three-condition RCT, found that the directive elements of MI are more instrumental in producing CT than the non-directive elements.

CT has also been shown to predict client outcomes (path *b* in Figure 1) in several studies; although, as with MICO, it has been conceptualized and defined slightly differently across research projects. Support has been found for a single category of combined CT to predict alcohol use outcomes (Campbell, Adamson, & Carter, 2010, Gaume, Bertholet, Faouzi, Gmel, & Daeppen, 2013; Moyers et al., 2007) as well as improvements in substance use

rates in a sample of homeless youth (Baer, Beadnell, Garrett, Hartzler, & Wells, 2008). Measures of the strength of change talk, rather than its frequency, indicate that the strength of client ability language predicted drinking rates and drug use (Amrhein, Miller, Yahne, Palmer & Fulcher, 2003; Gaume, Gmel, Faouzi, et al., 2008).

Finally, mediation analyses are important for investigating the mechanisms by which MI works as they aid in formulating a more complete understanding of what is occurring during treatment. Moyers et al. (2009) found significant main effects of MICO on outcomes (path *c*) and significant indirect effects (path *a**b) for MICO, CT and drinks per week at 5-week follow-up after the personalized feedback session. Vader et al., (2010), in a sample of college age students, did not find evidence for significant indirect effects (path *a**b) though there were significant relationships between the MICO and CT (path *a*) and CT and 3-month alcohol use (path *b*) in the condition receiving personalized feedback. They did not report any information about a main effect for MICO on alcohol use. Morgenstern et al. (2012) conducted a 3-armed randomized controlled trial comparing a standard care control, an MI condition that included personalized feedback and other directive activities to elicit client change talk such as importance/confidence rulers, and a Spirit Only condition which relied on the non-directive elements of MI They found significant effects for condition on commitment language (path *a*) and a trend toward significance for commitment language on alcohol use at 7-day follow-up (path *b*), but no significant indirect effects and no main effects. Finally, Pirlott et al., (2012), in a study using personalized feedback, investigated the use of MI to encourage fruit & vegetable consumption. This study showed significant effects for MICO on Total CT (path *a*) and CT on 12-month fruit & vegetable consumption (path *b*), significant indirect effects (path *a**b) and no main effect (path *c*).

Taken together, these mediation results are inconclusive. While the rigor and design of these studies are solid, any comparison of their results should be made cautiously in light of the fact that they often defined their predictors, mediators, and outcome variables differently, used different versions of similar coding instruments, had widely varying length of follow-ups, and used different statistical tests for mediation. Although it is premature to draw strong conclusions about the MI technical model at this point, the initial evidence supports further investigation into the proposed mediation. Also, it is important to note that alternative mediation models based on the relational elements of the complete theoretical model are not addressed in this study (Miller & Rose, 2009).

1.1. The current study

Using data from the MI condition of a 3-armed randomized controlled trial of a universal classroom-based substance abuse prevention program, we investigated whether the percentage of change talk (PCT) present in an MI session mediates the relationships between specific behaviors prescribed for MI fidelity and marijuana outcomes. As a universal prevention program, outcomes included prevention for non-users at baseline as well as reduction and cessation for adolescents already experienced in drug use. While the main trial addressed additional drug outcomes, marijuana use was the only outcome that showed a trend toward significance (p =.07) suggesting that the MI condition performed better than the classroom-only condition (Sussman, Sun, Rohrbach, & Spruijt-Metz, 2012). In this study, we investigated five indicators of MI quality as predictors: 1) the percentage of complex reflections (PCR), 2) the percentage of open questions (POQ), 3) percentage of reflections of change talk (PRCT), 4) percentage of MICO (PMIC) behaviors and 5) the reflections to questions ratio (RQR). This study is the first to conduct mediation analyses on the individual MI skills and the first to do so with structural equation modeling (SEM). In a series of 5 SEM models, we tested our hypotheses that PCT would mediate the relationship between PCR, POQ, RQR, PRCT, PMIC, and marijuana use outcomes.

2.0 Methods

2. 1 Procedure and Sample

The sample used in this study is derived from the 7th randomized trial of Project Toward No Drug Abuse, a classroom-based substance abuse prevention program. Twenty-four alternative high schools in Southern California participated. In total, 2397 students were enrolled in the selected classes and 1,704 (71.1%) were consented to participate in the study. Of these, 573 students at 8 schools were assigned to the 3-session MI booster condition and completed the pre-test data collection. In order to be included in the study, students under the age of 18 were required to return a signed parental consent form and a signed subject assent. Parental consent was not required for students over 18 years old. The University of Southern California's Institutional Review Board approved all study procedures. More detail about school selection can be found in Lisha et al. (2012).

In the MI booster condition, students were provided up to 3 MI sessions; the first occurred at school within 1- to 3-days of the classroom program, and the following two sessions were conducted via telephone at 3- to 4-month intervals. Hand-held devices were used for recording during the in-person sessions, while recorded telephone lines were used for the 2nd and 3rd sessions. During the first session, students discussed their impressions of the program and their drug use. If drug use did not appear problematic they were invited to choose a target behavior from an agenda setting tool that included topics ranging from high school graduation and employment to substance use.

Recordings were identified as discussing substance use from notes kept by the MI interventionists. Coders then independently assessed whether the sessions met the criteria as having a substance use target. In order to be considered a substance use target, substance use had to be addressed with the exploration exercise used during the MI session. For example, if a participant reported that they had cut back on their cigarette use, and the interventionist proceeded to explore job seeking, this session would not be considered a substance use target. The final sample of recordings excluded all MI sessions aiming to affect a non-substance use related outcome as these were expected to be irrelevant to changes in drug use. Meanwhile we included all sessions related to any drug use as data from one study suggests that the effects of an MI session may generalize to other substances (McCambridge & Strang, 2004).

Of the 1040 MI sessions conducted, 235 discussed substance use. Twelve of these substance use sessions did not have recordings, resulting in 223 to be included in the coded sample. In order to establish independence between observations only one substance use related session per student was included in the final sample (N = 170). Where multiple substance use sessions existed, the first available session was chosen. Of the youth represented in the substance use recordings, 122 completed the post-test assessment (see Figure 2: Consort Diagram). The final sample includes data from 17 interventionists having from 1 to 49 sessions in the sample. All interventionists participated in standardized training and regular supervision conducted by a member of the Motivational Interviewing Network of Trainers (MINT). Extensive details on the training and supervision of the interventionists and the content of the booster are published elsewhere (Barnett, Spruijt-Metz, Unger, Sun, Rohrbach, & Sussman 2012).

2.2 Coding and parsing

We coded the sample of substance MI sessions pertaining to substance use using the MISC 2.5 (Houck, Moyers, Miller, Glynn & Hallgren, 2013).The MISC 2.5 is a hybrid of the MISC 2.1 and the Sequential Code for Observing Process Exchanges (MI-SCOPE; Martin, Moyers, Houck, Christopher & Miller, 2005) designed to optimize the features from each

coding scheme. Specifically the MISC 2.5 allows for the capture of specific behaviors from the MISC 2.1, as well as valenced reflections and temporal order from the SCOPE. Like all versions of the MISC, it codes counselor and client language into mutually exclusive and exhaustive categories. Coding was conducted using the Center on Alcoholism Substance Abuse and Addictions (CASAA) Application for Coding Treatment Interactions (CACTI; Glynn, Hallgren, Houck, & Moyers, 2012). This software automates the parsing of recordings and stores sequential coding of each utterance. Using this process for parsing ensures that all coders code the same utterances, thereby increasing reliability. Although CACTI software does not require or utilize transcripts, we transcribed our entire sample of recordings for ease of parsing and coding.

Coding was performed in two passes. In the first pass, coders parsed the entire recording into utterances, or thought units. MISC coding requires that any two consecutive counselor statements that merit different codes (e.g., a reflection followed by a question), be identified as separate utterances. Utterances of client change language are parsed into separate utterances, even if the client emits consecutive utterances from the same change talk category.

In the second pass, a different coder applied codes to each client and counselor utterance. Each counselor utterance was assigned a behavior skill code. Utterances were coded as open (OQ) or closed questions (CQ) and simple (SR) or complex reflections (CR) with a positive (+), negative (-), neutral (0), or both positive and negative (±) valence. Valence refers to whether a reflection contains content that directs, or steers, the conversation toward change, away from change, or contains content that is unrelated to change. MICO included specific codes for affirming, supporting, and asking permission before giving advice; while MIIN included codes for confronting, warning, and giving advice without permission; and "Other" included codes for providing information about the session, filler, and comments designed to facilitate conversation. Meanwhile, each client utterance was categorized as either change talk (CT), counterchange talk (CCT), or unrelated to change (FN). CT includes statements of commitment ("I will cut back on smoking"), taking steps ("I've already slowed down."), desire ("I want to quit."), ability ("I think I can do it."), reason ("I have to stop for my health."), need ("I need to cut back so I can keep a job.") and "other" statements that do not fall into the previous categories. CCT includes statements counter to commitment ("There's no way I will stop."), taking steps ("I had a drink last night."), desire ("I really don't want to."), ability ("There is no way I'd be able to give it up."), reason ("It's not affecting my health."), need ("I really don't think I need to change.") and "other" statements that do not fall into the previous categories.

2.3. Training and Supervision of Coders

We provided 5 undergraduate and graduate students 40 hours of initial training in the MISC 2.5 and the CACTI software. Weekly coding meetings were held throughout the project to improve and maintain reliability. During the training period, all coding disagreements were resolved by a supervisor. Coders practiced on a series of non-substance use recordings until their inter-rater reliability was at criterion of 0.60 using established intraclass correlation (ICC) guidelines (Cicchetti, 1994). We randomly selected 20% of our coded sample using a random number generator for double coding. These 47 recordings were double coded in order to calculate final ICCs. Cicchetti's criterion identifies ICCs below .40 as poor, .40-.59 as fair, .60-.74 as good, and above .75 as excellent. For our data, final ICCs for counselor codes were .94 for open questions, .80 for closed questions, .94 for reflections overall, .48 for simple reflections, .45 for complex reflections, .84 for reflections of change talk, .82 for reflections of counter change talk, .68 for MI-consistent behaviors and .29 for MI-inconsistent behaviors. Client codes were .92 for change talk, .86 for counter change talk, and .88 for neutral responses. These results indicate that coders had some difficulty

differentiating simple reflections from complex reflections, and difficulty reliably identifying MIIN behaviors, which occurred infrequently. Only seven (.04%) recordings in the final sample contained any MIIN-behaviors in our dataset.

2.4 Measures

2.4.1 Predictors—For these analyses, five summary variables were constructed. We used four standard measures of quality from the MISC 2.5 and constructed one additional measure using the valenced reflection data. Summary variables for PCR, POQ, PRCT, RQR, and PMIC (see Table 1 for variable formulas) were calculated using the coded counselor data.

2.4.2 Mediator—For this analysis, in order to account for the highly variable length of sessions in this sample, we used percentage change talk (PCT) as the mediator.

2.4.3. Outcome—An ordinal measure with equal spacing between levels of marijuana use and a true zero was collected by asking respondents how many times they used marijuana during the past 30 days. Subjects were provided with twelve response options ranging from 0 to 100 (Sussman et al, 2012). The log of this variable was used to account for non-normality. At baseline, data was collected as a paper and pencil measure administered at the subjects school by project staff, unrelated to the MI intervention. One-year follow-up data was gathered either in person at the school if the subject was still enrolled or via the telephone by the same staff as baseline collection.

2.5. Analytical Approach

Structural Equation Modeling (SEM) was conducted to test for mediation using Mplus (v.6) (Muthén & Muthén, 1998). SEM allows for more precise estimates of direct and indirect effects than traditional regression approaches (Bentler & Chou, 1987). Mplus provides estimates for the relationship between indicator and mediator (path *a*), the relationship between mediator and outcome controlling for indicator (path *b*), the main effect, or relationship between indicator and outcome (path *c*), the direct effect, or relationship between indicator and outcome when controlling for the mediator (path *c′*) and indirect effects (path *a*b*) using the Delta method (Bishop, Fienberg, Holland, 1975). Mplus uses maximum likelihood estimation to retain data from all cases, including those with missing data at follow-up.

We tested 5 models, one for each of the following MI behavioral skill measures (POQ, RQR, PCR, PRCT, and PMIC). All models included PCT as the proposed mediator, logged marijuana use as the outcome, and controlled for logged baseline marijuana use. All mediation results are presented as both standardized and unstandardized estimates. Attrition analyses were conducted in two ways. First, demographics and baseline alcohol, cigarette and marijuana use were used to predict those without one-year follow-up data. Second, the SEM models were run on the sample with complete data to determine if results differed from the larger sample.

3.0 Results

The sample investigated in this study included 170 youth (70% male, 71% Latino, with a mean age of 16.7 years), with reported past 30 day drug use of 68% for alcohol use, 59% for cigarette use, and 36% for other drugs. Forty percent (40%) reported not using marijuana in the past 30 days, while 36% reported being a daily or near daily users of marijuana. Attrition analyses showed no significant predictors of dropout, and results from SEM models with only youth with complete data did not differ from models run with the entire sample.

The sessions had on average 56% POQ, 57% PCR, 42% PRCT, 33% PCT and a RQR of 1.29. Due to the infrequency of MIIN behaviors in the dataset we could not include PMIC in the final analyses. Table 2 shows that although MI skill variables are significantly correlated, all correlations were below .36 with the exception of PRCT and PCT ($r = 0.76$).

Main Effects (path *c*): Only one model showed a main effect between the MI indicator and drug use outcomes. PRCT directly influenced marijuana use ($\beta = -0.19$, $p < .05$); all others had coefficients smaller than -0.06 and were non-significant. All models controlled for baseline drug use.

Indirect Effects (path *a*b*): Significant indirect effects of MI skill on marijuana use were found for POQ ($\beta = -0.05$, $p < .05$), PCR ($\beta = -0.06$, $p < .05$), and a trend toward significance was found for RQR ($\beta = -0.04$, $p = .07$). Results for an indirect effect of PRCT were not significant ($\beta = -0.18$). Results for all indicators are presented in Table 3. Figure 3 presents one indicator, PRCT, as a path model for illustrative purposes.

Additional post-hoc analyses were conducted on the limited sample of youth (n=74) who had a target behavior of marijuana. Results showed a similar trend for a main effect of PRCT on outcomes ($\beta = -0.88$, $p < .10$), and significant relationships between MI skills and change talk (path a) and change talk and outcome (path b) for the other MI skills. These findings are consistent with the overall findings of mediation, however due to decreased sample size, significant indirect effects were not seen.

4.0 Discussion

The goal of this study was to compare the relative strength of the micro-skills of MI in a test of the hypothesized mediation model of MI. Overall, significant indirect effects were more common than significant main effects of counselor skill on outcomes. We found evidence of percent change talk as a mediator (i.e. significant indirect effects) of the relationship between marijuana outcomes and POQ ($p < .05$), PCT ($p < .05$), and RQR ($p < .10$). The strength of these relationships was quite similar leaving no strong conclusion about which micro-skill is a better predictor of outcome. Only PRCT behaved differently, showing a main effect on marijuana outcomes ($\beta = -.19$, $p < .05$), and no significant indirect effect via percent change talk.

4.1 Lack of Main Effects

We propose two explanations for this lack of main effects for POQ, PCR, and RQR on drug use. First, we propose that seeing no main effect, but a significant indirect effect, suggests that there is no reason to believe that a high percentage of a particular indicator, e.g. open questions, *alone*, would predict change (path *c*); our findings suggest that it is only when these open questions result in change talk (path *a*) that one would presume change to follow (path *b*). For example, we would not expect open questions such as "What are the reasons you drink?" to result in expression of change talk. In this case, the association between open questions and improved outcomes may be related to the valence or direction of the question. In other words, knowing the valence of a question may be much more informative than just knowing that an open question occurred. Similarly, having a high percentage of complex reflections or more reflections than questions, while ignoring the valence of the component skills, may tell very little about subsequent change talk and ultimately behavior change. In contrast, knowing the percentage or ratio of positively valenced vs negatively valenced skills may tell us much more.

Second, while conventional understanding of mediation holds that if there is no main effect between the predictor and the outcome, then there cannot be mediation, many have argued

that due to the timing of predictors, mediators and outcomes, inadequate power, or differing direction of effects, mediation may exist even in cases where a main effect does not appear (Hoyle & Kenny, 1999; Kenny, Kashy, & Bolger, 1998; MacKinnon, Fairchild, & Fritz, 2007; Shrout & Bolger, 2002; Zhao, Lynch, & Chen, 2010). In this case it is likely that main effects were not detected due to the length of time between the measurement of the predictor (counselor in-session skill) and the outcome variable (marijuana use at one year follow-up).

While differences in measurement make it difficult to compare results, main effects between counselor skills and behavior change have been found in other studies using some of these same measures. The relationship between PCR and outcomes was found again in a study by McCambridge et al. (2012). In a sample of adolescents attending alternative educational institutions in London, they found significant relationships between PCR and marijuana use outcomes at 3-month follow-up. Because this study did not measure client language or valence of counselor responses, they could not control for or investigate these variables as mediators. Their findings may have been the result of highly skilled reflective listening that emphasized CT over CCT. If their interventionists were trained to reinforce change talk, a higher percentage of CR may have been a proxy for higher PRCT.

In addition, Gaume et al. (2009) found a main effect of the counselor's PCR and PMIC after controlling for one category of change talk, client ability language. This finding suggests that ability language may operate differently than other categories of change talk. It may represent client confidence or self-efficacy about change, more than client motivation or the importance of behavior change. This notion appears to be supported by findings from Martin, Christopher, Houck & Moyers (2012) whereby factor analysis revealed that ability language had a unique relationship to outcomes than did the other categories of change talk. Additional investigations into the association between confidence/self-efficacy and change might be important for establishing ability language as a unique phenomenon demanding differential treatment.

4.2 Percent Reflection of Change Talk

Our findings reinforce the importance of the directional component of MI micro-skills and have implications for the use of this counseling method. The MISC 2.5 codes the valence or direction of the counselor's response to a client's statement about change by indicating whether a reflection is toward, away, or neutral about change. We further summarized these codes to create a new indicator of the percentage of reflections of change talk (PRCT) that captures the number of positive or toward change reflections over all reflections. In our data, PRCT, the percentage of the session during which the counselor specifically reflected change talk, was the only skill to demonstrate a main effect on outcomes. PRCT differs from the other indicators because it is a discrete counselor behavior conceptually tied to the explicit counseling goal, or behavior change target. To a novice listener, counselor reflections may appear to constitute a neutral mirroring of the content the client has offered. However, objective ratings indicate that this is not the case. Counselors often add meaning, feeling or direction, to their reflections, show a preference in choosing which aspects of the client's speech to reflect, and reframe "negative" client statements to "positive" ones. For example, clients often present change talk and counter change talk together ("I want to …, but….") and counselors must choose how to respond. If these counselor choices result in differential amounts of client change talk, then they are closely temporally related to the causal mechanism and consequently outcomes. Sequential analyses of this data are underway and will be presented in a future report. Our findings suggest that the specific directional skill of PRCT is an important indicator of competence in MI practice. As such we believe it should be considered one of the core MI skills and be given increased emphasis in research, training and supervision of practitioners.

4.3 Percent Change Talk

Before discussing limitations of our findings it is important to further address the issue of comparability between our project and other published studies addressing change talk as a mediator in MI. As previously noted, this is first use of percent change talk to measure this theoretically important mediator, and we chose it explicitly to account for the variability in session length for our sample. In this way, percent change talk is a measure with greater generalizability to actual clinical settings where sessions are less and less bound to the traditional one hour psychotherapy format. Various ways to account for variation in the length of session have been used by previous researchers. Baer et al., (2008) used frequency of change talk per five minute interval, Amhrein et al. (2003) broke sessions up into deciles to perform comparisons, and studies with a more uniform session length often use a straight measure of frequency. Since length of session has a direct influence on the frequency of any behavior occurring during session it is imperative to use some method to standardize these numbers across sessions. We chose to divide the number of instances of change talk by all other client utterances, which is conceptually straightforward and has the advantage of ease of calculation and replicability.

4.4 Limitations

Findings from this study should be considered in light of several limitations to generalizability due to the unique intervention and population of study participants. First, this intervention was unusual in that it was delivered in two settings, at school and via telephone. While the school sessions occurred easily, the telephone sessions posed challenges to reaching students for follow-up, maintaining consistent call lengths, and establishing rapport and keeping participants' attention. Second, we note that variation in client levels of change talk was influenced by including a pros and cons exercise in the intervention. This choice explicitly increased the amount of counter change talk present, thus reducing variance in our mediator. Third, the intervention was also different in that participants had the ability to set the agenda, which may have introduced some self-selection bias. We know that more students self-reported using drugs on the paper and pencil measure than talked about drugs during the MI sessions. It is conceivable that those who did speak to us were more motivated to change their behavior, thus biasing them toward change. However, this may have also been related to the counselors' ability to engage subjects about drug use. Validity of our findings may also be influenced by social-desirability bias, as marijuana use was only measured through self-report, and not biochemically verified. The decision to limit the analyses to marijuana outcomes does negatively impact the generalizability of this study's results, however it was most logical to investigate mediational hypotheses in the context of the only substance on which MI had an impact in the parent randomized controlled trial.

Our community sample of at-risk youth (70% male and 71% Latino) is unique in the MI literature. We contend that this population may have provided greater variability in drug use and problems associated with drug use than often seen in clinical samples, resulting in a floor effect, where there was less room for improvement. Any floor effect may also have been exacerbated by the choice to include non-marijuana users in the sample and the difficulty of tracking at-risk youth. However, despite these floor effects, we were still able to find robust relationships in our hypothesized model.

In addition there are limitations related to counselor skill that should be explored. While our analyses did not control for nesting within counselors, it is conceivable that counselor characteristics beyond MI skill may be associated with client change talk and outcomes. A practice effect resulting from varying number of sessions per counselor might have skewed data. If good counselors had more sessions this would also have restricted variance in the

predictor. For instance, as a result of rigorous training and supervision of interventionists we had so few instances of MIIN that we were unable to include the percentage of MICO in our analysis. Agency staff in actual intervention settings might be more likely to exhibit MIIN behaviors. Finally, it is important to note that despite extensive supervision and training, our coders reached only "fair" ICCs for complex and simple reflections, similar to other published studies with these variables (Gaume, Gmel, & Daeppen, 2008, Moyers et al., 2009). This modest level of reliability allows less confidence in the findings for PCR and may not accurately reflect counselor skill in this area.

Furthermore, there may be alternative explanations for our findings or alternative untested mediational pathways that deserve consideration. These analyses did not control for the number of sessions that subjects received. Our decision to include only one session per subject did not take into account the cumulative motivational effect of multiple sessions or account for variation in MI skill across sessions. In addition though we did not measure client readiness to change, it also may account for variability in a client's expression of change talk (Hallgren & Moyers, 2011; Moyers, Martin, Houck, Christopher, & Tonigan, 2009). Finally, our mediation model may be inaccurately specified. The indicator and mediator used in these analyses represent correlational data, as they were collected at the same point in time. While we know that path *a* and *b* preceded outcomes, we must consider the possibility that client language may influence counselor language as much as counselors influence client language. Even if this is true, understanding the relative contribution of the MI fidelity indicators is critically important for the training and development of practitioners.

4.5 Conclusions

Despite limitations, this study contributes to the current search for causal mechanisms in MI. It expands evidence for mediation to a study of MI on adolescent marijuana use without personalized feedback; whereas other mediation studies have all relied on hybrids of MI and objective information-giving, this intervention relied on the "relational" and "technical" aspects only (Miller & Rose, 2009). Additionally, it is the only study to look at micro-skills in MI separately and provide information about the relative merit of different clinical choices as MI sessions progress. Future research should attempt to replicate these findings in an effectiveness trial where greater variance in counselor skill would enhance our understanding of the relationship between indicators of MI quality, client change talk and outcomes. In conclusion, our findings support change talk as an active ingredient of MI and provide new empirical support for individual MI skills and their contribution to outcomes. Findings also support a call for increased training and measurement of the valence of counselor skills both in response to and eliciting change talk. From this data is clear that the counselor's ability or tendency to reflect change talk appears to be an important predictor of client success.

Acknowledgments

References

Amrhein PC, Miller WR, Yahne CE, Palmer M, Fulcher L. Client commitment language during motivational interviewing predicts drug use outcomes. Journal of consulting and clinical psychology. 2003; 71(5):862–878. [PubMed: 14516235]

Baer JS, Beadnell B, Garrett SB, Hartzler B, Wells EA. Adolescent change language within a brief motivational intervention and substance use outcomes. Psychology of Addictive Behaviors. 2008; 22(4):570–575.10.1037/a0013022 [PubMed: 19071983]

Barnett E, Spruijt-Metz D, Unger JB, Sun P, Rohrbach LA, Sussman S. Boosting a Teen Substance Use Prevention Program with Motivational Interviewing. Substance Use & Misuse. 2012; 47(4): 418–428.10.3109/10826084.2011.641057 [PubMed: 22216936]

Barnett E, Sussman S, Smith C, Rohrbach LA, Spruijt-Metz D. Motivational Interviewing for adolescent substance use: A review of the literature. Addictive Behaviors. 2012; 37(12):1325–1334.10.1016/j.addbeh.2012.07.001 [PubMed: 22958865]

Bishop, YMM.; Fienberg, SE.; Holland, PW. Discrete Multivariate Analysis: Theory and Practice. Cambridge, MA: MIT Press; 1975.

Campbell SD, Adamson SJ, Carter JD. Client language during motivational enhancement therapy and alcohol use outcome. Behavioural and cognitive psychotherapy. 2010; 38(4):399. [PubMed: 20519067]

Catley D, Harris KJ, Mayo MS, Hall S, Okuyemi KS, Boardman T, Ahluwalia JS. Adherence to principles of motivational interviewing and client within-session behavior. Behavioural and Cognitive Psychotherapy. 2006; 34(1):43.

Gaume J, Bertholet N, Faouzi M, Gmel G, Daeppen JB. Counselor motivational interviewing skills and young adult change talk articulation during brief motivational interventions. Journal of substance abuse treatment. 2010; 39(3):272–281. [PubMed: 20708900]

Gaume J, Bertholet N, Faouzi M, Gmel G, Daeppen JB. Does change talk during brief motivational interventions with young men predict change in alcohol use? Journal of substance abuse treatment. 2013; 44(2):177–185. [PubMed: 22658289]

Gaume J, Gmel G, Daeppen JB. Brief alcohol interventions: Do counsellors' and patients' communication characteristics predict change? Alcohol and alcoholism. 2008; 43(1):62–69. [PubMed: 17942439]

Gaume J, Gmel G, Faouzi M, Daeppen JB. Counselor skill influences outcomes of brief motivational interventions. Journal of substance abuse treatment. 2009; 37(2):151–159. [PubMed: 19339147]

Gaume J, Gmel G, Faouzi M, Daeppen JB. Counsellor behaviours and patient language during brief motivational interventions: a sequential analysis of speech. Addiction. 2008; 103(11):1793–1800.10.1111/j.1360-0443.2008.02337.x [PubMed: 19032529]

Glynn LH, Hallgren KA, Houck JM, Moyers TB. CACTI: Free, Open-Source Software for the Sequential Coding of Behavioral Interactions. PLoS ONE. 2012; 7(7):e39740.10.1371/journal.pone.0039740 [PubMed: 22815713]

Glynn LH, Moyers TB. Chasing change talk: The clinician's role in evoking client language about change. Journal of Substance Abuse Treatment. 2010; 39(1):65–70.10.1016/j.jsat.2010.03.012 [PubMed: 20418049]

Hallgren KA, Moyers TB. Does readiness to change predict in-session motivational language? Correspondence between two conceptualizations of client motivation. Addiction. 2011; 106(7):1261–1269. [PubMed: 21375643]

Hoyle RH, Kenny DA. Sample size, reliability, and tests of statistical mediation. Statistical strategies for small sample research. 1999:195–222.

Houck; Moyers; Miller; Glynn; Hallgren. Motivational Interviewing Skill Code 2.5. 2013. Retrieved from from the Center on Alcoholism, Substance Abuse and Addictions http://casaa.unm.edu/download/misc25.pdf)

Jensen CD, Cushing CC, Aylward BS, Craig JT, Sorell DM, Steele RG. Effectiveness of motivational interviewing interventions for adolescent substance use behavior change: A meta-analytic review. Journal of consulting and clinical psychology. 2011; 79(4):433–440. [PubMed: 21728400]

Kenny DA, Kashy DA, Bolger N. Data analysis in social psychology. The handbook of social psychology. 1998; 1(4):233–265.

Lisha NE, Sun P, Rohrbach LA, Spruijt-Metz D, Unger JB, Sussman S. An evaluation of immediate outcomes and fidelity of a drug abuse prevention program in continuation high schools: Project Towards No Drug Abuse (TND). Journal of Drug Education. 2012; 42(1):33–57. [PubMed: 22873013]

Macgowan MJ, Engle B. Evidence for optimism: behavior therapies and motivational interviewing in adolescent substance abuse treatment. Child and adolescent psychiatric clinics of North America. 2010; 19(3):527. [PubMed: 20682219]

MacKinnon DP, Fairchild AJ, Fritz MS. Mediation Analysis. Annual Review of Psychology. 2007; 58(1):593–614.10.1146/annurev.psych.58.110405.085542

Martin T, Moyers TB, Houck J, Christopher P, Miller WR. Motivational Interviewing Sequential Code for Observing Process Exchanges (MI-SCOPE) coder's manual. Unpublished. 2005; 16 Retrieved from http://casaa.unm.edu/download/scope.pdf.

McCambridge J, Day M, Thomas BA, Strang J. Fidelity to Motivational Interviewing and subsequent cannabis cessation among adolescents. Addictive Behaviors. 2011; 36(7):749–754.10.1016/j.addbeh.2011.03.002 [PubMed: 21440994]

McCambridge J, Strang J. The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomized trial. Addiction. 2004; 99(1):39–52. [PubMed: 14678061]

Miller WR, Benefield RG, Tonigan JS. Enhancing motivation for change in problem drinking: A controlled comparison of two therapist styles. Journal of consulting and clinical psychology. 1993; 61(3):455. [PubMed: 8326047]

Miller, WR.; Rollnick, S. Motivational Interviewing: Preparing people for change. New York: Guilford; 2002. Retrieved from http://www.guilford.com/pr/miller2.htm

Miller WR, Rose GS. Toward a theory of motivational interviewing. American Psychologist. 2009; 64(6):527. American Psychologist. [PubMed: 19739882]

Morgenstern J, Kuerbis A, Amrhein P, Hail L, Lynch K, McKay JR. Motivational Interviewing: A Pilot Test of Active Ingredients and Mechanisms of Change. Psychology of Addictive Behaviors. 201210.1037/a0029674

Moyers TB, Martin T. Therapist influence on client language during motivational interviewing sessions. Journal of Substance Abuse Treatment. 2006; 30(3):245–251. [PubMed: 16616169]

Moyers TB, Martin T, Christopher PJ, Houck JM, Tonigan JS, Amrhein PC. Client language as a mediator of motivational interviewing efficacy: Where is the evidence? Alcoholism: Clinical and Experimental Research. 2007; 31:40s–47s.

Moyers TB, Martin T, Houck JM, Christopher PJ, Tonigan JS. From in-session behaviors to drinking outcomes: A causal chain for motivational interviewing. Journal of Consulting and Clinical Psychology. 2009; 77(6):1113–1124. http://dx.doi.org.libproxy.usc.edu/10.1037/a0017189. [PubMed: 19968387]

Moyers TB, Martin T, Manuel JK, Hendrickson SML, Miller WR. Assessing competence in the use of motivational interviewing. Journal of substance abuse treatment. 2005; 28(1):19–26. [PubMed: 15723728]

Moyers, TB.; Martin, T.; Manuel, JK.; Miller, WR. Unpublished. Albuquerque, NM: University of New Mexico, Center on Alcoholism, Substance Abuse and Addictions; 2003. The motivational interviewing treatment integrity (MITI) code: Version 2.0.

Pirlott A, Kisbu-Sakarya Y, DeFrancesco C, Elliot D, MacKinnon DP. Mechanisms of motivaitonal interviewing in health promotion: a Bayesian mediation analysis. International Journal of Behavioral Nutrition and Physical Activity. 2012; 9:69.10.1186/1479-5868-9-69 [PubMed: 22681874]

Shrout PE, Bolger N. Mediation in experimental and nonexperimental studies: new procedures and recommendations. Psychological Methods. 2002; 7(4):422. Psychological Methods. [PubMed: 12530702]

Sussman S, Sun P, Rohrbach LA, Spruijt-Metz D. One-year outcomes of a drug abuse prevention program for older teens and emerging adults: Evaluating a motivational interviewing booster component. Health Psychology. 2012; 31(4):476–485. [PubMed: 21988096]

Vader AM, Walters ST, Prabhu GC, Houck JM, Field CA. The language of motivational interviewing and feedback: Counselor language, client language, and client drinking outcomes. Psychology of Addictive Behaviors. 2010; 24(2):190–197.10.1037/a0018749 [PubMed: 20565145]

Winters, KC.; Henly, GA. Personal Experience Inventory (PEI): Manual. Western Psychological Services; 1989.

Zhao X, Lynch JG, Chen Q. Reconsidering Baron and Kenny: Myths and truths about mediation analysis. Journal of Consumer Research. 2010; 37(2):197–206.
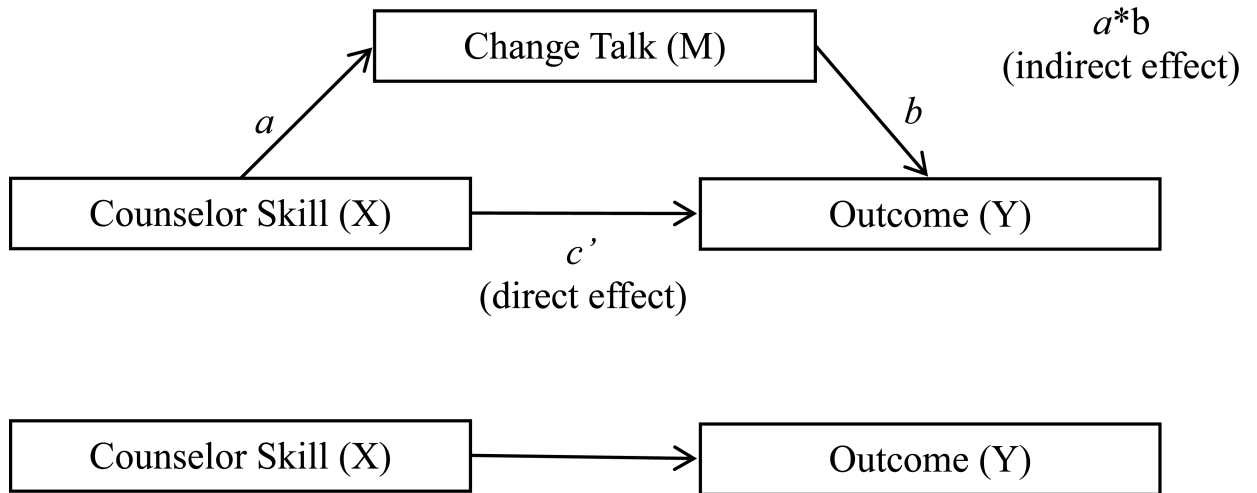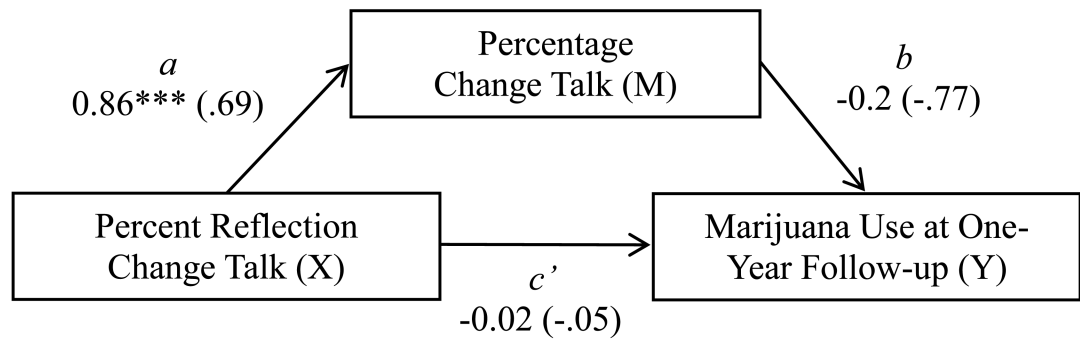
Figure 1.
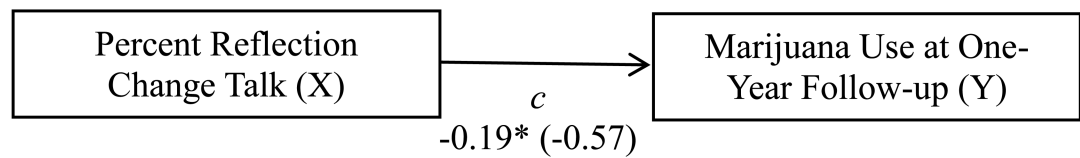Proposed mediation model illustrating the hypothesized causal mechanisms of MI being tested in this analysis.
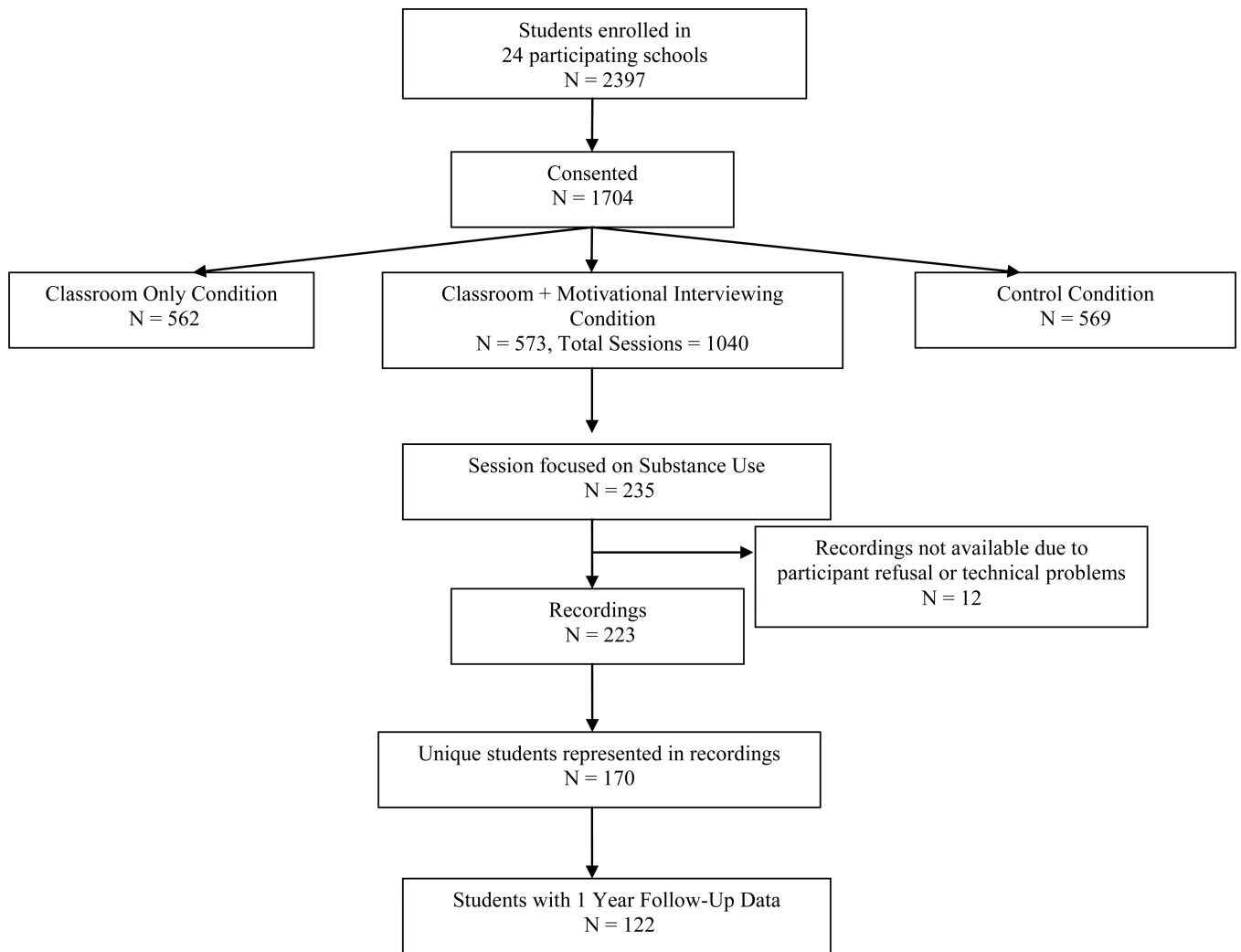
Figure 2. Consort diagram

Indirect Effect Model   *a*b* = -0.18 (-.53)

Percentage
Change Talk (M)

a
0.86*** (.69)

b
-0.2 (-.77)

Percent Reflection
Change Talk (X)

Marijuana Use at One-
Year Follow-up (Y)

c'
-0.02 (-.05)

Main Effect Model

Percent Reflection
Change Talk (X)

Marijuana Use at One-
Year Follow-up (Y)

c
-0.19* (-0.57)

Figure 3.
Results of path model for percent reflection of change talk on marijuana use at one-year
follow-up controlling for baseline drug use. Significant standardized (and unstandardized)
estimates, and p values [+] p < .10 *p < .05, **p < .01, ***p < .001;

Table 1

Measurement Details for all Variables Included in the Final Models

Predictor	
POQ: Percent Open Questions	OQ/(OQ+CQ)
PCR: Percent Complex Reflection	CR+ CR- + CR0 + CR± /(CR+ + CR- + CR0 + CR± + SR+ + SR- + SR0 + SR±)
RQR: Reflection to Question Ratio	(CR+ + CR- + CR0 + CR± + SR+ + SR- + SR0 + SR±) /(OQ+CQ)
PRCT: Percent Reflection of Change Talk	(CR+ + SR+)/ (CR+ + CR- + CR0 + CR± + SR+ + SR- + SR0 + SR±)
PMIC: Percent MI Consistent Behaviors	MICO/ (MICO + MIIN[a])
Mediator	
PCT: Percent Change Talk	CT/ (CT+CCT+FN)
Outcome	
# of times Marijuana Use in past 30 days at One Year Follow-Up[b]	0, 1–10, 11–20, 21–30, 31-40, 41-50, 51–60, 61–70, 71–80, 81–90, and 91–100+

[a] MIIN = MI Inconsistent Behaviors; this variable was not included in the final models due to lack of variance.

[b] Past 30 day Marijuana Use at Baseline was included in all models as a covariate.

Table 2

Univariate and Bivariate Statistics for Quality Indicators

	POQ	PCR	PRCT	RQR	PCT
Percent Open Questions (POQ)[c]	1.00				
Percent Complex Reflection (PCR)[c]	**0.22**	1.00			
Percent Reflection of Change Talk (PRCT)[c]	0.09	**-0.15**	1.00		
Reflection : Question Ratio (RQR)[c]	**0.36**	**0.29**	0.07	1.00	
Percent Change Talk (PCT)[c]	**0.19**	**0.22**	**0.76**	**0.18**	1.00
Number of Observations	170	168	170	170	170
Mean	0.56	0.57	0.42	1.29	0.33
Std Dev	0.18	0.26	0.21	0.61	0.17

*Bold indicates significance p < .05;

Table 3

Mediation Results for MI Quality Indicators Predicting Change in Marijuana Use at One Year Follow-Up

| | n | X --> M | M --> Y | Indirect Effect | Direct Effect | Total/Main Effect |
		a	b	a*b	c'	c
Percent Open Questions	160	0.22**(0.21**)	-0.22**(-0.82**)	-0.05*(-0.17*)	0.01 (0.03)	-0.04 (-0.14)
Percent Complex Reflection	158	0.25***(0.14***)	-0.24**(-0.87)	-0.06*(-0.14*)	0.03 (0.08)	-0.03 (-0.06)
Percent Reflection of Change Talk	160	0.86***(0.69***)	-0.20 (-0.77)	-0.18 (-0.53)	-0.02 (-0.05)	-0.19*(-0.57*)
Reflection to Question Ratio	160	0.18*(0.05*)	-0.22**(-0.83**)	-0.04+(-0.04+)	0.03 (0.03)	-0.02 (-0.02)

+ p < .10,

* p < .05,

** p < .01,

*** p < .001;

standardized (unstandardized) results; X = predictor variable; M = Mediator; Y= outcome variable. a = percent change talk on quality indicator; b = percent change talk on one year marijuana outcome controlling for quality indicator; c' = effect of quality indicator on one year marijuana outcome controlling for percent change talk; c = main effect of quality indicator on one year marijuana outcome. All models control for baseline marijuana use.