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AN EXAMINATION OF THE TECHNICAL AND RELATIONAL HYPOTHESES OF
MOTIVATIONAL INTERVIEWING IN A SAMPLE OF AFRICAN AMERICAN
ADOLESCENT GIRLS SEEKING OBESITY TREATMENT

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science
at Virginia Commonwealth University.

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Abstract

AN EXAMINATION OF THE TECHNICAL AND RELATIONAL HYPOTHESES OF MOTIVATIONAL INTERVIEWING IN A SAMPLE OF AFRICAN AMERICAN ADOLESCENT GIRLS SEEKING OBESITY TREATMENT

By: Rachel L. Boutté, MDiv

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University.

Virginia Commonwealth University, 2016

Major Director: Suzanne Mazzeo, Ph.D.
Professor and Director of Clinical Training
Department of Psychology

Adolescent obesity has increased exponentially over the past three decades in the United States. In response, behavioral interventions have been developed and implemented to address this epidemic; however, treatment adherence is often suboptimal. Motivational interviewing (MI) is a directive, person centered approach to reducing patient ambivalence about change, which has been shown to increase engagement in obesity interventions. The current study investigated the underlying process of MI by exploring two different, but related pathways that explain how change happens (e.g., the technical and relational hypotheses) in the context of a multidisciplinary obesity intervention with African American adolescent girls ($N = 30$). Results demonstrated that MI-consistent skills were associated with client “change talk,” or language consistent with their desire, ability, reasons, need, taking steps or commitment to change. Specifically, clinician reflection of client change language and support of client autonomy were especially important for increasing change language. Furthermore, client language related to

change was associated with three-month treatment adherence, and increased fruit and vegetable intake. However, the clinician's ability to embody the MI "spirit" was not related to either client language or three-month treatment adherence. Findings suggest that the technical aspect of MI helps explain this approach's effects on treatment adherence among African American girls with obesity.

An Examination of the Technical and Relational Hypotheses of Motivational Interviewing in a Sample of African American Adolescent Girls Seeking Obesity Treatment

Rates of adult and childhood obesity in the United States have reached epidemic proportions. According to the Centers for Disease Control and Prevention, obesity is related to several of the leading causes of preventable death, such as heart disease, stroke, type 2 diabetes, and certain cancers (Ogden, Carroll, Kit, & Flegal, 2014). Childhood obesity is especially problematic, as it is a significant predictor of both obesity and related comorbidities in adulthood. Because of the enduring consequences of childhood overweight and obesity, a great deal of research has investigated the effectiveness of interventions tailored to this age group (Kitzmann & Beech, 2011; McLean, Griffin, Toney, & Hardeman, 2003). Although family-based lifestyle interventions have shown great promise, attrition from these treatments is relatively high, and outcomes are often suboptimal (Grossi et al., 2006). Moreover, retention and treatment effects are poorest in the groups experiencing the greatest rates of obesity (i.e., persons of color and those with lower socioeconomic status) (Skelton & Beech, 2011). Obesity interventions that target high risk groups are thus faced with the daunting tasks of optimizing retention and treatment effects. Thus, it is important to include a treatment component which specifically addresses the underlying issues related to treatment adherence and engagement, maximizing patient exposure to treatment, and optimizing treatment effects.

Motivational interviewing (MI) is one approach which offers significant promise in increasing treatment engagement across a variety of health contexts. MI is a directive, person centered approach and an accompanying set of specific techniques. It was developed in the addiction treatment field to increase a person's intrinsic motivation to change (Miller & Rollnick, 2002). MI is used to help patients resolve ambivalence about specific behavioral changes they

desire to make. To facilitate change within an MI framework, the clinician engages in a collaborative, empathic relationship in which the patient is encouraged to explore the reasons for change that are personally relevant and consistent with his or her goals. Within this context, the clinician highlights the patient's own reasons for change to achieve consistency with his/her values (e.g., love for family, importance of career) or goals. The clinician then helps to develop discrepancy as a means to highlight inconsistencies between the patient's values and current behavior. As part of MI, an action plan is collaboratively developed to provide specific strategies to help the patient enact the desired change.

Since its inception, MI has been successfully utilized across a wide range of behavioral domains, including substance use, risky sexual behavior, medication adherence, and gambling (Borrelli, Riekert, Weinstein, & Rathier, 2007; Flickinger et al., 2013; Hodgins, Ching, & McEwen, 2009). More recently, MI has been applied to both pediatric and adult weight loss interventions (Armstrong et al., 2011; Bean, Jeffers, Tully, Thornton, & Mazzeo, 2014a; Bean et al., 2014b; DiRosa, 2009). Simultaneously, there is an increasing interest in understanding the mechanisms of action in MI. Although there is currently no formal theory of MI, the two predominant explanations proposed to explain the mechanisms through which MI acts are the technical hypothesis and the relational hypothesis. The technical hypothesis proposes that the technical characteristics of MI encounters affect change (e.g., clinician adherence to specific MI consistent language, such as open questions, Miller & Rose, 2009). In contrast, the relational hypothesis proposes that characteristics of the relationship between the clinician and patient in an MI encounter affect change (e.g., clinician expression of empathy, Miller & Rose, 2009).

The current study evaluated these hypotheses by examining the process of MI in a sample of African American adolescent girls seeking obesity treatment. The MI process was examined

using the Motivational Interviewing Skills Code (MISC) 2.5, a sequential coding system that provides behavioral codes of the spoken language of both the patient and the clinician (Martin, Moyers, Houck, Christopher, & Miller, 2005). These codes facilitated a detailed assessment of change language and evaluation of whether specific categories of language were related to three-month treatment adherence as measured by percentage attendance (overall) at intervention sessions. Findings will contribute to the growing literature on the mechanisms of action in MI, and further our understanding of the application of MI within a high-risk population of adolescent African American girls with obesity.

Literature Review

Definition and Prevalence of Pediatric Obesity

Obesity is an international public health crisis for both adults and children. In the United States (U.S.), obesity affects one third of adults and 17% of children and adolescents (Ogden et al., 2014). A common measure to determine overweight and obesity is body mass index (BMI), which assesses height in relation to weight. For children, obesity is defined as a BMI \geq 95th percentile age and sex; (children between the 85th and 95th BMI percentiles for their age and gender are considered overweight). According to the World Health Organization, 42 million children under the age of five met criteria for overweight or obesity in 2013 (World Health Organization, 2015).

Genetic, environmental, and behavioral factors influence the development of obesity (Karnik & Kanekar, 2012). A higher BMI in childhood is associated with obesity in adulthood, highlighting the importance of preventing and successfully treating pediatric overweight (Krebs et al., 2007). There are a myriad of troubling and chronic health outcomes associated with overweight and obesity. These include type 2 diabetes, cardiovascular disease, hypertension, and

sleep apnea (Kiess et al., 2001; Ogden et al., 2014). Moreover, there are psychosocial consequences related to childhood overweight and obesity, such as low self-esteem, body dissatisfaction, depression and ostracism from one's peer group (Ebbeling, Pawlak, & Ludwig, 2002; Swallen, Reither, Haas, & Meier, 2005).

Obesity in adolescents presents unique challenges to families as well as interventionists, given the biological, cognitive, and emotional changes associated with this developmental stage (Holmbeck et al., 2000). The onset of pubertal changes during adolescence bring about increased weight gain and changes in body shape and composition, which further complicates what constitutes an appropriate obesity intervention (Biro & Wien, 2010; Loomba-Albrecht & Styne, 2009). Additionally, the developmental goals of adolescence include the assertion of one's autonomy, which can negatively influence adolescents' engagement in a health behavior interventions, especially those requiring collaboration with parents (Daddis, 2011). However, it is vital to provide effective treatment to this age group, as longer duration of obesity in youth is related to worse outcomes in adulthood. Because of the enduring consequences of obesity, early and effective intervention is essential in diminishing obesity in adulthood.

Moreover, certain racial and ethnic groups, and those with lower socioeconomic status (SES) are disproportionately affected by overweight and obesity (Kalinowski et al., 2012). In the U.S., Mexican American children and adolescents and non-Hispanic Blacks (aged 6-19 years) have the highest prevalence of overweight, compared with their non-Hispanic White counterparts, even when controlling for SES (Wang & Beydoun, 2007). Further, although these groups have a higher risk for overweight and obesity, they also are more likely to drop out of treatment for these conditions than are their majority counterparts (Skelton & Beech, 2011).

Weight loss interventions. Due to the serious and widespread nature of the problem of obesity, there is an urgent need for feasible, effective weight loss interventions. There are many points of intervention that could be targeted when addressing pediatric overweight, ranging from the child's most proximal environments such as home and school, to the larger environmental context (i.e., the neighborhood). Within each setting, interventions have demonstrated some degree of efficacy (Karnik & Kanekar, 2012). Because many of children's food choices and opportunities for physical activity are decided by their caregivers, there is a growing literature indicating that multidisciplinary lifestyle interventions that engage the entire family are the most effective in reducing BMI in children and adolescents (Epstein, Paluch, Roemmich, & Beecher, 2007; Janicke et al., 2014). Family based interventions offer the added benefit of positively influencing health outcomes for the entire family (Epstein et al., 2007).

Nonetheless, attrition and program adherence are central challenges to the efficacy of any obesity intervention, highlighting the need for interventions that can specifically focus on these issues (Vinkers, Adriaanse, & de Ridder, 2013). Research has indicated that participants who attend a greater percentage of intervention sessions ultimately have better treatment outcomes than their counterparts who attend fewer sessions (Levine, Ringham, Kalarchian, Wisniewski, & Marcus, 2001; Zeller et al., 2004). However, low-SES and minority individuals manifest poorer adherence to and greater attrition from weight loss interventions (Skelton & Beech, 2011; Zeller et al., 2004). Limited research is available regarding strategies to address problems specific to these populations, despite the urgent need for better approaches to intervention for these groups (Skelton & Beech, 2011).

Various solutions have been proposed to address the challenges of attrition and the related problem of diminished treatment effects, such as making repeated contact with

participants, offering incentives for participation, and implementing a culturally sensitive intervention in a convenient location (Karlson & Rapoff, 2009). However, it is likely that internal barriers (e.g., ambivalence) to participation also exist, and might make the more practical or systemic barriers (e.g., transportation difficulties) more salient deterrents to treatment engagement. Motivational Interviewing (MI) has demonstrated initial promise as a strategy to address these internal barriers to participation when implemented as part of obesity interventions. Specifically, there is evidence to suggest that MI can increase treatment adherence and thus improve treatment outcomes in high risk groups (Hettema, Steele, & Miller, 2005a).

Motivational interviewing defined

MI might be particularly well-suited to address the challenges of attrition and adherence, because it focuses on a person's underlying personal reasons for wanting to change. This approach is believed to increase intrinsic motivation for change. Although initially developed for the treatment of substance abuse, MI has proven effective in numerous areas of behavioral change (Cushing, Jensen, Miller, & Leffingwell, 2014; DiRosa, 2009; Gayes & Steele, 2014; Heckman, Egleston, & Hofmann, 2010). MI is a directive, person centered way of being with patients (MI spirit), as well as a set of specific techniques, such as asking open ended questions, and using reflections and affirmations (Miller & Rollnick, 2013). MI helps people change by connecting what they value to the changes that they seek to make. The practitioner highlights the tensions that exist between a person's actions and his/her identified values. Unlike most other approaches, MI takes patient's ambivalence towards change seriously, and highlights the reality of simultaneously wanting and not wanting to change. In these ways, MI contrasts starkly with traditional information driven methods, such as providing advice, that dominate healthcare settings. MI targets the ambivalence that is a natural part of the decision making process, but

emphasizes the patient's reasons for wanting to change, rather than barriers to change, thereby facilitating intrinsic motivation.

MI is structured around four basic processes: engaging, focusing, evoking, and planning. The engagement stage is based on person centered empathic methods of counseling. In the engagement stage, clinicians build rapport and validate the patient through the use of open ended questions, affirmations, reflections, and summary statements. In the focusing phase, the patient identifies the target behavior that s/he wants to change and develops concrete goals which will lead to the desired outcome. It is also in this phase that values might be explored. In the evocation phase, specific reasons for the desired change are identified and the clinician helps elicit language (referred to as "change talk,") from the patient which explains why s/he wants to change and how s/he will accomplish this goal. Similarly, the clinician does not reinforce language opposing change ("sustain talk" or "counter change talk"). Specifically, clinicians focus on reinforcing the different types of change talk, including: the desire, ability, reasons, and need to change as well as commitment to change, activation for change and taking steps toward change. In this phase, scaling questions might be asked to assess how strongly a person desires to make change, and how confident s/he is in his/her abilities to do so. The final phase is planning, in which concrete plans might be outlined, if appropriate, based on the patient's level of readiness. These plans are derived from the collaborative effort of the patient and clinician. In the planning phase, the clinician asks several open ended questions to elicit ideas about steps patients can take towards the change they seek to make. Furthermore, the clinician promotes patients' self-efficacy by building on their strengths (identified in earlier phases of counseling). The planning phase typically ends with helping clients assess whether or not the plan is working

as they proceed. Not all phases are necessary for all patients in MI. Clinicians assess what is appropriate on an individual basis.

MI is also distinct from other intervention approaches because of its emphasis on the collaborative relationship between clinician and patient (MI "spirit"). The spirit of MI is rooted in Carl Roger's person centered therapy (Rogers & Koch, 1959). MI practitioners are encouraged to use unconditional positive regard and empathic listening to support patients' autonomy. Other important aspects of the relationship in MI are that is collaborative, and the patient is considered an equal partner with the clinician. The clinician is not viewed as the expert; instead the patient is seen as the expert on his or her own needs and reasons for wanting to change (or not). Importantly, the natural ambivalence that arises when a person is considering change is not viewed as pathological. Rather, it is respected and supported through accurate empathy, reflections, and support of patient autonomy (Miller & Rollnick, 2013).

Given the efficacy of MI in the treatment of substance abuse, investigations of MI have expanded to other areas of behavior modification (Hettema et al., 2005b; Miller, Wilbourne, & Hettema, 2003b). For example, MI has been used to address sexual risk behavior, gambling, diabetes, medication adherence, physical activity, diet, and weight loss (Cushing et al., 2014; Lundahl, Kunz, Brownell, Tollefson, & Burke, 2010; Tevyaw & Monti, 2004). Although the vast majority of research has been conducted in the area of substance abuse, a growing literature has demonstrated efficacy across domains (Hettema & Hendricks, 2010; Walker, Stephens, Rowland, & Roffman, 2011; Zuckoff, 2012). As the reach of MI has broadened, interest in developing a cohesive theory of MI has also increased.

The process of motivational interviewing

There are over three decades of research supporting the effectiveness of MI and its derivatives such as brief motivational interventions and motivational enhancement therapy (Burke, Dunn, Atkins, & Phelps, 2004; Dunn, Deroo, & Rivara, 2001; Erickson, Gerstle, & Feldstein, 2005; Miller, 1983). However, because MI was not a product of theory, but rather emerged from clinical practice, its key components and mechanisms of change are not completely understood (Miller & Rose, 2009).

Several hypotheses have been proposed to explain the mechanisms contributing to these desired outcomes, which have been found to occur in as little as one MI session (Miller & Rose, 2009). The two most thoroughly researched theories are the technical and relational hypotheses. The relational hypothesis asserts that characteristics of the therapeutic relationship (i.e., clinician empathy and MI spirit) are most predictive of positive treatment outcomes. The technical hypothesis is a proposed “causal chain” in which specific, MI-consistent clinician behaviors (e.g., open ended questions, reflections, and affirmations) elicit specific patient behaviors (i.e., change talk), which in turn are predictive of target behavior change. The underlying processes of MI can be examined through the use of validated coding systems, which provide methods of identifying and classifying verbal exchanges between clinicians and patients (Glynn & Moyers, 2012; Martin et al., 2005; Miller, Moyers, Ernst, & Amrhein, 2003a; Moyers, Martin, Manuel, Miller, & Ernst, 2010).

As the imperative to understand the active ingredients of MI has grown, systems of coding MI interventions have become more sophisticated. As many as ten different systems have been developed and used to address a variety of research questions investigating the MI process. These coding systems provide a framework for explaining MI theory. They range in complexity

from relatively simple systems which offer broad information, to more nuanced approaches that provide detailed information.

Coding systems. As noted above, several coding systems have been developed to investigate the mechanisms of MI, as research in this area has advanced. Coding systems provide critical information about clinician adherence to MI, patient outcomes, and mechanisms of change. Coding systems are used to categorize clinician and/or patient language, and to provide data on the frequency and nature of specific types of language. Broadly, clinician language can be categorized into two groups: MI consistent (MICO) and MI inconsistent (MIIN). Patient language is typically delineated into two major categories as well: change talk (CT) and counter change talk (CCT). Different coding systems measure these categories in varying degrees and levels of specificity. For example, several of the major coding systems (e.g., Motivational Interviewing Skills Code [MISC], Motivational Interviewing Sequential Code for Observing Process Exchanges [MI-SCOPE], and the Motivational Interviewing Treatment Integrity Code [MITI]) provide summary scores of clinician behaviors including percentages of complex and simple reflections and open and closed questions (Martin et al., 2005; Miller, Moyers, Ernst, & Amrhein, 2003; Moyers, Martin, Manuel, Miller, & Ernst, 2010). The MITI, which is the most widely used measure of treatment fidelity, also provides summary scores for MI adherent behaviors (e.g., asking permission before providing information, emphasizing patient autonomy, and facilitative affirmations) and MI non adherent behavior (e.g., advising without permission, direct negative confrontation, and directing with the use of imperative language). The Motivational Interviewing Skills Code (MISC) 2.5 provides an even more nuanced picture of clinician behavior and has 30 possible descriptive categories (detailed description provided in methods). Because the language of clinicians and patients is viewed within the MI framework as

either eliciting or hindering change behavior, it is important to review previous research on the relation between language and outcomes in interventions using this approach. The following sections provide a brief overview of relevant literature.

Clinician language. Across behaviors and populations, investigators have reported that clinician language predicts both change and counter change talk (Carcone et al., 2013b; Catley, 2006; Magill, Apodaca, Barnett, & Monti, 2010; Vader, Walters, Prabhu, Houck, & Field, 2010). Also, patient change talk is linked to better treatment outcomes; in contrast counter change talk is associated with poorer outcomes (Apodaca et al., 2014; D'Amico et al., 2015; Gaume, Bertholet, Faouzi, Gmel, & Daeppen, 2013; Moyers et al., 2007b). As mentioned above, MICO behaviors are those which are adherent to the principles of MI. These behaviors include open ended questioning, affirming patient behaviors that are consistent with change, and asking permission before providing advice. Furthermore, within MI, it is recommended that patient change talk is responded to with a reflection or other method of expanding upon the change talk, which serves to reinforce the desired action.

Multiple studies indicate that clinician MICO behaviors predict change talk, while MIIN behaviors predict counter change talk (D'Amico et al., 2015; Moyers & Martin, 2006; Moyers et al., 2007b; Vader et al., 2010). For example, in a sample of young adult males classified as “at risk” drinkers, MICO behaviors, especially reflections, by clinicians were associated with subsequent change talk from patients (Gaume, Bertholet, Faouzi, Gmel, & Daeppen, 2010a). In contrast, MIIN behaviors were commonly followed by counter change talk (Gaume et al., 2010a). Similarly, in a sequential analysis study of MI with adult drinkers, MICO was a significant predictor of change talk, and MIIN was a significant predictor of counter change talk (Moyers et al., 2007). Additionally, in one of the few experimental manipulations of the

mechanisms of change, Morgenstern et al. demonstrated that clinician behavior effectively and differentially evoked change talk, which in turn predicted better treatment outcomes (2012). Furthermore, a recent study with a sample of overweight African American adolescents found that specific categories of MICO behaviors (e.g., open ended questions and focusing on autonomy) were more likely to elicit change talk than others (Carcone et al., 2013b). In sum, although more research is need to clarify which behaviors work best with specific populations, there is strong evidence to suggest that specific clinician behaviors are predictive of patient language.

Patient language. Patient language was initially conceptualized into two broad categories: change talk, which is language supporting alterations in the targeting behavior, and resistance, which was initially seen as the opposing force to change talk (Miller & Rollnick, 2002). Since its initial conception, the idea of resistance has been further clarified. Currently, terms such as “sustain talk” or “counter change talk” are used to refer to patient language favoring the status quo (Miller & Rollnick, 2013).

In the early stages of MI research, change talk emerged as the key factor associated with positive treatment outcomes. Although most of the early research supported this finding (Amrhein, Miller, Yahne, Palmer, & Fulcher, 2003; Miller, Benefield, & Tonigan, 1993), several studies yielded mixed outcomes (Kuchipudi, Hobein, Flickinger, & Iber, 1990; Miller, Yahne, & Tonigan, 2003c; Treasure et al., 1999). One proposed explanation for these inconsistencies across studies was related to a lack of sophistication in coding procedures which operationalize MI (Miller & Rose, 2009). Consequently, more detailed coding systems emerged. Within one of those new coding frameworks (the Commitment Language Coding System), change talk was divided into specific aspects of motivation for change: desire, ability, reasons, need, and

commitment (Amrhein et al., 2003). Further, the frequency with which each of these aspects was evident during sessions could be coded within this framework. Also, this system evaluates the presence of distinct aspects of motivation during specific parts of a session, making it possible to track a patient's level of motivation at different time points within a session. Subsequent research (Aharonovich, Amrhein, Bisaga, Nunes, & Hasin, 2008; Hodgins et al., 2009) has indicated that the strength and pattern of commitment language are strong predictors of change behavior. Specifically, consistent use of commitment language near the end of an MI session was a better predictor of change than that same language in the earlier part of a session (Amrhein et al., 2003). In addition, language featuring other aspects of motivation were often precursors to commitment language, but typically did not directly predict change when occurring on their own (Miller & Rose, 2009).

Furthermore, some research suggests that the active ingredient which predicts change might vary across populations. In a sample of adolescent substance users, commitment language was not predictive of behavior change, although counter change talk was predictive of poorer outcomes, consistent with previous research (Bear et al., 2008). Bear and colleagues found that language which reflected *desire and ability to change* was most predictive of reduced substance use at one and three month follow up (2008). However, their sample was comprised exclusively of homeless youth who were not treatment seeking; thus their results might not be generalizable to other clinical populations.

Although there is relative agreement that clinician behavior elicits change talk, which in turn leads to positive treatment outcomes, the actual mechanisms of change remains unclear. The two dominant hypotheses (technical and relational) are discussed in depth in the following sections.

Mechanisms of change in MI

The technical hypothesis of MI. The technical hypothesis of MI focuses on the causal chain of specific types of speech between clinician and patient that lead to change in the target behavior. This causal chain has been studied in great depth, and several review papers and a meta-analysis have attempted to explain how the sequence of events within MI leads to the intended outcome (Apodaca & Longabaugh, 2009; Magill et al., 2014; Miller & Rose, 2009; Romano & Peters, 2014).

The technical hypothesis of MI states that clinicians' competent use of specific MI techniques elicit change talk, which in turn predicts the desired change in behavior. In an early test of this hypothesis, Miller and colleagues compared MI with a contrasting style of feedback in which clinicians attempted to persuade patients to change (Miller et al., 1993). Results suggested that patients receiving MI engaged in nearly twice as much change talk and manifested about half as much resistance as those in the other group (1993). Numerous subsequent studies have yielded similar results (Catley, 2006; Gaume, Bertholet, Faouzi, Gmel, & Daepfen, 2010; Glynn & Moyers, 2010).

The technical hypothesis of MI is operationalized through specific clinician skills (e.g., use of open questions, affirmations, reflections, supportive statements, advising with permission and showing support). Available coding systems can capture the frequency with which a clinician utilizes each of these behaviors, and assess patients' responses following specific clinician statements. Some research evaluating the technical hypothesis has relied solely on behavior counts; other studies have used more advanced techniques such as sequential analysis to capture the temporal order of patient and clinician statements.

The relational hypothesis of MI. The relational hypothesis of MI states that it is the supportive and collaborative relationship, consistent with the spirit of MI, that elicits patient change behavior (Romano & Peters, 2014). The relational hypothesis has been studied much less frequently than the technical hypothesis, and findings are more mixed (Pirlott, Kisbu-Sakarya, Defrancesco, Elliot, & Mackinnon, 2012; Tollison et al., 2013). Extant research has focused primarily on two constructs within this model: MI spirit and empathy.

For example, in Morgenstern et al.'s pilot study with problem drinkers, patients were assigned to one of three groups: 1) typical MI therapy (motivational enhancement therapy), 2) a relational only version of MI in which relational elements were emphasized and technical elements prescribed, or 3) a "self-change" control condition (2012). Results indicated that patients in the relational only condition manifested the greatest decreases in their drinking at the end of treatment. However, at one month follow up, there were no significant differences between patients in the traditional MI and the relational only treatment conditions (Morgenstern et al., 2012a). Several studies have found no relation between MI spirit and empathy and treatment outcomes (Magill et al., 2010; Pirlott et al., 2012; Tollison et al., 2013). However, a few studies have demonstrated a positive relation between empathy and outcome (Gaume, Gmel, & Daeppen, 2008; Thrasher et al., 2006; Woodin, Sotskova, & O'Leary, 2012) and several more have found a positive relation between the combination of MI spirit and empathy on treatment outcome (Baird et al., 2007; Thyrian et al., 2007).

MI spirit is operationalized in coding systems as a mean summary score of the following clinician behaviors: evocation, collaboration, and autonomy/support. Each element of MI spirit is coded individually and rated on a scale ranging from low (1) to high (5) in the MITI coding system, the most widely used tool for measuring this construct. Within this coding system,

empathy is measured as a separate construct and is operationalized in terms of reflective listening and clinicians' ability to share in patients' worldview and effectively communicate an understanding of their needs (Moyers et al., 2010).

In sum, there is some empirical support for both the technical and relational hypotheses. However, results are somewhat mixed and additional research is needed to clarify the active ingredients of MI. Some of the inconsistent findings might be attributed to the fact that MI has been utilized to address a variety of problems, with a range of samples, and in diverse settings (Arkowitz, Westra, Miller, & Rollnick, 2007; Armstrong et al., 2011; Baird et al., 2007; Barnett, Sussman, Smith, Rohrbach, & Spruijt-Metz, 2012; D O'Halloran et al., 2014). There might be differences in the aspects of MI that are most effective for specific behaviors and populations. The application of MI to weight management is one of the many domains in which this approach could be particularly useful and improve treatment adherence, retention, and outcomes for patients. As such, there is a need to better understand mechanisms of action in this context.

Motivational interviewing in practice

Motivational interviewing and weight loss. Several systematic reviews and meta-analyses have examined the effectiveness of MI to improve weight loss outcomes (Armstrong et al., 2011; Hettema, Steele, & Miller, 2005c; Lundahl et al., 2010). Because obesity is not in itself a behavior, but rather a potential outcome of a set of behaviors, one challenge involved in using MI to address this condition is to identify concrete behaviors (e.g., physical activity level, fruit and vegetable intake) that can be targeted for change (Resnicow, Davis, & Rollnick, 2006). In particular, to utilize coding instruments properly in the examination of the MI process, the target behavior must be clearly identified within the session. Even with these challenges, results of studies using MI in the treatment of adult and pediatric obesity are promising.

For example, in a systematic review of randomized control trials, Armstrong et al. found that MI increased adherence to specific weight loss behaviors. These behaviors, in turn, were associated with BMI reductions (2011). Specifically, in both group settings (Navidian et al., 2010) and in individual treatment, patients receiving MI in addition to standard behavioral weight loss manifested greater BMI reductions compared with patients not receiving MI (Carels et al., 2007). The addition of MI has also been effective in increasing the frequency of positive health behaviors associated with weight such as physical activity (Hardcastle, Blake, & Hagger, 2012), and fruit and vegetable intake (Pirlott et al., 2012). Although there have been a few studies which did not find any significant effect on BMI from the addition of MI (Befort et al., 2008; Buscemi, Yurasek, Dennhardt, Martens, & Murphy, 2011; Webber, Tate, Ward, & Bowling, 2010), findings are largely positive within the area of adult obesity treatment.

Motivational interviewing with adolescents. Although there is substantial evidence indicating that MI is effective with adult patients with diverse types of behaviors, much less is known about the use of this approach with adolescents (Brennan, Walkley, Fraser, Greenway, & Wilks, 2008). An emerging literature suggests that MI might be especially effective with adolescents due to its sensitivity to patient autonomy, a construct particularly salient during this developmental stage (Tevyaw & Monti, 2004). Further, because of the person-centered and exploratory nature of MI, adolescents might be particularly responsive to this approach, compared with the lecturing or confrontational methods often used in the classroom and home settings (Tevyaw & Monti, 2004). In their systematic review of MI in the treatment of pediatric obesity, Resnicow and colleagues concluded that although some adaptations might be necessary, MI holds great promise as an intervention approach for pediatric obesity (2006). Numerous studies have examined the role of MI in the treatment of pediatric obesity and related behaviors

(Ball et al., 2011; Bean et al., 2014b; Kelishadi et al., 2012; Macdonell, Brogan, Naar-King, Ellis, & Marshall, 2012; Schwartz et al., 2007; Söderlund, Nordqvist, Angbratt, & Nilsen, 2009; Taveras et al., 2011; Tripp, Perry, Romney, & Blood-Siegfried, 2011; Wasserman et al., 1998). Many of these investigations focused on health behaviors that are related to weight status, such as physical activity (Neumark-Sztainer et al., 2010), screen time (Taveras et al., 2011), and parent attitudes about eating behavior (Schwartz et al., 2007). Results of a recent study of Black adolescent males enrolled in an obesity intervention with an MI component indicated that specific clinician behaviors, such as language focused on the adolescent's autonomy over decision making, consistently elicited patient language predictive of behavior change (Carcone et al., 2013a). These results suggest that MI is effective in the context of adolescent obesity interventions, but that certain clinician skills might be particularly important in eliciting behavior change.

However, results regarding the efficacy of MI for adolescent weight loss have yielded somewhat inconsistent results. For example, in Bean et al.'s *MI Values* trial, there were no differences in BMI between adolescents who received the MI intervention and controls, although treatment adherence was improved in the MI group (2014b). Of note, all adolescents in *MI Values* participated in a multidisciplinary lifestyle intervention and within group BMI change was significant. Another study of overweight African American adolescents found no differences in BMI outcomes between a group that received a high intensity weight loss intervention with MI, and a group offered a moderate intensity control without MI. This moderate intensity group received only a third of the number of sessions as the full intervention (Resnicow, Taylor, Baskin, & McCarty, 2005). Thus, results of this study could be attributable, not only to the

differences in MI between groups (i.e., present or absent), but also could have been influenced by the differences in intensity of the primary treatment approach (i.e., high or moderate).

Similarly, in a sample of Latino adolescents, adding MI to a circuit training intervention yielded no added benefit (Davis et al., 2011). These results suggest that MI might not be equally effective across settings and groups (Ball et al., 2011). Moreover, it is unclear if the inconsistent findings are due primarily to population and setting or to other factors such as treatment fidelity, dose, and method of intervention (e.g., brief MI, motivation enhancement therapy). Thus, additional research is needed to understand the role of MI in adolescent obesity treatment either as a stand-alone intervention or, more commonly, as an adjunctive treatment to a lifestyle intervention.

Summary and Purpose of the Current Study

Pediatric obesity is a serious problem with numerous comorbidities. Interventions to address pediatric obesity are modestly successful, but attrition from these treatments is high. MI has yielded better adherence (e.g., number of sessions attended) and outcomes (e.g., % BMI reduction) in adult and pediatric obesity intervention trials (Armstrong et al., 2011; Bean et al., 2014b), compared with treatment as usual. In recent years, the mechanisms underlying MI have become a research focus. Of particular interest is enhancing understanding of the explanatory power of the relational and the technical hypotheses of MI. As noted previously, the technical hypothesis of MI asserts that specific MI techniques contribute to a causal chain in which clinician behaviors predict patient behaviors, which in turn, predict outcomes. The relational hypothesis asserts that the directive and empathic nature of the relationship between a clinician and patient, facilitated through the spirit of MI, is the mechanism of change. A better

understanding of these mechanisms of action is needed to guide intervention development and enhance treatment effects.

The purpose of the current study was to explore the technical and relational hypotheses of MI by examining motivational interviews conducted with African American adolescent girls enrolled in a multidisciplinary obesity intervention. The current study also examined specific clinician and adolescent participant language for their association with adherence to the intervention. Specifically, interviews were coded using the MISC 2.5 (Miller et al., 2003a) to enhance understanding of which clinician and participant behaviors are most strongly associated with treatment adherence, thus informing the application of MI to this high risk population.

Specific Aims

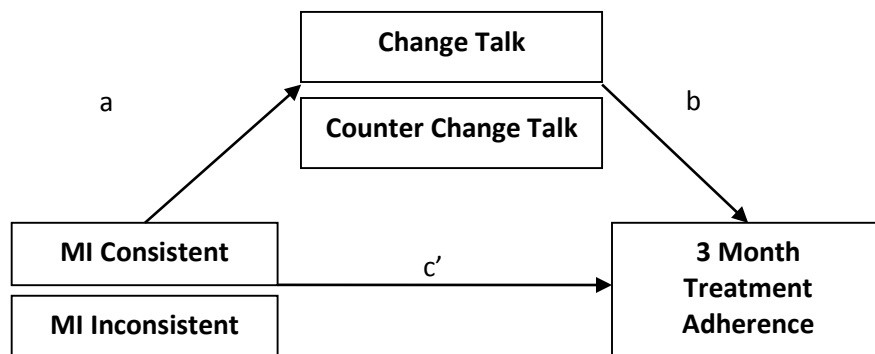
Aim 1. The first aim of the study was to examine if language (e.g., “change talk” or “counter change talk,” as measured by the Motivational Interviewing Skills Code [MISC 2.5]) expressed by African American adolescent girls during a MI intervention was associated with three-month treatment adherence to TEENS (Teaching, Encouragement, Education, Nutrition, Support), an adolescent obesity treatment program, as measured by % overall attendance at TEENS sessions. Overall adherence (% adherence to all TEENS sessions) was defined as attendance in the following domains: dietician, behavior support, and gym. It was hypothesized that participants’ expression of “change talk” and “counter change talk” would be related to treatment adherence at three months, such that change talk would be positively associated with adherence and counter change talk would be negatively associated with treatment adherence. See Figure 1.

Exploratory Aim 1a. If the relation between change talk and treatment adherence was supported (Aim 1), exploratory Aim 1a would examine which specific categories of change talk

and counter change talks (e.g., ability, reasons, desire, other, and commitment language) expressed by participants were associated with increased treatment adherence.

Aim 2. The second aim was to examine the relation between clinician behavior and participant outcomes as mediated by change talk. It was hypothesized that change talk would partially mediate the relation between clinician MI consistent language and three-month treatment adherence such that participant change talk was associated with increased treatment adherence, whereas counter change talk was associated with diminished treatment adherence. It was further hypothesized that participant change talk would partially mediate the relation between the relational aspects of MI (MI spirit) and three-month treatment adherence. See Figure 2.

Aim 3. Given the paucity of studies examining MI processes of change when targeting adolescents, this investigation explored additional potential variables that might further explain mechanisms of action in MI. To begin, we explored MI-consistent and inconsistent clinician and patient behaviors for their relation to the following study outcomes: BMI z score, total physical activity, fruit and vegetable intake, and kilocalories. Further, the ratio of change talk to counter change talk (percent change talk) was explored in relation to: three-month adherence overall, weeks participating at three months, three-month adherence with behavior sessions, and three-



month gym adherence. Additionally, individual categories of clinician language were examined in relation to patient change talk.

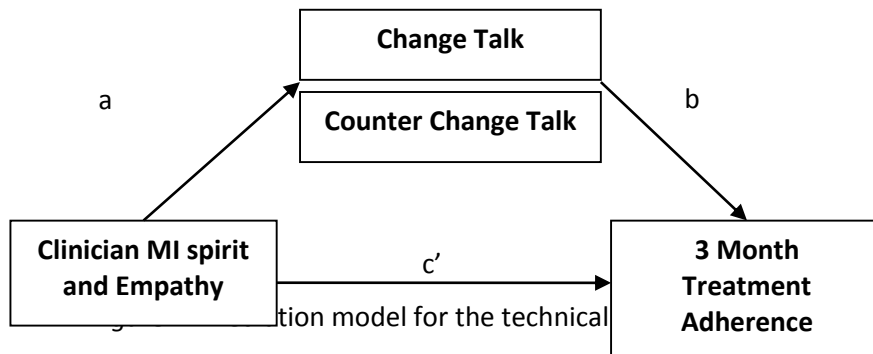


Figure 2. Mediation model for the relational hypothesis.

Method

TEENS and *MI Values* Trials

Participants. Participants for this study were enrolled in the *MI Values* study, a randomized controlled trial (RCT) of MI that was implemented as an adjunct to a multidisciplinary treatment program for adolescents with overweight and obesity, TEENS (Bean et al., 2011a). To be eligible for TEENS (and thus *MI Values*) participants had to be between 11 and 18 years of age, and have a BMI \geq 85th percentile for their age and gender (CDC, 2015). Participants also had to have a parent or caregiver that was willing to participate, an identified primary care physician, and no underlying medical condition associated with weight gain or loss which might interfere with behavioral weight management (e.g., Prader Willi Syndrome). A subset of TEENS participants ($n = 99$) completed the *MI Values* trial ($n = 58$ MI group; $n = 41$

education control group); adolescents were predominantly female (74%) and African American (73%); mean age = 13.8 ± 1.8 years, BMI percentile = 98 ± 1.2 .

Procedure. *TEENS Program.* TEENS is an Institutional Review Board-approved, empirically supported, family-based weight management program that includes structured physical activity, nutrition education, and behavioral support (Bean et al., 2011b; Evans et al., 2009; Wickham et al., 2009). Adolescents in *MI Values* were enrolled in TEENS, and met with a dietitian and behavioral support specialist on alternating weeks during the first six months of the study. In addition, they were required to engage in supervised physical activity ≥ 3 times per week at the TEENS gymnasium. Moreover, families were provided with YMCA memberships to encourage exercise on other days of the week. Participants and their parents completed a battery of assessments at baseline, three and six months. Assessments included measurement of anthropometrics, metabolic profiles, cardiorespiratory fitness, dietary intake, physical activity frequency, and psychosocial functioning (e.g., body image and self-esteem). Additionally, program attendance (dietitian, behavior support, and gym) and attrition were monitored. It was previously demonstrated that participation in TEENS was associated with significant improvements in dietary intake (Bean et al., 2011b), cardiorespiratory fitness (Evans et al., 2009), and BMI (Wickham et al., 2009). However, similar to other treatments targeting this underserved population, enhanced strategies to reduce attrition and further improved treatment effects were needed (Zeller et al., 2004). *MI Values* was designed to address these concerns via a low intensity adjunctive treatment (Bean, Mazzeo, Stern, Bowen, & Ingersoll, 2011a).

MI Values. *MI Values* was an adjunctive RCT embedded into the TEENS intervention to examine whether two MI sessions could increase patient adherence and ultimately improve treatment outcomes (Bean et al., 2011a). All participants who consented to TEENS between

2009 and 2011 ($n = 123$) were invited to participate in *MI Values*. Consented participants (82.1%) were randomized (using a random number generator) to either the MI or the education control treatment group. Participants received either MI or an educational intervention at weeks one and 10 of TEENS. Interventionists within TEENS were blinded to participants' condition, and only MI interventionists were trained in MI. Participants in both arms of *MI Values* completed TEENS treatment as usual, with assessments at baseline, three, and six months.

Training and fidelity monitoring for the *MI Values* trial are described in detail in Bean et al. (2014). Briefly, MI interventionists were trained by a member of the Motivational Interviewing Network of Trainers (MINT). They attended a two-day training, followed by supervision and coaching until competency was established as indicated by the PI (Bean) and objectively supported by competency standards set forth by the MITI 3.0 (Bean et al., 2011a; Moyers, Martin, Manuel, Miller, & Ernst, 2007a). The MITI Code is composed of global scores to capture the MI spirit: evocation, collaboration, autonomy support, direction, and empathy. The MITI also provides individual behavior counts for clinician language (e.g., giving information, open or closed questions, simple or complex reflections, MI adherent or nonadherent). Algorithms and cutoffs are provided in the MITI to determine adherence to MI.

MI sessions were ~30 minutes duration, during which interventionists followed a roadmap, which generally included the following components: Establish Rapport, Agenda Setting, Explore Target Behavior, Explore Values/Goals, Explore Ambivalence/Readiness to change, Negotiate Change Plan, and Summary. Week 1's MI session began with a card sort activity in which adolescents were presented with 39 value cards, which listed a value and an explanation of the value (e.g., popular, "to be well liked by others"). Participants identified their top five values and the interventionist guided them to explore the connection between their

values and their behavioral goals (e.g., diet or physical activity behaviors). Interventionists used a variety of MI techniques to develop discrepancy between adolescents' current behavior and described values. Specifically, open questions, affirmations and reflections were used to promote adolescent autonomy, resolve ambivalence, build self-efficacy, and elicit change talk. At the end of session 1, clinicians and adolescents collaboratively developed an action plan to change the targeted behavior, including anticipation of potential barriers and solutions. Session 2 occurred at week 10 of TEENS, during which interventionists examined progress towards the target behavior identified in session 1 and engaged in a second MI session. At the same time points as the MI arm (i.e., weeks one and 10 of TEENS), participants in the control condition viewed 30-minute health education videos about healthy eating and physical activity, proctored by the MI interventionists.

All MI sessions were audio recorded for adherence to MI using the MITI 3.0 by trained independent raters with satisfactory interrater reliabilities and intraclass correlations $\geq .80$ (Bean et al., 2011a). Ratings suggested that fidelity to MI was maintained throughout the trial (Bean et al., 2011a). Main findings from *MI Values* were that participants in the MI treatment arm had greater three-month adherence overall (89.2 % vs. 81.0 %, $p = 0.04$), and greater specific adherence to dietitian (91.3 % vs. 84.0%, $p = 0.046$) and behavioral support (92.9% vs. 85.2%, $p = 0.041$) visits. In addition, MI participants had greater overall six-month adherence (84.4 % vs. 76.2% $p = 0.026$) and greater adherence to behavioral support visits at 6 months (87.5% vs 78.8%, $p = 0.011$). As the MITI only coded clinician behaviors, it is unclear which elements of MI explain the improved treatment outcomes. The current study extended these findings by examining further the mechanisms of action in MI, via exploration of both clinician and patient behaviors.

The Current Study

Participants. For the current investigation, only African American female participants who were randomized to the MI treatment condition and completed session 1 of *MI Values* ($N = 30$) were included to enhance understanding of the application of MI to this specific high risk population. Indeed, the CDC reported that African American females have the highest rates of obesity compared with all other ethnic and racial groups in the US (2013). Further, this sample size is comparable to those examining the relation between clinician language, patient language, and outcomes in other populations (Carcone et al., 2013; Moyers et al., 2007b). The final sample was comprised of 30 African American female participants. Participants' mean age at baseline was 13.82 ($SD = 1.85$). Mean BMI was 36.88 kg/m² ($SD = 6.09$). See Table 1. Although session 2 audio recordings are available for some participants, only session 1 was transcribed as there is sufficient previous research to indicate that a single session of MI is effective for promoting behavior change (McCambridge & Strang, 2004). In addition, there were no dose effects in *MI Values* (Bean et al. 2014b). Specifically, participants that received two sessions of MI did not differ on outcomes from those that completed one session of MI.

Table 1.

Demographic characteristics of Current Study Participants and MI Values Study Participants.

| | Current Study Participants (N=30) | MI Values (N=58) | P |
|----------------|-----------------------------------|------------------|--------|
| Female (%) | 100% | 75.90% | 0.00** |
| Race | | | 0.00** |
| Black | 100% | 75.40% | |
| White | | 19.30% | |
| Other | | 5.30% | |
| BMI percentile | 98.88 (1.01) | 98.9(1.0) | 0.54 |
| BMI z-score | 2.38 (.28) | 2.4(0.3) | 0.25 |

| | | | |
|------------------------------|------------|-----------|-------|
| Age | 13.8 (1.8) | 13.6(1.8) | 0.69 |
| Parent Education | | | 0.03* |
| High School graduate or less | 20 | 19.6 | |
| Some College | 56.7 | 43.1 | |
| College degree or beyond | 20 | 37.3 | |
| Family income | | | 0.01* |
| < \$40,000 | 72.4 | 56 | |
| > 40,000 | 27.6 | 44 | |

* $p < .05$; ** $p < .01$; Note: BMI, body mass index

Procedure.

Trained raters coded audio recorded motivational interviews using the MISC 2.5 (Houck, Moyers, Miller, Glynn, & Hallgren, 2010).

Rater Training. Two doctoral students trained a team of six undergraduate raters on the MISC 2.5, under the supervision of Dr. Bean, a member of MINT. Raters were introduced to the principles of MI, specifically how to recognize different categories of clinician and patient language. Raters then practiced coding all possible types of speech included in the MISC 2.5 until correct identification of each independent code was demonstrated. Next, raters transcribed practice MI audiotapes according to the protocol set forth in the MISC 2.5. Raters practiced first coding with gold standard transcripts available from motivationalinterviewing.org. Then raters practiced with transcripts and audio from participants in the *MI Values* study over a period of four months, for a total of ~ 60 hours of training. None of the sessions from the current study (African American female participants) were used for training purposes. Raters independently conducted practice ratings and also participated in weekly group coding of sessions, with any coding disagreements resolved by a supervisor and discussed among the team. Practice sessions

were rated until interrater reliabilities (assessed via intraclass correlations [ICC]) met or exceeded .60 (Cicchetti, 1994). Intraclass correlations (e.g., $ICC = 0.6-1.0$) were calculated to determine reliability for each collapsed category. When ICCs were .6 or above coding of final study sessions commenced (Shrout & Fleiss, 1979).

Session Rating Protocol. After an acceptable level of reliability was reached, raters coded the 30 MI audiotapes for the current study. To ensure reliability during the final coding, twenty percent of sessions were randomly selected and double coded. As in training, weekly group coding meetings were held to reduce rater drift (Cicchetti, 1994). ICC's remained excellent: $\geq .70$ for all categories.

CASAA Application for Coding Treatment Interactions (CACTI). CACTI is a free open source software developed to facilitate the parsing and sequential coding of process content from therapeutic interactions (Glynn, Hallgren, Houck, & Moyers, 2012). This software enables audio recorded sessions to be parsed into utterances and coded reliably by human raters without the use of a transcript (Glynn et al., 2012). CACTI output is also in a format which can be input into sequential coding software such as the Generalized Sequential Querier (GSEQ) (Bakeman & Quera, 1995). CACTI was specifically developed in conjunction with the MISC 2.5 system, so its default settings are designed to be seamlessly integrated with the specific codes provided by the MISC 2.5. In the current study, 30 audiorecorded sessions with female AA participants were transcribed and coded using the MISC 2.5 in conjunction with the CACTI software. Following D'Amico and colleagues' recommendations, transcripts were made and referred to in the case of difficult audio or unclear utterances (2015).

Measures.

Motivational Interviewing Skills Code (MISC) 2.5. The MISC 2.5 (Houck et al., 2010) combines aspects of two existing coding systems: the MISC 2.1 (Miller et al., 2003a) and the Motivational Interviewing Sequential Code for Observing Process Exchanges (MI SCOPE) (Martin et al., 2005). The MISC 2.5 was created to enhance understanding of the mechanisms of MI through a sequential coding process of both patient and clinician utterances. Coding is conducted in a series of three separate coding passes. In the first pass, the coder listens to the MI session in its entirety without pausing the recording and records global ratings of the clinician on six dimensions: acceptance, empathy, direction, autonomy support, collaboration, and evocation. In addition, there is a global patient rating of self-exploration. See Table 2 for a list of global codes plus their descriptions. The second pass of coding parses the interview utterances, or complete fragments of thought. In this process, each utterance is separated from the previous one so that individual utterances can be assigned the appropriate behavioral code (e.g., a reflection vs. a question). Following parsing of the interview, the coder conducts a third pass in which individual utterances of both the patient and clinician are assigned behavioral codes. During the coding process, the audio clip may be paused as many times as is necessary to determine appropriate categorization of each utterance (Houck et al., 2010).

Patient language is coded in three broad and mutually exclusive categories (e.g., follow/neutral/ask, change talk, and counter change talk). See Table 3. Each of these broad categories is further delineated into more specific categories of behavior such as types of change talk (e.g., desire, ability, reason, need, taking steps, and commitment language). See Table 4. MISC 2.5 provides 17 possible categories for clinician language (open questions, neutral simple reflections, positive simple reflections, ambivalent simple reflections, neutral complex reflections, positive complex reflections, ambivalent complex reflections, advise with

permission, affirm, emphasize control, raise concern with permission, reframe, and support). See Table 5 for descriptions of all clinician behavior codes. Clinician language is also collapsed into broad categories (e.g. MI consistent responses, MI inconsistent, and other). See Table 6.

Table 2.

Clinician and Client Global Codes as defined by the MISC 2.5.

| Global Codes | Definition |
|---------------------|--|
| Acceptance | The degree to which the clinician communicates "unconditional positive regard". |
| Empathy | The degree to which the clinician demonstrates accurate understanding of the client's perspective. |
| Direction | The clinician's ability to keep the client focused on language related to the target behavior change. |
| Autonomy Support | Clinician language explicitly emphasizes that the client has the power to change or not change. |
| Collaboration | Clinician works together with client to examine possibilities for change. |
| Evocation | Clinician elicits deeper thought and exploration from the client. |
| Self-Exploration | Client's high point of personal reflection on changing behavior as it relates to personal circumstances. |

Note: MISC 2.5 = Motivational Interviewing Skills Codes 2.5

Table 3.

Specific categories that Comprise Study Variables of Client Language

| Change Talk (CT) | Counter Change Talk (CCT) |
|------------------|---------------------------|
| Desire+ | Desire- |
| Ability+ | Ability- |
| Reasons+ | Reasons- |
| Need+ | Need- |
| Commitment+ | Commitment- |

Taking Steps+

Taking Steps-

Other+

Other-

Table 4.

Client Behavior Codes, Definitions, and Examples as assessed by the MISC 2.5.

| Participant Behavior Code | Definition | Example |
|----------------------------------|--|--|
| Desire+ | Identifies a longing for behavior change. | "I want to stop drinking juice. " |
| Ability+ | Expresses confidence that behavior change is possible. | "I know I can eat better at school. " |
| Reasons+ | Identifies a motivating factors for change. | " If I don't lose some weight I might end up in the hospital" |
| Need+ | Expresses the necessity for change. | " I have to eat more fruits and vegetables" |
| Commitment+ | Explicit expression of intention to change. | " I am going to exercise for at least 30 minutes every day next week." |
| Taking Steps+ | Refers to recent changes the client has already made. | " Last week I ate less candy every day." |
| Other+ | Related to change, but is hypothetical or unrealistic. | " If all the fast food disappeared, I would eat better." |
| Desire- | Identifies a longing to maintain the current behavior. | " I love sweets." |
| Ability- | Expresses barriers that will make change impossible. | " My dad always brings soda home and that makes it hard." |
| Reasons- | Identifies a motivating factors for keeping behavior the same. | " My sister eats fried food all the time, it's normal." |
| Need- | Expresses the necessity for maintaining current behavior. | " I have to get fast food with my friends after school." |
| Commitment- | Explicit expression of intent to maintain the status quo. | "I am going to keep drinking as much juice as I want." |

| | | |
|--------------------|---|---|
| Taking Steps- | Refers to recent behavior that is in the direction away from change. | " I got a third helping of food at dinner yesterday." |
| Other- | Minimization of the problem, or expression of how changing is negative. | "My weight isn't really a problem." |
| Follow/Neutral/Ask | Responses that are not related to the target behavior change or are history or reporting information. | " I've always been big." (history) |

Note: MISC 2.5 = Motivational Interviewing Skills Codes 2.5

Table 5.

Clinician Behavior Codes and Definitions as assessed by the MISC 2.5

| Clinician Behavior Code | Definition |
|--------------------------------|---|
| Advise with Permission | Statements that offer advice, suggestions, or possible solutions in a way that allows client to "opt out". |
| Advise without Permission | Statements that offer advice, suggestions, or possible solutions in a way that allows client to "opt out". |
| Affirm | Statements that are positive or complimentary (can be expressed as appreciation, confidence, or reinforcement of achievements). |
| Confront | Responses that have a "negative parent quality" and may correct, shame, criticize or judge. |
| Direct | Statements that give an order, command, or direction. |
| Emphasize Control | Emphasizes client's power to choose, autonomy, and personal responsibility. |
| Facilitate | Acknowledgements for the client to continue speaking. |
| Filler | Pleasantries and other responses that do not better fit any other category. |
| Giving Information | Education, information, explanations, or feedback about a particular topic. |

| | |
|----------------------------------|---|
| Closed Questions | Questions that require yes/no responses or discrete pieces of information (frequency of a behavior, age). |
| Open Questions | Questions that provide the possibility for the client to expound in their response. |
| Simple Reflections 0 | Neutral statements that restate client language. |
| Simple Reflections + | Statements that restate client language that favors change. |
| Simple Reflections - | Statements that restate client language against change. |
| Complex Reflections 0 | Neutral statements that restate client language and add additional depth, meaning, or emotion. |
| Complex Reflections + | Statements that restate client language that favors change, and add additional depth, meaning, or emotion. |
| Complex Reflections - | Statements that restate client language against change and add additional depth, meaning, or emotion. |
| Simple Reflections ± | Statements that restate client language that is both towards and away from change. |
| Complex Reflections ± | Statements that restate client language that is both towards and away from change and add additional depth, meaning, or emotion. |
| Reframe | Statements that interpret and client utterance and provide a new meaning. |
| Raise Concern with Permission | Statements or questions that express the clinician's concern about a possible problem with the client's plan or goal, and has a tentative clause. |
| Raise Concern without Permission | Statements or questions that express the clinician's concern about a possible problem with the client's plan or goal. |
| Support | Statements that offer sympathy, compassion, or understanding to the client. |
| Structure | Statements that give information specific to the context of the study. |
| Warn | Statements that threaten by overemphasizing negative consequences. |

Note: MISC 2.5 = Motivational Interviewing Skills Codes 2.5

Table 6.

Specific Codes that Comprise Study Variables of Clinician Language.

| MI consistent (MICO) | MI Inconsistent (MIIN) | Other |
|-------------------------------|----------------------------------|--------------------|
| Advise with Permission | Advise without Permission | Facilitate |
| Affirm | Confront | Filler |
| Open Questions | Closed Questions | Giving Information |
| Emphasize Control | Direct | Structure |
| Simple Reflections 0 | Simple Reflections - | |
| Simple Reflections + | Complex Reflections - | |
| Simple Reflections ± | Warn | |
| Complex Reflections 0 | Raise Concern without Permission | |
| Complex Reflections + | | |
| Complex Reflections ± | | |
| Support | | |
| Reframe | | |
| Raise Concern with Permission | | |

Treatment Adherence. Percent attendance at TEENS study sessions (session attendance/ total possible session) was examined for behavior support sessions, dietitian sessions, and gym sessions. Overall adherence (% adherence to all TEENS sessions) was also examined.

Fruit and vegetable intake was measured based on 24-hour dietary recalls, that were conducted in person with adolescents and their parents. Intake of fruit and vegetables was combined and reflected an average of intake across 2 days. Total kilocalories were also assessed based on the food recall activity (Bean et al. 2011b).

Physical activity was assessed with a 7-day physical activity recall instrument which was conducted by study interventionists.

Body Mass Index was calculated using the Epi Info software program (CDC, Version 3.3). Weight was determined with the use of an electric scale, and participants wore light clothing and removed shoes.

Data Analyses

Data analyses were performed using SPSS version 23. Descriptive statistics were calculated to examine frequencies, means, and standard deviations and to check for normality of data to ensure that assumptions of statistical tests were met. Pearson's and point-biserial correlations were performed to analyze relations between specific elements of clinician behavior, participant speech, and treatment adherence outcomes. In regression analyses, age, baseline BMI, and family income were statistically controlled if analysis of first-order correlations suggested that the construct was significantly associated with the outcomes of interest. Power analyses determined that a power level of .82 was expected, which assumed a sample size of 30 sessions, an effect size of $f^2 = .15$, a two tailed test, and an alpha = .05.

In order to examine study outcomes, individual codes were collapsed into categories (MI consistent, MI inconsistent, change talk, counter change talk, percent change talk and percent counter change talk) consistent with the MISC 2.5 manual and previous literature (Glynn & Moyers, 2010; Moyers et al., 2007b; Pirlott et al., 2012). Clinician language was collapsed into the following categories: MI Consistent Language (MICO) and MI Inconsistent Language (MIIN). See Table 6. Client language was collapsed into frequency variables of change talk (CT) and counter change talk (CCT). See Table 5. Client language was also examined as percent scores: percent counter change talk (PCT) and percent counter change talk (PCCT) as indicated

in the MISC 2.5 manual (Houck et al., 2010). Percentage scores were calculated as follows: PCT (i.e., $CT / [CT + CCT]$) and PCCT (i.e., $CCT / [CT + CCT]$). Percentage scores represent a ratio of CT to CCT.

The first and second research aims, which examined the relations among clinician language (MI consistent or MI inconsistent), participant language (change talk or counter change talk), and treatment adherence, were assessed using four separate mediation models (Holmbeck, 1997; Preacher & Hayes, 2004). In model one (Figure 1), MI consistent language was the independent variable, change talk was the mediator, and three-month treatment adherence was the outcome. In model two (Figure 1) MI inconsistent language was the independent variable, counter change talk was the mediator, three-month treatment adherence was the outcome. Relations between: clinician language and participant language (path a), participant language and treatment outcome (path b), and clinician language and treatment adherence (path c) were examined.

In model three (Figure 2), the relational hypothesis of MI was tested using MI Spirit as the independent variable, change talk as the mediator, and three-month treatment adherence as the outcome. In model four (Figure 2) MI Spirit was the independent variable, counter change talk was the mediator, and three-month treatment adherence as the outcome. Relations between: clinician MI Spirit and participant language (change talk or counter change talk, path a), participant language and treatment outcome (path b), and clinician language and treatment adherence (path c) were examined.

To assess whether specific categories of change talk were associated with better treatment adherence (Aim 1a), a simultaneous multiple regression analysis was conducted, in which ability, reasons, taking steps and commitment language were entered as continuous predictor

variables and treatment adherence at three months (% overall adherence at behavior, gym, and nutrition sessions) was the outcome. Lastly, exploratory analyses were conducted to gain greater understanding into the mechanism of change in the relation between clinician and participant behaviors and treatment adherence in MI.

Posthoc Analyses. Exploratory analyses were conducted to further examine the relation between specific clinician and participant language and treatment adherence. Regression analyses were conducted examining the relation between PCT and PCCT and three-month overall treatment adherence. PCT and PCCT were also examined in relation to specific components of adherence: weeks participating at three months, three-month adherence with behavior sessions, and three-month gym adherence. Regression analyses were also conducted to examine which specific categories of CT and CCT were related to three-month overall treatment adherence. Further regression analyses examined individual categories of clinician language as it related to client language. Regression analyses were conducted to examine the following outcomes: BMI z score, total physical activity, fruit and vegetable intake, and total kilocalories, while controlling for baseline characteristics. Lastly, the client global code of self-exploration was examined in relation to clinician MI spirit and client CT.

Results

Descriptive Analyses

Skewness and kurtosis values varied widely for individual clinician codes throughout the sample, which was expected, as the occurrence of all behaviors are not equally distributed throughout the sample. Consistent with previous research (Moyers et al., 2007b) data were not transformed because the distribution of data was accurate based on clinician MI adherence. This

finding was expected because the MISC 2.5 is a detailed coding system which includes 25 possible clinician codes (see Table 5), and not all behaviors occurred across sessions. In particular, interventionists were mostly MI adherent, thus codes that were non adherent either occurred infrequently (in less than 20 % of sessions overall) or not at all. Codes that either did not occur or occurred too infrequently were excluded from analyses of discrete codes. Pearson's correlations revealed significant associations between several aspects of participant and clinician language. See Table 7.

Client change talk and counter change talk frequency. Descriptive statistics for the categories of participant change talk (CT) and counter change talk (CCT) revealed that certain types of CT were more common than others (see Table 8). Participants most frequently expressed the following categories of CT: Reason ($M = 21.27$, $SD = 8.24$), Other ($M = 9.4$, $SD = 10$), Ability ($M = 8.54$, $SD = 6.31$), and Commitment ($M = 8.97$, $SD = 6.42$). Categories of CCT most frequently expressed were Reason- ($M = 4.67$, $SD = 3.52$), Ability- ($M = 3.38$, $SD = 2.33$), Other- ($M = 3.38$, $SD = 3.75$), and Desire- ($M = 3.19$, $SD = 3.27$).

Clinician MI consistent and MI inconsistent language frequency. Descriptive statistics for the categories of clinician MI consistent (MICO) and MI inconsistent (MIIN) language revealed a higher prevalence of certain categories of language compared with others (see Table 3). Clinicians most frequently expressed the following categories of MICO: open questions ($M = 59.83$, $SD = 17.35$), positive complex reflections ($M = 23.65$, $SD = 14.45$), positive simple reflections ($M = 22.56$, $SD = 13.31$), and neutral simple reflections ($M = 20.85$, $SD = 11.38$). The most frequent categories of MIIN were as follows: negative simple reflections ($M = 7.50$, $SD = 6.65$), closed questions ($M = 7.10$, $SD = 4.71$), and negative complex reflections ($M = 4.09$, $SD = 4.52$).

Table 7.

Bivariate Correlations between MI Consistent Clinician (MICO) Language and Participant Change Talk (CT) as Assessed by the MISC 2.5

| Clinician Utterances | Participant Utterances | | | | | | |
|-----------------------|------------------------|----------|----------|-------|-------------|---------------|--------|
| | Desire+ | Ability+ | Reasons+ | Need+ | Commitment+ | Taking Steps+ | Other+ |
| Advise w/ Permission | -.326 | -.427 | .018 | -.495 | .075 | -.303 | -.112 |
| Affirm | -.044 | -.196 | .178 | -.239 | .208 | .164 | -.083 |
| Emphasize Control | .042 | .291 | .026 | .196 | .197 | .434 | .579** |
| Facilitate | .255 | .146 | -.091 | .356 | .312 | .696** | .749** |
| Filler | -.180 | .106 | -.082 | -.083 | -.218 | .025 | .168 |
| Open Questions | -.073 | -.050 | .005 | -.403 | .121 | -.378 | -.151 |
| Simple Reflections 0 | .145 | .274 | .118 | .248 | -.090 | -.160 | -.176 |
| Simple Reflections + | .245 | .155 | .154 | .290 | .007 | -.203 | -.031 |
| Simple Reflections ± | .492 | -.087 | .045 | .246 | .442 | -.366 | -.220 |
| Complex Reflections 0 | .003 | -.095 | .260 | .098 | .379 | .454 | .651** |
| Complex Reflections + | -.103 | -.225 | .454* | -.177 | .523** | -.099 | .429* |
| Complex Reflections ± | .713 | -.037 | .458 | -.162 | -.384 | -.366 | -.220 |
| Reframe | .074 | -.286 | -.154 | .233 | -.316 | -.354 | -.156 |
| Support | -.073 | -.135 | .654** | -.052 | -.330 | -.009 | .263 |

* $p < .05$; ** $p < .01$; Note: MISC = Motivational Interviewing Skills Code 2.5

Table 8.

Average Number of Occurrences of Change Talk (CT) and Counter Change Talk (CCT)

Statements Spoken by Participants ($N = 30$)

| | Minimum | Maximum | Mean | SD |
|----------|---------|---------|------|------|
| Desire+ | 1 | 11 | 3.81 | 2.84 |
| Ability+ | 2 | 29 | 8.54 | 6.31 |

| | | | | |
|---------------|---|----|-------|-------|
| Reasons+ | 5 | 44 | 21.27 | 8.24 |
| Need+ | 1 | 9 | 2.65 | 2.5 |
| Commitment+ | 1 | 26 | 8.97 | 6.42 |
| Taking Steps+ | 1 | 25 | 5.11 | 5.53 |
| Other+ | 1 | 44 | 9.4 | 10.07 |
| Desire- | 1 | 13 | 3.19 | 3.27 |
| Ability- | 1 | 11 | 3.38 | 2.33 |
| Reasons- | 1 | 13 | 4.67 | 3.52 |
| Need- | 1 | 1 | 1 | . |
| Commitment- | 1 | 2 | 1.33 | 0.52 |
| Taking Steps- | 1 | 2 | 1.12 | 0.35 |
| Other- | 1 | 15 | 3.38 | 3.75 |

Table 9.

Average Number of MI Consistent (MICO) and MI Inconsistent (MIIN) Statements Spoken by Clinicians

| | Minimum | Maximum | Mean | SD |
|---------------------------|---------|---------|-------|-------|
| Advise with Permission | 0 | 4 | 2 | 1.07 |
| Advise without Permission | 0 | 3 | 1.78 | 0.83 |
| Affirm | 0 | 16 | 9.31 | 3.63 |
| Confront | 0 | 4 | 2.00 | 1.73 |
| Direct | 0 | 7 | 2.75 | 1.84 |
| Emphasize Control | 0 | 6 | 2.68 | 1.55 |
| Facilitate | 0 | 37 | 10.14 | 9.93 |
| Filler | 0 | 16 | 2.91 | 3.31 |
| Giving Information | 0 | 20 | 6.14 | 5.50 |
| Closed Questions | 1 | 16 | 7.10 | 4.71 |
| Open Questions | 27 | 88 | 59.83 | 17.35 |
| Simple Reflections 0 | 0 | 41 | 20.85 | 11.38 |
| Simple Reflections + | 1 | 49 | 22.56 | 13.31 |

| | | | | |
|-----------------------|---|----|-------|-------|
| Simple Reflections - | 0 | 32 | 7.50 | 6.65 |
| Complex Reflections 0 | 0 | 42 | 12.15 | 12.22 |
| Complex Reflections + | 0 | 53 | 23.65 | 14.45 |
| Complex Reflections - | 0 | 21 | 4.09 | 4.52 |
| Simple Reflections ± | 0 | 9 | 2.17 | 2.36 |
| Complex Reflections ± | 0 | 3 | 1.67 | 0.86 |
| Reframe | 0 | 12 | 3.07 | 2.84 |
| Support | 0 | 8 | 3.14 | 1.9 |
| Structure | 1 | 39 | 14 | 8.64 |

Note: Warn, raise concern with permission, and raise concern without permission were excluded because they occurred too infrequently (< 20% of sessions) or not at all.

Technical hypothesis mediation models

Two mediation analyses were conducted to determine if patient language mediated the relation between clinician language and three-month treatment adherence (see Figures 3 and 4). First, the relation between clinician MI consistent language (MICO), CT, and three-month treatment adherence was examined. Results indicated MICO was not associated with three-month treatment adherence. However, in a second regression, MICO was related to CT, such that increased MICO was related to increased frequency of CT. When both MICO and CT were entered into a third regression, the relation between MICO and three-month treatment adherence was not significant, nor was the relation of CT to three-month adherence. See Figure 3.

The second analysis examined the relations among MI inconsistent language (MIIN), CCT, and three-month treatment adherence. In the first of these regressions, MIIN was not associated with three-month treatment adherence. In a second regression equation, MIIN was also unrelated to CCT. When both MIIN and CCT were entered into a third model, the relation between MIIN and three-month adherence was not significant. However, the relation between

CCT and three-month adherence was significant, such that increased CCT was associated with decreased three-month treatment adherence. When controlling for the effects of MIIN, CCT was a significant predictor of three-month treatment adherence. See Figure 4.

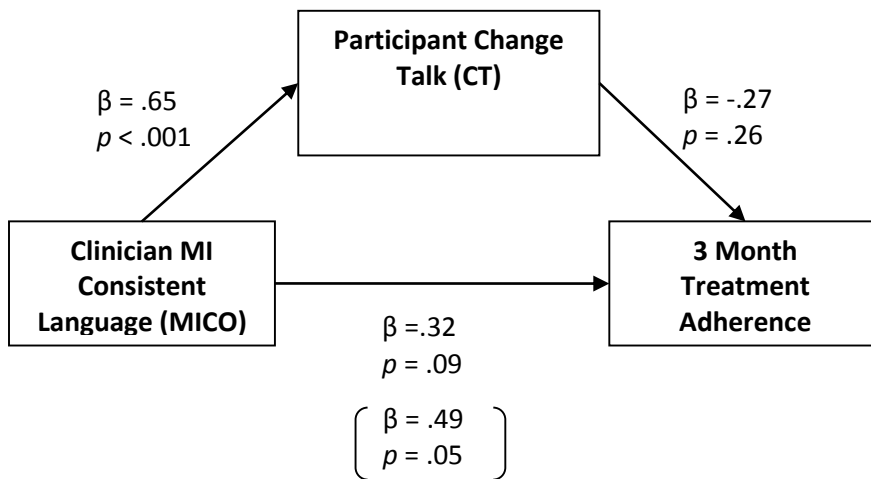


Figure 3. Mediation analysis for the technical hypothesis examining CT.

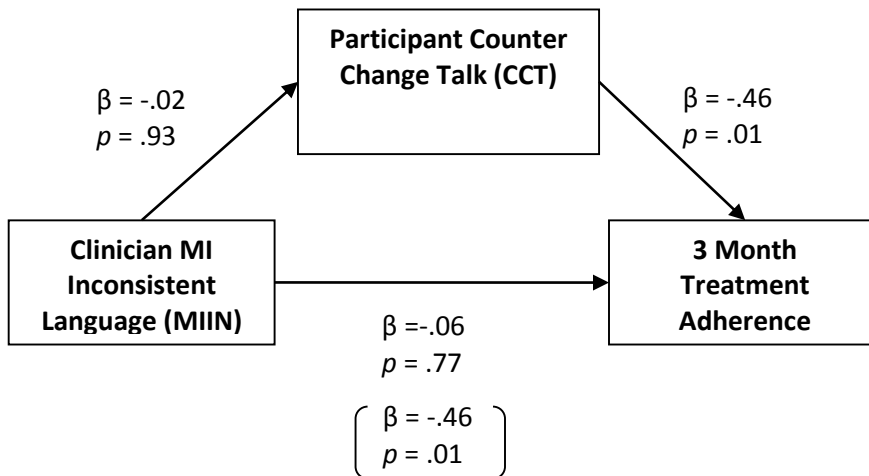


Figure 4. Mediation analysis for the technical hypothesis examining CCT.

Relational hypothesis mediation models

Two mediation analyses were conducted to determine if participant language mediated the relation between clinician MI Spirit (acceptance, empathy, autonomy support, collaboration, and evocation) and three-month treatment adherence (see Figures 5 and 6). In the first analysis, the relation between MI Spirit, CT, and three-month treatment adherence was examined. MI Spirit was not associated with three-month treatment adherence or to CT. When both MI Spirit and CT were entered into a third model, the relation between MI Spirit and three-month adherence was not significant, nor was the relation between CT and three-month treatment adherence. See Figure 5.

Next, the relations among MI Spirit, CCT, and three-month treatment adherence were examined. MI Spirit was not associated with either three-month treatment adherence. When both MI Spirit and CCT were entered into a third model, the relation between MI Spirit and three-month adherence was not significant. However, the relation between CCT and three-month treatment adherence was, such that greater CCT was associated with lower three-month treatment adherence. See Figure 6.

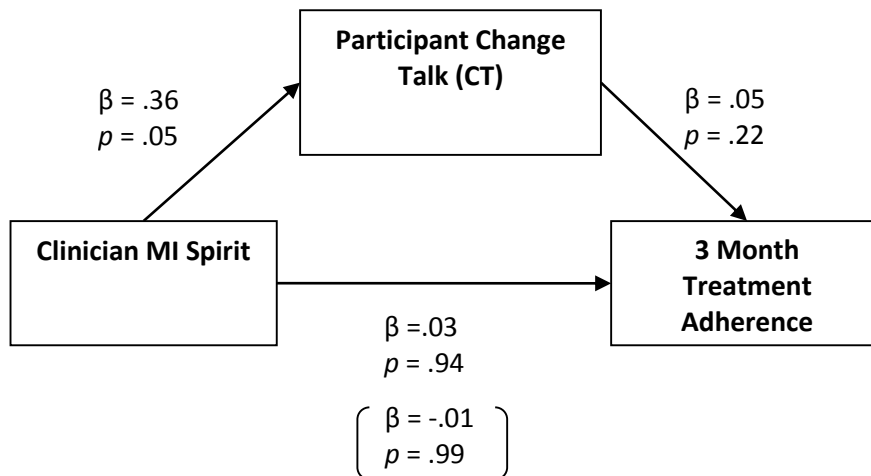


Figure 5. Mediation analysis for the relational hypothesis examining CT.

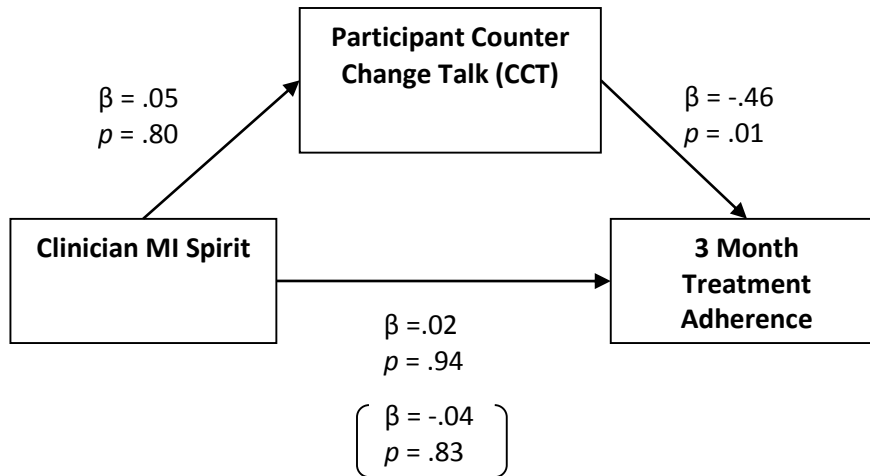


Figure 6. Mediation analysis for the relational hypothesis examining CCT.

Post Hoc Analyses

Technical hypothesis regression analyses. Regression analyses were conducted to examine the relation between the percent of change talk (PCT) and percent of counter change talk (PCCT) in relation to treatment adherence. A first regression analysis examined the relation between PCT and three-month treatment adherence, which was significant $\beta = .50$, $t(28) = 3.06$, $p = .01$, such that increased PCT was associated with greater treatment adherence. Individual regression analyses examined each component of treatment adherence separately. Specifically, increased PCT was associated with each individual component of treatment adherence: more weeks participating at three months $\beta = .48$, $t(28) = 2.90$, $p < .01$, increased three-month adherence with behavior sessions $\beta = .50$, $t(27) = 2.97$, $p = .01$, and increased three-month gym adherence $\beta = .45$, $t(27) = 2.59$, $p = .02$. Increased PCCT was associated with diminished three-month treatment adherence $\beta = -.50$, $t(28) = -3.06$, $p = .01$, such that greater PCCT was related to less three-month treatment adherence. Specifically, decreased PCCT was negatively associated with each individual component of treatment adherence: fewer weeks participating at

three months, $\beta = -.28$, $t(28) = -2.90$, $p < .01$, decreased increased three-month adherence with behavior sessions $\beta = -.49$, $t(27) = -2.97$, $p < .01$, $\beta = .45$, $p = .02$., and decreased three-month gym adherence $\beta = -.45$, $t(27) = -2.59$, $p = .02$.

Specific categories of CT and CCT were also examined in relation to three-month treatment adherence. A simultaneous multiple regression analysis examined which of the most frequently occurring categories of CT (reasons+, other+, ability+, and commitment language+) were associated with three-month adherence. The full model was not significant $F(4, 18) = .85$, $p = .51$, $R^2 = .02$. A simultaneous multiple regression analysis examined which of the most frequently occurring categories of CCT (reasons-, ability-, desire-, other -) were examined and the model was not significant $F(4, 2) = .28$, $p = .870$, $R^2 = .35$. Individual regressions examining participant ability-, $\beta = -.47$, $t(24) = -2.62$, $p = .02$, and taking steps- $\beta = -.76$, $t(6) = 8.53$, $p = .03$ were associated with three-month treatment adherence, such that more language about ability- and taking steps- was associated with less treatment adherence.

Relation between specific clinician language and patient language. A simultaneous multiple regression analysis examined which of the most frequently occurring categories of MICO (open questions, neutral simple reflections, positive simple reflections, neutral complex reflections, and positive complex reflections,) were associated with CT. To account for the inclusion of multiple simultaneous predictors, a Bonferroni correction was applied with the adjusted p value of $p < .01$. The overall model significantly predicted CT, $F(5, 20) = 7.03$, $p < .01$, $R^2 = .55$. Positive simple reflections $t(20) = 3.33$, $p < .01$ were significantly associated with CT. However, open questions $t(20) = -2.45$, $p = .02$, neutral simple reflections $t(20) = .33$, $p = .74$, neutral complex reflections $t(20) = 1.99$, $p = .06$, and positive complex reflections $t(20) =$

.243, $p = .02$ were not associated with CT. An individual regression found that the clinician variable emphasize control was significantly associated with CT, $\beta = .63$, $t(23) = 4.03$, $p < .001$.

CT and CCT and behavioral outcomes. A series of regression analyses examined the relation between CT and specific behavioral outcomes, while controlling for baseline level of behavior. A first regression found that while controlling for baseline fruit and vegetable intake, CT was associated with three-month fruit and vegetable intake $\beta = .51$, $t(28) = 3.76$, $p < .01$, such that greater change talk was associated with increased fruit and vegetable intake. However, CT was not associated with total kilocalories, $\beta = 8.31$, $t(16) = .923$, $p = .37$, minutes of physical activity, $\beta = .05$, $t(22) = .28$, $p = .78$, $\beta = -.01$, or BMI z-score $t(28) = -.13$, $p = .89$. A series of regression analyses found that CCT was not associated with BMI z score $\beta = -.03$, $t(19) = -.34$, $p = .74$, hours of physical activity at 3 months $\beta = -.13$, $t(23) = -.74$, $p = .46$, kilocalories $\beta = .21$, $t(28) = 1.23$, $p = .23$, or fruit and vegetable intake $\beta = .07$, $t(28) = .506$, $p = .61$.

Self-Exploration. A series of regressions examined the relation between self-exploration and patient outcomes. The first analysis found that self-exploration was significantly related to CT, $R^2 = .21$, $\beta = .48$, $t(28) = 2.91$, $p = .01$. To examine whether therapist language was associated with patient self-exploration, a regression analysis was conducted. Therapist MI Spirit was significantly related to self-exploration $R^2 = .51$; $\beta = .73$, $t(28) = 5.58$, $p < .001$. To examine which specific therapist language was related to self-exploration, a multiple regression was conducted in which the following therapist global codes were entered simultaneously: acceptance, empathy, autonomy support, collaboration, and evocation. To account for the inclusion of multiple simultaneous predictors, a Bonferroni correction was applied with the adjusted p value of $p < .01$. The overall model significantly predicted patient self-exploration $F(5, 24) = 9.62$, $p < .001$, $R^2 = .60$. and evocation $t(24) = 4.51$, $p < .001$ was significant related to

self- exploration. However, therapist acceptance $t(24) = 2.12, p = .04$, empathy $t(24) = -.39, p = .71$, autonomy support $t(24) = .49, p = .63$, and collaboration $t(24) = 4.51, p = .07$ were not independently related to self-exploration.

Discussion

Adolescent obesity is a significant and complex problem that has life threatening consequences which can endure well into adulthood. Interventions designed to address this pernicious problem are numerous, and use varied approaches (Kitzmann & Beech, 2011; McLean, Griffin, Toney, & Hardeman, 2003). Although several interventions have demonstrated the potential to be effective in addressing this very serious public health concern, low treatment adherence presents a significant barrier to intervention success (Vinkers, Adriaanse, & de Ridder, 2013). Especially among groups disproportionately affected by obesity, such as African American girls, suboptimal engagement and participant attrition remains a substantial obstacle which must be addressed (Skelton & Beech, 2011; Zeller et al., 2004). MI is one approach that has been found to increase treatment adherence in obesity interventions with adults and adolescents (Armstrong et al., 2011; Hettema, Steele, & Miller, 2005c; Lundahl et al., 2010) . However, little is understood about how MI works, especially within adolescents and minority populations. Therefore, the purpose of the current study was to explore the technical and relational hypotheses of MI in order to examine this treatment's active mechanisms of change. Specifically, patient and clinician language were examined in relation to three-month treatment adherence outcomes in a group of African American adolescent girls enrolled in a multidisciplinary obesity intervention. The current study found support for the technical hypothesis of MI.

Percent change talk (PCT), percent counter change talk (PCCT), and counter change talk (CCT) frequency were all associated with three-month treatment outcomes, such that greater PCT was related to better treatment adherence and greater PCCT and CCT frequency was associated with diminished treatment adherence. Although MICO was associated with higher frequencies of CT, only PCT was related to increased three-month treatment adherence. However, both frequency of CCT and PCCT were related to diminished treatment outcomes. When examined at the level of individual behaviors, clinician language that emphasized client control and reflected client change language was associated with increased frequency of CT. Also, specific categories of CCT, taking steps- and ability-, were associated with diminished treatment adherence. Further, increased frequency of CT was associated with increased fruit and vegetable intake. Lastly, increased client self-exploration was related to increased frequency of CT. These findings suggest that the technical aspects of MI are a useful way to facilitate client change language, and that expression of change language is related to treatment outcomes.

Technical hypothesis

Thirteen discrete MICO clinician behaviors were examined in this study (See Table 5). Overall, the full technical hypothesis, which asserts that behavioral outcomes are mediated by clinician language via patient language was not supported. Prior research on the technical hypothesis has produced mixed outcomes, and the literature examining adolescent populations is sparse (Davis et al., 2011; Resnicow, Taylor, Baskin, & McCarty, 2005). One reason that the outcomes are varied in the literature is that some studies have used frequency scores to measure patient and clinician language, while others have used percentage scores, and several have used both to explain different paths of the model (Glynn & Moyers, 2012; Moyers et al., 2007a; Pirlott et al., 2012). While frequency scores provide information about how much language

occurs, percentage scores provide information about how much certain language occurs in relation to other language. Frequency compared to percent is an important nuance because percentage scores tap into the construct of ambivalence, by examining which end of the spectrum language tends to fall on overall. The variation in measurement is largely due to the wide range of methods of examining language associated with the numerous coding systems (Glynn & Moyers, 2012; Martin et al., 2005; Miller, Moyers, Ernst, & Amrhein, 2003a; Moyers, Martin, Manuel, Miller, & Ernst, 2010). The current study found that the frequency of MICO was related to the frequency of CT, but the frequency of CT was not related to treatment outcomes. However, PCT was related to treatment outcomes.

In the current study, the frequency of MICO was associated with CT, but frequency of CT was not related to treatment adherence. In an early study of MI and substance use outcomes, frequency of resistance (language against change) was predictive of drinking outcomes, such that the more resistance they displayed, the more they drank, however no relation could be found between CT frequency and drinking outcomes (Miller et al., 1993). In a subsequent study, those same data were examined by breaking down categories of CT as well as investigating patterns of client speech over the course of the session. At the more nuanced level of analysis a relation was found between particular elements of CT, such as commitment language, and treatment outcomes (Amrhein, 1992). Further research has continued to demonstrate that the way that CT is operationalized will determine whether or not a relation between client speech and behavioral outcomes (Amrhein, 2003a; Hodgins et al., 2009). As such, one possible reason that the frequency of CT was not associated with outcomes in the current study is that the study design included open questions that specifically asked participants to state reasons for change. Reasons for and against change represented the most frequent categories of CT and CCT, so it was

unexpected that they were not associated with treatment outcomes. Although clinicians emphasized that the reasons should be personal, participants may have at times provided reasons that others (such as parents) had for their change. Thus, because of their developmental stage, the mere frequency of CT may not have been as meaningful as in adult populations. Because MI seeks to increase intrinsic motivation to change, it is critical that a person's reasons for change are his or her own (Miller & Rollnick, 2013).

However, the ratio of CT to CCT (PCT) was associated with adherence. This finding illuminates one of the central tenants of MI, which is that minimizing client ambivalence about change will result in increased change language, and thus more behavior change (Miller & Rollnick, 2002). This finding suggests that what may be most important is not simply eliciting a certain amount of CT, but actually tipping the scale in favor of CT relative to CCT. Although the full model was not significant, particular paths of the technical hypothesis were supported.

MICO and CT. One essential path in the technical hypothesis was supported in the current study; MICO was significantly associated with CT. This finding is consistent with previous research demonstrating that MICO clinician language is related to patient CT (D'Amico et al., 2015; Moyers & Martin, 2006; Moyers et al., 2007b; Vader et al., 2010). Furthermore, the current study extends prior investigations by examining specific categories of MICO in a sample of African American girls in the context of an obesity intervention. When examined at the level of individual clinician behaviors, the codes of positive simple reflections and emphasize control were associated with increased CT. This finding suggests that accurate restatements of patient language in the directions of change played a key role in eliciting CT. These results are consistent with those from a study with young adult males that were "at risk" drinkers, which also found that reflections were predictive of CT (Gaume, Bertholet, Faouzi, Gmel, & Daeppen,

2010a). Taken together, these results suggest that restatements of CT can both help the client to feel heard and reinforce the behaviors of change (Miller & Rose, 2009).

The current study also found that clinicians' emphasis on client control was related to CT. The code for emphasize control is defined as an incident in which the clinician “directly, acknowledges, honors, or emphasizes...freedom of choice, autonomy, and personal responsibility” (Houck et al., 2010). A recent study with African American adolescent boys also found that statements emphasizing autonomy were predictive of CT (Carcone et al., 2013). This finding also highlights the importance of deemphasizing the power differential typically present in most interactions between adolescents and adults (Tevyaw & Monti, 2004). This might have been especially salient within this sample of African- American female adolescents, because of the larger systems of injustice that can magnify the power differentials between them and their healthcare providers (Boulware, Cooper, Ratner, LaVeist, & Powe, 2003). This finding is further supported by the literature which suggests that, given adolescents' unique developmental stage, it might be especially appropriate to emphasize autonomy and choice (Tevyaw & Monti, 2004). Taken together, these findings suggest that clinicians using MI with this population should take special care to highlight their ability to choose what change they will engage in and to reflect patient language accurately, especially when it is in the direction of change.

Client language and treatment adherence. Another path in the technical hypothesis that was supported was the relation between client language (PCT and PCCT) and three-month treatment adherence. Specifically, PCT and PCCT were associated with three-month behavior compliance, three-month gym compliance, and weeks participating at three months, such that PCT was associated with improved adherence and PCCT was associated with diminished adherence. Previous literature has provided substantial findings that patient language predicts

behavior change across behavioral outcomes and populations (Baer, Beadnell, Garrett, Hartzler, Wells & Peterson, 2008; Gaume et al., 2010a; McCambridge & Strang, 2004; Moyers et al., 2007b). While this relation has been demonstrated many times, the current study extends these findings in a population that has not often studied, and does so in the context of a multifaceted obesity intervention (Christie & Channon, 2013). Furthermore, specific categories of client language were found to be particularly important in anticipating treatment outcomes. In particular, increased client language of ability and taking steps were associated with diminished treatment adherence. Previous research with adults has found that commitment language was predictive of behavior change over and above any other category of change talk (Miller & Rose, 2009). However, research with adolescent populations and substance use has shown that reasons+ and ability+ were predictive of behavior change, which indicates that different aspects of language may be important for adolescents (Baer et al., 2008). In the current study, language that focused on ability- was associated with outcomes, which is likely due to several barriers to change that were identified during interviews, such as lack of transportation to the gym and the difficulties of having continued access to high calorie food items in the home. Similarly, taking steps- was associated with treatment outcomes. Taking steps away from change might be especially significant in the context of an obesity intervention since participants were attempting to abstain from certain behaviors (i.e., consumption of sugary beverages) and well as commence other behaviors (i.e. physical activity). Thus, taking steps- could have included the refusal to engage in certain health related behaviors that would have contribute to treatment adherence (i.e., gym attendance).

In an exploratory aim which examined the relation between client language and specific behavioral outcomes, increased CT was associated with increased fruit and vegetable intake at

three months. This result is similar to that of another study, which found that African American adolescents that received MI in addition to a Social Cognitive intervention increased their fruit and vegetable intake (Wilson, Friend, Teasley, Green, Reaves, & Sica, 2002). Further, another previous study found that CT mediated the relation between MICO and fruit and vegetable intake (Pirlott et al., 2012). Taken together, these results suggest that increasing CT may be a powerful tool to increase healthy eating behaviors.

Relational Hypothesis

Clinician MI Spirit reflects an overall ability to be with a patient in a client-centered way, and is assessed with global codes that reflect the coder's overall impression of the session content. Overall, the full mediational model of the relational hypothesis was not supported in this study. In prior research, the relational hypothesis has not received as much attention as the technical model, and the few available studies have yielded mixed results (Gaume, Gmel, & Daeppen, 2008; Magill et al., 2010; Pirlott et al., 2012; Thrasher et al., 2006; Tollison et al., 2013).

The current study's results are consistent with previous literature which found no relation between MI spirit, empathy and treatment outcomes (Magill et al., 2010; Pirlott et al., 2012; Tollison et al., 2013). Previous research has suggested that some of the necessary components of behavioral weight loss interventions may be inherently at odds with the spirit of MI (Resnicow, Davis, & Rollnick, 2006). Additionally, the MISC 2.5 does not have a code specifically for MI Spirit, instead, MI Spirit is examined as a sum of the clinician global codes (see Table 2). Therefore, this variable may not have captured the same aspects of behavior as is defined by the MI Spirit variable in other studies.

Self-exploration. Although not a component of the relational hypothesis, results also indicated that clinicians' MI Spirit was associated with patients' self-exploration. The MISC 2.5 coding system defines self-exploration as the depth of introspection and intrapersonal exploration that the patient experiences at his/her "high point of self-exploration" in the session (Houck et al., 2010). The rating is not an average of behavior across the session, but rather a rating of the period of the session in which exploration occurs at its highest intensity. This finding is consistent with the idea that the client centered way of being, which is captured by MI Spirit, evokes a depth of contemplation in a patient (Romano & Peters, 2014). Specifically, the categories of acceptance and evocation significantly predicted patient CT. Acceptance in this context is defined primarily in terms of unconditional positive regard and respect for the patient (Romano & Peters, 2014). Especially for a group of adolescents experiencing obesity, acceptance is a powerful tool to elicit exploration, because of the social isolation and bullying that these adolescents face in multiple environments (Swallen, Reither, Haas, & Meier, 2005). Furthermore, self-exploration predicted patient CT. This finding is consistent with one of the theories underlying MI, self-perception theory, which asserts that individuals may gain awareness of incongruence within themselves by observing their own behavior (Cadler & Staw, 1975; Pirlott et al., 2012). In the current study, participants who had the most intense moments of insight might have had the opportunity to explore the discrepancy between their values and their current behaviors. Furthermore, that deep exploration, when connected with their personal experiences and reasons for change resulted in an increased amount of change talk.

In sum, the findings of the current study offer some important contributions to the literature about a population both at high risk for obesity, and of poor adherence to treatment. Moreover, this population has been typically understudied. As in prior literature, the current

study found support for the technical hypothesis of MI, indicating that MICO is associated with CT and that increased CT relative to CCT elicits better treatment outcomes.

Strengths and Limitations

The study adds to the extant literature on the burgeoning theory of MI, specifically by providing a detailed assessment of the factors influencing the relational and technical hypotheses. However, several limitations of the current investigation should be noted. One limitation is that the MI interventionists were typically MI consistent in their sessions. Thus, the relations between MIIN, CT and CCT were likely attenuated since the occurrence of MIIN was so infrequent. Furthermore, because weight loss is an outcome, rather than a behavior, participants focused on different health related behaviors across sessions, which does not allow for generalization about language related to one specific target behavior change. In addition, because the target of behavior change was not consistent across the sample (e.g. increasing physical activity, decreasing sugared beverage intake, increasing fruit or vegetable intake), compared with studies examining substance abuse, which makes it more difficult to generalize outside of the context of obesity interventions. Another limitation of the current study was the small sample size ($N = 30$); however, given the high number of utterances coded ($> 10,000$) power was exceptional. Further, the sample was composed entirely of African-American girls, which limits the generalizability of the findings to the broader population. This also represents a strength, however, in that the mechanisms of action in MI were examined within a traditionally underserved population, one that is at higher risk for obesity and its comorbidities (Kalinowski et al., 2012; Wang & Beydoun, 2007). Moreover, exploration of the mechanisms of action within MI have not been well examined in African American adolescents with obesity. Furthermore, there are conflicting data regarding which specific elements of change talk are most predictive of

actual change in adolescents. Thus, the current study contributes to this important area of research in which there is a relative paucity of literature and conflicting outcome data.

Future Directions

In the context of obesity interventions for adolescents, future research should consider the specific content of CT and CCT statements in order to gain greater insight into specific reasons change from the patient perspective. Especially for adolescents, the content may reveal important information that can inform obesity interventions that are tailored to meet the needs of the population. Furthermore, research examining patient language should pay special attention to both frequency counts as well as percentage scores. Likewise, sequential analyses should be conducted to examine the temporal relation between clinician language and patient language. Additionally, future research should examine further the role of patient autonomy support, since this variable seems to be of particular importance in adolescent samples. Qualitative interview data about patients' perception of autonomy as it relates to the therapeutic alliance and outcomes should inform training of MI interventionists working with adolescent populations.

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Vita

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