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Mechanisms of Motivational Interviewing in a Parent-focused Pediatric Obesity Intervention

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MECHANISMS OF MOTIVATIONAL INTERVIEWING IN A PARENT-FOCUSED PEDIATRIC OBESITY INTERVENTION

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at Virginia Commonwealth University

by

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Abstract

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Pediatric obesity is a major public health epidemic with serious physical and psychological consequences. Difficulty engaging families in treatment is a significant obstacle in addressing pediatric obesity, especially among underserved populations. Motivational interviewing (MI) is a collaborative, person-centered communication style that has been shown to reduce attrition, increase attendance, and improve patient treatment adherence; however, little is known about the process of MI and how it improves treatment engagement. This study examined clinician and parent language in a pre-treatment MI session that increased initial engagement in a parent-focused pediatric obesity intervention (N= 81). Results showed that increased parent change talk, and preparatory language in particular, was positively related to the likelihood of initial attendance at baseline. Additionally, certain types of MI consistent clinician strategies were positively associated with parent change talk. Complex positive reflections were correlated with preparatory language and overall change talk, suggesting this might be a particularly important

MI skill. Findings have implications for better understanding the process of MI and mechanisms through which MI can improve treatment engagement.

Mechanisms of Motivational Interviewing in a Parent-focused Pediatric Obesity Intervention

With approximately a third of U.S. children and adolescents overweight or obese, pediatric obesity is a major public health concern with serious physiological and psychological consequences (Ogden, Carroll, Kit, & Flegal, 2014). Children who are overweight or obese are at risk for significant problems including hypertension, type 2 diabetes, sleep apnea, depression, behavioral problems, and peer victimization (BeLue, Francis, & Colaco, 2009; Kiess et al.,2001; Young-Hyman et al., 2006). Pediatric obesity is likely to persist into adulthood, resulting in a lifetime of increased weight-related comorbidities and health care costs (Finkelstein, Graham, & Malhotra, 2014; Kiess et al., 2001). Given the multitude of enduring physiological and psychological problems, as well as the financial burden of obesity on the health care system, the current pediatric obesity epidemic necessitates effective prevention and treatment methods. Multidisciplinary lifestyle interventions have had some success in reducing pediatric obesity, however, results have been modest at best (Ho et al., 2012; McGovern et al., 2008; Peirson et al., 2015). Difficulty engaging parents and families is a major barrier to treatment effectiveness (Skelton & Beech, 2011). For a treatment to be considered effective, it must yield positive outcomes in "real world" clinical settings (Gartlehner, Hansen, Nissman, Lohr, & Carey, 2006). Treatment engagement broadly refers to patient participation in working toward treatment goals and includes both behavioral and attitudinal components (Staudt, 2007). Several terms are used interchangeably in the literature (e.g., adherence, compliance, participation; Littell, Alexander, & Reynolds, 2001). In pediatric obesity research, attrition and attendance are commonly used as simplistic ways to measure treatment engagement (Hampl, Paves, Laubscher, & Eneli, 2011;

Skelton & Beech, 2011). Indeed, attendance is arguably the most basic necessity for treatment delivery and subsequent effectiveness (Nock & Ferriter, 2005).

Unfortunately, high attrition and poor treatment attendance rates are common in pediatric obesity interventions (Grossi et al., 2006; Hampl et al., 2013; Hampl et al., 2011; Jeffery et al., 2000; Karlson & Rapoff, 2009; Skelton & Beech, 2011). Premature treatment dropout and poor treatment attendance decrease the cost-effectiveness of interventions and impede positive treatment outcomes (Hampl et al., 2013). If families do not participate or remain in treatment, an intervention is unlikely to demonstrate effectiveness (Skelton & Beech, 2011). These issues are especially problematic with underserved populations (ethnic/racial minority and lower socioeconomic status [SES] populations); importantly, these populations also experience the highest rates of obesity (Ogden et al., 2014). Understanding how to improve treatment engagement, particularly with underserved populations, is crucial to advancing the effectiveness of pediatric obesity interventions.

Research supports that interventions involving parents are the most effective in reducing body mass index (BMI) in children (Epstein, Paluch, Roemmich, & Beecher, 2007; Janicke et al., 2014). Given children's reliance on parents for many needs (e.g., transportation, food purchasing, access to activities), parents are instrumental in making changes to family eating and activity habits (Boutelle, Cafri, & Crow, 2011). Recent research supports that parent-focused pediatric obesity interventions (i.e., those that exclusively involve parents) are as, or more, effective in reducing a child's BMI than family-based programs (i.e., those that involve parents and children; Kitzmann, et al., 2010; Skelton & Beech, 2009; Golan, Kaufman, & Shahar, 2006). Additionally, findings suggest such programs are more cost-effective than family-based programs (Janicke et al., 2009; Skelton & Beech, 2009; Golan et al., 2006). As such, parents are

an important target of efforts to improve engagement and outcomes in pediatric obesity interventions.

Various strategies have been used to improve parental treatment engagement in pediatric obesity interventions with mixed success (e.g., use of incentives, making frequent contact, providing childcare, and offering interventions in an accessible location; Karlson & Rapoff, 2009; Nock & Ferriter, 2005; Skelton & Beech, 2011). Many of these strategies address known external barriers to participation; however, there are likely internal barriers to treatment engagement as well (e.g., ambivalence about participation). One promising method to improve parental treatment engagement that addresses parents' internal barriers is motivational interviewing (MI).

MI is a collaborative, person-centered communication style used to elicit and strengthen motivation for change (Miller & Rollnick, 2013). MI encourages patients to consider reasons for change that are consistent with their goals and values (e.g., love for family, health and spirituality) and highlights discrepancies between current health behaviors and self-identified goals and values. Specific strategies include using open-ended questions, affirmations, and complex reflections in a nonjudgmental and accepting manner. These strategies are used to elicit what is known as "change talk," patient language that explains why a patient desires change and how he or she will accomplish making changes. Clinicians are encouraged to reinforce change talk as opposed to "sustain talk," language that opposes change or favors the status quo. In doing so, the clinician aims to increase the patient's change talk and decrease the patient's sustain talk. Eliciting change talk is a hallmark of MI and facilitates the patient's motivation, autonomy, self-efficacy, and readiness to make behavioral changes (Miller & Rollnick, 2013).

Originally designed for use in the addiction treatment field, MI has been used to promote treatment engagement and behavior change in a wide array of adult and pediatric behavioral health contexts (Erickson, Gerstle, & Feldstein, 2005; Gayes & Steele, 2014; Hettema, Steele, & Miller, 2005; Martins & McNeil, 2009; Miller & Rollnick, 2013; Resnicow, Davis, & Rollnick, 2006; Taveras et al., 2011). MI delivered early in treatment has been shown to reduce attrition, increase attendance, improve adherence to treatment recommendations, and enhance outcomes in many areas of health (Hettema et al., 2005). It has also been recommended as a "prelude to treatment" to address ambivalence about beginning treatment (Brown & Miller, 1993). Although research is nascent with pediatric interventions, MI appears promising in addressing issues with treatment engagement such as treatment initiation, retention, and attendance (Bean et al., 2014b; Erickson et al., 2005; Resnicow et al., 2006; Schwartz et al., 2007).

As support for MI has expanded, there has been a growing interest in understanding the process of MI (Miller & Rose, 2009; Resnicow et al., 2006). Specifically, how and why does MI work? What clinician behaviors promote patient change and what processes within the patient lead to change (Doss, 2004; Weersing & Weisz, 2002)? No formal theory conceptualizes the mechanisms by which MI operates; however, two predominant explanations have been proposed: the "technical hypothesis" (the clinician's proficient use of MI strategies affects change) and the "relational hypothesis" (the clinician's empathy and embodiment of the "spirit of MI" affect change) (Arkowitz, Westra, Miller, & Rollnick, 2008; Miller & Rose, 2009). These hypotheses are not mutually exclusive or incompatible. Rather, a combination of technical and relational factors likely influence behavioral change, but the exact mechanisms of MI remain understudied and unclear (Miller & Rose, 2009).

More rigorous research is needed to understand how MI works and particularly how it can improve parental engagement in pediatric obesity interventions. Such research is needed given the high public health relevance of pediatric obesity, known problems with treatment engagement, and the key role of parental involvement in addressing pediatric obesity. Clarifying the process through which change occurs in MI could guide future intervention development and refine clinician training. For example, if specific clinician behaviors or techniques are more relevant than others to increasing treatment engagement and subsequent outcomes, it will be prudent to emphasize those when designing interventions and training clinicians (Miller & Rose, 2009).

To enhance understanding of how MI increases parental treatment engagement, this study examined parent and clinician language in one session of MI delivered prior to a parent-focused pediatric obesity intervention, NOURISH^{+} (*N*ourishing *O*ur *U*nderstanding of *R*ole-modeling to *I*ncrease *S*upport and *H*ealth). NOURISH^{+} was a randomized controlled, pediatric obesity intervention targeting parents of overweight and obese children ages 5-11 years (Bean, Wilson, Thornton, Kelly, & Mazzeo, 2012; Mazzeo et al., 2008; Mazzeo et al., 2012). NOURISH+MI was designed to investigate if implementing a brief MI "pre-treatment" would enhance treatment retention, attendance, and outcomes in this parent-focused pediatric obesity intervention (Bean et al., 2014a). Using the Motivational Interviewing Skills Code (MISC 2.5; Houck, Moyers, Miller, Glynn, & Hallgreen, 2010), this study examined the verbal exchanges between clinicians and parents to explore linguistic patterns of communication during one pre-treatment session of MI that increased treatment engagement.

Detailed coding of these encounters facilitated the investigation of several key questions. These included: is parent change talk related to treatment engagement? If so, are specific

categories of parent change talk more strongly related to treatment engagement than others? Also, how do the technical and relational hypotheses apply when MI is used with parents of overweight and obese children? That is, to what extent does the clinician's use of MI specific techniques affect change in parent change talk and subsequent treatment engagement compared to the clinician's empathy and embodiment of the "spirit of MI"? Finally, do certain types of clinician language (e.g., open-ended questions, reflections) elicit certain types of parent language (e.g., reasons for change, commitment to change)? As a secondary aim, this study will examine if parent change talk is related to clinical outcomes (e.g., child BMI percentile, dietary changes, and physical activity). Investigating these questions will help clarify mechanisms involved in MI that could improve parental treatment engagement in pediatric obesity interventions, inform intervention development, refine clinician training, and ultimately enhance clinical outcomes in an area of high public health significance.

Literature Review

Pediatric Obesity

Pediatric obesity is a serious U.S. public health concern. Currently nearly a third of U.S. children ages 2 to 19 years are affected by overweight or obesity, with highest prevalence among African-American and Latino youth and youth from lower SES backgrounds (Ogden et al., 2014). Overweight is commonly defined for children and adolescents as a BMI above at or above the 85th percentile, but below the 95th percentile of the Center for Disease Control and Prevention (CDC) sex-specific BMI-for-age growth charts from 2000; obesity is defined as a BMI at or above the 95th percentile (Kuczmarski et al., 2000). The American Heart Association (AHA; Go et al., 2013) estimates approximately 23.9 million children are overweight or obese in the U.S.

Children who are overweight and obese are at increased risk for heart disease, type 2 diabetes, liver disease, sleep apnea, and musculoskeletal problems (Kiess et al., 2001). Many of these conditions were once considered diseases of adulthood but now are presenting at ages younger than seen in previous generations. Further, unhealthy habits formed in childhood are likely to carry over into adulthood; a four year old child who is obese has a 20% chance of being obese as an adult and an adolescent with obesity has an 80% likelihood of being obese as an adult. As a result, these children might be part of the first generation to live sicker lives and die at younger ages than the generation before them (Olshansky et al., 2005).

Children who are overweight and obese are also at significant risk for comorbid mental health problems including depression, low self-esteem, body dissatisfaction, social marginalization, and peer victimization (BeLue et al., 2009; Young-Hyman et al., 2006). Given the prevalence and consequences of pediatric weight problems, reducing childhood obesity remains a top priority for prevention and intervention efforts.

Pediatric Obesity Interventions

A number of genetic, environmental, and behavioral factors contribute to "energy imbalance" and the development of obesity. Energy imbalance occurs when individuals consume more calories than what their bodies burn based on their growth, physical activity level, and body functioning (Hill, Wyatt, & Peters, 2012). Factors such as the abundance of hypercaloric convenience foods, screen time, and lack of safe play areas are widespread and have all contributed to the rise in obesity (Wang, Gortmaker, Sobol, & Kuntz, 2006). This leaves room for many different points of entry for intervention (e.g., treatments at the individual and family level, school-based treatments, or urban planning). Although an ideal approach to pediatric

obesity prevention and intervention has not been agreed upon, there are common key elements emphasized across programs (Ball et al., 2012).

One common key element of pediatric obesity interventions is the inclusion of parents in treatment. The most promising treatments have been family-based multidisciplinary lifestyle interventions that focus on behavioral modification (e.g., increased physical activity, improved dietary quality; Epstein et al., 2007; Ho et al., 2012; Janicke et al., 2014; McGovern et al., 2008; Peirson et al., 2015). Parents and the home environment are paramount to determining children's eating and exercise habits. Typically, parents determine the foods and activities available to children, especially when they are young. Thus, the inclusion of parents in treatment is integral. Family-based multidisciplinary lifestyle interventions have yielded moderate success in decreasing BMI in children and adolescents; however, families struggle with the demands of behavioral change, and attrition rates from interventions are high (Grossi et al., 2006; Jeffery et al., 2000; Karlson & Rapoff, 2009). Interventions that involve the whole family are also costly to implement, especially when underutilized (Skelton & Beech, 2011). In response, research attention has turned to parent-focused interventions as an alternative (Ewald et al., 2014).

Recent research has suggested that intervening exclusively with parents is as effective or more effective than family-based programs in reducing child BMI. Additionally, findings suggest they are more cost-effective than family-based programs (Ewald et al., 2014; Golan et al., 2006; Janicke et al., 2009; Kitzmann, et al., 2010). Focusing on parents empowers them as the agents of change responsible for influencing, modeling, and guiding healthy eating and exercise behaviors as a family. Targeting parents in pediatric obesity interventions has resulted in improved child weight outcomes, particularly when behavioral changes are expected of the parent as well (Golan et al., 2006). Unfortunately, research examining parent-focused pediatric

obesity interventions with more diverse populations has been limited (Ewald et al., 2014; Mazzeo, Gow, Stern, & Gerke, 2008). Research specific to developing and improving parent-focused pediatric obesity interventions with underserved populations is needed, especially given the higher burden of obesity in racially and ethnically diverse children (Ogden et al., 2014). Moreover, this population also demonstrates to greatest difficulties with retention and treatment engagement (Skelton & Beech, 2011).

Problems with Treatment Engagement

Although research on pediatric obesity intervention effectiveness has expanded in recent years, there has been much less attention paid to strategies that could improve treatment engagement. A recent review of attrition in pediatric weight management programs indicated dropout rates range from 27% to 73%, with the majority of programs reporting rates above 50% (Skelton & Beech, 2011). Problems with high attrition and low treatment attendance are of key relevance to optimizing pediatric obesity research and interventions. Challenges with attrition and attendance in clinical trials make it difficult to determine treatment effectiveness (Karlson & Rapoff, 2009; Skelton & Beech, 2009). Furthermore, programs are unlikely to be successful if families do not remain in or attend treatment. Indeed, research shows that attending a greater percentage of intervention sessions leads to better treatment outcomes (Zeller et al., 2004).

Treatment engagement is especially problematic with racial/ethnic minority and low-SES groups (Skelton & Beech, 2011; Zeller et al., 2004). Despite having the greatest need for intervention and the highest risk for attrition, there is little research on treatment engagement strategies specific to racial/ethnic minority and low-SES populations (Skelton & Beech, 2011). As such, research on improving treatment engagement in pediatric obesity interventions targeting underserved populations is sorely needed.

There are a number of reasons why it might be particularly difficult to engage parents from racial/ethnic minority and low-SES backgrounds. This population is known to have more external or physical barriers to treatment engagement (e.g., financial limitations, difficulty scheduling, lack of childcare, inconvenience of location; Skelton & Beech, 2011). Various strategies have been used to address these concerns with mixed success (e.g., use of incentives, making frequent contact, providing childcare, and offering interventions in an accessible location with easy parking; Karlson & Rapoff, 2009; Nock & Ferriter, 2005; Skelton & Beech, 2011). Additionally, efforts have been made to increase the cultural sensitivity of pediatric obesity interventions for racial/ethnicity minority and low-SES families (e.g., incorporating differences in body image ideals, acknowledging pragmatic challenges of single-parent households; Ammerman, Leung, & Cavallo, 2006). Yet, even when recommended strategies to reduce barriers to treatment and increase cultural sensitivity are followed, attrition and attendance remain problematic (Karlson & Rapoff, 2009; Mazzeo et al., 2008).

As such, it is highly likely that other barriers to change also exist, such as ambivalence about entering treatment or making behavioral changes. According to Miller and Rollnick (2013), ambivalence is a normal part of the road to change that involves simultaneously wanting to change and not wanting to change. One reason why parents might be ambivalent about engaging in a parent-focused pediatric obesity intervention is that parents of overweight and obese children are often overweight or obese themselves, especially if they come from racial/ethnic minority and low-SES backgrounds (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). As such, they might have their own ambivalence about making family-wide behavioral changes to eating and exercise habits. Few studies have examined predictors of attrition from pediatric obesity interventions; however, evidence supports that parent BMI and minority status

are both associated with attrition (Jelelian et al., 2008; Zeller et al., 2004). These findings point to the need for effective strategies to engage parents and address ambivalence, particularly with parents from underserved populations who are also overweight or obese. One promising approach that has demonstrated success in addressing ambivalence and increasing treatment engagement is motivational interviewing (MI; Hettema et al., 2005).

Motivational Interviewing

MI is a collaborative, goal-oriented communication style with particular emphasis on the language of change. MI is designed to strengthen patient motivation for change and commitment to a specific goal by eliciting and exploring the patient's own reasons for change within an atmosphere of acceptance and compassion (Miller & Rollnick, 2013). MI is both a style of being with patients ("spirit of MI") and a set of specific techniques (e.g., open-ended questions, highlighting discrepancies; Miller & Rollnick, 2013). Although MI was originally developed for use with substance abusing populations, it has subsequently been used to promote behavioral change across a variety of contexts and problem areas including smoking cessation, weight loss, and medication adherence (Erickson et al., 2005; Miller & Rollnick, 2013; Hettema et al., 2005; Martins & McNeil, 2009; Resnicow et al., 2006; Taveras et al., 2011).

MI differs from the traditional medical model of health care delivery in which the clinician is the "expert" and the patient is an inactive recipient of health information. The "spirit of MI" is rooted in Carl Roger's person-center therapy model that emphasizes self-actualization (Rogers, 1959). MI also emphasizes the use of a collaborative approach to facilitate change in attitudes and behaviors (Miller & Rollnick, 2013). Within this model, patients are the experts on their needs, desires, and reasons for changing or maintaining the status quo. Importantly, patients' ambivalence toward change is not viewed as "resistance" but rather a natural

occurrence. When patients discuss reasons why they do not wish to change or do not believe they are able to change, such language is known as "sustain talk." It is important for clinicians to "resist the righting reflex"—the tendency to want to correct, provide advice, or convince the patient to change in response to sustain talk. Instead, the clinician accepts ambivalence, and uses MI to guide the patient toward increased change talk. Theoretically, by focusing on the patient's change talk, rather than sustain talk, the clinician helps build motivation and self-efficacy (Miller & Rollnick, 2013).

The Process of Motivational Interviewing

There are four basic phases involved in delivering MI: engaging, focusing, evoking and planning (Miller & Rollnick, 2013). The engagement phase is used to build rapport with patients, better understand their perspectives, and provide empathic validation. In the focusing phase, the clinician guides patients in self-identifying a target behavior that they wish to change. During the evocation phase, the clinician facilitates patients' discussions of reasons for desired change, why change is important to them, and how making changes connects with their personal values and goals. The clinician also might highlight discrepancies between current behaviors and patients' self-identified goals and values. The final phase is planning, in which clinicians and patients discuss goals and plans for change based on patients' level of readiness. If appropriate, clinicians elicit ideas for initial steps patients can take toward change and highlight patient strengths. These phases are not all needed for a successful MI session to take place. Rather, clinicians move through these phases as appropriate on an individual basis (Miller & Rollnick, 2013).

Throughout these phases, the clinician uses various techniques to promote change talk, resolve ambivalence, provide accurate empathy, and support patients' self-efficacy. The clinician elicits change talk from patients through open-ended questioning, highlighting reasons for

change, affirmations and reinforcing change talk as it emerges. The acronym DARNCAT is commonly used to summarize different types of change talk: expressions of the patient's **D**esire for change, **A**bility to change, **R**easons for change, **N**eed for change, **C**ommitment to change, **A**ction to change, and **T**aking steps to change. The first four types (desire, ability, reasons, need) are known as "preparatory language" and thought to evoke increasingly strong "commitment language" (commitment, action, taking steps) (Miller & Rollnick, 2013). In turn, increasingly strong commitment language has been shown to promote subsequent behavioral change (Miller & Rose, 2009).

Specific MI strategies such as open-ended questions, affirmations, complex reflections, and summary statements can be used to elicit and reinforce change talk. Importance and confidence rulers can also be used to assess the strength of patients' desire for change and self-efficacy to change. When using this strategy, clinicians ask patients to rate on a scale of 1-10 how important it is to them to make the identified changes and how confident they are in their ability to do so. Then, clinicians ask patients why they are at the number they selected and not a lower number (providing an opportunity to affirm change talk). Clinicians might also ask patients to consider what it would take for them to be one point higher on the scale (providing an opportunity to evoke further change talk). These types of questions, known as scaling questions, facilitate an increased readiness to change (Miller & Rollnick, 2013).

The efficacy of MI has been supported across a wide range of adult and pediatric health behavioral contexts including medication adherence, weight loss, and smoking cessation (Erickson et al., 2005; Gayes & Steele, 2014; Miller & Rollnick, 2013; Hettema et al., 2005; Martins & McNeil, 2009; Resnicow et al., 2006; Taveras et al., 2011). Although many studies support the use of MI, there is variability in the size of effects across studies, even within the

same problem area (Hettema et al., 2015). Indeed, some studies have reported null findings (e.g., Kuchipudi, Hobein, Flickinger, & Iber, 1990; Miller, Yahne, & Tonigan, 2003b; Treasure et al., 1999). Even within well-controlled multi-site trials, MI has worked at some sites but not others (e.g., Ball et al., 2007). As such, there is an increased interest in conducting therapy process research to understand MI and factors influencing its efficacy and effectiveness (Miller & Rose, 2009).

Change Processes in MI

When MI was first conceived, it emerged from clinical practice rather than a specific theory. As such, the process through which MI facilitates change is not completely understood (Miller & Rose, 2009). Although research has generally offered empirical support for MI's effectiveness, it is unclear what it is about a clinician's behaviors, strategies, or style that explains the relation between MI delivery and treatment outcomes. Clarifying the mechanisms of action in MI would not only help optimize effectiveness of this approach, but also could be used to guide intervention development and clinician training (Moyers, Miller, & Hendrickson, 2005). For example, if specific MI consistent behaviors (e.g., clinician's accurate expression of empathy, use of open-ended questions) are more strongly related to behavior change than others, they might be important to emphasize when designing interventions or training clinicians.

Figure 1 provides a visual depiction of hypothesized relations among key process and outcome variables in MI. Since its inception, there have been two main hypothesized pathways through which MI is thought to promote behavioral change and research evidence supporting both (Miller & Rose, 2009). These pathways are referred to as the "technical hypothesis" and the "relational hypothesis." The "technical hypothesis" regards the clinician's proficient use of specific MI techniques as the means to promote patient change talk, decrease patient sustain talk,

and in turn, predict behavior change. The "relational hypothesis" posits that the clinician's style of being or "spirit of MI," as embodied by accurate empathy and positive regard, make it possible for patients to explore change and ultimately make behavioral changes (Miller, 1983; Miller & Rose, 2009). These hypotheses are not mutually exclusive and might in fact, be interrelated. It is likely that technical and relational factors both contribute to behavior change, but very little research has examined mechanisms of MI within pediatric obesity interventions.

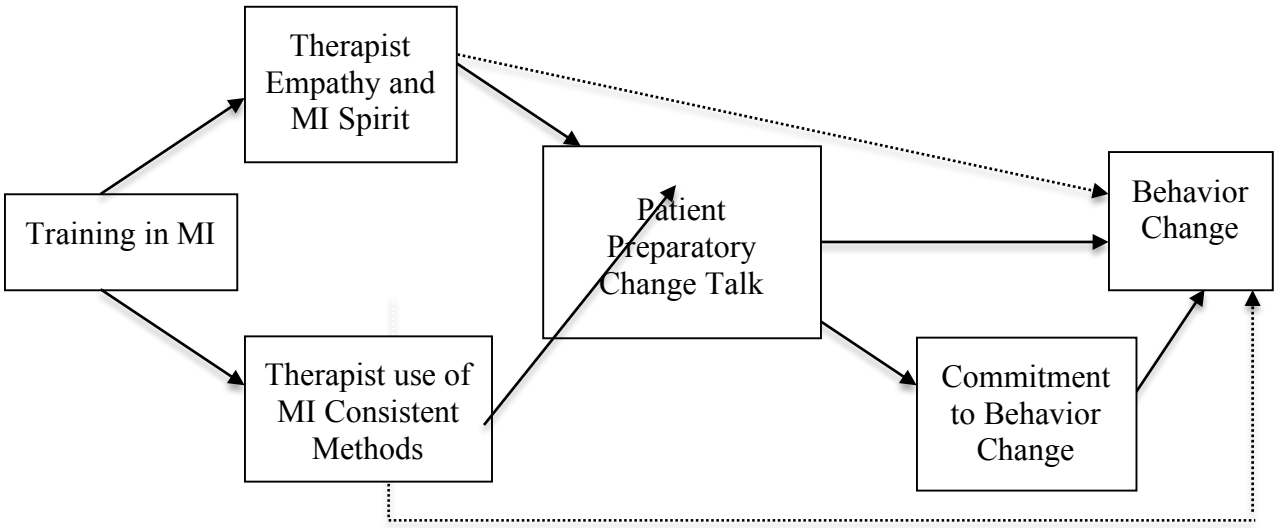

Figure 1. Hypothesized relations among process and outcome variables in MI

With both hypotheses, patient change talk is emphasized as a precursor to behavioral changes and an important mechanism involved in change. Indeed, numerous studies have demonstrated that eliciting change talk is directly linked to behavioral change (Miller & Rose, 2009). A guiding principle of MI is to have patients, rather than clinicians, make arguments for behavioral change. As Miller and Rose (2009), the importance of patient change talk is supported by research on implementation intentions (Gollwitzer, 1999; Gollwitzer & Schaal, 1998), self-perception theory (Bem, 1967; Bem, 1972), and cognitive dissonance (Festinger, 1957). Implementation intentions are if-then plans that specify how an individual will strive for a set goal (Gollwitzer, 1999; Gollwitzer & Schaal, 1998). Verbalizing implementation intentions, or

commitment and plans to change, is key in MI. According to self-perception theory (Bem, 1967; Bem, 1972), individuals believe more strongly in their own expressed arguments for change. Research on cognitive dissonance supports that individuals experience discomfort and attempt to resolve incongruence between beliefs and behaviors (Festinger, 1957). Rogerian theory supports the importance of the clinician fostering the "necessary and sufficient" interpersonal conditions to facilitate the patient exploring ambivalence (Rogers, 1959).

The practical implication is that MI operates in two stages. First, the clinician strengthens a patient's intrinsic motivation for change through evoking and reinforcing preparatory change talk (desire, ability, reasons, and need for change) and highlighting discrepancies between the patient's self-identified desires and current behaviors. Then, the clinician strengthens the patient's commitment to change through evoking and reinforcing commitment language (commitment, activation, and taking steps toward change). Through MI consistent strategies and the clinician's embodiment of the "spirit of MI," patient change talk, specifically commitment language, emerges throughout an MI session. As Miller and colleagues have pointed out (2009), patient change talk likely does not literally cause behavior change; "chanting aloud one hundred times, 'I will change, I will change'" does not make a person change. Rather, patient change talk likely represents an underlying mechanism of change, an attitudinal shift that results in increased commitment to change and subsequent behavioral change.

The technical hypothesis. The technical hypothesis focuses on the causal chain between specific types of clinician and patient language; MI-consistent clinician language (MICO; open-ended questions, developing discrepancies) is hypothesized to elicit patient change talk, which in turn predicts behavioral change. By contrast, MI inconsistent clinician language (MIIN) elicits sustain talk, and subsequent sustained behavior (D'Amico et al., 2015; Moyers & Martin, 2006;

Moyers et al., 2007b; Vader et al., 2010). The level of skill with which the clinician uses MI techniques and the sequence of verbal events are key variables in the technical hypothesis. For the technical hypothesis to be accurate, MICO clinician language must be related to patient change talk.

The relation between clinician techniques and patient change talk has been examined across many studies. Several review papers and a meta-analyses summarize how the sequence of clinician and patient language within an MI session lead to behavior change (Apodaca & Longabaugh, 2009; Magill, Apodaca, Barnett, & Monti, 2010; Romano & Peters, 2014). The first study to examine the technical hypothesis compared MI with a contrasting communication style in which clinicians attempted to convince patients of the need to change (Miller, Benefield, & Tonigan, 1993). Patients in the MI condition voiced nearly twice as much change talk and half as much sustain talk compared to patients in the comparison group. Since then, numerous studies have supported that clinician use of MI strategies is linked with patient change talk (e.g., Moyers & Martin, 2006; Moyers et al., 2007b; Catley, 2006; Gaume et al., 2010; Glynn & Moyers, 2010).

The strongest evidence for the technical hypothesis comes from studies that have employed sequential coding and analysis techniques. Moyers and colleagues (Moyers & Martin, 2006; Moyers et al., 2007b) used this technique to examine the link between MICO and MIIN clinician utterances and subsequent patient change talk and resistance. Results indicated MICO clinician statements tended to be followed by patient change talk statements. Additionally, patient change talk increased the probability of continued MICO clinician utterances. This level of linguistic coding detail has allowed researchers to test the technical hypothesis with much greater specificity than only using behavioral frequencies.

The relational hypothesis. The relational hypothesis posits that the qualities of the collaborative clinician-patient relationship, consistent with the "spirit of MI", elicit patient behavioral change (Romano & Peters, 2014). The "spirit of MI" is congruent with a patient-centered, collaborative style of empathic and supportive counseling stressed as essential to MI. Compared with investigations of the technical hypothesis, fewer studies have examined the relational hypothesis in MI. Moreover, those that have yielded more mixed findings (Morganstern et al., 2012; Pirlott, Kisbu-Sakarya, DeFrancesco, Elliot, & MacKinnon, 2012; Tollison et al., 2013)

Relational factors in MI are typically defined as the clinician's "spirit of MI" and use of empathy. The "spirit of MI" is operationalized as clinician evocation, collaboration, and support of patient autonomy. Empathy is measured as a separate construct and operationalized as the clinician's accurate reflections and ability to understand the patient's needs and perspective (Moyers et al., 2005; Moyers et al., 2010). Although several studies have found no relation between MI spirit, empathy, and treatment outcomes (Magill et al., 2010; Pirlott et al., 2012; Tollison et al., 2013), others demonstrate a positive relation between empathy and outcome (Gaume, Gmel, & Daeppen, 2008; Thrasher et al., 2006; Woodin, Sotskova, & O'Leary, 2012). Several more studies have demonstrated support for the relational hypotheses when measuring the combined effect of MI spirit and empathy on treatment outcome (Baird et al., 2007; Thyrian et al., 2007).

Overall, there is some empirical support for the technical and relational hypotheses; however, findings have been mixed and further research is needed to clarify the process of change in MI. One reason for mixed findings might be that MI is used to address a diverse array of problems with various populations (Hettema et al., 2005). It might be important to consider

that mechanisms of MI might differ depending on the problem type, sample, and setting. Different elements of MI might be more or less relevant depending on the context of its application. Thus, it is highly important to examine process of change within MI with different populations and treatment modalities.

MI Coding Systems

A variety of coding systems have been developed and validated to assess MI fidelity and the process of MI. These coding systems allow objective raters to identify and classify verbal exchanges between clinicians and patients and provide standardized ratings of MI relevant variables. They range in complexity from relatively simple systems, which offer broad information on macro-processes (e.g., Moyers, Martin, Manuel, Miller, & Ernst, 2010), to more detailed approaches that provide nuanced information on micro-processes (e.g., Houck et al., 2010). Macro-process measures have a more global focus (e.g., therapy session, course of treatment) while micro-process measures focus upon small units of measurement (e.g., utterances, speaking turns; McLeod, Islam, & Wheat, 2013). Macro-process measures are most appropriate for assessing broader process-outcome relations and micro-process coding is well-suited for more nuanced examination of within-session processes (Hogue, Liddle, & Rowe, 1996).

Different coding systems use varying levels of specificity to code the frequency and strength of these types of clinician and patient language. Broadly speaking, clinician language is classified into MI consistent language (MICO) and MI inconsistent language (MIIN); patient language is classified in to change talk (CT) and sustain talk (ST). Some coding systems yield global scores based on raters listening to the entirety of the session and providing a single rating (e.g., Moyers et al., 2007a; Moyers et al., 2010). Others yield scores of clinician and patient

language based on coding specific utterances throughout the course of a session (e.g., percentages of open versus closed questions based on the coding of each utterance or frequency counts; e.g., Houck et al., 2010).

The most widely used measure, the Motivational Interviewing Treatment Integrity code (MITI), yields summary scores for MICO behaviors (e.g., emphasizing patient autonomy, asking permission before giving advice), MIIN behaviors (e.g., negative confrontation, advising without permission), and percentages (Moyers et al., 2010). Other measures provide a more detailed assessment of each clinician and patient utterance. For example, the Motivational Interviewing Skills Code (MISC) 2.5 (Houck et al., 2010) has 30 possible categories for clinician and patient utterances. Clinician and patient language provide the basis for understanding mechanisms involved in the process of MI. As such, it is important to review research findings linking specific types of clinician and patient language with treatment outcomes.

Clinician language. Across various problem areas and populations, substantial literature supports that clinician MICO behaviors predict CT and clinician MIIN behaviors predict ST (Apodaca et al., 2014; Carcone et al., 2013; Catley 2006; D'Amico et al., 2015; Gaume et al., 2013; Magill et al., 2010; Moyers & Martin, 2006; Moyers et al., 2007b; Vader et al., 2010). Clinician MICO behaviors include the use of open-ended questions, affirmations, complex reflections, and asking permission before giving information. MIIN behaviors include direct negative confrontation, providing information without asking permission, and directing with the use of imperative language (Moyers et al., 2010).

Recent evidence points to the importance of examining specific types of MICO behaviors, rather than MICO and MIIN behaviors broadly. A 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 (e.g. reflections of ambivalence; Carcone et al., 2013). Thus, while strong evidence supports the links among clinician language, patient language, and subsequent change, further research is needed to clarify if specific types of MICO behaviors work best with specific populations.

Patient language. Patient language is broadly categorized into two categories: change talk (CT), which is language that favors behavioral change, and sustain talk (ST), which is language favoring the status quo (Miller & Rollnick, 2013). Most research has supported the link between CT and positive treatment outcomes (e.g., Apodaca & Longbaugh, 2009; Gaume et al., 2008; Baer et al., 2008, Moyers et al., 2007), however, a few studies have had mixed outcomes (Kuchipudi et al., 1990; Miller, Yahne, & Tonigan, 2003; Treasure et al., 1999). One explanation for mixed findings is that coding systems lacked sophistication in operationalizing MI constructs such as CT (Miller & Rose, 2009). Consequently, more detailed coding systems emerged such that specific types of CT could be coded.

More advanced coding systems were developed that divided CT into specific types (e.g., desire, ability, reasons, need, and commitment) and could account for the frequency of those types of CT over the course of sessions (e.g., Commitment Language Coding System; Amrhein, Miller, Yahne, Palmer, & Fulcher, 2003). This more sophisticated coding enables measurement of the frequency of specific types of CT occurring during a session. In addition, this coding can assess whether certain types are CT more or less related to positive treatment outcomes. For example, researchers could track the frequency with which patients discussed their desire to change throughout an MI session. Subsequent studies indicated that the strength and pattern of commitment language near the end of MI sessions was a better predictor of behavioral change than overall CT or commitment language at the beginning of sessions (Aharonovich, Arnrhein,

Bisaga, Nunes, & Hasin, 2008; Amrhein et al., 2003; Hodgins et al., 2009). Other types of CT (desire, ability, reasons, need) were often precursors to commitment language, but did not predict behavioral change on their own (Miller & Rose, 2009).

Some studies, however, have yielded different findings regarding the relation between commitment language and treatment outcomes. In a study of adolescent substance users, commitment language did not predict behavior change; rather, language reflecting desire and ability to change was most predictive of reduced substance use at 3-month follow-up (Baer et al., 2008). Thus, while it is generally agreed that CT leads to positive treatment outcomes, further research is needed to clarify how different types and patterns of CT relate to outcomes with different populations. Additionally, research is needed to clarify whether specific types of clinician behaviors and strategies are more or less related to the types of CT of interest.

Overall, understanding how patient and clinician language relates to behavioral change has important implications for MI interventions and training. This information could be used to help tailor MI interventions to specific populations, guide how clinicians are trained to deliver MI, and ultimately enhance the effectiveness of MI. In areas such as pediatric obesity, where MI research is relatively young, such data would pave the way for intervention development, clinician training, and effective treatment delivery.

MI and Engagement in Pediatric Obesity Interventions

Several systematic reviews have examined the effectiveness of MI in improving weight loss outcomes (Armstrong et al., 2011; Hettema et al., 2005; Lundahl et al., 2010). MI has been found to yield better treatment engagement (e.g., percent of sessions attended; Bean et al., 2014b) and outcomes (e.g., % BMI reduction; Armstrong et al., 2011) in adult and pediatric obesity intervention trials; however, the effects or mechanisms of MI have not been examined

when parents are targeted as the exclusive agents of change for their child's weight. Particularly with underserved populations, there are many reasons why parents might have difficulty making behavioral changes. As such, MI might be particularly well suited to reduce ambivalence, enhance motivation, and collaboratively discuss reasons for change to enhance treatment engagement. MI acknowledges that ambivalence is a normal part of the change process, but emphasizes patients' self-identified reasons for change rather than barriers to change. In doing so, MI facilitates patients' intrinsic motivation and confidence in their ability to change (Miller & Rollnick, 2013).

In adult obesity interventions, MI has been shown to increase adherence to specific weight loss behaviors and in turn, result in BMI reductions (Armstrong et al., 2011). MI has been shown to increase the frequency of positive health behaviors such as physical activity (Hardcastle, Blake, & Hagger, 2012), and fruit and vegetable intake (Pirlott et al., 2012). Patients receiving MI in addition to a standard behavioral weight loss intervention (group or individual treatment) had greater BMI reductions than patients not receiving MI (Navidian, et al., 2010). A few studies found no effect of MI on BMI (Befort et al., 2008; Buscemi, Yurasek, Dennhardt, Martens, & Murphy, 2011; Webber, Tate, Ward, & Bowling, 2010); however, the findings are largely positive within the area of adult obesity treatment. Given the need for parents to make family-wide behavioral changes in pediatric obesity interventions, existing research on adult obesity interventions suggests MI is a promising approach.

Several studies have examined the role of MI in the treatment of pediatric obesity and obesity related behaviors; however none have been exclusively parent-focused (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). Similar to the literature with adults, studies showed MI increased positive health behaviors such as physical activity (Neumark-Sztainer et al., 2010), decreased unhealthy behaviors such as excessive screen time (Taveras et al., 2011), and improved parent attitudes about eating behavior (Schwartz et al., 2007). Although these studies did not exclusively focus on parents as the targets of change, results are promising for the use of MI to promote engagement and positive treatment outcomes in parent-focused pediatric obesity interventions.

Specific elements of MI might be more or less important when using MI with parents of children with overweight and underserved populations. For example, in a recent obesity intervention targeting Black adolescents, results indicated that specific types of clinician behaviors (e.g., highlighting adolescent autonomy) elicited patient CT (Carcone et al., 2013). Although this study only examined different types of clinician MICO language and not the clinician's MI Spirit, it provides an excellent example of how examining the process of MI at a more detailed level can elucidate how MI specifically works with particular populations. Examining MI and the technical and relational hypotheses at a more detailed level would similarly provide meaningful information about optimizing MI with this specific population.

The effectiveness of MI might depend not only on the type of clinician behaviors, but also in how treatment engagement and outcomes are measured. For example, in a trial conducted by Bean and colleagues (2014), there were no significant differences in BMI in adolescents that received an MI intervention in addition to a multidisciplinary behavioral intervention when compared with a control group (who received the multidisciplinary behavioral intervention plus health education); however, attendance at treatment sessions was higher in the MI group. Further, MI was more effective in improving treatment attendance in these low income, low

education families. These findings suggest MI might be particularly well suited to address treatment attendance in a population that not only has disproportionately high obesity rates, but also is the most difficult to engage.

In general, MI is apt to address issues with treatment engagement, particularly problems with treatment initiation and early attrition. Large effects have been found when MI has specifically targeted treatment retention and adherence (Aubrey, 1998). MI focuses on eliciting motivation for change, while recognizing and accepting ambivalence toward change as natural (Miller & Rollnick, 2009). MI has been demonstrated to have the greatest effectiveness for patients who are in earlier stages of readiness or have greater resistance to change (Miller & Rollnick, 2013). For individuals who might be unsure about their motivation to engage in treatment, MI meets them where they are in the stages of readiness for change (pre-contemplation, contemplation, preparation, and action; Prochaska & DiClemente, 1984).

Although theory on the stages of readiness for change aligns well with MI, it is important to recognize that this is not the foundation of MI. Rather, MI was initially an atheoretical style of interaction that emerged from clinical practice and was unique in matching clinician behavior to an individual's stage of readiness (Miller & Rollnick, 2013). Because it recognizes that all individuals might not be ready to participate in treatment or make behavioral changes, MI might be especially useful to address the high levels of attrition at the outset of obesity trials when individuals are most likely to be conflicted about treatment.

Indeed, studies have shown that MI yields relatively high effect sizes when added at the outset of another treatment to improve initiation, retention, and attendance (Aubrey, 1998; Brown & Miller, 1993; Daley et al., 1998). This suggests a synergistic association between MI and other active treatments, such that MI serves to promote treatment engagement and enhance

positive treatment effects via increased treatment attendance. Given that the outset of treatment is a particularly high point of attrition in pediatric obesity interventions (Skelton & Beech, 2011), adding MI as a prelude to treatment is a promising approach for improving treatment engagement and outcomes. Understanding how pre-treatment MI can improve parental treatment engagement is highly important given the prevalence of pediatric obesity, the severity of this condition's physiological and psychological consequences, and the importance of parental involvement in pediatric obesity interventions.

The Current Study

This study examined how MI affected treatment engagement outcomes (treatment initiation, treatment attendance, and completion of follow-up assessments) in a parent-focused pediatric obesity intervention (NOURISH^{+}). Treatment initiation was measured as attendance at baseline orientation that took place prior to the start of NOURISH^{+}. Treatment attendance was measured as the number of NOURISH^{+} sessions attended. Completion of follow-up assessments was measured as attendance at immediate post-treatment and 4-month follow up assessments. The types of parent and clinician language associated with treatment engagement and outcomes were examined using the MISC 2.5.

The purpose of this study was to examine the dialogue between parents and clinicians during MI sessions and explore the technical and relational hypotheses of MI in this context. Key variables of interest were percentage of parent change talk (%CT), percentage of MI consistent clinician language (%MICO), and MI Spirit/Empathy. Within this study, the parent was the target patient. Specific study aims and hypotheses are outlined below.

Aims and Hypotheses

Aim 1. The first aim of this study was to examine if parent change talk (%CT) was associated with treatment engagement outcomes as indicated by 1) treatment initiation (baseline

attendance); 2) overall treatment attendance (number of NOURISH^{+} sessions attended); 3) post-treatment assessment attendance; and 4) 4-month follow up assessment attendance). It was hypothesized that parent change talk would be positively related to treatment engagement outcomes.

Aim 1a. A sub-aim was to examine whether specific categories of parent change talk, such as preparatory language (%PREP), commitment language (%CML), or individual change talk behavior codes, were associated with treatment engagement outcomes (baseline attendance, overall NOURISH^{+} attendance, and attendance at post-treatment and 4-month follow-up assessments). Based on previous research, it was hypothesized that commitment language would have the strongest association with treatment engagement outcomes.

Exploratory Aim 2. An exploratory aim of this study was to examine the technical hypothesis of MI. This study investigated whether there was a relation between MI consistent clinician language (%MICO) and treatment engagement outcomes (baseline attendance, NOURISH^{+} attendance, and attendance at post-treatment and 4-month follow-up assessments). It was hypothesized that MI consistent clinician language would be positively related to treatment engagement outcomes.

Exploratory Aim 2a. If a relation between MI consistent clinician language (%MICO) and treatment engagement existed, a subsequent aim was to assess if the relation between %MICO and treatment engagement was partially mediated by parent change talk (%CT). It was hypothesized that MI consistent clinician language would be positively related to treatment engagement outcomes and that this relation would be partially mediated by parent change talk.

Exploratory Aim 3. An additional goal was to examine the relational hypothesis of MI to investigate whether there was a relation between MI Spirit/Empathy (as measured by MISC 2.5

Empathy global score) and treatment engagement outcomes (baseline attendance, overall NOURISH^{+} attendance, and attendance at post-treatment and 4-month follow-up assessments).

Exploratory Aim 3a. If a relation between clinician MI Spirit/Empathy and treatment engagement existed, a subsequent aim was to assess if the relation between MI Spirit/Empathy and treatment engagement outcomes was partially mediated by parent change talk (%CT). It was hypothesized that MI Spirit/Empathy would be positively related to treatment engagement outcomes and this relation would be partially mediated by parent change talk.

Exploratory Aim 3b. If both the technical and relational hypotheses were supported, the goal was to compare the relative strength of the technical and relational hypotheses by comparing both mediation models.

Exploratory Aim 4. Aim 4 was to examine if specific types of MI consistent clinician language (e.g., open-ended questions, complex reflections) were related to specific types of parent change talk (e.g., preparatory language, commitment language). This analysis was exploratory, as it was not known whether specific types of MI consistent clinician language would be more related to specific types of parent change talk.

Secondary Aim. A secondary aim of this study was to examine if parent change talk (%CT) was associated with clinical outcomes as indicated by 1) change in child weight status (child BMI percentile); 2) change in parent weight status (parent BMI); 3) child dietary changes (change in average calories consumed, as reported on the 24 hour food record); changes in child levels of physical activity (change in minutes spent doing moderate or vigorous physical activity, as reported on the Physical Activity Recall). This secondary aim was exploratory as the target of the MI intervention was to increase treatment engagement. As such, it was unclear whether

parent change talk prior to the intervention would have any influence on clinical treatment outcomes.

Method

Participants

Parents. Participants in this study were parents (or caregivers) from the NOURISH+MI study, a randomized controlled trial (RCT) of MI that was implemented as an adjunct to an intervention for parents of overweight and obese children, NOURISH^{+} (*N*ourishing *O*ur *U*nderstanding of *R*ole-modeling to *I*ncrease *S*upport and *H*ealth). To be eligible for NOURISH^{+} (and as a result NOURISH+MI), parents had to be at least 18 years old and have a child aged 5-11 years with a BMI $\geq$ 85th percentile for age and gender (Kuczmarski et al., 2000). The child had to primarily reside in the parent's home and could not have an underlying medical etiology of obesity (e.g., Prader-Willi Syndrome). Parents were required to be able to speak English, follow basic instructions, and perform simple exercises (e.g., walking). Parents were ineligible for the study if they were non-ambulatory, pregnant, had a medical condition that might have been negatively impacted by exercise, or had a psychiatric diagnosis that would impair their ability to respond to assessments or participate in a group (see Bean et al., 2014a for detailed study methods).

For the purposes of this study, all parents enrolled in NOURISH+MI that completed the first MI telephone session were included (N = 88). Based on self-report at telephone screening, these parents were 94% female; 47% African-American; M parent age = 40.13 years (SD = 9.87). Their children (N = 99) were 44% female, 48% African-American, M child age = 8.22 years (SD = 2.02). Clinical data could only be confirmed for those parents that attended baseline (n = 64). Of those parents that attended baseline, the mean parent BMI was 36.80 kg/m^2 (SD = 9.50) and the mean child BMI was in the 97th percentile (SD = 3.98).

Interventionists. MI interventionists were six clinical psychology doctoral students trained in MI by a member of the Motivational Interviewing Network of Trainers (MINT), Dr. Melanie Bean. The interventionists were all female and predominantly White (one Asian-American). Interventionists attended a two-day training, followed by supervision and coaching until MI proficiency was established as indicated by standards set forth by an objective adherence coding system, the MITI 3.1.1 (Bean et al., 2011a; Moyers, et al., 2010). Table 1 in Appendix A displays mean MI proficiency ratings across interventionists for MI delivered in Session 1 and compares them to MITI 3.1.1 proficiency standards.

Procedure

NOURISH$^+$ and NOURISH+MI design. NOURISH$^+$ and NOURISH$^+$ MI are described in greater detail in separate publications (Mazzeo et al., 2012; Bean et al., 2014a) and will be described here briefly. NOURISH$^+$ was a 6-session group-based intervention for parents of overweight and obese children. The intervention was exclusively parent-focused and is grounded in Social Cognitive Theory (Bandura, 1986), which emphasizes the importance of role modeling. Parents were targeted as the primary role models of healthy eating and exercise behaviors for their children and the leading agents of change within their families (Faith et al., 2012).

NOURISH$^+$ aimed to increase parental self-efficacy to affect health behavioral changes. The program included guided goal setting and self-monitoring to teach parents how to set and achieve goals to improve their entire family's health. Families of all racial/ethnic backgrounds were eligible to participate, but the program was developed in a way that was culturally sensitive to African-American families and families from lower socio-economic statuses. For example, the

program recognized differences in traditional foods, differences in body image ideals and financial challenges facing single parent homes (Ammerman et al., 2006).

In the pilot of NOURISH, of those parents that participated in treatment, parents randomly assigned to the NOURISH group significantly reduced their child's BMI percentile ($p = 0.02$) compared to the parents assigned to the control group (Mazzeo et al., 2014). While these findings were promising, strategies to reduce attrition and increase treatment adherence were needed. In terms of treatment initiation, 50% of individuals that completed the telephone-screen for NOURISH did not attend the baseline session/orientation, representing a huge loss of potential parents in the trial (and a common point of attrition across trials; Skelton & Beech, 2011). Overall, of those who did participate in NOURISH, only 48% attended more than half of the intervention sessions and thus might not have received an adequate dose of treatment for effectiveness. Further, 32% of NOURISH parents did not attend the post-test and 66% did not attend the 6-month follow up, making it difficult to assess long-term effects. Of note, these attrition and attendance data are similar to those found in other obesity interventions targeting a similar population (Skelton & Beech, 2011). Several changes were made to the piloted program to improve treatment engagement before beginning an ongoing larger trial, NOURISH^{+} (e.g., increased hands-on experience and more convenient locations). NOURISH+MI was proposed as an adjunctive intervention that might further increase treatment engagement, especially at the point of treatment initiation where parent dropout was highest across trials.

In the NOURISH+MI trial, parents were randomly assigned at telephone screening to either the main NOURISH^{+} trial (and subsequently randomized to NOURISH^{+} or control) or to NOURISH+MI. NOURISH+MI parents received the same NOURISH^{+} intervention, with two added sessions of brief MI (approximately 20 minutes) compared to reminder calls only. A

detailed outline of study procedures is presented in Figure 2. MI sessions were delivered via telephone after the initial telephone screen/consent (MI session 1) and in person (MI session 2) after the baseline orientation, but before NOURISH^{+} began. These are common points of attrition across obesity interventions and were selected for this reason (Skelton & Beech, 2010).

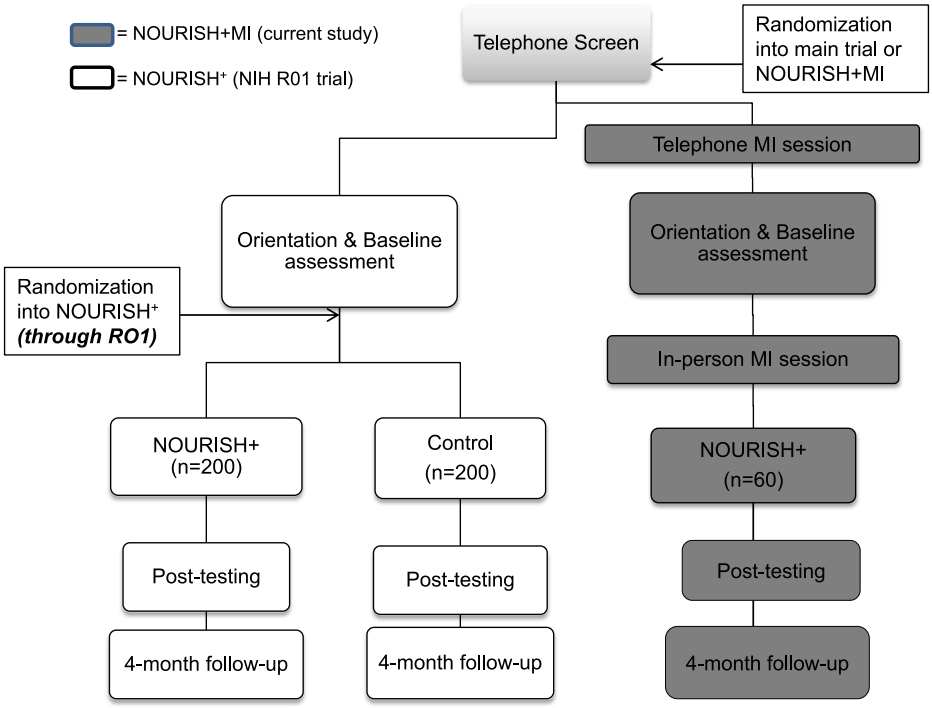

Figure 2. Consort flow in NOURISH^{+} and NOURISH+MI trial

NOURISH+MI intervention. Parents provided their verbal consent prior to beginning the screening interview and provided written consent prior to beginning the baseline assessment for themselves and their children (via parental consent form). Children provided written assent at baseline. The Institutional Review Board of Virginia Commonwealth University approved all study procedures. Trained MI interventionists conducted all MI sessions. MI interventionists were independent from the NOURISH^{+} intervention to reduce risk of contamination.

The first MI session was delivered via telephone in a two-week window after the initial telephone screening and consent. The main goal of MI session 1 was to explore ambivalence and

readiness to participate in the NOURISH^{+} intervention and increase attendance at baseline and subsequent intervention sessions. During session 1, parents were guided to discuss parent-determined reasons for change, barriers and facilitators to change, motivation to make behavioral changes, and confidence in their ability to make changes using strategies such as open-ended questions and complex reflections. Parents and their children then attended an in-person orientation night to complete baseline assessments. The second MI session was scheduled to take place in-person in the two-week window after baseline but before beginning the NOURISH^{+} group intervention. The aim of MI session 2 was to build upon the relationship established and content explored in session 1 and to explore the parents' core values in relation to current family/child health behaviors.

The MI sessions were unscripted as research indicates that manualized MI is less efficacious than MI without a manual or script (Hettema et al., 2005). Instead, a "session roadmap" was used as a guide to MI interventionists. The roadmap included a flexible outline of goals and topics for each session. Throughout both MI sessions, the interventionists used MI consistent strategies in a non-confrontational, directive manner. Interventionists employed techniques such as using open questions to explore reasons for change and ambivalence, using reflections and affirmations to express empathy, developing discrepancies between values and current health behaviors, highlighting parent autonomy, and supporting parents' self-efficacy for change. At the conclusion of each session, interventionists summarized what parents said, empathized with difficulties noted, highlighted parent-reported reasons for change, and reflected readiness and willingness to change. The overarching goal of these sessions was to enhance participation in NOURISH^{+}.

Preliminary NOURISH+MI findings. Parents who completed one telephone MI session were more likely to attend the baseline orientation session (74%) compared to parents who received reminder calls only (53%, $p < .001$; Bean, Jeffers, Thornton, Gow, & Mazzeo, 2016). Although MI session 2 audio recordings were available for some parents ($n = 57$), there were no significant differences in NOURISH^{+} session 1 attendance or overall treatment attendance in those who completed one session of MI compared to two sessions.). Further, there is sufficient previous research to indicate that a single session of MI is effective (McCambridge & Strang, 2004). As such, the current investigation includes MI session 1 only. Attendance at post-treatment or 4-month follow-up assessments did not differ for those who received MI prior to treatment compared to those who received reminder calls only (Bean et al., 2016).

Coding Procedures

MI fidelity. MI sessions were audio recorded and previously coded for fidelity and competence using the MITI 3.1 (Moyers et al., 2010). Overall, ratings exceeded standardized levels of proficiency (see Table 1 in Appendix A).

MI linguistic coding. Transcripts of audio-recorded sessions were created by trained undergraduate research assistants. Linguistic coding of clinician and parent language in the MI sessions was assessed using the Motivational Interviewing Skills Code (MISC) 2.5 in conjunction with CACTI software, described below (Glynn, Hallgren, Houck, & Moyers, 2012; Houck, Moyers, Miller, Glynn, & Hallgren, 2010). The PI and trained research assistants conducted all coding (see training procedures below).

MISC 2.5. The MISC 2.5 is a combination of the MISC 2.1 (Miller et al., 2003a) and the Motivational Interviewing Sequential Code for Observing Process Exchanges (MI SCOPE; Martin et al., 2005). This coding system was developed to examine MI at a micro-level through a

sequential coding process of parent and clinician utterances (Moyers et al., 2010); however, it also provides global and summary codes at the macro-level of the entire session. Global codes are on six dimensions: Acceptance, Empathy, Direction, Autonomy Support, Collaboration, Evocation, and Self Exploration. See Table 2 in Appendix B for a list of each global code and its definition. There are 15 individual behavior codes for patient language that fall into 3 broad categories (change talk, sustain talk, and other). There are 25 individual behavior codes for clinician language that can be classified into 3 broad categories (MI consistent, MI inconsistent, and Other). See Tables 3 and 4 in Appendix B for a list of patient and clinician behavior codes, definitions, and examples.

Coding occurred in three separate coding passes according to the MISC 2.5 manual. First, the rater listened to the entire MI session and completed global clinician and parent codes. In the second pass, raters parsed the interview into individual parent and clinician utterances (complete fragments of thought). During the third pass, the rater assigned behavioral codes to each of the individual parent and clinician utterances. During the coding process, the audio clip could be paused to determine appropriate categorization of each utterance. Transcripts of sessions were also available for reference during coding (Houck et al., 2010). After coding was completed, behavior codes were compiled to create summary scores for the entire session as indicated in the MISC 2.5 manual (Houck et al., 2010). See Table 5 in Appendix B for a complete list of summary scores and formulas for calculating each score.

Summary scores were compiled for the following parent behaviors: percentage of parent change talk out of all change and sustain talk (%CT) and percentage of individual change talk behavior codes out of all change talk and sustain talk (%D+, %A+, %R+, %N+, %C+, %TS+). In addition, change talk was further broken down into preparatory language (%PREP) and

commitment language (%CML). Preparatory language is language about contemplating change (Desire+, Ability, Reason+, and Need+), while commitment language reflects taking action toward change (Commitment+, Taking Steps+). Summary scores were calculated based on the percentage of preparatory language out of all change talk and sustain talk (%PREP) and the percentage of commitment language out of all change talk and sustain talk (%CML).

Summary scores were created for the following clinician behaviors: percentage of MICO out of all MICO and MIIN (%MICO), ratio of reflections to questions (R/Q), percentage of open questions out of total questions (%OQ), percentage of complex positive reflections out of total reflections (%CR+), percentage of negative complex reflections out of total reflections (%CR-), percentage of positive simple reflections out of total reflections (%SR+), percentage of simple negative reflections out of total reflections (%SR-), and percentage of complex positive and simple reflections out of total reflections (%Reflections+).

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). Audio-recorded sessions are parsed into utterances without the use of a transcript by human raters. These parsed utterances can then be assigned behavioral codes using a standardized coding system such as the MISC 2.5. Following D'Amico and colleagues' recommendations, transcripts were made available and referred to in the case of difficult audio or unclear utterances (2015). Researchers developed CACTI in conjunction with the MISC 2.5 system, a coding system that assigns behavioral codes to clinician and parent language in MI session. Thus, use of the MISC 2.5 fits seamlessly with CACTI software.

Training procedure. Two doctoral level students trained a team of five undergraduate research assistants on the MISC 2.5 and CACTI, under the supervision of Dr. Bean, a member of MINT. Raters learned the MISC 2.5 coding system and CACTI software over the course of four months, for a total of approximately 60 hours of training. The doctoral students met with the undergraduate raters on a weekly basis, assigned weekly training tasks, and provided regular feedback on training progress.

First, raters were introduced to the principles of MI. They were taught to identify different categories of clinician and patient language using the MISC 2.5 manual and weekly group discussions. Raters then practiced global coding sessions and coding all possible types of speech included in the MISC 2.5 until correct identification of each independent code was demonstrated. Raters practiced coding with gold standard transcripts and audio available from motivationalinterviewing.org. Then raters practiced with transcripts and audio from parents in a similar trial, the *MI Values* study (Bean et al., 2011a). Raters independently completed ratings and participated in weekly discussion with graduate student supervisors to answer questions on coding procedures, provide clarification on coding decision rules, and resolve any coding disagreements.

To ensure readiness to begin coding, global codes and behavioral codes from training sessions were assessed for inter-rater reliability and validity. To assess inter-rater reliability, a fully-crossed design was used, such that every rater coded each practice session. For global codes, an intra-class correlation (ICC, Shrout & Fleiss, 1979) was used to assess reliability due to the codes being interval data. For behavior codes, Kappa was calculated due to the codes being categorical data (Hallgren, 2012). To assess validity, "gold standard" codes were agreed upon by

the graduate level supervisors who first independently completed ratings and then met to resolve discrepancies, with consultation and guidance provided by faculty supervisor, Dr. Bean.

A total of 18 practice sessions were global coded by all raters. An ICC was calculated for the Empathy global item, used to measure MI Spirit/Empathy. The ICCs were based on a two-way random effects model for all raters (Shrout & Fleiss, 1979). Following Cicchetti (1994), ICCs below .40 reflect "poor" agreement, ICCs from .40 to .59 reflect "fair" agreement, ICCs from .60 to .74 reflect “good” agreement, and ICCs .75 and higher reflect "excellent" agreement. The Empathy global item demonstrated excellent inter-rater reliability, ICC (2, 7) = .88. To assess validity, each individual rater’s global codes were compared to “gold standard” ratings. The ICCs for the Empathy global item were within the range of good to excellent agreement, ICC (2, 2) = .64-.91.

A total of 10 practice sessions were behavior coded. Fewer practice sessions were behavior coded than global coded due to the length of the coding and review process for hundreds of parses per session. For the categorical behavior codes, Light’s Kappa (Light, 1971) was calculated to determine inter-rater reliability for multiple raters (Hallgren, 2012). Landis and Koch (1977) provided guidelines for interpreting Light’s Kappa values, with values from 0.0 to 0.2 indicating slight agreement, 0.21 to 0.40 indicating fair agreement, 0.41 to 0.60 indicating moderate agreement, 0.61 to 0.80 indicating substantial agreement, and 0.81 to 1.0 indicating almost perfect or perfect agreement. Light’s Kappa indicated moderate agreement between raters on individual behavior codes, $\kappa = 0.60$. When individual behavior codes were collapsed into categories relevant to analyses (e.g., MICO, CT), inter-rater agreement increased to substantial, $\kappa = 0.65$.

To assess validity, each rater's individual behavior codes were compared to "gold standard" codes using Cohen's Kappa. Agreement between each rater and the "gold standard" was within the range of moderate to substantial agreement (κ = .50-.75). Once individual behavior codes were collapsed into summary score categories (e.g., MICO, CT), the agreement between each rater and the "gold standard" was within the range of substantial to excellent agreement (κ = .62-85).

Session rating protocol. A primary rater was randomly assigned to each session using a partially crossed design, such that sessions conducted by different therapists were relatively distributed across the raters. A second rater was randomly assigned to 20% of MI sessions using a partially crossed design to ensure reliability raters were evenly spread across other raters. This subset of sessions was double coded to allow for continued assessment of inter-rater reliability and to monitor rater drift. Weekly team coding meetings were held to reduce rater drift and to provide booster training as needed. Two doctoral level students led these meetings under the supervision of Dr. Bean.

From the study sample (N = 81), a total of 16 sessions were double-coded (approximately 20% of the sample) to ensure that raters continued to meet acceptable levels of inter-rater reliability beyond the training period. Cohen's Kappa reflected substantial agreement between raters on individual behavior codes, κ = .60. Once individual behavior codes were collapsed into summary score categories (e.g., MICO, CT), inter-rater reliability increased to the excellent range, κ= .74 (Landis & Koch, 1977). Inter-rater reliability on the Empathy global code was also in the excellent range, ICC (2, 1) = .81 (Cichetti, 1994; Shrout & Fleiss, 1979). Due to good inter-rater reliability, the primary rater's codes were deemed acceptable for use in analyses.

Measures

Parent and clinician language. The MISC 2.5 was used to measure all parent and clinician language variables. The MISC 2.5 produced three types of variables: frequency scores, summary scores, and global ratings. After sessions were parsed, parent and clinician utterances were assigned individual behavior codes. Individual parent and clinician behavior codes are defined in Tables 3 and 4 in Appendix B. Frequency scores indicated the number of times an individual behavior code occurred. These frequency scores were then collapsed into broad types of parent and clinician language (e.g., change talk, sustain talk) and used to create summary scores. Summary scores were used in analyses to represent important parent and clinician language variables: change talk (%CT), preparatory language (%PREP), and commitment language (%CML), and MI consistent clinician language (%MICO). The formulas for calculating summary scores are presented in Table 5 in Appendix B. The global rating for Empathy was used as a measure of overall MI Spirit/Empathy.

Treatment engagement. There were four ways in which treatment engagement was measured. Treatment initiation was measured as attendance (yes/no) at the initial baseline orientation session (referred to herein as baseline attendance). Overall treatment attendance was defined as the number of NOURISH^{+} sessions attended. Attendance (yes/no) at post-treatment assessment and 4-month follow up assessment time points were also included as measures of ongoing study engagement.

Treatment outcomes. The weight outcomes of interest were 1) change in child weight status (defined as the amount of change in child BMI percentile between baseline and post-treatment assessment) and 2) change in parent weight status (defined as the amount of change in parent BMI values between baseline and post-treatment assessment). Child dietary changes were

measured using information reported by parents on the 24 hour food record (change in average daily calories between baseline and post-treatment assessment). Changes in child levels of physical activity was measured using information reported by parents on the Physical Activity Recall (change in minutes spent doing moderate or vigorous physical activity between baseline and post-treatment assessment). Additional details on how treatment outcomes were measured in NOURISH+MI are reported separately (Bean et al., 2014).

Analyses

All data analyses were performed with SPSS version 24. Frequencies, percentages, means, and standard deviations were calculated for each predictor and treatment engagement outcome variable. Family SES, parent ethnicity, child BMI percentile, parent BMI, and clinician were examined using bivariate analyses to test if these variables were significantly related to treatment engagement outcomes. There were no significant relations among any of these variables and treatment engagement outcomes. Thus, these variables were not controlled for in analyses.

Research Aim 1 was to examine whether parent language (%CT) was associated with treatment engagement (defined as baseline attendance, NOURISH^{+} attendance, and completion of post-treatment and 4-month follow-up assessments). It was hypothesized that %CT would be positively associated with treatment engagement. These analyses were conducted using logistic regressions for dichotomous outcomes (attendance or non-attendance at baseline, post-treatment, and 4-month follow up assessment) and negative binomial regressions for count data (number of NOURISH^{+} sessions attended; Cameron & Trivedi, 1998).

The goal of research Aim 1a was to examine whether specific categories of CT (%PREP, %CML, or %Individual Behavior Codes) were associated with treatment engagement. It was

hypothesized that %CML would be most strongly associated with engagement. Aim 1a was assessed using logistic regressions and negative binomial regressions entering MISC 2.5 summary scores of %D+, %A+, %R+, %N+, %CML, and %PREP as continuous variables and treatment engagement variables as the outcome (baseline attendance, NOURISH^{+} attendance, and attendance at post-treatment and 4-month follow-up assessments).

The overall goal of research Aim 2 was to explore the technical hypothesis of MI. The first step was to examine if there was direct effect between clinician behavior (%MICO) and treatment engagement outcomes (baseline attendance, NOURISH^{+} attendance, and attendance at post-treatment and 4-month follow-up assessments; MacKinnon et al., 2007). Each treatment engagement outcome was analyzed separately. It was hypothesized that %MICO would be positively related to treatment engagement outcomes. If there was a significant direct effect, Aim 2a was to assess if %CT mediated the relation between %MICO and treatment engagement outcomes. As depicted in Figure 3, there were three paths examined: the relation between %MICO and %CT (path a), CT and treatment engagement (path b), and MICO and treatment engagement (path c′).

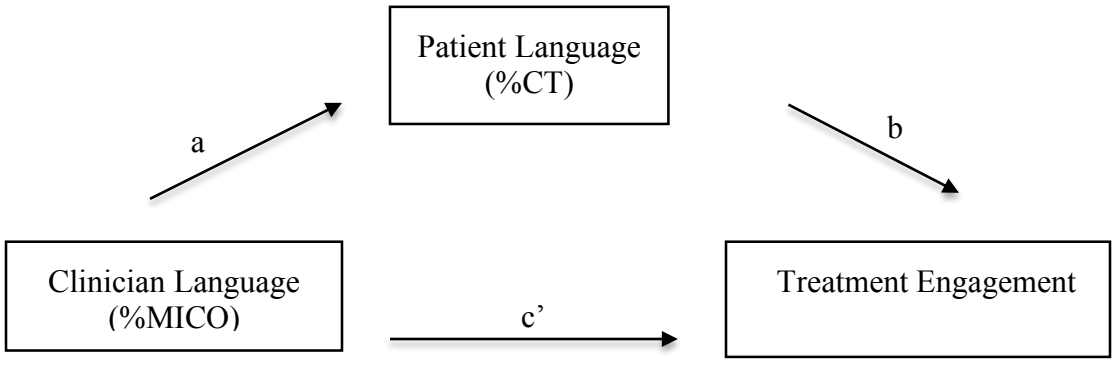

Figure 3. Technical hypothesis of motivational interviewing

The overall goal of research Aim 3 was to explore the relational hypothesis. As with Aim 2, the first step was to establish whether there was a direct effect between MI Spirit/Empathy and treatment engagement outcomes (baseline attendance, NOURISH^{+} attendance, post-treatment

assessment attendance, and 4-month follow up assessment attendance; MacKinnon et al., 2007). It was hypothesized that MI Spirit/Empathy would be positively related to treatment engagement outcomes. If there was a direct effect, Aim 3a was to examine if %CT mediated the relation between MI Spirit/Empathy and treatment engagement. As shown in Figure 4, there were three paths examined: the relation between MI Spirit/Empathy (path a), %CT and treatment engagement (path b), and MI Spirit/Empathy and treatment engagement (path c′).

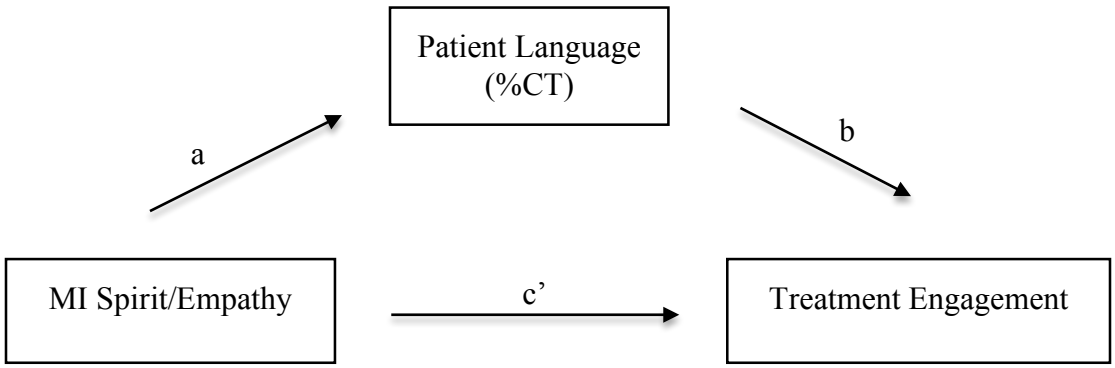

Figure 4. Relational hypothesis of motivational interviewing

The goal of Exploratory Aim 4 was to examine whether certain types of MICO (e.g., R/Q, %OQ, %CR+) were related to specific types of CT (e.g., % individual CT behavior codes, %CT, %CML, %PREP). This analysis was exploratory, as it was not known which specific types of MI consistent behavior would be most related to parent change talk and counter change talk. For these analyses, a bivariate correlation was used to assess the association between types of MICO and CT.

Finally, a secondary aim was to examine if parent language (%CT) is associated with clinical outcomes as indicated by 1) change in child weight status (child BMI percentile); 2) change in parent weight status (parent BMI); 3) child dietary changes (change in average calories consumed as reported on the 24 hour food record between baseline and post-treatment); changes in child levels of physical activity (change in minutes spent doing moderate or vigorous physical

activity as reported on the Physical Activity Recall between baseline and post-treatment). It was hypothesized that change talk would be positively related to clinical outcomes in those that completed treatment. These hypotheses were investigated using linear regressions.

All 81 parents were included in analyses examining baseline attendance. Analyses of treatment and post-treatment assessment attendance accounted for attrition by excluding those parents that did not attend baseline. Parents that did not complete baseline (dropout between MI session 1 and baseline; $n = 19$) were excluded from analyses examining NOURISH^{+}, post-treatment assessment, and 4-month follow up assessment attendance. Parents that did not attend baseline could not have attended NOURISH^{+} sessions, post-treatment assessment, or 4-month follow-up assessment. Thus, they were excluded from these analyses. Those parents that attended baseline but did not attend any NOURISH^{+} sessions (dropout between baseline and NOURISH^{+}) were still included in all analyses because they could have still participated in treatment sessions and post-treatment/4-month follow-up assessments.

Results

Descriptive Analyses

Clinician language. Clinicians in this study were highly MI adherent, using 93% MI consistent language (MICO) on average. MI inconsistent behaviors (MIIN) occurred infrequently or not at all in sessions.

Clinician behavior codes were not expected to have equal distribution throughout the sample. Thus, it was not surprising to find that skewness and kurtosis values varied widely for behavior codes. There were no missing data. Consistent with previous research, (e.g., Moyers et al, 2007) data were not transformed because this was an accurate reflection of the sessions.

Average frequencies for each clinician behavior code are reported in Table 6. Clinicians most frequently expressed the following categories of MICO: Complex Positive Reflections (*M*

= 26.01, *SD* =18.15), Open Questions (*M* = 16.21, *SD* = 7.80), and Affirmations (*M* = 4.48, *SD* = 3.47). The following behavior codes did not occur in any sessions: Advise with or without Permission, Confront, Direct, Raise Concern with or without Permission, and Warn.

Table 6

Average Frequency of MI Consistent (MICO) and MI Inconsistent (MIIN) Clinician Utterances

Behavior Code	Type	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
Affirm	MICO	0.00	17.00	4.48	3.47	1.61	3.52
Emphasize Control	MICO	0.00	3.00	.12	0.53	4.68	21.93
Reframe	MICO	0.00	3.00	.23	0.64	3.01	8.99
Support	MICO	0.00	13.00	.98	1.99	3.58	16.9
Open Question	MICO	4.00	38.00	16.21	7.80	.67	-.16
Simple Reflections+	MICO	0.00	29.00	3.60	5.48	2.43	6.63
Complex Reflections+	MICO	5.00	160.00	26.01	18.15	5.22	37.37
Total Reflections+	MICO	9.00	166.00	29.62	18.17	5.49	40.00
Closed Question	MIIN	0.00	12.00	4.14	2.73	.82	.37
Simple Reflections-	MIIN	0.00	4.00	0.27	0.71	3.25	11.87
Complex Reflections-	MIIN	0.00	9.00	1.60	2.06	1.74	2.97
Total Reflections-	MIIN	0.00	9.00	1.83	2.22	1.45	1.66

Note: Advise with Permission, Advise without Permission, Confront, Direct, Raise Concern with Permission, Raise Concern without Permission, and Warn never occurred and were excluded

Clinician behavior codes were also aggregated into summary scores, as detailed in the methods section. Average summary scores for clinician behavior codes are displayed in Table 7. Summary scores (%MICO, %CR+, %SR+, %Reflections+) were checked for univariate outliers

by visual inspection of histograms and box plots in SPSS (Tabachnick & Fidell, 2007). When producing boxplots, SPSS defines values that are > +/- 3.0 interquartile ranges from the inner fences as extreme outliers and values between +/-1.5 and +/-3.0 as mild outliers. Based on boxplot inspection, there were few outliers for %MICO (1 mild), %CR+ (4 mild, 1 extreme), %SR+ (5 mild, 6 extreme), and %Reflections+ (1 mild, 1 extreme). Due to the exploratory nature of this study and confirmation that these values were accurate, all data were included in analyses.

Overall, clinician language was highly MI consistent. On average 79% of all clinician questions were open-ended. In terms of reflections, the average ratio of reflections to questions was 1.73, and approximately 94% of all reflections were positive (reflected change talk). More specifically, 82% were complex positive reflections and 12% were simple positive reflections.

Table 7

Average Summary Scores for Clinician Behaviors

Summary Score	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
%MICO	.78	1.00	0.93	.04	-0.61	0.73
%MIIN	.00	0.22	0.07	.04	0.61	0.73
R/Q	.38	7.55	1.73	.96	3.22	16.74
%OQ	.43	1.00	0.79	.12	-.74	0.88

%CR+	.18	1.00	0.82	.19	-1.72	2.61
%CR-	.00	0.26	0.05	.06	1.33	0.96
%SR+	.00	0.75	0.12	.18	2.28	4.76
%SR-	.00	0.10	0.01	.02	2.65	6.54
%Reflections+	.73	1.00	0.94	.07	5.49	39.99

Note: %MICO = % MI consistent language, %MIIN = % MI inconsistent language R/Q = Ratio of reflections to questions, %OQ = % Open Questions, %CR+ = % Complex positive Reflections, %CR- = % Negative Complex Reflections, %SR+ = % Positive Simple Reflections, %SR- = % Negative Simple Reflections, %Reflections+ = % Total Positive Reflections

The average MI Spirit/Empathy was 4.42 (*SD* = .59) indicating that interventionists had a MI consistent relational style characterized by warmth, empathy, collaboration, and client-centeredness. The range of possible scores was 1-5, however, all interventionists received a rating of 3 or above on all sessions. There were no missing data and visual inspection of histograms and boxplots revealed no outliers for MI Spirit/Empathy. Results suggested that not only were interventionists consistent in delivering MI consistent techniques, but also they were consistent with an empathic and MI consistent relational style.

Parent language. Individual parent behavior codes were also not evenly distributed. Overall, parents expressed more change talk than sustain talk (*M* %CT = .86, *SD* = .09). Within different categories of change talk, Preparatory Language (PREP) occurred more frequently than Commitment Language (CML). On average, each session contained nearly twice as many PREP utterances (*M* = 39.54, *SD* = 6.72) compared to CML utterances (*M* = 21.00, *SD* = 6.72). Clinicians most frequently expressed the following types of change talk: Reasons+ (*M* = 23.77, *SD* = 12.86), Other+ (*M* = 7.07, *SD* = 5.76), and Taking Steps+ (*M* = 5.04, *SD* = 4.66). The most frequently expressed type of ST was Ability- (*M* = 3.09, *SD* = 3.63). Average frequencies for each parent behavior code are reported in Table 8.

Table 8

Average Frequency of Change Talk and Sustain Talk Parent Utterances

Behavior Code	Type	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
Desire+	CT	0.00	20.00	3.23	4.16	1.79	3.43
Ability+	CT	0.00	10.00	2.10	2.49	1.31	1.18
Reasons+	CT	4.00	86.00	23.77	12.86	1.85	6.28
Need+	CT	0.00	17.00	3.37	3.22	2.09	5.53
Commitment+	CT	0.00	17.00	1.68	2.55	3.38	16.32
Taking Steps+	CT	0.00	20.00	5.04	4.66	1.15	1.18
Other+	CT	0.00	27.00	7.07	5.76	1.05	.84

Total Preparatory Language	CT	11.00	99.00	39.54	16.78	1.30	2.04
Total Commitment Language	CT	0.00	21.00	6.72	5.29	0.79	-.24
Desire-	ST	0.00	3.00	0.31	.72	2.58	6.24
Ability-	ST	0.00	18.00	3.09	3.63	2.10	5.73
Reasons-	ST	0.00	13.00	1.42	2.65	2.58	6.87
Need-	ST	0.00	15.00	0.46	2.14	5.70	33.92
Commitment-	ST	0.00	1.00	0.04	.19	5.00	23.54
Taking Steps-	ST	0.00	3.00	0.31	.74	2.53	5.75
Other-	ST	0.00	10.00	2.22	2.86	1.36	.93

Note. CT = Change Talk, ST = Sustain Talk

Parent behavior codes were also aggregated into summary scores, as detailed in the methods section. Summary scores (%CT, %PREP, %CML) were checked for univariate outliers by visual inspection of histograms and box plots in SPSS (Tabachnick & Fidell, 2007). Based on boxplot inspection, there a few outliers for %CT (4 mild*),* %PREP (1 mild), %CML (5 mild, 6 extreme), and %Reflections+ (2 mild). Given that outliers were mild and analyses were exploratory, all data were included in analyses.

Average summary scores for parent behaviors codes are displayed in Table 9. Approximately 86% of parent language consisted of change talk (*M* = .86, *SD* = .09). Preparatory language made up a larger percentage of parent language (% PREP *M* = .74, *SD* = .13) than commitment language (%CML *M* = .13, *SD* = .09), indicating a greater percentage of

parent statements were about contemplating change as opposed to committing to change. Reasons for change (Reasons+) made up 45% of parent language about change (M = .45, SD = .16), with each other category of change talk accounting for <10% of parent language.

Table 9

Average MISC 2.5 Summary Scores for *Parent Language*

Summary Score	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
%CT	.61	1.00	.86	.09	-0.66	0.42
%PREP	.33	1.00	.74	.13	-0.44	0.06
%CML	.00	.37	.13	.09	0.64	-0.32
%D+	.00	.43	.06	.07	2.26	8.03
%A+	.00	.17	.04	.04	1.23	0.85
%R+	.08	.84	.45	.16	0.16	-0.24
%N+	.00	.17	.06	.04	0.71	-0.23

%C+	.00	.17	.03	.03	1.68	3.27
%TS+	.00	.30	.09	.08	0.78	-.08
%ST	.00	.39	.14	.09	0.66	0.42

Note. %CT = % Change Talk, %PREP = % Preparatory Language, %CML = % Commitment Language, %D+ = % Desire for change, %A+ = % Ability to change, %R+ = % Reasons for change, %N+ = % Need for change, %C+ = % Commitment to change, %TS+ = % Taking steps toward change, %ST+ = % Sustain Talk

Relation Between Parent Change Talk and Treatment Engagement

The first aim of the study was to examine whether change talk (%CT) was related to treatment engagement outcomes (baseline attendance, NOURISH^{+} attendance, post-treatment assessment attendance, 4-month follow-up assessment attendance). Logistic regressions were conducted to examine the effect of %CT on the likelihood that parents would attend baseline, post-treatment assessment, and 4-month follow up assessment (all dichotomous treatment outcomes). A negative binomial regression was used to examine the effect of %CT on the number of NOURISH^{+} sessions attended (count data).

For baseline attendance, the logistic regression model was statistically significant, χ^2 (1) = 9.41, p = .002. The model explained 16.50% (Nagelkerke R^2) of the variance in baseline attendance. There was a significant relation between %CT and baseline attendance, such that for every 10% increase in CT, the odds that a parent would attend baseline increased by 2.42 times, 95% CI [1.32, 4.47].

Further analyses examined whether certain categories of change talk were related to baseline attendance. There was significant relation between %PREP and baseline attendance, such that for every 10% increase in parent preparatory language, the odds that a parent would attend baseline increased by 1.57 times, χ^2 (1) = 4.98, p = .026. The model explained 9.0% (Nagelkerke R^2) of the variance in baseline attendance. There was no significant relation

between %CML and baseline attendance, χ^2 (1) = .002, p = .964. A 10% increase in commitment language did not have a significant effect on baseline attendance, (OR = .99, p = .964, 95% CI [.56, 1.76]).

Because there was a significant relation between %PREP and baseline attendance, further analyses were conducted to examine whether specific types of preparatory language (%D+, %A+, %R+, %N+) were related to baseline attendance. There was no significant relation between the percentage of individual PREP behavior codes and baseline attendance (%D+ χ^2 (1) = 2.95, p = .086; %A χ^2 (1) = .021, p = .885; %R χ^2 (1) = .121, p = .728; %N χ^2 (1) = 2.71, p = .10). This indicated that 10% increase in any of these individual behavior codes did not have a significant effect on baseline attendance (%D OR = 2.22, p = .130, 95% CI [.79, 6.23]; %A OR = 1.09, p = .886, 95% CI [-1.27, 3.60]; %R OR = 1.06, p = .728, 95% CI [.77, 1.47]; %N OR = 2.94, p = .120, 95% CI [.75, 11.44]).

In terms of follow-up attendance, the relation between %CT and post-treatment assessment attendance was not significant, χ^2 (1) = 2.53, p = .112. For every 10% increase in change talk, the odds of a parent attending post-treatment assessment did not significantly increase (OR = .58, p = .120, 95% CI [-1.29, 1.16]). There was a significant negative relation between %CT and 4-month follow up assessment attendance, χ^2 (1) = 6.803, p = .009; for every 10% increase in CT, the odds that a parent would not attend 4-month follow up increased by 2.56 times, 95% CI [-.75, 6.76].

Finally, a negative binomial regression was performed to examine the effect of %CT on the number of NOURISH$^+$ sessions attended. There was no significant relation between %CT and the number of NOURISH$^+$ sessions attended, χ^2 (1) = .45, p = .502. A 10% increase in

change talk did not significantly affect the number of NOURISH+ sessions attended, (OR = .88, p = .50, 95% CI [.61, 1.28]).

In sum, the percentage of change talk expressed, and specifically the percentage of preparatory language expressed, had a statistically significant effect on increasing baseline attendance; however, percentage of change talk did not significantly increase the likelihood of any other treatment engagement outcomes.

Technical and Relational Hypotheses

Aims 2 and 3 of the study were to test the technical and relational hypotheses of MI. The technical hypothesis predicted a relation between the technical delivery of MI (%MICO) and treatment engagement that is mediated by %CT. The relational hypothesis predicted a relation between the relational factors in MI delivery (MI Spirit/Empathy) and treatment engagement that is mediated by %CT. Theoretically, both technical and relational factors are thought to influence outcomes in MI, and change talk is hypothesized to be the mechanism through which change occurs. It should be noted that there was little variability in %MICO (see Table 7) and in MI Spirit/Empathy due to high MI fidelity that likely influenced results.

Logistic regressions were conducted to examine the effect of %MICO on attendance at baseline, post-treatment assessment, and 4-month follow up assessment. Results did not indicate a significant relation between %MICO and baseline attendance (χ^2 (1) = .071, p = .790), post-treatment assessment attendance (χ^2 (1) = 1.65, p = .199,) or 4-month follow up assessment attendance (χ^2 (1) = .02, p = .899). A 10% increase in MICO did not significantly increase the odds of baseline attendance (OR = 1.18, p = .789 95% CI [-1.27, 4.08]), post-treatment assessment attendance, (OR = 2.28, p = .199, 95% CI [.65, 8.00]), or 4-month follow up assessment attendance (OR = 1.07, p = 899, 95% CI [-1.26, 3.09]). Results did not differ when

the same logistic regressions were run using the frequency of MICO utterances to measure therapist MI consistency. The results suggested that the percentage of MI consistent clinician language did not influence attendance at baseline, post-treatment assessment, or 4-month follow-up assessment; however, limited variability in %MICO likely influenced results.

A negative binomial regression was conducted to examine the relation between %MICO and the number of NOURISH^{+} sessions attended. Results indicated %MICO was not significantly related to overall NOURISH^{+} attendance (χ^2 (1) = 3.59, p = .058). There was a trend toward significance, such for every 10% increase in MICO, the odds of NOURISH^{+} attendance improving increased by 1.87 times. This trend suggested that clinician MI consistency in a pre-treatment MI session might be related to overall treatment attendance among those parents that enrolled in NOURISH^{+}, however, the results only approached significance and variability in %MICO was limited.

To test the relational hypothesis, the same types of analyses were conducted to examine the effects of MI Spirit/Empathy on treatment engagement outcomes (baseline attendance, NOURISH^{+} attendance, post-treatment assessment attendance, 4-month follow up assessment attendance). As with %MICO, there was little variability in MI Spirit/Empathy ratings. Results indicated MI Spirit/Empathy was not significantly related to baseline attendance (χ^2 (1) = .190, p = .663), post-treatment assessment attendance (χ^2 (1) = .196, p = .658,) or 4-month follow up assessment attendance (χ^2 (1) = .06, p = .807). For every one unit change in MI Spirit/Empathy (based on the MISC 2.5 Global Empathy code rated on a 1-5 scale), there was no significant change in baseline attendance (OR = 1.21, 95% CI [.51, 2.90]), post-treatment assessment attendance (OR = .82, 95% CI [.34, 1.99]), or 4-month follow up assessment attendance (OR = .90, 95% CI [.37, 2.16]); however, variability in MI Spirit/Empathy likely influenced results.

A negative binomial regression was performed to assess the relation between MI Spirit/Empathy and overall NOURISH^{+} attendance. There was also no relation between MI Spirit/Empathy and the number of NOURISH^{+} sessions attended (χ^2 (1) = .065, p = .799), such that a one unit change in MI Spirit/Empathy did not have a significant effect on the number of NOURISH^{+} sessions attended (OR = .99, 95% CI = [.95, 1.04]).

Overall, there was little variability in MICO and MI Spirit/Emapthy and no statistically significant relation between these aspects of clinician language and any of the treatment engagement outcomes. Thus, it was not possible to proceed with testing mediation models because there were no direct effects of technical or relational factors n treatment engagement for change talk to mediate (MacKinnon et al., 2007).

Relation Between MICO and Change Talk

An additional aim of the study was to examine whether specific types of MICO (e.g., %OQ, %CR+) were related specific types of CT (e.g., %PREP, %CML). Although there was no direct effect of %MICO on treatment engagement outcomes, the relation between %MICO and %CT remained of interest. The %CT in a session, particularly %PREP, significantly increased the odds of baseline attendance. Thus, examining whether specific types of MICO were related to preparatory language was of interest.

As displayed in Table 10, Spearman's correlations revealed significant associations between some aspects of parent and clinician language. Specifically, the percentage of total positive reflections (%Reflections+) was significantly correlated with the percentage of overall change talk (%CT) and preparatory language (%PREP) in particular. As %Reflections+ increased, %CT and %PREP also increased. In terms of individual behavior codes, an increase in complex positive reflections (%CR+) was significantly correlated with an increase in Reasons+

(%R+), but a decrease in Ability+ (%A+). Thus, while complex positive reflections were associated with an increase in change talk overall, it appears that some types of change talk increased (overall preparatory language, reasons for change) while others decreased (ability to change).

Table 10

Spearman's Correlations Between MISC 2.5 MICO Summary Scores and CT Summary Scores

MICO Summary Score	Change Talk Summary Score									
	%CT	%PREP	%CML	%D+	%A+	%R+	%N+	%C+	%TS+	%O+
%MICO	.10	.13	-.09	.14	-.11	.04	.18	-.21	-.04	-.01
R/Q	.05	-.04	.10	-.07	-.13	.07	.17	.05	.10	-.12
%SR+	.01	-.01	-.03	-.10	.13	.06	-.03	.01	-.04	-.17
%CR+	.23*	.16*	.04	-.06	-.25*	.22*	-.05	.12	-.01	.01
%Reflections+	.52**	.31**	.06	-.19	-.26*	.50**	-.05	.28*	-.03	-.23*
%OQ	.07	.16	-.15	.09	-.07	-.02	.17	-.26	-.10	.09

Note: %MICO = % MI consistent language, R/Q = Ratio of reflections to questions, %SR+ = % Positive Simple Reflections, %CR+ = % Complex positive Reflections, %Reflections+ = % Total Positive Reflections, %OQ = % Open Questions, %CT = % Change Talk, % PREP = % Preparatory Language, %CML = % Commitment Language, %D+ = % Desire for change, %A+ = % Ability to change, %R+ = % Reasons for change, %N+ = % Need for change, %C+ = % Commitment to change, %TS+ = % Taking steps toward change, %O+ = % Other change talk
*$p < .05$; **$p < .01$

To further explore the association between specific types of MICO and change talk, Spearman's correlations were conducted for the frequencies of MICO and CT codes. Results of these analyses are displayed in Table 11. As the frequency of clinician MICO utterances increased, the frequency of parent change talk utterances also increased. More specifically, an increase in MICO frequency was associated with an increase in PREP, A+, R+ and C+ frequencies. To examine whether certain MICO behaviors were associated with certain types of CT, correlations between specific types of CT and MICO were examined. The overall frequency of positive reflections (Reflections+) was correlated with the frequency of CT. In particular, the frequency of complex positive reflections (CR+) was significantly correlated with the

frequencies of PREP, CML, R+, N+, and C+. Additionally, the frequency of Emphasize Control (EC) was correlated with the frequency of PREP, specifically D+. As the frequency of clinician utterances that emphasized parent control increased (EC), the number of parent utterances about contemplating the benefits of change significantly increased. Specifically, statements about the desire to change increased. Another specific MICO behavior that was positively correlated with specific types of CT was Affirmation (AF). The frequency of AF was significantly correlated with the frequency of commitment language (CML) and ability to change (A+).

Table 11

Spearman's Correlations Between MICO Frequency Scores and CT Frequency Scores

MICO Frequency	CT Frequency									
	CT	PREP	CML	D+	A+	R+	N+	C+	TS+	O+
MICO	.35*	.30*	.18	.08	.27*	.25*	.21	.25*	.04	.02
SR+	.18	.13	.13	-.06	.16	.22	.03	.08	.05	-.11
CR+	.29**	.28**	.30**	.11	.08	.30*	.32*	.38**	.13	-.05
Reflections+	.46**	.37**	.29**	.09	.18	.41**	.33**	.36**	.13	-.07
OQ	.02	.03	-.03	-.01	.16	.02	.02	.08	-.12	.02
AF	.14	.03	.24*	.07	.29**	.06	.01	.12	.23	-.12
EC	.21	.23*	.10	.34*	-.03	.13	.15	-.12	.02	.06
RF	.02	.03	-.04	.13	-.11	-.07	.08	-.08	-.13	.03
SU	-.09	-.06	-.03	.14	-.06	-.11	-.12	.09	-.11	.12

Note: MICO = MI consistent language, SR+ = positive simple reflections, CR+ = complex positive reflections, Reflections+ = total positive reflections, OQ = open questions, CT = change talk, PREP = preparatory language, %CML = commitment language, D+ = desire for change, A+ = ability to change, R+ = reasons for change, N+ = need for change, C+ = commitment to change, TS+ = taking steps toward change, O+ = other change talk
*$p < .05$; **$p < .01$

In sum, frequencies of specific MICO techniques were associated with specific types of change talk. Complex positive reflections were associated with increases in parents' expressions of preparatory language, commitment language, reasons for change, need for change and commitment to change. Other MICO strategies that were correlated with change talk were Emphasize Control, Affirmation, and Support. Increased frequency of clinician utterances emphasizing parent control were also associated with parent utterances about wanting to change. An increase in Affirmations from clinicians was associated with increased parent statements about commitment to change and ability to change.

Additional Exploratory Analyses

Relation between MI Spirit/Empathy and change talk. Although there was no direct effect of MI Spirit/Empathy on treatment engagement outcomes, the relation between MI Spirit/Empathy and change talk remained of interest. Based on linear regressions, there was not a significant relation between MI Spirit/Empathy and %CT, $\beta = -.01$, $t\ (79) = -.64$, $p = .521$, or MI Spirit/Empathy and CT frequency, $\beta = 1.95$, $t\ (79) = .56$, $p = .575$.

Differences in MICO and change talk according to baseline attendance. One lingering question was whether there were any differences in clinician and parent language in sessions with individuals that attended baseline compared to individuals that did not attend baseline. An independent-samples t-test was conducted to compare MICO summary scores for MI sessions in which the parent attended baseline compared to sessions in which the parent did not attend baseline. There were no significant differences in clinician's global empathy, %MICO, %Reflections+, R/Q, or %OQ.

When specific types of positive reflections were examined, there was a statistically significant difference in %CR+ used with parents that attended baseline ($M = .85$, $SD = .17$) and

parents that did not attend baseline (M = .74, SD = .23); $t(79) = 2.20$, p = .03). Individuals that attended baseline had clinicians who made more complex positive reflections compared to other types of reflections (e.g., simple positive reflections, simple and complex negative reflections). By contrast, there was a trend toward the opposite relation between %SR+ and baseline attendance, $t(79) = 1.89$, p = .06. Fewer simple reflections were used with parents that attended baseline (M = .10, SD = .16) than parents that did not attend baseline (M = .18, SD = .20), but this difference was only marginal. It is important to note that %CR+ and %SR+ are related values. Both %CR+ and %SR+ are percentage scores based on the frequency of each type of reflection out of all possible types of reflections (positive and negative simple reflections, positive and negative complex reflections). Thus, as one increases, the other naturally decreases.

Therefore, additional analyses were conducted to investigate differences in the frequencies of CR+ and SR+ in sessions with parents that attended baseline compared to parents that did not attend baseline. Analyzing the data in this manner did not take into account differences in the length of session or the verbosity of the clinician, but allowed for the variables to be mathematically unrelated. When frequencies of CR+ and SR+ were examined, there was a statistically significant difference in the frequency of SR+ used with parents that attended baseline (M = 2.94, SD = 5.21) and parents that did not attend baseline (M = 5.79, SD = 5.88); $t(79) = 2.03$, p = .05. These results suggested that use of more positive simple reflections is associated with decreased baseline attendance. There were no statistically significant differences in the frequency of complex positive reflections used with individuals that attended baseline compared to those that did not.

MICO and treatment outcomes. A series of regression analyses examined the relation between MICO and specific treatment outcomes (change in parent BMI, change in child BMI

percentile, change in physical activity, and change in caloric consumption), while controlling for baseline level of behavior. Analyses were conducted using MICO frequency and %MICO as two different ways of analyzing results due to the limited variability in %MICO. There was no significant relation between MICO frequency or the percentage of MICO and specific treatment outcomes; $p > .05$.

Change talk and treatment outcomes. Regression analyses were also used to examine the relation between CT and specific treatment outcomes (change in parent BMI, change in child BMI percentile, change in physical activity, and change in caloric consumption), while controlling for baseline level of behavior. Analyses were conducted using CT frequency and %CT as two different ways of analyzing results. There were no significant relations between change talk frequency or the percentage of change talk and specific treatment outcomes; $p > .05$.

Discussion

It is critically important to understand ways to improve treatment engagement in pediatric obesity interventions, especially among high-risk populations who manifest lower engagement and higher attrition (Ogden et al., 2014; Skelton & Beech, 2011; Zeller et al., 2004). The goal of this study was to investigate the process of MI in pre-treatment sessions that improved treatment engagement in a parent-focused pediatric obesity intervention. A standardized observational coding system (i.e., MISC 2.5; Houck et al., 2011) was used to examine the process of MI by analyzing parent and clinician language. Consistent with previous research and theory on the process of MI, results of this study underscored the importance of change talk in predicting treatment initiation and also suggested an association between certain MICO strategies and increased change talk (Miller & Rollnick, 2013).

Although full meditation models of the technical and relational hypotheses could not be tested, results were consistent with previous studies showing support for some paths in the

technical model (Magill et al., 2014). There was evidence supporting a link between change talk and likelihood of treatment initiation (path b) and there was support for an association between certain types of MICO and change talk (path a). Results offered specificity about the association between certain types of MICO and certain types of change talk. Such information is not only helpful in understanding the process of MI, but also might inform future pre-treatment MI interventions and clinician training.

Change Talk and Treatment Engagement

Consistent with previous research and theory on the process of MI, parent change talk predicted the likelihood of treatment engagement (Apodaca & Longbaugh, 2009; Baer et al., 2008; D'Amico et al, 2015; Gaume et al., 2008; Gaume et al. 2013; Miller & Rollnick, 2013; Moyers et al., 2007). Results indicated that increasing parent change talk, and specifically preparatory language, increased the likelihood of parent attendance the initial baseline session. This finding suggests that one way to improve parent treatment initiation in pediatric obesity interventions is to target increasing change talk and preparatory language. These results pave the way for further research on how MI might be used to enhance treatment engagement in pediatric obesity interventions.

A secondary aim was to examine whether certain types of change talk were more related to treatment engagement than others. Findings showed that preparatory language was significantly correlated with initial treatment engagement, but commitment language was not. These results were inconsistent with the proposed model in which preparatory language leads to commitment language, which subsequently predicts behavior change (Miller, Moyers, Amrhein, & Rollnick, 2006; Miller & Rollnick, 2013). Although commitment language was thought to be more strongly associated with behavior change than preparatory language, other studies have

also found preparatory language to be associated with target behavior changes (Baer et al., 2008; Gaume et al., 2008; Martin et al., 2011). These results provide evidence that preparatory language is associated with treatment initiation and highlight the need to further examine the role of different types of change talk. It is possible that preparatory language is more relevant for treatment engagement when individuals are in the preparation stage of treatment (consistent with the this study's findings, as parents were preparing to enter treatment), whereas commitment language might be more relevant later when individuals are in the action stage of treatment and making changes to lifestyle behaviors (Prochaska & DiClemente, 1984).

Beyond baseline attendance, change talk was not significantly related to NOURISH^{+} treatment attendance. It is likely that the pre-treatment MI session was most relevant to getting people "in the door" for treatment, but was not enough to influence remaining in treatment or completing later assessments. To impact overall NOURISH^{+} attendance, it might be beneficial to incorporate MI specific to treatment engagement throughout NOURISH^{+} or to incorporate booster MI sessions to encourage ongoing motivation. Although the percentage of change talk appeared to be negatively related to follow-up assessment attendance, these findings ought to be interpreted cautiously given the number of factors that could have influenced follow-up attendance in the months between the pre-treatment MI sessions and follow-up assessments.

Clinician Language Associated with Change Talk

Reflections and change talk. Several key findings from this study highlighted the relation between reflections and change talk, as well as nuances in the use of different types of reflections. Results showed that out of all clinician reflections, the percentage of positive reflections was associated with increased change talk and preparatory language. This finding adds to mounting evidence that attending specifically to making positive reflections is associated

with increased change talk (D'Amico et al., 2015; Glynn & Moyers, 2010; Moyers et al., 2011). To expand on this finding and on previous research, a closer examination of different types of positive reflections was completed.

Follow-up analyses suggested that when the percentage of positive reflections was divided into the percentage of complex positive reflections and the percentage of simple positive reflections, only complex positive reflections were related to change talk. It is important to note that the way in which percentage scores were computed might have influenced these results. Thus, using frequencies of behaviors was another way of examining the data and one that is frequently used in the literature (e.g., Gaume et al., 2010; Moyers et al., 2009).

When frequencies of different types of positive reflections were examined, results were similar. There was a significant correlation between complex positive reflections and change talk but not simple positive reflections and change talk. The frequency of complex positive reflections was associated with increases in overall preparatory language and overall commitment language, specifically reasons for change, need for change and commitment to change. By contrast, the frequency of simple positive reflections was not associated with any types of change talk. Consistent with literature on MI, these results provide empirical support for complex reflections being more helpful than simple reflections (Miller & Rollnick, 2013).

It is important to note that complex positive reflections might have been an indicator of how clinicians responded to ambivalence. A double-sided complex reflection can reflect both sides of the parent's desire to change, but a double-sided complex reflection that is positive emphasizes the side of the parent that wants to change. For example, if a parent expressed concern about having time for NOURISH+ because her child just started playing sports, the interventionist could reflect sustain talk (e.g., right now is not the best time to participate) or

reframe this as change talk (e.g., even though you are really busy, it is important to you to make time for him to be involved in physical activity). The former example is thought to increase sustain talk while the latter is thought to increase change talk by highlighting physical activity as something the parent values. Previous researchers suggested that these types of reflections are more likely to increase change talk, but did not actually separate complex from simple reflections in their analyses (D'Amico et al., 2015). As such, this study offers empirical support for the advantages of complex positive reflections over positive simple reflections in increasing change talk.

Indeed, results of this study suggested that simple positive reflections might actually have the opposite effect on change talk and preparatory language. Descriptive analyses indicated that simple positive reflections occurred more frequently with individuals that did *not* attend baseline compared to individuals that did. It was not expected that positive simple reflections would be associated with non-attendance, as positive simple reflections are still an MI consistent behavior. One interpretation of this finding is that the use of positive simple reflections (e.g., simply repeating what parents said) might have indicated a difference in the overall quality of conversations about change. These results suggest it is important for clinicians to not only maximize complex positive reflections, but also to minimize simple positive reflections.

Relation between other specific types of MICO and change talk. When clinician language was broken down into individual behavior codes, there were certain types of MICO behaviors associated with certain types of change talk. For example, the frequency of statements emphasizing parent control was associated with increased change talk and preparatory language, specifically discussing desire for change. This result fits with the importance of highlighting autonomy in MI to increase change talk (Miller & Rollnick, 2013). Other types of MICO were

associated with different types of change talk. For example, the frequency of affirmations was associated with parent statements about having the ability to change. This finding likely represents clinicians affirming parents when they discuss positive thoughts about their ability to change; however, this conclusion cannot be drawn without analysis of the sequence of events and bi-directional effects.

An unexpected finding was a negative correlation between the percentage of positive reflections and Ability+. These results might represent the use of positive reflections to respond to a parent discussing uncertainty about their ability (both Ability+ and Ability-) by responding to ambivalence with a positive double-sided complex reflection. For example, if a parent discussed knowing what healthy foods to choose (Ability+), but having difficulties with financial barriers to buying healthy foods (Ability-), the clinician might have responded by highlighting this a reason to participate in NOURISH^{+} (e.g., to learn strategies for buying healthy groceries on a budget). In the future, a closer examination of the content of utterances and the sequence of dialogue would help to elucidate this finding.

Overall, results highlighted an association between specific types of MI consistent clinician techniques and parent change talk. Clinician behaviors associated with change talk included complex positive reflections, emphasizing parent control, positive affirmations, and supportive statements. Previous research on the process of MI has mainly been done in the field of substance use (Apodaca et al, 2009; Magill et al., 2014). Only a few studies have examined the process of MI in adolescent obesity interventions (Carcone et al., 2013; Jacques-Tiura et al., 2016) and none have explored the process of MI in obesity interventions targeting children. Thus, this study expands knowledge on the process of MI to a novel population and target behavior—parental treatment engagement in a parent-focused pediatric obesity intervention.

Limitations and Strengths

The overall lack of variability in MI consistency was a limitation in this study. Because interventionists were highly proficient in their use of MI, that amount of MI inconsistent language behaviors and the range of MI Spirit/Empathy scores was small. This limited the ability to examine the effects of MI inconsistent language on change talk and treatment engagement. It also made it difficult to examine the relational hypothesis because MI Spirit/Empathy scores were so high with limited variability ($M = 4.42$, $SD = .59$). Yet, this was an overall strength of NOURISH+MI as it indicated excellent clinician training and fidelity in MI.

Another related limitation was the uneven distribution of behavior codes that might have influenced results. Some variables had little to no meaningful variance, which might have impacted the ability to detect effects or potentially magnified effects with the inclusion of outliers. Additionally, using a correlational design limited the ability to draw any conclusions about the direction of effects between clinician and parent language and causality. As an initial exploratory examination of parent and clinician language in these sessions, it was valuable to characterize and report correlational findings based on non-transformed data. Steps were taken to ensure that the uneven distribution of data did not unduly impact findings by selecting analyses that were better fit for nonparametric data (e.g., Spearman's correlations; Sheskin, 2011).

There were also differences in change talk with regard to whether parents were discussing making changes to eating and exercise behaviors for their child, themselves, or their entire family by enrolling in NOURISH^{+}. NOURISH^{+} is a parent-focused pediatric obesity intervention that emphasizes the importance of parents as role models in making family-wide changes. Accordingly, it was relevant to code change talk related to child, parent, and family-wide behaviors, as the parent was still the primary agent of change. Using the MISC 2.5, it was

not possible to code when change talk and sustain talk referenced parent, family, or child behaviors. Thus, it was not possible to explore how ambivalence or enthusiasm about parents changing their own behaviors might have been related to treatment engagement.

There were a number of study strengths in terms of its implications. First, this study contributes to building empirical evidence to support the theory of MI. Until recently, only a few studies had examined the change processes and mechanisms involved in MI (Apodaca & Longbaugh, 2009; Magill et al, 2014; Miller & Rollnick, 2013; Miller & Rose, 2009). Additionally, this is the first study to date to examine the process of MI when used to increase treatment engagement in a parent-focused pediatric obesity intervention. Although two studies have recently examined the process of MI in adolescent-focused obesity interventions (e.g., Carcone et al, 2013; Jacques-Tiura et al., 2016), this is the first to investigate parent and clinician language in an obesity intervention for younger children.

There were several strengths related to the study design as well. The study sample represented parents from diverse racial and socio-economic backgrounds. Thus, it has great public health relevance related to improving pediatric obesity treatment targeting a population with the highest levels of obesity and the most barriers to treatment engagement (Skelton & Beech, 2011). Rater training for this study was rigorous and as evidenced by excellent inter-rater reliability when double-coded sessions were examined. Entire sessions were coded to capture the full conversation (versus only a segment of the session) and sessions were previously rated with the MITI 3.1 as having high MI fidelity. Use of the MISC 2.5 allowed for coding clinician and parent language with great specificity by parsing and coding specific utterances and yielding both frequency and summary percentage scores (Houck et al., 2010).

The ability to examine results with both frequency scores and summary scores was a strength of this study. Previous studies have used different methods to capture parent and clinician language or have used one method to measure clinician language and the other to measure parent language (Glynn & Moyers, 2012; Moyers et al., 2007a; Pirlott et al., 2012). There is no consensus on the best method for measuring these variables, which might account for inconsistencies in the literature. Using both methods highlighted differences that can emerge depending on how variables are operationalized. Including both methods provides important data that can be used to inform measurement in future studies.

Frequency scores and summary scores are both valid ways of capturing parent and clinician language, but there are nuances between the two. For example, a MICO frequency score indicated the total number of MI consistent clinician utterances, which was affected by the length of the session and verbosity of the clinician. The summary score (%MICO) indicated the number of MI consistent clinician utterances relative to MI inconsistent utterances, which was affected by the limited number of MI inconsistent utterances. Both methods have drawbacks and can influence findings. Thus, presenting data using both methods increased the transparency of results.

Study Implications and Future Directions

This study represents an important first step in understanding a common process by which MI influences behavior change. Across studies that have examined the process of MI, change talk has consistently been a key predictor of future behavior change, but most research on the process of MI has focused on changing a specific health behaviors and not on increasing treatment engagement (Amrhein et al., 2003; Apodaca & Longbaugh, 2009; Baer et al., 2008; D'Amico et al, 2015; Gaume et al., 2008; Gaume et al. 2013; Miller & Rollnick, 2013; Moyers et

al., 2007; Pirlott et al, 2012). MI has been increasingly used as an adjunct or prelude to treatment to facilitate treatment engagement, but little has been known about *how* MI influences treatment engagement (Romano & Peters, 2015). This study contributes to the literature by investigating the process of MI when targeting treatment engagement in a parent-focused pediatric obesity intervention. Findings demonstrated the same relation between change talk and behavior change found in previous studies, except in this study the target behavior was enrolling in treatment. Overall, this study adds to support that change talk is an important precursor to making subsequent behavioral changes. Whether the targeted behavior is initiating treatment or making a specific health behavior change, change talk appears to be an instrumental predictor of future behavioral change.

Results of this study have important implications for improving treatment engagement in pediatric obesity interventions that have notoriously high rates of attrition. The period of time between signing up for a pediatric obesity intervention and attending the first session is a critical point of attrition across studies (Skelton & Beech, 2011). If a brief pre-treatment MI intervention focusing on using specific MI consistent skills to increase parent change talk can enhance the likelihood of treatment initiation, it might be beneficial to incorporate these skills into phone calls for screening or scheduling.

It is possible that this type of pre-treatment intervention might boost initial engagement in other interventions as well. A previous review of studies suggested that MI increased treatment engagement (defined as attendance) in treatments for mood, anxiety, psychotic and eating disorders (Romano & Peters, 2015). As such, it would be interesting to explore the effects of pre-treatment MI on treatment engagement in other populations, paying particular attention to MI

consistent strategies associated with change talk and the role of change talk as a predictor of change.

In future research related to increasing treatment engagement in parent-focused pediatric interventions, there are a number of follow-up questions that would be interesting to investigate. Results of this study suggested pre-treatment change talk is a significantly related to the likelihood of treatment initiation. Findings also provided important insight into the associations between MICO, change talk, and treatment engagement; however, the causal relation between these variables was not examined. Next steps for this line of research should include an investigation of the temporal relation between MICO, change talk, and treatment engagement through the use of sequential analysis techniques (Bakeman & Quera, 1995).

An experimental study in which the amount of MICO in the pre-treatment intervention is manipulated could also be examined to help clarify whether specific MICO behaviors actually elicit change talk or if change talk naturally varies as a reflection of parent readiness to change independent of the clinician. It is possible that simply having the opportunity to talk with a member of the NOURISH+ team prior to the intervention influenced baseline attendance. Although all parents received reminder calls, the length of these calls varied depending on whether parents received the MI intervention or simply reminder information. To further investigate, a follow up study would have to include a control comparison group that spent an equivalent amount of time talking with a member of the NOURISH+ team who is not delivering MI (e.g., answering close-ended questions about current eating and exercise behaviors). This would provide the opportunity to examine how different levels of MICO influence change talk and subsequent treatment engagement.

Finally, investigating differences in the content of change talk might be particularly relevant to this study because NOURISH+MI is a parent-focused pediatric-obesity intervention. It would be interesting to explore whether parents who expressed a desire for change in their childrens' behavior but sustain talk toward changing their own behavior would be less likely to remain in a parent-focused intervention.

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Appendix A

Table 1

Motivational Interviewing Proficiency at Session 1 Compared with MITI 3.1[a] *Recommended Proficiencies*

MITI 3.1 Domain	Mean Rating[b] *M* (*SD*)	MITI 3.1 Recommended Proficiencies	
		Basic Competency	Proficiency
Global Spirit[c]	4.6 (0.41)	3.5	4
Reflection:Question	1.6 (0.72)	1.0	2.0
% Complex Reflections[e]	91.0% (0.05)	40%	50%
% Open Questions[f]	73.2% (0.12)	50%	70%
% MI Adherent[g]	100% (0.00)	90%	100%

[a]MITI 3.1 = Motivational Interviewing Treatment Integrity Code, Version 3.1
[b]Means represent ratings from 6 interventionists
[c]Global Spirit = (Evocation + Collaboration + Autonomy)/3
[d]Ratio = Total Reflections/Total Questions
[e]% Complex Reflections = (Complex Reflections/Total Reflections) x100
[f]% Open Questions = (Open Questions/Total Questions) x100
[g]% MI Adherent = MI Adherent/(MI Adherent + MI Non-adherent)
* = $p < .01$

Appendix B

Codes and Summary Scores for the Motivational Interviewing Skills Code (MISC 2.5)

Table 2

MISC 2.5 Clinician and Patient Global Codes

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 patient's perspective.
Direction	The clinician's ability to keep the patient focused on language related to the target behavior change.
Autonomy Support	Clinician language explicitly emphasizes that the patient has the power to change or not change.
Collaboration	Clinician works together with patient to examine possibilities for change.
Evocation	Clinician elicits deeper thought and exploration from the patient.
Self-Exploration	Patient's high point of personal reflection on changing behavior as it relates to personal circumstances.

Table 3

MISC 2.5 Patient Behavior Codes, Definitions, and Examples

Behavior Code	Type	Definition	Example
Desire+	CT	Identifies a longing for behavior change.	"I want my kids to be healthy."
Ability+	CT	Expresses confidence that behavior change is possible.	"I know we can make good choices when eat at home."
Reasons+	CT	Identifies motivating factors for change.	"I don't want him to have diabetes."
Need+	CT	Expresses necessity for change.	"He needs to learn to like vegetables while he's young."
Commitment+	CT	Explicit expression of intention to change.	"I am going to start packing his lunches this year."
Taking Steps+	CT	Refers to recent changes the patient made.	"Last week we went to the park after school every afternoon."
Other+	CT	Related to change, but is hypothetical or unrealistic.	"If I didn't have to work, then my family would eat better."
Desire-	ST	Identifies a desire to maintain current behavior.	"Big Sunday dinners are a huge part of our family tradition."
Ability-	ST	Expresses barriers that will make change impossible.	"I don't have time to go grocery shopping."
Reasons-	ST	Identifies motivating factors for not changing behavior.	"I don't want him to feel left out so I want him to still have candy."
Need-	ST	Expresses the necessity for maintaining behavior.	"I need to pick up fast food for dinner during the week."
Commitment-	ST	Explicit expression of intent to maintain the status quo.	"I am not going to take sodas out of our house."
Taking Steps-	ST	Refers to recent behavior that is counter to change.	"I decided to just go all out on buying Halloween candy."
Other-	ST	Minimizing problem or stating how change is neg.	"Her weight isn't really a problem."
Follow Neutral/Ask	Other	Responses unrelated to target behavior or are reporting history/info.	"She was a really big baby."

Note: CT = Change Talk, ST = Sustain Talk

Table 4

MISC 2.5 Clinician Behavior Codes, Definitions, and Examples

Behavior Code	Type	Definition	Example
Advise with Permission	MICO	Statements that offer advice, suggestions, or solutions that allows patient to "opt out".	Would you mind if I shared tips other parents have found helpful with planning healthy snacks?
Advise without Permission	MIIN	Statements that offer advice, or solutions that do not allow patient to "opt out".	You should consider buying frozen vegetables so they won't go bad.
Affirm	MICO	Statements that are positive or complimentary (e.g., confidence, reinforcement).	You have already made changes to your cooking that have made a huge difference!
Confront	MIIN	Responses that have a "negative parent quality" and correct, criticize or judge.	You're compromising your health for the sake of convenience.
Direct	MIIN	Statements that give an order or command	You have got to stop bringing junk food into the house!
Emphasize Control	MICO	Emphasizes patient's power to choose, autonomy, and personal responsibility.	It is totally up to you to decide what's going to fit best with your family right now.
Facilitate	Other	Acknowledgements for the patient to continue speaking.	I see.
Filler	Other	Pleasantries and other responses that do not better fit any other category.	Hope you are doing well today!
Giving Information	Other	Education, information, explanations, or feedback about a particular topic.	If you have any questions between now and then, the best person to call is our project coordinator.
Closed Questions	MIIN	Questions that elicit discrete responses (e.g., yes/no, age).	Do you have any questions for me?
Open Questions	MICO	Questions that provide the possibility for the patient to expound in their response.	What do you think some of the benefits would be of your son losing weight?
Simple Reflections 0	MICO	Neutral statements that restate patient language.	You're not sure what this program is going to be like.
Simple Reflections +	MICO	Statements that restate patient language that favors change.	You want to eat healthier.
Simple Reflections -	MIIN	Statements that restate patient language against change.	It's just too hard to find time.

Table 4 (continued)

Behavior Code	Type	Definition	Example
Complex Reflections 0	MICO	Neutral statements that restate patient language and add additional depth	Sounds like you have a really hectic day today!
Complex Reflections +	MICO	Statements that restate patient language that favors change, and add additional depth, meaning, or emotion.	When you realized some of the small changes you made had an impact, you really wanted to do more.
Complex Reflections -	MIIN	Statements that restate patient language against change and add additional depth, meaning, or emotion.	You sometimes feel hopeless about the possibility that things could be any different.
Simple Reflections ±	MICO	Statements that restate patient ambivalence	You are really feeling two ways about this.
Complex Reflections ±	MICO	Statements that restate patient language that is both towards and away from change and add additional depth, meaning, or emotion.	On the one hand you're tired of pushing your kids to eat healthier. On the other hand, want them to start good habits at a young age.
Reframe	MICO	Statements that interpret a patient utterance and provide a new meaning.	You've got to be a really strong person to keep trying after all that.
Raise Concern with Permission	MICO	Statements or questions that express the clinician's concern about a possible problem with the patient's plan or goal, but is tentative.	This might not be your top priority today, but I'm worried about that you might fall back onto old habits once things get busy again.
Raise Concern without Permission	MIIN	Statements or questions that express the clinician's concern about a possible problem with the patient's plan or goal.	I'm worried that could harm your relationship with your daughter.
Support	MICO	Statements that offer sympathy, compassion, or understanding to the patient.	You have really been through a lot.
Structure	Other	Statements that give information specific to the context of the study.	Now I'd like to switch gears and ask you a little bit more about exercise.
Warn	MIIN	Statements that threaten by overemphasizing negative consequences	You're going to end up with even more medical problems.

Note: MICO = MI Consistent, MIIN = MI Inconsistent

Table 5

MISC 2.5 Formulas for Calculating Summary Scores

Summary Scores	Speaker	Formula	Description
%CT	Patient	CT/[CT+ST]	Frequency of change talk utterances out of all meaningful patient language
%PREP	Patient	PREP/[CT+ST]	Frequency of preparatory language (desire+, ability+, reasons+, and need+) out of all meaningful patient language
%CML	Patient	CML/[CT+ST]	Frequency of commitment language (commitment+ and taking steps+) out of all meaningful patient language
%D+, %A+, %,R+, %N+, %C+, %TS+	Patient	% Individual Behavior Code/[CT+ST]	Frequency of each individual behavior code out of all meaningful patient language
%MICO	Clinician	MICO/[MICO+MIIN]	Frequency of MI consistent language out of all meaningful clinician utterances
R/Q	Clinician	Total Reflections/ Total Questions	Ratio of the frequency of clinician reflections to clinician questions
%OQ	Clinician	Open questions/ Total Questions	Frequency of open questions out of total clinician questions
%CR+	Clinician	Complex Reflections+/ Total Reflections	Frequency of complex reflections of change talk out of total reflections
%CR-	Clinician	Complex Reflections-/ Total Reflections	Frequency of complex reflections of sustain talk out of total reflections
%SR+	Clinician	Simple Reflections+/ Total Reflections	Frequency of simple reflections of change talk out of total reflections
%SR-	Clinician	Simple Reflections-/ Total Reflections	Frequency of simple reflections of sustain talk out of total reflections
%Reflections+	Clinician	Positive Reflections/ Total Reflections	Frequency of all reflections of change talk out of total reflections

Vita

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