EXAMINATION OF SELF-DETERMINATION THEORY CONSTRUCTS AS MEDIATORS OF THE EFFECT OF MOTIVATIONAL INTERVIEWING ON TOBACCO CESSATION OUTCOMES

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EXAMINATION OF SELF-DETERMINATION THEORY CONSTRUCTS AS MEDIATORS OF THE EFFECT OF MOTIVATIONAL INTERVIEWING ON TOBACCO CESSATION OUTCOMES

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University of Missouri-Kansas City, 2021

ABSTRACT

Despite an abundance of evidence supporting the efficacy of motivational interviewing for health behavior change, little is known about how it works. This study conducted a secondary analysis of autonomous motivation as a mediator of motivational interviewing's effects in a recently completed randomized controlled clinical trial comparing motivational interviewing to health education on smoking quit attempts (KC Quest). Results of the parent trial unexpectedly revealed that motivational interviewing was not more effective than health education for inducing quit attempts of smoking cessation. While the mechanism through with the interventions is still unknown it remains feasible that motivational interviewing led to quit attempts and cessation by increasing autonomous motivation while health education was effective through a different mechanism.

Interventions consisted of motivational interviewing (n=90) and health education (n=92). The primary outcome was the occurrence of any quit attempt defined as a serious quit attempt of at least 24 hours (Biener & Abrams, 1991; Marlatt, Curry, & Gordon, 1988) by Week 26. The Treatment Self-Regulation Questionnaire (TSRQ), developed from self-

determination theory (SDT:Deci & Ryan, 1985), assesses the degree of autonomous self-regulation regarding why people engage or would engage in healthy behavior. Change scores from baseline to week 26 in the Autonomous (AR) and Controlled regulation (CR) subscales were computed for use in the mediation modeling.

Log-binomial regression mediation examining each mediator separately revealed neither AR nor CR mediated effects of motivational interviewing or health education on quit attempts. A strength of the KC Quest enrollment was the inclusion of a racially diverse group of participants (67.2% Black) most adversely effected by smoking co-morbidities. Our current study did not detect a difference in smoking outcomes based on motivation mediators among Black participants.

An important implication of this study is that while self-regulation failed to explain how, motivational interviewing and health education both increased quit attempts. There is a need for future investigations to examine other SDT constructs, such as relatedness and competence, as potential mediators of smoking interventions.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the College of Arts and Science have examined a dissertation titled "Examination of Self Determination Theory Constructs as Mediators of the Effect of Motivational Interviewing on Tobacco Cessation Outcomes" presented by Kimberly Krust Bray, candidate for the Doctor of Philosophy degree, and certify that in their opinion it is worthy of acceptance.

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CHAPTER 1

INTRODUCTION

Effective provider-client communication regarding health behavior is essential for providing optimal health care. Research shows adherence to health providers' recommendations tends to be low; 30-60% of information provided in the provider-client encounter is forgotten within an hour of the encounter (DiMatteo et al., 2002). Moreover, DiMatteo et al. (2002) showed that 50% of health recommendations are not followed by patients. To address this challenge research has focused on identifying methods of communicating with patients that are more effective at increasing adherence to health behavior recommendations.

One important method of communicating with patients that has received considerable attention in the literature is Motivational Interviewing (MI). MI was developed from research in alcohol counseling which indicated outcomes were improved by applying client-centered communication. MI is a method of counseling designed to increase patient motivation for behavior change through use of a compassionate, collaborative, and autonomy supportive style (Miller & Rollnick, 2013). MI has been widely applied to address behavior change including tobacco cessation, exercise, sexual risk reduction, gambling, and treatment adherence (Lundahl et al., 2013; Lundahl, , et al., 2010 Resnicow et al., 2002; & Ruback, et al., 2005). A number of meta-analyses indicate MI is significantly (10–20%) more effective than no treatment and generally equal to other viable treatments for a wide variety of problems ranging from substance use (alcohol, marijuana, tobacco, and other drugs) to reducing risky behaviors and increasing client engagement in treatment.

Despite strong evidence for the efficacy of MI (Lundahl et al., 2013; Ruback et al., 2005; & Lundahl, et al., 2010), less is known about the underlying mechanisms of action. Understanding how MI works is important because it may lead to improvements in training, practice, and improved efficacy. A number of potential mechanisms of action have been proposed to explain how MI works. Most attention has focused on a model involving a relational component, such as counselors communicating empathy, and a technical component where client's statements regarding interest in changing behavior are elicited (Amrhein, Miller, Yahne, et al., 2003; Miller & Rollnick, 2013). Notably, a number of researchers have pointed to the compatibility between MI and Self-Determination Theory (SDT), considered one of the leading theories of motivation and widely applied to health behavior change (Markland et al., 2005; Resnicow, 2002).

SDT represents a broad theory of motivated behavior (Deci & Ryan, 2008) describing the relative roles of internal and external motivation and how social and cultural factors enhance or undermine people's sense of choice and initiative. SDT proposes that self-regulated behavior can be described as lying along a continuum of relative autonomy, reflecting the extent to which the person fully endorses and is committed to what they are doing. At the more controlled end of this continuum, is behavior motivated by external regulations, such as the rewards and punishments that others might control. An example of external regulation is a patient engaging in a weekly exercise program because their employer's wellness program is providing a financial incentive. The more autonomous end of this continuum reflects motives for engaging in behavior because of interest, curiosity, care, or abiding values. An example of autonomous regulation is a person engaging in a weekly exercise program because they have decided it is important for their health and well-

being. Importantly, autonomously regulated behaviors are more stable, done with greater care and accompanied by more positive experiences than externally regulated behaviors (Ryan & Deci, 2000).

The links between STD and MI are extensive and include similar assumptions about individuals and psychological health and growth. They both posit individuals have an innate tendency for personal growth towards psychological integration. Both MI and STD are closely aligned on the human propensity for personal growth. MI in fact is described by Miller as a movement toward integration and cohesion when the client's beliefs, attitudes, and behaviors become consistent with the values core to their personal identity (Miller, 1994). This is accomplished in MI when the client recognizes inconsistencies between a behavior and their core values and sense of self. STD and MI also both convey support for clients, encourage exploration of the client's own reasons for change, and refrain from pressuring patients to change. STD suggestions for specific behavioral strategies are also similar to MI including: eliciting and acknowledging client perspectives, supporting client choices, providing a rationale for advice given, providing a menu of effective options of change, minimizing control and judgement and exploring aspirations (Patrick & Williams, 2012).

These theoretical links are supported by a number of studies that have found MI effects mediated by SDT constructs. For example, in a large trial with African American participants (Shaikh et al., 2011) autonomous motivation mediated 17% of the effect of MI on fruit and vegetable consumption. That is, MI was positively associated with autonomous motivation, which in turn, was positively related to fruit and vegetable consumption. A number of studies examined the impact of MI on autonomous regulation and found that

autonomous motivation is increased by MI (Knittle et al., 2015; Webber et al., 2011; & West et al., 2011). Although these studies are supportive of links between MI and SDT, the sample sizes are generally small and from homogenous groups and limited in the health behaviors examined.

A recent randomized controlled trial compared MI to health education for smoking cessation in a large diverse sample and hypothesized that MI would be more effective than health education because it would be more likely to foster internalized, or more autonomous motivation, for smoking cessation (Catley et al., 2016). Because health education (HE) was delivered in the form of an informational lecture with minimal interactivity it was assumed that MI would be more likely to foster autonomy support and lead to attempts to quit smoking. Unexpectedly the main outcome analysis found no significant difference between MI and health education in fostering quit attempts. From a mediational perspective, this suggests that either autonomous motivation was not impacted as expected by MI (relative to HE) or that autonomous regulation was increased but that it did not lead to behavior change.

The purpose of the present study is to extend existing research on mechanisms of action associated with MI by examining the mediating role of autonomous motivation in this trial. Examination of autonomous regulation in this existing data set stands to increase understanding of how MI works. as well as clarify the reason for the main findings of the clinical trial.

CHAPTER 2

LITERATURE REVIEW

Health communication was incorporated in the national health goals in 2010 (Office of Disease Prevention and Health Promotion 2010). Health communication contributes to all aspects of disease prevention and health promotion and is relevant in a number of contexts, including health professional-patient relations. The set of Leading Health Indicators, which focus on key health improvement activities and are described in *Healthy People 2010: Understanding and Improving Health*, all depend to some extent on effective health communication. Numerous studies of provider-patient communication support the connection among the quality of the provider-patient interaction, patient behavior, and health outcomes (Ha & Longnecker, 2010).

One important method of communicating with patients that has received considerable attention in the literature is Motivational Interviewing (MI). MI has been defined as a person-centered, goal-directed method of communication for eliciting and strengthening intrinsic motivation for positive change (Miller & Rollnick, 2013). The counselor uses strategies to elicit the client's perspective regarding the possibility of behavior change. Contrary to the way addiction therapy was commonly practiced, MI avoids "confronting" or challenging clients about their behavior and instead fosters a collaborative approach to explore the client's perspective about their behavior. Counselors establish a non-confrontational and supportive climate in which clients are invited to express their views about the positive and negative aspects of their current behavior. Rather than providing the patient with arguments for why they should change, the therapist encourages the patient to become their own advocate for change by exploring the discrepancy between what the client

perceives as ideal goals or behavior for their life compared to their current situation. The usefulness of MI for patients with alcohol use disorders led to it being used for patients with other addictions including cocaine (Bernstein et al., 2005; Stein, Herman, & Anderson, 2009; Stotts, Schmitz, Rhoades et al., 2001), gambling (Hodgins, et al., 2009; Hodgins, et al., 2004) and for a variety of other health behaviors (e.g., exercise, oral health, and nutrition) in which motivation plays a key role (Anshel & Kang, 2008; Campbell et al., 2009; Brand et al., 2013; Alomomani et al., 2009; Resnicow et al., 2008; Weinstein, et al., 2006).

MI is characterized by a philosophy or "spirit", processes, and specific skills. The spirit consists of collaboration, acceptance, evocation, and compassion. There are four processes: engaging, focusing, evoking, and planning. The core communication skills include: asking open questions, affirming, reflecting, summarizing, and providing information and advice with permission. What characterizes MI is the particular way these skills are strategically used to help clients move in the direction of change by implementing the processes in a manner that is consistent with the underlying philosophy. Through the four processes, MI uses a guiding communication style to engage with clients, clarify their strengths and aspirations, evoke their own motivations for change, while promoting their autonomy in decision making.

Efficacy of Motivational Interviewing

The efficacy of MI has been evaluated in several hundred studies exploring a wide-range of types of behavior change. Several meta-analyses have explored the contribution of MI compared with other interventions to help determine whether MI is effective in promoting behavior change (Burke, et al, 2003; Burke, et al., 2004; Hettema & Hendricks,

2010; Hettema, et al., 2005; Lai, et al., 2010; Lundahl et al., 2010; Rubak, et al., 2005; Vasilaki, et al., 2006). Effect sizes for MI are typically small to moderate when MI is compared to no or minimal treatment (Burke et al., 2003; Lundahl et al., 2010). When compared to active treatment, MI effect sizes are generally not significant (Burke et al., 2003; Vasilaki et al., 2006).

Among the health behaviors that MI has been used to address is tobacco use. Similar to findings for other behaviors, MI's effects for treatment of tobacco dependence are modest when compared to other conditions (Hettema & Hendricks, 2010). MI for smoking cessation has not been associated with significant effect sizes when compared with strong treatments but may have moderate effect sizes when compared with weak treatments (Lundahl et al., 2010). About half of 23 MI for tobacco cessation studies involving non-pregnant participants yielded effect sizes greater than the small range though most long-term studies were not significant. Mean short-term abstinence rates were modest; 13.8% for MI conditions and 11.2% for comparison conditions (Hettema & Hendricks, 2010), but the significant increase in quitting is a robust finding (Lai et al., 2010).

Theory of Motivational Interviewing

Although the efficacy of MI has been established in many areas, there is less understanding of the underlying mechanisms of action of MI. Understanding the mechanism of action is important because it can help to improve training and treatment and potentially lead to stronger outcomes.

The development of MI is described as atheoretical because it was developed from the practice experience of Miller and Rollnick (2012) rather than on theoretical grounds.

However, a number of potential mechanisms of action have been proposed to explain how MI works. Theories underlying MI's effectiveness involve clinically rich and complex sets of variables and relationships, which can be explicit but lack integration into a formal and comprehensive theory.

Some proposed mechanisms relate to counselors' behaviors such as through communicating empathy and acceptance. Carl Rogers' client centered approach to therapy includes absolute worth, accurate empathy autonomy support, and affirmation (Roger's, 1951). Absolute worth refers to an attitude of profound acceptance and respect for the other person's worth as a both necessary and sufficient condition for change to occur. The counselor does not judge or place conditional acceptance on a client. According to Roger's this is because when individuals experience themselves as unacceptable their ability to change is obstructed. Another critical aspect of acceptance Carl Rogers viewed as necessary for change is accurate empathy. This active interest in an effort to understand another's internal perspective is referred to as active empathy. This is distinct from feelings of sympathy for a client's perspective; it is an ability to understand another's frame of reference or "inner world of private personal meaning". Acceptance also means honoring and respecting an individual's autonomy or self-direction. Rogers believed that when given the essential therapeutic conditions clients will receive therapeutic benefit. This includes complete freedom to be and to choose.

Other proposed mechanisms relate to client behaviors such as expressing "change talk" which are any statements the client makes indicating interest in behavior change. The potential effect of change talk on behavior change can be understood in terms of Bem's Self Perception Theory (1972). According to Self-Perception Theory, although common intuition

would lead one to assume our actions are determined by our attitudes this is not always the case. In fact, behavior can lead individuals to form attitudes consistent with their behavior. In MI a person's verbalizations of intent ("change talk" behavior) may become beliefs of intent, and may thus lead to subsequent behavior change (Bem, 1972).

Miller and Rose (2009) have proposed a model of how MI works that involves technical and relational components. The relational component refers to the underlying philosophy of MI as a crucial component of its efficacy. This philosophy is (a) collaborative rather than authoritarian, (b) evokes the client's own motivation rather than trying to "install" it, and (c) honors the client's autonomy. Without the relational component, the client will not engage in the further processes necessary to increase motivation and the likelihood of change. Once the client is engaged by means of an empathic interpersonal context, attention can be turned to a collaborative focus on a particular problem to be addressed. These relational factors guide the client to tap into underlying motivation to change. This is consistent with an extensive body of psychotherapy literature which indicates therapy outcomes are strongly affected by the counselor-client relationship.

More unique to MI is the technical component which refers to the role of "change talk". Change talk consists of client utterances that favor the target behavior change. As the client discusses his or her experience of ambivalence regarding the target change, the therapist selectively attends to language in favor of changing. The intent is to increase both the quantity and strength of change talk so that the client will hear their own arguments for change. This is based on the hypothesis that people are more likely to be persuaded by arguments they make themselves than those they hear from others. In essence, therapists are helping clients to talk themselves into changing. MI is thus thought to lead to behavior

change because it encourages or elicits change talk from clients. Expressions of change, particularly with strong commitment utterances is a good predictor of future change.

Autonomous Motivation as a Mediator of Behavior Change in MI.

Aside from theories focused on within session behaviors and interactions between counselors and clients, there has also been attention to how MI relates to Self-Determination Theory (Patrick & Williams, 2012), an established theory of motivation that has been widely applied to health behavior change. In this line of research MI is hypothesized to work because it fosters autonomous motivation a particular type of self-regulation or motivation based on Self-Determination Theory.

SDT represents a broad theory of personality development and self-motivated behavior change (Deci & Ryan, 2008). The two main assumptions are based on an individual's need to grow and gain fulfillment through internal sources of motivation. SDT also focuses on how social and cultural factors facilitate or undermine people's sense of volition and initiative, in addition to their well-being and the quality of their performance. Conditions supporting the individual's experience of **autonomy, competence,** and **relatedness** are argued to foster the most volitional and high quality forms of motivation and engagement for activities, including enhanced performance, persistence, and creativity (Ryan & Deci, 2000).

Much basic research stemming from SDT examines experimentally how the processes and structures of rewards, directives, feedback, praise, positive regard, and other change-related factors enhance or diminish self-motivation and outcomes. SDT proposes all behaviors can be described as lying along a continuum of relative autonomy, reflecting the extent to which the person fully endorses and is committed to what they are doing. At the

more controlled end of this continuum is behavior that is motivated by external regulations, such as the rewards and punishments that others might control. Controlled motivation consists of both external regulation, in which one's behavior is a function of external contingencies of reward or punishment, and introjected regulation, in which the regulation of action has been partially internalized and is energized by factors such as an approval motive, avoidance of shame, contingent self-esteem, and ego-involvements (Deci & Ryan, 2008). An example of external regulation is a client engaging in a behavior because they were pressured or mandated to do so by a counselor.

The more autonomous end of this continuum reflects motives for engaging in behavior for the inherent interest and satisfaction derived from engaging in the action itself. Autonomous motivation is relevant to both intrinsic motivation and extrinsic motivation, which refers to activities that are not inherently rewarding (such as health behaviors or school work). According to SDT, extrinsic motivations also have the potential to be autonomous if the individual has identified with the activity's value and ideally integrated it into their sense of self. SDT differentiates types of extrinsic motivation in terms of the degree to which it has been internalized, suggesting the more fully it is internalized and integrated with one's self the more autonomously regulated the behavior is said to be.

This distinction is important in the behavior change context as engaging in a new behavior such as diet and exercise or smoking cessation is unlikely to be experienced as inherently enjoyable. As such the critical distinction in SDT is how people internalize and integrate extrinsic motivations and come to self-regulate their behaviors in order to engage autonomously in actions in their daily life. (Desi & Ryan, 1985; Ryan and Deci, 2000).

Thus, health behaviors can be said to be autonomously motivated if self-regulation is identified or integrated.

A considerable body of research supports the view that more autonomously regulated behaviors, as measured using this continuum of autonomy framework, are more stable, done with greater care and quality, and accompanied by more positive experiences (Ryan & Deci, 2000). Differences in relative autonomy have predicted both motivational persistence, quality of behavior and learning, and well-being outcomes in many domains including education, work, sports, exercise, and environmental behaviors (Deci & Ryan, 2000; Ryan and Deci, 2000). The importance of the relative autonomy of motivation has been directly related to treatment participation and outcomes in health care and psychotherapy (Patrick & Williams, 2012).

Theoretical links between SDT and MI

A number of papers have outlined how MI is consistent with SDT principles highlighting ways in which MI practice is consistent with recommended SDT strategies for fostering autonomy support (Markland, Ryan, Tobin, Rollnick, 2005; Patrick & Williams, 2012). The links between STD and MI are extensive and include similar assumptions about individuals having and innate tendency for personal growth towards psychological integration. According to Miller MI is designed to foster integration and cohesion so that the client's attitudes and beliefs become consistent with the values core to their personal identity (Miller, 1994). The MI practitioner helps the client recognize inconsistencies between a behavior and their core values and sense of self. STD and MI also both convey support for clients, encourage exploration of the client's own reasons for change, and refrain from pressuring patients to change. There are suggestions in STD for behavioral strategies that are

similar to those used in MI including: eliciting and acknowledging client perspectives, supporting client choices, providing a rationale for advice given, providing a menu of effective options of change, minimizing control and judgement, and exploring aspirations (Patrick & Williams, 2012).

Links between MI and STD can also be understood at the level of how MI philosophy, processes, and skills or strategies relates to the three psychological needs for autonomy and self-regulation (competence, relatedness and autonomy). According to SDT interventions that meet these needs are most likely to foster autonomously motivated behavior change. Consideration of MI practice suggests it should provide the social-environmental conditions of competence, autonomy, and relatedness suggested as necessary by SDT to promote this tendency. Each is briefly discussed in turn below.

Competence: MI philosophy includes recognition that individuals have their own strengths, motivations, and resources that should be activated in order for change to occur. For example, the MI strategy of Affirming an individual's abilities is aligned with fostering competence. It is designed to support and encourage the person's inherent strengths and efforts. Another way in which MI fosters competence is through providing advice or information which can be offered when judged as relevant. In the MI method the strategy is to ask permission to share the advice, provide the advice, and follow-up with an inquiry regarding what the individual thinks of the advice. This is designed to preserve the client's autonomy while providing additional resources or information to increase their sense of competence for making behavior change.

Relatedness: The MI philosophy elements of "acceptance" and "partnership" fit well with the principle of relatedness. Clients are accepted with unconditional positive regard

without judgement or blame. According to MI principles the client and practitioner should work together as partners rather than as expert and recipient. It is important to engage clients as partners because they are "experts on themselves and their lives". MI is therefore done "with someone", not "on" or "to them".

MI's links to relatedness are also evident in the Engaging process which is used at the beginning of the encounter to establishing mutual trust and a respectful relationship. MI strategies are also relevant for relatedness including the use of open-ended questions, reflections, and summaries. For example, acceptance is demonstrated by voicing understanding for the client's position or perspective through reflections and summaries. These strategies allow the patient to engage with the practitioner in a way that communicates their participation is valued. Reflections also assure the client feels validated and that the MI counselor has empathy for the client's experience.

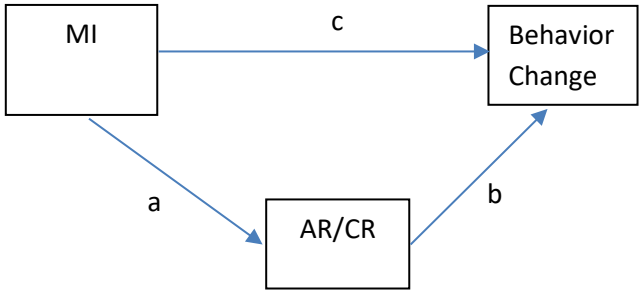
Autonomy: MI philosophy include acceptance which includes autonomy support as a sub-component. In MI the practitioner is supposed to communicate acceptance by recognizing and supporting the patient's freedom to decide what and how they will or will not change. MI processes include evoking which is a process for eliciting the individual's own reasons for change. In MI one goal of the evoking process is to facilitate a client's expression of self-motivational statements or change talk to increase motivation for change based on their own reasons for change. This is consistent with SDT's emphasis on autonomous or internalized motivation. Even when the final process of MI, the planning process, is reached planning is conducted in a manner to help the client chart a path to change utilizing their own ideas for how change can occur. At the level of specific strategies, MI also

utilizes open ended questions which provide an individual with an opportunity to discuss behavior change from the perspective of their own experiences and perceptions.

Empirical Support for Autonomous Motivation as a Mediator of MI's Effect

A significant body of research has investigated the role of autonomous regulation as a mediator of MI's treatment effects. Figure 1 depicts the hypothesized mediational pathway. The mediation model also includes controlled motivation (which also encompasses introjected motivation) as a potential mediator because controlled motivation is conceptually tied to autonomous motivation and is very often included in studies of autonomous motivation. In the model the effect of MI on controlled motivation is hypothesized to be in the opposite direction of autonomous motivation because MI should shift motivation from being controlled to being more autonomous. Reviewed studies looked at the full mediational chain as well whether MI increases the mediator (path a) or whether the mediator leads to behavior change (path b) (Figure 1). All studies used the Treatment Self Regulation Questionnaire (Levesque et al., 2007) to assess autonomy consistent with the SDT model. The reviewed studies examine a variety of health outcomes including weight management, physical activity, fruit and vegetable intake and oral health.

Figure 1 Theorized mediational pathway of MI's effects on behavior change



MI Relationship to Autonomous Regulation (path a).

Seven studies have examined the relationship between MI treatment and autonomous regulation (i.e., path A). These include studies in which the effect of MI on the mediator is examined in comparison to alternative treatments and a study in which the effect of MI on the mediator is reflected in the extent of practitioner adherence to MI. Most of the path A studies examined physical activity and weight loss with two studies focused on oral health behaviors. This section focuses only on path A results and where studies also examined path B, those results are reviewed in the next section.

Three of the seven studies focused on weight loss. Befort and colleagues (2008) examined the effect of a 16-week behavioral program with the addition of four sessions of MI compared to the same program with four sessions of didactic health education. Participants were 44 African American women who were obese. There was significant weight loss and improvement in diet in both groups. Results suggest that either MI did not have its effects through autonomous motivation or both treatments operated through the autonomous motivation mechanism.

A more complex picture emerged in a study by Webber and colleagues (2011) who adopted SDT as the theoretical framework in comparing a standard internet-based weight

loss program with a MI-based internet intervention among 32 overweight or obese women. Although there was significant weight loss over 16 weeks, autonomous motivation *decreased* in both the standard and MI groups. This reduction in autonomous motivation reached significance only in the control group. However, examination of predictors of weight loss showed treatment condition moderated the effect of baseline controlled motivation on weight loss. While having a high level of baseline controlled motivation was negatively associated with weight loss, moderation analysis revealed individuals with high baseline controlled motivation lost less than 1 kg of body weight if they were assigned to the standard treatment group or 4.6 kg if they were assigned to a MI treatment group. Therefore, although the findings did not support a direct of effect of MI on increased autonomous motivation (or lower controlled motivation) the MI-based intervention appeared to have buffered the negative effects of initial controlled motivation.

The third weight related study examined the effects of a novel motivation-focused approach, including an autonomy-promoting component based on MI, compared to a traditional skill-based approach for promoting weight loss maintenance among 338 overweight women (West et al., 2011). All participants underwent a six-month behavioral treatment program before being randomized to treatment conditions and followed for a further twelve months. Although the treatment conditions produced comparable sustained weight losses and both groups lost significantly more weight than controls, participants in the MI group had significantly greater autonomous motivation for weight control than the skills-based group at the mid-point of the maintenance period. Although the effect size was small, this study is the only weight loss focused study to provide support for Path A.

Knittle and colleagues (2014) conducted both of the relevant physical activity focused studies. The first was a pilot study conducted to determine whether adherence to MI related to short-term changes in physical activity (PA) and regulatory style among 27 clients with rheumatoid arthritis allocated to an MI treatment group in a randomized trial (Knittle et al., 2014). Regulatory style was assessed using the Treatment Self Regulation Questionnaire subscales for autonomous regulation, introjected regulation, and external regulation. Two weeks after receiving the MI intervention there were no significant changes in physical activity or in autonomous, introjected or external regulatory style. However, greater reflection to question ratios (an indicator of greater adherence to MI principles) and interviews with a greater percentage of MI-adherent statements were associated with decreases in introjected (i.e., more controlled) regulation. Motivational Interviewing sessions rated as higher in global spirit and with a greater percentage of MI adherent behaviors were also associated with decreases in introjected regulation.

The second study examined the effects of targeting both the motivation and action phases of behavior change in a 5-week intervention to increase physical activity (PA) among clients with rheumatoid arthritis (Knittle et al., 2014). Clients were randomized to a control group (n=40), which received a group-based client education session led by a physical therapist, or a treatment group (n=38), which received the education session plus a MI session from a physical therapist and two self-regulation coaching sessions from a rheumatology nurse. At post-treatment (6 weeks) and 6-months follow-up, significantly more treated patients than controls met current PA recommendations and the experimental group had significantly higher autonomous regulation at 6 months compared to the control group.

Thus both physical activity focused studies found MI had effects on self-regulation in expected directions.

Two additional studies examined path A in the context of MI for oral hygiene. In one, the capacity of MI to enhance the efficacy of an oral hygiene intervention was examined in individuals with severe mental illness (schizophrenia, bipolar disorder or depression) (Almomani, et al., 2009). Sixty subjects received either MI plus oral health education or oral health education alone. Brief MI sessions were conducted by a doctoral psychology student. Subjects in the intervention received MI prior to oral hygiene instructions. Clinical oral indices and self-regulation were assessed at four and eight weeks after intervention. Self-regulation measures examined included autonomous, external and introjected motivation. The results indicate MI increased introjected rather than external or autonomous motivation. The authors interpreted this result positively (i.e., consistent with Path A) because introjected motivation is more internalized than external motivation. The authors speculated that MI may have increased introjected rather than autonomous motivation because severe mental illness (or taking psychotropic medications) may diminish motivation and hinder the capacity to internalize extrinsic goals.

In the second oral health study, Brand and colleagues (2012) examined the efficacy of brief MI for improving internal motivation for oral hygiene behaviors compared to solely traditional oral hygiene education in 56 patients with gum disease who were in maintenance therapy. Brief MI was performed by a psychologist who was trained in gum disease and oral hygiene needs. There was no effect of MI on autonomous or controlled regulation at both six and twelve weeks. Both groups began and ended the study with approximately the same level of knowledge, autonomy and controlled regulation.

In summary, most path A studies examining the link between MI and autonomous and controlled motivation showed some significant associations between MI and self-regulation although it was not always increased autonomous motivation. Two reported MI studies increased autonomous motivation, two showed reduced controlled or introjected regulation while three studies reported no effect of MI on self-regulation.

Autonomous Regulation and Behavior change (path b).

Only one study using MI and examining path b was identified and this study was previously discussed under path A. As noted above, Webber et al. (2010) compared a standard and MI enhanced internet behavioral weight loss interventions among 80 women. These authors found that although there was significant weight loss over 16 weeks, autonomous motivation *decreased* in both the standard and MI groups. However, high controlled motivation at baseline was associated with less weight loss in the control group but not in the motivation enhanced group. With respect to the relationship between self-regulation measures and weight loss, the authors reported the maintenance of autonomous motivation level was a possible mechanism by which the intervention might have affected adherence (measured by self-monitoring) and weight reduction.

Full Mediation

Only one study has examined the full mediation model. Shaikh, Vinokur, Yaroch, Williams and Resnicow (2011) conducted a large clinical trial in which 1,021 African American adults recruited from 16 congregations were randomly assigned to one of three groups; educational material only, culturally focused educational material or culturally focused educational material and telephone based motivational interviewing to increase consumption of fruit and vegetable intake. The MI group received four telephone counseling

calls. Two were on nutrition and two on physical activity each lasting about 30 minutes. Both the culturally focused educational materials and MI interventions produced a change in autonomous motivation that contributed to an increase in fruit and vegetable intake. Structural equation modeling demonstrated autonomous motivation was both a significant mediator of the effects of MI on fruit and vegetable intake for individuals with low baseline AM. Autonomous motivation mediated 17% of the effect on fruit and vegetable intake in the MI and culturally focused educational material group. Social support, self-efficacy and controlled motivation were not significant mediators.

Summary

Taken together reviewed studies show some potential for Self Determination Theory constructs to mediate the effects of Motivational Interviewing. Most studies that examined the link between MI and autonomous and controlled motivation (path a) showed significant associations between MI and self-regulation constructs including autonomous motivation, introjected regulation, and reduced controlled regulation (Knittle et al., 2014; West et al., 2011; 2011;Webber et al,. 2010; & Almomani et al., 2009. Two studies reported no effect of MI on self-regulation (Brand et al.,2012; Befort et al.,2008). Evidence is more scarce for path B. The 17% variance accounted for by the single full mediation study is a promising moderate effect (Shaikh et al,, 2011).

Limitations

Although existing research is promising studies are limited by the generally small sample sizes and lack of racial diversity in the sample. Most studies also do not report the quality of MI. The gold standard for MI fidelity assessment is Motivational Interviewing Treatment Integrity (MITI) coding, which is somewhat arduous and time-consuming and

requires special training (Moyers, Miller, & Hendrickson, 2005). Additionally, several studies are based only on asynchronous interventions such as internet based or written information. Thus, examination with larger samples a comparison to matched intensity interventions and assurance of MI quality are needed. Studies have also been limited to weight loss, physical activity, oral hygiene, and fruit and vegetable intake. Despite MI's widespread use for tobacco cessation, no studies have examined autonomous regulation as a mechanism of action of MI in smokers.

Purpose

In light the research gap related to the role of autonomous and controlled motivation as possible mediators of the effect of MI, the purpose of this study was to conduct a secondary analysis of autonomous motivation as a mediator of MI's effects in a recently completed randomized controlled clinical trial comparing MI to health education (HE). HE was chosen for semblance to MI because of its theoretical contrast to MI. Whereas MI was expected to be effective by increasing autonomous motivation, HE was designed to be a minimally interactive, didactic intervention that would be conducive to autonomy support and fostering autonomous motivation.

Results of the parent trial unexpectedly revealed that MI was not more effective than HE for inducing quit attempts of smoking cessation. Although this precludes MI being more effective than HE because of MI's effects on autonomous motivation it does not preclude the possibility that MI led to quit attempts and cessation by increasing autonomous motivation while HE was effective through a different mechanism. This study therefore aims to increase understanding of MI's mechanism of action in smoking behavior change by clarifying the results of the randomized trial. Specifically, the study examined whether MI led to increased

quit attempts and cessation through increased autonomous motivation (and less controlled motivation) relative to HE.

CHAPTER 3

METHOD

Overview of Project KC Quest

This study consists of a secondary data analysis drawn from Project KC Quest (Catley et al., 2012), a randomized controlled trial examining the efficacy of MI on smoking behaviors among smokers with low motivation to quit. This study compared MI's effects on quit attempts and cessation to an intensity-matched control condition (i.e., Health Education; HE) and a minimal intervention control condition (i.e., Brief Advice; BA). Participants were randomly assigned using a computer-generated sequence to receive MI, HE, or BA in a 2:2:1 ratio. In these analyses only participants in MI and HE will be included.

Participants

The de-identified data set from a study protocol previously reviewed and approved by the Institutional Review Board of the University of Missouri-Kansas City will be used for this investigation. Participants were recruited community-wide using word-of-mouth, newspaper ads, flyers, billboards, internet advertising, and physician referral. Eligible participants were 18 years or older, English speaking, reporting smoking a minimum of one cigarette per day, not currently using a smoking cessation medication, and not currently motivated or ready to quit smoking. Readiness-to-quit was defined as reporting no intention to quit in the next 7 days and motivation-to-quit was defined as scoring 6 or less on a 0 to 10-point scale of motivation to quit smoking. Enrolled participants were prescreened by phone and rescreened during a baseline visit during which self-reported smoking status was confirmed using a carbon monoxide monitor (Bedfont Scientific piCO+ Smokerlyzer®; CO level of 7 ppm or higher (MacLaren et al., 2010; Pearce & Hayes, 2005). Participants

received compensation for time and travel in the form of payment for each survey and counseling session completed (up to $120 for BA and $150 for MI and HE).

Interventions

MI: The MI intervention consisted of four 20-minute sessions at baseline, Week 6, Week 12, and Week 18. MI sessions were unscripted and counselors used an empathetic, collaborative, and autonomy supportive style and methods of MI to encourage smokers to quit. Counselors elicited patient engagement in the conversation by exploring patient ambivalence regarding smoking cessation, developing discrepancy between the client's goals/ values (e.g., health) and current behaviors (i.e., smoking) and utilizing strategies to increase "change talk" while avoiding arguing or disputing "sustain talk." Provision of information was minimized and offered with permission only when judged necessary. For participants who expressed an interest in quitting, the MI counselor worked to strengthen the commitment for change and used an MI style to complete a quit plan and follow-up sessions. The quit plan included changing environmental triggers, preparing for obstacles, self-rewarding, setting a quit date, and choosing medication. Counselors were trained to maintain an MI style during the formulation of the quit plan.

HE: The HE intervention consisted of equivalent contact time to MI, but differed from MI by focusing on providing prescriptive information to participants on the risks of smoking, advantages of quitting, and overcoming the obstacles to cessation without the use of MI principles to elicit participant engagement. The four-session HE intervention was based on the "5 R's" (i.e., relevant risks of smoking, rewards of quitting, roadblocks to cessation, repetition at each visit) of the U.S. Clinical Practice Guideline with the exclusion

of features characteristic of MI. To ensure HE was distinct from MI, counselors followed a script and presented information via a computer during in-person visits.

The HE script included assessment of smoking and cessation history using a standardized set of questions. Counselors purposely avoided engaging participants in conversation other than to ask if there were any questions about the provided information and at the conclusion to ask whether they wanted to make a plan to quit smoking. Counselors were also able to answer common questions or comments by patients using pre-scripted answers. For those wanting to quit, counselors helped participants to formulate a quit plan with the same components as the quit plan for MI. Counselors were trained to maintain an "advice-oriented" style of counseling during quit planning. Subsequent sessions reviewed progress with the quit plan and avoiding relapse.

Pharmacotherapy: All Participants who committed to making a quit attempt by setting a quit date were offered free pharmacotherapy including a 12-week supply of free varenicline or nicotine replacement therapy.

Counselors: Counselors were three master's-level professionals experienced with delivering MI in randomized trials. Because research indicates relational counselor effects can be stronger than technical effects, each counselor delivered all three treatments (Kim et al., 2006; Lutz, et al., 2007). This avoided confounding counselor and treatment effects. To prevent treatment contamination, the HE arm was scripted and stringent measures were implemented to ensure MI fidelity. Training, practice, and supervision for each of the interventions continued until counselors met fidelity criteria for three consecutive sessions (training hours per counselor were 96 for MI and 28.5 for HE). Counselors then began counseling enrolled participants and received regular group supervision of randomly selected

recent audio recordings from separate expert clinicians for each of the interventions (weekly for MI and every other week for HE). Study-specific rating scales were completed to verify fidelity. To verify treatment integrity, the duration of sessions was assessed and a randomly selected 10% of regular sessions (i.e., excluding quit plans and follow-ups) were independently evaluated (38 MI and 37 HE), using the MI Treatment Integrity Code 3.0 by an expert coding group blind to group assignment. The Code yields ratings of counselor adherence to MI, including overall ratings of the session (e.g., expression of empathy) and behavior counts (e.g., frequency of open-ended questions).

Measures

Self-reported psychosocial measures were obtained at baseline, Week 12, and Week 26 (see Table 1) via a computerized assessment administered at a research laboratory. Demographic information and descriptive characteristics were assessed at baseline and smoking outcomes at Weeks 12 and 26. Other psychological measures were assessed at all three time points. The sections below describe the measures relevant to the analyses in this study.

Demographics and descriptive characteristics. Baseline demographics assessed included age, gender, race/ethnicity, education, and employment. Smoking characteristics assessed at baseline included cigarettes smoked per day, number of years smoking, number of prior quit attempts, and level of nicotine dependence assessed with the *time to first cigarette* (TTF) in the morning (Heatherton, Kozlowski, Frecker, Rickert, & Robinson, 1989). Time to first cigarette was assessed with the question "How soon after you first wake up do you smoke your first cigarette?" (see Appendix A) and responses are scored from 1 (*within 5 minutes*) to 4 (*after 60 minutes*). Cigarettes smoked per day (i.e., level of smoking)

was assessed by asking: “During the past 7 days, on the day(s) that you smoked, on average how many cigarettes did you smoke per day?” (Hughes et al., 2003). Number of years smoking was determined by asking: “How old were you when you first started smoking?” (Harris et al., 2003). Number of prior quit attempts was determined by asking: “In your lifetime, how many times (if any) have you seriously tried to quit smoking; that means not smoking at all for at least 24 hours?” (Boardman et al., 2005; Richter, Gibson, Ahluwalia, & Schmelzle, 2001).

Smoking behavior outcomes. The primary outcome was the occurrence of any quit attempt defined as a serious quit attempt of at least 24 hours (Biener & Abrams, 1991; Marlatt, Curry, & Gordon, 1988) by Week 26. Quit attempt was assessed at Weeks 12 and 26 by asking: “Since your last survey visit, how many times (if any) have you seriously tried to quit smoking, that means not smoking at all for at all for at least 24 hours?” The secondary outcome was biochemically verified 7-day point-prevalence abstinence at Week 26 (Benowitz et al., 2002; Hughes et al., 2003). Biochemical verification of those who self-reported abstinence was conducted by research staff using cotinine test strips for saliva (Cooke et al., 2008).

Autonomous and Controlled Motivation. The Treatment Self-Regulation Questionnaire (TSRQ), developed from self-determination theory (Deci & Ryan, 1985), assesses the degree of autonomous self-regulation regarding why people engage or would engage in healthy behavior (Levesque et al., 2007). The 15-item scale (see Appendix C) includes four subscales representing different types of motivation along a continuum of autonomy (from most to least self-determined): autonomous, introjected, external regulation, and amotivation. Participants are asked to use a 7-point Likert scale ranging from 1 (*not at*

all true) to 7 (*very true*) to indicate how true each reason to stop smoking or continue not smoking is for them. The TSRQ controlled motivation subscale (TSRQ-C) is composed of introjected and external regulation items. Internal consistency for the TSRQ autonomous motivation subscale (TSRQ-A) for smoking has been reported as .86 (Williams et al., 2006). In the current study, TSRQ-A and TSRQ-C at baseline including all data available had alphas of .86 and .82 (N = 182), respectively. The TSRQ-A at Weeks 12 and 26 for participants randomized to groups had alphas of .91 (n = 240) and .88 (n =182), respectively. The TSRQ-C at Weeks 12 and 26 for participants randomized to groups had alphas of .86 (n = 240) and .88 (n = 182), respectively. In mediation analysis change scores were used. Change scores were calculated by subtracting baseline scores from week 26 scores for the TSRQ-A and TSRQ-C.

Statistical Analysis Plan

Frequency distributions were examined for each categorical variable. The distribution of continuous variables was examined with box plots and histograms. Cross tabulations and scatterplots were generated for categorical and continuous variables respectively to identify outliers. Outliers for which true values cannot be recovered from the raw data will be recorded as missing. Descriptive statistics will be calculated for each variable (mean and standard deviation or, if the distributions were skewed, median and inter-quartile range).

Main Analysis

To test the primary mediation hypotheses the theorized mechanisms of action were examined in a two-step log-binomial analysis. We fit two models for each mediator:
Linear model:

mediator = B0 + B1*arm

Log-binomial model:

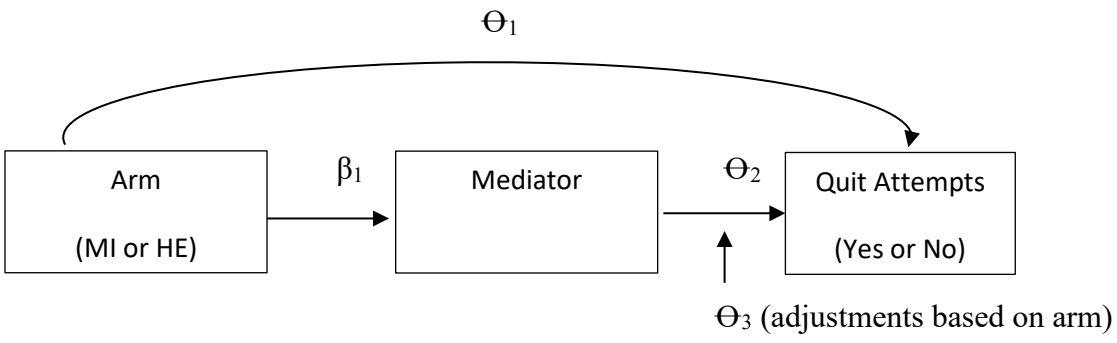
log(outcome) = theta0 + theta1*arm + theta2*mediator + theta3*arm*med

Models were limited to these variables (no covariates) to maximize the number of events (positive outcomes) per model degree of freedom.

The natural direct (NDE), natural indirect (NIE), and total effects were computed for each mediator (Agler & DeBoeck, 2017). The NIE is of primary interest here, as it reflects the influence of the intervention through the mediator. The NDE will be incomplete for any single model if the intervention works through multiple mediators, as will the total effect (computed as the product of the NIE and NDE in this binary outcome context).

Point estimates were computed by fitting the models to the original data using the GLIMMIX Procedure in SAS 9.4. We computed 95% bootstrap confidence limits for the effects by creating 2,500 bootstrap samples (with stratified sampling to ensure the same proportion of successful outcomes in each bootstrap sample), fitting all models to each bootstrap sample, and identifying the 5th and 95th percentiles of the resulting bootstrap distribution for each effect.

Figure 2. Mediation model with natural indirect effect parameters



CHAPTER 5

RESULTS

Preliminary Analyses

Summary statistics for demographic variables of participants who met study inclusion criteria (*n*=182) are displayed in Table 1. Participant's ages ranged from 18 to 70 years with a mean of 46.3 (*SD*=10.7). Participants were nearly equally split among males and females and among those single and partnered. The majority of participants identified themselves as being Black (67.2%, *n*=123), with the next most commonly identified race being White (27.3%, *n*=50). The majority reported earning a high school diploma or GED (65.6%). The mean number of cigarettes smoked per day ranged from 4-45 cigarettes with an average of 15.0(SD=8.9).

Table 1. Demographic characteristics of study participants (*N=182)*

Variable	*n*(%)	*Mean (SD)*
Age		46.3 (10.7)
Gender		
Female	83(45.4)	
Male	99(54.1)	
Marital Status		
Single	106(57.9)	
Married	33(18.0)	
Divorced	43(23.5)	
Race		
Black	123(67.2)	
White	50(27.3)	
Hispanic or Latino	4(2.2)	
Asian	5(3.1)	
Education		
< High School	35(19.1)	
High School/GED	120(65.6)	
College degree	22(12.0)	
Graduate Degree	5(2.7)	
Cigarettes/day		16.5 (8.7)

Descriptive statistics for key model variables of interest by intervention group at baseline, week 12 and week 26 as well as reliability of scaled measures are shown in Table 2. The analysis included only those participants who responded to both the 12 and 26 week assessments. Internal consistency was acceptable for all measures (ranging from .82 to .91). Variables were examined for normality using histograms and, skewness and kurtosis statistics which were well within accepted ranges with the exception of quit attempts. Change scores from baseline were computed for use in the mediation modeling.

Participants in both groups began the study with high levels of Autonomous vs. Controlled regulation, with few differences at baseline. Changes in Autonomous and Controlled regulation were positive (i.e., participants on average increased in AR and CR) and greatest in the HE group compared to the MI group. There was a change in AR of 9.0 (SD=10.8) for HE and 5.6 (SD= 8.8) for MI. CR change in the HE group was 3.5(SD=6.2) and in the MI group 2.4 (SD=5.8).

Table 2. Characteristics of key study variables

	MI n=90	*HE n=92*	*Total*	*Internal Consistency*
Variable	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*a*
AR				
Bl	25.1 (10.0)	24.0 (10.1)	24.4 (10.1)	0.86
Wk 12	30.9 (6.3)	32.3 (9.0)	31.4 (10.4)	0.91
Wk 26	30.7 (9.9)	33.9 (7.6)	31.8 (9.5)	0.88
AR Δ	5.6 (8.8)	9.9 (10.8)		
CR				
Bl	9.1 (4.8)	9.1 (6.1)	9.0 (5.5)	0.82
Wk 12	11.5 (1.7)	11.2 (6.2)	11.3 (6.2	0.86
Wk 26	11.7 (6.0)	12.6 (7.5)	12.2 (6.8)	0.88
CR Δ	2.6 (5.8)	3.5 (6.2)		
Quit Attempts				
Week 12	0.34 (0.5)	0.42 (0.5)	1.6 (1.3)	-
Week 26	0.51 (0.5)	0.58 (0.5)	0.2 (1.5)	-

ARΔ = Autonomous regulation subscale at week 26 – autonomous regulation subscale at baseline.
CRΔ = Controlled regulation subscale at week 26 – controlled regulation subscale at baseline

Correlations between the potential mechanisms of action (change scores in AR and CR) and their relationships with treatment group and quit attempts are shown in Table 3. AR and CR were both positively and moderately correlated with each other (r=.41, p=.001). Being in the MI group was associated with slightly lower AR and CR (r= -0.17, p<.05 and r= -0.08, p<.05 for AR and CR, respectively). Consistent with the previously reported main outcome from the trial group, MI was also associated with slightly fewer quit attempts (r= -0.09, p<.05 respectively). AR and CR were positively and weakly associated with quit attempts (r=.16, p<.05 and .15, p<.05, respectively).

Table 3. Correlations among key study variables

Variables	AR Δ	CR Δ	QA
Group (HE= 0; MI=1)	-.17*	-.08	-.09
AR Δ		.41*	.16*
CR Δ			.15*

Note. * p<.05, **p<.01, Δ= Baseline to 26-week change scores, AR=Autonomous Regulation, CR= Controlled Regulation, QA= Quit Attempts

The NDE, NIE, and total effect estimates, shown in Table 4, are interpretable as risk ratios. The results are also depicted in Figures 3 and 4 which illustrates the mediation models and the effects examined. This includes Θ_1 which represents the relationship between treatment arm (MI and HE) and the outcome (quit attempts), β_1 which represents the relationship between the treatment arm (MI and HE) and the mediator variables AR (Figure 3) and CR (Figure 4), and Θ_3 which represents the coefficient for the mediator arm (Theta 2) multiplied by the mediator interaction.

Results indicated weak mediation effects for both mediators but the effect of group was opposite to that hypothesized. Based on estimates of the NIE, the HE intervention rather than the MI intervention was associated with 2% higher probability of a quit attempt through its effect on change in autonomous motivation and 1% higher probability of a quit attempt through its effect on change in controlled motivation.

Figure 3 AR mediation model

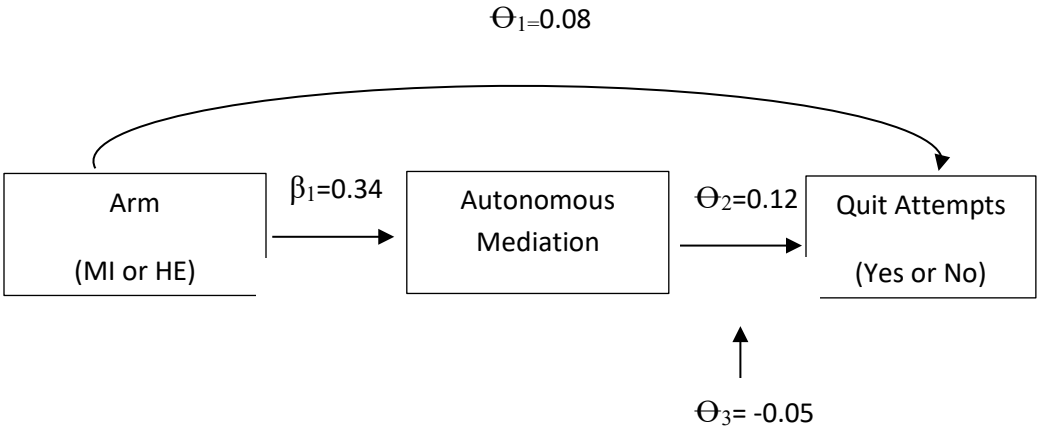
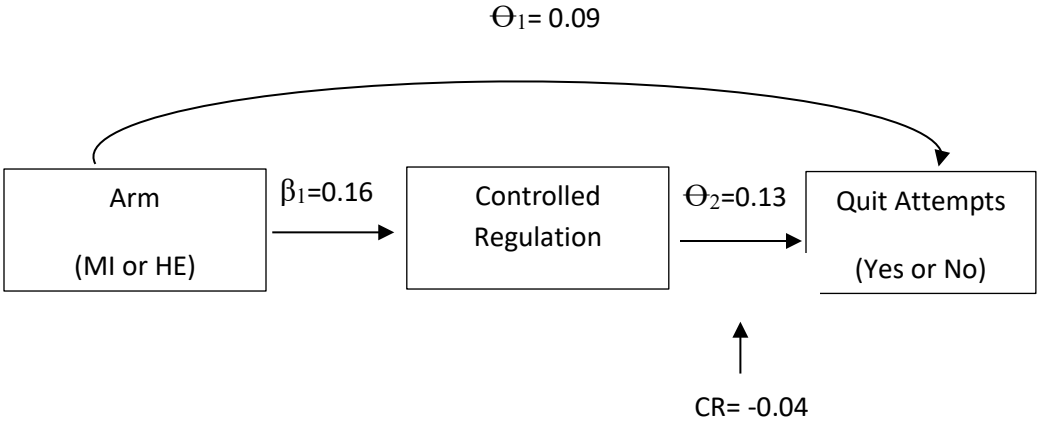


Figure 4 CR mediation model



On average, participants in the HE group increased in autonomous and controlled motivation from baseline to 26 weeks, whereas scores for participants in the MI group increased to a lesser degree. This resulted in positive regression coefficients (b1) for HE in the models for the two types of motivation, reflecting the difference between change scores for the two groups. In autonomous motivation SD units, change scores for the HE group were higher by 0.34 on average (95% CI 0.11, 0.57). Controlled motivation change scores differed by 0.16 (95% CI -0.12, 0.43) SD units.

Neither AR (0.12 CI -0.04, 0.29) nor CR (0.13 CI -0.13, 0.28) change scores had a significant effect on quit attempts as evidenced by the theta 2 confidence intervals including 0. The non-zero theta3 values suggest that the direct effect of the intervention (see theta1) and the effect of the mediator change score (theta2) may not be additive, but these estimates are too imprecise to draw firm conclusions.

Table 4. Natural indirect effect and parameters

	NIE		Θ_1		Θ_2		Θ_3		β_1	
Mediator	RR	95% CI	*RR*	*95% CI*	*RR*	*95% CI*	RR	95% CI	*RR*	95% CI
AR Δ	1.02	0.87, 1.37	0.08	-0.14, 0.31	0.12	-0.04, 0.29	0.05	-0.25, 0.14	0.34	0.11, 0.57
CR Δ	1.01	0.87, 1.37	0.09	-0.13, 0.28	0.13	-0.13, 0.28	0.04	-0.25, 0.25	0.16	-0.12, 0.43

Because of the unexpected effect of treatment group on the mediators and evidence from prior analysis of this data set that race interacted with treatment to affect smoking outcomes (Grobe, Goggin, Harris et al., 2020), we conducted supplementary analyses to explore the role of race. Two preliminary regression models were conducted to test the interaction between treatment group and Black (vs. other) race on change in AR and CR at week 26. The interaction of treatment and identifying as Black did not significantly predict change in AR at week 26, $b = –4.75$, t (179) = -4.62, $p = .15$. Similarly, the interaction of treatment and identifying as Black did not significantly predict change in CR at week 26, $\beta =$ –0.26, t(179) = -0.23, $p = .82$. Treatment response in relation to race therefore did not appear to account for the unexpected results.

CHAPTER 6

DISCUSSION

The present study examined changes in autonomous and controlled motivation from baseline to 26 weeks as possible mediators of the effects of MI on smoking quit attempts in the context of a trial comparing MI to Health Education. We expected MI to have an effect on quit attempts through an increase in AR and decrease in CR.

The main analyses separately examined AR and CR as mediators and found weak mediation effects for both. However, the effect of group on the mediators was opposite to that hypothesized with the HE intervention rather than the MI intervention associated with a slightly higher probability of a quit attempt through its effect on change in each of the mediators. The predictive strength was very small as AR and CR explained only 1% each of the variance in quit attempts.

Although contrary to theoretical predictions, and a number of prior health behavior change studies, the finding that AR did not mediate the relationship between MI and quit attempts is consistent with a randomized smoking cessation trial that examined autonomous and controlled motivation as mediators of the effect of treatment with varying intensity of MI (Cupertino et al, 2011). In this randomized controlled trial among rural smokers, greater intensity of MI was not associated with greater autonomous and controlled motivation variables.

In other prior studies of AR as a mediator of MI's effects on health behaviors. there have been mixed results. This includes several studies that did not utilize formal mediation analysis and explored only the first step in the mediation pathway. Of these, five observed no effect of MI on AR (Befort et al.,2008; Webber et al., 2010; Knittle et al., 2014; Almomani et al., 2009; Brand et al., 2012), while two observed an increase in AR (West et

al., 2011; Knittle et al., 2014). Lastly, the only formal mediation study examining predictors of MI on fruit and vegetable intake reported AR mediated 17% of the effect of MI and a culturally focused education group (Shaikh et al., 2011).

These mixed results may suggest that AR is more likely to be a mediator in dietary or weight loss interventions. This may be due to intervention effects being stronger than in smoking cessation which may be more difficult because it involves changing an addictive behavior.

The finding that the effect of MI was not mediated through a reduction in CR was also consistent with some of the mixed results of prior work. Webber et al. (2010) examined the relationship between MI and CR in a study of weight loss and found no impact of MI on CR. Two studies examining fruit and vegetable intake and weight maintenance found no effect of MI on CR (Resnicow et al., 2008; West et al.,2011) Similarly, one study examining self-regulation and MI on oral health also found no impact of CR (Brand et al., 2012) while another reported increase introjected regulation, a form of self-regulation that falls between AR ad CR (Almomani et al., 2009) The only study examining the full mediation pathway between MI and self- regulation reported CR was not a significant mediator (Shaikh et al., 2011).

Although it was hypothesized that MI would reduce CR, the results of this study fit with a pattern that more consistently shows CR does not mediate the effects of MI on smoking quit attempts. We expected smokers with a low desire to quit would have higher levels of controlled regulation as expected when an individual changes in response to an external demand or belief they have to comply. It was anticipated MI would lead to what Deci and Ryan (2002) refer to as internalization, representing a decline in controlled motivation and an

increase in autonomous motivation. Internalizing the regulation of behavior is highly relevant for smoking cessation (Williams, 2002). KC Quest recruited smokers with a low desire to quit and low or relatively low CR. Typically, those with addition behaviors such as alcohol, or drugs enter treatment with low AR but high or relatively high CR. These baseline levels of self-regulation might allow MI to reduce CR yet increase AR.

Taken together the unexpected results of this study fit with a mixed pattern of AR findings in the literature and may be related to relatively weaker effects in smoking cessation interventions. Another possible explanation concerns the control group in this study. The parent study addressed a previous gap in the literature by comparing MI to an intensity matched control group. The present findings should therefore be interpreted in light of the control group to which MI was compared. The results may therefore be due to HE not being distinct from MI in ways that were expected. While STD theory is closely aligned with principles of MI, it is possible HE also conveyed qualities such as empathy and acceptance, resulting in similar effects to MI on AR and CR. This investigation tested the effect of MI relative to HE and STD constructs. The results of the present study suggest interventions other than MI, especially well done HE, could have effects similar to MI on AR and CR.

Future research should examine the characteristics of interventions that are critical to fostering change in key theoretical constructs. For example, Williams et al. (2006b) found that a four 4-contact primary care-based counseling intervention based on SDT significantly improved 12 month quit rates compared to “community care” through AR. That is, community care was sufficiently distinct from the SDT-based counseling intervention to differentially impact AR but it is not clear why. In the parent trial for the present study there was verification that MI was delivered with fidelity and was distinct from HE on the

expected MI fidelity criteria but these differences apparently did not relate to differences in fostering of AR. Identifying the interventions characteristics that matter is key. The HE matched control was designed to be warm and supportive but to focus on giving advise rather than eliciting participant engagement. This may not have been distinct enough from MI. For example, confrontation has been shown to be one of the most important negative predictors of outcomes in MI and it may be that interventions that are distinct in confrontation are key to having an impact on AR and CR.

It is also important to recognize that this study's examination of MI and SDT, overlap focused only on autonomous and controlled motivation. While our outcomes did not confirm the key self-regulation constructs as a mechanism, SDT is a multifaceted theory for explaining health behavior change that encompasses additional constructs such as perceived competence and relatedness. The role of these other constructs in SDT is also very consistent with MI principles. While studies of SDT intervention have shown the importance of perceived confidence on smoking outcomes in a primary care setting (Williams, Gange, Ryan & Deci, 2002), examination of perceived competence and relatedness as mediators in MI interventions is lacking and should be the focus of future research.

In addition to examining links between MI and STD, one of the purposes of this investigation was to clarify the findings of the parent tobacco cessation trial to advance understanding of smoking cessation interventions The parent trial unexpectedly found HE to be at least as effective as MI for fostering smoking behavior change. In theoretically based intervention trials, results can be unexpected because the intervention does not impact the theorized mediators as expected and/or because the theorized mediators do not impact the outcome as expected. If the interventions do not impact the mediators as expected, revision

or enhancement of the intervention may be called for, whereas if the theorized mediators fail to impact the outcomes as expected, revision of theory may be indicated.

The present study results revealed the relationship between intervention and the mediators was very weak and the effects of AR and CR on the outcome was also extremely weak. This suggests the unexpected results were due to the interventions not impacting AR and CR as expected, rather than because AR and CR did not affect quit attempts as expected. This highlights that the widely accepted view that MI is an effective intervention for fostering smoking cessation is almost exclusively based on comparisons with less intense interventions (typically brief advice) rather than interventions that are theoretically distinct. Equally intense interventions such as HE may have similar effects to MI because they can have similar effects on key mediators. Future research should continue to try to identify interventions of equal intensity that might differentially impact key mediators, which may in turn lead to better cessation outcomes.

One other consideration in interpreting the unexpected results was that a previous analysis of the data from this study revealed a strong pattern in which the effects of MI relative to HE were moderated by race (Grobe et al., 2020). That analysis found MI may be less effective for smoking cessation in African American compared to non-black smokers. For this reason, an exploratory analysis was conducted to determine whether there was any indication of race moderating the effect of MI (vs HE) on the mediators Our results did not detect a moderating effect of identifying as Black suggesting this was not a likely explanation for findings.

There are a number of limitations to consider in interpreting the results of this study. One limitation is the assumption of causal direction. That is, there are limitations to the use

of mediational analysis for testing causal mechanisms. While the randomized design ensured that treatment group had causal effects on the mediators, we cannot be sure that the change in AR and CR preceded changes in quit attempts because quit attempts were measured retrospectively and could have occurred before or after the week 12 measurement of AR and CR The present mediation analysis can therefore be considered a correlational analysis that examined whether the data were consistent with a hypothesized causal pathway. Additionally, unobserved confounders can still be responsible for the mediator-outcome association. Another limitation of this study is that quit attempts were based on self-report. However, in the main outcome analysis the findings for quit attempts followed a similar pattern to biochemically confirmed cessation, thereby increasing confidence in the validity of our quit attempt outcome. A third limitation of the study was that the small sample size was not large enough for evaluation of a comprehensive mediational model incorporating all variables simultaneously. The analyses in this study examined AR and CR separately which ignores their potential interdependence. A final limitation concerns generalizability. Results should be generalized cautiously outside of predominately diverse smokers with a low desire to quit.

CONCLUSION

Overall, the present study did not find support for a theorized model in which MI's effects on quit attempts were mediated by autonomous and controlled motivation. The unexpected lack of advantage of MI over HE in the trial was at least in part because MI did not have the expected stronger effects on autonomous motivation.

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APPENDIX A

TREATMENT SELF-REGULATION QUESTIONNAIRE

Pleae indicate how true each reason to stop smoking/continue not smoking is for you.

1 2 3 4 5 6 7

not at all true somewhat true very true

The reason I would stop smoking is: (Baseline)

The reasons I would stop smoking/continue not smoking : (Week 12 and 26)

Autonomous motivation

_____ Because stopping smoking is very important for being as healthy as possible

_____ Because I personally believe it is the best thing for my health

_____ Because I feel that I want to take responsibility for my own health

_____ Because stopping smoking is an important choice I really want to make

_____ Because I have carefully thought about it and believe stopping smoking is very important for many aspects of my life

_____ Because stopping smoking is consistent with my life goals

Introjected regulation

_____ Because I would feel guilty or ashamed of myself if I smoked

_____ Because I would feel bad about myself if I smoked

External regulation

_____ Because I feel pressure from others to stop smoking permanently

_____ Because others would be upset with me if I smoked

_____ Because I want others to see I can do it

_____ Because I want others to approve of me

Amotivation

_____ I really don't think about stopping smoking

_____ I don't really know why

_____ Because it is easier to do what I am told than think about stopping smoking

VITA

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