The Effects of Adding Motivational Interviewing to a Behavioral Coaching Intervention to Increase Physical Activity

Ryley Acrea
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THE EFFECTS OF ADDING MOTIVATIONAL INTERVIEWING TO A BEHAVIORAL COACHING INTERVENTION TO INCREASE PHYSICAL ACTIVITY

By

Ryley J. Acrea

A Thesis Submitted to the
Graduate School
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF ARTS

College of the Pacific
Behavioral Psychology

University of the Pacific
Stockton, California

2021
THE EFFECTS OF ADDING MOTIVATIONAL INTERVIEWING TO A BEHAVIORAL COACHING INTERVENTION TO INCREASE PHYSICAL ACTIVITY

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THE EFFECTS OF ADDING MOTIVATIONAL INTERVIEWING TO A BEHAVIORAL COACHING INTERVENTION TO INCREASE PHYSICAL ACTIVITY

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By

Ryley J. Acrea
DEDICATION

This thesis is dedicated to my mother, Christine, my father, Robert, and to my partner, Zach, for their love, support, and patience. I am so very grateful for you all.
ACKNOWLEDGEMENTS

I would like to thank my advisor, Dr. Matthew Normand, for all the skills he helped me shape during my time in graduate school. I am very grateful to Dr. Kohn for her help and consultation while I developed motivational interviewing as a skill. I am also very grateful for Dr. Miltenberger for his time and feedback throughout the thesis process. I would also like to thank my lab mates who helped me with tasks that were instrumental in completing my thesis. I also want to thank my partner, Zach, for being my greatest supporter and best friend. Finally, thank you to Meg Patel for always being willing to provide feedback on my thesis, her endless encouragement, and her long phone calls when I was stressed.
THE EFFECTS OF ADDING MOTIVATIONAL INTERVIEWING TO A BEHAVIORAL COACHING INTERVENTION TO INCREASE PHYSICAL ACTIVITY

Abstract

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2021

Most people do not meet the physical activity guidelines set forth by the Center for Disease Control (CDC) and World Health Organization (WHO). Sufficient physical activity plays an important role in preventing chronic illnesses, such as Type 2 diabetes, which are a burden on the health care system. Health coaching (a client-centered approach to improve health outcomes) holds promise as a preventive strategy to change health behavior and limit office visits, thereby reducing the burden of illnesses caused by physical inactivity. One component of health coaching that warrants more research is motivational interviewing. The current study used a multiple baseline across participants design to evaluate the effects of adding motivational interviewing to a client-led behavioral coaching intervention to increase physical activity. In the current study, each participant took more steps in intervention compared to baseline, but the role of MI was somewhat unclear.
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<tr>
<td>CDC</td>
<td>Center for Disease Control</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>MI</td>
<td>Motivational Interviewing</td>
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<td>MVPA</td>
<td>Moderate-to-Vigorous Physical Activity</td>
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<td>MITI</td>
<td>Motivational Interviewing Treatment Integrity</td>
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<tr>
<td>MISC</td>
<td>Motivational Interviewing Skill Code</td>
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<td>PAR-Q</td>
<td>Physical Activity Readiness Questionnaire</td>
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<tr>
<td>M</td>
<td>Mean</td>
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<td>r</td>
<td>Correlation Coefficient</td>
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Evidence suggest that physical activity is an important component of a healthy lifestyle, and that some activity is better than none (CDC, 2020; WHO, 2020), and The Physical Activity Guidelines for Americans (2019) recommend that adults move more throughout their daily activities (HHS, 2019). Physical activity can be classified as light, moderate or vigorous, and the clearest health benefits are associated with moderate-to-vigorous physical activity (MVPA). Moderate intensity activities, like brisk walking or bicycling, produce modest increases in breathing and heartrate, whereas vigorous physical activity, like jogging or bicycling uphill, produces more elevated levels in breathing and heartrate (CDC, 2020; Kaleth et al., 2013). The primary health benefits associated with increased MVPA are cardiovascular and muscular improvements, like the prevention of age-related bone loss and diseases, (HHS, 2019; Santos et al., 2017; WHO, 2020) and reduced risks of developing heart disease, hypertension, Type 2 diabetes, osteoporosis, certain types of cancer (Fetcher et al., 1996) and premature death (Garcia-Aymerich et al., 2006; Warburton et al., 2006). Adults who engage in any MVPA throughout their week gain more health benefits than those who do not (CDC, 2020; HHS, 2019).

According to the Center for Disease Control and Prevention (CDC, 2020), adults should engage in 150–300 minutes per week of moderate physical activity, or 75–150 minutes per week of vigorous physical activity (CDC, 2020; Ding et al., 2016; Kohl et al., 2012). Despite the documented benefits of MVPA, less than 10% of adults in the United States meet these physical activity guidelines (CDC, 2020; Tucker et al., 2011; WHO, 2020). The disadvantages of a sedentary lifestyle include increased risk of cancer (i.e., colon, breast, and uterine), heart disease (i.e., coronary artery disease, heart attack), osteoporosis, stroke, obesity, high blood pressure
(hypertension), high cholesterol, Type 2 diabetes, mental health disorders (i.e., depression, anxiety, and chance of dementia), and even death (Booth et al., 2012; CDC, 2020; WHO, 2020).

Physical inactivity is now considered a pandemic due to the number of people who are physically inactive, and the diseases associated with that inactivity (Abu-Omar et al., 2017; Ding et al., 2016, 2017). In 2013, the worldwide healthcare costs of physical inactivity were estimated to be $53.8 billion. Of that, approximately $5 billion was spent on coronary heart disease, $6 billion on stroke, $37.6 billion on Type 2 diabetes, $2.7 billion on breast cancer, and $2.5 billion on colon cancer. Of the $53.8 spent worldwide, $25.7 billion was spent on healthcare costs within the United States, alone (Ding et al., 2016, 2017). Physical inactivity also indirectly affects the healthcare system in the form of lost productivity and premature mortality (Ding et al., 2016; Jonk et al., 2015; Wennberg et al., 2010). Every year, physical inactivity causes more than 5 million deaths (Lee et al., 2012) and costs billions of dollars to societies around the world (Ding et al., 2016, 2017).

As rates of chronic diseases and associated costs continue to rise in the United States, there is an increasing focus on preventive healthcare models to help patients manage and prevent disease (Simmons & Wolever, 2013). Preventive healthcare fall into three categories (CDC, 2020; WHO, 2020): (a) primary prevention, which aims to reduce the likelihood of diseases in people with no symptoms, (e.g., immunization of healthy adults, periodic examination, blood test, or health education); (b) secondary prevention, which aims to identify and treat people who have risk factors or are at early stage of diseases, (e.g., pap smears to detect early forms of cancer); (c) and tertiary prevention, which aims to treat symptomatic patients in an effort to decrease complication or severity of disease, (e.g., sugar control in a diabetic in order to mitigate vision and nerve problems). Historically, the preventive healthcare model has focused on
managing a specific disease condition as opposed to managing the patient’s behavior (Bodenheimer, 2002). This model remains both expensive and ineffective in the treatment of chronic diseases, due to the number of people who have more than one chronic condition and competing life circumstances that impair their capacity to self-manage those conditions (Bodenheimer, 2002).

Behavior management interventions are needed to change behavior to reduce healthcare-related and personal costs, as well as reduce the frequency of primary healthcare office visits (Wolever et al., 2013). Self-management may be one way to promote behavior change within the healthcare system. Self-management has been defined as involving the person with the chronic disease in activities that help protect and promote health and help manage the symptoms and signs of illness (Bodenheimer, 2002). Self-management strategies enable participants to make informed choices, adopt new skills that can be applied to new problems as they arise, and practice new health behaviors (Bodenheimer, 2002). The primary goal is to teach self-management skills so that after an educational intervention, the individual can apply behavior-change tactics that produce desired behavior changes.

Typically, allied health professionals—professionals who work interdependently with nurses and physicians—implement self-management programs, and these professionals may be useful in promoting education within the healthcare system (Lee et al., 2012; Zenzano, et al., 2011). Allied health professionals can take on some of the responsibilities to advance lifestyle changes, prevention, and patient health (Lee et al., 2012), but they do not diagnose medical conditions. Instead, they give people information needed to make informed decisions about how to lead healthy lives (Lipscomb, 2006). As the need for these types of professionals has increased, new “coaching” interventions have been developed to guide and improve life, health,
and health risk of individuals (Huffman, 2016). Health coaching (e.g., coaching professionals that work with people struggling with chronic health issues) and wellness coaching (e.g., coaching that is oriented more to prevention and continued wellness) have received considerable attention over the last few years (Huffman, 2016).

**Health Coaching**

Health coaching is a client-centered approach that is rooted in “eclectic” behavior-change science and principles of lifestyle medicine (ACE, 2020). Typically, a health coach (e.g., allied health professional) works one-on-one or in small groups with individuals to teach them about healthy lifestyle changes and helps them set reasonable goals to make those healthy changes (Normand & Bober, 2020). Health coaching might improve physical activity and related health outcomes such as increased weight control (Temmingh et al., 2013) and reduced risk of diabetes and hypertension (Willard-Grace, 2015; Wolever & Druesicke, 2016).

There is a growing body of research demonstrating the effectiveness of health coaching, however, there is no consistent definition of what composes “health coaching” practices across studies (Finn & Watson, 2017; Olsen, 2013). The American Council on Exercise (2020) provides a definition of a health coach:

> An advanced fitness professional responsible for working independently and with other professionals to help a wide variety of individuals and groups adopt structured behavior-change programs that focus on lifestyle and weight management through physical activity, nutrition, and education necessary to improve and maintain health, fitness, weight, body composition, and metabolism. (p. 623)

The National Society of Health Coaches (2020) also provides a definition of health coaching:

> Health coaching is the use of evidence-based skillful conversation, clinical strategies, and intervention to engage clients actively and safely in health behavior change to better self-manage their health, health risk, and acute or chronic health condition resulting in optimal wellness, improved health outcomes, lowered health risk, and decrease healthcare costs. (p. 1)
Both definitions describe clients engaging in healthy lifestyle changes; the former focuses on how the behaviors need to change to achieve a healthy lifestyle and focuses on the health coach, while the latter focuses on the benefits of healthy lifestyle change and the field of health coaching. Other descriptions of health coaching vary with respect to the typical duration, frequency, and length of coaching sessions, and the training required to act as a health coach (Finn & Watson, 2017; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010).

To evaluate consistencies across health coaching practices, Caldwell et al. (2013) analyzed the transcripts of 69 coaching calls and categorized the health coaching interaction. The purpose was to evaluate whether health coaches use evidence-based conversations and clinical interventions to engage clients in health behavior change. The two main categories evaluated were the health coach’s ability to explore the participant’s experience and active intervention (Caldwell et al., 2013). Exploring the participant’s experience included affirmations of the participant’s progress, rapport building, and reflection to check understanding (Caldwell et al., 2013). Active intervention included reframing statements made by the health coach, providing tentative suggestions and advice, and offering information and rationale for a particular approach to overcoming a barrier or achieving a goal (Caldwell et al., 2013). The data reported by Caldwell et al. (2013) suggest that the principle most consistently practiced by health coaches is exploring the participant’s experience. That is, health coaching practice is most focused on patient-centeredness and the patient-orientated health goals that guide the work within a supportive coaching partnership.

In another evaluation of what constitutes health coaching, Olsen and Nesbitt (2010) conducted a systematic review that included 15 studies to identify the core components of health coaching. The inclusion criteria focused on studies in which coaching was named as the
intervention. The authors concluded that the core components of effective health coaching programs included the use of goal setting, self-monitoring, collaboration with healthcare professionals, and motivational interviewing (Finn & Watson, 2017; Olsen & Nesbitt, 2010). Across studies, participants who received the health coaching intervention in a physical activity program were typically asked to set goals with the experimenter and self-monitor their progress throughout the study (Brodin et al., 2008; Lisspers et al., 1999; Olsen & Nesbitt, 2010; Rice et al., 2008).

Health coaching outcomes have also been evaluated. For example, Kivela et al. (2014) reviewed 13 randomized controlled trials and quasi-experimental design studies published between 2009 and 2013 to evaluate the effectiveness of health coaching and describe the effects of health coaching on adult patients with chronic diseases. The inclusion criteria included specific studies in which healthcare professionals provided health coaching to adults with chronic diseases. The authors concluded that health coaching produced a positive effect on patients’ physiological, behavioral, and psychological conditions and on their social life. Other improvements have been made in more specific areas such as nutrition, medication adherence, weight loss, and increased physical activity (Olsen & Nesbitt, 2010). Health coaching has been frequently evaluated in terms of the physical inactivity problem within the United States. Research has shown that health coaching has led to increases in total walking distance traveled (Vale et al., 2003), regular exercise (Bray et al., 2008; Schuessler et al., 2007), adherence to physical activity programs (Holland et al., 2005; Olsen & Nesbitt, 2010), and increased levels of physical activity in general (Kivela et al., 2014).

The contributions of the health coaching literature seem promising, but the research methods used have limitations. The studies primarily used group designs that provided little
information about individual measures (Finn & Watson, 2017; Kazdin, 2020; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010). Capturing individual measures using single-case designs would allow researchers to examine the patterns and stability of performance and make intervention decisions based on baseline performance (Kazdin, 2011). Additionally, most health coaching studies rely on self-report of performance and behavior change (Finn & Watson, 2017; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010). Self-report (i.e., verbal behavior) is under different controlling variables than the actual target behaviors (Kazdin, 2011), such as physical activity, diet, etc. Because many of the measures used in the health coaching literature, such as weight, height, BMI (Leahey & Wing, 2013), body measurement, and physical activity (O’Hara, et al., 2016), are obtained via self-report, different studies can produce different outcomes even when they are designed to assess the same construct (Kazdin, 2011). Attrition or drop-out is another limitation evident in many health coaching studies (Finn & Watson, 2017; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010). Attrition makes it difficult to draw valid inferences about the effects of the intervention under study (Armbruster & Kazdin, 1994), specifically because group arrangements can vary nonrandomly if participants drop out of the study. Finally, most of the health coaching studies use nonrandomized assignment (Finn & Watson, 2017; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010). Nonrandomized assignment does not allow researchers to draw conclusions about the study because individual differences might not be randomly distributed across conditions and might therefore be responsible for changes in the dependent variable (Kazdin, 2011).

**Applied Behavior Analysis**

The main goal in health coaching is to individualize a behavior change plan, which is like what behavior analysts do (Kivela et al., 2014; Normand & Bober, 2020). Some of the
behavioral interventions used within the health coaching literature resemble those used in applied behavior analysis (Normand & Bober, 2020) and researchers in applied behavior analysis have used similar behavioral interventions to increase physical activity. These interventions have included goal-setting, feedback, and self-monitoring (Donaldson & Normand, 2009; Fitterling et al., 1988; Green et al., 2016; Miller et al., 2018; Normand, 2008; Valbuena et al., 2015; VanWormer 2004; Zarate et al., 2019), and the improved physical activity outcomes have been reported in terms of increased step counts (Miller et al., 2018; Normand, 2008; Solley et al., 2014; Valbuena et al., 2015; VanWormer, 2004; Zarate et al., 2019), improved adherence to a behavioral intervention (Fitterling et al., 1988), increased calorie expenditure (Donaldson & Normand, 2009), and decreased bouts of sitting (Green et al., 2016).

VanWormer (2004) reported one of the first behavior-analytic studies evaluating the effects of a coach in combination with several behavioral intervention components. VanWormer (2004) used self-monitoring and e-counseling to increase intervention adherence and physical activity levels. Physical activity was defined as any activity that resulted in a step recorded by a pedometer and was assessed in three different phases: baseline, self-monitoring, and self-monitoring with e-counseling. After baseline, where participants wore blinded pedometers to prevent activity feedback, the participants began a self-monitoring phase during which they wore their pedometers unblinded and recorded daily step totals. A subsequent intervention phase followed the self-monitoring phase, in which self-monitoring was combined with e-counseling involving step review, weekly goal setting, and praise. Compared to baseline, all participants took more daily steps during the intervention phase. However, there was no clear distinction between physical activity performance in the self-monitoring phase and the self-monitoring with e-counseling phase, suggesting that the addition of a (a type of) health coach was not beneficial.
More recently, Valbuena et al. (2015) evaluated the effects of a web-based behavioral intervention (Fitbit) for increasing physical activity that was similar in some ways to the VanWormer (2004) intervention. The study examined whether contact from a coach through videoconferences and e-mail would enhance the effectiveness of a Fitbit program. During baseline, participants wore a covered Fitbit One device and, along with being told to wear the device, they were told to upload their daily data until they received further instructions. During each phase, participants had to sync their activity data once at any point during the day. After completing baseline, participants started the first intervention phase of the study. The Fitbit intervention used the commercial web- and app-based programs provided by Fitbit for promoting physical activity and weight loss. The Fitbit program incorporated self-monitoring, goal setting, feedback, and social support. After stabilization of the step data was observed during the Fitbit phase, participants completed a second intervention phase that was like the first, but with the addition of a behavioral coach. A weekly meeting was scheduled through video conferencing where the behavioral coach set step goals for the participants based on percentile schedules. For three of six participants, the Fitbit program alone increased physical activity, and the addition of the coaching sessions resulted in further increases. These increases ranged from 10.2% to 89.1% in mean step counts for all six participants.

When evaluating health outcomes, the behavior analytic and health coaching literature use similar behavioral components (self-monitoring, feedback, and goal setting). VanWormer (2004) and Valbuena et al. (2015) offer frameworks for evaluating the effects of coaching using single-case experimental designs. Both studies evaluated whether the addition of a coach would enhance results after a behavioral intervention was implemented. Valbuena et al. (2015) suggested that after self-monitoring, goal setting, and feedback have been used, the addition of a
coach enhances the results of a behavioral intervention. However, one of the most common components of health coaching, motivational interviewing, has not been used in applied behavior analysis research, to date. Apart from Raiff et al. (2016), the authors evaluated the effects of MI on a diabetes intervention. Motivational interviewing (MI) is one factor that distinguishes the behavioral components of health coaching from applied behavior analysis. Applied behavior analysis could benefit from MI because it is based on a client-led approach rather than directive or confrontational approach (Christopher & Dougher, 2009). A client-led approach might offer more acceptance and understanding compared to a more confrontational approach. Acceptance, in turn, might facilitate more change in the target behavior (Christopher & Dougher, 2009).

Motivational Interviewing

Motivational interviewing might improve physical activity outcomes within the field of health coaching. In the MI literature, self-monitoring and feedback are not part of MI but used in combination with MI. For example, improvements among problem drinkers who received MI appeared to be mediated by increased adherence to a standard alcoholism treatment program (Brown & Miller, 1993). The results of this study suggest that when MI was used in combination with addiction interventions, it increased adherence to the program, this increase in adherence is what likely led to, or at least greatly contributed to, a reduction in drinking. MI might be an effective intervention component, but its use in health coaching still needs to be evaluated.

Motivational Interviewing is a key component of health coaching (Butterworth et al., 2007) and has been fully described in the literature (Butterworth et al., 2007; Linden et al., 2014). MI is a counseling style initially used to treat addictions, but it has increasingly been used in healthcare settings such as school clinics, primary care offices, and mental health clinics
Miller and Rollnick (2002) defined MI as “a client-centered, directive method for enhancing intrinsic motivation for change by exploring and resolving ambivalence about behavior change” (p. 25). MI is “client-centered” in the sense that the client is providing the direction for learning and implementing change (Olsen & Nesbitt, 2010). MI is “directive” in the sense that the therapist reinforces the client’s statements about change (Christopher & Dougher, 2009; Miller & Rollnick, 2002).

In behavior analytic terms, MI is “directive” in that the therapist evokes and differentially reinforces change talk (Christopher & Dougher, 2009). “Intrinsic” motivation can be understood as automatic reinforcement or behavior maintained by its automatic consequences, without being paired with environmental contingencies (Vollmer, 1994). “Exploring and resolving ambivalence” can be conceptualized as the verbalization of the consequences associated with the target behavior, after a verbal commitment to either change or not change the target behavior (Christopher & Dougher, 2009). Through a behavior analytic lens, MI can be seen as a strategy by which the therapist evokes and reinforces change talk by tacting the consequences for the occurrence and nonoccurrence of the target behavior (Christopher & Dougher, 2009). This allows the client to engage in self-mands (e.g., “I am going to change my exercise routine”), which might correspond with subsequent behavior changes (Christopher & Dougher, 2009).

There are four guiding principles for using MI in practice (Miller & Rollnick, 2002). The first is to express empathy, which involves using reflective listening to demonstrate understanding of what the client is reporting (Miller & Rollnick, 2002). Expressing empathy has been described in the literature as the ability to adopt another person’s perspective (Sigman et al., 1992) and experience a “congruent emotional state” (Yirmiya et al., 1992). In behavior analytic terms, during MI sessions there are certain verbal discriminative stimuli (e.g., “It is hard to find
time to exercise”) that evoke responses we might label empathetic (e.g., “It sounds like you are busy, but exercise is important to you”; Sivaraman, 2017). The second principle is to develop discrepancy, specifically between client’s stated goals and their current behavior (Miller & Rollnick, 2002). By listening and reflecting what was said by the client, it is important to get the client to clearly identify the discrepancy or difference between their current behavior and their new goals (Christopher & Dougher, 2009). The third principle is to roll with resistance, which means not arguing with client about change (Miller & Rollnick, 2002). Instead of arguing, it is important to help the client clearly identify positive consequences of changing their current behavior as well as negative consequences of continuing their current behavior (Motivational Interviewing, 2020). The fourth principle is to support self-efficacy, which means enhancing the client’s belief in the possibility of successful change (Biglan, 1987; Miller & Rollnick, 2002; Resnicow et al., 2012). This is done by helping the client describe the ways they can achieve their goals and by helping them arrange relevant antecedents and consequences which are intended to evoke and reinforce behavior change (Normand & Bober, 2020). After the client contacts some form of reinforcement (e.g., increased steps, weight loss), the change in behavior will be more likely to occur in the future under similar conditions.

In addition to the four guiding principles, MI therapists are taught eight strategies for successful practice (Miller & Rollnick, 2002). One strategy is the use of client-centered counseling skills, which entails placing the client’s perspective at the center of services (Miller & Rollnick, 2012). A second strategy is to recognize change talk and sustain talk (Miller & Rollnick, 2002). In this context, “change talk” refers to statements that express desire, ability, and reason to change the target behavior, whereas “sustain talk” refers to statements about inability to change the target behavior (Miller & Rollnick, 2002). From an operant perspective,
the client speech is differentially reinforced, which involves the therapist reinforcing change talk, while ignoring or minimizing attention for resistance or sustain talk that may block the opportunity for change talk to occur (Christopher & Dougher, 2009; Miller & Moyers, 2006). Once the therapist recognizes change talk, the therapist is then able to evoke and reinforce change talk (Christopher & Dougher, 2009; Miller & Moyers, 2006), which are the third and fourth strategies (Miller & Rollnick, 2002).

Miller and Rollnick (2002) described strategies to evoke client change talk, and to respond in ways that strengthen it once it has been evoked, and they describe these strategies using the acronym OARS, which denotes Open-ended questions, Affirmations, Reflections, and Summaries (Miller & Moyers, 2006; Miller & Rollnick, 2002). For example, the MI therapist might ask open-ended questions (e.g., “In what ways might this change be a good thing?”), the answers to which might be change talk (Miller & Moyers, 2006). After change talk has occurred, the therapist may ask for elaboration, affirm it, or reflect it with a summary (Miller & Rollnick, 2002). If sustain talk or resistance occurs, the fifth and sixth strategies are to respond to it by using the strategy of rolling with resistance (Miller & Rollnick, 2002). A therapist who responds to the sustain talk and resistance could reframe, which means to suggest a different meaning or perspective (e.g., “I hear you saying changing your exercise routine is very important and I also hearing you saying you don’t have time. What do you make of that?”; Miller & Moyers, 2006). Miller and Rollnick (2002) described the MI response as rolling with resistance (e.g., not arguing with the client about change) rather than opposing it. Potentially, arguing with the client about change could reinforce the sustain talk or resistance (Christopher & Dougher, 2009).
The seventh strategy is to negotiate a change plan. After the client has expressed ways to change the target behavior, Miller and Rollnick (2002) suggest moving on to the development of a behavior change plan. The typical procedure is for the therapist to provide a summary of change talk that the client has engaged in for making a change, and then to ask a key open-ended question, which is “What next?” (Miller & Moyers, 2006). After a change plan has been developed, the client will use commitment language (e.g., “I will…), rather than change talk (Miller & Rollnick, 2002). This is the last strategy, consolidating commitment to change. For example, throughout MI sessions a client will engage in change talk (e.g., “I hope to exercise more” or I hope to exercise more”); however, when a client uses commitment language they enter into a verbal agreement with the therapist (e.g., “I will change my exercise routine”).

Researchers have evaluated the relationship between change talk and positive treatment outcomes. For example, Amrhein et al. (2003) reviewed videotapes of 84 drug users in MI sessions and recorded the frequency of verbal statements expressing commitment, need, readiness, and reasons to change their habit. The authors concluded that when a client’s statements about committing to behavior change increased throughout an MI session, improvements in treatment outcomes were observed. Other studies have reported similar outcomes whereby earlier statements of the desire, ability, and reasons to change predicted significant outcomes, like changes in drinking habits (Baer, 1997; Baer et al., 1987; Moyers et al., 2007). However, these are correlational relationships, and it is possible that change talk might have increased because treatment outcomes were improving, not the other way around.

MI has been used in areas of research like promoting physical activity (Hardcastle et al., 2013; McDoniel, 2010; Perry & Butterworth, 2011; Webber et al., 2008), encouraging medication adherence (Raiff et al., 2016), reducing smoking (Rohesenow, 2015), managing
chronic conditions such as obesity (Barnes et al., 2014; Bus et al., 2017) and diabetes (Young et al., 2020), managing readmission rates (Benzo et al., 2015), and improving health outcomes based on health questionnaires (Butterworth et al., 2006; Linden et al., 2010). Motivational interviewing has also significantly enhanced results when added to other behavioral interventions (Barnes et al., 2014; Bean et al., 2014; Diiorio et al., 2003; Golin et al., 2006; Rohsenow et al., 2015; Smith et al., 1997; Young et al., 2020). These results were based on self-reported measures and involved an MI group compared to a no-MI group. The enhancements reported included increased adherence to weight loss programs (Barnes et al., 2014; Bean et al., 2014; Smith et al., 1997), improved medication adherence (Diiorio et al., 2003; Golin et al., 2006; Young et al., 2020) and reduced smoking (Rohsenow, 2015). A review of the literature shows that many studies have evaluated motivational interviewing combined with other behavioral interventions to increase treatment adherence in health promotion programs (Barnes et al., 2014; Bean et al., 2014; Diiorio et al., 2003; Golin et al., 2006; Rohsenow et al., 2015; Smith et al., 1997; Young et al., 2020). These behavioral interventions include goal-setting (Barnes et al., 2014; Bean et al., 2014; Diiorio et al., 2003; Golin et al., 2006; Rohsenow et al., 2015; Smith et al., 1997; Young et al., 2020), feedback (Bean et al., 2014; Barnes et al., 2014; Golin et al., 2006; Young et al., 2020), self-monitoring (Barnes et al., 2014; Diiorio et al., 2003; Golin et al., 2006; Smith et al., 1997; Young et al., 2020), and contingent vouchers (Rohsenow et al., 2015).

Smith et al. (1997) were one of the first to examine whether the addition of a motivational interviewing component, to a behavioral obesity intervention, would enhance treatment outcomes. Their single-blind study included a 16-session group behavioral weight-control program that measured calorie intake, physical activity, and blood glucose. Participants went to weekly group meetings that provided nutritional information and behavior modification
training in eating and exercise. Self-monitoring was part of the behavioral intervention by which participants recorded their daily calorie consumption and physical activity in diaries. Diaries were collected after each weekly group session to be reviewed by program staff, and then returned with feedback about diet, physical activity, and glucose control. Participants in the intervention group received the same components with the addition of motivational interviewing sessions, during which the participants and researchers collaborated and agreed upon realistic and attainable goals. Three individual motivational interviewing sessions were conducted by a psychologist (trained in MI) that followed the standard guidelines of MI. The results of this study suggest that the addition of motivational interviewing to a standard behavior treatment program may significantly enhance the outcomes (Smith et al., 1997). Additionally, the data suggests that the addition of motivational interviewing to a standard behavioral weight-control program enhances adherence (i.e., attendance at group meetings, number of days calories were recorded, exercise frequency) to treatment recommendations (i.e., moderate calorie restriction, fat gram recommendations, increased physical activity; Smith et al., 1997).

However, West et al. (2016) evaluated whether the addition of online MI chats to a Web-based, group behavioral obesity treatment program enhances weight loss outcomes compared to the Web-based weight control program alone. The authors concluded that the addition of online MI chats to a behavioral weight control program did not enhance weight loss. These results were based on self-reported measures. Individuals who were overweight were randomized to either the behavioral weight control treatment or the behavioral weight control treatment plus individual MI chat sessions. Both groups received weekly synchronous, online group chat behavioral lessons and individualized feedback on progress towards meeting exercise and calorie goals. The participants in the treatment group also received six individual MI sessions delivered
by an MI therapist via Web chat. The web-based MI sessions lasted approximately 30-min. These sessions were focused on the four guiding principles of MI (i.e., expressing empathy, rolling with resistance, developing a discrepancy, and promoting self-efficacy). Each chat concluded with a goal that was determined collaboratively (e.g., engaging in self-monitoring using a journal, or something else the participant identified as likely to be effective).

Both Smith et al. (1997) and West et al. (2016) attempted to determine whether the addition of MI enhances the results of a behavioral package. However, there are seven major limitations evident in these studies along with the MI literature, as a whole. The first limitation is the use of group designs (Butterworth et al., 2006, 2007; Linden et al., 2010; Smith et al., 1997; West et al., 2016). Conclusions about intervention effects in group research are based primarily on comparisons of means at the final assessment. Comparing means among groups that receive different conditions is not a direct way to examine performance of individuals. The second limitation of the MI literature is that most researchers do not report individual measures in their studies (Butterworth et al., 2006, 2007; Linden et al., 2010; Smith et al., 1997; West et al., 2016). Collecting individual measures would allow researchers to examine the patterns and stability of performance and make intervention decisions based on individual performance (Kazdin, 2020). In single-case designs, the assessment is continued throughout the course of the study in which a participant serves as their own control (Kazdin, 2020). The third limitation is most studies rely on self-report of behavior change (Butterworth et al., 2006; Butterworth et al., 2007; Linden et al., 2010; Smith et al., 1997; West et al., 2016). Self-report of behavior change is under control of different controlling variables than the actual target behaviors (Baer et al., 1968, 1987; Kazdin, 2020).
The fourth limitation evident in several studies evaluating MI is the lack of a control group (Bus et al., 2017; Butterworth et al., 2006; Golin et al., 2006; Linden et al., 2010; Perry & Butterworth, 2011). For example, Bus et al. (2017) hypothesized that participants in the in-person health coaching group would have better outcomes than those in the online health coaching group and therefore included two groups that both received a health coaching intervention to compare the relative efficacy of the two different groups. Without a no-MI control group, researchers were unable to determine whether a change was due to the treatment or if it was some other variable that caused the results (Kazdin, 2020).

The fifth limitation is that numerous studies evaluating the impact of MI on health outcomes have not measured the integrity of MI implementation (Barnes et al., 2014; Bus et al., 2017; Hardcastle et al., 2013; Linden et al., 2010; McDoniel et al., 2010; Raiff et al., 2016; Rohesenow et al., 2016; Smith et al., 1997; Webber et al., 2008; Young et al., 2020), despite having a method to do so (i.e., MITI 4.2.1 and MISC; Moyers et al., 2010, 2016). Without evaluating the integrity of MI implementation there is no guarantee the intervention was implemented consistently or correctly. Additionally, the sixth limitation is that previous research did not specify the procedures used to train healthcare professionals to implement MI (Butterworth et al., 2006; Linden et al., 2013), instead making vague statements that the sessions were conducted by healthcare professionals “rigorously trained” in MI (Butterworth et al., 2006). Both limitations are problematic because there is no way to know if the MI sessions were implemented with integrity, it is difficult to draw conclusions about the effectiveness of MI from these studies (Butterworth et al., 2006; Bus et al., 2017; Kazdin, 2011; Lawson et al., 2013; Linden et al., 2010).
The seventh, and final limitation is that MI is never evaluated in isolation, but rather is typically evaluated within a package intervention alongside several other behavior-change strategies (Barnes et al., 2014; Bean et al., 2013; Bus et al., 2017; Hardcastle et al., 2013; Linden et al., 2010; McDoniel et al., 2010; Raiff et al., 2016; Rohesenow et al., 2016; Smith et al., 1997; Webber et al., 2008; Young et al., 2020). For example, Bean et al. (2013) evaluated the effects of motivational interviewing as part of an obesity program. The obesity program included weekly a MI session combined with feedback and goal setting, along with a supervised physical activity program. The authors concluded that MI enhanced adherence to the obesity intervention, but there actually is no way to know what role MI played. In other words, MI was not isolated, so there is no way to be sure that MI was responsible for a differential effect.

**Purpose**

Although it is one of the most common components of health coaching, MI has not been used in applied behavior analysis research (but see Raiff et al., 2016 for an exception). Several studies in applied behavior analysis have combined coaching sessions with behavioral intervention packages to increase physical activity (Normand, 2008; Valbuena et al., 2015; VanWormer 2004). The coaching sessions looked similar across studies, but the type of coaching was different than what is typical of health coaching (e.g., it was not client-centered). In applied behavior analysis interventions, the experimenters typically set the participant’s goals (e.g., Normand, 2008; Valbuena et al., 2015; VanWormer 2004), review participant step totals, and deliver individualized feedback (Donaldson & Normand, 2009; Normand, 2008; Valbuena et al., 2015; VanWormer 2004). In health coaching, the experimenter helps educate the participant about health behavior change and helps them set self-identified and reasonable health goals (Willard-Grace, 2015; Wolever & Druesicke, 2016) in a much less directive way.
The purpose of the current study was to use a multiple-baseline across participants research design to evaluate the effect of motivational interviewing on participants’ physical activity, using MI as it would be used by a health coach as a client-let intervention. In the current study, self-monitoring, feedback, and client-set goals were implemented across all conditions. MI was evaluated to determine whether it enhanced physical activity outcomes compared to self-monitoring, feedback, and goal setting alone.
CHAPTER 2: METHOD

Participants

We recruited four female participants (see Figure 1) via an online flyer posted to the University of the Pacific campus health Instagram page (https://pacific.campuswell.com). The recruitment flyer (see Appendix A) described the required qualifications of participants (18 years or older), potential benefits to the participants, and contact information of the experimenter.

Potential participants were invited to attend a brief screening session with the experimenter; those who met the inclusion criteria (described below) were invited to attend a subsequent session that served as the start of the study. Eligible participants (inclusionary criteria) were 18 years or older, had internet access, and were interested in increasing their step count. Exclusionary criteria consisted of (a) having a major surgical procedure within the previous 6 weeks, as this could have led to reinjury, (b) answering “Yes” to any question on the PAR-Q (see Appendix B), and (c) otherwise indicating high risk for a cardiovascular incident on the PAR-Q. We also had a baseline step criterion for exclusion. Participants who met or exceeded 10,000 steps during baseline would have been excluded from the study.

Prior to the screening session (see Appendix C), the experimenter sent electronic versions of the PAR-Q and the Change in Activity Level Readiness quiz (see Appendix D). Interested participants who scored highly on the Change in Activity Level Readiness quiz were presumed to be a better fit for the study than those who scored lower. In other words, we were interested in participants who were actively seeking a health coach, as opposed to participants who might be reluctant to participate in health coaching (which is more typical of when MI is delivered, according to Miller and Rollnick, 2002). The experimenter also sent an informed consent form
(see Appendix E) and a demographics form (see Appendix F) to each applicant. During the meeting, the experimenter helped the participant complete the forms, if necessary, and explained the purpose of the study. An initial meeting was scheduled for each eligible participant. If an applicant did not meet the inclusionary criteria, they were thanked for their time and no additional sessions were scheduled.

**Setting and Materials**

All research activities involving subjects occurred online via Zoom, a peer-to-peer cloud-based web conferencing application. Each session involved only the participant and experimenter, and each participant was asked to go to a quiet room in their home during the meeting. All materials were delivered via mail or email. Each participant had the option to keep their Fitbit device (described below) at the conclusion of the study.

We used a Fitbit Inspire 2 to record all primary and secondary dependent variables (see below). A Fitbit Inspire 2 is a wrist-worn activity tracker that is used to estimate physical activity, particularly steps taken (Cole et al., 2020). Cole et al. (2020) assessed the feasibility and reliability of the Fitbit Inspire 2 to assess daily physical activity levels. The results showed that the Fitbit Inspire 2 worn on the wrist could be used to assess daily physical activity levels, and that moderate-to-vigorous physical activity appeared to be the best measure of physical activity. However, the Fitbit Inspire 2 is a newer model, so additional research is warranted to determine the reliability of this model (Cole et al., 2020).

The Fitbit Inspire 2 was linked with a mobile device via the Fitbit app or with a computer via the Fitbit website. All activity data were synced for each participant to access via the Fitbit app. Before delivering the Fitbit, the experimenter created a unique online Fitbit account for each device. Each participant had access to the account paired with their device for the duration
of the study. After each participant was given their Fitbit account log-in, each participant could access the features offered by the Fitbit Inspire 2 (e.g., goal setting and feedback). The Fitbit Inspire 2 offered a goal setting feature. This feature allowed participants to set goals for step count, calories burned, distance traveled, and active minutes, if they chose to do so. Additionally, a notification appeared every hour if the participant did not meet a specific step count. Once the participant met a specific step count every hour (minimum of 250 steps per hour), the participant received recognition from the Fitbit Inspire 2.

**Response Measurement and Reliability**

The primary dependent variable was the number of steps taken per day, as measured by the Fitbit Inspire 2, a permanent-product recording system. A secondary dependent variable included overall activity during the physical activity program. We measured overall activity by active minutes and zone minutes. We monitored overall activity throughout the study to determine if participants who exhibited a low step count exhibited a higher level of overall activity.

A tertiary dependent variable was treatment adherence to the physical activity program. Treatment adherence was defined as the participant sending their daily step count to the experimenter each day, wearing their Fitbit each day, and attending scheduled weekly meetings with the experimenter. To ensure attending to their daily step totals, each participant sent their daily step count to the experimenter at the end of each day. Each day, a checkmark (i.e., Yes or No) was scored if the participant sent their daily step, wore their Fitbit, and attended the weekly coaching session. In addition, each week, a percent of opportunity was calculated for each measure (i.e., sent daily step count, wore the Fitbit, and attended the meeting). These data were collected to measure the participants’ engagement throughout the study.
Procedure

We used a multiple-baseline across participants design to evaluate the effectiveness of the Behavioral Coaching sessions, as well as the effects of adding MI to the Behavioral Coaching sessions. The study comprised a minimum 12 weekly coaching sessions (described below), followed by one additional, optional coaching session for purposes of assessing social validity (described below). A minimum of 12 weekly coaching sessions was implemented because this aligns with the health coaching description. Following at least 3 weeks of Behavioral Coaching, Behavioral Coaching with motivational interviewing (MI) sessions (described below) were administered. The MI sessions were scheduled sooner than 3 weeks if there was stability in the step count data or if the participants missed two to three Behavioral Coaching sessions. Table 1 summarizes the similarities and differences across Behavioral Coaching and MI sessions.

Motivational interviewing training. Motivational interviewing sessions were conducted by the experimenter. Prior to the start of the study, the experimenter completed an online 4-hour motivational interviewing workshop, provided by SGJ Consulting. Subsequently, the experimenter spent approximately 30-hours across 6 months with a Licensed Clinical Psychologist at the University of the Pacific who had formal training in, and professional experience using, MI. During weekly meetings, the Licensed Clinical Psychologist provided immediate feedback on mock video recorded MI sessions.

Baseline. During the initial meeting (see Appendix G), the experimenter explained the role of the coach, familiarized the participant with the features of the Fitbit (e.g., navigate how to turn it on/off, how to charge it, battery life, features it offers), and explained the benefits of increasing their daily step counts (Tudor-Locke et al., 2011).
The study only accommodated health goals related to increased step count; other health goals were not targeted. If the participant expressed interest in other health-related goals, the experimenter referred them to University of the Pacific Health Services.

Participants were instructed to wear their Fitbit during all waking hours and were provided access to the online Fitbit account. Throughout the study, participants were instructed to send their daily step count (e.g., from their Fitbit account screen displayed on their mobile device or computer) by midnight each day via their preferred method of communication (text or email). Additionally, for purposes of staggering the baselines, each participant was told it will be 7–18 days before the first Behavioral Coaching session was scheduled. The Behavioral Coaching sessions were scheduled in a staggered succession across participants, allowing at least 3 days (depending on data patterns) to elapse between the date each participant attended their first Behavioral Coaching session.

**Behavioral coaching.** Behavioral Coaching sessions were scheduled once per week, with each session lasting approximately 10–15-min (Valbuena et al., 2015). During all Behavioral Coaching sessions (see Appendix H and I), the experimenter and participant reviewed the Fitbit data from the previous week using the online Fitbit account dashboard. Along with a step goal, each participant had a predetermined number of days to which they should have met their self-set step goal (e.g., 8,500 steps for 5 out of 7 days), as determined by the experimenter. If the participant met their self-set goal for 5 out of 7 days, the experimenter provided tailored feedback (e.g., “Great job meeting your step goal 5 out of 7 days this week”, see Appendix J). The experimenter also asked the participant what they did on days that they met their step goal (no further questions were asked). Additionally, the experimenter asked the participant whether they wanted to set a new step goal or keep the current step goal. If the
participant did not meet their self-set step goal for 5 out of 7 days, the experimenter provided tailored feedback (e.g., “Try again next week”; see Appendix J) and the participant tried another week with the same self-set step goal. The experimenter also asked the participant what they did on days that they did not meet their step goal (no further questions were asked). Across participants, Behavioral Coaching sessions were implemented for a minimum of 3 to 5 weeks or until stability was reached.

**Motivational interviewing.** During the MI phase, Behavioral Coaching plus MI was combined into one session (see Appendix K). This type of coaching structure closely approximates health coaching implementation. Prior to the first MI session, the experimenter explained that the coaching sessions were going to be about 30-min and that more input would be expected from the participant during the 30-min coaching sessions. During the MI sessions (see Appendix L), the experimenter followed Miller and Rollnick’s (2002) four guiding principles (i.e., expressing empathy, develop a discrepancy, roll with resistance, support self-efficacy), and incorporated the eight strategies for successful practice (e.g., recognize change talk and sustain talk, evoking change talk). More specifically, MI was implemented during the sessions to gather more information on the client’s performance in reaching their self-set step goal. If the participant met their goal, tailored feedback was provided. If the participant did not meet their goal, the participant and the experimenter discussed the discrepancy between their goals and their current behavior, while the experimenter summarized participant statements, asked open-ended questions, and evoked and responded to change talk. Across participants, Behavioral Coaching plus MI sessions were implemented approximately the same number of weeks as Behavioral Coaching (i.e., 3 to 5 weeks) or until the participant participated in approximately 12 coaching sessions.
Social validity survey. At the conclusion of the study participants completed a social validity survey (see Appendix O). Questions were answered on a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree). The purpose of the survey was to determine whether the participants reported being satisfied with the Behavioral Coaching and MI sessions and to assess if they would be likely to participate in such sessions in the future. Additionally, the participants were offered one additional meeting and were given the choice of either a Behavioral Coaching session or a MI session. Data were collected on whether the participants chose to attend an additional meeting, what type of session they chose, if they attended the scheduled meeting, if they wore their Fitbit, and their step count during the week prior to the meeting.

Independent variable check. An independent observer evaluated one the Behavioral Coaching (see Appendix M) and one MI coaching (see Appendix N) session for each participant. We randomly selected the sessions to evaluate for each participant, and the coder was blinded to the type of coaching session. In other words, the coder did not know if they were watching a Behavioral Coaching or Behavioral Coaching plus MI session. The coder was a Licensed Clinical Psychologist at University of the Pacific who possessed formal training in and professional experience using MI. For each participant, the coder rated two recordings (one Behavioral Coaching, one MI) on the degree to which they accurately depicted a typical MI session, in terms of the use of standard motivational interviewing principles. The coder also evaluated whether the Behavioral Coaching components were used during each observed coaching session.
CHAPTER 3: RESULTS

Step Count

Figure 2 depicts the step count across days for the four participants. Due to the variability in the daily step count data, these data are also presented as a 7-day simple moving average in Figure 3, and as weekly average step counts per week in Figure 4. Across all three data presentations (Figures 2-4), we observed similar level changes and trends in step count data across participants. However, the weekly data in Figure 4 reveals more trending compared to Figures 2 and 3. Specifically, the data for P1 and P3 trended upward across baseline and intervention phases. The data for P4, on the other hand, suggests countertherapeutic trending, insofar as her step count data trended up during baseline and during the first intervention phase, but down when MI was introduced. Figure 2 was used to make all intervention decisions; therefore, all participants started intervention after stable data trends were observed in terms of daily step counts during baseline. Overall, all participants took more steps during intervention compared to baseline (See Table 2). The step counts of P1 and P3 exhibited an increasing trend across both intervention phases (i.e., Behavioral Coaching and Behavioral Coaching Plus MI), and exhibited more stable step counts during intervention compared to baseline. The step counts of P2 were more variable across both phases but exhibited a slight increasing trend, overall. P2 was the only participant for whom a clear pattern was evident on the weekends, consistently taking fewer steps compared to weekdays. In contrast, the step counts of P4 exhibited an increasing trend when Behavioral Coaching was introduced, but a decreasing trend after MI was introduced.
Figure 2 also depicts whether the participants met their daily goals. Compared to Behavioral Coaching, P1, P2, and P3 met their goal more often during the Behavioral Coaching plus MI phase, whereas P4 met her goal more often during the Behavioral Coaching phase.

Figure 5 depicts how often each participant met their weekly goal. Below each graph, the proposed goal is detailed, along with the participants’ actual accomplishments. The proposed goal was discussed during the coaching meeting.

**Zone and Active Minutes**

The Fitbit reported two types of activity: zone and active minutes. We analyzed both types of activity because active minutes could only be seen via the online Fitbit account and zone minutes could only be seen via the Fitbit app. All participants attended to their zone minutes via the Fitbit app, and none attended to zone minutes via the online Fitbit account. Participants earned active min by engaging in 10-min or more of continuous moderate-to-vigorous physical activity. They earned zone minutes when they engaged in activities that put them in the fat burn (i.e., moderate; range, 50 to 69% of max heart rate), cardio (i.e., hard; range, 70 to 84% of max heart rate), or peak heart rate zone (i.e., vigorous; range, 85 to 100% of max heart rate), with 1-min earned for being in the fat burn zone, and 2-min earned for each min they were in the cardio or peak zones (Fitbit Help, 2021). Both zone and active minutes were defined by heart rate.

Figure 9 depicts zone minutes across participants. There were no obvious differences across participants between baseline and intervention, and the data remained variable across participants (See Table 3). During Behavioral Coaching plus MI, P2 and P4’s zone minutes data show a slight decreasing trend. Additionally, the overall average did not stay elevated for P4, but there were more spikes in her zone minute data during the Behavioral Coaching phase compared to the baseline and Behavioral Coaching plus MI. Figure 10 depicts active minutes across participants.
There were no differences in active minutes across baseline and intervention for P1, P2, and P4 (See Table 4). However, P3 exhibited an increasing trend across both intervention phases (i.e., Behavioral Coaching and Behavioral Coaching plus MI).

For all participants, we calculated correlation coefficients (see Figures 11–14) between zone minutes and step-count, active minutes and step-count, and active minutes and zone minutes. A higher correlation was observed between step-count and zone minutes for P4 \( (r = .70) \) compared to step-counts and active minutes. In contrast, a higher correlation was observed between step count and active minutes for P1 \( (r = .66) \), P2 \( (r = .91) \), and P3 \( (r = .69) \) compared to step-counts and zone minutes, although the correlation coefficients for P1 and P3 were still relatively weak. This corresponds to their self-report of walking throughout their day. In other words, P1, P2, and P3 would take breaks throughout their day to walk for about 10–15 min, while P4 would take fewer walks for longer periods of time. Correlation coefficients between active minutes and zone minutes were low for P4 \( (r = .45) \) and P3 \( (r = .66) \), medium for P1 \( (r = .79) \), and high for P2 \( (r = .90) \), which suggests that for P2, it might not matter if we or P2 were attending to active or zone minutes.

**Intervention Adherence**

We collected data on intervention adherence, defined as the participant sending their daily step count to the experimenter each day, wearing their Fitbit each day, and attending scheduled weekly meetings with the experimenter. Each participant sent their daily step count data, wore their Fitbit and attended the scheduled weekly meetings 100% of the time.

**Social Validity Questionnaire**

Figure 15 depicts the answers to the Likert-type scale questions on the social validity questionnaire, and all participants we surveyed gave each statement a high score (i.e., mostly 4
and 5). In other words, participants found the intervention to be acceptable. The average scores (and range of scores) to a few key questions were as follows: “The health coaching sessions helped me achieve my goals” = 4.5 (range, 4 to 5), “I am happy with my overall experience” = 4.75 (range, 4 to 5), “The experience was worth the time spent” = 4.75 (range, 4 to 5), “I enjoyed talking to the health coach” = 4.75 (range, 4 to 5), “Viewing my weekly step total during coaching sessions helped increase my physical activity” = 4.75 (range, 4 to 5), and “I would not recommend health coaching to a close family member” = 1.25 (range, 1 to 2). Table 5 depicts the answers to the free-response questions. Each participant reported that the Behavioral Coaching plus MI was the most beneficial. They reported that the MI sessions were more personalized, which contributed to helping them to achieve their goals. Additionally, P1, P2, and P3 completed an additional week of coaching, and they chose to receive another Behavioral Coaching plus MI session. Overall, the participants reported that the experience was worth their time, that they would recommend health coaching to a close family member, and that they were happy with the overall experience.

Independent Variable Check

We recorded each coaching session, and a coder watched approximately 20% of the sessions for each participant and scored whether the coach completed the relevant components. The coder scored across four MI components (cultivating change talk, softening sustain talk, partnership, empathy; See Appendix N) for each observed session. A mean score of 3.5 across the four components is considered competent performance (Moyers et al., 2016). The mean score across the Behavioral Coaching plus MI sessions was 4.5, suggesting that the experimenter demonstrated a high level of competence when implementing MI. The mean score across the Behavioral Coaching sessions was 1.8, suggesting that the experimenter demonstrated a low
level of competence when implementing MI. A low score is desirable, as the experimenter did not use MI during the Behavioral Coaching sessions, so the MI competence score should be lower. The coder also scored each observed session based on whether the Behavioral Coaching components (e.g., displaying the participant’s Fitbit data, providing feedback on goals met or not met, asking for context on days that goal was met and not met; See Appendix M) were used. The experimenter used the Behavioral Coaching components across all coded sessions.

**Session Lengths**

Table 6 depicts Behavioral Coaching and Behavioral Coaching plus MI session lengths. P1, P2, and P3 had 13 coaching sessions, and P4 had a total of 10 coaching sessions. P4 only had 10 coaching sessions because of a change in schedule towards the end of the study. The Behavioral Coaching session lengths ranged from 5.3 min to 11.2 min, and the Behavioral Coaching plus MI session lengths ranged from 11.3 min to 40.4 min. P1 had one shorter MI session (i.e., 11.3 min) due to technical difficulties. Overall, the length of the Behavioral Coaching with MI sessions was the typical length of a standard health coaching session.
All participants took more steps during intervention compared to baseline, and three (P1, P2, P3) of four participants met their daily goal more often during the Behavioral Coaching plus MI phase compared to Behavioral Coaching alone. P1, P2, and P3 continued to set new daily and weekly goals and met or exceeded these goals (See Table 7). MI did not produce obvious changes in total step counts, but it appeared to lead to more consistent goal attainment for these three participants. It is also worth noting that for P1 and P3, the goals seemed to influence their behavior, as their step totals corresponded to the goal lines, which was not the case for the other participants. Only P4 met her goals more often during the Behavioral Coaching intervention.

The current study supports the findings of previous research (Valbuena et al., 2015; VanWormer, 2004) that showed behavioral coaching can increase step counts (See Table 8). The current study is similar to Valbuena et al. (2015) in that step counts were more stable during the intervention phases, but it differs from Vanwormer (2004), who reported less stability in step counts during the intervention phases. In Valbuena et al. (2015) and VanWormer (2004), behavioral coaching resulted in overweight adults taking more steps during the intervention. The current study extends these findings, showing that an intervention package consisting of Behavioral Coaching plus MI can produce modest increases in step counts.

In more quantitative terms, similar to Valbuena et al. (2015) and VanWormer (2004), most participants’ daily step counts did not exceed 10,000 during baseline. However, after the first intervention phase was introduced, there were moderate increases in step counts. The participants in the current study exhibited a 32% step count increase ($M = 8,825$ steps, range, 280 to 22,404 steps) during the first intervention compared to baseline ($M = 6,706$). Valbuena et al.
(2015) observed a 20% increase in step counts across participants \((M = 6,485\text{ steps},\ \text{range},\ 670\ \text{to}\ 28,950\ \text{steps})\), and VanWormer (2004) observed an 18% in increase in step counts \((M = 8,000\ \text{steps},\ \text{range},\ 4,740\ \text{to}\ 15,692)\). After the second intervention was introduced, there were further increases in step counts reported by Valbuena et al. (2015), VanWormer (2004), and the current study. Participants in the current study exhibited a 36% step count increase \((M = 9,148\ \text{steps},\ \text{range},\ 54\ \text{to}\ 19,000\ \text{steps})\) in the second intervention compared to the first intervention. Valbuena et al. (2015) observed a 23% increase in step counts across participants \((M = 8,008\ \text{steps},\ \text{range},\ 598\ \text{to}\ 29,662\ \text{steps})\), and VanWormer (2004) observed an 25% increase in step counts \((M = 10,000\ \text{steps},\ \text{range},\ 5,060\ \text{to}\ 15,890)\).

There are several other findings that also warrant discussion. One is that although participants took more steps during intervention phases compared to baseline, the changes across phases were relatively small. Small or slow changes are typical in physical activity research of this kind and, in terms of health outcomes, small overall changes are important. Each participant took approximately 1,000 – 5,000 more steps by the end of the study compared to the start. It also is important to note that, across weeks, the participants’ goals continued to increase, whether it be a new daily step goal or the number of days they wanted to meet their daily step goal. As such, even if a daily goal was not met compared to a previous day or week, the overall step count could still be higher. At the start of the study, the experimenter recommended to each participant that they walk between 8,000 to 10,000 steps per day (Tudor-Locke et al., 2011), which is roughly equivalent to the physical activity guidelines recommended by the CDC (i.e., 150–300 min per week of moderate physical activity, or 75–150 min per week of vigorous physical activity). Taking approximately 10,000 steps each day appears to be the “gold-standard,” but sedentary individuals who start accumulating 8,000 steps each day begin to see health
improvements such as weight loss and lowered risk of developing or worsening chronic illnesses (Tudor-Locke et al., 2011). P1 and P3 consistently walked more than 8,000 steps each day, and P1, P2, and P4 self-reported weight loss throughout the study.

Additionally, the results of the current study suggest that some participants might be better suited for MI than others. The ideal candidate for MI is an individual who is resistant to starting a treatment program or unprepared to make the necessary life changes (Miller & Rollnick, 2002). Accordingly, P2 and P4 were the ideal participants for MI in the current study. These participants scored lower on the Change in Activity Level Readiness Questionnaire (P2 = 6/11, P4 = 7/11) compared to the other participants (P1 = 10/11, P3 = 9/11). According to the Academy of Nutrition and Dietetics (2011), individuals who score higher than an 8 are presumed to have good reason for wanting to change their activity level and a good understanding of the steps needed to succeed. Additionally, P2 and P4 participants did not come to the coaching sessions with a plan of how they would meet their step goals. In other words, they did not seem prepared to make changes. Their sessions included more evoking change talk, whereby the coach had to rely on the OARS approach, focusing on asking open-ended questions (e.g., “How might change be a good thing?”). On the other hand, P1 and P3 came to sessions with plans for meeting their step goals. Their sessions included more reinforcing change talk (e.g., “It is great that you came up with walking more in the mornings to increase your total daily step count. What will this look like?”). The results for P4 suggest that, even if MI might be effective for some participants, it might not necessarily work for all participants. On the social validity questionnaire, P4 noted that the MI sessions were more helpful in increasing her step count, indicating a discrepancy between her behavior and her self-report. Future research is needed to evaluate why certain individuals are better suited for MI compared to others who may not be.
A final noteworthy finding of this study was that the use of Fitbits to track steps might not be representative of overall activity. We observed relatively weak correlations between steps and active minutes and steps and zone minutes. Brewer et al. (2017) compared the accuracy of various, unspecified models of the Fitbit and the ActiGraph GT3X+ accelerometer, which has been well validated in the health research literature. They concluded that the Fitbit is not a valid indicator of steps per day, as it often overestimates by as many 1,300 steps. However, Brewer et al. (2007) concluded that the Fitbit was valid in terms of measuring active minutes, as the Fitbit was comparable to the accelerometer, in this regard. Therefore, the use of Fitbits to track steps per day might not be appropriate in future research of this kind. Instead, active minutes might be a better dependent variable. Although active minutes might be a better dependent variable than steps in some circumstances, there is an important limitation. When an individual is sedentary, physical activity tend to increase heart rate more than it does once an individual is consistently more active, when heart rate tends to be less affected. Researchers should keep this concern in mind when determining the device used to measure the dependent variable, as it raises questions about how useful the wrist worn Fitbits are for future research.

Interestingly, a procedural complication arose that made staggering the interventions across participants more difficult than anticipated. When scheduling the first coaching sessions (i.e., moving from baseline to intervention), we experienced reactivity to the coaching session being scheduled. In other words, we observed stable data patterns in baseline and therefore scheduled the initial Behavioral Coaching session for a given participant. After we scheduled the first Behavioral Coaching session, there was sometimes a sudden increase in the participants’ step counts leading up to the scheduled session. In response, we had to reschedule the initial coaching session for some participants (P2, P3, P4) until stable data trends were again observed.
(i.e., we would have to move the scheduled meeting to a later date). Future researchers might want to schedule the first coaching session with a shorter delay, minimizing the time between scheduling the first coaching session and the actual meeting.

A few strengths of the current study are worth noting. The current study extends the health coaching literature by using a single-case design rather than group design, where each participant served as their own control (Kazdin, 2020). As a result, we were able to directly observe individual performance across participants and examine the patterns of performance to make intervention decisions (Kazdin, 2020). Additionally, the primary dependent measure in this study was objective (i.e., steps were recorded by a Fitbit), which is not typical in the health coaching literature, where data collection is mostly self-report (Butterworth et al., 2006; 2007).

Another strength of this study is that the experimenter received extensive MI training and we assessed MI integrity, unlike many published MI studies (Barnes et al., 2014; Bus et al., 2017; Hardcastle et al., 2013; Linden et al., 2010; McDoniel et al., 2010; Raiff et al., 2016; Rohesenow et al., 2016; Smith et al., 1997; Webber et al., 2008; Young et al., 2020). This current study also extends the MI literature in that we specified the procedures used to train the experimenter, whereas many published MI studies do not (Butterworth et al., 2006; Linden et al., 2013). The intervention integrity assessment could be strengthened by having multiple professionals rate the degree to which MI was implemented with integrity.

A final strength of this study is the delivery of MI as a secondary intervention (i.e., Behavioral Coaching plus MI). In the health coaching literature, MI is often used at the beginning of an intervention (Finn & Watson, 2017; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010); however, Miller and Rollnick (2002) recommended that MI be implemented as a secondary intervention or as an additive component to an intervention for individuals who are
unprepared or unmotivated to change (also see Finn & Watson, 2017; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010). The goal would be to increase the motivation and commitment to change (Miller & Rollnick, 2002). For example, Brown and Miller (1993) added MI to an alcohol treatment program when the participants did not exhibit 100% adherence to the program, after which program adherence improved. The current study supports these findings, as well as the findings reported by Smith et al. (1997), who found that implementing MI as a secondary intervention produced modest increases in physical activity.

There are some limitations of the current study, however. The length of the intervention could be considered limitation. The current study emulated the typical duration of a health coaching interaction (i.e., 12 weeks), unlike Valbuena et al. (2015), which lasted between 22 and 31 weeks. An advantage of a study that spans an extended period of time is that participants would likely be observed during a number of small and large lifestyle changes. In this study, for example, all participants took vacations and had busy and varying schedules (work or school). Despite these obstacles, P1, P2, and P3 still were able to increase their physical activity across the duration of the study. However, approximately 2 weeks after we introduced the MI phase, P4 moved to a different state and left a job that required a lot of walking to start a more sedentary job, which seems to have contributed to the decrease in step totals observed after the Behavioral Coaching phase. As Valbuena et al. (2015) noted, interventions longer than 12 weeks are needed to see if persistent changes in physical activity can be produced in spite of the various life circumstances arising for participants.

Another limitation is that we tried to approximate health coaching with respect to the components of the intervention (i.e., self-monitoring, feedback, goal setting, and a focus on increasing physical activity), but this is not necessarily what health coaching would look like in
practice. Although most health coaching interventions include goals related to physical activity, they also include other goals such as nutrition and weight loss (Finn & Watson, 2017; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010). Future research should evaluate the effects of personalizing the intervention goals for each participant. Also, typical health coaching interventions include participants with pre-existing health conditions (Finn & Watson, 2017; Kivela et al., 2014; Olsen, 2013; Olsen & Nesbitt, 2010), whereas none of the participants in the current study had pre-existing health conditions. Future research could evaluate the effects of health coaching with those populations (Barnes et al., 2014; Hardcastle et al., 2013; McDoniel et al., 2010; Raiff et al., 2016; Smith et al., 1997; Webber et al., 2008; Young et al., 2020). It also is worth noting that, in practice, clients pay for health coach services. The participants in this study did not pay for services, but they were motivated enough to enroll in the current study. Future research could evaluate health coaching interventions with a contingency management component, perhaps such that participants would pay at the start of the study and earn some or all of the money back based on meeting their goals.

A couple limitations regarding intervention integrity are also worth mentioning. One limitation is that although we tried to blind the coder to the type of coaching session they were observing, it was impossible to blind them to the duration of the session. In other words, the Behavioral Coaching sessions were typically shorter than the Behavioral Coaching plus MI sessions, so possibly the coder knew which session they were observing. The second limitation is that although we had integrity measures for the coaching sessions, the MI code was difficult to use across the Behavioral Coaching sessions. The code was difficult to use because it was specifically intended for sessions when MI was meant to be implemented. Therefore, during the Behavioral Coaching sessions, it was often hard to score because MI was not used. The coder
often did not give a score 1 through 5, rather “N/A” for some MI components. The most common components that were scored “N/A” across the Behavioral Coaching sessions, were softening sustain talk and partnership. Researchers could assess MI integrity measures that could be better used in future research of this kind.

Finally, we cannot ignore the fact that we conducted the study during the coronavirus (COVID-19) pandemic. The impact of the pandemic was considerable, and the stay-at-home orders imposed resulted in the closure of fitness and activity centers, public places, schools, workplaces, and the overall interruption of social life. All of these factors likely hindered fitness goals and negatively affected health outcomes. All four participants reported that their daily routines changed because of the alterations to their work and school schedules and settings. Before the pandemic, participants had more opportunities to walk and move throughout their daily activities, such as walking to and from classes and around campus to meetings.

In summary, the current study provides a method for evaluating the effectiveness of MI used as part of a behavioral coaching intervention targeting physical activity. Behavioral Coaching alone moderately increased step counts for all participants, and there is some evidence to suggest that MI might have enhanced the effects for three out of four participants. MI is one of the most common components of health coaching, but it is rarely used in applied behavior analysis research or practice (but see Raiff et al., 2016). Instead, other components of health coaching, such as self-monitoring, feedback, and goal setting, are used in applied behavior analysis research. As such, MI is one factor that distinguishes the standard health coaching model from applied behavior analysis approaches. In the current study, although we only saw possible facilitative effects of MI three out of four participants, all four participants took more steps in intervention compared to baseline. According to Tudor-Locke et al. (2001), step counts
ranging between 8,000 to 10,000 each day are associated with some health benefits, including improved cardiovascular health, reduced hypertension, and reduced risk of developing Type 2 diabetes (CDC, 2020; WHO, 2020). In the future, the procedures of the current study could be combined with other behavioral interventions, such as contingency management, in an effort to produce larger improvements in health behavior.
REFERENCES


Brewer, W., Swanson, B. T., & Ortiz, A. (2017). Validity of Fitbit's active minutes as compared with a research-grade accelerometer and self-reported measures. *BMJ Open Sport & Exercise Medicine, 3*(1), e000254. https://doi.org/10.1136/bmjsem-2017-000254


Table 1
Different Components of Behavioral Coaching and Behavioral Coaching Plus MI Sessions

<table>
<thead>
<tr>
<th>Behavioral Coaching</th>
<th>Behavioral Coaching plus Motivational Interviewing</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the beginning of this phase, the participant set an initial daily step goal.</td>
<td>At the beginning of this phase, the experimenter explained that the coaching sessions will increase to approximately 30-min and that during the coaching sessions, they would like more input from the participant.</td>
</tr>
<tr>
<td>During each weekly meeting (10-15mins) one time per week:</td>
<td>During each weekly meeting (30-mins):</td>
</tr>
<tr>
<td>Reviewed participants weekly step count with graph made by experimenter and Fitbit account dashboard (determine if they did or did not meet their goal).</td>
<td>Reviewed participants weekly step count with graph made by experimenter and Fitbit account dashboard (determined if they did or did not meet their goal).</td>
</tr>
<tr>
<td>Provided feedback on step count performance (praise or constructive feedback).</td>
<td>Provided feedback on step count performance (praise or constructive feedback).</td>
</tr>
<tr>
<td>Identified day (or days) with highest step count in week and discussed contextual variables (did not ask for elaboration/examples).</td>
<td>Identified day (or days) with highest step count in week and discussed contextual variables (asked for further elaboration/examples).</td>
</tr>
<tr>
<td>Identified day (or days) with lowest step count in week and discussed contextual variables (did not ask for elaboration/examples).</td>
<td>Identified day (or days) with lowest step count in week and discussed contextual variables (asked for further elaboration/examples).</td>
</tr>
<tr>
<td>If applicable, asked participant if they would like to modify step goal for the following week.</td>
<td>If applicable, asked participant if they would like to modify step goal for the following week.</td>
</tr>
<tr>
<td></td>
<td>Did not provide suggestions.</td>
</tr>
</tbody>
</table>
(Table 1 Continued)

<table>
<thead>
<tr>
<th>Behavioral Coaching</th>
<th>Behavioral Coaching plus Motivational Interviewing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflected the change talk. Didn’t just repeat it but offered a complex reflection that makes a guess about what the person may mean (e.g., “you’re concerned how not exercising may affect you”, “Even better than normal! How did you do this?”).</td>
<td></td>
</tr>
<tr>
<td>Affirmed it (e.g., “you’re concerned how not exercising may affect you”).</td>
<td></td>
</tr>
<tr>
<td>Summarized the change talk that was heard (e.g., “getting more exercise is very important to you”).</td>
<td></td>
</tr>
<tr>
<td>Elicited (e.g., “I wonder if there’s anything else you’ve wondered about how not exercising affects you”).</td>
<td></td>
</tr>
<tr>
<td>Responded to and reinforced change talk.</td>
<td></td>
</tr>
<tr>
<td>Planned (e.g., “where do you want to go from here?”).</td>
<td></td>
</tr>
<tr>
<td><strong>Asked the participant if they have any questions.</strong></td>
<td><strong>Asked the participant if they have any questions.</strong></td>
</tr>
<tr>
<td><strong>Scheduled the next meeting.</strong></td>
<td><strong>Scheduled the next meeting.</strong></td>
</tr>
<tr>
<td><strong>Told participants they can send the experimenter an email with any questions.</strong></td>
<td><strong>Told participants they can send the experimenter an email with any questions.</strong></td>
</tr>
</tbody>
</table>

*Note.* The Behavioral Coaching sessions were adapted from Valbuena et al. (2014) and VanWormer (2004). The Behavioral Coaching plus MI sessions were adapted from Miller & Moyers (2006), Miller & Rollnick (2012), Miller et al. (2008).
### Table 2

*Daily Mean Step Counts Across Participants*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline</th>
<th>Behavioral Coaching</th>
<th>Behavioral Coaching plus MI</th>
<th>Social Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>7,885</td>
<td>9,840</td>
<td>10,312</td>
<td>9,473</td>
</tr>
<tr>
<td>P2</td>
<td>5,453</td>
<td>4,917</td>
<td>6,264</td>
<td>4,601</td>
</tr>
<tr>
<td>P3</td>
<td>7,647</td>
<td>9,866</td>
<td>11,184</td>
<td>11,073</td>
</tr>
<tr>
<td>P4</td>
<td>5,841</td>
<td>10,677</td>
<td>8,833</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Table 3

*Mean Zone Minutes Across Participants*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline</th>
<th>Behavioral Coaching</th>
<th>Behavioral Coaching plus MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>34 mins</td>
<td>43 mins</td>
<td>31 mins</td>
</tr>
<tr>
<td>P2</td>
<td>52 mins</td>
<td>46 mins</td>
<td>46 mins</td>
</tr>
<tr>
<td>P3</td>
<td>14 mins</td>
<td>19 mins</td>
<td>25 mins</td>
</tr>
<tr>
<td>P4</td>
<td>45 mins</td>
<td>92 mins</td>
<td>43 mins</td>
</tr>
</tbody>
</table>
Table 4
*Mean Active Minutes Across Participants*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline</th>
<th>Behavioral Coaching</th>
<th>Behavioral Coaching plus MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>27 mins</td>
<td>39 mins</td>
<td>24 mins</td>
</tr>
<tr>
<td>P2</td>
<td>47 mins</td>
<td>37 mins</td>
<td>45 mins</td>
</tr>
<tr>
<td>P3</td>
<td>31 mins</td>
<td>49 mins</td>
<td>68 mins</td>
</tr>
<tr>
<td>P4</td>
<td>5 mins</td>
<td>6 mins</td>
<td>3 mins</td>
</tr>
</tbody>
</table>
### Table 5

**Summary of Free Response Questions on Social Validity Questionnaire**

<table>
<thead>
<tr>
<th></th>
<th>Was there a portion of the experience you would like to change? If so, what changes?</th>
<th>Did you prefer the longer or shorter coaching sessions? Why/why not?</th>
<th>What was your biggest barrier?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P1</strong></td>
<td>No Answer</td>
<td>Longer coaching sessions. I liked how I could think about my week in a more detailed way. I liked how the experimenter asked more questions that I had to think about more before answering.</td>
<td>Busy with work – not allocating enough to walking because of work.</td>
</tr>
<tr>
<td></td>
<td>Have the longer coaching session be throughout the study, I felt like I got more out of the shorter sessions (i.e., Behavioral Coaching sessions).</td>
<td>Longer coaching sessions. I felt like since I got more information, we had a better discussion about my week. And the discussion helped me realize things that I may not have realized on my own or before.</td>
<td>During the weekday - how busy I was. I felt generally lazy, or I just had too much other stuff to do. I would prioritize work or sleeping sometimes over walking.</td>
</tr>
<tr>
<td><strong>P3</strong></td>
<td>Incorporating the box graphs that the experimenter made earlier on. It was a different representation than on the Fitbit dashboard. It provided more context – the graphs show on a continuous scale. See on a day to day how I was progressing. This was more motivational and informational. Using those with the Fitbit dashboard makes it more complete.</td>
<td>Recommends longer coaching sessions, I was able to get more personalized coaching. Able to cover a lot more of the background of the walking – talked about process which made it more sustainable, problem solving.</td>
<td>I wasn’t as motivated in the beginning of the study. The shorter coaching sessions – I didn’t feel like there was a benefit to hitting my goals. Whereas the longer coaching (i.e., Behavioral Coaching with MI), I liked because it more detailed and made the walking seem more purposeful. There was a reason to be more consistent. The shorter coaching sessions were shallow and longer coaching sessions were a lot deeper.</td>
</tr>
<tr>
<td><strong>P4</strong></td>
<td>I thought the coaching was going to be bit different, thought it would involve nutrition. Recommend adding more topics besides just walking/exercise like nutrition.</td>
<td>Longer coaching sessions because it gave me more insight about my steps.</td>
<td>I was in the mindset that on my days off, I should just relax. Typically, on those days, I felt lazier</td>
</tr>
</tbody>
</table>
Table 6
Behavioral Coaching and Behavioral Coaching Plus MI Session Lengths

<table>
<thead>
<tr>
<th></th>
<th>Behavioral Coaching</th>
<th>Behavioral Coaching plus MI</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>17</td>
<td>32</td>
<td>49</td>
</tr>
<tr>
<td>( M )</td>
<td>7.5 min</td>
<td>25.4 min</td>
<td>18.5 min</td>
</tr>
<tr>
<td>( SD )</td>
<td>1.9</td>
<td>6.9</td>
<td>10.2</td>
</tr>
<tr>
<td>Range</td>
<td>5.3–11.2 min</td>
<td>11.3–40.4 min</td>
<td>5.3–40.4 min</td>
</tr>
</tbody>
</table>
Table 7
Percentage of Daily Goals Met Across Phases for Each Participant

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline</th>
<th>Behavioral Coaching: Goal Met</th>
<th>Behavioral Coaching plus MI: Goal Met</th>
<th>Social Validity: Goal Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>N/A</td>
<td>79%</td>
<td>85%</td>
<td>57%</td>
</tr>
<tr>
<td>P2</td>
<td>N/A</td>
<td>48%</td>
<td>72%</td>
<td>57%</td>
</tr>
<tr>
<td>P3</td>
<td>N/A</td>
<td>76%</td>
<td>93%</td>
<td>100%</td>
</tr>
<tr>
<td>P4</td>
<td>N/A</td>
<td>79%</td>
<td>75%</td>
<td>N/A</td>
</tr>
<tr>
<td>Study</td>
<td>Baseline</td>
<td>Behavioral Coaching/Fitbit/Self-Monitoring</td>
<td>Behavioral Coaching plus MI/ Fitbit plus Coaching/Self-Monitoring plus Coaching</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Range</td>
<td>% Increase from Baseline</td>
<td>M</td>
</tr>
<tr>
<td>Current Study</td>
<td>6,706</td>
<td>164–21,525</td>
<td>8,825 280–22,404</td>
<td>32</td>
</tr>
<tr>
<td>VanWormer (2004)</td>
<td>6,766</td>
<td>N/A</td>
<td>8,000 4,740–15,692</td>
<td>18</td>
</tr>
</tbody>
</table>

*Note.* Each graph from Valbuena et al. (2015) and VanWormer (2004) were analyzed via [www.graphreader.com](http://www.graphreader.com) to determine the step count ranges.
Figure 1. Participant demographics
Figure 2. Step counts across participants. Daily goals are depicted by the dashed horizontal lines, Phase means are depicted by the solid horizontal lines. Below each participants’ graph is a box graph that depicts whether each participant met their daily goal or not. The black boxes depict the participant met their goal and the white depicts the participant did not meet their goal.
Figure 3. 7-day simple moving average across participants. A 7-day simple moving average line was used to smooth out the variability across phases by creating a constantly updated average step-count.
Figure 4. Average daily step counts across participants
Figure 5. Weekly step goals met for participant 1 through 4
Figure 6. Zone minutes across days for each participant. A 7-day simple moving average line was used to smooth out the variability across phases by creating a constantly updated average step-count.
Figure 7. Active minutes across days for each participant. A 7-day simple moving average line was used to smooth out the variability across phases by creating a constantly updated average step-count.
Figure 8. Correlation coefficients for participant 1. The top left corner depicts the correlation coefficient between active minutes and steps, the bottom left depicts the correlation coefficient between zone minutes and steps, and the right middle depicts the correlation coefficient between active minutes and zone minutes.
Figure 9. Correlation coefficients for participant 2. The top left corner depicts the correlation coefficient between active minutes and steps, the bottom left depicts the correlation coefficient between zone minutes and steps, and the right middle depicts the correlation coefficient between active minutes and zone minutes.
Figure 10. Correlation coefficients for participant 3. The top left corner depicts the correlation coefficient between active minutes and steps, the bottom left depicts the correlation coefficient between zone minutes and steps, and the right middle depicts the correlation coefficient between active minutes and zone minutes.
Figure 11. Correlation coefficients for participant 4. The top left corner depicts the correlation coefficient between active minutes and steps, the bottom left depicts the correlation coefficient between zone minutes and steps, and the right middle depicts the correlation coefficient between active minutes and zone minutes.
Figure 12. Social validity responses across participants. The last three questions of the questionnaire were reverse coded.
APPENDIX A: RECRUITMENT FLYER

UNIVERSITY OF THE PACIFIC

ARE YOU INTERESTING IN GETTING MORE PHYSICAL ACTIVITY?

Please contact Ryley Acrea for more information
r_acrea@u.pacific.edu
916-838-6543

YOU’RE INVITED TO PARTICIPATE!

Participants:
• Are between the ages of 18-75.
• Have not recently been told by a doctor that you should refrain from exercise.
• Have had no major operations within the past 4 weeks.
• Have reliable internet and smart phone access.
• Specifically interested in increasing daily step count.

Benefits: 3 months of free health coaching. Keep Fitbit after completing the study.

STUDY INFORMATION

Maybe you have wanted to increase your daily step count but are unsure how? Researchers at University of the Pacific are looking to recruit participants for a study on health coaching who are interested in increasing their daily step count.

Participating in this study will include 1 initial session, followed by 8-10 weekly 15-30 minute sessions via Zoom. Additionally, you will receive access to use a device.
APPENDIX B: PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

NAME _________________________________________________________

DATE OF BIRTH _________________________ AGE: ________________

Has the test procedure(s) that you will participate in been fully
explained to you? (Circle Yes or No):

Any information provided on this form will be treated as confidential.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Has your doctor ever said that you have a heart condition and that you should only perform physical activity recommended by a doctor?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Do you feel pain in your chest when you perform physical activity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 In the past month, have you had chest pain when you were not performing any physical activity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Do you lose your balance because of dizziness or do you ever lose consciousness?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Do you have a bone or joint problem that could be made worse by a change in your physical activity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Is your doctor currently prescribing any medication for your blood pressure or for a heart condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Do you know of any other reason why you should not engage in physical activity?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I __________________________________________ declare that the above information is correct at the time of completing this questionnaire on date _____/_____/______.

If you have answered “No” to all questions then you can be reasonably sure that you can take part in the physical activity requirement of this project.

Please note: If your changes so that you can answer YES to any of the above questions, notify the investigators and consult with your doctor regarding the level of physical activity that you can participate in.

If you have answered “Yes” to one or more of the above questions, consult your physician before engaging in physical activity. Tell your physician which questions you answered “Yes” to. After a medical evaluation, seek advice from your physician on what type of activity is suitable for your current condition, and whether you are able to participate in the present study.

Doctor’s Name________________________________________ Date ________/_______/______

Doctor’s Signature ____________________________________

Signature of Investigator ______________________________ Date ________/_______/______
Prior to the screening session: PAR-Q, Change in Activity Level Readiness quiz, demographics, and informed consent were sent via email

1. Introductions.

2. Purpose of the study (i.e., increase step count).

3. Assisted in completing the forms (i.e., readiness questionnaires, demographics, informed consent).

4. If the participant met inclusionary criteria (i.e., 18-55 years old and has internet access):
   a. The initial Behavioral Coaching session was scheduled.
   b. Participants preferred way of receiving the Fitbit was discussed (e.g., contactless delivery or by mail).

5. If the participant did not meet inclusionary criteria:
   a. They were thanked for their time and no further sessions were scheduled.

APPENDIX D: CHANGE IN ACTIVITY READINESS QUESTIONNAIRE

Are you ready to increase your physical activity? Your attitude about making a change affects your ability to succeed. Mark each item true or false. It’s important that these answers reflect the way you really are, not how you would like to be.

1. ______ I have thought a lot about my physical activity habits to pinpoint what I need to change.
2. ______ I have accepted the idea that I need to make permanent, not temporary, changes in my habits.
3. ______ I will only be successful if I greatly increase my physical activity.
4. ______ I accept that it’s best if I increase my activity level slowly.
5. ______ I’m thinking of becoming more active now because I really want to, not because someone else thinks I should.
6. ______ I think becoming more active will solve other problems in my life.
7. ______ I am willing and able to increase my regular physical activity.
8. ______ I can increase my activity level successfully if I have no “slip-ups.”
9. ______ I am ready to commit some time and effort each week to organizing and planning my activity progress.
10. ______ Once I see some progress, I usually lose my motivation to keep going until I reach my goal.
11. ______ I want to start a physical activity program, even though my life is unusually stressful right now.

Note: The weight loss readiness was developed by the Academy of Nutrition and Dietetics and is based on the transtheoretical model of behavior change. This is a modified version, made to address readiness to begin a physical activity program, specifically.
Change in Activity Level Readiness Quiz Scoring

1. To score the quiz, look at your answers to items 1, 2, 4, 5, 7, 9. Score “1” if you answered “true” and “0” if you answered “false.”

2. For items 3, 6, 8, 10, 11, score “0” for each true answer and “1” for each false answer.

3. To get your total score, add the scores for all. If you scored 8 or higher, you probably have good reasons for wanting to change your activity level now and a good understanding of the steps needed to succeed.

Note: The weight loss readiness was developed by the Academy of Nutrition and Dietetics and is based on the transtheoretical model of behavior change. This is a modified version, made to address readiness to begin a physical activity program, specifically.
APPENDIX E: INFORMED CONSENT FORM

UNIVERSITY OF THE PACIFIC

Department of Psychology
RESEARCH SUBJECT'S CONSENT TO PARTICIPATE IN RESEARCH
The Effectiveness of Motivational Interviewing in A Client-Centered Model to Increase Physical Activity

Name of Lead Researcher: Ryelye Acea
Name of Faculty Advisor: Dr. Matthew Normand

You are being invited to participate in a research study, and your participation is entirely voluntary.

A. Purpose of Research. The purpose of this research is to examine the effects of two styles of coaching on the physical activity level of adults. It is expected that the information gained from this study will provide important information about the behavioral changes resulting from the intervention. This information will aid in the development of better interventions to improve the health and fitness of adults.

B. Duration of Participation. You will be involved in the study for a total range of 7-14 weeks. During this time, you will be involved in one baseline meeting, followed by 7-14 total coaching sessions, each approximately 30-min Zoom contacts with the experimenter (i.e., 3.5-7 hours total).

C. Research Procedures. A Fitbit Inspire 2 fitness tracker will be provided to you at the start of the study by mail or contactless drop-off. If you decide to participate, you will be asked to 1) wear the fitness tracker each day and email or text Fitbit metrics to the experimenter daily for a period of 7-14 weeks, 2) meet with a behavioral coach by video call on a weekly basis for approximately 10-30-min at a time for a range of 7-14 consecutive weeks, and 3) complete a number of questionnaires. Across coaching sessions, you will guide discussion and set your own physical activity goals with support and feedback from the coach during 7-14 sessions. If you currently use a fitness tracker, you will be asked to use only the tracker provided by the experimenter for the duration of the study.

D. Foreseeable Risks. There are some possible risks involved for participants. You may experience discomfort over the course of the study if your physical activity goals are not met.

Additionally, there will be minimal physical risk posed as a product of increased physical activity. The University of the Pacific is not responsible in the event of a research related injury. By agreeing to participate in this study, you agree to assume full responsibility for any injuries which might occur as a result of increased physical activity. If a medical incident occurs, please contact your usual medical provider.

Although not anticipated, it is possible that a loss of confidentiality may occur during data collection and as researchers share information about the sessions.
E. **Benefits.** There are some benefits to this research, and in particular the benefits may include the increased physical activity may reduce risk for serious health conditions and improving physical fitness and overall health, perhaps even increasing life expectancy and alleviating a burden on and from the healthcare system. If you participate, you will be able to keep the Fitbit. You will be able to keep the Fitbit once you have completed the study. In other words, you will be allowed to keep the Fitbit at approximately 7 weeks.

F. **Alternative Procedures.** There are no alternative research procedures for this study. You do not have to participate and can stop at any time you do not want to continue.

I. **CONFIDENTIALITY**

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. The information collected will be used for research purposes only.

We will take reasonable steps to keep confidential any information that is obtained in connection with this research study and can be identified with you.

Measures to protect your confidentiality are storing session recordings on a University-issued computer, shared between researchers using a secure server.

Upon conclusion of the research study, the data obtained will be maintained on a secure server and will be destroyed after a period of seven years after the research is completed.

II. **PARTICIPATION**

You were selected as a possible participant in this study because you are over 18 years old and you are specifically interested in increasing your step count.

Your decision whether or not to participate will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to participate, you are free to discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

III. **EXPERIMENTAL PROCEDURES**

No experimental procedures will be used in this study.

IV. **COLLECTION OF INFORMATION OR BIOSPECIMENS**

Identifiers will be removed from the identifiable private information, and such information will not be used or distributed for future research studies.
V. UNIVERSITY CONTACT INFORMATION

I am the lead researcher in this study and I am a graduate assistant at the University of the Pacific, Psychology Department. This research study is part of my thesis for my Master's in Psychology.

If you have any questions about the research at any time, please contact me at (916)838-6543 or by email at r_aerea@u.pacific.edu, or Dr. Matthew Normand at 209-946-7317 or contact him by email at mnormand@pacific.edu.

If you have any questions about your rights as a participant in a research project or wish to speak with an independent contact, please contact Human Subjects Protections in the Office of Research and Sponsored Programs, University of the Pacific at (209) 946-3903 or by email at IRB@pacific.edu.

VI. COMPENSATION & NO COMMERCIAL PROFIT

Upon completion of the study, you will be offered possession of the Fitbit Inspire 2.

VII. ACKNOWLEDGEMENT AND SIGNATURE

I hereby consent: (Indicate Yes or No)

- To be audio/video recorded during this study.
  ___Yes  ___No

- For such audio/video records resulting from this study to be kept for records and for an independent observer to rate the principal investigator’s behavior.
  ___Yes  ___No

- For my identity to be disclosed in written materials resulting from this study.
  ___Yes  ___No
You will be given a copy of this form to keep.

Your signature below indicates that you have read and understand the information provided above, that you have been afforded the opportunity to ask, and have answered, any questions that you may have, that your participation is completely voluntary, that you understand that you may withdraw your consent and discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled, that you will receive a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Signed: ______________________ Date: ______________________

Research Study Participant (Print Name): ______________________

Researcher Who Obtained Consent (Print Name): ______________________
APPENDIX F: DEMOGRAPHICS QUESTIONNAIRE

Demographics Questionnaire

1. What is your age in years?
   - I prefer to not answer.

2. Which categories describe you? Select all that apply:
   - White
   - Black or African American
   - American Indian or Alaska Native
   - Asian Indian
   - Chinese
   - Filipino
   - Other Asian (for example, Hmong, Laotian, Thai, Pakistani, Cambodian)
   - Vietnamese
   - Korean
   - Japanese
   - Native Hawaiian
   - Guamanian or Chamorro
   - Samoan
   - Other Pacific Islander (for example, Fijian, Tongan)
   - Other race. Please specify: Mexican American
   - I prefer to not answer.

3. Are you of Hispanic, Latino, or Spanish Origin?
   - No, not of Hispanic, Latino, or Spanish origin
   - Yes, Mexican, Mexican American, Chicano
   - Yes, Puerto Rican
   - Yes, Cuban
   - Yes, another Hispanic, Latino, or Spanish origin. Please specify (for example, Argentinean, Colombian, Dominican, Nicaraguan, Salvadoran, Spaniard):
     - I prefer to not answer.

4. How do you currently describe your gender identity?
   - Please specify: Female
   - I prefer to not answer.
5. What is your sex?
   □ Male
   □ Female
   □ I prefer to not answer.

6. What is the highest level of school you have completed? Select one. If currently enrolled, mark the previous grade or highest degree received.
   □ High school diploma or equivalent (e.g., GED)
   □ Some college, no degree
   □ Associate's degree
   □ Bachelor's degree
   □ Master's degree (e.g., MA, MS, Meng, Med, MSW, MBA)
   □ Professional degree beyond a bachelor's degree (e.g., EdS, MD, DDS, JD)
   □ Doctorate degree (e.g., EdD, PhD)
   □ Other (please specify):
   □ I prefer to not answer.

7. What is your marital status?
   □ Now married
   □ Widowed
   □ Divorced
   □ Separated
   □ Never married
   □ I prefer to not answer.

8. What is your current employment status? Select all that apply:
   □ Part-time employment (20 or fewer hours/week)
   □ Part-time employment (21-34 hours/week)
   □ Full-time employment (35-49 hours/week)
   □ Full-time employment (50+ hours/week)
   □ Unemployed
   □ Retired
   □ Student
   □ Other (please specify):
   □ I prefer not to answer.
9. Do you currently use a pedometer or other monitor of physical activity?
   □ Yes
   If so, please specify which one(s):
   If so, please specify which features:
   If so, please specify how often (for example, twice per day, once per day, once per week, once or twice per month):
   □ No

10. Have you ever used a pedometer or other monitor of physical activity?
    □ Yes
    If so, please specify which one(s):
    If so, please specify which features:
    If so, please specify how often (for example, twice per day, once per day, once per week, once or twice per month):
    If so, please specify when you last used the device (for example, approximately three months ago, two years ago):
    □ No
Prior to the initial meeting: Fitbit was delivered by mail for each participant.

1. Greeting.
2. Role of a behavioral coach explained.
3. The experimenter described the benefits of the participant increasing their step count (e.g., https://ijbnpa.biomedcentral.com/articles/10.1186/1479-5868-8-79)
4. The experimenter familiarized the participant to the Fitbit.
5. The participant was told they will be put on a short waitlist before the next meeting was scheduled, but to start wearing their Fitbit during waking hours. They were also told to start sending their Fitbit totals to the experimenter at the end of each day.
Prior to each behavioral coaching session: The participant sent all Fitbit data from the previous week.

1. Greeting.
2. The experimenter displayed the participants online Fitbit account dashboard.
3. Reviewed participants data from the previous week.
4. Determined if client-set goal was met
   a. Provided praise contingent on meeting their goal (e.g., “Great job meeting X goal”).
      i. Asked what they did on days that they met their goal.
      ii. Asked if they would like to keep the same goal or increase their step goal.
   b. Provided feedback contingent on the participate not meeting their goal (e.g., “let’s try again next week to meet X goal”).
      i. Asked what they did on days that they did not meet their goal.
      ii. The participant kept the same step goal.
5. Asked if the participant had any questions
6. Scheduled next session.
7. Salutation
APPENDIX I: BEHAVIORAL COACHING EXAMPLE SCRIPT

Adapted from Valbuena et al. (2015)

Experimenter: Hi, how are you?
Participants: Good.

Experimenter: How was your week? How did walking go?

Participant: It went well. I met my goal of walking 9,000 steps 5 out of 7 days.

Experimenter: Excellent. Great job meeting that 9,000 step walking goal for 5 days.

Participant: Thank you.

Experimenter: Looking at the graph I made for you, which shows your step count per day, you did meet your 9,000 step goal. How does it feel?

Participant: I feel great. I love how I have found a routine for at least 5 out of 7 days to meet my goal.

Experimenter: Great work. When you did reach your goal, what has your routine been?

Participant: I have been waking up an hour earlier on those days to get a long walk in before I start my day. I have also been walking round my house during breaks between zoom meetings.

Experimenter: I am so glad you found something that works well for you. On days that you did not reach your goal, what does your routine look like?

Participant: At the start of the week, I am in the habit of waking up early, but as the week goes on I get a little burnt out.

Experimenter: Okay. So, there is still some room for improvement.

Participant: Yes.

Experimenter: Would you like to keep your step goal or modify it?

Participant: Since I did not meet my goal for the entire week, let’s keep my goal at 9,000 steps a day.

Experimenter: Okay. Would this time work well for your next week?

Participant: Yes.
<table>
<thead>
<tr>
<th>Met Goal</th>
<th>Failed to Meet Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>You reached your goal of (exercise goal). Great job! I knew you could do it!</td>
<td>You didn’t reach your goal this week of (exercise goal). Let’s dig deep and try harder this week.</td>
</tr>
<tr>
<td>It looks like you reached your exercise goal this week. That’s awesome! How does it feel?</td>
<td>Your goal this week was (exercise goal) and you reached (realized goal). Let’s see if we can overcome some barriers this week.</td>
</tr>
<tr>
<td>Your goal for this week was (exercise goal) and you hit (realized goal). That’s amazing! You really worked hard and it shows!</td>
<td>Your goal this week was (exercise goal) and you hit (realized goal). Let’s reflect on this week and see what we need to work on.</td>
</tr>
<tr>
<td>Your goal was (exercise goal) and you hit (realized goal). You’re doing so well. Keep up the good work!</td>
<td>You hit (realized goal), but your goal this week was (exercise goal). How can we get these numbers up to hit your goals?</td>
</tr>
<tr>
<td>You knocked it out of the park this week. Your goal was (exercise goal) and you hit (realized goal). Fantastic effort!</td>
<td>You fell short of your goal of (exercise goal) with a number of (realized goal). What can we do to make sure that doesn’t happen next week?</td>
</tr>
<tr>
<td>Your goal was (exercise goal) and you reached (realized goal). Very impressive. How did you manage it?</td>
<td>Your goal was (exercise goal), however you only achieved (realized goal). I know you can do it; this week is your week.</td>
</tr>
</tbody>
</table>
APPENDIX K: MOTIVATIONAL INTERVIEWING AGENDA

1. Greeting.

2. The experimenter displayed the participants online Fitbit account dashboard.

3. Reviewed participants data from the previous week.

4. Determined if client-set met their goal

   a. Provided praise contingent on meeting their goal (e.g., “Great job meeting X goal”).
   
   b. Provided feedback contingent on the participant not meeting their goal (e.g., “let’s try again next week to meet X goal”).

5. The goal of this session was to gather more information about how they did or did not reach their goals (p. 259).

   a. Asked more about it. Ask for an example or for elaboration (e.g., “In what ways…”).
   
   b. Reflected the change talk. Didn’t just repeat it but offered a complex reflection that made a guess about what the participant meant (e.g., “you’re concerned how not exercising may affect you”, “Even better than normal! How did you do this?”).
   
   c. Affirmed it (e.g., “you’re concerned how not exercising may affect you”).
   
   d. Summarized the change talk that was heard (e.g., “getting more exercise is very important to you”).
   
   e. Elicited (e.g., “I wonder if there’s anything else you’ve wondered about how not exercising affects you”)
f. Planned (e.g., “where do you want to go from here?”).

6. Asked if the participant had any questions

7. Scheduled next session

8. Salutation
Adapted from Miller & Moyer (2006); Miller & Rollnick (2012); Miller et al. (2008)

Experimenter: Hi, how are you?

Participants: Good.

Experimenter: How was your week? How did walking go?

Participant: It went well. I met my goal of walking 9,000 steps 5 out of 7 days.

Experimenter: Excellent. Great job meeting that 9,000 step walking goal for 4 days. How does it feel, to meet your step goal?

Participant: I feel great. I love how I have found a routine for at least 5 out of 7 days to meet my goal.

Experimenter: Great work. You’re mentioning a routine - When you did reach your goal, what has your routine been?

Participant: I have been waking up an hour earlier on those days to get a long walk in before I start my day. I have also been walking around my house during breaks between zoom meetings.

Experimenter: I am so glad you found something that works well for you (Affirmation). That sounds like a brief overview of your routine. Let’s break it down and be more specific. What is going on in your day when you do reach your goal (Open-ended question)?

Participant: Yes, right now I work from home. So, my day is a bit different compared to before COVID. I wake up, go for a walk, and get ready for work. I work for most of the morning and then have lunch. Then after lunch, I am back work until about four. After work, I like to do things around my house or run any errands. Then I normally go to bed early.

Experimenter: Wow. I would first like to point out that you found a time to walk and get more exercise on your own. I did not tell you or give you suggestions about when to get some more steps in, you found that time and that is great (Affirmation). Secondly, it sounds like you are busy (express empathy). And COVID and working from home, sound like they may have put a wrench in your typical walking routine (summary). Would you say that is accurate?

Participant: Yes.

Experimenter: Okay, I’d like to come back to your routine in a second but what did your walking routine look like before COVID and working from home (open-ended question)?
Participant: Yeah, you kind of mentioned this, but it did screw up my walking routine (potentially sustain talk). Before COVID, I was walking around on my lunch breaks and walking after dinner with my husband. I really want to get into my normal routine (change talk).

Experimenter: Wow. Walking and getting back into your exercise routine sounds very important to you (responding to the change talk and expressing empathy). Your walking schedule was a bit different before COVID (reframing the sustain talk), you were walking twice a day (once on lunch and once after dinner). And now, you are walking once a day (early in the morning) (summary). What do you make of that difference (open-ended question and showing a discrepancy)?

Participant: Well, I don’t have time for two walks a day.

At this point the experimenter could bring up the participants schedule again (it was still an overview of their day). So, the experimenter could ask for 1–2-hour time-blocks. This will allow the experimenter to gather all the information about the participants daily routine. After the experimenter can operationally define the participants schedule when they do meet their goal, this may be a direction the conversation could go.

Experimenter: Now that we have a good idea about what goes on during your day when you do meet your goal, tell me more about your routine on days that you did not reach your goal (open-ended question)? It looks like you had a decrease in your step count the last 3 days.

Participant: At the start of the week, I am in the habit of waking up early, but as the week goes on, I get a little burnt out.

Experimenter: Okay, sounds like you have a lot of motivation at the start of your week, and as the week progresses you get more and more tired (reflection). Does that sound about right?

Participant: Yes.

Experimenter: Similar to how we broke down your day by hour chunks when you do reach your goal, let’s do the same when you do not reach your goal.

This is where the participant will break down their schedule again, the experimenter can ask clarifying questions, use reflections and summaries, and ask open ended questions to gather as much information as possible. If the client engages in any change talk, talk about the change talk and what they just said they might change. Gather more information about how the change may be implemented and be a good thing. Based on the information that the experimenter has gathered this may be a direction the conversation could go:

Experimenter: You mentioned your lunch break is an hour and you like to have a quick snack and then chill on your phone. What would it look like or on a scale from 1-10 (1 being not likely to 10 being highly likely), how likely would it be if you went on a walk? (Negotiating a change plan).

Participant: I would give it a 9. I would go on a walk during my lunch (commitment language).
Experimenter: Excellent. You gave it a high number. Why not a 5 or a 6?

Participant: Well, I have the time on my lunch. There is no reason why I couldn’t go for a walk. That is what I used to do, and I will do it now (commitment language).

Experimenter: Yes, you used to do this prior to COVID, so it would be like adjusting back into your routine.

Participant: Yes!

Experiment: Since you rated it so high. (As in you would be very likely to walk during your lunch). Is this something you want to try next week?

Participant: Yes.

Experimenter: Okay, great. I look forward to seeing how it goes. Would this same time work well for your next week?

Participant: Yes.

Experimenter: Okay, have a great week. Bye!
APPENDIX M: TREATMENT INTEGRITY - BEHAVIORAL COACHING SESSIONS

Adapted from Valbuena et al. (2015)

This was used for both Behavioral Coaching and MI sessions. For each participant, 20% of sessions were scored (2 sessions for each participant [one Behavioral coaching and one Behavioral Coaching with MI]).

<table>
<thead>
<tr>
<th>Behavioral Coaching Checklist</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>The experimenter logged into the participants Fitbit account to access their dashboard</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Provided feedback on step-count goal performance (praise or constructive feedback)</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>If the participant met their goal, the experimenter asked the participant if they would like to set a new goal or keep their goal the same</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>If the participant did not meet their goal, the experimenter told the participant they will keep the same step goal</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Identified day(s) with the highest step-count in week and discuss contextual variables</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Identified day(s) with the lowest step-count in week and discuss contextual variables</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>The experimenter asked additional questions about the participants’ week</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Asked the participant if they have questions</td>
<td>Y N N/A</td>
</tr>
<tr>
<td>Scheduled time for a Behavioral Coaching session the following week</td>
<td>Y N N/A</td>
</tr>
</tbody>
</table>
APPENDIX N: TREATMENT INTEGRITY-MI SESSIONS

Adapted from Motivational Interviewing Treatment Integrity 4.2.1 (MITI)

These scores were meant to capture the rater’s overall judgement about the implementation of MI.

### Cultivating Change Talk (p. 5)

<table>
<thead>
<tr>
<th>Low</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Clinician shows no explicit attention to, or preference for, the client’s language in favor of changing.

Clinician sporadically attends to client language in favor of change – frequently misses opportunities to encourage change talk.

Clinician often attends to the client’s language in favor of change but misses some opportunities to encourage change talk.

Clinician consistently attends to the client’s language about change and makes efforts to encourage it.

Clinician shows a marked and consistent effort to increase the depth, strength, or momentum of the client’s language in favor of change.

### Softening Sustain Talk (p. 7)

<table>
<thead>
<tr>
<th>Low</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Clinician consistently responds to the client’s language in a manner that facilitates the frequency or depth of arguments in favor of the status quo.

Clinician usually chooses to explore, focus on, or respond to the client’s language in favor of the status quo.

Clinician gives preference to the client’s language in favor of the status quo but may show some instances of shifting the focus away from sustain talk.

Clinician typically avoids an emphasis on client language favoring the status quo.

Clinician shows a marked and consistent effort to decrease the depth, strength, or momentum of the client’s language in favor of the status quo.
### Partnership (p. 9)

<table>
<thead>
<tr>
<th>Low</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clinician actively assumes the expert role for the majority of the interaction with the client. Collaboration or partnership is absent.</td>
<td>Clinician superficially responds to opportunities to collaborate.</td>
<td>Clinician incorporates client's contributions but does so in a lukewarm or erratic fashion.</td>
<td>Clinician actively fosters collaboration and power sharing so that client’s contributions impact the session in ways that they otherwise would not.</td>
</tr>
</tbody>
</table>

### Empathy (p. 11)

<table>
<thead>
<tr>
<th>Low</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clinician gives little or no attention to the client’s perspective.</td>
<td>Clinician makes sporadic efforts to explore the client’s perspective. Clinician’s understanding may be inaccurate or may detract from the client’s true meaning.</td>
<td>Clinician is actively trying to understand the client’s perspective, with modest success.</td>
<td>Clinician shows evidence of deep understanding of client’s point of view, not just for what has been explicitly stated but what the client means but has not yet said.</td>
</tr>
<tr>
<td>2</td>
<td>Clinician makes active and repeated efforts to understand the client’s point of view. Shows evidence of accurate understanding of the client’s worldview, although mostly limited to explicit content.</td>
<td>Clinician shows evidence of deep understanding of client’s point of view, not just for what has been explicitly stated but what the client means but has not yet said.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Relevant Definitions for Integrity sessions (Adapted from MITI):

- **Cultivating Change Talk (p. 6):**
  - The clinician shaped the client’s language in favor of change.
  - Elicited and reinforced change talk.
  - Did not miss opportunities to explore more deeply when client offered change talk.

- **Softening Sustain Talk (p. 8):**
  - Shifted focus of sustain talk toward the target change goal.
  - May have used reflections to move the conversation away from sustain talk.

- **Partnership (p.10):**
  - Negotiated the agenda and goals for the session.
  - Facilitated client evaluation of options and planning.
  - Explicitly identified client as the expert and decision maker.
  - Clinician favored discussion of client’s strengths and resources rather than examining deficits.

- **Empathy (p. 12):**
  - Effectively communicated an understanding of the client beyond what the client says in sessions.
  - Showed great interest in client’s perspective or situation.
  - Attempted to “put self in client’s shoes”.
  - Often encouraged client to elaborate, beyond what is necessary to merely follow the story.
  - Used many accurate complex reflections.
Data Sheet for Behavioral Coaching plus MI sessions:

Participant (Number): ______  Recording Number: ______  Rater Initials: ______

Date: ______

<table>
<thead>
<tr>
<th>Motivational Interviewing Dimension</th>
<th>Circle the Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivating Change Talk</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Softening Sustain Talk</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Partnership</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Empathy</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
APPENDIX O: SOCIAL VALIDITY SURVEY

<table>
<thead>
<tr>
<th>Would you like to continue in the study for an additional week?</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue shorter or longer coaching?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>-----</td>
<td>---------</td>
</tr>
<tr>
<td>1. The goals set were too challenging.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. The experience was worth the time spent.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. I enjoyed talking to the health coach.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. The health-coaching sessions helped me achieve my goals.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. The use of a smartphone/computer made the process more difficult.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6. The preset goals helped increase my physical activity.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7. Viewing my daily step totals on the Fitbit site helped increase my physical activity.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8. Viewing my weekly step totals during coaching sessions helped increase my physical activity.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9. I would not recommend health-coaching to a close family member.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10. I am happy with the overall experience.</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
11. Was there any portion of the experience you would like to change? If so, what change(s) do you recommend?

12. Did you prefer the longer or shorter coaching session? Why/Why not?