Investigation of Motivational Interviewing Techniques to Address Health Disparities for Low-Income Hispanic Women Either At Risk for or Diagnosed with Diabetes Type-2

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ABSTRACT
Hispanic adults are almost twice as likely to have been diagnosed with diabetes than non-Hispanic whites, and Hispanic women have a 1.5 times greater chance of dying from the disease than non-Hispanic white women. Diabetes type 2 (DM2) is the most common type, and accounts for up to 95% of newly diagnosed cases. Although physical activity (PA) is an essential component to DM2 self-management, Hispanic women are less physically active than Hispanic men, and over 40% of these women do not engage in leisure-time PA. Motivational Interviewing (MI) has been found to improve PA levels for non-Hispanic adults with DM2, and may be a feasible PA intervention for Hispanic women either at risk for or diagnosed with DM2.

This dissertation includes 2 literature reviews and the dissertation study, a single-arm quasi-experimental intervention study. The literature reviews investigated how social ecological levels have been applied to PA interventions for Hispanic women with DM2, and explored the effectiveness of MI for PA self-management for adults with DM2. Last, the PI conducted a study to determine the feasibility of MI counseling for PA self-management among Hispanic women either at risk for or diagnosed with DM2 in the community setting. Preliminary results indicate MI may be a feasible approach for PA self-management with Hispanic women either at risk for or diagnosed with DM2. The findings within this dissertation help direct future studies, and begin to address health disparities facing Hispanic women.
INTRODUCTION

Diabetes is the 7th leading cause of death in the United States (Centers for Disease Control and Prevention, 2016). Around 9.3% of the U.S. population has diabetes, and medical expenses for those with diabetes are two times higher than those without the disease. Of concern, adults of Hispanic origin are almost twice as likely to have been diagnosed with diabetes than non-Hispanic white adults, and are three times more likely to begin treatment for diabetes related end-stage renal disease (U.S. Department of Health and Human Services: Office of Minority Health, 2016a).

The Hispanic population is the largest minority group in the U.S. (US Department of Commerce, 2013), and the US Department of Health and Human Services (US-DHHS) found Hispanic women had a 1.5 times greater chance of dying from diabetes than non-Hispanic white women (U.S. Department of Health and Human Services: Office of Minority Health, 2016a). Type 2 diabetes mellitus (DM2) is the most common type, and it accounts for almost 95% of newly diagnosed cases (Centers for Disease Control and Prevention, 2014a). The National Standards for Diabetes Self-Management Education and Support stress the importance of DM2 self-management, and emphasize how lifestyle changes can prevent or delay the debilitating and life-threatening complications associated with the disease (Haas et al., 2014).

One self-management behavior essential to DM2 is physical activity (PA). The American Diabetes Association (American Diabetes Association, 2013) reports that PA improves the body’s ability to use insulin, lowers hemoglobin A1C, and reduces the overall risk for DM2 complications. However, Hispanic adults are 30% less likely to engage in PA than non-Hispanic White adults (U.S. Department of Health and Human Services: Office of Minority Health, 2016b). Furthermore, according to the 2012 National Health Interview Survey, Hispanic
women are less physically active than Hispanic men (Centers for Disease Control and Prevention, 2014b). Survey findings revealed that 41.6% of Hispanic women fail to engage in leisure-time PA, and women who are immigrants of low socioeconomic status are the most vulnerable (D’Alonzo & Saimbert, 2013). Low-income immigrant women live in unsafe neighborhoods and lack access to exercise facilities. Culturally, family responsibilities pose the strongest barrier to PA. Hispanic women often prioritize family needs before their own (D’Alonzo & Saimbert, 2013).

Theoretical Framework

According to Bandura’s Social Cognitive Theory (SCT), self-efficacy is a key concept influencing behavior change (Glanz, 2008). Self-efficacy is the personal belief about one’s ability to perform a behavior. Thus, when individuals feel a sense of control over their behavior, they are more motivated to act despite obstacles or challenges they may face (Glanz, 2008). Research findings indicate community-based programs that promote self-efficacy are correlated with significantly improved PA outcomes for Hispanic women with DM2 (Soderlund, 2016). One potentially effective PA intervention for Hispanic women with DM2 is Motivational interviewing (MI).

Motivational Interviewing

MI is a brief, patient-centered, cost effective counseling technique that promotes self-efficacy for health behavior change (Rollnick, 2008). MI counselors use the Transtheoretical Model to assess an individual’s stage of change, and then apply interview strategies for each stage (Administration, 1999). Ultimately, counselors aim to help patients resolve ambivalent feelings about behavior change, and promote self-efficacy by helping patients explore how they can improve their own health (Rollnick, 2008). Studies investigating the
efficacy of MI for adults with DM2 have reported significantly improved PA outcomes (Armstrong et al., 2013; Chlebowy et al., 2015; Cinar & Schou, 2014; Clark, Hampson, Avery, & Simpson, 2004). Since MI has been found to improve DM2 PA self-management in non-Hispanic populations, this counseling technique may also be an effective intervention for Hispanic women at risk for or diagnosed with DM2.

Specific Aims

This dissertation includes three manuscripts; (1), a review of those social ecological levels that have been applied to PA interventions for Hispanic women with DM2; (2) a review of how MI techniques have been used with PA interventions for adults with DM2; and (3) an analysis of MI counseling sessions to address health disparities for Hispanic women with DM2. This research dissertation examines the feasibility of MI and PA counseling sessions for Hispanic women either at risk for or diagnosed with DM2.

Aim 1: Identify individual and social environmental factors associated with improved PA outcomes for Hispanic women with DM2.

The first manuscript is a literature review that used the social ecological model (McLeroy, Bibeau, Steckler, & Glanz, 1988) as a framework to identify the individual and social environmental factors associated with successful PA interventions for Hispanic women with DM2 (Soderlund, 2016). This review answered the questions: (1) What social ecological levels have been applied to PA interventions? (2) What individual and social environmental intervention strategies are associated with successful PA outcomes? Given that Hispanic women have a greater chance of dying from diabetes and are less likely to engage in PA than non-Hispanic White adults and Hispanic men, understanding the social ecological factors associated with successful PA interventions for Hispanic women is a necessary step to address
this health disparity. The database search for this review identified 10 primary research studies
that used DM2 PA interventions for Hispanic women. Results from this review suggest that
successful PA interventions were associated with intrapersonal, interpersonal, and community
based intervention strategies. Findings indicate DM2 programs should focus on a combination
of intervention levels, and place a greater emphasis on PA strategies.

**AIM 2: Determine the effectiveness of MI counseling sessions for PA self-management for
Adults with DM2**

The second manuscript is a literature review that helps to determine the effectiveness of
MI counseling sessions for improving PA outcomes for adults with DM2. The review questions
addressed were: (1) How have MI techniques been applied to PA interventions for adults with
DM2? (2) What MI approaches are associated with successful PA outcomes for adults with
DM2? A variety of approaches can be used to deliver MI counseling sessions, and insights
regarding effective techniques will help guide future research. The database search for this
review identified 9 primary research studies that investigated MI counseling sessions for DM2
self-management. MI approaches related to significant PA outcomes included: target a minimal
number of self-management behaviors; use counselors proficient in MI; and implement MI
protocols that emphasize either the duration or frequency of sessions.

**AIM 3: Evaluate the feasibility of two 30 minute MI and PA counseling sessions among
Hispanic women either at risk for or diagnosed with DM2 over a 2-month period of time.**

This quantitative one-group pretest and posttest study design (Study ID #Pro00045001)
examined the feasibility of MI and PA counseling sessions for DM2 PA self-management with
Hispanic women in the community setting. Two face-to-face MI and PA counseling sessions
were conducted to determine if women would engage in 2 MI and PA counseling sessions, and
to explore the relationship between stage of change and subsequent walking exercise.
Preliminary results indicate MI may be a feasible approach for helping Hispanic women either at risk for or diagnosed with DM2 increase levels of PA. All eligible women enrolled in the study, attended 2 MI and PA counseling sessions, and completed follow-up measures. In addition, half progressed into a latter stage of change after MI sessions. Although this study was not designed to test efficacy of the intervention, half of the participants reported higher levels of PA at the 2-month follow-up time, indicating support for future larger studies investigating MI for PA.
References


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MANUSCRIPT 1: REVIEW OF LITERATURE

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Abstract

Hispanic women are less physically active and have higher rates of diabetes type 2 (DM2) when compared to other population groups. This review uses the social ecological model (SEM) as a framework to identify the individual and social environmental factors associated with successful physical activity (PA) interventions for Hispanic women with DM2. Research questions include; 1) Which social ecological levels have been applied to PA interventions? 2) Which individual and social environmental intervention strategies are associated with successful PA outcomes? Database searches using CINAHL, PubMed, and Scopus for the years 2000 – 2015 identified 10 studies; with six using quasi-experimental study designs, and 4 using randomized controlled designs. Inclusion criteria were Hispanic/Latina women with DM2; ≥ 70% women; PA interventions; measures of PA; and quantitative designs. Future research should focus on a combination of intervention levels, and DM2 programs should place a greater emphasis on PA intervention strategies.
Physical Activity Interventions for Hispanic Women with Diabetes Type 2

Diabetes is a leading cause of death and disability in the United States (Centers for Disease Control and Prevention, 2014). An estimated 9.3% of the US population has diabetes (CDC, 2014). Persons with diabetes have medical expenses 2 times higher than those without the disease (CDC, 2014a). Type 2 diabetes (DM2) accounts for 90% to 95% of all newly diagnosed cases (CDC, 2014).

The Hispanic population is the largest minority group in the U.S Adults of Hispanic origin are almost twice as likely to be diagnosed with diabetes than non-Hispanic White adults, have higher rates of end-stage renal disease from diabetes, and are 50% more likely to die from the disease (US Department of Health and Human Services, 2012). In addition, Hispanic women are diagnosed with diabetes more often than men (US Department of Commerce, 2013; USDHHS, 2012).

The National Standards for Diabetes Self-Management Education and Support stress the importance of self-management for diabetes care, and emphasize how lifestyle changes can prevent or delay the debilitating and life-threatening complications associated with the disease (Haas et al., 2014). One component central to DM2 self-management is physical activity (PA). PA stimulates glucose uptake by skeletal muscle, improves the body’s ability to use insulin, can lower high cholesterol levels, and helps with weight loss (CDC, 2015; National Institute of Diabetes and Digestive and Kidney Disease, 2014; Suh, Paik, & Jacobs, 2007). Regular PA helps to keep blood glucose levels within target range; and can prevent or delay the onset of DM2 related cardiovascular, kidney, and neuropathic disease (NIDDK, 2014a, 2014b; Thomas, Elliott, & Naughton, 2006). Although PA is central to DM2 self-management, Hispanic adults are 30% less likely to actively engage in PA than non-Hispanic White adults (USDHHS, 2011).
Furthermore, the 2012 National Health Interview Survey reported that Hispanic women are less active than Hispanic men (CDC, 2014b; D'Alonzo & Saimbert, 2013). The survey revealed that 41.6% of Hispanic women do not participate in leisure-time PA, and immigrants of low socio-economic status are the most vulnerable. Low-income Hispanic women lack access to safe neighborhoods and exercise facilities. In addition, many women have little time for PA since low wage jobs often limit one’s control over hours worked (D'Alonzo & Saimbert, 2013; Larsen, Pekmezi, Marquez, Benitez, & Marcus, 2013). Culturally, family responsibilities pose the strongest barrier to regular engagement in PA. Hispanic women often prioritize the needs of spouse, children, and family members over their own (D'Alonzo & Saimbert, 2013).

Despite these barriers, recent research has shed light on how PA self-management programs can be established for Hispanic women. The purpose of this review was to use the social ecological model (SEM) as a framework to determine individual and social environmental factors associated with successful PA interventions for Hispanic women diagnosed with DM2.

**Social Ecological Model**

Both individual and social environmental factors contribute to behavior change, and the Social Ecology Model (SEM) is a useful tool for exploring the multiple factors involved (McLeroy, Bibeau, Steckler, & Glanz, 1988). The model assumes, individual behaviors are affected by, and affect the social environment. The 5 levels of the SEM illustrate the factors influencing individual behavior, and include: (a) intrapersonal (Individual), (b) interpersonal, (c) institutional, (d) community, (e) and public policy levels of change (Golden & Earp, 2012; McLeroy et al., 1988). Intervention strategies directed at all levels of the SEM will have the greatest impact on behavioral change for Hispanic women.
The intrapersonal level involves education, training, and skills enhancement for a target population, and consists of individual characteristics such as knowledge, attitudes, behavior, and self-concept (Golden & Earp, 2012; McLeroy et al., 1988). The interpersonal level involves modifications to the home and family environment, and consists of social support systems and social networks within the community. The institutional level involves modifications to institutional environments or services, and consists of social institutions. The community level involves modifications to community environments or services and consists of relationships among organizations. Lastly, the public policy level involves the creation or modification of public policy, which consists of local, state, and national laws and policies (Golden & Earp, 2012; McLeroy et al., 1988).

A disproportionate number of Hispanic women suffer from DM2. Although PA is an essential component to DM2 self-management, various socio-cultural and environmental barriers prevent Hispanic women from engaging in adequate levels of PA. The purpose of this review was to use the SEM as a framework to identify the social ecological factors associated with successful PA interventions for Hispanic women with DM2. This review was guided by the following research questions: 1) Which ecological levels of influence have been applied to PA interventions for Hispanic women with DM2? 2) Which individual and social environmental intervention strategies are associated with successful PA outcomes for Hispanic women with DM2?
Methods

Search Strategy

The aim of this review was to identify primary research studies that used physical activity (PA) interventions for Hispanic women diagnosed with DM2. The healthcare databases used for this search included CINAHL, PubMed, and Scopus. Articles searched were published from 2000 to 2015 and included the following key search terms: Hispanic, Mexican American, Latino, physical activity, exercise, self-care, and Diabetes Type 2. To gain a broad understanding of PA intervention strategies for Hispanic women with DM2, all types of settings and disciplines were considered for this review. Research articles saved from this search met the following inclusion criteria: (a) Latina and Hispanic participants diagnosed with DM2; (b) a majority of women participants (≥ 70% women); (c) use of physical activity intervention strategies; (d) a measure of PA; (e) results for levels of PA; (f) quantitative experimental research; (g) and written in English. This search retrieved a total of 2,304 articles, 157 abstracts for review, 23 articles for critique, and concluded with 10 research articles that met criteria for this review.

Results

All studies in this review were conducted in the United States. The articles included 5 randomized controlled studies (Hu, Osborn, Rosal, Toobert, Vincent), and 5 quasi-experimental study designs (Castillo, M-N, McEwen, Pena, Two-Feathers). Among these results, 6 were feasibility or pilot studies (Hu, Castillo, McEwen, Martyn-Nemeth, Pena, Vincent) and 2 were mixed method study designs (Castillo & Vincent).

Among these results, only 1 implemented an intervention for PA alone (Martyn-Nemeth, Vitale, & Cowger, 2010), and the remaining interventions targeted PA along with other diabetes self-management behaviors (Castillo et al., 2010; Hu, Wallace, McCoy, & Amirehsani, 2014;
McEwen, Pasvogel, Gallegos, & Barrera, 2010; Osborn et al., 2010; Pena-Purcell, Boggess, & Jimenez, 2011; Rosal et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Two Feathers et al., 2005; Vincent, 2009). Participants were primarily women of low socioeconomic status, and only 1 study examined all female participants (Toobert, Strycker, Barrera, et al., 2011). This review provides characteristics of the studies with significant PA outcomes in Table 1, and characteristics of the studies without significant PA outcomes in Table 2.

Each study included in this review conducted PA interventions that corresponded to at least 2 levels of the SEM. All interventions targeted the intrapersonal level, 6 studies addressed the interpersonal level (Castillo et al., 2010; Hu et al., 2014; Rosal et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Two Feathers et al., 2005; Vincent, 2009), 2 studies focused on the institutional level (Osborn et al., 2010; Toobert, Strycker, Barrera, et al., 2011), 8 addressed the community level (Castillo et al., 2010; Hu et al., 2014; Martyn-Nemeth et al., 2010; McEwen et al., 2010; Pena-Purcell et al., 2011; Rosal et al., 2011; Two Feathers et al., 2005; Vincent, 2009), and no interventions targeted the policy level.

SEM

Intrapersonal (Individual) level

Each study in this review placed a heavy emphasis on PA interventions directed at the intrapersonal level of the SEM. Primary intervention strategies included education, training/skills enhancement, and cultural tailoring. This review identified common intervention components associated with significant PA outcomes for each study.

Educational components associated with significant PA outcomes included strategies for low literacy needs, and regular PA instruction. Strategies used to address low literacy included bilingual community health workers (Castillo et al., 2010), and low literacy materials written in
Spanish (Vincent, 2009). The DM2 program by Pena-Purcell et al. (2011) was designed for participants with low literacy needs, however the specific strategies used were not reported. Although McEwen et al. (2010) did not specifically address low literacy needs, bilingual community health workers (promotoras) met individually with participants to help with the interpretation of educational content provided during group meetings.

The frequency of PA instruction was also associated with significant PA outcomes. DM2 Programs with significant PA findings were primarily group based, and on average met more than once per month (Castillo et al., 2010; McEwen et al., 2010; Pena-Purcell et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009). In addition, two programs repeated key concepts related to PA throughout the intervention (Pena-Purcell et al., 2011; Vincent, Pasvogel, & Barrera, 2007), and another devoted 1 hour to PA instruction and practice each week (Toobert, Strycker, Barrera, et al., 2011). McEwen et al. (2010), identified PA as a primary outcome measure and trained community residents (promotoras) provided individual sessions between group meetings to address questions and barriers related to DM2 self-care (including PA).

Common training and skills enhancement intervention components associated with significant PA outcomes included goal setting, feedback, and empowerment strategies. Feedback (Castillo et al., 2010; Pena-Purcell et al., 2011; Vincent et al., 2007), and goal setting/action plans (Castillo et al., 2010; Pena-Purcell et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009) were identified as common strategies in most studies with significant PA outcomes. Although McEwen et al. (2010) did not specifically mention goal setting or feedback interventions, participants were given a pedometer with a log book, and trained community residents (promotoras) provided individualized DM2 self-care review sessions (including PA) between group sessions.

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Each DM2 program implemented empowerment strategies to enhance PA skills mastery. In addition, most programs associated with significant PA outcomes were designed from empowerment based theories or models that promote self-efficacy for DM2 self-care (Castillo et al., 2010; Pena-Purcell et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009). The majority of empowerment based interventions used problem solving strategies (Castillo et al., 2010; Pena-Purcell et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent et al., 2007), and modeling or demonstrations to help with the application of PA skills application in the real world setting (Pena-Purcell et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent et al., 2007).

All DM2 programs associated with significant PA outcomes were culturally tailored (Castillo et al., 2010; McEwen et al., 2010; Pena-Purcell et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009). Each program either used bilingual health professionals (Pena-Purcell et al., 2011), bilingual community health workers (Castillo et al., 2010), or both (McEwen et al., 2010; Rosal et al., 2011; Vincent, 2009). Common techniques included the use of health materials written in Spanish (Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009), the inclusion of a support person (family member or friend) to some or all intervention sessions (Castillo et al., 2010; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009), and options for desired types of PA (McEwen et al., 2010; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009). PA intervention options included walking (Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009), aerobics with Latin steps and music (Toobert, Strycker, Barrera, et al., 2011), or dance (Vincent, 2009).

The remaining studies in this review either did not test for statistical significance (Martyn-Nemeth et al., 2010), or did not find significant outcomes associated with PA (Hu et al.,
2014; Osborn et al., 2010; Rosal et al., 2011; Two Feathers et al., 2005). The study conducted by Martyn-Nemeth et al. (2010) only implemented interventions for PA self-management, not other DM2 self-care behaviors. Although the majority of participants met PA goals, the study did not test for statistical significance. The program did include educational components and goal setting, but primarily focused on weekly exercise sessions using cultural music and dance (Martyn-Nemeth et al., 2010).

DM2 programs that did not report significant PA outcomes included interventions related to education, training/skills enhancement, and cultural tailoring that were similar to intervention studies with significant results (Hu et al., 2014; Osborn et al., 2010; Rosal et al., 2011; Two Feathers et al., 2005). However, the studies reported significant results for other DM2 self-care behaviors. Authors concluded that future DM2 self-care studies may need to focus on more specific PA action plans (Hu et al., 2014), or suggested they may need to place a stronger emphasis on PA interventions (Osborn et al., 2010; Rosal et al., 2011; Two Feathers et al., 2005).

**Interpersonal Level**

DM2 programs associated with significant PA outcomes directed interventions at the interpersonal level (Castillo et al., 2010; McEwen et al., 2010; Pena-Purcell et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009). In addition, each program was based from a theoretical framework or model that linked social support to healthy behaviors. The DM2 programs aimed to educate, train, and/or improve the skills of social support persons by using Hispanic community health workers, or by encouraging participants to bring a family member or friend to intervention sessions. The degree of social support involvement varied among the studies (Castillo et al., 2010; McEwen et al., 2010; Pena-Purcell et al., 2011; Toobert, Strycker, King, et al., 2011; Vincent, 2009).
McEwen (2010) trained promotoras (Mexican community health workers) to implement informational, emotional, and appraisal support interventions in participant homes and during group sessions. Vincent (2009) emphasized family engagement as an important component to DM2 self-care in the Hispanic/Latino cultures, and encouraged participants to bring a family member to each session (Vincent, 2009). The remaining programs either encouraged participants to bring a family member or friend (Castillo et al., 2010), included a family night midway through the program (Toobert, Strycker, Barrera, et al., 2011), or listed family support as a PA intervention (Pena-Purcell et al., 2011). Although family support was listed as an intervention, the intervention was not described, and it is unknown how family members helped with social support (Pena-Purcell et al., 2011).

Two DM2 programs directed at the interpersonal level lacked significant PA outcomes (Hu et al., 2014; Rosal et al., 2011). Hu et al. (2014) implemented a family based intervention that included family member attendance and 2 family nights with the entire family. Rosal et al. (2009) encouraged family member attendance, however further detail regarding family member involvement was not provided.

Many studies encouraged the education, training, or skills enhancement of support persons by inviting them to intervention sessions (Castillo et al., 2010; Hu et al., 2014; Rosal et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009). However, there were only 2 that mentioned actual family member attendance (Hu et al., 2014; Toobert, Strycker, Barrera, et al., 2011), and only 1 reported the methods used to recruit family members (Hu et al., 2014). The program by Hu et al. (2014) was a family-based intervention that collected demographic and research data from both the target population and family members. Toobert, Strycker, Barrera, et al. (2011) discussed the involvement of family members during intervention activities, but did
not report details pertaining to family member recruitment or attendance. Although many DM2 program interventions were directed at the interpersonal level, most studies did not report recruitment strategies or outcomes related to social support person attendance (Castillo et al., 2010; Pena-Purcell et al., 2011; Rosal et al., 2011; Vincent, 2009).

**Institutional Level**

One DM2 program directed PA interventions at the institutional level (Osborn et al., 2010). The program included one 90 minute DM2 self-care intervention in the primary care setting. Bilingual medical assistants (MA’s) received 40 hours of training from a Certified Diabetes Educator and a Registered Dietitian, and delivered the entire intervention. MA’s allocated 30 minutes for exercise, and 60 minutes for diet. Although outcomes for diet were significant, outcomes for PA were not significant (Osborn et al., 2010).

**Community Level**

All studies associated with significant PA outcomes conducted interventions at the community level of the SEM (Castillo et al., 2010; McEwen et al., 2010; Pena-Purcell et al., 2011; Toobert, Strycker, Barrera, et al., 2011; Vincent, 2009). Interventions consisted of modifications to community services, and DM2 training of community residents. Health professionals and/or community residents facilitated programs at various community locations. DM2 programs took place at neighborhood churches (Castillo et al., 2010; McEwen et al., 2010; Pena-Purcell et al., 2011), the library (Pena-Purcell et al., 2011), community centers (Castillo et al., 2010; Toobert, Strycker, King, et al., 2011; Vincent, 2009), schools, and senior centers (Castillo et al., 2010). Trained community residents (community Health Workers or Promotoras) either helped facilitate program delivery alongside health care professionals (McEwen et al., 2010; Vincent, 2009), or delivered the entire intervention (Castillo et al., 2010).
McEwen et al. (2010) trained community residents to implement individual sessions in participants’ homes, and used community residents to accompany health professionals during group sessions. Vincent (2009) used community residents to facilitate group support sessions, and Castillo et al. (2010) trained community residents to deliver the entire intervention. Residents received 1 year of supervision and support prior to program delivery with participants (Castillo et al., 2010). The program by Martyn-Nemeth et al. (2010) took place in the community setting and was linked to increased levels of PA, however the researchers did not use significance testing.

The remaining community based programs were not associated with significant PA outcomes (Hu et al., 2014; Rosal et al., 2011; Two Feathers et al., 2005). All 3 DM2 programs took place in the community setting (Hu et al., 2014; Rosal et al., 2011; Two Feathers et al., 2005), and 2 programs trained community residents (lay workers) to either deliver the entire program (Two Feathers et al., 2005) or to assist with program delivery (Rosal et al., 2011). Two Feathers et al. (2005) trained community residents over the course of 10 weeks, and research staff observed community residents during 1 session prior to intervention delivery. Rosal et al. (2011) used community residents to assist health professionals during intervention delivery, however details pertaining to specific intervention activities carried out by the community residents were not provided.

**Policy**

Studies from this review did not include interventions directed at the policy level. Yet, authors acknowledged unsafe neighborhood environments as a major barrier to PA for the Hispanic/Latino population (Castillo et al., 2010; Martyn-Nemeth et al., 2010; Osborn et al.,
In order to build safer neighborhood environments and offer protected places for exercise, change must occur at the policy level.

Discussion

All DM2 studies target the intrapersonal level and place a heavy emphasis on education, training, and skill enhancement of the target population. This review identified several intervention approaches that were common among the studies with significant PA outcomes. Common approaches included regular PA instruction, goal setting, feedback, empowerment based strategies derived from theory or a model, cultural tailoring, and strategies for low literacy needs. The identification of intrapersonal interventions associated with significant outcomes is informative, however many studies lacking PA significance used similar intervention strategies. These findings illustrate the importance of methods used, and highlight the potential influence of interventions at different levels of the SEM. Methodological factors associated with significant PA outcomes included the repetition of key concepts and activities, and group sessions conducted more than once per month. Studies that lacked significance reported a weaker emphasis on PA compared to other DM2 self-care interventions. Although, diet and blood glucose monitoring are complex self-care activities that require multiple educational, training, and skill enhancement sessions, perhaps the emphasis placed on PA intervention strategies should not be underestimated.

All DM2 programs implementing interventions at the interpersonal level were based from theoretical frameworks or models that link self-care behaviors to social support. Most studies reporting significant PA outcomes encouraged the education, training, and skills enhancement of family members or friends by inviting them to intervention sessions. Although there appears to
be an association between DM2 education of support persons and significant PA outcomes, the relationship is unclear. Information pertaining to social support intervention methods and outcomes was limited. To gain more insight into this relationship, it would be helpful to know the techniques used to promote support person attendance, the number of sessions each support person attended, and which participants had the assistance of a support person.

Only one DM2 program was conducted in the institutional setting. Although self-management outcomes for diet were significant, outcomes for PA were not. Medical assistants dedicated 60 minutes to dietary self-care interventions, and 30 minutes towards PA. Findings indicate the need for a greater emphasis on PA interventions examined in the institutional setting.

Results from this review illustrate the significance of community based DM2 programs for PA self-care. Most studies in this review took place in the community setting, and all studies with significant PA outcomes conducted community based interventions. When comparing studies at the community level, DM2 programs with significant PA outcomes provided more extensive supervision and/or training to community residents who assisted with or delivered the PA interventions.

None of the studies discussed change at the policy level. However, studies discussed unsafe neighborhood environments as a major barrier to PA. To help improve PA, healthcare professionals and policy makers must advocate for adequate places to exercise, such as safer neighborhood environments and access to public facilities.

Limitations

Limitations of this review must be taken into consideration. This review only included studies written in English, the majority of studies used a small sample size, and only 1 study recruited all women participants. Most studies associated with significant PA outcomes were 1
group pretest and posttest designs, only 2 conducted long-term follow-up assessments, and 1 objectively measured PA using pedometers. Significant PA outcomes may be the result of weaker intervention designs. In addition, most studies targeted multiple DM2 self-care behavior change. Thus, details pertaining to PA intervention methods were limited, and some studies that lacked significant PA outcomes found significant outcomes for other DM2 self-care behaviors.

**Future Research**

Suggestions for future research include PA interventions directed at multiple levels of the SEM, the use of theoretical frameworks or models that include social support and self-efficacy as core constructs, and stronger intervention designs. DM2 programs with significant PA outcomes combined the intrapersonal, interpersonal, and community intervention levels, and used frameworks or models that link social support and self-efficacy to healthy behaviors. To better estimate the effectiveness of PA interventions, future research should use objective measures of PA, and use more rigorous study designs. In addition, although PA concepts and self-management behaviors are fairly straightforward when compared to other DM2 self-management activities, this review indicates researchers should place a greater emphasis on PA intervention strategies. Recommendations include the implementation of regular PA sessions, repetition of PA concepts, collection of social support person data, and the support of adequately trained staff or assistants. Lastly, further research investigating the institutional and policy levels is needed.

**Conclusion**

The SEM was used as a Framework to identify the factors associated with successful PA interventions for Hispanic women with DM2. Most studies investigated multiple DM2 self-care behavior change, and successful PA interventions were associated with the intrapersonal, interpersonal, and community levels of the SEM. Although PA concepts and exercise regimens
are fairly easy to learn when compared to other DM2 self-care behaviors, findings suggest that DM2 programs should not minimize the emphasis placed on PA intervention strategies.
Figure 1. Prisma Flow Diagram

Records identified through database searching PubMed, CINAHL, and Scopus. (n = 2095)

Remaining records after duplicates removed (n = 631)

Records screened by title and abstract (n = 157)

Records excluded (n = 474)

Full-text articles assessed for eligibility (n = 76)

Full-text articles eligibility criteria (n = 66)

Studies included in review (n = 10)
<table>
<thead>
<tr>
<th>Author</th>
<th>Place &amp; Intervention Setting</th>
<th>Theory, Framework, or Model</th>
<th>Levels of SEM</th>
<th>Sample</th>
<th>Measures of PA</th>
<th>Self-Care Results</th>
<th>Study Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Castillo et al. (2010)</td>
<td>US, Illinois Churches, schools, senior centers, community centers</td>
<td>Diabetes Education Program: Program is consistent with adult ed. and empowerment theory</td>
<td>Intrapersonal, Interpersonal, Community</td>
<td>Sample: n=70 completed pre &amp; posttest data; 75.7% women; mean age 58; years education 6.8; 58.6% &lt; $1600/ month</td>
<td>Self-report questionnaire</td>
<td>Significant: PA, foot care, glucose monitoring, medication adherence</td>
<td>Quantitative, quasi-experimental (Pilot); Qualitative, 2 focus group post-intervention Mixed Methods</td>
</tr>
<tr>
<td>Pena-Purcell, Boggess, &amp; Jimenez (2011)</td>
<td>US, Texas Community setting (church, library, etc.)</td>
<td>Social Cognitive Theory, &amp; Self-Regulation Theory</td>
<td>Intrapersonal, Interpersonal Community</td>
<td>Sample: IG n=139; Mean age IG 59; IG 71.6% female; 70% annual Income &lt; 20,000;</td>
<td>Self-report questionnaire</td>
<td>Significant: PA, diet, glucose monitoring</td>
<td>Quasi-experimental (Pilot): Repeated measures design</td>
</tr>
<tr>
<td>Toobert, Strycker, Barrera, et al. (2011); Toobert, Strycker, King, et al. (2011)</td>
<td>US, Colorado Community setting</td>
<td>DM2 program based on a logic model to help problem solving, social support, and self-efficacy</td>
<td>Intrapersonal, Interpersonal Community</td>
<td>Sample: n=280; 100% female; Age 30 to 75; 2/3 of annual income &lt; 50,000</td>
<td>Self-report questionnaires</td>
<td>Significant: PA at 6 months; diet Non-significant: PA at 12 months, and long-term outcomes at 24 months</td>
<td>Randomized Controlled Trial</td>
</tr>
<tr>
<td>Vincent (2009)</td>
<td>US, Arizona</td>
<td>Chronic Disease Self-Management Model (based from Social Cognitive Theory)</td>
<td>Intrapersonal, Interpersonal Community</td>
<td>Sample: n=20; 71% female; Mean age 56; 76% &lt; $20,000 annual income</td>
<td>Self-report questionnaire Pedometer</td>
<td>Significant: PA (questionnaire &amp; steps/day); Glucose monitoring</td>
<td>Randomized Controlled Trial (Feasibility). Mixed Methods</td>
</tr>
</tbody>
</table>

Note: IG = Intervention Group
<table>
<thead>
<tr>
<th>Author</th>
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<th>Levels of SEM</th>
<th>Sample</th>
<th>Measures of PA</th>
<th>Self-Care Results</th>
<th>Study Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hu, Wallace, McCoy, &amp; Amirehsani (2014)</td>
<td>US, North Carolina Community clinics</td>
<td>Social Cognitive Theory</td>
<td>Intrapersonal, Interpersonal, Community</td>
<td>Sample: n=36; 75% female; Mean age (50); 72% &lt; 12 yrs education; 94% reported household income &lt; $10,000</td>
<td>Self-report questionnaires (and at 1-month follow-up), foot care</td>
<td>Non-Significant: PA</td>
<td>Quasi-experimental (Pilot); 1-grp longitudinal</td>
</tr>
<tr>
<td>Martyn-Nemeth, Vitale, &amp; Cowger (2010)</td>
<td>US, Illinois Community health clinic</td>
<td>Social Ecological Model</td>
<td>Intrapersonal, Community</td>
<td>Sample: n=19; 88% female; 50% bw 51 &amp; 60 yrs old; 7% completed High school, rest had lower levels of education</td>
<td>Self-Report log: Start and stop times for exercise; Pedometer: Logged steps walked per day (data not analyzed since documentation wasn’t thorough)</td>
<td>No significance testing: 80% reported being physically active ≥ 6 days/week.</td>
<td>Quasi-experimental (Pilot); Single group pretest posttest</td>
</tr>
<tr>
<td>Osborn et al. (2010)</td>
<td>US, North East Primary Care Clinic</td>
<td>Information-Motivation-Behavioral Model</td>
<td>Intrapersonal, Institutional</td>
<td>Sample: n=118; 79% female; Mean age IG 56.9; IG 10% High school ed. or higher</td>
<td>Self-report questionnaire</td>
<td>Significant: Diet Nonsignificant: PA</td>
<td>Randomized Controlled Trial</td>
</tr>
<tr>
<td>Rosal (2009)</td>
<td>US, Boston Latino center, senior center, YMCA</td>
<td>Social Cognitive Theory, Motivational Interviewing, Patient-Centered Counseling Model, Adult Education Principals</td>
<td>Intrapersonal, Interpersonal, Community</td>
<td>Sample: n=252; 77% female; &gt; ½ between 45 and 64 years of age; 50% &lt; 10,000 annual income</td>
<td>Self-report, 24 hour recall</td>
<td>Significant: Diet glucose monitoring Nonsignificant: PA</td>
<td>Randomized Controlled Trial</td>
</tr>
<tr>
<td>Two-Feathers (2005)</td>
<td>US, Michigan</td>
<td>Social Cognitive Theory</td>
<td>Intrapersonal, Interpersonal, Community</td>
<td>Sample: n=40 (Latinos); 82.5% female; Mean age 54.3; 80% &lt; High school education</td>
<td>Self-report questionnaire</td>
<td>Significant: Diet glucose monitoring Nonsignificant: PA</td>
<td>Quasi-experimental: 1 group before &amp; after design</td>
</tr>
</tbody>
</table>

Note: IG = Intervention Group
References


MANUSCRIPT 2: REVIEW OF LITERATURE

Under review, Chronic Illness (2016). *Effectiveness of Motivational Interviewing for Improving Physical Activity Self-Management for Adults with Type 2 Diabetes: A Review.*

Abstract

Objectives: This review examines the effectiveness of motivational interviewing (MI) for physical activity (PA) self-management for adults diagnosed with diabetes type 2 (T2DM). Motivational interviewing is a patient centered individually tailored counseling intervention that aims to elicit a patient’s own motivation for health behavior change. Review questions include (1) How have MI techniques been applied to PA interventions for adults with T2DM? (2) What MI approaches are associated with successful PA outcomes with DM2? Methods: Database searches used PubMed, CINAHL, and PsycINFO for the years 2000 to 2016. Results: A total of nine studies met review criteria, eight were randomized controlled designs, and one quasi-experimental design. Criteria for inclusion was Motivational Interviewing (MI) used as the principal intervention in the tradition of Miller & Rollnick, measurement of PA, statistical significance reported for PA outcomes, quantitative research, and articles written in English. Discussion: Findings suggest, MI sessions should target a minimal number of self-management behaviors, be delivered by counselors proficient in MI, and use MI protocols with an emphasis placed either on duration or frequency of sessions.
Motivational Interviewing for Improving Physical Activity for Adults with Type 2 Diabetes

Diabetes mellitus is the 7th leading cause of death in the United States (Centers for Disease Control and Prevention, 2016). Around 29 million American adults have diabetes, and more than 90% suffer from diabetes mellitus type 2 (T2DM) (Centers for Disease Control and Prevention, 2014b). The clinical marker for T2DM is hyperglycemia. Hyperglycemia can lead to serious complications including heart disease, stroke, retinopathy, kidney failure, and lower-limb amputation (Centers for Disease Control and Prevention, 2014b). According to the 2014 Disability and Health Data System, around 20% of Americans with T2DM suffer from a mobility related disability, 19% from a vision disability, and 16.5% from a cognitive disability (Centers for Disease Control and Prevention, 2014a). Mortality risk is 50% higher for adults with diabetes than for those without the disease (Centers for Disease Control and Prevention, 2014c).

T2DM and related complications are also associated with increased body mass index. (Ganz et al., 2014; Gray, Picone, Sloan, & Yashkin, 2015; Nordstrom, Pedersen, Gustafson, Michaelsson, & Nordstrom, 2016). However, regular physical activity (PA) can help maintain adequate blood glucose levels and prevent or delay complications related to the disease (Centers for Disease Control and Prevention, 2014b). PA can lead to weight loss, help maintain a healthy weight, improve the body’s ability to use insulin, and reduce elevated cholesterol (National Institute of Diabetes and Digestive and Kidney Diseases, 2014; Centers for Disease Control and Prevention, 2015c). For optimal PA health benefits, the Centers for Disease Control and Prevention (Centers for Disease Control and Prevention, 2015b) recommends 150 minutes of moderate-intensity aerobic activity, and two days of muscle strengthening activities per week. Moderate-intensity aerobic activity increases the heart rate for sustained periods of time and
includes activities like brisk walking, water aerobics, running, and bicycling. Common muscle-strengthening exercises include push-ups, sit-ups, yoga, or lifting weights (Centers for Disease Control and Prevention, 2015b). Although adults with T2DM may have activity restrictions, only 60 minutes of moderate-intensity aerobics per week can have health benefits (Centers for Disease Control and Prevention, 2015a).

Despite PA benefits, less than 40% of US adults with diabetes engage in regular physical activity (Centers for Disease Control and Prevention, 2012; Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007). Thus, there is a need for evidence based self-management interventions, as outlined in the National Standards for Diabetes Self-Management Education and Support (Haas et al., 2014). Patient-centered, individually tailored interventions are associated with improved lifestyle change. As a result, T2DM self-management interventions should facilitate action-oriented goal setting and should adapt to meet needs based on an individual’s age, comorbidities, cultural factors, health literacy, and psychosocial circumstances (Haas et al., 2014). One example of a patient-centered self-management intervention is motivational interviewing (MI).

MI is an individually tailored counseling intervention that aims to elicit a patient’s own motivation for health behavior change. Reviews of the literature provide evidence for the efficacy of MI in the healthcare setting. For instance, MI sessions have led to increased PA for those with chronic health conditions (O'Halloran et al., 2014), beneficial lifestyle behavior change for different types of cancer (Spencer & Wheeler, 2016), reduced sexual risk behavior for those with HIV (Naar-King, Parsons, & Johnson, 2012), decreased substance abuse (Smedslund et al., 2011), and smoking cessation (Lindson-Hawley, Thompson, & Begh, 2015). However, few studies on MI have specifically addressed T2DM and PA self-management. Therefore, the purpose of this review was to examine the effectiveness of MI as an intervention to help improve
Motivational Interviewing

MI counselors use certain techniques to guide conversations towards behavior change. The counselor’s goal is to help patients resolve ambivalent feelings they may have about lifestyle change (Rollnick, 2008). Specifically, MI techniques are based on four guiding principles: (1) resist the temptation to tell patients what to do; (2) aim to understand a patient’s own motivation for change, since their own reasons will most likely trigger change; (3) have and express empathy when listening to patients; (4) and empower patients. The underlying “spirit” of MI requires providers to engage in a collaborative partnership, to connect behavior change with each patient’s own values and concerns, and ultimately to respect autonomy by accepting the choices patients make about their lives. MI was initially developed for substance abuse, but now is widely used and examined in the health care setting (Rollnick, 2008). The purpose of this review is to determine the efficacy of MI counseling approaches to facilitate PA self-management for adults diagnosed with T2DM.

Review Question 1: How have MI techniques been applied to PA interventions for adults with T2DM?

Review Question 2: What MI approaches are associated with successful PA outcomes for adults with DM2?

Method

Search Strategy

The goal of this review was to identify primary research studies that used MI as the principal intervention to improve levels of PA for individuals diagnosed with T2DM. Healthcare
databases used for the search included CINAHL, PubMed, and PsycINFO. Reference lists of retrieved articles were reviewed to complete the search. The following key search terms for published articles between 2000 and 2016 were included: motivational interviewing, health coaching, wellness coaching, diabetes type 2, diabetes, obesity, physical activity, and exercise. Articles in this review met the following inclusion criteria: (a) MI was used in the tradition of Miller & Rollnick as the principal intervention, (b) measurements of PA were included (c) statistical significance was reported for PA outcomes, (d) quantitative experimental research was used, and (e) articles were written in English. Studies either reported using MI in the tradition of Miller and Rollnick, or the type of MI used was verified by the author. Use of MI in the tradition of Miller and Rollnick was verified through written correspondence with R. Whittemore, PhD (May 2016) and R.J. Sigal, MD (August 2016). Studies were excluded if sample populations were 10 or less, and if MI was used in conjunction with another principal intervention strategy or counseling method. However, MI used in conjunction with face-to-face or phone T2DM education met criteria for inclusion. This search retrieved a total of 826 articles, 114 abstracts for review, 32 articles for eligibility, and concluded with nine studies that met criteria for this review. For one of the nine studies, only the abstract was available (Armstrong et al.) Based on written correspondence with M.J. Armstrong, PhD (July 2016), the full article is pending publication. Figure 1 illustrates the article selection process. Content reported in this review was based from the Preferred Reporting items for Systematic Reviews and Meta-Analyses checklist (Moher, Liberati, Tetziaff, & Altman, 2009).
Figure 1. Prisma Flow Diagram

Records Identified through PubMed, CINAHL, and PsycINFO database search (n = 826)

Number of Records after duplicates removed (n = 315)

Records screened by title and abstract (n = 114) → Excluded Records (n = 82)

Full-text articles reviewed for eligibility (n = 32) → Ineligible full-text articles (n = 23)

Studies included in review (n = 9)
**Study Characteristics**

Studies used in this review were conducted in the United States, Canada, Europe, Asia, and South Africa. Research designs included seven randomized controlled trials (Armstrong et al. 2013; Cinar & Schou, 2014; Clark, Hampson, Avery, & Simpson, 2004; Heinrich, Candel, Schaper, & de Vries, 2010; R. J. Mash et al., 2014; Rubak, Sandbaek, Lauritzen, Borch-Johnsen, & Christensen, 2011; Whittemore, Melkus, Sullivan, & Grey, 2004), one non-randomized controlled trial (Chlebowy et al., 2015), and one quasi-experimental design (Calhoun et al., 2010). Among these results, two were pilot studies (Calhoun et al., 2010; Whittemore et al., 2004). Most studies examined middle-aged adults with a mean age between 50 and 60 years old (Armstrong et al. 2013; Calhoun et al., 2010; Chlebowy et al., 2015; Clark et al., 2004; Heinrich et al., 2010; R. J. Mash et al., 2014; Whittemore et al., 2004). One study examined female participants only (Whittemore et al., 2004). The majority of studies reporting the average length of T2DM diagnosis recruited participants who had T2DM for five years or less (Calhoun et al., 2010; Heinrich et al., 2010; Whittemore et al., 2004). Clark et al. (2004) examined participants who had a diagnosis of T2DM for an average of eight years, and Rubak et al. (2011) recruited participants with screen detected T2DM. All studies examined MI to help improve two or more T2DM self-care behaviors. This review provides study characteristics for studies with significant PA outcomes in Table 1, and characteristics of studies lacking significant PA outcomes in Table 2.
### Table 1  
**Characteristics of Studies With Significant PA Findings**

<table>
<thead>
<tr>
<th>Author (2013)</th>
<th>M. J. Armstrong, PhD (written communication, September, 2016)</th>
<th>Location &amp; setting</th>
<th>Sample</th>
<th>MI Group, Control Group, &amp; Attrition</th>
<th>MI Proficiency</th>
<th>Length of T2DM diagnosis</th>
<th>Self-care measures</th>
<th>Self-care results</th>
<th>Study Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armstrong (2013)</td>
<td>Canada Exercise site</td>
<td>Inclusion: Adults with T2DM, completed exercise program Sample (n=55), female (55%), Mean age (66.3), Mean baseline A1C (6.9%), SES (N/S)</td>
<td>MI Sessions: Face to face delivered by researcher MI dose (2), length (30 to 45 minutes) Study Arms: MI plus standard care group; standard care without MI group Attrition: 44/55 completed study</td>
<td>Satisfactory</td>
<td>N/S</td>
<td>Self-report: PA</td>
<td>Baseline and 6 month assessment times</td>
<td>PA Results: At 6 months MI mean MET-min/week group significantly more than mean UC at 6 months (p=0.0361).</td>
<td>RCT</td>
</tr>
<tr>
<td>Chlebowy et al. (2015)</td>
<td>South Eastern USA Outpatient clinics</td>
<td>Inclusion: age ≥ 18, African American ethnicity, T2DM taking oral hypoglycemic or insulin, English speaking Sample (n= 62), female (64.5%), Mean age MI (55.8), UC (53), BMI MI (36.3), UC (33), Mean baseline A1C MI (7.3), UC (8.1), low-income</td>
<td>MI Sessions: Face to face delivered by Baccalaureate nurses (not employees of clinic intervention site) delivered sessions over 3 months MI dose (4 to 6), intervals (every 2 weeks), length (45 to 60 minutes) Study Arms: MI Intervention group, and T2DM clinic care group Attrition: MI (53.8%), UC (50%)</td>
<td>Satisfactory</td>
<td>N/S</td>
<td>Objective: PA accelerometer, blood glucose monitor Self-report: medication usage</td>
<td>Baseline and 3 month assessment times</td>
<td>PA Results: Increased odds of adhering to PA recommendations (P = 0.018) Self-care Results: Medication usage or glucose monitoring (p &gt; 0.05)</td>
<td>Non-randomized controlled trial (convenience sample)</td>
</tr>
<tr>
<td>Cinar &amp; Schou (2014)</td>
<td>Turkey, Istanbul Outpatient clinics</td>
<td>Inclusion: T2DM, Age 30 to 65, minimum of 4 functional teeth, no psychological treatment or hospitalization Sample (n= 186), Mean age (N/S), age 30 to 65, women (N/S), BMI (MI 14% &lt; 30) HE (17% &lt; 30) Mean baseline A1C (7.5%) SES (N/S)</td>
<td>MI Sessions: Face to face delivered by Dental professional over 6 months MI dose face to face (5 to 6), phone (3 to 4), length (N/S) Study Arms: MI group, and HE group (standard oral healthcare advice, diet, PA) Attrition: 7% drop out; 13% did not attend all sessions</td>
<td>N/S</td>
<td>T2DM diagnosis: Mean MI (13.1) HE (10.8)</td>
<td>Self-report: PA &amp; Tooth Brushing frequency</td>
<td>Baseline and 16 month follow-up</td>
<td>PA Results: MI group who brushed teeth at least once per day were more likely to be physically active, 95% CI, odds ratio 2.1 (1.5 – 3.2), p&lt;0.001</td>
<td>RCT</td>
</tr>
<tr>
<td>Clark et al (2004), Clark &amp; Hampson (2001)</td>
<td>UK, National Health Service Diabetes center</td>
<td>Inclusion: Age 40 to 70, T2DM suboptimal condition, BMI ≥ 25, able to engage in walking program Sample (n= 100), mean age (59.5), female (42%), Mean BMI (31), Mean baseline A1C (8.42), SES (N/S)</td>
<td>MI Sessions: Face to face and phone delivered by researcher over 3 months MI dose face to face (1), phone (3), length 30 minute (face to face), 10 minute (phone) Study arms: MI and UC group Attrition: 6% at 12 month follow-up</td>
<td>N/S</td>
<td>Approximately 8 years</td>
<td>Self-report: PA &amp; Diet</td>
<td>Baseline, 3 month, &amp;12 month long-term follow-up</td>
<td>PA Results: MI group (SDSCA questionnaire) significantly more PA than control group at 3 months, t (98)=2.118, p=0.037, and 12 months t (98)=2.248 p=0.021; PA not significant (PASE questionnaire) Diet Results: MI group significantly improved over UC for substituting high-fat foods for low-fat at 3 months, but not 12; and decreasing daily fat intake at 12 months, but not 3 months. Significant findings between groups were not found on other dietary measures</td>
<td>RCT</td>
</tr>
</tbody>
</table>

**Abbreviations:** N/S, Not Specified; Usual Care, UC; Health Education (HE); Randomized Controlled Trial (RCT); Confidence Interval, CI

### Table 2  
**Characteristics of Studies Without Significant PA Findings**

<table>
<thead>
<tr>
<th>Author</th>
<th>Location &amp; setting</th>
<th>Sample</th>
<th>MI Group, Control Group, &amp; Attrition</th>
<th>MI Proficiency</th>
<th>Length of T2DM diagnosis</th>
<th>Self-care measures</th>
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<td>N/S</td>
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<td>Self-report: PA &amp; Diet</td>
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</table>

**Abbreviations:** N/S, Not Specified; Usual Care, UC; Health Education (HE); Randomized Controlled Trial (RCT); Confidence Interval, CI
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<tr>
<th>Author</th>
<th>Location and setting</th>
<th>Sample</th>
<th>MI Group, Control Group, &amp; Attrition</th>
<th>MI Proficiency</th>
<th>Length of DM2 diagnosis</th>
<th>Self-care measures</th>
<th>Self-care results</th>
<th>Study Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heinrich et al (2010)</td>
<td>Europe, Southern Netherlands</td>
<td>Inclusion: T2DM ≤ 5 years, between 40 – 70 years old. Sample (n=584), Mean age (59), female (44.9%), BMI (41.3%) below 28; 42.2% above 30, mean baseline A1C (6.49). Lower education (61.7%), Medium education (23.6%), Higher education (14.7%)</td>
<td>MI Sessions: Face to face delivered by nurses recruited from general practices over 24 months during regular T2DM visits. MI dose (3 or 4), length (20 minute) Study Arms: MI plus UC, and UC alone</td>
<td>Attrition: 77% completed 12 month follow-up, 72% completed 24 month follow-up, 67% completed both follow-up times, 5% filled out none.</td>
<td>N/S</td>
<td>T2DM diagnosis: ≤ 1 year (26.4%), 2 to 3 years (47%), 4 to 5 years (26.6%)</td>
<td>Self-report: PA, Diet, Smoking</td>
<td>Baseline, 12 month, &amp; 24 month follow-up</td>
</tr>
<tr>
<td>Rubak et al (2011)</td>
<td>Europe, Denmark; Outpatient clinics</td>
<td>Inclusion: Newly diagnosed T2DM, age 40 to 69 Sample (n=628), mean age (61), female (42%), mean BMI MI (30.5) CG (30.8), mean baseline A1C at screening (6.9%), SES (N/S)</td>
<td>MI Sessions: Face to face delivered by General Practitioners (GP) over 1 year MI dose (3), length (45 minutes) Study Arms: MI group GP’s used MI during regular T2DM consultations, UC group GP’s delivered consultations without MI Attrition: On average, MI group received &lt; 2 of 3 consultations</td>
<td>MI Sessions: Detected during screening for research project</td>
<td>N/S</td>
<td>T2DM diagnosis: Detected during screening for research project</td>
<td>Self-report: PA, Smoking</td>
<td>Baseline &amp; 1 year follow-up</td>
</tr>
<tr>
<td>Mash et al (2014)</td>
<td>South Africa, Cape Town Community health centers</td>
<td>Inclusion Criteria: T2DM patient in community health center; Exclusion: Type 1 diabetes, acute mental or physical illness Sample: n=1570; Mean age MI = 55.8 (11.3); UC = 56.4 (11.6); Women MI = 71.5%, UC = 75.7%, Mean Weight kg MI = 84.4 (18.7); UC = 83.9 (18.5); Mean baseline A1C MI= 8.9 (2.3) UC= 9.3 (2.3); SES: N/S</td>
<td>MI Sessions: Group delivered by community health promoters trained in MI over 6 months MI dose (4 monthly), length (N/S) Study Arms: MI group received MI by health promoters, UC group included education, and individual counseling by providers Attrition: MI group 59.4% no sessions; 28% ≤ 2 sessions</td>
<td>Lacked listening skills and guiding communication style</td>
<td>N/S</td>
<td>T2DM diagnosis: Detected during screening for research project</td>
<td>Self-report: PA, diet, foot care, smoking, medication use</td>
<td>Baseline &amp; 12 month follow-up</td>
</tr>
<tr>
<td>Whittenmore (2004)</td>
<td>USA, Northeastern Connecticut Diabetes education center</td>
<td>Inclusion: T2DM, female, age 30 to 70, cleared for exercise by doctor, A1C &gt; 7% Sample (n=753), mean age (57.6), Overweight or obese (96%). Mean baseline A1C (7.7%), low to low-middle income</td>
<td>MI Sessions: Face to face and phone delivered by nurses over 6 months MI dose face to face (6), phone (2), length (N/S) Study Arms: MI group received MI plus UC, UC group received UC alone Attrition: Low</td>
<td>MI Sessions: Face to face by researcher over 3 weeks MI dose (2), length (30 minutes)</td>
<td>MI Sessions: Detected during screening for research project</td>
<td>T2DM diagnosis: Mean 2.7 years</td>
<td>Self-report: PA &amp; diet</td>
<td>Baseline, 3 months, &amp; 12 months</td>
</tr>
<tr>
<td>Calhoun (2010)</td>
<td>USA Montana Indian health services clinic</td>
<td>Inclusion: Tribal members on Northern Plains Reservation ≥ 18 years old. T2DM, receiving T2DM treatment at local Indian Health Service clinic Sample (n=256), mean age (54), female (53.8%), Mean BMI (31.8), mean baseline A1C (8.8)</td>
<td>MI Sessions: Face to face by researcher over 3 weeks MI dose (2), length (30 minutes)</td>
<td>Attrition: 77% completed both sessions</td>
<td>MI Sessions: Face to face by researcher over 3 weeks MI dose (2), length (30 minutes)</td>
<td>T2DM diagnosis: Mean 4.4 years</td>
<td>Self-report: PA, &amp; Diet Note: MI focused on any self-management behaviors addressed by participants (smoking, blood glucose monitoring, medication, &amp; mood)</td>
<td>Baseline &amp; 3 months</td>
</tr>
</tbody>
</table>

**Abbreviations:** N/S, Not Specified; UC, Usual Care; RCT, Randomized Controlled Trial (RCT)
MI Outcomes

Three MI approaches related to significant PA outcomes for adults with T2DM were found in this review: (1) target a minimal number of self-management behaviors; (2) delivery of MI by health professionals likely proficient in MI; and (3) MI protocols with an emphasis placed on either duration or frequency of sessions.

Self-Management Measures & Results

Four studies included MI interventions that were associated with significant PA outcomes. Chlebowy et al. (2015) objectively measured PA using an accelerometer at two time points. Participants assigned to MI or usual care (UC) wore the accelerometer for one week at baseline and at the three-month follow-up time. A logistical regression model found that MI significantly increased the odds that a participant followed recommended levels of PA. Regression models also were used to evaluate medication usage and glucose monitoring; however, MI did not have a significant effect on other T2DM self-management behaviors (Chlebowy et al., 2015). Cinar & Shou (2014) used self-report questionnaires to measure PA and tooth brushing frequency at baseline and at the 16-month follow-up time. Data from PA multiple-choice questionnaires were reclassified into dichotomous answers, “Favorable PA” and “Unfavorable PA”. Patients who brushed their teeth at least once per day were significantly more likely to be physically active in the MI group verses those in the health education group (Cinar & Schou, 2014). Armstrong et al. (2013) measured PA using a self-report questionnaire to determine PA maintenance results after an 8-week exercise program. Differences in PA maintenance between the MI and control group were examined using linear mixed modeling. The MI group was significantly more active at 6 months than the control group (Armstrong et al., 2013).
Clark et al. (2004) used self report questionnaires to measure PA and dietary habits. PA was measured using two different self-report questionnaires and results were mixed. The researchers used a PA Scale for the Elderly (PASE) to measure leisure time, household, and work-related PA over seven days, and no significant differences occurred between the MI and UC group. However, the Summary of Diabetes Self Care Activities (SDSCA) questionnaire was used to measure PA frequency over seven days. The researchers found that the MI group when compared to UC had significantly increased PA at 3 and 12 months after baseline. The intervention group improved significantly more than the UC group for two items on the dietary scales (Clark et al., 2004).

Five MI studies were not associated with significant PA outcomes. Heinrich et al. (2010) used self-report questionnaires to measure PA, dietary intake, sedentary behavior, and smoking at baseline, 12 months, and 24 months. The SDSCA questionnaire measured whether participants engaged in 30 minutes of PA per week, and the International Physical Activity Questionnaire (IPAQ) measured the amount and intensity of PA in the last seven days. No significant outcomes for self-management behaviors were found in the MI group. However, the UC group had significantly lower fat intake at 12 and 24 months (Heinrich et al., 2010). Rubak et al. (2011) used the self-report IPAQ to measure PA, and the SDSCA to report smoking habits at baseline and 12 months. Medication use was determined by pharmacy purchases. No significant differences were found between the MI and control groups for PA or smoking; however both groups purchased almost 100% of recommended T2DM medications (Rubak et al., 2011). Mash et al. (2014) used the SDSCA self-report questionnaire to measure PA, diet, exercise, foot care, medication use, and smoking at baseline and 12 months. No significant differences were found between the MI and the UC group for T2DM self-care activities (R. J.
Mash et al., 2014). Whittemore et al. (2004) used a self-report PA questionnaire that differentiated between structured exercise and physical activities of daily living in the previous month. Dietary behavior was measured with the self-report SDSCA questionnaire. There was a trend towards increased PA for women in the MI group, but results were not significant. Women in the MI group reported significantly better dietary behaviors (Whittemore et al., 2004). Calhoun et al. (2010) used self-report questionnaires at baseline and three months to estimate the amount of PA for the last seven days and to estimate the consumption of healthy and unhealthy foods. PA and diet were the two self-management behaviors measured. However, the MI counselor targeted any self-management behavior the participant wanted to discuss, such as smoking, blood glucose monitoring, medication management, and mood. Measures of health related behaviors were not significant (Calhoun et al., 2010).

**MI Counseling Approaches**

MI approaches associated with significant PA outcomes included the use of MI sessions in outpatient clinical settings over time periods that ranged from 3 to 16 months. Chlebowy et al. (2015) used baccalaureate prepared nurses to deliver six MI sessions over three months in an outpatient medical clinic. Individual sessions were scheduled every two weeks and lasted around 45 minutes to an hour. Around 50% were lost to attrition in both groups, and participants actually received 4 to 6 sessions (Chlebowy et al., 2015). Cinar & Schou et al. (2014) used a dental professional to deliver five to six individual MI sessions in the outpatient clinical setting, as well as three to four phone sessions. Questionnaires were filled out at baseline and at 16 months post-intervention. Details pertaining to length of MI sessions were not specified. Participant dropout rate was 7%, and 13% did not take part in all the sessions (Cinar & Schou, 2014). Armstrong et al. (2013) evaluated the impact of MI for PA maintenance following an
eight week exercise program. The principal investigator conducted two individual 30 to 45 minute MI sessions. The first session was conducted at the end of the eight week exercise program, and the last session was three months later (M.J. Armstrong, PhD., written communication, August, 2016).

Clark et al. (2004) measured PA outcomes using two self-report questionnaires and found mixed results. Research interventionists delivered an individual 30-minute MI session at a diabetes center along with three subsequent 10-minute MI phone sessions over three months (Clark & Hampson, 2001). Attrition was low, 6% of participants were lost at the final 12-month follow-up assessment time (Clark et al., 2004).

Studies that lacked significant PA outcomes examined MI interventions in the primary and community health care setting over time periods that ranged from 3 weeks to 2 years. Heinrich et al. (2010) planned to implement quarterly MI sessions during routine T2DM visits each year for 24 months. Nurses recruited from primary care clinics delivered individual 20-minute MI sessions during regular T2DM consultations. Participants attended three or four sessions each year (Heinrich et al., 2010). Rubak et al. (2011) used general practitioners to deliver three 45-minute MI sessions over one year, however participants attended less than two of the three consultations (Rubak et al., 2011). Mash et al. (2014) recruited health promoters from district health services and planned to deliver four 20 to 60-minute group sessions with 10 to 15 participants. The intervention took place over six months, and post-intervention follow-up data were collected at 12 months. Close to 60% of participants did not attend any MI educational sessions. The remaining participants attended two sessions or less (28%) (Mash et al., 2014).
Final studies lacking significant PA outcomes delivered MI sessions within six months or less (Calhoun et al., 2010; Whittemore et al., 2004). Whittemore et al. (2004) used nurses to deliver six individualized MI sessions and two brief follow-up phone calls over six months. Five MI sessions were delivered within the first three months. Subsequent phone calls and the last MI session were completed over the last three months; the attrition rate was low (Whittemore et al., 2004). A researcher in the Calhoun et al. (2010) study delivered two 30-minute MI sessions for each participant over three weeks. Approximately 77% of participants completed the study (Calhoun et al., 2010).

**MI Training & Fidelity**

Two of the four studies with significant PA outcomes provided MI fidelity measurement results. In the study by Chlebowy et al. (2015), bachelor degree prepared registered nurses (RNs) with T2DM care experience received extensive MI training by a motivational interviewer network trainer. After training, fidelity assessments for adherence to MI techniques were conducted throughout intervention delivery. All MI sessions were audio recorded and assessed using the MI Treatment Integrity (MITI) scale. Assessment scores indicated satisfactory MI proficiency (Chlebowy et al., 2015). Armstrong, PhD (written correspondence, September 2016) recorded all MI sessions and MI fidelity was determined by randomly sampling 25% of the recordings. A psychologist used the MITI scale and rated the MI counselor as MI proficient (M.J. Armstrong, written correspondence, September 2016). Cinar & Schou (2014) and Clark et al. (2004) did not report information pertaining to MI training or fidelity assessment.

Four studies that lacked significant PA outcomes reported details pertaining to MI training, and two reported details about MI fidelity assessments. In the study by Heinrich et al. (2010), nursing staff were taught MI techniques by a certified MI trainer during two 5-hour
sessions, and received MI counseling charts to guide them through T2DM consultations. Nurses received written feedback at three months from two audio taped consultations by a MI-trained researcher, and direct feedback during consultations at 9, 11, and 18 months after training by a MI-trained teaching nurse. Nurse proficiency in MI counseling techniques was not reported (Heinrich et al., 2010).

In the study by Rubak et al (Rubak et al., 2011), a trained teacher provided 1½-day MI training sessions, and two half-day follow-up sessions for general practitioners (GPs) over the first year. Fidelity measures were not discussed (Rubak et al., 2011). Mash et al. (2014) initially trained health promoters during a four-day workshop. The workshop focused on the first two sessions and included communication style, structure of the sessions, skills, and diabetes knowledge. Two months later, a two-day workshop was delivered to reinforce previous training and to focus on the previous two sessions. MI fidelity was evaluated by a researcher at the health center at least twice, and 36 randomly selected audio-recorded sessions were assessed for MI proficiency using the MITI scale. Findings indicated achievement of an overall collaborative style of communication, but health promoters lacked sufficient listening skills and the guiding communication style (Mash et al., 2012). In the study by Calhoun et al. (2010), the research interventionist was trained and supervised by a MI Network Trainer. MI sessions were not coded to ensure fidelity (Calhoun et al., 2010). In the study conducted by Whittemore et al. (2004), MI training and fidelity were not discussed.
Discussion

Close to half the studies reported significant outcomes for PA. Despite mixed results, insights gained about effective counseling approaches show promise for MI and T2DM PA self-management. This review identified three MI approaches associated with significant PA outcomes.

The first MI approach found that sessions were more successful when counselors focused on a minimal number of T2DM self-management behaviors. For example, most studies with significant PA outcomes either targeted PA alone, or with one other self-management behavior. In contrast, most studies lacking PA significance targeted three or more T2DM self-management behaviors over the course of the intervention. Although one study lacking significant PA outcomes only targeted two behaviors, outcomes for dietary self-management were significant and a trend towards improved PA was found. Even though a large conceptual category like T2DM self-management does qualify as a target behavior for a MI session (T.B. Moyers, PhD, written correspondence, September 2016) (Moyers, Martin, Manuel, Miller, & Ernst, 2010), findings from this review indicate MI may be more effective when counselors prioritize a minimal number of target behaviors over the course of a few sessions.

The second MI approach associated with significant PA outcomes included delivery of MI sessions by counselors more likely proficient in MI. Most studies used researchers affiliated with the project to deliver the MI sessions. However, one study with significant findings recruited and trained baccalaureate prepared nurses in MI who were not employees of the study site. In contrast, the majority of studies lacking PA significance recruited and trained healthcare professionals or community health promoters from study site locations. MI proficiency may help explain the variance in findings. Only three studies measured MI fidelity, and satisfactory
ratings for MI proficiency were only found among studies reporting significant PA outcomes. These findings support the assumption that researchers or health professionals’ part of the research team more likely had an interest in the guiding principles of MI, and therefore were more proficient at using MI techniques.

The third MI approach associated with significant PA outcomes found counselors were only required to emphasize either the duration, or frequency of MI sessions. One study protocol included sessions that lasted 30 to 45 minutes in length, however a low dose of two sessions was delivered over six months. Another protocol included an initial face to face 30 minute session along with three monthly phone sessions, but the phone sessions only lasted 10 minutes. The majority of studies lacking PA significance either implemented short and infrequent sessions because of study protocol guidelines or high attrition rates.

Limitations & Future Research

Limitations of this review must be taken into consideration. Studies included in this review were all written in English. Although the majority of studies were randomized controlled trial designs, one controlled trial did not include randomization, two were pilot studies, and one of the pilot studies was a pretest posttest design. Only one study measured PA objectively, making data related to PA measurement subject to social desirability and recall bias.

Information pertaining to MI approaches was missing. Some studies did not include a description of usual care, length of MI sessions, and most did not address MI intervention fidelity. Most interventions targeted two or more T2DM self-management behaviors, however the degree MI sessions focused on PA self-management is unknown. In addition, since a limited number of studies have examined the effectiveness of MI for T2DM PA self-management, one abstract was included in this review. Although information and data reported in the abstract
through written correspondence with the author helped strengthen the findings in this review, the full article is pending publication.

Recommendations for future research include more thorough reports pertaining to MI approaches used, and stronger intervention designs that include long-term follow up outcomes. All MI studies should include details pertaining to dose, length, and frequency of sessions. In addition, since MI studies typically target multiple self-management behaviors, investigators should report the amount of focus placed on the different behaviors. To better understand the efficacy of MI for PA self-management, future studies must use objective measures for PA. To help address barriers related to time within the healthcare setting, further investigation into the usefulness of group and phone MI sessions is needed. Most importantly, few studies measured MI fidelity. MI proficiency may be highly correlated with significant PA outcomes.

Conclusion

Although results for the effectiveness of MI were mixed, MI shows promise for T2DM PA self-management. Studies lacking significance either used MI to target multiple self-management behaviors or counselor MI proficiency was not reported. Findings from this review suggest MI proficient counselors who emphasize PA self-management may help improve PA self-management outcomes.
References


MANUSCRIPT III: DISSERTATION STUDY


Abstract

Hispanic adults are almost twice as likely to be diagnosed with diabetes than non-Hispanic whites, and Hispanic women have a 1.5 times greater chance of dying from diabetes than non-Hispanic white women. The purpose of this study was to examine the feasibility of Motivational Interviewing (MI) sessions for physical activity (PA) self-management with Hispanic women either at risk for or diagnosed with diabetes type 2 (DM2). A total of 12 women enrolled into this single-arm feasibility study and attended 2 MI and PA counseling sessions over 2 months. Primary outcomes for this feasibility study included recruitment, retention, protocol adherence, and attrition. Participants were recruited from a regional occupational program in Southern California, all identified as Mexican American ethnicity, 7 were at risk for DM2, and the remaining had a diagnosis of DM2. All participants attended 2 MI sessions and completed questionnaires at 2-month follow-up. Half of the participants progressed into a latter stage of change for PA after 2 MI sessions, indicating a trend towards improved PA outcomes. Preliminary results suggest MI sessions are a feasible approach for high-risk Hispanic women for PA self-management. Future research using more rigorous study designs to evaluate the effectiveness of MI for PA outcomes warrants further investigation.
Feasibility of MI Sessions for Hispanic women at risk or diagnosed with DM2

Diabetes mellitus is a leading cause of death in the United States (Centers for Disease Control and Prevention, 2014b). An estimated 9.3% of the US adult population has diabetes, and the percentage increases to 12.3% when considering adults with undiagnosed diabetes (Centers for Disease Control and Prevention, 2014a). Type 2 diabetes (DM2) is the most common type, and accounts for 90% to 95% of all newly diagnosed cases (Centers for Disease Control and Prevention, 2014b). Of concern, adults of Hispanic origin are almost twice as likely to be diagnosed with diabetes than non-Hispanic White adults, and are three times more likely to begin treatment for diabetes related end-stage renal disease (U.S. Department of Health and Human Services, 2016). The Hispanic population is the largest minority group in the U.S. (US Department of Commerce, 2013), and the U.S. Department of Health and Human Services (2016) found Hispanic women had a 1.5 times greater chance of dying from diabetes than non-Hispanic white women.

According to The National Standards for Diabetes Self-Management Education and Support, lifestyle changes can prevent or delay the debilitating and deadly complications associated with the disease (Haas et al., 2014). One essential lifestyle change is physical activity (PA). The American Diabetes Association (2013) reports PA improves the body’s ability to use insulin, improves hemoglobin A1C levels, and reduces one’s risk for disease related complications. However, a 2014 National Health Interview Survey found 55.2% of Hispanic adults did not meet Federal PA guidelines, and were 30% less likely to engage in PA than non-Hispanic White adults (U.S. Department of Health and Human Services: Office of Minority Health, 2016). Furthermore, a 2012 National health Interview revealed 41.6% of Hispanic
women do not participate in leisure-time PA, and Hispanic women were less active than Hispanic men (Centers for Disease Control and Prevention, 2014c; D'Alonzo & Saimbert, 2013).

According to Bandura’s Social Cognitive Theory (SCT), self-efficacy is a key concept influencing behavior change (K. Glanz, Rimer, B.K., Viswanath, K., 2008). Self-efficacy is the personal belief about one’s ability to perform a behavior. When individuals lack confidence in their ability to change behavior, they express low self-efficacy. When individuals feel confident in their ability to change a behavior, they are expressing high self-efficacy and are more motivated to act despite obstacles or challenges they may face (K. Glanz, Rimer, B.K., Viswanath, K., 2008).

**Motivational Interviewing**

MI is a brief, patient centered, cost effective counseling technique that promotes self-efficacy for health behavior change (S. Rollnick, Miller, W.R., & Butler, C., 2008). MI counselors use the Transtheoretical Model to assess an individual’s stage of change, and then apply interview strategies for each stage (Administration, 1999). Ultimately, counselors aim to help patients resolve ambivalent feelings about behavior change, and promote self-efficacy by helping patients explore how they can improve their own health (S. Rollnick, Miller, W.R., & Butler, C., 2008). Studies investigating the efficacy of MI for adults with DM2 have reported significantly improved PA outcomes (Armstrong et al., 2013; Chlebowy et al., 2015; Cinar & Schou, 2014; Clark, Hampson, Avery, & Simpson, 2004). Since MI has been found to improve DM2 PA self-management in non-Hispanic populations, this counseling technique may also be an effective intervention for Hispanic women at risk for or diagnosed with DM2.
**Research Question:** Is a brief, community-based MI and PA counseling intervention a feasible approach for increasing levels of PA for Hispanic women either at risk for or diagnosed with DM2?

**Methods**

**Study Design**

A quasi-experimental design was used to examine the feasibility of delivering MI sessions to increase levels of PA with Hispanic women either at risk for or diagnosed with DM2. The MI intervention consisted of two 30-minute sessions over two months. Results from this pilot study were used to determine if larger definitive trials using MI and PA counseling with Hispanic women were warranted, and if modifications were needed. Due to minimal psychological and physical risk to human subjects, this study was submitted to the Medical University of South Carolina’s (MUSC) Internal Review Board (IRB) for expedited review. Standard IRB forms, a signed letter of support from the ROP director, and an off-campus research IRB form was approved by the University IRB.

**Theoretical Framework**

Social cognitive theory (SCT) asserts key determinants of health behavior change include self-efficacy, goal setting, outcome expectancy, and social support (Glanz, Rimer, & Viswanath, 2008). Thus, when individuals feel a sense of control over their behavior, they are more motivated to act despite obstacles or challenges they may face (Glanz et al., 2008; USDHHS, 2005). Motivational Interviewing (MI) is a brief, easily learned, cost effective technique that promotes self-efficacy and goal setting for health behavior change (Rollnick, Miller, & Butler, 2008b; Substance Abuse and Mental Health Services Administration, 1999). Studies
investigating MI techniques to increase levels of PA with adults diagnosed with DM2 have reported significant results.

**Participants and Setting**

Purposive sampling was used to recruit a sample of (n=12) participants from a suburban regional occupational program (ROP) and technical center in Southern California. Recruitment flyers were typed in both Spanish and English and were given to instructors, staff, and students. The flyers included a brief description of the intervention offered at the ROP, receipt of gift cards for participation, eligibility criteria, and the PI contact number. In order to help with recruitment, the PI used a Hispanic bilingual nurse research assistant (RA) who helped to hand out flyers, answer questions about the project, and with translation for women with limited English. The PI informed interested participants about the receipt of a $15 gift card after completing meetings at baseline, MI session two, and at follow-up as an incentive for participating in the study.

The following eligibility criteria were used to guide recruitment: women who 1) self-identify as Hispanic or Latina; 2) are 18 to 69 years old; 3) understand either English or Spanish; 4) have a body mass index (BMI) ≥ 25; 5) are identified to be at risk for DM2 by the American Diabetes Association Type 2 Diabetes at risk assessment questionnaire; or, 6) have a clinical diagnosis of pre-diabetes or DM2. Exclusion criteria were 1) pregnancy (self-report); 2) a diagnosis of cognitive impairment (self-report); 3) having been told by a provider to restrict mild or moderate exercise activity. A total of 12 Hispanic women either at risk for or with DM2 enrolled and participated in the study. The study included baseline face-to-face meetings, MI and PA counseling sessions at baseline and 1 month, and a 2-month follow-up assessment time. All participants completed the consent process prior to baseline assessments.
Intervention

The PI participated in five 8-hour days of MI training in the tradition of Miller and Rollnick from certified motivational interviewing network trainers (MINT). To help ensure MI proficiency, a MINT trainer evaluated and approved MI techniques used by the PI in a simulated counseling session prior to the study. The intervention took place over two months, and the PI scheduled both MI and PA counseling sessions. The first session occurred within one week of participant enrollment, and the second session took place one month after the initial session. Participants received either a reminder call or text message from the PI one day before each session.

Motivational interviewing (MI) was conducted by the PI in the tradition of Miller and Rollnick (2008) using the following four principles of MI: resisting the righting reflex, understanding client motives, high-quality listening, and client empowerment to help improve self-efficacy and goal setting (Rollnick et al., 2008). MI sessions for Hispanic women with DM2 were aimed to foster PA change, improve self-efficacy, and motivate participants into the latter stages of change for increased levels of PA. The MI techniques of moving past ambivalence and towards change talk aimed to instill self-efficacy were implemented (Rollnick et al., 2008b). According to Bandura’s SCT, individuals with higher self-efficacy are more likely to engage in behavior change (Glanz et al., 2008).

In addition to MI, PA counseling consisted of PA and DM2 self-management education, with particular attention to setting PA goals for increased walking exercise. Participants received a Yamax Power Walker EX-510 Pedometer, and a daily log to keep track of steps walked per day. The PI instructed participants on how to use the pedometer and informed participants they were able to keep the pedometer after study completion. Participants were encouraged to set
realistic and mutually agreed upon goals, and not to exceed 8,000 steps walked per day.

Satisfaction with pedometer use in sedentary adults is related to setting realistic goals that aim to reach 8,000 steps walked per day (Korkiakangas & al., 2010). Participants received PI contact information in the form of a business card, and the PI was available for questions or concerns by phone during regular business hours.

**Measures**

Baseline demographics and measures included level of PA, stage of change (SOC) for PA, and waist circumference. Demographic questions included age, marital status, race, English proficiency, primary language spoken at home, health insurance status, and years of education, and number diagnosed with DM2. Measurements were obtained at baseline and two-month follow-up intervals.

**Clinical Measure**

The PI measured Waist Circumference (WC) at the top of the iliac crest at the end of normal respiration (CDC, 2007). WC was recorded in inches.

**PA Self-Management**

The Rapid Assessment of Physical Activity (RAPA-1) questionnaire is a brief 7-item dichotomous (Yes/No) measure for mutually exclusive levels of PA ranging from 1 to 5 (University of Washington, 2006). Affirmative responses indicate the corresponding score. The score is used to categorize participants into 1 of the 5 levels of PA: (1) score of 1 is sedentary, (2) score of 2 is under-active, (3) score of 3 is under-active regular light activities, (4) scores of 4 or 5 are under-active regular activities, and (5) scores of 6 or 7 are considered active (University of Washington, 2006). The RAPA demonstrated reasonably valid measures for assessing levels of PA with Mexican American adults in the clinical setting. Validity and test-retest reliability
were reported as 0.45 (p < 0.05) and 0.65 (p < 0.01) (Vega-Lopez, Chavez, Farr, & Ainsworth, 2014).

Readiness for PA change was assessed using the Stage of Exercise Behavior Change (SEBC) questionnaire. The SEBC is a one item scale that links a response choice to one of the five TTM stages of change: pre-contemplation (I currently do not exercise and I do not intend to start exercising in the next six months); contemplation (I currently do not exercise, but I am thinking about starting to exercise in the next six months); preparation (I currently exercise some but not regularly); action (I currently exercise regularly, but I have only begun doing so in the last six months); maintenance (I currently exercise regularly and have done so for longer than six month) (Bezyak, Berven, & Chan, 2011). Results for test-retest reliability using coefficient K were 0.78 (Marcus, Selby, Niaura, & Rossi, 1992).

Waist circumference (WC) measurement took place in a private quiet room at the CHC. The PI explained the WC procedure to each participant prior to measurement. The PI located the area just above the right upper ilium of the pelvis (CDC, 2007). The tape aligned horizontally around the waist and was snug but did not compress skin. Measurement occurred at the end of normal expiration (CDC, 2007), and WC was recorded in inches. The tape measure was sanitized with alcohol pads after participant measures.

Feasibility Measures
Feasibility outcomes were based on recruitment, retention, protocol adherence, and attrition measures. Recruitment included the number of participants approached, the number who did not meet eligibility, the number who provided written informed consent, and the percent who provided baseline data. Retention included the number who attended 1 and 2 MI and PA counseling sessions, and protocol adherence was based on logged steps walked per day,
pedometer use (documentation in log), and participants failing to complete questionnaires at two months. The number of participants who dropped out of the study determined attrition.

**Statistical Analysis**

Data was analyzed using SPSS software. Descriptive data for baseline characteristics report the mean, standard deviation (SD), median, range (age), frequency, and proportion (marital status, English proficiency, language spoken at home, health insurance status, and level of education).

**Feasibility Measures**

Feasibility outcomes were based on recruitment, retention, protocol adherence, and attrition measures. Recruitment included the number of participants approached, the number who did not meet eligibility, the number who provided written informed consent, and the percent who provided baseline data. Retention included the number who attended 1 and 2 MI and PA counseling sessions, and protocol adherence was based on logged steps walked per day, pedometer use (documentation in log), and participants failing to complete questionnaires at two months. The number of participants who dropped out of the study determined attrition.

**Impact Outcomes**

The Wilcoxon Signed Rank Test was used to compare quantitative PA outcomes (ranks) at pre- and post-intervention times. Median PA outcomes were determined for each SEBC stage of change (Table 4). In addition, the portion of participants who progressed into a latter stage of change from baseline measurement was determined.
Results

Baseline Characteristics

Study participants (n=12) included Mexican American women with a mean age of 39.8 (SD = 16.4), who were primarily English speaking (91.7%), and married (50%). The majority reported attending some college but did not have a degree (75%). Women either had private health insurance (58.3%), or state funded insurance through Medi-Cal (33.3%) or Medicare (8.3%). Based on the American Diabetes Association DM2 risk assessment test (American Diabetes Association, n.d.) most women were at risk for DM2 (58%) and the remaining had a diagnosis of DM2. Table 1 includes demographic data.
<table>
<thead>
<tr>
<th>Demographics</th>
<th>N</th>
<th>Proportion</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yr)</strong></td>
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<td></td>
<td>39.8</td>
<td>16.4</td>
<td>37.5</td>
<td>23</td>
<td>67</td>
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<td><strong>Highest education level (n)%</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>High school</td>
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<td>16.7%</td>
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<tr>
<td>Some college, no degree</td>
<td>9</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate degree, technical, occupational, or</td>
<td>1</td>
<td>8.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vocational program</td>
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<td><strong>Relationship Status</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Married</td>
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<td>50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Separated</td>
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<td>8.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td>4</td>
<td>33.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living with</td>
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<td>8.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mexican American</td>
<td>12</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>English Proficiency</strong></td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Very well</td>
<td>11</td>
<td>91.7%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not well</td>
<td>1</td>
<td>8.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Language spoke at home</strong></td>
<td>12</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>English</td>
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<td></td>
<td></td>
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<td>Spanish</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Not reported</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Health Insurance/Health care plan</strong></td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>7</td>
<td>58.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>1</td>
<td>8.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medi-Cal</td>
<td>4</td>
<td>33.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Employment Status</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paid for work in last calendar year</td>
<td>9</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paid for self-employment in last calendar year</td>
<td>1</td>
<td>8.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diabetes type 2 (DM2)</strong></td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5</td>
<td>41.7%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at DM2 diagnosis</td>
<td></td>
<td></td>
<td>44.2</td>
<td>9.9</td>
<td>47</td>
<td>30</td>
<td>57</td>
</tr>
</tbody>
</table>
Feasibility Outcomes

A total number of 29 women were screened for this project, and 12 met inclusion criteria (Table 2). All 12 women enrolled, attended 2 MI and PA counseling sessions, and completed questionnaires at the 2-month follow-up time. All women received pedometers, however only 3 partially filled out logs to document number of steps walked per day (Table 2).

<table>
<thead>
<tr>
<th>Table 2: Feasibility Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recruitment</strong></td>
</tr>
<tr>
<td>Number approached</td>
</tr>
<tr>
<td>Number who did not meet</td>
</tr>
<tr>
<td>Eligibility</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Eligible Participants</strong></td>
</tr>
<tr>
<td>Number of eligible participants</td>
</tr>
<tr>
<td>Number who provided consent</td>
</tr>
<tr>
<td>Percent who provided baseline data</td>
</tr>
<tr>
<td><strong>Retention</strong></td>
</tr>
<tr>
<td>Number attending 1 MI session</td>
</tr>
<tr>
<td>Number attending 2 MI sessions</td>
</tr>
<tr>
<td><strong>Protocol adherence</strong></td>
</tr>
<tr>
<td>Logged steps walked per day</td>
</tr>
<tr>
<td>Pedometer use indicated by documentation in log</td>
</tr>
<tr>
<td>Failed to complete 2 month Questionnaires</td>
</tr>
<tr>
<td><strong>Retention</strong></td>
</tr>
<tr>
<td>Number who dropped out</td>
</tr>
</tbody>
</table>

Impact Outcomes

Findings from the Wilcoxin signed-rank test showed that 2 MI and PA counseling sessions over 2 months did not significantly increase PA levels ($Z = -0.781, p = .435$), or decrease waist circumference ($Z = -0.462, p = .644$). The median RAPA score was 5.0 baseline, and 4.5 at post-intervention, results in Table 3. The median waist circumference score was 47.1 at baseline, and 46.5 at post-intervention. However, a trend towards increased levels of PA and decreased
waist circumference was observed. Half of the participants reported increased PA levels at post-intervention follow-up, and 7 had decreased waist circumference measurements at the post-intervention follow-up time.
Table 3. Impact Outcomes

Wilcoxon Signed Rank Test shows that 2 MI sessions did not lead to statistically significant PA outcomes over 2 months

<table>
<thead>
<tr>
<th></th>
<th>Median Pre-MI (range)</th>
<th>Median Post-MI (range)</th>
<th>Z-statistic</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAPA</td>
<td>5 (1 - 7)</td>
<td>4.5 (2 - 7)</td>
<td>-0.781</td>
<td>.435</td>
</tr>
<tr>
<td>WC</td>
<td>46.6 (34.2 – 55.5)</td>
<td>46.5 (34.1 – 54.4)</td>
<td>-0.462</td>
<td>.644</td>
</tr>
</tbody>
</table>

(2) Post MI RAPA < Baseline MI RAPA
(4) Post MI RAPA = Baseline MI RAPA
(6) Post MI RAPA > Baseline MI RAPA
(7) Follow-up WC Measures < Baseline WC Measures
(3) Follow-up WC Measures > Baseline WC Measures
(2) Follow-up WC Measures = Baseline WC Measures

Results indicate a relationship between the stage of change at baseline and outcome levels of PA (Table 4). Median RAPA outcome scores tended to be higher for participants in the latter stages of change at baseline. However, this was not true for waist circumference outcomes. Lastly, findings suggest MI and PA counseling sessions may have helped participants progress into a later stage of change (Table 5). Fifty percent of participants progressed into a latter stage of change after receiving 2 MI and PA counseling sessions.

Table 4. Impact Outcomes

Baseline Stages of change and PA outcomes [Median (range)]

<table>
<thead>
<tr>
<th></th>
<th>Pre-contemplation (n= 2)</th>
<th>Contemplation (n=4)</th>
<th>Preparation (n=3)</th>
<th>Action (n=2)</th>
<th>Maintenance (n=1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAPA</td>
<td>3 (3-3)</td>
<td>3.5 (2-7)</td>
<td>5 (4-7)</td>
<td>6.5 (6-7)</td>
<td>7 (7-7)</td>
</tr>
<tr>
<td>WC</td>
<td>40.3 (39.7 - 41)</td>
<td>47 (46-48.6)</td>
<td>46 (46 – 52.4)</td>
<td>40.6 (34.1 – 47.1)</td>
<td>54.4 (54.4 – 54.4)</td>
</tr>
</tbody>
</table>
Table 5. Impact Outcomes: Proportion of participants who progressed into a later stage of change following 2 MI sessions

<table>
<thead>
<tr>
<th>Baseline score = follow-up score</th>
<th>N = 12</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>41.7%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8%</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

This dissertation study contributes knowledge to the growing body of implementation science targeting health disparities for Hispanic women. Preliminary findings suggest that MI is a feasible counseling approach for improving PA self-management with Hispanic women either at risk for or diagnosed with DM2. A total of 29 Hispanic women were screened at a regional occupational program in rural Southern California. All eligible women (n = 12) enrolled in the study, attended both MI and PA counseling sessions, and completed questionnaires at the 2-month follow-up time. The majority of participants failed to document pedometer steps walked per day, however, self-report measures indicate half increased levels of PA and progressed into a latter stage of change at the 2-month follow-up time. Although PA and WC outcomes lacked significance, feasibility for PA self-management was the primary aim of this study.

Recruitment, retention, and intervention strategies addressed both cultural and contextual factors, and likely contributed to successful feasibility outcomes. Key factors included cultural tailoring, social support, repetition of PA concepts, along with the recruitment and delivery of MI sessions at a community-based site. Consistent with recruitment and retention recommendations from Wallace & Bartlett (2013), the PI established trust by partnering with a Hispanic Bilingual research assistant (RA), offered compensation in the form of gift-cards, encouraged family or friend attendance during walking activities, provided study materials in both Spanish and English, and conducted the intervention at a familiar and convenient location. Most participants attended the ROP center daily for work or class, and scheduled MI sessions during scheduled breaks.
Other strategies contributing to successful outcomes include the use of a MI proficient counselor, and implementation of patient-centered counseling techniques. Although few DM2 studies using MI for PA self-management have assessed MI fidelity during participant counseling sessions, studies reporting the use of MI proficient counselors have been associated with significant PA outcomes (Armstrong, PhD, written correspondence, September 2016; Chilhowie et al., 2015). Prior to study implementation, the PI was rated as MI proficient by a certified MINT trainer. Furthermore, MI counselors build a collaborative relationship by using empowerment techniques and avoid telling others what to do (S. Rollnick, Miller, W.R., & Butler, C., 2008). Lessons learned from a 20-year diabetes self-management research program in Starr County Texas found Hispanic women avoid circumstances with health providers that pertain to weight loss; avoidant behaviors stem from previous weight loss failures (Brown & Hanis, 2014). Although discussions centered around PA health behavior change, the content did not focus on weight loss. MI techniques may help foster trust, and evoke interest in referring other potential participants into the study.

Limitations and Future Research

This was a one-group pre-test posttest design with a small sample size; results cannot be generalized beyond the population studied. Future research should use more rigorous study designs with larger sample sizes. Although the PI was rated as MI proficient prior to the study, MI fidelity was not evaluated with study participants. To ensure MI proficiency, future studies should assess fidelity with research participants. Last, this study lacked objective measures of PA. Participants either forgot to attach their pedometer, or viewed logging steps into a notebook as burdensome. Walsh et al. (2016) demonstrated the use of a mobile application improved PA outcomes with young adults. Since all participants in the provided cellphone numbers for
appointment reminders, mobile applications may be a more convenient way to objectively measure PA with Hispanic women.

**Conclusion**

This study contributes knowledge to the growing body of implementation science targeting health disparities. Preliminary results indicate MI may be a feasible approach for PA self-management with Hispanic women either at risk for or diagnosed with DM2. All eligible women enrolled in the study, attended 2 MI and PA counseling sessions, and completed follow-up measures. Furthermore, half reported increased PA and progressed into a latter stage of change at the 2-month follow-up time. This was a one-group pre-test posttest design with many limitations. In order to determine the efficacy of MI for Hispanic women, future studies using more rigorous research methods with larger sample sizes are needed.
References


CONCLUSION

Three manuscripts are included in this dissertation: (1) a literature review that used the social ecological model as a framework to identify the factors associated with successful PA interventions for Hispanic women with DM2, (2) a literature review examining the effectiveness of MI counseling sessions for improving PA outcomes for adults with DM2, and (3) a quasi-experimental study that examined the feasibility of MI and PA counseling sessions for DM2 PA self-management with Hispanic women in the community setting. Findings from this dissertation indicate MI may be a feasible approach for assisting Hispanic women with DM2 to improve PA self-management.

The literature review exploring SEM factors associated with successful PA outcomes for Hispanic women with DM2 examined 10 studies meeting inclusion criteria. Findings indicate that methodological factors associated with significant PA outcomes at the intrapersonal level included the repetition of key concepts and activities. Most programs focused on multiple DM2 self-care behaviors, and programs that emphasized PA were associated with significant PA outcomes. At the interpersonal level, all DM2 programs were based on models or theoretical frameworks that link self-care activities to social support. However, information pertaining to social support interventions and outcomes were limited. Overall, successful PA programs were culturally tailored and associated with the intrapersonal, interpersonal, and community level factors. More research at the institutional and policy levels is needed. This project was based on findings in this review and included a bilingual Hispanic nurse to help with the recruitment of women from the community, encouraged social support during walking exercise, and emphasized PA self-management for DM2.
The literature review examining the effectiveness of MI counseling sessions for improving PA outcomes for adults with DM2 resulted in 9 studies that met inclusion criteria. Although results for the effectiveness of MI were mixed, MI shows promise for DM2 PA self-management. Studies lacking significance used MI to target multiple self-management behaviors, did not emphasize either the duration or frequency of sessions, or did not report the use of MI proficient counselors. Prior to this dissertation’s MI project, the principal investigator was trained and approved by a certified motivational interviewing network trainer in MI proficiency. In addition, this project placed an emphasis on PA self-management and session frequency.

This dissertation study examined the feasibility of MI and PA counseling sessions for DM2 PA self-management with Hispanic women in the community setting. All eligible participants enrolled, attended 2 MI sessions, and completed follow-up questionnaires. However, most participants failed to log steps walked per day. Results indicate MI sessions in the community setting are a feasible approach for addressing PA self-management for Hispanic women. In addition, 50% of participants reported increased PA, and progressed to a latter stage of change at post-intervention follow-up. These findings support future MI research for PA self-management with Hispanic women either at risk for or with DM2.

**Research & Practice Implications**

This dissertation leads to several research and clinical practice implications for PA self-management with Hispanic women either at risk for or with DM2. Although diet, medication management, and blood glucose monitoring are complex self-management behaviors when compared to PA, the emphasis on PA intervention strategies should not be underestimated.
(Soderlund, 2016). Studies with significant PA outcomes reported the repetition of key PA concepts, and implemented intervention activities more than once per month (Soderlund).

MI sessions for PA self-management show promise for Hispanic women either at risk for or with DM2. The following recommendations are based on findings from studies investigating MI for DM2 self-management. First, MI counselor proficiency is associated with significant PA outcomes (M.J. Armstrong, PhD., written communication, August, 2016; Chlebowy et al. 2015; Mash et al., 2014). To help determine the efficacy of MI for PA self-management, researchers can use a reliable measure like the MI Treatment Integrity (MITI) (Pierson et al., 2007) to assess counselor proficiency during participant sessions. MI interventions should also emphasize either session frequency or duration. MI sessions should be conducted using monthly intervals lasting at least 10 minutes each, or use 3-month intervals lasting at least 30 minutes each (M.J. Armstrong, PhD., written communication, August, 2016; Chlebowy et al., 2015; Calhoun et al., 2010; Cinar et al., 2014; Clark et al., 2004; Heinrich et al., 2010; Rubak et al., 2011; Whittemore et al., 2004). Furthermore, MI interventions often target multiple DM2 self-management behaviors. However, findings indicate counselors should prioritize 1 to 2 behaviors at a time (Armstrong, 2013; Chlebowy et al., 2015; Calhoun et al., 2010; Cinar et al., 2014; Clark et al., 2004; Heinrich et al., 2010; Rubak et al., 2011; Whittemore et al., 2004). Since attitudes towards different DM2 self-management behaviors likely vary, counselors should take sufficient time to address ambivalent attitudes for each behavior.

Immigration status and trust are major barriers to the recruitment and retention of Hispanic adults (Vincent et al., 2013; Wallace & Bartlette, 2013). However, the following cultural and contextual intervention strategies help address these barriers. Consistent with recommendations from Vincent et al. (2013), the PI partnered with a Hispanic bilingual research
assistant (RA), implemented the MI intervention at a convenient and familiar location, offered study materials written in both Spanish and English, and provided a reminder call or text message 1 day before each appointment. Additional strategies included face-to-face recruitment, use of a private room for potential participants to enquire about the project, and the PI built a trusting relationship with site director and administration manager. The site director and manager were provided the PI’s contact information for questions or concerns, and received updates about the progress and acceptability of the project throughout the study.

In addition to the community-based ROP recruitment site, this project included 4 primary care clinic recruitment site locations. The PI attempted to build rapport with clinic staff by providing brief project in-services, provided PI contact information for questions or concerns, brought desserts or bagels during clinic visits, and offered an end of project gift-card raffle for staff members who helped recruit eligible and interested patients into the study. However, multiple contextual barriers resulted in poor recruitment outcomes. The PI was not a clinic employee, clinic contact persons changed due to high staff turnover rates, clinic contact persons were often busy and unavailable, and although staff voiced enthusiasm for the project, many forgot to hand out flyers and blamed the chaotic clinic environment.

**Limitations**

Limitations of this dissertation study should be taken into consideration. The study was a one-group pre-test posttest feasibility study with a small sample size. Results cannot be generalized beyond the population examined. Although the PI was rated as MI proficient by a certified MI trainer prior to the study, MI proficiency was not evaluated during counseling sessions with participants. In addition, this study did not measure objective PA outcomes. Although pedometers and logbooks were provided to participants, most did not log steps walked per day.
Last, although recruitment from the community was a success, many Hispanic women affiliated with the ROP failed to inquire about the study. Participants already somewhat motivated to address health concerns more likely enrolled in the study.

**Future Research**

This dissertation study was a quasi-experimental single-arm design; future research should include more rigorous study designs. Further recommendations include use of a MI treatment fidelity measure during participant sessions, and objective measures of PA. Findings indicate the MITI is a reliable measure of MI fidelity (Pierson et al., 2007), and can be used to evaluate taped MI sessions with participants. Walsh et al. (2016) successfully used a mobile application to measure PA with young adults. Since all participants in the study owned a cellphone, use of a mobile application may be a convenient way to objectively measure PA with Hispanic women. Last, since individual and psychosocial environmental problems such as depression, diabetes distress, and low-health literacy all contribute to poor health outcomes, these problems may be important measures to include for future PA self-management interventions (CDC, 2014b; Zagarins et al., 2012).

**Summary**

Hispanic women with DM2 face alarming health disparities, making successful self-management strategies a priority. The three manuscripts included in this dissertation focused on PA self-management. The manuscripts addressed SEM factors associated with successful PA outcomes, the potential effectiveness of MI for DM2 PA self-management, and the feasibility of MI for Hispanic women with DM2. Results from this dissertation indicate that MI may be a feasible and effective approach for improving PA self-management outcomes for Hispanic women either at risk for or diagnosed with DM2.
References


Appendix A: Instruments Used in Dissertation Study

States of Exercise Behavior Change (Marcus, Selby, Niaura, & Rossi, 1992)

For each of the following questions, please circle True or False. Please be sure to read the question carefully.

- I currently do not exercise and I do not intend to start exercising in the next six months. True/False
- I currently do not exercise, but I am thinking about starting to exercise in the next six months. True/False
- I currently exercise some but not regularly. True/False
- I currently exercise regularly, but I have only begun doing so in the last six months. True/False
- I currently exercise regularly and have done so for longer than six month. True/False

Permission:

From: Conner, Kathryn (kcconner@ucsd.edu)
Sent: 8/13/15 at 8:41 AM
To: psoderlund@ucla.edu
Subject: Physical Activity Scale – PERMISSION GRANTED

Dr. Marcus grants you permission to use the physical activity scale and also requests that if you would please, keep her posted about the findings of your work. There is no fee associated with using the scale.

Kind regards,
kathe

Kathryn Conner
Executive Assistant | Office of Department Chair
Department of Family Medicine & Public Health

Dear Dr. Marcus,
I am a PhD candidate from the Medical University of South Carolina, and I currently work at UCLA. This fall I will be conducting a pilot study for Latina women diagnosed with diabetes type 2 and I would like to know if I could use the physical activity stages of change scale you developed (see below). If so, please let me know if there is a fee associated with using your scale. Thank you for your help.
Best regards,
Patty
### Rapid Assessment of Physical Activity (University of Washington, 2006)

**How physically active are you?** *(Check one answer on each line)*

<table>
<thead>
<tr>
<th></th>
<th>Does this accurately describe you?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) I rarely or never do any physical activities.</td>
<td>Yes</td>
</tr>
<tr>
<td>2) I do some <strong>light</strong> or <strong>moderate</strong> physical activities, but not every week.</td>
<td>Yes</td>
</tr>
<tr>
<td>3) I do some <strong>light</strong> physical activity every <strong>week</strong>.</td>
<td>Yes</td>
</tr>
<tr>
<td>4) I do <strong>moderate</strong> physical activities every week, but less than 30 minutes a day or 5 days a week.</td>
<td>Yes</td>
</tr>
<tr>
<td>5) I do <strong>vigorous</strong> physical activities every week, but less than 20 minutes a day or 3 days a week.</td>
<td>Yes</td>
</tr>
<tr>
<td>6) I do 30 minutes or more a day of <strong>moderate</strong> physical activities, 5 or more days a week.</td>
<td>Yes</td>
</tr>
<tr>
<td>7) I do 20 minutes or more a day of <strong>vigorous</strong> physical activities, 3 or more days a week.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Scoring Instructions, RAPA:**

**Score as sedentary:**

1. I rarely do any physical activities

**Score as under-active:**

2. I do some light or moderate physical activities

**Score as under-active regular – light activities:**

3. I do some light physical activity every week.
Score as under-active regular:

4) I do moderate physical activities every week, but less than 30 minutes a day or 5 days a week.
5) I do vigorous physical activities every week, but less than 20 minutes a day or 3 days a week.

Score as active:

6) I do 30 minutes or more a day of moderate physical activities, 5 or more days a week.
7) I do 20 minutes or more a day of vigorous physical activities, 3 or more days a week.

Permission:

Permission to use the Rapid Assessment of Physical Activity scale was granted by Kristen Hammerback, Research Scientist/Program Development at University of Washington in August 2015. To verify permission granted, contact Kristin either by email or phone provided below.

Kristen Hammerback, khammerb@uw.edu (206-616-3146)
Appendix B: IRB Approvals and Forms used in Dissertation Study
Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Harborview Office Tower
19 Hagood Ave., Suite 601, MSC857
Charleston, SC 29425-8570
Federal Wide Assurance # 1888

APPROVAL:
This is to certify that the research proposal Pro00045001 entitled:
Investigation of Motivational Interviewing Sessions to Address Health Disparities with Low-Income Hispanic Women with Diabetes Type 2 (DM2)

Submitted by: Patricia Soderlund
Department: Medical University of South Carolina

for consideration has been reviewed by IRB-I - Medical University of South Carolina and approved with respect to the study of human subjects as adequately protecting the rights and welfare of the individuals involved, employing adequate methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. No IRB member who has a conflicting interest was involved in the review or approval of this study, except to provide information as requested by the IRB.

Original Approval Date: 8/27/2015
Approval Expiration: 8/26/2016

Type: Expedited

Chair, IRB-I - Medical University of South Carolina
Mark Hamner

Statement of Principal Investigator:
As previously signed and certified, I understand that approval of this research involving human subjects is contingent upon my agreement:

1. To report to the Institutional Review Board for Human Research (IRB) any adverse events or research related injuries which might occur in relation to the human research. I have read and will comply with IRB reporting requirements for adverse events.
2. To submit in writing for prior IRB approval any alterations to the plan of human research.
3. To submit timely continuing review reports of this research as requested by the IRB.
4. To maintain copies of all pertinent information related to the research activities in this project, including copies of informed consent agreements obtained from all participants.
5. To notify the IRB immediately upon the termination of this project, and/or the departure of the principal investigator from this Institution and the project.

*Electronic Signature: This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.
Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Harborview Office Tower
19 Hagood Ave., Suite 601, MSC857
Charleston, SC 29425-8570
Federal Wide Assurance # 1888

APPROVAL:

This is to certify that the research proposal Pro00045001 entitled:
Investigation of Motivational Interviewing Sessions to Address Health Disparities with Hispanic Women at risk for or diagnosed with Diabetes Type 2

submitted by: Patricia Soderlund
Department: Medical University of South Carolina
Review for Pro00045001

for consideration has been reviewed by the IRB and approved with respect to the study of human subjects as adequately protecting the rights and welfare of the individuals involved, employing adequate methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. No IRB member who has a conflicting interest was involved in the review or approval of this study, except to provide information as requested by the IRB.

Continuing Review Approval Date: 8/23/2016
Approval Expiration: 8/22/2017

Type: Expedited

Vice Chairman, IRB-I - Medical University of South Carolina
• Susan Newman, PhD, RN, CRRN

Statement of Principal Investigator:

As previously signed and certified, I understand that approval of this research involving human subjects is contingent upon my agreement:

1. To report to the Institutional Review Board for Human Research (IRB) any adverse events or research related injuries which might occur in relation to the human research. I have read and will comply with IRB reporting requirements for adverse events.
2. To submit in writing for prior IRB approval any alterations to the plan of human research.
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• Electronic Signature: This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.
Medical University of South Carolina
CONSENT TO BE A RESEARCH SUBJECT
[Motivational Interviewing to address Health Disparities for Latina/Hispanic Women either at risk for or Diagnosed with Diabetes Type 2: A Feasibility Study]

A. PURPOSE AND BACKGROUND:

You are being asked to volunteer for a research study. This research is sponsored by the Medical University of South Carolina. The purpose of this study is to help determine if motivational interviewing techniques can help increase physical activity with Latina/Hispanic women diagnosed with diabetes type 2. You are being asked to participate in this study because you are a Latina/Hispanic female at risk for or diagnosed with diabetes type 2. The nurse researcher in charge of this study is Patricia Davern Soderlund an advanced practice registered nurse. This study is being performed at community centers, regional occupational program learning centers, and primary care clinics in Southern California and will involve approximately 15 volunteers.

B. PROCEDURES:

If you agree to be in this study, the following will happen:

1. You will meet with the nurse researcher to obtain details about the purpose and duration of the study, and informed consent will be obtained from you if you agree to participate.
2. If you agree to participate and sign the informed consent, the nurse researcher will ask you to answer questions about your health, and physical activity habits. During the first visit, basic demographic questions will include your age, marital status, ethnicity, number of children, English proficiency, primary language spoken at home, health insurance status, length of diabetes diagnosis, education attainment, and work status. In addition, you will be asked to answer questions about your current levels of physical activity. The nurse researcher will then ask to measure your waist circumference, and you will receive a pedometer to monitor the number of steps you walk each day. You will be taught how to use the pedometer and will be given a log to keep track of your steps walked per day. After you answer the questions, have your waist circumference measured, and learn how to use the pedometer, you will be asked to attend 2 Motivational Interviewing and Physical Activity counseling sessions. Motivational interviewing is a
communication approach designed to explore behavior change. During the interview you will be asked about your current levels of physical activity, whether or not you think you engage in enough physical activity, and if relevant any barriers to physical activity.

3. Motivational Interviewing and Physical Activity Counseling sessions will last about 30 minutes each. The interview sessions will be scheduled with the nurse researcher at convenient times for you. The first motivational interviewing and physical activity counseling session will be scheduled within 2 weeks of your first meeting at the clinic, and the second will be scheduled 1 month after the first session. During the sessions you will be asked questions about your current levels of physical activity, and whether or not you would like to increase your amount of daily walking. We will review reasons for and against increased walking behaviors, and determine if you would like to set a daily walking goal to help improve your health.

4. At the end of the research project (2 months after starting the project), you will be asked to answer questions in person at the clinic about your levels of physical activity, hand in your physical activity log, and have your waist circumference measured.

**C. DURATION:**

Participation in the study will take place over a period of 2 months. You will be asked to attend a total of 3 visits with the nurse researcher at your clinic. The first two visits will include a 30 minute Motivational Interviewing and Physical Activity counseling session with the nurse researcher. In addition, you will be asked to complete questionnaires and have your waist circumference measured at the first visit when the study begins and at the last visit when the study ends. The first visit will take approximately 1 hour, the second will take about 30 minutes, and the last visit will take about 15 minutes.

**D. RISKS/DISCOMFORTS:**

The physical, psychological, and social risks associated with this study are minimal.

1. Physical: The treatment you receive may prove to be less effective or to have more side effects than the other study treatment(s) or
other available treatments. You may experience physical discomfort associated with increased levels of physical activity. If you increase your level of physical activity too quickly you may experience soreness in your muscle and/or joints, or cause more serious injury. If this occurs, you can decrease the frequency and amount of your activity, or decide to withdraw from the study. Increased PA could lead to hypoglycemia, if changes in blood sugar are detected you are advised to contact your primary care provider. In case you experience significant discomfort or injury, Ms. Soderlund will provide you with contact information to local health care service prior to the start of the study. In addition participants will be advised to walk in safe areas during daylight hours, and encouraged to walk with a partner.

2. Psychological: You may experience uncomfortable thoughts and/or feelings when discussing or answering questions related to your health. If this occurs, you can choose not to discuss a topic, answer a question/questions, or withdraw from the study. If you prefer to discuss your uncomfortable thoughts or feelings, Ms. Soderlund can provide you with contact information of local counselors to help assist with your concerns.

3. Confidentiality: There is potential risk associated with the breach of confidentiality and the information collected from you. To minimize this risk, your name and any identifying details (such as address and phone number) will be replaced with an ID number, and this ID number will be associated with the data collected about you. When information about the study is reported, you will not be identified.

E. BENEFITS:

The potential benefit to you is that the interview may help motivate you to increase your levels of physical activity, and thus help you manage your diabetes. However, this benefit cannot be guaranteed.

F. COSTS:

You will not be charged for participating in this study.

G. PAYMENT TO PARTICIPANTS:
In return for your time and effort, you will be paid up to $45 for completing study measures.

- $15 gift card after completing questionnaires at baseline
- $15 gift card after MI session 2
- $15 gift card after completing questionnaires at 2 months

If you do not complete the study, you will receive a gift card for each time you complete questionnaires.

In addition, you will receive a $10 Target Card for each interested and eligible patient you help to recruit into the study. Newly enrolled patients will be asked how they heard about the study. If the newly enrolled participant states your name, the PI will contact you by phone to let you know you will receive an additional $10 Target Card. You will be given the option to pick up the card at the clinic, or have it mailed to your home address.

Payments that you receive from MUSC for participating in a research study are considered taxable income per IRS regulations. Payment types may include, but are not limited to: checks, cash, gift certificates/cards, personal property, and other items of value. If the total amount of payment you receive from MUSC reaches or exceeds $600.00 in a calendar year, you will be issued a Form 1099.

**H. ALTERNATIVES:**

You may have heard about this study at a community center, regional occupational program learning center, or at your primary care clinic. If you choose not to participate in this study, your decision will not impact your relationship with your community center, your enrollment or grades at your learning center, or treatment you have been receiving from your primary care clinic. You will continue to receive standard treatment you have been receiving from your primary care doctor. Standard diabetes treatment includes regular check-up appointments, education related to diet and exercise, and medication and insulin therapy management as needed.

Results of this research will be used for the purposes described in this study. This information may be published, but you will not be identified. Information that is obtained concerning this research that can be identified with you will
remain confidential to the extent possible within State and Federal law. The investigators associated with this study, the sponsor, and the MUSC Institutional Review Board for Human Research will have access to identifying information. All records in South Carolina are subject to subpoena by a court of law.

In the event that you are injured as a result of participation in this study, you should immediately go to the emergency room closest to you, or in case of an emergency go to the nearest hospital, and tell the physician on call that you are in a research study. They will call your doctor who will make arrangements for your treatment. If the study sponsor does not pay for your treatment, the Medical University Hospital and the physicians who render treatment to you will bill your insurance company. If your insurance company denies coverage or insurance is not available, you will be responsible for payment for all services rendered to you.

Your participation in this study is voluntary. You may refuse to take part in or stop taking part in this study at any time. You should call the investigator in charge of this study if you decide to do this. Your decision not to take part in the study will not affect your current or future medical care or any benefits to which you are entitled.

The investigators and/or the sponsor may stop your participation in this study at any time if they decide it is in your best interest. They may also do this if you do not follow the investigator’s instructions.

Volunteers Statement

I have been given a chance to ask questions about this research study. These questions have been answered to my satisfaction. If I have any more questions about my participation in this study or study related injury, I may contact Patricia Soderlund at (949) 547-6510. I may also contact the Medical University of SC Hospital Medical Director (843) 792-9537 concerning medical treatment.

If I have any questions, problems, or concerns, desire further information or wish to offer input, I may contact the Medical University of SC Institutional Review Board for Human Research IRB Manager or the Office of Research Integrity Director at (843) 792-4148. This includes any questions about my rights as a research subject in this study.

I agree to participate in this study. I have been given a copy of this form for my own records.
If you wish to participate, you should sign below.

Signature of Person Obtaining Consent

Date

Signature of Participant

Date
Are you a Latina/Hispanic woman at risk for or diagnosed with Diabetes Type 2?

Patricia Soderlund is a Nurse Researcher from the Medical University of South Carolina is doing a Self-Management Research study. This project is for research, and will have no impact on any current treatment you are receiving.

Participants will receive: The study will be at your primary care clinic location and:
- a pedometer (at no cost)
- compensation in the form of Gift Cards
- involves answering survey questions
- 2 brief interviews

You may be eligible to participate if you are a Latina/Hispanic Woman either at risk for or diagnosed with Diabetes Type 2 who:
- is between 18 and 69 years old
- speaks and reads basic English
- approved by your medical provider to engage in mild to moderate exercise

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IRB Number: Pro00045001
Date Approved 2/25/2016
Approval Request: Motivational interviewing sessions for Hispanic women diagnosed with diabetes type 2

Patricia Soderlund is an advanced practice registered nurse and PhD candidate from the Medical University of South Carolina, and will be conducting a pilot study to help determine if Motivational Interviewing (MI) sessions in the community care setting is a feasible approach for increasing levels of physical activity for low-income Hispanic women. Participants will be randomized into two arms, an intervention group (MI and PA counseling session, n=15), and a control group (usual care, n=15). The total duration for recruitment and study procedures will take approximately 4 months. Results from this pilot study will determine if larger definitive trials using MI with Hispanic women are warranted, and if modifications are needed.

MI is a brief easily learned technique that nurtures a collaborative partnership between the patient and healthcare provider (Rollnick, Miller, & Butler, 2008). MI techniques help patients overcome ambivalent attitudes towards behavior change, and can evoke one’s own motivation and resources for behavior change (Rollnick, Miller, & Butler, 2008). Patricia received advanced training in Motivational Interviewing from a Network Trainer (MINT) this summer, 2015.


Request from Lestonnac Clinics:

- A private room to conduct x2 motivational interviewing sessions (30 minutes each) for n=15 Hispanic women diagnosed with diabetes type 2
- To hang and hand out flyers to interested and potentially eligible participants at your clinic
- A private room for participants in both the Motivational Interviewing and usual care group (n=30) to fill out a demographic form, x2 brief questionnaires, and to have their waist circumference measured at baseline and the 3 month follow-up time
- Participants will receive two $15 Gift Cards, and a pedometer

Lestonnac Clinic Executive Director Signature request:

A signature from the Executive Director indicates Patricia Soderlund has received approval to conduct the MI pilot study for Hispanic women at Lestonnac Clinics.

Signature: [Signature]

Date: 5/6/15
Approval Request: Self-management intervention for Latina women at risk for or diagnosed with diabetes type 2

I am a nurse PhD candidate from the Medical University of South Carolina conducting a small self-management research project for Latinas at risk for or with diabetes type 2 (DM2). A total of 10 women are needed for the project. Women who want to participate will receive a brief DM2 self-management intervention and will be asked to fill out brief questionnaires related to self-management. Participants will receive a pedometer and three $15 gift cards for participating. I am also working with a bilingual research associate who will help hand out flyers and provide interpreter services for Latinas with limited English.

Request from Program Supervisor/Director:

- To hand out flyers
- Use of a room to conduct the self-management intervention and for women to fill out questionnaires to fill out questionnaires.

Approval Signature from Program Supervisor/Director:

Signature: [Signature] Date: 6-30-16