Review of Motivational Interviewing in promoting health behaviors☆☆

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A B S T R A C T

There is considerable evidence for the effectiveness of Motivational Interviewing (MI) in the treatment of substance abuse, as well as a number of other health behavior areas. The present paper summarizes and critically reviews the research in three emerging areas in which (MI) is being applied: diet and exercise, diabetes, and oral health. Although 10 prior reviews focused in part on MI studies in the areas of diet, exercise, or diabetes, the present paper provides an up-to-date review, and includes oral health as another emerging area of MI research. Overall, 37 articles were reviewed: 24 in the areas of diet and exercise, 9 in the area of diabetes, and 4 in the oral health area. Research in these areas suggests that MI is effective in all these health domains, although additional research is needed, particularly in the oral health arena. Specifically, future research in the areas of diet and exercise should examine the clinical utility of MI by health care professionals (other than dietitians), studies in the area of diabetes should continue to examine long-term effects of MI on glycemic control, and research in the area of oral health should focus on developing additional trials in this field. Further, future studies should demonstrate improved research methodology, and investigate the effects of possible outcome mediators, such as client change talk, on behavior change.

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1. Introduction

Motivational Interviewing (MI) has been applied to a number of areas of behavioral change, and is best known for applications in the realm of substance abuse. MI has been utilized in several health arenas with promising results, for example, among individuals with HIV, to reduce risky behaviors, and to reduce substance abuse and improve HIV medication adherence (e.g., Parsons, Rosof, Punzalan, & Di Maria, 2005). This paper will provide a brief overview of MI and will evaluate empirical studies testing the effectiveness and clinical utility of MI in...
three health areas: diet and exercise, diabetes, and oral health. Further, suggestions to guide future research are provided.

1.1. Description of Motivational Interviewing

Miller and Rollnick (2002) defined MI as a client-centered, “directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence” (p. 25). MI is a directive psychosocial intervention used to identify and resolve discrepancies between desired behaviors and actual behaviors, and to increase motivation to facilitate behavior change (Miller & Rollnick, 2002). Concepts such as reflective listening are balanced with a directive approach. The “spirit” (Miller & Rollnick, 2002; p. 34) of MI includes principles of collaboration, evocation (of motivation from the client herself), and client autonomy.

MI consists of two phases. During phase one, intrinsic motivation for change is enhanced whereas in phase two, commitment to change is strengthened (Miller & Rollnick, 2002). The goal of MI is to strengthen the importance of change from the patient’s perspective (Burke, Arkowitz, & Menchola, 2003), using four basic principles to enhance motivation: (a) expression of empathy, (b) development of discrepancy, (c) rolling with resistance, and (d) the support of self-efficacy (Miller & Rollnick, 2002). Discrepancy is developed between desired behaviors and actual behaviors. The patient presents reasons for change while the facilitator provides support. Alternately, if the patient is resistant to change, the facilitator “rolls” with it instead of fighting against it. If and when the patient is ready to initiate a change, the facilitator supports that decision (Miller & Rollnick, 2002).

MI involves a client-centered approach to consultation. MI adheres to the concept that behavior change is not the sole responsibility of the patient, but is a shared endeavor. Practitioners are in a unique position to either enhance the client’s motivation to change or to contribute to resistance (Rollnick, Mason, & Butler, 2002). Traditionally, in health care settings, recommendations for behavior change are delivered through brief advice-giving in which overt recommendations are provided (Hergtiae & Sefi, 1992; Rollnick et al., 2002). MI challenges traditional intervention delivery methods by suggesting that patients know what is best for themselves, and that professionals should work with them to determine what behavior change strategies will work best, while acknowledging freedom of choice. A menu of choices is one way in which recommendations can be given while maintaining the patient’s freedom of choice (Rollnick et al., 2002).

1.2. Past reviews and meta-analyses

Ten prior reviews, which have focused at least in part on diet, exercise, or diabetes, have been published, and are presented chronologically. A review of studies focused on MI in the oral health arena has not been published. Each presented review includes studies that met certain requirements of methodological rigor, individually administered MI, and adaptations of MI in a variety of health areas.

Brief MI interventions in the areas of substance abuse, smoking, HIV risk behaviors, and diet and exercise were reviewed by Dunn, DeRoo, and Rivara (2001). There were 29 studies reviewed that delivered MI face-to-face, included MI monitoring, random assignment, inclusion of a control group, and measurement of behavioral and/or health outcomes. Dunn and colleagues reported support for MI in the areas of substance abuse, and diet and exercise, smoking cessation and HIV risk reduction, with effect sizes (i.e., Hedge's g) ranging from .23 to 2.17. Among the areas reviewed, diet and exercise demonstrated the most significant effects whereas the most modest effects were found in the area of smoking cessation.

Burke, Arkowitz, and Dunn (2002) examined 26 studies in which interventions based on MI principles were delivered individually and face-to-face. The meta-analysis found small to moderate effect sizes (i.e., $d = .25$ to .57) when MI was compared to no treatment or treatment as usual for substance abuse, as well as diet and exercise; support for MI for smoking cessation and reduction of HIV-risk behaviors, however, was more modest.

Burke et al. (2003) conducted a meta-analysis of 30 controlled clinical trials to examine the effectiveness of adaptations of MI (AMIs) in the areas of alcohol abuse, smoking cessation, drug addiction, HIV-risk behaviors, treatment adherence, and diet and exercise. Criteria for inclusion in the meta-analysis included using an intervention based on MI principles, and MI being delivered to an individual. AMIs were determined to be as effective as other treatments, and more effective than no-treatment or placebo controls, in the areas of alcohol, drugs, and diet and exercise. As in the review the year before, however, there was contradictory evidence in the areas of smoking cessation and HIV-risk behaviors.

VanWormer and Boucher (2004) conducted a meta-analysis of 38 studies examining the effectiveness of AMIs in the areas of alcohol problems, drug addiction, smoking cessation, HIV-risk behaviors, diet and exercise, treatment compliance, eating disorders, asthma management, and injury-risk behaviors. AMIs were found to be as effective as other general interventions and yielded moderate effect sizes (i.e., $d = .35$ to .56) in areas such as substance abuse, as well as diet and exercise.

Hettema, Steele, and Miller (2005) reviewed studies examining the effectiveness of MI in the areas of alcohol, smoking, HIV/AIDS, drug abuse, treatment compliance, gambling, intimate relationships, water purification/safety, eating disorders, and diet and exercise. There were 72 articles included in which a group or individual intervention with components of MI was delivered, a posttreatment outcome measure was included, a control or comparison group was present, and a procedure to determine the pretreatment equivalence of groups was utilized. Hettema, Steele, and Miller (2005) reported a range of effect sizes (i.e., $g = .30$ to .77) across MI studies, which suggest medium to large effects. Interestingly, effect sizes were found to be higher when MI was used with Native Americans; however, similar findings were not found when MI was used with African Americans or Hispanic Americans. Also, higher effect sizes were noted when sessions were not guided by a manual.

Rubak, Sandbaek, Lauritzen, and Christensen (2005) performed a meta-analysis to examine the effectiveness of MI across 72 randomized, controlled studies in a variety of health areas, including diet and exercise, diabetes, and substance abuse. A significant effect of MI was demonstrated in 74% of the studies reviewed. Among studies with MI sessions that lasted 60 minutes, 81% showed an effect. Rubak, Sandbaek, Lauritzen and Christensen (2005) suggest that the likelihood of an effect was positively correlated with the number of encounters and with a prolonged follow-up period. Overall, MI was found to outperform traditional advice-giving in 75% of studies reviewed. Of the studies that targeted diet and exercise, diabetes, asthma, or smoking, 72% demonstrated an effect. Smoking studies yielded an effect in 67% of those reviewed, whereas diabetes, asthma, and diet and exercise studies reported an effect in 77% of the studies reviewed (Rubak et al., 2005).

Knight, McGowan, Dickens, and Bundy (2006) discussed eight studies in the fields of diabetes, asthma, hypertension, hyperlipidemia, and heart disease in a systematic review of MI in physical health care settings. Three studies were in the area of diabetes (e.g., Channon, Smith, & Gregory, 2003), one in the area of asthma (e.g., Schmaling, Blume, & Afari, 2001), one in the area of hypertension (e.g., Woolard et al., 1995), one in the area of hyperlipidemia (e.g., Mhurchú, Margetts, & Speller, 1998), and two in the area of heart disease (e.g.,
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<td>Bennett, Young, Nail, Winters-Stone, and Hanson (2008)</td>
<td>72</td>
<td>Physically inactive adults who stated they were ready to increase physical activity</td>
<td>Motivational interviewing (35), Control (37)</td>
<td>Monthly MI telephone calls over six months — one 30-minute and four 15-minute calls</td>
<td>Audiotapes were randomly selected and coded using MITI</td>
<td>16%</td>
<td>6 months</td>
<td>Adults in the MI group reported significantly increased self-efficacy for exercise compared to the control group. Changes in physical activity were not significant.</td>
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<td>Befort et al. (2008)</td>
<td>33</td>
<td>Obese African American women</td>
<td>Weight loss program and motivational interviewing (14), Weight loss program and health education (19)</td>
<td>16 weekly group behavioral weight loss program sessions</td>
<td>Four 30-minute individual MI sessions — two contacts via phone and two in-person</td>
<td>25% of tapes were randomly selected and reviewed during weekly supervision</td>
<td>23%</td>
<td>16 weeks</td>
<td>Significant decreases in daily calories and weight, and significant increases in fruit and vegetable intake were reported in both groups; however, no significant differences were noted between groups. Women in both groups reported significantly reduced motivation and self-efficacy for diet and exercise.</td>
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<td>Greaves et al. (2008)</td>
<td>141</td>
<td>Adults with BMI of 28 kg/m² or more</td>
<td>Intervention (68), Control (69)</td>
<td>Dietary and physical activity recommendations</td>
<td>Up to 11 individual, face-to-face or telephone sessions, with a mean of 34 minutes per contact</td>
<td>BECCI was used to determine treatment fidelity of sessions with an actor</td>
<td>18%</td>
<td>6 months</td>
<td>A significantly higher proportion of those in the intervention group achieved 5% weight loss compared to those in the control group. No other significant differences between groups were noted.</td>
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<td>Hardcastle, Taylor, Bailey, and Castle (2008)</td>
<td>218</td>
<td>Adults ages 18 to 65 at risk for coronary heart disease</td>
<td>Counseling intervention (AMI) (125), Control group (93)</td>
<td>Exercise and nutrition leaflet</td>
<td>Up to five 20 to 30-minute AMI sessions</td>
<td>Review of audiobooks and monthly consultation meetings</td>
<td>35%</td>
<td>6 months</td>
<td>A significant increase in physical activity was noted in the intervention group compared to the control group. A significant decrease in BMI was observed in the intervention group compared to the control group. Both groups reported significantly increased fruit and vegetable intake and reduced fat intake.</td>
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<tr>
<td>Webber, Tate, and Quintiliani (2008)</td>
<td>18</td>
<td>Women ages 22 to 65</td>
<td>Online motivational interviewing group (9), Online motivational interviewing group with values discussion (9)</td>
<td>Behavioral weight loss lessons via email</td>
<td>Two 1-hour online MI sessions</td>
<td>N/A</td>
<td>10%</td>
<td>8 weeks</td>
<td>Participants in both groups reported a significant decrease in weight; however, no differences between groups were noted.</td>
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<td>Ahluwalia et al. (2007)</td>
<td>173</td>
<td>Smokers in Section 8 housing developments</td>
<td>Fruit and vegetable (FV) (107), Smoking cessation (SC) (66)</td>
<td>FV: cookbook, a FV video, bag of FV, diet educational materials, SC: nicotine gum, educational materials</td>
<td>Up to five sessions for each group</td>
<td>Weekly supervision and review of a subset of select session audiotapes using MISC</td>
<td>24%</td>
<td>3, 5, 20 weeks</td>
<td>Significantly greater fruit and vegetable consumption was noted in the FV group than in the SC group.</td>
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<tr>
<td>Bennett, Lyons, Winters-Stone, Nail, and Sherer (2007)</td>
<td>56</td>
<td>Physically inactive adult cancer survivors</td>
<td>Motivational interviewing (28), Control (28)</td>
<td>None</td>
<td>One 30-minute session and two follow up telephone calls</td>
<td>Review of select session audiotapes</td>
<td>14%</td>
<td>3, 6 months</td>
<td>A significant increase in physical activities was noted in the MI group compared to the control group. Participants who received MI lost significantly more weight and engaged in more physical activity than those who did not.</td>
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<td>Carels et al. (2007)</td>
<td>55</td>
<td>Obese, sedentary adults</td>
<td>Behavioral weight loss program (27), Behavioral weight loss program with stepped care (28), of which 19 received MI</td>
<td>None</td>
<td>46 to 60 minutes sessions provided to participants in the behavioral weight loss program with stepped care who failed to meet their weight loss goals</td>
<td>Randomly selected 20-minute audiotapes of sessions were evaluated using MITI</td>
<td>16%</td>
<td>3, 6, 12, 18 weeks</td>
<td>MI and Team reported increased fruit and vegetable consumption, reduced weight gain, and increased number of sit-ups in 1 minute.</td>
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<tr>
<td>Elliot et al. (2007)</td>
<td>599</td>
<td>Firefighters</td>
<td>Individual motivational interviewing (202), Team-centered curriculum (234), Control (163)</td>
<td>MI and Team received Firefighters’ Health &amp; Fitness Guide; control received test results only</td>
<td>Written field notes were compared to the protocol</td>
<td>MI and Team reported increased fruit and vegetable consumption, reduced weight gain, and increased number of sit-ups in 1 minute.</td>
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<td>Perry, Rosenfeld, Bennett, and Potempa (2007)</td>
<td>46</td>
<td>Rural women</td>
<td>Heart to Heart (HTH) with MI (23), Control (23)</td>
<td>Weekly 1-hour group walk for women in HTH</td>
<td>weekly 10-minute follow up telephone calls</td>
<td>9%</td>
<td>12 weeks</td>
<td>A significant increase in walking distance and social support was noted in the HTH with MI group, but not in the control group.</td>
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<td>Schwartz et al. (2007)</td>
<td>91</td>
<td>Children with one parent</td>
<td>Minimal intervention (40), Intensive intervention (30), Control (21)</td>
<td>None</td>
<td>Parents in the minimal intervention received one MI session; Parents in the intensive intervention received two MI sessions*</td>
<td>One or two of the first MI sessions were audiotaped and evaluated to provide feedback and MI coaching MISC was used by an independent coder to evaluate MI proficiency</td>
<td>33%</td>
<td>1, 3, 6 months</td>
<td>A decrease in mean BMI was noted in all groups; however, significant differences were not noted between groups.</td>
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<td>Butterworth, Linden, McClay, and Leo (2006)</td>
<td>239</td>
<td>Adults in Employee Wellness Program</td>
<td>Treatment (121), Control (118)</td>
<td>Employee Wellness Program</td>
<td>At least one 30-minute initial MI session and two follow-up contacts; participants determined actual number of sessions received</td>
<td></td>
<td>13%</td>
<td>3 months</td>
<td>Self-reported mental health status and function significantly improved after the treatment; however, improvement in physical health status and function was not significant; control group did not show significant differences at follow-up.</td>
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<td>Fuemmeler et al. (2006)</td>
<td>889</td>
<td>Adults who attend church</td>
<td>Body and Soul Intervention with peer counseling based on MI (561), Control (328)</td>
<td>Healthy eating self-help materials (e.g., cookbook, video)</td>
<td>One session* and two 20–30 minute telephone calls “Process evaluation”</td>
<td>N/A</td>
<td>28%</td>
<td>4 months</td>
<td>Fruit and vegetable intake was significantly increased more among students in the intervention group compared to the control group.</td>
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<tr>
<td>Richards, Kattelmann, and Ren (2006)</td>
<td>437</td>
<td>18 to 24 year-old rural college students</td>
<td>Intervention (157), Control (157)</td>
<td>None</td>
<td>Personalized letter tailored to stage of change, one motivational interviewing session*, and a minimum of two email contacts</td>
<td>N/A</td>
<td>35%</td>
<td>5 months</td>
<td>A significant increase in energy expenditure was noted in the standard care and MI, and the MI groups; energy expenditure decreased in the standard care group. All groups demonstrated significant increases in walking distances at follow-up, but no differences between groups were noted.</td>
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<tr>
<td>Brodie and Inoue (2005)</td>
<td>60</td>
<td>Patients with chronic heart failure ages 65+</td>
<td>Standard care and MI (20), Standard care (18), Motivational interviewing (22)</td>
<td>None</td>
<td>Eight one-hour sessions</td>
<td>N/A</td>
<td>14%</td>
<td>1 year</td>
<td>Significant increase in fruit and vegetable intake was noted in all three groups. Adults in the self-help and the self-help and MI groups reported significantly greater intake than control group; however, the self-help group did not differ significantly from the self-help with MI group.</td>
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<td>Resnicow, Jackson, et al. (2005)</td>
<td>906</td>
<td>Adults who attend church</td>
<td>Standard education materials/Control (267), Self-help (335), Self-help and MI (304)</td>
<td>Self-help materials including nutrition video, cookbook, exercise video, exercise guide, pedometer, and workout cassette: health fair</td>
<td>Four MI telephone calls*</td>
<td>12 hours ongoing individual/group supervision</td>
<td>16%</td>
<td>6 months, 1 year</td>
<td>No significant differences in BMI, weight, measurements, blood pressure, and glucose levels were noted at follow-up.</td>
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<td>Resnicow, Taylor, Baskin, McCarty (2005)</td>
<td>123</td>
<td>Adolescents ages 12–16 with BMI above the 90th percentile Firefighters</td>
<td>High-intensity intervention (53), Moderate-intensity intervention/Control (70)</td>
<td>Weekly group behavioral sessions, healthy messages delivered via paging device</td>
<td>Four to six 20 to 30 minute MI telephone calls over six months</td>
<td>N/A</td>
<td>0%</td>
<td>6 months</td>
<td>Firefighters in both the team-based and individual interventions demonstrated significant reductions in cholesterol compared to the control group. Those in the individual intervention group reported significantly reduced fat intakes, whereas those in the team-based intervention reported a significant increase in physical activity. Neither intervention affected fruit and vegetable intake.</td>
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<td>Elliot et al. (2004)</td>
<td>33</td>
<td>Firefighters</td>
<td>Team-based curriculum (12), Individual-oriented intervention/MI (10), Control (11)</td>
<td>Firefighters’ Health and Fitness Guide</td>
<td>Four sessions up to 60 minutes each and a negotiated number of additional telephone or in-person contacts</td>
<td>25 of 40 audiotapes were coded using MISC</td>
<td>10%</td>
<td>6 months</td>
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<td>Study</td>
<td>Participants</td>
<td>Intervention Details</td>
<td>Outcomes</td>
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<td>Resnicow et al. (2004)</td>
<td>854 Adults who attend church</td>
<td>Body and Soul Intervention (8 churches), Control (8 churches) Cookbook and educational materials 1+ MI telephone callsa</td>
<td>Review and coding of audiotapes by experienced MI staff 16% 6 months Intervention participants reported significantly greater fruit and vegetable intake and reduced percentage of calories from fat compared to those in the control group. Further, significant increases in intrinsic and extrinsic motivation, self-efficacy, and social support to eat more fruits and vegetables were reported by those in the intervention group.</td>
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<td>Bowen et al. (2002)</td>
<td>175 Women 60+</td>
<td>Women’s Health Initiative’s standard dietary modification intervention/Control (88), Women’s Health Initiative’s standard dietary modification intervention with MI (87) WHI group dietary intervention Three contactsa “Feedback and discussion” N/A 1 year A significant decrease in consumption of energy from fat was noted in the intervention with MI group. Further, women in this group completed more fat scores and attended more intervention session than women in the control group.</td>
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<td>Resnicow et al. (2001)</td>
<td>861 Adults who attend church</td>
<td>Nutritional education (316), Self-help intervention with one cue call (278), Self-help intervention with one cue call and 3 MI calls (267) One MI session (105), One MI session plus incentive (106), Up to six MI sessions (104) Up to six MI sessions plus incentive (103), Control (105) Healthy eating video, cookbook, and printed education materials (e.g., newsletter) Three MI telephone calls, lasting a mean of 11 to 15 minutes each At least two telephone calls were observed before counselor certification N/A 1 year Significant increases in fruit and vegetable intake were reported by the group that received 3 MI calls. No significant changes were noted in other groups.</td>
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<td>Harland et al. (1999)</td>
<td>523 Adults ages 40 to 64</td>
<td>40 minutes each 30 leisure center vouchers as the incentive</td>
<td>N/A 15% 12 weeks, 1 year Participants in the intensive MI and incentive group reported the highest proportion of increased physical activity compared to other groups. Significant improvement in physical activity was shown in the intervention groups compared to the control group; however, no significant differences between intervention groups were noted.</td>
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<td>Berg-Smith et al. (1999)</td>
<td>127 Adolescents in the Dietary Intervention Study in Children (DISC)</td>
<td>DISC motivational intervention (127) None Three sessionsa Monthly case conferences, roleplay practice, and review of intervention strategies N/A 1-3 months A decrease in the mean proportion of calories from fat and consumption of dietary cholesterol was noted in the intervention group</td>
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<td>Mhurchú et al. (1998)</td>
<td>97 Patients with hyperlipidaemia</td>
<td>Standard intervention (50), Motivational intervention (47) None Three sessions, lasting a mean of 1 hour, 42 minutes Development and use of coding system to determine if interventions were different N/A 20% 12 weeks Significant reductions in total and saturated fat intake, and energy intake from fat were reported in both groups at 12 weeks; differences were not noted between groups.</td>
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Note: N/A, Information not available; BECCI = Behaviour Change Counseling Index; MITI = Motivational Interviewing Treatment Integrity; BMI = Body Mass Index.

a Length of session was not reported.
McHugh et al., 2001). Overall, the authors reported positive results for the effects of MI on outcomes in the areas reviewed.

Resnicow, Davis, and Rollnick (2006) focused their review on youth studies that used MI to modify diet or physical activity (e.g., Resnicow et al., 2005), diabetes (e.g., Channon et al., 2003), and other behaviors, such as smoking (e.g., Colby et al., 1998), and included some adult studies that used MI to modify diet or physical activity (e.g., Smith, Heckemeyer, Kratt, & Mason, 1997). The authors suggest that although MI might be a feasible intervention to use with children and adolescents, additional studies with youth are needed in the areas reviewed to determine the clinical utility of MI in the prevention or treatment of pediatric obesity (Resnicow et al., 2006).

Most recently, Van Dorsten (2007) provided a summary of studies examining the effectiveness of MI for weight loss and exercise. Results of eight studies in the area of weight loss (e.g., Carels et al., 2007) and two studies in the area of exercise (e.g., Harland et al., 1999) were reported. The author concluded that MI was shown to significantly improve diet and exercise behaviors, regimen adherence, and weight loss, based on the studies reviewed.

1.3. Summary

Across the 10 reviews, the use of MI was, in general, strongly supported in affecting health behavior change and maintenance; MI typically was more effective than no treatment and when compared to traditional advice giving (Rubak et al., 2005). Nevertheless, several limitations were identified through the reviews conducted to date. Most commonly, studies have focused on adaptations of MI and not on “pure” MI as an intervention (Burke et al., 2003). The duration of MI sessions varied greatly. Additionally, high attrition rates have been identified as a common threat to internal validity among studies examining the effectiveness of MI (Burke et al., 2003). Attempts to improve the internal validity of studies investigating MI have been made by many authors, including efforts to ensure treatment fidelity (e.g., Miller, Benefield, & Tonigan, 1993; Project MATCH, 1997; Stephens, Roffman, & Curtin, 2000). Overall, MI has among the highest mean methodological quality in substance abuse treatment outcome research (Miller & Wilbourne, 2002). Although not presented in the current paper, several systematic reviews and meta-analyses examining MI in a variety of other health areas, such as substance abuse, have been published (e.g., Miller & Wilbourne, 2002; Noonan & Moyer, 1997).

1.4. Critical review of MI in emerging health arenas

MI was first developed as a method to help individuals decrease alcohol and drug abuse and has been empirically supported for the treatment of substance abuse. MI is a promising intervention to encourage health behavior change in general, in a variety of settings, alone or in conjunction with traditional interventions (Rollnick et al., 2002). Existing MI research on promoting health behaviors, however, has methodological limitations that must be addressed with future research. The purpose of the present paper is to critically review literature using MI to enhance the health care behaviors of patients in three areas (i.e., diet and exercise, diabetes, and oral health), since the first published article on MI (Miller, 1983) through 2008. Articles were acquired through a search of the MI website (www.motivationalinterviewing.org), through article and book reference lists, and through database searches (e.g., Psych Info and Medline); search keywords included the use of single terms (e.g., Motivational Interviewing, motivation) and the use of a combination of descriptive labels for each health area (e.g., Motivational Interviewing and diabetes; motivation and diet).

This review is unique in that a comprehensive, critical, and focused review of MI in the areas of diet and exercise, diabetes, and oral health has not been conducted. Although MI studies of diet, exercise, and diabetes have been examined in the literature, new studies have appeared since the prior reviews were published. No review of studies examining the effectiveness of MI in the area of oral health has yet been published. These three health areas were selected because they represent the growing empirical research examining the effectiveness of MI to encourage positive health behaviors. There were 37 empirical studies were reviewed: 24 in the areas of diet and exercise, 9 in the area of diabetes, and 4 in the oral health area. Over time, the numbers of MI studies across these three areas have increased, as evidenced by the number of published empirical studies annually: 1997 – 1 article; 1998 – 1 article; 1999 – 2 articles, 2001 – 2 articles, 2002 – 1 article, 2003 – 4 articles, 2004 – 3 articles, 2005 – 3 articles, 2006 – 4 articles, 2007 – 10 articles, and 2008 – 6 articles.

1.4.1. Diet and exercise

Health care professionals are in a unique position to promote dietary change and increased exercise in patients facing a variety of health risks and issues through imparting information, skills training, and fostering motivation. Although diet and exercise are discussed here as a separate topic, both play an important role in other health areas, including obesity, diabetes, and oral health. These two health areas of health behavior, while related in terms of impact on outcomes (e.g., body mass index [BMI]), may be distinct in terms of how MI (and other interventions) can positively impact change or maintenance. There have been 24 published empirical articles identified as utilizing MI as an intervention to modify diet and/or exercise behaviors. A summary of the empirical articles utilizing MI in the areas of diet and exercise is provided in Table 1. Overall, studies support the effectiveness of MI in the areas of diet and exercise (e.g., Berg-Smith et al., 1999; Bowen et al., 2002; Harland et al., 1999; Resnicow et al., 2000, 2001; Smith et al., 1997), both alone, and in combination with other interventions. Specifically, patients who received MI reported increased self-efficacy related to diet and exercise (e.g., Bennett et al., 2008; Resnicow et al., 2004), increased physical activity (e.g., Bennett et al., 2007; Carels et al., 2007; Harland et al., 1999; Hardcastle et al., 2008), reduced caloric intake (e.g., Befort et al., 2008), and increased fruit and vegetable consumption (e.g., Amlawal et al., 2007; Befort et al., 2008; Elliot et al., 2007; Hardcastle et al., 2008; Resnicow et al., 2000, 2001, 2004, 2005; Richards, Kattelmann, & Ren, 2006). Further, patients who received MI demonstrated decreased BMI (e.g., Hardcastle et al., 2008; Schwartz et al., 2007) after the intervention. Although MI was not always found to be more effective than other treatments, overall the findings support the clinical utility of MI in these areas.

1.4.2. Diabetes

The management of diabetes requires lifelong patient adherence to behaviors associated with diet restrictions, medication treatment, regular medical consultations, exercise regimens, restricted alcohol consumption, and smoking cessation (Clark & Hampson, 2001; Stott, Rees, Rollnick, Pill, & Hackett, 1996). Patients vary in their readiness and willingness to make recommended changes or to develop a lifestyle consistent with these stipulations, but most present with some degree of ambivalence about change (Rollnick, Kninnersley, & Stott, 1993).

Table 2 shows a summary of nine published empirical studies examining the use of MI in either Type 1 or Type 2 diabetes management. Participants in five studies were diagnosed with Type 1 diabetes (i.e., Channon et al., 2003, 2007; Ismail et al., 2008; Knight et al., 2003; Viner et al., 2003), whereas four studies focused on individuals with Type 2 diabetes (i.e., Brug et al., 2007; Clark & Hampson, 2001; Smith et al., 1997; Smith-West et al., 2007). Lifestyle changes (e.g., diet and exercise) were the focus of MI, regardless of type of diabetes. Studies examining the use of MI (e.g., Channon et al., 2003) or MI in combination with other interventions (e.g., Smith et al., 1997) provided evidence for the effectiveness of MI in this health area.
<table>
<thead>
<tr>
<th>Article</th>
<th>n</th>
<th>Population</th>
<th>Comparison groups (n)</th>
<th>Concurrent treatment/other materials</th>
<th>Dose of MI</th>
<th>Fidelity measures</th>
<th>Attrition rates</th>
<th>Follow up</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ismail et al. (2008)</td>
<td>344</td>
<td>Adults with Type 1 diabetes</td>
<td>Usual care (121), Usual care with Motivational enhancement therapy (MET) (117), Usual care with MET plus Cognitive Behavior Therapy (106)</td>
<td>None</td>
<td>Offered up to four 50-minute sessions</td>
<td>MITI was used to evaluate a random sample of 20 tapes from each group</td>
<td>11%</td>
<td>3, 6, 9, 12 months</td>
<td>No significant differences in HbA1c levels, or secondary outcomes measures (e.g., BMI), were noted between groups.</td>
</tr>
<tr>
<td>Brug et al. (2007)</td>
<td>209</td>
<td>Newly diagnosed Type 2 diabetes patients</td>
<td>Motivational interviewing trained dieticians (83), Control dieticians (59)</td>
<td>None</td>
<td>One 30–45 minute session and three or four 15-minute follow up sessions</td>
<td>MITI and MISC were used to evaluate 15-minute transcripts of sessions Biweekly supervision and review of select session audiotapes</td>
<td>26%</td>
<td>N/A</td>
<td>A significant reduction of saturated fat score and an increase in fruit intake was noted in patients of MI trained dieticians compared to control dieticians. Significant decreases in BMI, WC, and HbA1c were noted in both groups.</td>
</tr>
<tr>
<td>Channon et al. (2007)</td>
<td>66</td>
<td>Teenagers with Type 1 diabetes</td>
<td>Motivational interviewing (38), Control group (28)</td>
<td>None</td>
<td>Determined by participant — with a mean of 4 sessions over 12 months* Five –45 minute sessions</td>
<td>Weekly supervision and review of randomly selected audiotapes using “standardized coding”</td>
<td>21%</td>
<td>6, 12, 24 months</td>
<td>Significant weight loss was noted in both groups; the MI group lost significantly more weight than the control group at 6 and 12 month follow-up. Weight regain occurred by 18 month follow-up. Glycemic control significantly improved in both groups at 6 and 12 month follow-up; women in the MI group had significantly better glycemic control compared to the control group. However, a significant increase in blood glucose levels was noted by 18 months.</td>
</tr>
<tr>
<td>Smith-West, Dillo, Bursac, Gore, and Greene (2007)</td>
<td>217</td>
<td>Overweight women with Type 2 diabetes</td>
<td>Motivational interviewing (109), Attention control (108)</td>
<td>18-month, 42 session, group-based behavioral obesity treatment</td>
<td>Weekly supervision and review of randomly selected audiotapes using “standardized coding”</td>
<td>7%</td>
<td>6, 12, 18 months</td>
<td>Significant weight loss was noted in both groups; the MI group lost significantly more weight than the control group at 6 and 12 month follow-up. Weight regain occurred by 18 month follow-up. Glycemic control significantly improved in both groups at 6 and 12 month follow-up; women in the MI group had significantly better glycemic control compared to the control group. However, a significant increase in blood glucose levels was noted by 18 months.</td>
<td></td>
</tr>
<tr>
<td>Channon et al. (2003)</td>
<td>47</td>
<td>Adolescents with Type 1 diabetes and one parent</td>
<td>Intervention/contemplators (22), Comparison group (25)</td>
<td>None</td>
<td>Determined by participant — 1 to 9 sessions with a mean of 5 sessions over 6 months</td>
<td>Weekly individual supervision</td>
<td>N/A</td>
<td>6 months</td>
<td>A significant reduction in mean HbA1c concentrations was observed during and after the intervention period, whereas no significant changes were observed in the comparison group. Patients reported a reduction in fear of hypoglycemia and a Living with Diabetes score, suggesting that diabetes had become easier to cope with and manage. The majority of participants (77%) reported having made one or more positive changes during the intervention period.</td>
</tr>
<tr>
<td>Viner, Christie, Taylor, and Hey (2003)</td>
<td>41</td>
<td>Adolescents ages 11 to 17 with poorly controlled Type 1 diabetes</td>
<td>Intervention (21), Control (20)</td>
<td>None</td>
<td>Six weekly group sessions*</td>
<td>N/A</td>
<td>N/A</td>
<td>1–3, 4–6, 7–12 months</td>
<td>A significant reduction in mean HbA1c concentrations was observed during and after the intervention period, whereas no significant changes were observed in the comparison group. Patients reported a reduction in fear of hypoglycemia and a Living with Diabetes score, suggesting that diabetes had become easier to cope with and manage. The majority of participants (77%) reported having made one or more positive changes during the intervention period.</td>
</tr>
<tr>
<td>Knight et al. (2003)</td>
<td>20</td>
<td>Adolescents ages 13 to 16 with poorly controlled Type 1 diabetes</td>
<td>Intervention (6), Control (14)</td>
<td>None</td>
<td>Six weekly one-hour group sessions based on MI</td>
<td>N/A</td>
<td>N/A</td>
<td>6 months</td>
<td>A significant reduction in mean HbA1c concentrations was observed during and after the intervention period, whereas no significant changes were observed in the comparison group. Patients reported a reduction in fear of hypoglycemia and a Living with Diabetes score, suggesting that diabetes had become easier to cope with and manage. The majority of participants (77%) reported having made one or more positive changes during the intervention period.</td>
</tr>
<tr>
<td>Clark and Hampson (2001)</td>
<td>100</td>
<td>Patients with Type 2 diabetes</td>
<td>Intervention (50), Control (50)</td>
<td>Participants were given booklets reinforcing healthy eating and increased physical activity.</td>
<td>Four sessions and three follow-up telephone calls*</td>
<td>N/A</td>
<td>N/A</td>
<td>12, 24, 52 weeks</td>
<td>Only descriptive baseline data were reported because the project was not completed before the article was published. Participants indicated greater adherence to dietary modifications than to increased physical activity by self report of achievement of dietary and physical activity goals at 1-week and 3-week follow-ups. Only descriptive baseline data were reported because the project was not completed before the article was published. Participants indicated greater adherence to dietary modifications than to increased physical activity by self report of achievement of dietary and physical activity goals at 1-week and 3-week follow-ups. All groups showed significant weight reductions at 4-month follow-up. Individuals in the weight-control program with MI, however, had greater group meeting attendance, completed more food diaries, monitored their blood glucose levels more often, and achieved better glucose control than those in the weight-control program alone.</td>
</tr>
<tr>
<td>Smith et al., (1997)</td>
<td>16</td>
<td>Older, obese women with Type 2 diabetes</td>
<td>Behavioral weight-control program (10), Behavioral weight-control program with MI (6)</td>
<td>16-session group behavioral weight-control program</td>
<td>Three sessions*</td>
<td>N/A</td>
<td>28%</td>
<td>4 months</td>
<td>All groups showed significant weight reductions at 4-month follow-up. Individuals in the weight-control program with MI, however, had greater group meeting attendance, completed more food diaries, monitored their blood glucose levels more often, and achieved better glucose control than those in the weight-control program alone.</td>
</tr>
</tbody>
</table>

Note: N/A, Information not available; MITI = Motivational Interviewing Treatment Integrity; MISC = Motivational Interviewing Skills Code; BMI = Body Mass Index; WC = waist circumference; HbA1c = a test of glycated hemoglobin in blood used as a measure of glucose control.

* Length of session was not reported.
MI was found to be effective in assisting patients control glucose levels (e.g., Channon et al., 2003, 2007; Smith et al., 1997; Vinier et al., 2003; Smith-West et al., 2007), increase physical activity (e.g., Smith-West et al., 2007), decrease weight (e.g., Smith et al., 1997; Smith-West et al., 2007), and engage in dietary changes (e.g., Brug et al., 2007; Clark & Hampson, 2001), both alone and in combination with other interventions. Further, MI appeared to contribute to additional successes, such as increased self-efficacy (e.g., Vinier et al., 2003) and increased sense of control over diabetes (e.g., Knight et al., 2003).

1.4.3. Oral (dental) health

In recent years, oral health problems have been associated with a variety of systemic health issues, such as diabetes (Jansson, Lindholm, Lindh, Groop, & Bratthall, 2006), cardiovascular disease (Beck & Offenbacher, 2005; Genco, Offenbacher, & Beck, 2002), low birth weight (Jeffcoat, Guers, Reddy, Goldenberg, & Hauth, 2001), premature birth (Jeffcoat, Guers, Reddy, Cliver et al., 2001; Offenbacher et al., 2006), and respiratory illness (Mojon, 2002). Engaging in appropriate oral health care not only can prevent many dental problems but also may impact other systemic health issues, such as diabetes, heart and lung disease, and stroke (Peterson, 2003).

Although MI is relatively new to oral health, it seems to be a promising method to improve oral health status, based on four available articles on caries prevention or attendance at dental appointments. Table 3 provides a summary of these published empirical studies. There is other important work in the oral health area that focuses on health behaviors not included in the present review, including tobacco and alcohol use. MI has shown promise in preserving the oral health of infants and other children, with the intervention targeted at their mothers (e.g., Harrison et al., 2007; Weinstein et al., 2004, 2006) (or perhaps their fathers, or other caregivers). MI also seems to have potential to address the self-care of adolescents and adults, with particular applications to special populations (e.g., pregnant women) whose oral health status may be related to other health outcomes (e.g., length of pregnancy). Delay or avoidance of timely dental care is an important area that MI ultimately may help to address, although the present data are quite preliminary (e.g., Skaret et al., 2003). With only four studies published in this area, the field invites further work.

1.4.4. Summary

There were 37 published empirical articles in the areas of diet and exercise, diabetes, and oral health that were reviewed. Each of the studies reviewed focused on health-related behaviors that require lifelong adherence in order to achieve maximum health benefits. For example, consistent glycemic control is essential in the treatment of diabetes to ensure the best possible outcomes. As such, after behavior change is achieved, the focus shifts to maintenance of these behaviors. Individuals who received MI showed significant behavior changes with important implications for their health across the areas of diet and exercise, diabetes, and oral health, more often than not. In many cases, behavior changes were maintained over a long period of time (e.g., one or two years); however, follow-up data beyond two years in these areas were not available, but should be a focus of future research.

2. Assessment of major issues

Development and implementation of MI, a treatment vehicle through which information, motivation, and recommendations can be provided to patients, has immense clinical implications. MI been shown to be effective in a number of health areas, including diet and exercise, diabetes management, and oral health; however, several methodological concerns require additional focus in order to more confidently demonstrate the effectiveness of MI. Specifically, training and practice issues, treatment integrity issues, treatment dose and delivery, and other methodological issues are discussed.
2.1. Training and practice

To deliver MI appropriately, training and practice are essential. Training procedures utilized in the studies reviewed here typically were rarely or insufficiently identified and described (Burke et al., 2003). Further, MI training can vary in factors such as length of training and training methods, perhaps resulting in variability of skill acquisition (Madson, Loignon, & Lane, 2009). Training alone may not be sufficient for the absorption and integration of motivational skills (Berg-Smith et al., 1999). Although increases in MI proficiency often were noted after training workshops (e.g., Miller, Yahnke, Moyers, Martinez, & Pirritano, 2004), a tendency to return to baseline over time, with no additional training, feedback, or coaching, has been observed (Miller & Mount, 2001). Ongoing practice and feedback are needed to fully learn and maintain skills (Miller & Rollnick, 2002). In fact, eight stages in learning MI were identified by Miller and Moyer (2006), suggesting that learning MI begins with understanding MI spirit and ultimately results in the integration of MI with other theoretical approaches through continued education and practice. Future studies should focus and report on improved MI training and ongoing practice with coaching (Miller et al., 2004).

2.2. Treatment integrity

Despite the availability of useful, validated treatment integrity tools, many studies fail to assess treatment integrity over the course of the intervention, or they fail to report this assessment. In recent years, two behavioral coding systems have been developed and are widely used to address the need to assess treatment integrity in the delivery of MI, and as a learning tool in MI training. For a review of other fidelity measures that are available see Madson and Campbell (2006). The Motivational Interviewing Skill Code (MISC) 1.0 was developed in 1997 to assess the quality of MI utilized by identifying active components (e.g., reflections) of MI (Miller, Moyers, Ernst, & Amrhein, 2003). The latest version of this coding system, MISC 2.1, was released in 2008 to “improve on earlier versions of the MISC in reliability, efficiency, and relevance to training and clinical practice” (Miller, Moyers, Ernst, & Amrhein, 2008; p. 1). Entire filmed or audiotaped recordings and transcripts are coded using MISC 2.1 in three passes. The first pass provides clinician global ratings on the dimensions of acceptance, empathy, and MI spirit and a client global rating based on self-exploration on a 7-point Likert scale (Miller et al., 2008; Moyers, Martin, Catley, Harris, & Ahluwalia, 2003). The second pass provides clinician behavior codes using 15 major categories of behavior (e.g., advise, affirm, confront, direct). The third pass provides client behavior codes using eight content codes (e.g., reasons, taking steps, commitment). More experienced coders may wish to combine the second and third passes (Miller et al., 2008).

The Motivational Interviewing Treatment Integrity (MITI) code Version 2.0 was developed by Moyers, Martin, Manuel, Hendrickson, and Miller (2005) to assess 10 elements of MI. MITI is considered to be simpler than MISC as a tool to assess treatment integrity and provide feedback. Whereas MISC examines both the clinician and client behaviors and the interaction between the two, MITI focuses only on the behavior of the clinician. Further, MITI consists of only one pass through session tapes, reducing the time and cost required to code tapes (Moyers, Martin et al., 2005), but again, only provides information about the clinician. Whereas, coders using MISC 2.1 code the entire session, coders using MITI 3.0 code a randomly selected 20-minute portion of the recording. In the most recent version of the MITI 3.0, coders provide global scores on a 5-point Likert scale characterizing the interaction based on Evocation, Collaboration, Autonomy/Support, Direction, and Empathy. Particular behaviors, such as giving information, questions, reflections, and behaviors that are consistent (e.g., supporting the client) and that are not consistent with MI (e.g., confronting) are counted (Moyers, Martin, Manuel, Miller, & Ernst, 2007). Although both MISC and MITI can provide treatment integrity information and feedback related to clinicians’ implementation of MI, use of MISC may be more appropriate in verifying the effectiveness and clinical utility of MI in the three research arenas discussed in this review (and others). MITI may be more efficient if treatment outcome is not the focus of coding.

2.3. Treatment dose and delivery

Miller and Rollnick (2002) propose that dose of counseling is related to behavior change or outcome; however, motivation for change also plays a role. Previous reviews have suggested that length and number of MI sessions are associated with behavior change, such that among studies with two MI sessions and at least 60 minutes of contact per encounter, 81% showed an effect (Burke et al., 2003; Rubak et al., 2005). Additional study, however, is needed in this area, as some studies demonstrate significant behavior change after relatively few MI sessions, whereas others fail to demonstrate significant behavior change after many MI sessions. For example, Bennett et al. (2007) reported a significant increase in physical activities after one 30-minute MI session and two follow-up phone calls whereas participants who received three MI sessions in the Murch et al. (1998) study did not demonstrate significant changes in total and saturated fat intake, or energy intake from fat compared to the control group. The type of dependent variable, of course, is an important factor which may impact whether and when change can be evidenced. Although MI dose may be an important factor in treatment outcome, many studies fail to report length of MI sessions. Further, a description of session content rarely is provided.

2.4. Other methodological issues

Other general methodological concerns include lack of power, small sample sizes, mixed intervention groups, and lack of treatment control groups among some of the studies reviewed here. Several studies lacked adequate power to identify differences between groups, related to small sample sizes. Further, combining MI with other interventions, while perhaps wise clinically (e.g., MI and a weight loss program), makes it impossible to determine the unique contributions of MI on behavior change. Similarly, without the inclusion of appropriate control groups, the unique effects of MI cannot be determined. Such concerns have been reported in other reviews (e.g., Knight et al., 2006), and have been addressed in more recent MI studies in the areas discussed in this review.

3. Conclusions and future research directions

MI is a promising intervention to encourage positive health behavior change in medical and dental settings (Resnicow et al., 2002), as noted in the studies presented here. Specifically, MI may help individuals improve their oral health, and may enhance adherence to diet and exercise modification programs, and diabetes management. MI has been found to be more effective than no treatment, and in many cases, more effective than other active treatments (Burke et al., 2003). MI also may be more cost-effective than other treatments, adding to its applicability. MI may be more cost-effective than other treatments, adding to its applicability potential (Burke et al., 2003; Knight et al., 2003). Further, MI can be utilized by a variety of health care professionals (e.g., physicians, dentists, nurses, dieticians) and applied in a variety of settings (e.g., churches, medical centers) to influence a variety of health behaviors. Because MI can be delivered in a relatively short time, health professionals can incorporate it into clinical practice or apply it in time-sensitive situations. Finally, acceptability of MI among patients is very high, allowing health care professionals to work with their patients to improve their health. In all three health areas reviewed here, health care providers may be prone to give advice and to be confrontational with their patients. In these
areas (and others). MI provides a “kinder and gentler,” respectful, and perhaps more efficacious approach that is less likely to produce resistance among patients.

Although many of the studies conducted to date in the three areas reviewed in this paper have several limitations, MI still seems clearly indicated for a variety of health behavior arenas beyond addictions. Importantly, recent studies have been more methodologically sophisticated. Future research should continue to focus on designing studies that have improved methodology including assuring adequate power, preventing or at least measuring attrition, providing improved training to interventionists, and ensuring treatment integrity, in addition to improving overall study design. Diet and exercise has commanded greater research focus relative to the other two areas. Clearly, more research is needed with a breadth of populations to contribute to the research base of MI in oral health care. Finally, although MI is being rapidly applied to a variety of settings, several important questions remain to be answered. What are the active ingredients in MI? What processes mediate the outcome of MI? How much does client language predict outcome (e.g., Amrhein, Miller, Yahne, Palmer, & Fulcher, 2003; Moyers, Martin, Christopher, et al., 2007)? How do therapist characteristics affect client behavior (e.g., Moyers, Miller, & Hendrickson, 2005)? What is the acceptability and effectiveness of MI among ethnic and racial minorities? Through a programmatic research effort, the effectiveness and clinical utility of MI in these three areas, and other health arenas, can be further developed.

References
