



Review of Motivational Interviewing in promoting health behaviors☆☆☆

Renata K. Martins*, Daniel W. McNeil*

West Virginia University, 53 Campus Drive, P.O. Box 6040, Morgantown, West Virginia 26506-6040 USA

ARTICLE INFO

Article history:

Received 29 October 2006

Received in revised form 5 February 2009

Accepted 11 February 2009

Keywords:

Motivational Interviewing

Diet

Exercise

Diabetes

Oral health

Dental health

Review

ABSTRACT

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.

Published by Elsevier Ltd.

Contents

1.	Introduction	283
1.1.	Description of Motivational Interviewing	284
1.2.	Past reviews and meta-analyses	284
1.3.	Summary	288
1.4.	Critical review of MI in emerging health arenas	288
1.4.1.	Diet and exercise	288
1.4.2.	Diabetes	288
1.4.3.	Oral (dental) health	290
1.4.4.	Summary	290
2.	Assessment of major issues	290
2.1.	Training and practice	291
2.2.	Treatment integrity	291
2.3.	Treatment dose and delivery	291
2.4.	Other methodological issues	291
3.	Conclusions and future research directions	291
	References	292

☆ This paper is based on a preliminary doctoral examination in the West Virginia University Department of Psychology, submitted by the first author and supervised by the second author.

☆☆ We would like to thank William Fremouw, Ph.D. for his involvement in the preliminary examination process. Appreciation also is extended to colleagues in the Anxiety, Psychophysiology, and Pain Research Laboratory in the Department of Psychology at West Virginia University for their support of this project.

* Corresponding authors. D.W. McNeil is to be contacted at Tel.: +1 304 293 2001x31622.

E-mail addresses: renatakmartins@aol.com (R.K. Martins), Daniel.McNeil@mail.wvu.edu (D.W. McNeil).

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 (Hertig & 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 to examine the effectiveness of MI in diet modification. Significant effects were found in three of the four reviewed studies. Importantly, the review suggests that MI can be effective in small doses; however, more frequent contact with patients can increase behavior change.

Burke, Dunn, and Atkins (2004) conducted a meta-analysis of 39 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, hyperlipidaemia, 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 hyperlipidaemia (e.g., Mhurchu, Margetts, & Speller, 1998), and two in the area of heart disease (e.g.,

Table 1

Summary of 24 empirical studies utilizing Motivational Interviewing in the areas of diet and exercise.

Article	n	Population	Comparison groups (n)	Concurrent treatment/ other materials	Dose of MI	Fidelity measures	Attrition rates	Follow up	Outcome
Bennett, Young, Nail, Winters-Stone, and Hanson (2008)	72	Physically inactive adults who stated they were ready to increase physical activity	Motivational interviewing (35), Control (37)	Pedometer	Monthly MI telephone calls over six months – one 30-minute and four 15-minute calls	Audiotapes were randomly selected and coded using MITI	16%	6 months	Adults in the MI group reported significantly increased self-efficacy for exercise compared to the control group. Changes in physical activity were not significant.
Befort et al. (2008)	33	Obese African American women	Weight loss program and motivational interviewing (14), Weight loss program and health education (19)	16 weekly group behavioral weight loss program sessions	Four 30-minute individual MI sessions – two contacts ^a via phone and two in-person	25% of tapes were randomly selected and reviewed during weekly supervision	23%	16 weeks	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.
Greaves et al. (2008)	141	Adults with BMI of 28 kg/m ² or more	Intervention (68), Control (69)	Dietary and physical activity recommendations	Up to 11 individual, face-to-face or telephone sessions, with a mean of 34 minutes per contact	BECCI was used to determine treatment fidelity of sessions with an actor	18%	6 months	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.
Hardcastle, Taylor, Bailey, and Castle (2008)	218	Adults ages 18 to 65 at risk for coronary heart disease	Counseling intervention (AMI) (125), Control group (93)	Exercise and nutrition leaflet	Up to five 20 to 30-minute AMI sessions	Review of audiotapes and monthly consultation meetings	35%	6 months	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.
Webber, Tate, and Quintiliani (2008)	18	Women ages 22 to 65	Online motivational interviewing group (9), Online motivational interviewing group with values discussion (9)	Behavioral weight loss lessons via email	Two 1-hour online MI sessions	N/A	10%	8 weeks	Participants in both groups reported a significant decrease in weight; however, no differences between groups were noted.
Ahluwalia et al. (2007)	173	Smokers in Section 8 housing developments	Fruit and vegetable (FV) (107), Smoking cessation (SC) (66)	FV: cookbook, a FV video, bag of FV, diet educational materials, SC: nicotine gum, educational materials	Up to five sessions for each group ^a	Weekly supervision and review of a subset of select session audiotapes using MISC	24%	3, 5, 20 weeks	Significantly greater fruit and vegetable consumption was noted in the FV group than in the SC group.
Bennett, Lyons, Winters-Stone, Nail, and Scherer (2007)	56	Physically inactive adult cancer survivors	Motivational interviewing (28), Control (28)	None	One 30-minute session and two follow up telephone calls	Review of select session audiotapes	14%	3, 6 months	A significant increase in physical activities was noted in the MI group compared to the control group.
Carels et al. (2007)	55	Obese, sedentary adults	Behavioral weight loss program (27), Behavioral weight loss program with stepped care (28), of which 19 received MI	None	46 to 60 minute sessions provided to participants in the behavioral weight loss program with stepped care who failed to meet their weight loss goals	Randomly selected 20-minute audiotapes of sessions were evaluated using MITI	16%	3, 6, 12, 18 weeks	Participants who received MI lost significantly more weight and engaged in more physical activity than those who did not.
Elliot et al. (2007)	599	Firefighters	Individual motivational interviewing (202), Team-centered curriculum (234), Control (163)	MI and Team received <i>Firefighters' Health & Fitness Guide</i> ; control received test results only	Four sessions, lasting a mean of 42 minutes each, with the possibility of five additional in-person or phone contacts	10% of audiotapes were evaluated with MISC	18%	12 months	MI and Team reported increased fruit and vegetable consumption, reduced weight gain, and increased number of sit-ups in 1 minute.
Perry, Rosenfeld, Bennett, and Potempa (2007)	46	Rural women	Heart to Heart (HTH) with MI (23), Control (23)	Weekly 1-hour group walk for women in HTH	One 30-minute session with weekly 10-minute follow up telephone calls	Written field notes were compared to the protocol	9%	12 weeks	A significant increase in walking distance and social support was noted in the HTH with MI group, but not in the control group.

(continued on next page)

Table 1 (continued)

Article	n	Population	Comparison groups (n)	Concurrent treatment/ other materials	Dose of MI	Fidelity measures	Attrition rates	Follow up	Outcome
Schwartz et al. (2007)	91	Children with one parent	Minimal intervention (40), Intensive intervention (30), Control (21)	None	Parents in the minimal intervention received one MI session; Parents in the intensive intervention received two MI sessions ^a	One or two of the first MI sessions were audiotaped and evaluated to provide feedback and MI coaching	33%	1, 3, 6 months	A decrease in mean BMI was noted in all groups; however, significant differences were not noted between groups.
Butterworth, Linden, McClay, and Leo (2006)	239	Adults in Employee Wellness Program	Treatment (121), Control (118)	Employee Wellness Program	At least one 30-minute initial MI session and two follow-up contacts; participants determined actual number of sessions received	MISC was used by an independent coder to evaluate MI proficiency	13%	3 months	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.
Fuemmeler et al. (2006)	889	Adults who attend church	Body and Soul Intervention with peer counseling based on MI (561), Control (328)	Healthy eating self-help materials (e.g., cookbook, video)	One session ^a and two 20–30 minute telephone calls	“Process evaluation”	12%	6 months	Fruit and vegetable intake was significantly increased among adults in the intervention.
Richards, Kattelman, and Ren (2006)	437	18 to 24 year-old rural college students	Intervention (157), Control (157)	None	Personalized letter tailored to stage of change, one motivational interviewing session ^a , and a minimum of two email contacts	N/A	28%	4 months	Fruit and vegetable intake was significantly increased more among students in the intervention group compared to the control group.
Brodie and Inoue (2005)	60	Patients with chronic heart failure ages 65+	Standard care and MI (20), Standard care (18), Motivational interviewing (22)	None	Eight one-hour sessions	N/A	35%	5 months	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.
Resnicow, Jackson, et al. (2005)	906	Adults who attend church	Standard education materials/Control (267), Self-help (335), Self-help and MI (304)	Self-help materials including nutrition video, cookbook, exercise video, exercise guide, pedometer, and workout cassette; health fair	Four MI telephone calls ^a	12 hours ongoing individual/group supervision	14%	1 year	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.
Resnicow, Taylor, Baskin, McCarty (2005)	123	Adolescents ages 12–16 with BMI above the 90th percentile	High-intensity intervention (53), Moderate-intensity intervention/Control (70)	Weekly group behavioral sessions, healthy messages delivered via paging device	Four to six 20 to 30 minute MI telephone calls over six months	N/A	16%	6 months, 1 year	No significant differences in BMI, weight, measurements, blood pressure, and glucose levels were noted at follow-up.
Elliot et al. (2004)	33	Firefighters	Team-based curriculum (12), Individual-oriented intervention/MI (10), Control (11)	<i>Firefighters' Health and Fitness Guide</i>	Four sessions up to 60 minutes each and a negotiated number of additional telephone or in-person contacts	25 of 40 audiotapes were coded using MISC	0%	6 months	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.

Resnicow et al. (2004)	854	Adults who attend church	Body and Soul Intervention (8 churches), Control (8 churches)	Cookbook and educational materials	1+ MI telephone calls ^a	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.
Bowen et al. (2002)	175	Women 60+	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 contacts ^a	"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.
Resnicow et al. (2001)	861	Adults who attend church	Nutritional education (316), Self-help intervention with one cue call and 3 MI calls (267)	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	15%	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.
Harland et al. (1999)	523	Adults ages 40 to 64	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)	30 leisure center vouchers as the incentive	40 minutes each	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.
Berg-Smith et al. (1999)	127	Adolescents in the Dietary Intervention Study in Children (DISC)	DISC motivational intervention (127)	None	Three sessions ^a	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
Mhurchú et al. (1998)	97	Patients with hyperlipidaemia	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	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.

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 & Moyers, 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., Ahluwalia et al., 2007; Befort et al., 2008; Elliot et al., 2007; Hardcastle et al., 2008; Resnicow et al., 2000, 2001, 2004, 2005; Richards, Kattelman, & 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, Kinnorsley, & 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 2

Summary of 9 empirical studies utilizing Motivational Interviewing in the area of diabetes.

Article	n	Population	Comparison groups (n)	Concurrent treatment/ other materials	Dose of MI	Fidelity measures	Attrition rates	Follow up	Outcome
Ismail et al. (2008)	344	Adults with Type 1 diabetes	Usual care (121), Usual care with Motivational enhancement therapy (MET) (117), Usual care with MET plus Cognitive Behavior Therapy (106)	None	Offered up to four 50-minute sessions	MITI was used to evaluate a random sample of 20 tapes from each group	11%	3, 6, 9, 12 months	No significant differences in HbA _{1c} levels, or secondary outcomes measures (e.g., BMI), were noted between groups.
Brug et al. (2007)	209	Newly diagnosed Type 2 diabetes patients	Motivational interviewing trained dieticians (83), Control dieticians (59)	None	One 30–45 minute session and three or four 15-minute follow up sessions	MITI and MISC were used to evaluate 15-minute transcripts of sessions	26%	N/A	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 HbA _{1c} were noted in both groups.
Channon et al. (2007)	66	Teenagers with Type 1 diabetes	Motivational interviewing (38), Control group (28)	None	Determined by participant – with a mean of 4 sessions over 12 months ^a	Biweekly supervision and review of select session audiotapes	21%	6, 12, 24 months	Mean HbA _{1c} was significantly reduced in the MI group compared to the control group at 12 and 24 months.
Smith-West, Dillo, Bursac, Gore, and Greene (2007)	217	Overweight women with Type 2 diabetes	Motivational interviewing (109), Attention control (108)	18-month, 42 session, group-based behavioral obesity treatment	Five ~45 minute sessions	Weekly supervision and review of randomly selected audiotapes using “standardized coding”	7%	6, 12, 18 months	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.
Channon et al. (2003)	47	Adolescents with Type 1 diabetes and one parent	Intervention/contemplators (22), Comparison group (25)	None	Determined by participant – 1 to 9 sessions with a mean of 5 sessions over 6 months	Weekly individual supervision	N/A	6 months	A significant reduction in mean HbA _{1c} 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 <i>Living with Diabetes</i> 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.
Viner, Christie, Taylor, and Hey (2003)	41	Adolescents ages 11 to 17 with poorly controlled Type 1 diabetes	Intervention (21), Control (20)	None	Six weekly group sessions ^a	N/A	N/A	1–3, 4–6, 7–12 months	HbA _{1c} values significantly dropped in participants in the intervention groups, consistent with improved glucose management, whereas the HbA _{1c} in control participants did not change significantly. Self-reported self-efficacy was significantly improved after the intervention whereas self-efficacy among those in the control group remained unchanged. No significant changes in self-care or well-being were reported.
Knight et al. (2003)	20	Adolescents ages 13 to 16 with poorly controlled Type 1 diabetes	Intervention (6), Control (14)	None	Six weekly one-hour group sessions based on MI	N/A	N/A	6 months	Participants in the treatment group reported feeling more in control of their diabetes and more open to discussing their diabetes. Consequences of having diabetes were described as less restrictive at follow up than before the intervention.
Clark and Hampson (2001)	100	Patients with Type 2 diabetes	Intervention (50), Control (50)	Participants were given booklets reinforcing healthy eating and increased physical activity.	Four sessions and three follow-up telephone calls ^a	N/A	N/A	12, 24, 52 weeks	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.
Smith et al., (1997)	16	Older, obese women with Type 2 diabetes	Behavioral weight-control program (10), Behavioral weight-control program with MI (6)	16-session group behavioral weight-control program	Three sessions ^a	N/A	28%	4 months	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.

Note. N/A, Information not available; MITI = Motivational Interviewing Treatment Integrity; MISC = Motivational Interviewing Skills Code; BMI = Body Mass Index; WC = waist circumference; HbA_{1c} = a test of glycated hemoglobin in blood used as a measure of glucose control.

^a 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; Viner 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., Viner 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 arena 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 life-long 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.

Table 3
Summary of 4 empirical studies utilizing Motivational Interviewing in the area of oral health.

Article	n	Population	Comparison groups (n)	Concurrent treatment/other materials	Dose of MI	Fidelity measures	Attrition rates	Follow up	Outcome
Harrison, Benton, Everson-Stewart, and Weinstein (2007)	240	South Asian Punjabi-speaking mothers with healthy infants aged 6 to 18 months	Motivational interviewing (122), Control/health education (118)	Pamphlet; viewed 11-minute educational video, "Preventing tooth decay for infants and toddlers"	One 45-minute session, 6 follow-up telephone calls, 2 postcards	Biweekly supervision and review of select session audiotapes	15%	2 years	Children with mothers in the MI group had significantly fewer cavities (a 46% lower rate) at follow-up than children with mothers in the control group.
Weinstein, Harrison, and Benton (2006)	240	South Asian Punjabi-speaking mothers with healthy infants aged 6 to 18 months	Motivational interviewing (122), Control/health education (118)	Pamphlet; viewed 11-minute educational video, "Preventing tooth decay for infants and toddlers"	One 45-minute session, 6 follow-up telephone calls, 2 postcards	Biweekly supervision and review of select session audiotapes	15%	2 years	Children with mothers in the MI group experienced significantly fewer new cavities and obtained significant more fluoride varnish applications than children with mothers in the control group.
Weinstein, Harrison, and Benton (2004)	240	South Asian Punjabi-speaking mothers with healthy infants aged 6 to 18 months	Motivational interviewing (122), Control/health education (118)	Pamphlet; viewed 11-minute educational video, "Preventing tooth decay for infants and toddlers"	One 45-minute session and 6 follow-up telephone calls, 2 postcards	Audiotapes were periodically reviewed to ensure consistent MI delivery	N/A	2, 4, 6 weeks; 6 months; 1 year	Children with mothers in the MI group had fewer cavities than children in the control group.
Skaret, Weinstein, Kvale, and Raadal (2003)	50	18-year-old adolescents with a history of dental appointment avoidance	Response cards (13), Motivational interviewing (12), Combined RC + MI (12), Control/health education (13)	None	One brief, structured telephone interview ^a based on MI approach	N/A	36%	N/A	Adolescents who received the three interventions viewed the interventions as credible.

Note. N/A, Information not available.

^a Length of session was not reported.

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, Loigon, & 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, Yahne, 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 Moyers (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 most 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 Mhurchú 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 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

- Ahluwalia, J. S., Nollen, N., Kaur, H., James, A. S., Mayo, M. S., & Resnicow, K. (2007). Pathways to health: Cluster-randomized trial to increase fruit and vegetable consumption among smoker in public housing. *Health Psychology, 26*, 214–221.
- Amrhein, P. C., Miller, W. R., Yahne, C. E., Palmer, E., & Fulcher, L. (2003). Client commitment language during motivational interviewing predicts drug use outcomes. *Journal of Consulting and Clinical Psychology, 71*, 862–878.
- Beck, J. D., & Offenbacher, S. (2005). Systematic effects of periodontitis: Epidemiology of periodontal disease and cardiovascular disease. *Journal of Periodontology, 11 Supplement*, 2089–2100.
- Befort, C. A., Nollen, N., Ellerbeck, E. F., Sullivan, D. K., Thomas, J. L., & Ahluwalia, J. S. (2008). *Journal of Behavioral Medicine, 31*, 367–377.
- Bennett, J. A., Lyons, K. S., Winters-Stone, K., Nail, L. M., & Scherer, J. (2007). Motivational interviewing to increase physical activity in long-term cancer survivors. *Nursing Research, 56*, 18–27.
- Bennett, J. A., Young, H. M., Nail, L. M., Winters-Stone, K., & Hanson, G. (2008). A telephone-only motivational intervention to increase physical activity in rural adults: A randomized controlled trial. *Nursing Research, 57*, 24–32.
- Berg-Smith, S. M., Stevens, V. J., Brown, K. M., van Horn, L., Gernhofer, N., Peters, E., et al. (1999). A brief motivational intervention to improve dietary adherence in adolescents. *Health Education Research, 14*, 399–410.
- Bowen, D., Ehret, C., Pedersen, M., Snetelaar, L., Johnson, M., Tinker, L., et al. (2002). Results of an adjunct dietary intervention program in the Women's Health Initiative. *Journal of the American Dietetic Association, 102*, 1631–1637.
- Brodie, D. A., & Inoue, A. (2005). Motivational interviewing to promote physical activity for people with chronic heart failure. *Journal of Advanced Nursing, 50*, 518–527.
- Brug, J., Spikmans, F., Aartsen, C., Breddveld, B., Bes, R., & Ferreira, I. (2007). Training dietitians in basic motivational interviewing skills results in changes in their counseling style and in lower saturated fat intakes in their patients. *Journal of Nutrition Education and Behavior, 39*, 8–12.
- Burke, B. L., Arkowitz, H., & Dunn, C. (2002). The efficacy of motivational interviewing and its adaptations. In W. R. Miller, & S. Rollnick (Eds.), *Motivational interviewing: Preparing people for change* (pp. 217–250). New York: Guilford Press.
- Burke, B. L., Arkowitz, H., & Menchola, M. (2003). The efficacy of motivational interviewing: A meta-analysis of controlled clinical trials. *Journal of Consulting and Clinical Psychology, 71*, 843–861.
- Burke, B. L., Dunn, C. W., & Atkins, D. C. (2004). The emerging evidence base for motivational interviewing: A meta-analytic and qualitative inquiry. *Journal of Cognitive Psychotherapy, 18*, 309–322.
- Butterworth, S., Linden, A., McClay, W., & Leo, M. C. (2006). Effect of motivational interviewing-based health coaching on employees' physical and mental health status. *Journal of Occupational Health Psychology, 11*, 358–365.
- Carels, R. A., Darby, L., Cacciapaglia, H. M., Konrad, K., Coit, C., Harper, J., et al. (2007). Using motivational interviewing as a supplement to obesity treatment: A stepped-care approach. *Health Psychology, 26*, 369–374.
- Channon, S. J., Huws-Thomas, M. V., Rollnick, S., Hood, K., Cannings-John, R. L., Rogers, C., et al. (2007). A multicenter randomized controlled trial of motivational interviewing in teenager with diabetes. *Diabetes Care, 30*, 1390–1395.
- Channon, S., Smith, V. J., & Gregory, J. W. (2003). A pilot study of motivational interviewing in adolescents with diabetes. *Archives of Disease in Childhood, 88*, 680–683.
- Clark, M., & Hampson, S. E. (2001). Implementing a psychological intervention to improve lifestyle self-management in patients with type 2 diabetes. *Patient Education Counseling, 42*, 247–256.
- Colby, S. M., Monti, P. M., Barnett, N. P., Rohsenow, D. J., Weissman, K., Spirito, A., et al. (1998). Brief motivational interviewing in a hospital setting for adolescent smoking: A preliminary study. *Journal of Consulting & Clinical Psychology, 66*, 574–578.
- Dunn, C., DeRoo, L., & Riva, F. P. (2001). The use of brief interventions adapted from MI across behavioral domains: A systematic review. *Addiction, 96*, 1725–1743.
- Elliot, D. L., Goldberg, L., Duncan, T. E., Kuehl, K. S., Moe, E. L., Breger, R. K. R., et al. (2004). The PHLAME firefighters' study: Feasibility and findings. *American Journal of Health Behavior, 28*, 13–23.
- Elliot, D. L., Goldberg, L., Kuehl, K. S., Moe, E. L., Breger, R. K. R., & Pickering, M. A. (2007). The PHLAME (Promoting Healthy Lifestyles: Alternative Models' Effects) firefighter study: Outcomes of two models of behavior change. *Journal of Occupational and Environmental Medicine, 49*, 204–213.
- Fuemmeler, B. F., Masse, L. C., Yaroch, A. L., Resnicow, K., Campbell, M. K., Carr, C., et al. (2006). Psychosocial mediation of fruit and vegetable consumption in the Body and Soul effectiveness trial. *Health Psychology, 25*, 474–483.
- Genco, R., Offenbacher, S., & Beck, J. (2002). Periodontal disease and cardiovascular disease. *Journal of the American Dental Association, 133*, 145–225.
- Greaves, C. J., Middlebrooke, A., O'Loughlin, L., Holland, S., Piper, J., Steele, A., et al. (2008). Motivational interviewing for modifying diabetes risk: A randomized controlled trial. *British Journal of General Practice, 58*, 535–540.
- Hardcastle, S., Taylor, A., Bailey, M., & Castle, R. (2008). A randomized controlled trial on the effectiveness of a primary health care based counseling intervention on physical activity, diet and CHD risk factors. *Patient Education and Counseling, 70*, 31–39.
- Harland, J., White, M., Drinkwater, C., Chinn, D., Farr, L., & Howel, D. (1999). The Newcastle exercise project: A randomised controlled trial of methods to promote physical activity in primary care. *British Medical Journal, 319*, 828–832.
- Harrison, R., Benton, T., Everson-Stewart, S., & Weinstein, P. (2007). Effects of motivational interviewing on rates of early childhood caries: A randomized trial. *Pediatric Dentistry, 29*, 16–22.
- Heritage, J., & Sefi, S. (1992). Dilemmas of advice: Aspects of delivery and reception in interactions between health visitors and first-time mothers. In P. Drew, & J. Heritage (Eds.), *Talk at work: Interaction in institutional settings* (pp. 359–417). Cambridge: Cambridge University Press.
- Hettema, J., Steele, J., & Miller, W. R. (2005). Motivational interviewing. *Annual Review of Clinical Psychology, 1*, 91–111.
- Ismail, K., Thomas, S. M., Maissi, E., Chalder, T., Schmidt, U., Bartlett, J., et al. (2008). Motivational enhancement therapy with and without cognitive behavior therapy to treat type 1 diabetes. *Annals of Internal Medicine, 149*, 708–719.
- Jansson, H., Lindholm, E., Lindh, C., Groop, L., & Bratthall, G. (2006). Type 2 diabetes and risk for periodontal disease: a role for dental health awareness. *Journal of Clinical Periodontology, 33*, 408–414.
- Jeffcoat, M. K., Guers, N. C., Reddy, M. S., Cliver, S. P., Goldenberg, R. L., & Hauth, J. C. (2001). Periodontal infection and preterm birth. *Journal of the American Dental Association, 132*, 845–880.
- Jeffcoat, M. K., Guers, N. C., Reddy, M. S., Goldenberg, R. L., & Hauth, J. C. (2001). Current evidence regarding periodontal disease as a risk factor in preterm birth. *Annals of Periodontology, 6*, 183–188.
- Knight, K. M., Bundy, C., Morris, R., Higgs, J. F., Jameson, R. A., Unsworth, P., et al. (2003). The effects of group motivational interviewing and externalizing conversations for adolescents with Type-1 diabetes. *Psychology, Health, & Medicine, 8*, 149–158.
- Knight, K. M., McGowan, L., Dickens, C., & Bundy, C. (2006). A systematic review of motivational interviewing in physical health care settings. *British Journal of Health Psychology, 11*, 319–332.
- Madson, M. B., & Campbell, T. C. (2006). Measures of fidelity in motivational enhancement: A systematic review. *Journal of Substance Abuse Treatment, 31*, 67–73.
- Madson, M. B., Loigon, A. C., & Lane, C. (2009). Training in motivational interviewing: A systematic review. *Journal of Substance Abuse Treatment, 36*, 101–109.
- McHugh, F., Lindsay, G. M., Hanlon, P., Hutton, I., Brown, M. R., Morrison, C., et al. (2001). Nurse led shared care for patients on the waiting list for coronary artery bypass surgery: A randomized controlled trial. *Heart, 86*, 317–323.
- Mhurchú, C. N., Margetts, B. M., & Speller, V. (1998). Randomized clinical trial comparing the effectiveness of two dietary interventions for patients with hyperlipidaemia. *Clinical Science, 95*, 479–487.
- Miller, W. R. (1983). Motivational interviewing with problem drinkers. *Behavioural Psychotherapy, 11*, 147–172.
- Miller, W. R., Benefield, R. G., & Tonigan, J. S. (1993). Enhancing motivation for change in problem drinking: A controlled comparison of two therapist styles. *Journal of Consulting and Clinical Psychology, 61*, 455–461.
- Miller, W. R., & Mount, K. A. (2001). A small study of training in motivational interviewing: Does one workshop change clinician and client behavior? *Behavioral and Cognitive Psychotherapy, 29*, 457–471.
- Miller, W. R., & Moyers, T. B. (2006). Eight stages in learning motivational interviewing. *Journal of Teaching in the Addictions, 5*, 3–17.
- Miller, W. R., Moyers, T. B., Ernst, D., & Amrhein, P. (2003). *Motivational Interviewing Skill Code (MISC), Version 2.0* Retrieved March 2, 2006, from <http://www.motivational-interviewing.org>
- Miller, W. R., Moyers, T. B., Ernst, D., & Amrhein, P. (2008). *Motivational Interviewing Skill Code (MISC), Version 2.1* Retrieved December 2, 2008, from <http://casaa.unm.edu/download/misc.pdf>

- Miller, W. R., & Rollnick, S. (2002). *Motivational interviewing: Preparing people for change*, 2nd ed. New York, NY: Guilford.
- Miller, W. R., & Wilbourne, P. L. (2002). Mesa grande: A methodological analysis of clinical trials of treatments for alcohol use disorders. *Addiction*, 97, 265–277.
- Miller, W. R., Yahne, C. E., Moyers, T. B., Martinez, J., & Pirritano, M. (2004). A randomized trial of methods to help clinicians learn motivational interviewing. *Journal of Consulting and Clinical Psychology*, 72, 1050–1062.
- Mojon, P. (2002). Oral health and respiratory infection. *Journal of the Canadian Dental Association*, 68, 340–345.
- Moyers, T. B., Martin, T., Catley, D., Harris, K. J., & Ahluwalia, J. S. (2003). Assessing the integrity of motivational interviewing interventions: Reliability of the motivational interviewing skills code. *Behavioural and Cognitive Psychotherapy*, 31, 177–184.
- Moyers, T. B., Martin, T., Christopher, P. J., Houck, J. M., Tonigan, J. S., & Amrhein, P. C. (2007). Client language as a mediator of motivational interviewing efficacy: Where is the evidence? *Alcoholism: Clinical and Experimental Research*, 31, 40s–47s.
- Moyers, T. B., Martin, T., Manuel, J. K., Hendrickson, S. M. L., & Miller, W. R. (2005). Assessing competence in the use of motivational interviewing. *Journal of Substance Abuse Treatment*, 28, 19–26.
- Moyers, T. B., Martin, T., Manuel, J. K., Miller, W. R., & Ernst, D. (2007). *Revised global scales: Motivational interviewing treatment integrity 3.0* Retrieved November 1, 2008, from <http://casaa.unm.edu/download/miti3.pdf>
- Moyers, T. B., Miller, W. R., & Hendrickson, S. M. L. (2005). How does motivational interviewing work? Therapist interpersonal skill predicts client involvement within motivational interviewing sessions. *Journal of Consulting and Clinical Psychology*, 73, 590–598.
- Noonan, W. C., & Moyers, T. B. (1997). Motivational interviewing. *Journal of Substance Misuse: For Nursing, Health & Social Care*, 2, 8–16.
- Offenbacher, S., Boggess, K. A., Murtha, A. P., Jared, H. L., Lief, S., McKaig, R. G., et al. (2006). Progressive periodontal disease and risk of very preterm delivery. *Obstetrics and Gynecology*, 107, 29–36.
- Parsons, J. T., Rosof, E., Punzalan, J. C., & Di Maria, L. (2005). Integration of motivational interviewing and cognitive behavioral therapy to improve HIV medication adherence and reduce substance use among HIV-positive men and women: Results of a pilot project. *AIDS Patient Care and STDs*, 19, 31–39.
- Perry, C. K., Rosenfeld, A. G., Bennett, J. A., & Potempa, K. (2007). Heart to heart: Promoting walking in rural women through motivational interviewing and group support. *Journal of Cardiovascular Nursing*, 22, 304–312.
- Peterson, P. E. (2003). The World Oral Health Report 2003: Continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Programme. *Community Dentistry and Oral Epidemiology*, 31, 3–23.
- Project MATCH Research Group (1997). Matching alcoholism treatments to client heterogeneity: Project MATCH posttreatment drinking outcomes. *Alcoholism: Clinical and Experimental Research*, 23, 1300–1311.
- Resnicow, K., Campbell, M. K., Carr, C., McCarty, F., Wang, T., Periasamy, S., et al. (2004). Body and soul: A dietary intervention conducted through African-American churches. *American Journal of Preventive Medicine*, 27, 97–105.
- Resnicow, K., Davis, R., & Rollnick, S. (2006). Motivational interviewing for pediatric obesity: Conceptual issues and evidence review. *Journal of the American Dietetic Association*, 206, 2024–2033.
- Resnicow, K., Dilorio, C., Soet, J. E., Borrelli, B., Ernst, D., Hecht, J., et al. (2002). Motivational interviewing in medical and public health settings. In W. R. Miller, & S. Rollnick (Eds.), *Motivational interviewing: Preparing people for change* (pp. 251–269). New York: Guilford Press.
- Resnicow, K., Jackson, A., Blissett, D., Wang, T., McCarty, F., Rahotep, S., et al. (2005). Results of the healthy body healthy spirit trial. *Health Psychology*, 24, 339–348.
- Resnicow, K., Jackson, A., Wang, T., De, A. K., McCarty, F., Dudley, W. N., et al. (2001). A MI intervention to increase fruit and vegetable intake through Black churches: Results of the Eat for Life program. *American Journal of Public Health*, 91, 1686–1693.
- Resnicow, K., Taylor, R., Baskin, M., & McCarty, F. (2005). Results of Go Girls: A weight control program for overweight African-American adolescent females. *Obesity Research*, 13, 1739–1748.
- Resnicow, K., Wallace, D. C., Jackson, A., Digirolamo, A., Odom, E., Wang, T., et al. (2000). Dietary change through African American churches: Baseline results and program description of the Eat for Life trial. *Journal of Cancer Education*, 15, 156–163.
- Richards, A., Kattelmann, K. K., & Ren, C. (2006). Motivating 18- to 24-year-olds to increase their fruit and vegetable consumption. *Journal of the American Dietetic Association*, 106, 1405–1411.
- Rollnick, S., Kinnery, P., & Stott, N. (1993). Methods of helping patients with behaviour change. *British Medical Journal*, 307, 188–190.
- Rollnick, S., Mason, P., & Butler, C. (2002). *Health behavior change: A guide for practitioners*. London, England: Churchill Livingstone.
- Rubak, S., Sandbaek, A., Lauritzen, T., & Christensen, B. (2005). Motivational interviewing: A systematic review and meta-analysis. *British Journal of General Practice*, 55, 305–312.
- Schmaling, K. A., Blume, A. W., & Afari, N. (2001). A randomized controlled pilot study of motivational interviewing to change attitudes about adherence to medications for asthma. *Journal of Clinical Psychology in Medical Settings*, 8, 167–171.
- Schwartz, R. P., Hamre, R., Dietz, W. H., Wasserman, R. C., Slora, E. J., Myers, E. F., et al. (2007). Office-based motivational interviewing to prevent childhood obesity: A feasibility study. *Archives of Pediatric Adolescent Medicine*, 161, 495–501.
- Skaret, E., Weinstein, P., Kvale, G., & Raadal, M. (2003). An intervention program to reduce dental avoidance behavior among adolescents: A pilot study. *European Journal of Paediatric Dentistry*, 4, 191–196.
- Smith, D. E., Heckemeyer, C. M., Kratt, P. P., & Mason, D. A. (1997). Motivational interviewing to improve adherence to a behavioral weight-control program for older obese women with NIDDM: A pilot study. *Diabetes Care*, 20, 52–54.
- Smith-West, D. S., Dillo, V., Bursac, Z., Gore, S. A., & Greene, P. G. (2007). Motivational interviewing improved weight loss in women with type 2 diabetes. *Diabetes Care*, 30, 1081–1087.
- Stephens, R. S., Roffman, R. A., & Curtin, L. (2000). Comparison of extended versus brief treatments for marijuana use. *Journal of Consulting and Clinical Psychology*, 68, 898–908.
- Stott, N. C. H., Rees, M., Rollnick, A., Pill, R. M., & Hackett, P. (1996). Professional responses to innovation in clinical method: Diabetes care and negotiating skills. *Patient Education and Counseling*, 29, 67–73.
- Van Dorsten, B. (2007). The use of motivational interviewing in weight loss. *Current Diabetes Reports*, 7, 386–390.
- VanWormer, J. J., & Boucher, J. L. (2004). Motivational interviewing and diet modification: A review of the evidence. *The Diabetes Educator*, 30, 404–416.
- Viner, R. M., Christie, D., Taylor, V., & Hey, S. (2003). Motivational/solution-focused intervention improves HbA_{1c} in adolescents with Type 1 diabetes: A pilot study. *Diabetic Medicine*, 20, 739–742.
- Webber, K. H., Tate, D. F., & Quintiliani, L. M. (2008). Motivational interviewing in internet groups: A pilot study for weight loss. *Journal of the American Dietetic Association*, 108, 1029–1032.
- Weinstein, P., Harrison, R., & Benton, T. (2004). Motivating parents to prevent caries in their young children. *Journal of the American Dental Association*, 135, 731–738.
- Weinstein, P., Harrison, R., & Benton, T. (2006). Motivating mothers to prevent caries: Confirming the beneficial effect of counseling. *Journal of the American Dental Association*, 137, 789–793.
- Woolard, J., Beilin, L., Lord, T., Puddey, I., MacAdam, D., & Rouse, I. (1995). A controlled trial of nurse counseling on lifestyle change for hypertensives treated in general practice: Preliminary results. *Clinical and Experimental Pharmacology and Physiology*, 22, 466–468.