

MOTIVATIONAL INTERVIEWING AND SMOKING BEHAVIORS:
A CRITICAL APPRAISAL AND LITERATURE REVIEW OF
SELECTED CESSATION INITIATIVES¹

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Summary. — The present paper systematically reviewed and critically appraised three different dimensions of motivational interviewing currently utilized in smoking cessation initiatives: social support, motivation, and tailored interventions. A review of four databases generated 57 primary articles, 17 of which met the inclusion criteria of an intervention study utilizing at least one dimension of motivational interviewing, adults between 18 and 64 years, no comorbidities, and a follow-up period of at least 6 weeks. More than 11,600 participants are represented in this review. The implementation of social support, motivation, and tailored interventions yielded mixed results. Furthermore, threats to validity emerged, including self-report, follow-up period, sample sizes, *a priori* differences in groups, and web-based and text-based interventions. Further research must ascertain the efficacy of the three dimensions of motivational interviewing indicated by the mixed results reported in terms of statistical significance of cessation rates. More empirically rigorous designs with evaluations based on stringent replicable criteria are needed.

Half of the world's smokers, or approximately 650 million people, will be killed by tobacco-related diseases, establishing smoking as a leading cause of preventable death (Fagerstrom, 2002). In North America, an estimated 20% of people 12 years of age and older were smokers in 2005, marking a 6% decline since 2000 (Shields, 2007). Despite this lower prevalence, the number of deaths attributed to smoking has been increasing (Shields, 2007). The worldwide high prevalence of smoking, established negative health outcomes of smoking and benefits of cessation, and the addictive nature of cigarettes indicate the continued need for efficacious smoking cessation programs (Fagerstrom, 2002; Edwards, 2004; Perkin, Conklin, & Levine, 2007; Shields, 2007; Lindblom, 2009).

Motivational interviewing has been applied in smoking cessation initiatives and is a client-centered directive method focused on enabling change through the enhancement of intrinsic motivation and the exploration and resolution of ambivalence (Miller & Rollnick, 1991; Miller, 1996). The method is based on five foundational principles: identifying discrepancies between thought and action, supporting client autonomy, being empathetic toward the client, avoiding confrontation, and adjusting to resistance (Miller & Rollnick, 1991). These principles have been broadly applied to strategies currently employed in cessation interventions, name-

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ly, the first facilitates motivation, the second is achieved through social support (Edwards & Orford, 1977), and the latter three empower change through tailoring the intervention to the individual.

Purpose

This literature review had a two-fold purpose. First, primary studies were selected *a priori* based on the three different dimensions of motivational interviewing (social support, motivation, and tailoring the intervention). These dimensions of motivational interviewing and their overall efficacies at facilitating cessation were compared. Second, each study's methodology was appraised critically and problems of design and methods were addressed where appropriate.

METHOD

Four relevant electronic databases related to health and behavior were searched for smoking cessation programs employing cognitive-behavioral interventions: CINAHL, Sage Journals, SCOPUS, and SocINDEX. Utilizing these databases, this literature review attempted to identify all studies that used a formal program or intervention for cessation of smoking. The intervention had to extend at least 6 weeks, using samples of adults in the age range of 18 to 64 years, who did not have any comorbidities, and deal with cognitive behavior approaches, social support, and identified motivations. These database searches generated 57 potential articles, and each article's reference list was also hand-searched for additional suitable studies.

Inclusion/Exclusion Criteria

Each article was reviewed carefully for the following inclusion criteria: an intervention study that described at least one of the aforementioned dimensions of motivational interviewing: English speaking adults between 18 to 64 years, no co-morbidities, had smoking cessation statistics, and a follow-up period of a minimum of 6 weeks. Six weeks was selected to ensure an adequate number of studies was included in the review; the authors acknowledge this 6-week time-frame is not sufficiently long to ensure sustained behavior change. Studies which combined the intervention with other intervention strategies (i.e., cognitive behavioral techniques, nicotine replacement therapy, etc.), and/or the absence of a control or comparison group, were also included as variables for analysis in this review. Exclusion criteria were: participants with comorbidities, as the aim of this review was to assess the three dimensions of motivational interviewing with participants who could fully focus on the intervention, and studies without statistics. Seventeen of 57 studies met the aforementioned inclusion criteria.

Data Extraction

Once each study was determined as eligible for the study design, sample sizes, setting, participants, intervention, and outcome data were extracted. Subsequently, the potential biases were identified by examining sampling, blinding, and selective reporting, as well as other factors including attrition, compliance, and adequacy of procedures. Both the data extraction form and the assessment of bias were created based on headings described by the Cochrane Protocol (Higgins & Green, 2008). Studies were summarized in alphabetical order in Table 1, with smoking statistics being reported for the last follow-up time available. Studies which used more than one dimension of motivational interviewing were categorized into the dimension of motivational interviewing that was primary to the intervention. Results were presented utilizing the three different dimensions and validity as subheadings (Table 1).

RESULTS

Social Support

Social support is commonly understood to mean "leading the subject to believe that [s]he is cared for and loved, esteemed, and a member of a network of mutual obligations" (Cobb, 1976, p. 300). Social support, when implemented in smoking cessation programs, typically involves providing participants with an individual who supports them in the achievement of their cessation goal (May, West, Hajek, McEwen, & McRobbie, 2006). This method was utilized in May, *et al.*'s study (2006) in which participants were assigned randomly either to a control ($n = 326$) or intervention ($n = 237$) group. Both groups received group-based treatment. However, the participants in the intervention group were matched with a partner from their group, to provide support *to* and receive support *from* (May, *et al.*, 2006). The cessation rates, at 24 weeks, for the control and intervention groups were comparable at 15% and 13%, respectively (odds ratio = 1.45). These researchers suggested all participants had pre-existing social support from family members and friends that masked the social support effect in this study.

A study by Andrews, Felton, Wewers, Waller, and Tingen (2007) examined changes in social support as a possible predictor of continued smoking cessation. The authors compared a control group ($n = 52$) to an empowerment counseling group ($n = 51$). The control group was provided with written self-help and smoking cessation educational materials. The intervention group consisted of six sessions and two booster sessions, nicotine replacement therapy, and social and spiritual support. Andrews, *et al.* (2007) reported cessation rates of 5.7% for the control group and 27.5% for the intervention group at six-month follow-up. When baseline

TABLE 1
SUMMARY OF MOTIVATIONAL INTERVIEWING STRATEGIES IN SMOKING CESSATION PROGRAMS 1995–2010

Author	Population		Intervention Description	Limitations	Cessation Results
	Intervention	Control			
Andrews, <i>et al.</i> (2007)	<i>n</i> = 51 women living in subsidized housing in Georgia Population statistics <i>M</i> age = 40.2 yr. <i>M</i> no. of cigarettes per day = 13.27 *Motivated to quit	<i>n</i> = 52 women living in another subsidized housing development in Georgia *Motivated to quit	Intervention: empowerment counseling in a group (6 sessions and 2 booster sessions), nicotine replacement therapy, social support, and spiritual support Control: self-help written smoking cessation materials and education	1. CO results were not described 2. Intervention and control group differed on several baseline demographics 3. Varying dosages of intervention 4. Lack of defined protocol for spiritual enhancement	Self-report and CO testing at 6 mo. Intervention: 27.5% Control: 5.7% Odds ratio = 6.25 *Significant
Carlson, <i>et al.</i> (2000)	<i>n</i> = 971 <i>M</i> age = 39.9 yr. 66.1% were female <i>M</i> no. of cigarettes per day = 25.1 *Motivated to quit		Intervention: eight 90-min. group sessions over 4 mo. utilizing education, self-monitoring, nicotine fading, motivation, and behavioral modifications	1. Self-report 2. Only 33.9% of sample was contacted at 8 yr. 3. Participants valued intervention but qualitative methods were not discussed	Self-report at 8 yr. Intervention: 16.2%
Carlson, <i>et al.</i> (2003)	<i>n</i> = 1,800 <i>M</i> age = 42.2 yr. 63.1% were female <i>M</i> no. of cigarettes per day = 21.4 *Motivated to quit		Intervention: eight 90-min. group sessions over 4 mo. utilizing education, self-monitoring, nicotine fading, motivation, and behavioral modifications	1. Self-report 2. 23% of participants did not complete all assessments, and analysis revealed those who completed analysis where less dependent on tobacco	Self-report at 3 mo. Intervention: 39.5%
Cohn, <i>et al.</i> (2000)	<i>n</i> = 111 57 people smoked 20+ cigarettes a day and 54 smoked between 10–20 cigarettes a day		Intervention: 6-wk., seven session program with education and prevention for relapse based on “Freedom from Smoking” program	1. Self-report 2. Only 51% of participants completed the program 3. 23 of the 57 participants who completed the study reported using NRT outside the scope of the study	Self-report at 6 wk. Intervention: 44%

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Note.—*n* = number of participants; pharm. = pharmacological; NRT = nicotine replacement therapy.

TABLE 1 (CONT'D)
SUMMARY OF MOTIVATIONAL INTERVIEWING STRATEGIES IN SMOKING CESSATION PROGRAMS 1995–2010

Author	Population		Intervention Description	Limitations	Cessation Results
	Intervention	Control			
Free, <i>et al.</i> (2008)	<i>n</i> = 102 <i>M</i> age = 36 yr. for entire sample 48% were female in entire sample Median number of cigarettes per day = 20 in entire sample	<i>n</i> = 98	Intervention: 4 wk. of text messages which include key elements of support for successful cessation as identified in systematic reviews Control: 49 simple, short, generic text messages	1. Biochemical verification was not provided for all participants who claimed cessation 2. No restriction of use of other cessation strategies during intervention 3. 7-day point prevalence was used	Self-report and saliva test at 6 mo. Intervention: 8.5% Control: 6.7% <i>p</i> = .60 Relative risk = 1.28 Chi-squared test Not statistically significant
Gilbert & Sutton (2006)	<i>n</i> = 753 <i>M</i> age = 39.3 yr. 65.8% were female *Motivated to quit	<i>n</i> = 704 <i>M</i> age = 39.1 yr. 64.2% were female *Motivated to quit	Intervention: Quitline, a hotline smokers can call to receive smoking cessation support and 0–4 proactive calls by counsellors at Quitline Control: no intervention	1. Self-report 2. Approximately 60% of participants completed 1 yr. assessment 3. No protocol for content of calls	Self-report at 1 yr. Intervention: 9.3% Control: 9.5% <i>F</i> test Non-significant
Hernández-López, <i>et al.</i> (2009)	CBT <i>n</i> = 38 <i>M</i> age = 42.43 years for entire sample 64% of entire sample were female <i>M</i> no. of cigarettes per day = 23.9 for entire sample	ACT <i>n</i> = 43	CBT: seven weekly 90-min. group cessation of 8–10 individuals focused on preparation for quitting, quitting, and maintenance/relapse prevention ACT: seven weekly 90-min. group cessation of 8–10 individuals focused on clarifying value of quitting and acceptance of quitting	1. Of the 81 participants, only 56 received all five sessions, and only 42 completed the 1-yr. follow-up 2. Non-random assignment, participants who contacted one agency received CBT and the other agency received ACT	Self-report and CO test at 1 yr. CBT: 13.2% ACT: 30.2% <i>p</i> = .06 Odds ratio = 5.13 Nonsignificant

Note.—*n* = number of participants; pharm. = pharmacological; NRT = nicotine replacement therapy.

TABLE 1 (CONT'D)
SUMMARY OF MOTIVATIONAL INTERVIEWING STRATEGIES IN SMOKING CESSATION PROGRAMS 1995–2010

Author	Population		Intervention Description	Limitations	Cessation Results
	Intervention	Control			
Killen, <i>et al.</i> (2008)	Telephone counseling <i>n</i> = 154 <i>M</i> age = 45.57 yr. 38.3% were female <i>M</i> no. of cigarettes smoked per day = 20.55	General support <i>n</i> = 147 <i>M</i> age = 46.07 yr. 42.2% were female <i>M</i> no. of cigarettes smoked per day = 19.37	Tel. counseling: four 30-min. treatment sessions to develop skills to resist urges, as well as weekly calls to a check in and track progress, and 9 wk. of Zyban® and 8 wk. of NRT Comparison: same as intervention, but instead of weekly calls, four 5-min. calls providing general support	1. Approximately 50% NRT compliance 2. Only 83% of reported cessation were verified	Self-report and CO test at 1 yr. Tel.: 31% Comparison: 27% Non-significant
May, <i>et al.</i> (2006)	<i>n</i> = 237 Given as entire population statistics <i>M</i> age = 43.6 yr. 62% were female <i>M</i> no. of cigarettes per day = 23 *Motivated to quit	<i>n</i> = 326 *Motivated to quit	Intervention: group-based treatment consisting of six weekly sessions based on the “withdrawal-oriented” model of cessation and assigned buddy Control: Same as intervention, without buddy component *113 participants were offered NRT	1. Self-report 2. No limit on utilizing additional cessation resources 3. Some participants were offered NRT, but not equally across groups	Self-report at 24 wk. Intervention: 13% Control: 15% Odds ratio = 1.45 Non-significant
O’Loughlin, <i>et al.</i> (1997)	<i>n</i> = 113 <i>M</i> age = 44.8 yr. 73.5% were female <i>M</i> no. of cigarettes per day 27.5 *Motivated to quit	<i>n</i> = 299 <i>M</i> age = 38.6 yr. 51.4% were female <i>M</i> no. of cigarettes per day 20.8 *Motivated to quit	Intervention: “Yes, I Quit” five 2-hr. group sessions at 1-wk. intervals with one booster session after the intervention and 2 booster mail-outs at 3 and 6 mo. after the intervention Control: baseline assessment only	1. Self-report 2. Only 12.2% of participants attended all sessions 3. Comparison group was based on a 1992 survey 4. No assessment impact of tailored intervention 5. Excluded participants lost to follow-up from cessation rates	Self-report at 6 mo. 22.3% of subjects reported cessation

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Note.—*n* = number of participants; pharm. = pharmacological; NRT = nicotine replacement therapy.

TABLE 1 (CONT'D)
SUMMARY OF MOTIVATIONAL INTERVIEWING STRATEGIES IN SMOKING CESSATION PROGRAMS 1995–2010

Author	Population		Intervention Description	Limitations	Cessation Results
	Intervention	Control			
Resnicow, <i>et al.</i> (1997)	<i>n</i> = 703 <i>M</i> age = 44 yr. 58% were female <i>M</i> no. of cigarettes per day = 15.3 *Motivated to quit	<i>n</i> = 541 <i>M</i> age = 46.4 yr. 65% were female <i>M</i> no. of cigarettes per day = 16.5 *Motivated to quit	Intervention: health education materials (booklet and video) plus booster call asking them to complete health education material Control: Health education material (booklet and video)	1. Self-report 2. Only 1/3 of intervention sample were reached for booster call (due to quick recruitment and not checking for completeness of recruitment form at intake)	Self-report at 6 mo. Intervention: 11.2% Control: 7.9% Chi-squared <i>p</i> = .06 Odds ratio = 2.03 Non-significant
Rodgers, <i>et al.</i> (2005)	<i>n</i> = 852 18+ yr. of age *Motivated to quit	<i>n</i> = 853 18+ yr. of age *Motivated to quit	Intervention: regular text messaging providing education and distraction Control: one text message every 2 wk. reminding them they were in the study	1. 125 participants reported quitting and were invited to take a saliva test: 23 were not smoking, 26 had levels indicating they were still smoking, and 76 did not attend 2. Possible confound as use of other cessation strategies was not limited, and information on government subsidy for NRT was provided to participants 3. Incentive of one month free text messaging was provided to participants 4. Participants were not blinded to group allocation	Self-report and some saliva testing at 6 wk. Intervention: 28% Control: 13% Confidence intervals <i>p</i> < .0001 Relative risk = 2.20 *Significant
Swartz, <i>et al.</i> (2006)	<i>n</i> = 171 18+ yr. of age 53.2% were female *Motivated to quit	<i>n</i> = 180 18+ yr. of age 50.6% were female *Motivated to quit	Intervention: Internet site that presented current strategies for smoking cessation and motivational material tailored to participants' ethnicity, sex, and age Control: waitlisted for 90 days (continued on next page)	1. Self-report 2. Only 6.1% of participants provided a complete final assessment 3. 56% of users set a quit date, which was study criteria	Self-report at 3 mo. Intervention: 12.3% Control: 5.0% Chi-squared <i>p</i> = .02 Odds ratio = 2.66 *Significant

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TABLE 1 (CONT'D)
SUMMARY OF MOTIVATIONAL INTERVIEWING STRATEGIES IN SMOKING CESSATION PROGRAMS 1995–2010

Author	Population		Intervention Description	Limitations	Cessation Results
	Intervention	Control			
Te Poel, <i>et al.</i> (2009)	<i>n</i> = 224 M age for entire sample = 46.1 yr. 56.1% of sample were female M no. of tobacco products per day = 22	<i>n</i> = 234 M no. of tobacco products per day = 20	Intervention: received a computer tailored e-mail letter between seven to nine pages Control: received a generic non-tailored seven-page e-mail	1. Self-report 2. Over 50% of participants were lost to follow-up 3. Feedback on intervention was provided 6 months post-intervention inhibiting accurate recall	Self-report at 6 mo. Intervention: 20.4% had not smoked in past wk. Control: 7.8% had not smoked in past week <i>p</i> = .01 Odds ratio = 4.04 *Significant
Tindle, <i>et al.</i> (2006)	<i>n</i> = 17 M age = 48 yr. Gender = 11 female, 6 male 20 < cigarettes per day = 11 20 + cigarettes per day = 6 *Motivated to quit	<i>n</i> = 17 M age = 49 yr. Gender = 11 female, 6 male 20 < cigarettes per day = 11 20+ cigarettes per day = 6 *Motivated to quit	Intervention: six guided-imagery sessions and a home study which included a workbook and four audio CDs Control: wait-listed	1. Majority of participants did not meet recommend use of guided imagery per week 2. Small sample size 3. Participants were not blinded to group allocation 4. Participants had higher use of complementary therapies than National average	Self-report and saliva Cotinine at 12 wk. Intervention: 29% Control: 12% Non-significant
Williams, <i>et al.</i> (2006)	<i>n</i> = 714 M age = 45.5 yr. 62.7% were females M no. of cigarettes per day = 20.3 30.8% used pharmacological intervention	<i>n</i> = 292 M age = 44.8 yr. 66.8% were females M no. of cigarettes per day = 20.9 15.8% used pharmacological intervention	Intervention: self-determination theory—meet with counsellors four times, received Public Health Services booklet “You Can Stop Smoking” and list of active cessation programs in their area. Control: received Public Health Services booklet “You Can Stop Smoking” and list of active cessation programs in their area.	1. Biochemical verification only took place for some cessation measures 2. Attrition rate of 303 participants, with significantly more non-whites than whites dropping out of the study 3. Accepted only a small portion of the population with mental illness, not representative sample	Self-report and saliva testing at 6 mo. Intervention: 11.2% Control: 3.7% Chi-squared test with <i>p</i> < .001 Odds ratio = 3.22 *Significant
Zernig, <i>et al.</i> (2008)	<i>n</i> = 366 M age = 43.3 yr. 56.6% were female Fagerstrom score = 5.3	<i>n</i> = 413 M age = 43.6 yr. 58.1% were female Fagerstrom score = 5.5	Intervention: 1.5 day psychotherapeutic intervention consisting of psychoeducation and training in autosuggestion techniques Pharmacological: 9 wk. of Zyban®	1. Only 587 participants completed 1-yr. assessment 2. 38.5% of participants rejected the pharmacological aid	Self-report at 1-yr. CO test and cotinine Intervention: 39.1% Pharm.: 12.3% <i>p</i> < .001 Odds ratio = 4.55 *Significant

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differences were controlled, the results were significant (odds ratio = 6.25). The authors determined that changes in total social support did not affect abstinence outcomes significantly.

A study by Killen, Fortmann, Schatzberg, Arredondo, Murphy, Hayward, *et al.* (2008) used both nicotine replacement therapy and social support to aid in cessation attempts. The control group ($n = 147$) received four sessions that focused on resisting the urge to smoke, and then four follow-up scripted telephone sessions. The intervention group ($n = 154$) received the same initial sessions and made weekly calls to a voicemail service that tracked progress to cessation. Also, if participants indicated they were having urges to smoke, then a phone call from a staff member was made to provide social support (Killen, *et al.*, 2008). Prior to the intervention, both groups received 17 weeks of nicotine replacement therapy (Killen, *et al.*, 2008). Cessation results at one-year follow-up were not statistically significant, with 27% of the control group and 31% of the intervention group reporting abstinence (Killen, *et al.*, 2008).

Free, Whittaker, Knight, Abramsky, Rodgers, and Roberts (2008) used a text-messaging-based intervention. Participants were randomly assigned to the control ($n = 98$) or intervention ($n = 102$) group. The control group received regular generic text messages regarding cessation. The intervention group received text messages offering support in their cessation attempt; the latter were based on elements identified as effective through a previous evaluation (Free, *et al.*, 2008). At six-month follow-up, 6.7% of the control group and 8.5% of the intervention group had their cessation claims verified biochemically, results were not significant (relative risk = 1.28). These four studies indicate that social support had mixed results in promoting smoking cessation.

Motivation

Four studies focused on motivational interventions. Motivation is generally understood in terms of individual drives to achieve a desired behavior or outcome (White, 1959). Williams, McGregor, Sharp, Levesque, Kouides, Ryan, *et al.* (2006) tested the utility of self-determination theory as an intervention for smoking cessation. Self-Determination Theory assumes an individual's autonomy and intrinsic motivation together facilitates a desired behavioral change (Williams, *et al.*, 2006). Participants were assigned randomly to a control ($n = 292$) or intervention ($n = 714$) groups, and both groups received public health services booklets and a list of cessation programs available in the area (Williams, *et al.*, 2006). The intervention group also received four one-on-one counseling sessions focused on augmenting intrinsic motivation (Williams, *et al.*, 2006). Cessation rates were 3.8% and 11.2% (odds ratio = 3.22; $p < .001$) for the control and in-

intervention groups, respectively, at six-month follow-up (Williams, *et al.*, 2006). These results supported the application of self-determination theory and, more specifically, intrinsic motivation enhancement to facilitate smoking cessation (Williams, *et al.*, 2006).

A study by Zernig, Wallner, Grohs, Kriechbaum, Kemmler, and Sarria (2008) compared psychotherapy ($n = 366$) and a nine-week pharmacological intervention ($n = 413$). Psychotherapy focused on increasing motivation through guided imagery techniques aimed at self-determination, competence, self-worth, and autonomy. The pharmacological intervention used was Zyban[®], as it eases nicotine withdrawal symptoms and reduces urges by acting on neurotransmitters (Insel & Roth, 2008). The researchers found the psychotherapy group results were significant compared to the Zyban[®] group, with cessation rates of 39.1% and 12.3%, respectively, at one-year follow-up (odds ratio = 4.55; $p < .001$).

Conversely, in a study which involved proactive phone calls to participants from Quitline, a telephone service available to individuals trying to quit smoking, Gilbert and Sutton (2006) found cessation rates were not statistically significant between the control ($n = 704$) and intervention ($n = 753$) groups at one-year follow-up (9.5% and 9.3%, respectively). The proactive calls from the Quitline counsellors attempted to instill motivation in the participants (Gilbert & Sutton, 2006). The authors suggested motivation to quit smoking cannot be instilled in participants; rather participants must be intrinsically motivated to quit.

Two studies, one by Carlson, Taenzer, Koopmans, and Bultz (2000) and another by Carlson, Taenzer, Koopmans, and Casebeer (2003), used eight 90-minute group sessions focused on education, self-monitoring, nicotine fading, motivation, and behavioral modifications to promote cessation ($n_s = 971$ and 1,800, respectively). The former study followed participants for eight years and had a self-report quit rate of 16.2%. The latter study followed participants for three months and reported a self-report quit rate of 39.5% (Carlson, *et al.*, 2000; Carlson, *et al.*, 2003).

A study by Hernández-López, Luciano, Bricker, Roales-Nieto, and Montesinos (2009) compared acceptance and commitment therapy to cognitive-behavioral therapy. Acceptance and commitment therapy assessed value clarification as a means to increase motivation to quit whereas Cognitive Behavioral Therapy focused on preparing participants to quit. At one-year follow-up, the authors found higher results for the acceptance and commitment therapy group ($n = 43$), with cessation rates of 30.3% compared to 13.2% in the cognitive behavioral therapy group ($n = 38$); however, the differences between the two groups were non-significant due to the small sample size and group differences observed at baseline

(odds ratio = 5.13). These four studies did not give a clear indication of how motivation-enhancing strategies affect smoking cessation.

Tailoring Cessation Programs to the Individual or Group

Three studies assessed programs tailored to reflect and better address participants' specific cultural and personal factors to facilitate cessation. A study by Swartz, Noell, Schroeder, and Ary (2006) randomly assigned participants to either a control ($n = 180$) or an intervention ($n = 171$) group. The control group was wait-listed for 90 days and subsequently given access to the program. The intervention group received access to a website-based platform that provided users with cessation material tailored to each participant's ethnicity, sex, and age. These researchers reported significant differences in cessation between the control group, 5.0%, and the intervention group, 12.3%, at three-month follow-up (odds ratio = 2.66; $p < .02$). The results suggest tailoring programs to individuals can be a useful application.

Similarly, Rodgers, Corbett, Bramley, Riddell, Wills, Lin, *et al.* (2005) randomly assigned participants to two groups. In the control group ($n = 853$), participants received a text message every two weeks reminding them they were participating in the study. Participants in the intervention group ($n = 852$) received regular personalized text messages offering education about smoking cessation and distraction from smoking. Cessation rates for the control group, 13%, and intervention group, 28%, were significant at six-week follow-up (relative risk = 2.66; $p < .0001$; Rodgers, *et al.*, 2005). Likewise, in a study by Te Poel, Bolman, Reubsæet, and de Vries (2009), participants were randomly assigned to two groups. The control group ($n = 234$) received a non-tailored e-mail with facts and information about cessation. The intervention group ($n = 224$) received tailored feedback in an e-mail (using information participants provided in a previous questionnaire). When the control group was compared to the tailored feedback group, the seven-day abstinence rates reported at six months were significantly different, 7.8 and 20.4%, respectively (odds ratio = 4.40; $p < .01$).

Although the three studies discussed above had increased cessation rates, not all programs using tailored interventions have resulted in statistically higher cessation rates than control groups. Cohn, Dodson, French, Ervin, Ciarlariello, and Wilson (2000) recruited 111 smoking parents of children with respiratory diseases and offered them a cessation program tailored to inform the parents how smoking negatively affected their children. This program resulted in cessation for 44% of participants immediately following the program. A study by Tindle, Barbeau, Davis, Eisenberg, Park, Phillips, *et al.* (2006) randomly assigned participants to either a control group ($n = 17$), where participants were wait-listed, or an interven-

tion group ($n = 17$) which utilized participant-generated guided imagery to promote smoking cessation. Results were non-significant at 12-week follow-up between the control and intervention groups, with cessation rates of 12% and 29%, respectively (Tindle, *et al.*, 2006). The researchers proposed the lack of difference was likely due to the small sample size.

A study by Resnicow, Vaughan, Futterman, Weston, Royce, Parns, *et al.* (1997) randomly assigned participants into two groups. The control group ($n = 541$) received generic educational material on smoking cessation. The intervention group ($n = 703$) received educational material for cessation based on cultural values of African-American women. The material also included a reminder call tailored to their stage of change and encouragement to complete the educational material. Cessation results were not significant at six-month follow-up (odds ratio = 2.03). Another study which utilized tailored cessation material distributed to women of low socioeconomic status was conducted by O'Loughlin, Paradis, Renaud, Meshefedgian, and Barnett (1997). The control group ($n = 299$) had a baseline assessment only. The intervention group ($n = 113$) consisted of five two-hour weekly sessions focusing on cessation skills, motivation and coping strategies as well as a booster session two weeks later. A six-month cessation rate of 22.3% was reported for the intervention group. However, no assessment was undertaken to examine the effect of the tailored intervention compared to the control group and the significance of this result was not assessed. Based on the above review of tailored methods, personalizing smoking cessation programs for the individual or the culture generates mixed results with respect to promoting cessation.

DISCUSSION

This literature review examined three dimensions of motivational interviewing (social support, motivation, and tailoring the intervention) used in primary smoking cessation studies for adults, and assessed the efficacy of motivational interviewing in promoting cessation. Overall, the results were mixed. Intrinsic motivation was found to be a better predictor of cessation success (Williams, *et al.*, 2006) when compared to other individuals attempting to instill external motivation (Gilbert & Sutton, 2006). Studies in which programs were tailored to individuals, or were client-centered, demonstrated mixed results with regard to facilitating smoking cessation (Resnicow, *et al.*, 1997; Cohn, *et al.*, 2000; Rodgers, *et al.*, 2005; Swartz, *et al.*, 2006).

There were several threats to validity which merit underlining. The primary threat to validity common to nine of the studies reviewed was the use of self-report as the only measure of cessation (O'Loughlin, *et al.*, 1997; Resnicow, *et al.*, 1997; Carlson, *et al.*, 2000; Cohn, *et al.*, 2000; Carlson, *et al.*, 2003; Gilbert & Sutton, 2006; May, *et al.*, 2006; Swartz, *et al.*, 2006;

Te Poel, *et al.*, 2009). Self-report was problematic because quit rate was the key variable in cessation intervention studies and it lacked validity. Also, of the eight studies that used some form of biochemical cessation verification, either carbon monoxide testing or cotinine tests, there were additional concerns. Specifically, four studies did not biochemically verify *all* claims of cessation (Rodgers, *et al.*, 2005; Williams, *et al.*, 2006; Free, *et al.*, 2008; Killen, *et al.*, 2008), and one study did not present the results of the tests (Andrews, *et al.*, 2007). The use of self-report was problematic as there was the possibility of a spurious relationship between variables and the possibility of inflated cessation rates (Benowitz, Jacob, Ahijevych, Jarvis, Hall, LeHouezec, *et al.*, 2002). The validity concerns of utilizing self-report were further amplified as four of the eight studies, which employed some form of biochemical verification of cessation, yielded mixed results regarding statistically significant cessation rates when compared with control groups (Rodgers, *et al.*, 2005; Tindle, *et al.*, 2006; Williams, *et al.*, 2006; Andrews, *et al.*, 2007; Free, *et al.*, 2008; Killen, *et al.*, 2008; Zernig, *et al.*, 2008; Hernández-López, *et al.*, 2009). Furthermore, when valid independent measures of cessation were used, cessation rates were much lower and frequently did not differ significantly from control groups' rates.

Another threat to validity was the inconsistency in follow-up periods. Cessation vacillates over time with relapse being more common than prolonged cessation in the first six months of a quit attempt (Fisher & Katz, 1999; Gutmann, Carter, Sobell, Prevo, Toll, Levin Gutwein, Sobell, *et al.*, 2004). A standard time frame required to be fairly confident relapse will not occur has not been established; however, the Surgeon General and several researchers suggest a minimum of two years (Ockene, Emmons, Mermilstein, Perkins, Bonollo, Voorhees, *et al.*, 2000; Gutmann, *et al.*, 2004). Although a minimum of six weeks was chosen for studies to be included in this literature review, the ideal follow-up period of two years was met only in one study (Hernández-López, *et al.*, 2009). Moreover, 12 of the studies examined in this review did not meet the one-year standard follow-up widely accepted in cessation studies. The highest quit rates reported in this review were from studies with follow-up periods of less than one year (Carlson, *et al.*, 2003; Tindle, *et al.*, 2006). Follow-up periods of at least one year, and preferably two years, are required to gain a more realistic understanding of the ability of interventions to both enable and maintain cessation.

Further threats to validity included sample size, *a priori* differences, and interventions where dose was hard to ensure. Three studies had small sample sizes (Andrews, *et al.*, 2007; Hernández-López, *et al.*, 2009; Tindle, *et al.*, 2009). These small sample sizes led to low statistical power. Moreover, several studies had major *a priori* differences between groups; these included, for example, the sex distribution of the sample, tobacco use, and

age (O'Loughlin, *et al.*, 1997; Gilbert & Sutton, 2006; Killen, *et al.*, 2008). Lastly, four studies used web-based methods, or text messages which resulted in major concerns surrounding external validity, consistency in the delivery and dose of the intervention, as well as the circumstances in which the intervention was received (Rodgers, *et al.*, 2005; Swartz, *et al.*, 2006; Free, *et al.*, 2008; Te Poel, *et al.*, 2009).

By far, the major limitations to current research on smoking cessation programs are the reliance on self-report tools and the inconsistency in the use of biochemical verification and inadequate follow-up periods. Without biochemical verification of all cessation claims, there is the possibility that social desirability bias artificially inflates cessation results (King & Burner, 2000). This important issue points to the absolute need for further research into smoking cessation programs to include biochemical verification of cessation within the research design. Biochemical verification, as opposed to self-report alone, will eliminate the potential effect of social desirability bias and allow for a definitive determination that the observed cessation rates accurately match individuals' claims to have quit smoking. Furthermore, given that relapse is so prevalent within the first six months of a quit attempt, the lack of consistency in follow-up periods, and the use of follow-up periods of less than one year brings the efficacy of interventions at maintaining cessation into question (Brownell, Marlatt, Lichtenstein, & Wilson, 1986; Ockene, *et al.*, 2000; Gutmann, *et al.*, 2004). Extending follow-up periods to a minimum of one year would allow a better assessment of the effect of interventions at not only initiating but also maintaining cessation, thereby providing a more accurate portrayal of the efficacy of cessation programs for the long term.

Given the massive detriments to health caused by smoking and the well-established benefits of cessation, the prevalence of smoking in North America is alarming. There is an urgent need for efficacious smoking cessation programs. These smoking cessation programs must be constructed based on stringent criteria, and the replication of findings needs to be assured to be confident the most efficacious cessation programs are being offered. Therefore, future research should be based on and derived from sound empirical methods with a focus on determining the most efficacious strategies for smoking cessation.

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