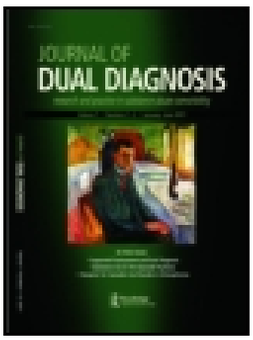

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ABSTRACT. Two hundred eight psychiatrically complex military veterans (97% male; $n = 201$) were recruited as part of a study investigating the differential efficacy of three brief (one-session) motivational interviewing (MI) interventions to yield changes in smoking behavior. Participants were randomly assigned to one of three MI interventions: MI alone, MI plus breathing instruction, or MI plus incentive spirometry (a tool for feedback about lung

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function and an inexpensive form of biofeedback. Results suggested that smoking behavior, measured by self-reported number of cigarettes per day and confirmed by expired carbon monoxide levels, decreased across groups over time. However, there were no differences among treatment conditions on cigarettes per day or measures of tobacco dependence. Implications for harm reduction in this challenging population are discussed.

KEYWORDS. Motivational interviewing, smoking, tobacco, spirometry

Over the last 2 decades, motivational interviewing techniques, as described and developed by Miller and Rollnick (1991, 2002), have generated enormous clinical and research interest. Efforts in this area seem to have culminated in a paradigm shift within the addiction treatment field, with care providers across disciplines and treatment foci seeking and receiving training in adaptations of motivational interviewing (AMIs; O'Leary Tevyaw & Monti, 2004). At least four meta-analyses published to date examine the effectiveness of the various AMIs (Burke, Arkowitz, & Menchola, 2003; Dunn, Deroo, & Rivara, 2001; Noonan & Moyers, 1997; Bien, Miller, & Tonigan, 1993) and support such a paradigm shift. Results across these meta-analyses demonstrate that AMIs have outcomes superior to no treatment or to placebo control. In addition, when AMIs were compared to other active treatments, such as cognitive-behavioral therapy (CBT), the effect size for any reported differences was very close to zero (Burke et al., 2003). Based on the meta-analyses alone, one might surmise that AMIs are superior to no treatment and are as effective as more intensive and costly CBT (Burke et al., 2003; Dunn, Deroo & Rivara, 2001; Noonan & Moyers, 1997; Bien et al., 1993).

A number of researchers have looked closely at the data regarding the utility of AMIs for tobacco cessation more specifically. Here, the literature is equivocal (e.g., Hecht, Borrelli, Breger, DeFrancesco, Ernst, & Resnicow, 2005), with modest results for pregnant smokers (Ershoff, Quinn, Boyd, Stern, Gregory, & Wirtschafter, 1999; Stotts, DiClemente, Dolan-Mullen, 2002), teenage smokers with polysubstance use (McCambridge & Strang, 2004; Tait & Hulse, 2003), smokers with schizophrenia (Steinberg, Ziedonis, & Krejci, 2004), cancer patients (Wakefield, Olver, & Whitford, 2004), adolescent psychiatric patients (Brown et al., 2003), and methadone-maintained pregnant smokers (Haug, Svikis, & DiClemente, 2004).

One explanation for the data on AMIs for tobacco cessation is that the gold standard for outcome in the treatment of tobacco dependence

(i.e., biochemically verified sustained tobacco abstinence) is an unnecessarily conservative outcome. In fact, smoking cessation may not be the only (or most appropriate) measured outcome of motivational interviewing (MI), as the "true" target of MI is *engagement in change efforts*, either independently or with professional help. The techniques of motivational interventions are indeed more effective for fostering attendance at smoking cessation programs (Steinberg et al., 2004), reducing the number of cigarettes smoked (Wakefield et al., 2004), and moving individuals through stages of change for tobacco (Hecht et al., 2005), with moderate effect sizes. Therefore, the utility of AMIs in smoking cessation remains an area of interest, and it would be premature to drop AMIs from clinical research agendas.

AMIs AMONG INDIVIDUALS WITH PSYCHIATRIC COMORBIDITY

Research focused on the efficacy of AMIs among populations with increased vulnerability for tobacco dependence appears to be of primary importance. The problem of tobacco dependence is inflated among patients with mental illness (Lasser, Boyd, Woolhandler, Himmelstein, McCormick, & Bor, 2000). Unfortunately, clinical trials typically include psychiatric conditions as exclusion criteria. In addition, smoking cessation trials among individuals with psychiatric comorbidity have generated mixed results. Some trials have reported discouraging outcomes (e.g., Dalack & Meador-Woodruff, 1999), while others have observed more promising results. For example, in a test of the efficacy of a single session of MI in motivating smokers with schizophrenia, an MI intervention, when compared to standard psychoeducational counseling and brief advice, led to a greater proportion of participants contacting a treatment provider and receiving a first session of counseling compared to the other conditions (Steinberg et al., 2004).

Given these findings and given the challenge in assisting smokers with psychiatric comorbidity quit smoking (Dalack & Meador-Woodruff, 1999), as well as the elevated rate of smoking among veteran samples (Hankin, Spiro, Miller, & Kazis, 1999; Dobie, Kivlahan, Maynard, Bush, Davis, & Bradley, 2004), we sought to examine the efficacy of adjuncts to MI with a population of military veterans with psychiatric comorbidity. Because our clinical and research experience with veterans with multiple psychiatric comorbidities suggests that reinforcement schedules and availability of alternative adaptive reinforcers are often very limited, we were interested

in adding a low-cost behavioral task that might serve to increase the power of the personal feedback component of the MI.

The goal of this brief intervention study was to evaluate the effects of enhanced MI that incorporated both pulmonary function test feedback and daily biofeedback practice designed to focus patients in a concrete manner on their pulmonary functioning. We chose to evaluate the relative efficacy of incentive spirometry (IS) and breathing instruction (BI), added to a platform of MI. We chose the incentive spirometer, a low-cost, relatively simple portable biofeedback device used to exercise the diaphragm in patients following surgery (Bastin, Moraine, Bardocsky, Kahn, & Mélot, 1997). Although IS has not been used expressly as an adjunct to tobacco dependence treatment, the function of IS is to practice controlled breathing, with provision of immediate feedback about one's progress. Further, it was hypothesized that it may increase the salience of the personal feedback (pulmonary function tests) of MI. Therefore, IS was conceptualized as an ideal contrast to the prescribed instructions in deep breathing. BI was chosen, as it has face validity but no clear demonstrated benefits for pulmonary functioning or smoking cessation (e.g., Payne, Unpublished manual). MI/BI was included as a comparison to MI alone and to MI/IS. By including MI/BI, we hoped to control for the breathing component of MI/IS to better understand whether MI/IS led to success over and above MI with BI. We evaluated the relative utility of these three different types of MI within a psychiatrically and medically complex population.

We hypothesized that within our psychiatrically complex population of patients who had not presented for smoking cessation treatment or expressed motivation for smoking cessation, patients treated with practice-enhanced MI (MI/BI and MI/IS) would evidence more change than patients treated with MI alone and that this change would be largest among patients who received the incentive spirometer. We anticipated a reduction in smoking over all conditions. Dependent variables included measures of self-reported smoking rate, nicotine dependence, and expired carbon monoxide (CO).

METHODS

Participants

Two hundred eight military veterans (97% male; $n = 201$) were recruited as part of a study investigating the differential efficacy of three

brief (one-session) MI interventions to facilitate engagement in smoking cessation efforts and yield changes in smoking behavior. Participants were recruited using flyers posted throughout the VA Boston Healthcare System. Flyers made no mention of quitting smoking. Rather, they solicited for individuals who currently smoked cigarettes and "were curious about their lung functioning." The study was approved by the VA Boston Healthcare System's Internal Review Board, and all participants provided informed consent before initiating the study.

Procedure

Criteria for study participation were aimed at being maximally inclusive to facilitate generalizability across veterans. Individuals were eligible for participation if they were at least 18 years old, smoked cigarettes on a daily basis (by self-report), and were planning to remain in the Boston area for the following 6 months. There were no exclusion criteria related to psychiatric conditions, substance abuse history, or physical conditions.

Veterans contacted (or were contacted by) research staff by telephone to complete initial eligibility screening. A subset of veterans presented to the research staff office without appointment expressing interest in participation; these veterans were screened for eligibility in person. Once determined to be eligible for study participation, individuals were scheduled for a baseline assessment. This baseline assessment generally took place within 3 weeks of the telephone screening. During the in-person baseline assessment at the clinic-based laboratory, participants completed the informed consent process and self-report measures of smoking-, coping-, and mood-related variables. At that time, they also completed physiological measures, including expired CO and pulmonary function tests including lung capacity, volume of air expired in one second, and resting heart rate. All participation was voluntary; veterans were compensated ($40) for their time to complete the assessment. At the conclusion of the baseline assessment, participants were randomly assigned to an intervention condition and given an appointment time within 1 to 2 weeks to return the clinic. Participants were told only that they had an appointment to get feedback on the assessment and speak with a doctor about any concerns they might have related to their smoking.

The follow-up period included six follow-up assessments at monthly intervals with a research assistant, each lasting 30 minutes. Participants completed an abbreviated self-report assessment packet and the same physiological measures as in the baseline assessment. Participants were

provided with written appointment cards indicating their follow-up assessment time and were given telephone reminder calls the night preceding the appointment. Each follow-up appointment was scheduled at the previous meeting or by phone or letter (if the previous meeting was missed). Participants were given the opportunity to complete the follow-up assessments by telephone (excluding the physiological measures) if necessary.

Interventions

During the intervention meeting, participants met with one of three clinical psychologists, who delivered one of three treatment conditions: (1) MI alone, (2) MI plus instruction in deep breathing (MI/BI), or (3) MI plus instruction in the use of an incentive spirometer for practice in breath/diaphragmatic control (MI /IS). The single MI session was developed based on Miller and Rollnick's (1991, 2002) MI manual and was informed by the Project MATCH motivational enhancement manual (Project MATCH Research Group, 1994). A single session of MI has been shown to be effective in several studies with both adults and young adolescents (e.g., Colby et al., 1998; McCambridge & Strang, 2004). Study therapists were all doctoral-level psychologists with a minimum of 3 years' experience treating addictions (including nicotine dependence) and were trained using the Motivational Interviewing Professional Training Series (Miller & Rollnick, 1998). Each therapist conducted all three interventions in order to minimize the potential confound of therapist effects. The MI sessions lasted 40 to 50 minutes and included elicitation of idiographic smoking history and the patient's perceptions about his/her smoking; elicitation of self-motivating statements; presentation and discussion of personalized feedback, including smoking-, mood-, and coping-related variables, and pulmonary function tests; discussion of benefits and concerns regarding smoking; and (if appropriate) development of a change plan and provision of smoking cessation referrals.

In addition to the MI portion of the intervention, participants in the MI/BI condition were trained in deep breathing. Participants were told to breathe deeply and slowly for 5 minutes. The clinician then demonstrated the diaphragmatic deep breathing technique and had the patient demonstrate his/her understanding of this technique in session. Following the MI portion of the intervention, participants in the MI/IS condition were trained to use the incentive spirometer. Participants were shown the incentive spirometer device, and the goal of the device, which was to exhale moderately and continuously, was explained. Participants were instructed to exhale so that

the gauge would rise to the mid-region. The goal of the IS practice was to control the gauge with exhalation. Clinicians demonstrated with an incentive spirometer and then gave the participant his or her own incentive spirometer to demonstrate understanding by practicing in session. The post-session instruction for both deep breathing and IS was to practice three times daily.

Measures

Demographics Questionnaire

This brief self-report measure assesses age, sex, education, employment status, intimate partnership status, income, and ethnicity. Participants were also asked to indicate use of current prescribed medications.

Fagerstrom Test of Nicotine Dependence (FTND)

The FTND (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) was used to assess severity of nicotine dependence. Internal consistency within this sample was adequate ($\alpha = .64$). The FTND has demonstrated good convergent validity with biochemical indices of heaviness of smoking (Heatherton et al., 1991).

Smoking Quantity and Frequency

Smoking quantity was measured at baseline and follow-up by the items, "How many cigarettes do you smoke per day?" and "Have you smoked in the past month?" Self-reported smoking abstinence was verified by CO assessment (ppm < 10). Point prevalence abstinence was defined as zero cigarettes smoked per day, reported on the day of assessment.

Stages of Change Questionnaire

This inventory (Prochaska & DiClemente, 1983) evaluates psychological readiness for changing smoking behavior, based on Prochaksa and DiClemente's (1982) model of behavior change. The perceived importance of quitting smoking was assessed with a 0 (*not at all important*) to 10 (*extremely important*) rating scale. Psychometric data support the use of the stages of change questionnaire, with stability ranging from.88 to.98 (Morera, Johnson, & Freels, 1998).

Expired CO

Expired CO was measured using the Bedfont EC50 Micro-Smokelyzer Breath Carbon Monoxide Monitor. CO monitors were calibrated following manufacturer's guidelines. To increase stability of the measurement, two CO measurements were taken for each participant. Expired CO levels of 10 ppm or higher were considered consistent with status as a regular smoker (Perkins, 1996).

Follow-Up Assessment

Assessment at follow-up included each of the measures mentioned above with the exception of the demographics questionnaire, the FTND, and the stages of change questionnaire. Follow-up assessment also included a brief assessment of engagement in smoking cessation treatment, including entry into a smoking cessation program, use of a self-help line, nicotine replacement therapy, medication (bupropion), as well as unaided efforts to reduce smoking or quit cold turkey.

Data Analysis Plan

To test treatment effects on point prevalence abstinence, number of cigarettes smoked per day, and CO levels across the 6 months of follow-up assessments, we used generalized estimating equations (GEE; Liang & Zeger, 1986; Zeger & Liang, 1986) with a compound symmetric covariance matrix specified. GEE offers an extension of both linear and logistic regression to analyses of repeated measures data by correcting standard errors of models coefficients to account for clustered or correlated dependent measures. All analyses included a linear effect of time (i.e., month) and controlled for baseline levels of nicotine dependence as assessed by the FTND and the perceived importance of quitting smoking. Analyses of cigarettes per day (CPD) and CO levels also included the respective variable at baseline as a covariate. The treatment condition was dummy-coded with MI/BI as the reference group, allowing us to test differences between MI/IS and MI/BI and between MI/IS and MI alone. GEE allows for inclusion in the analysis of individuals with missing dependent observations. We chose this as our primary analysis to analyze all available data. We then conducted worst-case analyses in which we assumed that missing equals smoking for point prevalence abstinence and substituted baseline levels of CPD and CO for missing data on those variables. In no case did using available data compared to worst-case analyses lead to different

conclusions regarding treatment effects. As a second step of each analysis, we entered interactions between treatment condition dummy codes and time to determine whether differences between conditions remained constant during follow-up. Power was approximately .80 (depending on the degree of correlation between time points for a given outcome) for detecting differences between conditions of medium size (d = .50) using GEE for the primary analyses (Rochon, 1998). Effects as small as d = .40 could be detected with power of .80 in analyses with no missing data (i.e., the worst-case analyses).

RESULTS

A total of 208 participants were recruited over the period of 1 year and were randomized to the three conditions of MI alone ($n = 67$), MI/IS ($n = 67$), and MI/BI ($n = 74$). All participants completed the assigned intervention. Monthly follow-up data were obtained on at least one occasion for 149 participants (71.6%). However, missing data were common among those who provided at least some follow-up data, with only 83 (39.9%) providing data for all 6 monthly follow-ups. Conditions did not differ significantly on the mean number of completed follow-ups or on the percentage of those providing any follow-up data. Participants who completed any of the six assessments were significantly older ($p \leq .001$), though "completers" (completed between 1 and 6 follow-ups; $n = 149$) did not differ significantly from "non-completers" (attended no follow-ups; $n = 59$) regarding sex, marital status, annual income, or ethnicity.

Data for demographic variables were available for 190 to 208 participants, depending on the variable (Table 1). The mean age of participants was 49 years; over half the sample was Caucasian ($n = 140$; 67.3%). The average level of education for the sample was 12.7 years ($SD = 2.1$), and the majority of participants were unemployed and/or disabled ($n = 155$; 75.2%). Participants' modal annual income was less than $10,000, and the majority (86.5%) were either never married, were separated, or were divorced.

Participants smoked an average of 23 CPD ($SD = 12.3$) and reported a mean duration smoking history of approximately almost 32 years ($SD = 9.1$), with an average of 6.5 ($SD = 14.1$) quit attempts. Average expired CO was 17.1 ppm ($SD = 10.15$), and 78.7% of participants at baseline had a baseline CO score of $\geq$10 ppm. As expected, the sample was complicated by substance use and psychiatric comorbidity. Chart review indicated that

TABLE 1. Participant Demographic Data

Variable	MI Alone ($n = 67$)	MI/BI ($n = 74$)	MI/IS ($n = 67$)	Test for Difference
Male sex	100%	95.9%	94%	$\chi^2(2) < 1$, *ns*
Age, years (mean)	49.06	49.64	47.5	t = *1.13, ns*
Marital status, No.				
Never married	26	23	22	$\chi^2(10) < 1$, ns
Separated	5	11	6	
Married/living together	6	10	6	
Divorced	29	29	4	
Widowed	3	1	3	
Highest grade completed (mean)	12.5	13.0	12.5	$\chi^2(26) < 1$, *ns*
Annual income (median)	$*10,000–$*14,999*	$*10,000–$*14,999*	$*10,000–$*14,999*	$\chi^2(8) < 1$, *ns*
Employment status, %				
Employed	13.4	13.5	15.4	$\chi^2(10) = 4.7$, *ns*
Full-time student	0	2.7	3.0	
Disabled	44.8	45.9	40.0	
Full-time homemaker	0	0	1.5	
Retired	9.0	8.1	7.7	
Unemployed	32.8	29.8	32.4	
Ethnicity, %				
White	*74.6*	*66.2*	*61.2*	$\chi^2(8) = 11.5$, *ns*
American Indian/Alaskan Native	*0*	*0*	*6.0*	
Black	*22.4*	*27.0*	*28.4*	
Hispanic	0	*1.4*	*1.5*	
Other	3.0	5.4	2.9	

Note. BI = breathing instruction; MI = motivational interviewing; IS = incentive spirometry.

96% of participants ($n = 199$) had a history of mental health care delivered within the VA. More specifically, 66% of participants carried a diagnosis of substance-use disorder ($n = 137$) and 62% ($n = 129$) carried at least one non–substance use Axis I psychiatric diagnosis. Forty-five percent of participants ($n = 93$) carried two non–substance use Axis I psychiatric diagnoses, and 30% ($n = 62$) carried three such diagnoses. The majority (71%) of those participants who had an Axis I psychiatric diagnosis had a mood disorder diagnosed ($n = 91$). Among participants with an Axis I psychiatric diagnosis, additional diagnoses included post-traumatic stress disorder (PTSD) ($n = 54$; 42%), non-PTSD anxiety disorder ($n = 33$; 26%), and psychotic disorder ($n = 48$; 37%). In addition, a high percentage of participants presented to a VA care provider for a lung-related disease (in

the previous 3 months), including 14.9% ($n = 31$) with chronic obstructive pulmonary disease, 1.0% ($n = 2$) with lung cancer, 3.8% ($n = 8$) with emphysema, and 6.3% ($n = 13$) with asthma. An additional 13.5% ($n = 28$) presented with bronchitis.

Baseline Comparisons of Treatment Conditions

There were no significant differences in treatment conditions at baseline on smoking-related variables, including FTND, motivation for quitting smoking, CO, spirometry, or CPD. In addition, between-groups tests on baseline characteristics were conducted. The three groups did not differ significantly in age, sex, marital status, employment status, or income (see Table 1). Groups were slightly unbalanced by sex, with no women in the MI alone condition and 3 and 4 women in the MI/IS and MI/BI conditions, respectively. In addition, there were no significant differences regarding psychiatric comorbidity among the three conditions.

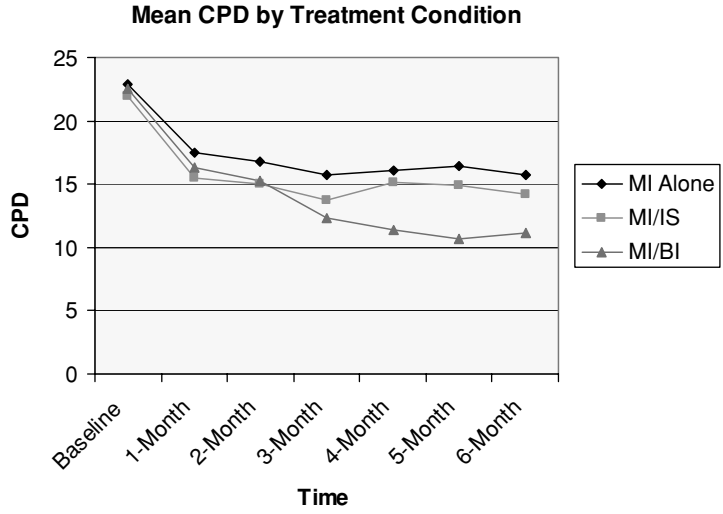
Smoking Outcomes

Point Prevalence Abstinence

Point prevalence abstinence rates in the MI/IS condition were 4.5%, 4.7%, 8.6%, 8.8%, 12.5%, and 10.3% at 1, 2, 3, 4, 5, and 6 months, respectively. Abstinence rates in the MI/BI condition were 9.0%, 8.6%, 14.7%, 14.3%, 15.1%, 16.6%, respectively, at each follow-up point, and abstinence rates in the MI condition were 0%, 0%, 7.6%, 9.4%, 6.6%, and 13.3%, respectively, at each follow-up point. However, if a worst-case assumption was made and missing data were treated as continued smoking, abstinence rates in the MI/IS condition were 3.0%, 3.0%, 4.5%, 4.5%, 6.0%, and 4.5% at each follow-up point. Again using worst-case assumption, abstinence rates in the MI/BI condition were 5.4%, 4.0%, 6.8%, 6.8%, 6.8%, and 6.8%, and abstinence rates in the MI alone condition were 0%, 0%, 4.5%, 4.5%, 3.0%, and 6.0%.

In the GEE model predicting point prevalence abstinence at follow-ups, the linear effect of time was significantly positive ($B = .22$; $SE = .09$; odds ratio [OR] = 1.25; $p = .018$), indicating that the odds of abstinence increased about 25% with each subsequent month. Greater importance of quitting also was associated with greater odds of abstinence ($B = .46$; $SE = .14$; $OR = 1.58$; $p = .001$). Both FTND and the treatment dummy codes did not approach significance ($p > .30$). Interactions between the treatment dummy codes and time were nonsignificant.

FIGURE 1. Changes in Self-Reported Smoking for the Motivational Interviewing (MI)/Incentive Spirometry (IS), MI/Breathing Instruction (BI), and MI Alone Treatment Groups Over the 6-Month Follow-Up Period

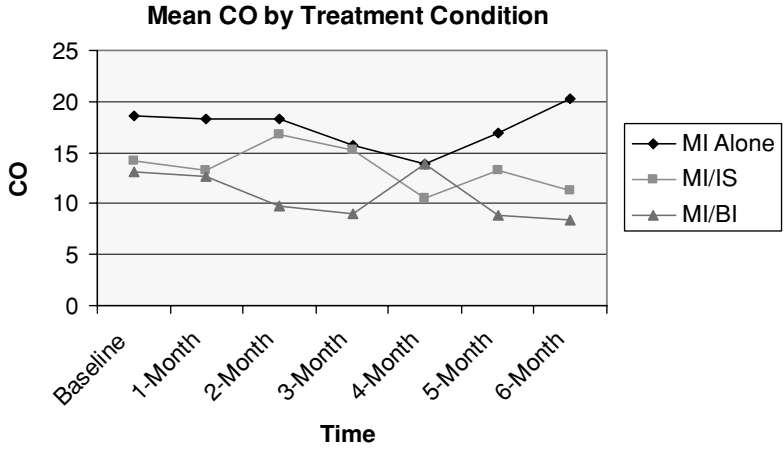


CPD

Figure 1 shows average CPD at baseline and across each month of follow-up for each treatment condition. CPD generally decreased from over 20 at baseline to the mid to low teens during follow-up. For analysis purposes, square-root transformations were conducted to correct positive skewness. As an initial analysis, we conducted paired *t*-tests comparing baseline CPD to CPD at each follow-up. Results indicated that CPD was significantly lower than baseline at each follow-up ($p < .0001$). This was true even when worst- case assumptions were used.

The results of the GEE analysis predicting follow-up CPD controlling for baseline showed that the effect of time was significantly negative ($B = -.10$; $SE = .03$; $p = .0006$), indicating that CPD decreased significantly over the 6 months of follow-up. Greater FTND scores were associated with higher CPD ($B = .11$; $SE = .05$; $p = .026$), whereas greater importance of quitting was associated with lower CPD ($B = -.15$; $SE = .04$; $p = .0002$). Treatment conditions did not differ significantly on CPD ($p > .65$). Interactions between the treatment dummy codes and time also were nonsignificant. Analyses using

FIGURE 2. Changes in Carbon Monoxide (CO) for the Motivational Interviewing (MI)/Incentive Spirometry (IS), MI/Breathing Instruction (BI), and MI Alone Treatment Groups Over the 6-Month Follow-Up Period



a worst-case assumption rendered the effects of time and FTND nonsignificant, but the effect of importance of quitting remained significant ($B = –.12$; $SE = .03$; $p < .0001$).

CO Levels

Mean CO levels obtained at baseline and during follow-ups for each treatment condition are shown in Figure 2. CPD and CO correlated moderately highly at each follow-up, with an average r of.67 (range = .64 to .73). CO levels were consistently in the mid teens at baseline and across follow-ups, except in the MI/BI condition in which CO levels were consistently below 13 after the first month of follow-up. For analysis purposes, square-root transformations were conducted for CO to correct positive skewness. We conducted paired t-tests comparing baseline CO to CO at each follow-up. Only month 5 CO was significantly lower than baseline CO ($p = .009$), a result that was not altered by using worst-case assumptions.

Results of the GEE analysis predicting follow-up CO controlling for baseline indicated that CO levels tended to decrease during follow-up, ($B = –.05$; $SE = .03$; $p = .059$). Greater nicotine dependence scores were associated with higher CO ($B = .09$; $SE = .03$; $p = .01$), whereas greater

importance of quitting was associated with lower CO ($B = –.11$; $SE = .03$; $p = .0004$). The dummy code for the MI/IS versus MI/BI comparison was significantly negative ($B = –.57$; $SE = .19$; $p = .003$), indicating that those receiving MI/BI had significantly lower CO levels during follow-ups than those receiving MI/IS. The dummy code for the MI/IS versus MI comparison was in the same direction but was nonsignificant ($B = –.29$; $SE = .19$; $p = .12$). Interactions between the treatment dummy codes and time also were nonsignificant. Analyses using worst-case assumptions rendered the effect of FTND nonsignificant, but the other effects that were significant remained so.

Smoking Cessation Intervention Involvement

Participants were evaluated at each 1-month follow-up point regarding their participation in smoking cessation efforts, including attending a smoking cessation group, using a self-help quit line, quitting cold turkey, or other efforts such as nicotine replacement therapy. Between 55.3% (at 1-month follow-up) and 39.4% (at 6-month follow-up) reported that they were currently trying to modify their smoking behavior using one or more of the above methods. There were no differences between groups on type of treatment-seeking involvement.

DISCUSSION

MI has received considerable attention over the past 2 decades; however, equivocal findings across studies have raised questions about its utility for tobacco cessation. One reason for this debate may be related to disparities in how outcomes are assessed and whether researchers are using too stringent a criterion to document meaningful change (i.e., abstinence). The current study evaluated the gold standard outcome variable (i.e., cigarette abstinence) but also included additional outcome variables (i.e., change in CPD and CO levels).

Although a fully controlled trial was not conducted, results from the current study support previous findings that adaptations of MI may be useful in assisting psychiatrically complex veterans change tobacco use. With respect to abstinence outcomes, biochemically verified quit rates across the follow-up period ranged from 0% to 16.6% across treatment conditions. Collapsing across groups, there was a linear increase in abstinence

with each subsequent month. Abstinence was also associated with greater importance of change.

However, our data do not support our hypotheses regarding practice-enhanced MI, in that participants in the MI/IS condition did not report significantly lower CPD or produce significantly lower CO values at follow-up than participants in the other two conditions. In fact, contrary to our hypotheses, participants in the MI/BI condition performed significantly better regarding CO than participants in the MI/IS condition. The difference remained significant if those who were abstinent at any given time point were removed. Reasons for this finding are unclear but may be related to a difficulty with incorporating the IS instruction with changes in participants' own smoking behavior. In other words, it is possible that IS provided useful feedback for patients in session, but new knowledge about their lung function from IS did not carry forward to meaningful smoking behavior change after the session. This could possibly have been because the spirometer is an unusual instrument with which participants were unfamiliar. Alternatively, the spirometer exercise may not have sufficiently prompted participants to consider their smoking behavior in relationship to their performance on the IS. In contrast, BI may have led to greater change in CO because it may have represented a simpler intervention that may have lent itself better than IS to daily practice.

With respect to reduction in CPD, even when considering the worst-case scenario of missing data, CPD was significantly lower at each follow-up compared to baseline. We would argue that although there were no statistically significant reductions by treatment condition, there was a significant effect for time over the 6-month follow up period. Specifically, looking across treatment conditions, participants reduced daily cigarette use from over a pack per day (approximately 23 CPD) to just over a half-pack per day (approximately 13 CPD). Though no level of tobacco use can be considered safe and these participants would be considered treatment failures by general standards, this change represents an approximately 57% reduction in cigarette smoking. Such changes may translate into improved functioning and potential health benefits (Chaudhuri et al., 2006). Moreover, reduction in cigarette consumption may have important public health implications by virtue of less secondhand smoke exposure (Gilpin & Pierce, 2002). Notably, smokers can achieve and maintain reduced smoking levels (Colletti, Supnick, & Rizzo, 1982; Glasgow, Klesges, Klesges, Vasey, & Gunnarson, 1985), and there is no evidence that this reduction decreases or undermines interest in cessation (Carpenter, Hughes, & Keely, 2003). Although reduction itself does not correspondingly reduce exposure to

harmful toxins, including CO (Hurt et al., 2000), a recent meta-analysis indicated that reduction in cigarettes is predictive of later tobacco cessation even in unmotivated smokers (Carpenter, Hughes, & Solomon, 2004). Taken together, these data suggest that very brief motivational interventions may have important clinical effects. Given the disappointing smoking cessation outcomes within this type of population (Glassman et al., 1990; Hurt et al., 1994; Joseph, Nichol, & Anderson, 1993) (i.e., complicated by psychiatric and other substance-use comorbidity), this is at least a step in the right direction.

Limitations

There are a number of limitations to the current study that warrant mention. Foremost, the study was not fully controlled in that it did not contain a no-MI condition to control for therapist time and attention. Consequently, we are unable to parcel out the effects of treatment versus no treatment or a psychological placebo. Thus, all promising findings reported here must be considered preliminary. Second, therapist adherence to MI procedures was not systematically evaluated throughout the trial. The high level of education and training, as well as their experience in treating nicotine dependence and other addictions, assuages this concern somewhat. Nevertheless, a future fully controlled trial would also benefit from systematic, formal monitoring of therapist adherence. Third, although a strength of the study was repeated assessment over time, we recognize that the 6-month follow-up duration was relatively brief and the data only speak to point prevalence abstinence, versus sustained abstinence. The importance of longitudinal assessment is highlighted by our data suggesting an increased likelihood of abstinence with each subsequent month. Fourth, during the follow-up period, self-reported data were collected regarding the level of practice of the MI/IS and MI/BI procedures. When evaluating these data, inconsistencies (such as 9 participants in the MI alone condition who reported conducting either daily deep breathing or IS) were found, which decreased our confidence in their validity. Thus the degree to which veterans may have actively engaged in the various treatments beyond the initial dose of MI that was provided was not clear. Fifth, it should be noted that participants in all conditions had contact with research staff, who administered smoking assessment at each follow-up point. It is possible that this contact could have had an effect on participants' motivation to quit smoking and contributed to the outcome. Finally, the study included primarily a male sample. Given previous findings of sex differences in response to nicotine

replacement (Munafò, Bradburn, Bowes, & David, 2004) and differences in smoking cessation in male and female veterans specifically (Sherman, Fu, Joseph, Lanto, & Yano, 2005), additional research is needed to evaluate whether MI has differential effects for men versus women. This point is particularly true in a veteran sample, given the increasing enrollment of women in the military.

CONCLUSIONS

Though preliminary in nature, our results suggest that brief motivational interventions may be beneficial for patients who smoke and struggle with multiple psychiatric issues. Future research is needed to evaluate the utility of MI for tobacco cessation that includes pulmonary functioning feedback, particularly for patients with psychiatric comorbidity. These findings further argue that it is critical for researchers to assess and report multiple outcomes systematically across studies in order to provide a better understanding of clinically meaningful changes beyond abstinence. This is particularly true given the focus of MI—to increase motivation for and engagement in efforts to change, rather than abstinence per se. Reduction may also be a more palatable and achievable starting point for recalcitrant, psychiatric smokers.

NOTES

1. A copy of the manual may be obtained from the first author.

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