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Initial efficacy of MI, TTM tailoring and HRI's with multiple behaviors for employee health promotion

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Abstract

Objective. This study was designed to compare the initial efficacy of Motivational Interviewing (MI), Online Transtheoretical Model (TTM)-tailored communications and a brief Health Risk Intervention (HRI) on four health risk factors (inactivity, BMI, stress and smoking) in a worksite sample.

Method. A randomized clinical trial assigned employees to one of three recruitment strategies and one of the three treatments. The treatment protocol included an HRI session for everyone and in addition either a recommended three TTM online sessions or three MI in person or telephone sessions over 6 months. At the initial post-treatment assessment at 6 months, groups were compared on the percentage who had progressed from at risk to taking effective action on each of the four risks.

Results. Compared to the HRI only group, the MI and TTM groups had significantly more participants in the Action stage for exercise and effective stress management and significantly fewer risk behaviors at 6 months. MI and TTM group outcomes were not different.

Conclusion. This was the first study to demonstrate that MI and online TTM could produce significant multiple behavior changes. Future research will examine the long-term impacts of each treatment, their cost effectiveness, effects on productivity and quality of life and process variables mediating outcomes.

Keywords: Multiple behavior change; Motivational Interviewing; TTM tailoring; Exercise; Stress; Smoking; BMI

Introduction

Increasingly it is recognized that a major barrier to dissemination of evidence-based health promotion programs is that most programs were not designed or developed to reach at-risk populations (Glasgow et al., 2003). They were designed for and evaluated on self-selected samples of at-risk individuals. For example, in the United States Public Health Services 1996 Clinical Guidelines for the Treatment of Tobacco, over 3000 studies on tobacco were identified. The guidelines were able to recommend a broad range of evidence-based interventions for motivated smokers; i.e., those prepared to quit in the next month (Fiore et al., 1996). There were no evidence-based interventions recommended for unmotivated smokers, even though they make up more than 80% of all U.S. smokers (Velicer et al., 1995) and more than 90% of daily smokers (Wewers et al., 2003). In the second edition of the guidelines there were over 6000 studies identified (Fiore et al., 2000). These evidence-based treatments were not designed to reach the vast majority of unmotivated smokers.

When health care systems disseminate free, evidence-based smoking cessation clinics for motivated smokers, the percentage of smokers who participate nationally is 1% (Lichtenstein and Hollis, 1992). When states issue Requests For Proposals (RFPs) to deliver for free, evidence-based quit lines recommended by CDC, they typically budget for one quarter of 1% of smokers using the programs each year (our analysis of four RFPs). Our project applied health promotion interventions that were developed and evaluated with unmotivated as well as

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motivated populations since these are the types of programs that can have the most impact.

MI was originally developed for addictions counseling in the 1980s and is described as a "directive [goal-oriented], client-centered counseling style for eliciting behavior change by helping clients to explore and resolve ambivalence" (Miller and Rollnick, 2002). This approach has been found to produce significant efficacy across a broad range of health risk behaviors including alcohol abuse, smoking, high-risk sexual behaviors, exercise, and diet (Burke et al., 2003; Hettema et al., 2005). MI-based health coaching has also been found to improve physical and mental health status in a worksite setting (Butterworth et al., 2006). In most MI studies, however, only a single risk behavior has been targeted at one time. The present study is the first to apply MI-based health coaching simultaneously to four health risks in a worksite setting.

TTM-tailored print feedback has been found to be effective with a broad range of single health behaviors including smoking (e.g., Prochaska et al., 1993, 2001a,b), stress (Evers et al., 2006), medication adherence (Johnson et al., 2006a,b), mammography (Rakowski et al., 1998), diet (Greene et al., in press), sun protection (Weinstock et al., 2002), exercise (Marcus et al., 1998; Velicer et al., 2006), and depression (Levesque and VanMarter, 2007). TTM-tailored print feedback has also been found effective when treating: (1) three health behaviors in a population of parents whose teens were participating in health promotion at school (Prochaska et al., 2004); (2) four behaviors in a population of primary care patients (Prochaska et al., 2005); 3) three behaviors in a population of patients with diabetes (Jones et al., 2003); and (4) three behaviors in a population of overweight individuals (Johnson et al., in press). Comparable TTM-tailored feedback has also been presented in a multimedia format (Redding et al., 1999), but not yet online.

This project is the first time that TTM tailoring was delivered online to a population of adults. This project is also the first time that MI delivered in person and telephonically was compared to TTM tailoring.

This report is part of the first randomized population trial to be based on impact on multiple behaviors. The original impact equation was reach (percent participating) times efficacy (percent who change). Our first report compared three additive recruitment strategies to enhance reach: 1. persuasive communications; 2. persuasive communications plus small incentives; and 3. both of these plus person-to-person telephone outreach (Butterworth et al., 2007). This report compares the initial efficacy of three interventions (health risk assessment and intervention only (HRI), online HRI plus Transtheoretical Model-tailored communications (TTM), and online HRI plus Motivational Interviewing-based health coaching (MI)) targeting four health risks: stress, exercise, smoking, and BMI.

Methods

Procedure

Prior to recruitment, a random sample of $N=6000$ employees at a major medical university were randomly assigned to one of three additive recruitment strategies (mail/email only, mail/email + incentive, and mail + incentive + phone prompt) and to one of three treatment groups (HRI, MI, and TTM). Employees in recruitment group 1 received a persuasive letter and email inviting them to participate in the study. Employees in recruitment group 2 received the same letter and email plus a small incentive for each time that they participated in the study. Employees in recruitment group 3 received a phone call if they did not respond to the same initial letter, email, and incentive offer. Participants were recruited into the specific treatment condition they had been randomized into to as would be the case in real-world programs. Employees in all groups received an initial email inviting them to join the study. If an employee stated (by phone or email) that s/he did not want to participate, s/he was not approached again. If there was no response, two follow-up persuasive emails invited study participation and provided a link to the study Web site. The study Web site described the study, contained informed consent information and documentation and provided links to the baseline survey. Eligible participants were at risk for at least one risk behavior targeted in the study (exercise, stress, BMI >25, or smoking). More details about baseline recruitment procedures and sample characteristics are reported elsewhere (Butterworth et al., 2007). All study procedures and communications were reviewed and approved by Institutional Review Boards at OHSU and URI.

Measures

Demographics included age, gender, race and ethnicity, and years of education completed. Self-reported height and weight were also assessed, which were then used to compute BMI categories.

Stage of change was assessed for all groups across all behavioral risks. For smoking cessation, a three-item algorithm was used with precontemplation defined as not intending to quit smoking in the next 6 months; contemplation defined as intending to quit in the next 6 months; and preparation defined as intending to quit in the next month and having made a quit attempt in the past 12 months. This cessation algorithm has been found to have strong predictive validity over 6 months (DiClemente et al., 1991), 12, 18 and 24 months (Prochaska et al., 2004;Velicer et al., 2007). For exercise, the items and algorithm recommended by Sarkin and colleagues (2001) were adapted to reflect the 30 min/day × 5 days/week criterion. For dietary fat, the items and algorithm reported by Prochaska and colleagues (2004, 2005) were used. For stress management, the items and algorithm reported by Evers and colleagues (2006) were used.

Outcome measures

The primary outcome measure for each of three risk behaviors (exercise, stress, and smoking) was the percentage of those not at criterion (at risk) at baseline who were in action (at criterion) at the 6-month follow-up. The action criterion for smoking was point prevalence abstinence; for exercise the criterion was 30 min of moderate exercise at least 5 days a week; and for stress the criterion was effectively managing stress via relaxation, physical activity, and/or social support. For BMI categories, the primary outcome measure was percent above or below a BMI of 25. These outcome measures reflect the percentage who progressed from at risk for a particular behavioral risk at baseline to being at criteria at 6 months.

Interventions

All randomized groups received the HRI at baseline. The second group received additional MI-based health coaching and the third group received additional TTM-tailored feedback.

HRI. The HRI combines a traditional HRA that provides feedback on what stages of change participants were in for each risk and the single most important step they could take to begin progressing. The HRI was provided by Pro-Change Behavior Systems.

MI. In addition to the HRI described above, MI-based health coaching was provided face-to-face or telephonically according to the preference and convenience of each participant. The initial MI session was 30–45 min and the two follow-up sessions were 10–15 min. Health coaches were deemed proficient in MI per the Motivational Interviewing Skill Code (MISC) (Moyers et al., 2003). During each session they addressed the participant's risk factor(s) and employed

client-centered techniques such as empathic listening, collaboration, evocation, and affirmation in order to establish rapport, reduce resistance, support self-efficacy, and elicit "change talk" (one's own reasons and arguments for change) (Hettema et al., 2005; Miller and Rollnick, 2002). The intended outcome of these MI sessions was for clients to resolve ambivalence (a central goal), move through the stages of change (Prochaska, 1979), and follow through on desirable lifestyle change, which would ideally result in reduced health risks and improved health outcomes. Health coaches were supervised by an MI specialist who is part of the Motivational Interviewing Network of Trainers (MINT).

TTM. In addition to the HRI described above, TTM assessments and tailored feedback on each construct (stage, pros, cons, efficacy, and processes) relevant to the participant's stage for a particular risk behavior were provided online using Pro-Change LifeStyle Management Programs (Evers et al., 2006; Johnson et al., in press). Participants could interact online with up to four tailored intervention programs (stress, exercise, smoking, and weight management), depending on what they were at risk for at baseline (see Table 1). In the first session an algorithm generated normative feedback comparing participants' efforts to peers who made the most progress for their current stage. Remaining sessions provided ipsative feedback on which variables the participants were improving and on which they needed to make better efforts.

Three sessions of TTM-tailored feedback were recommended for each risk and future sessions could only occur after at least 30 days passed to allow some progress to be achieved. As in real-world applications, participants could access as many sessions for each risk as they preferred over the 6 months of treatment.

Statistical analyses and power

For purposes of power calculation, analyses were assumed to be one-way analyses of variance. Two-tailed significance tests were employed for the overall ANOVA tests ($\alpha = .05$). Significant ANOVA results were followed by two group ANOVAs to assess specific directional hypotheses (one-tailed $\alpha = .05$). Under this set of assumptions, a sample size of 125 per group was sufficient for the follow-up procedures to detect as little as 1% of the outcome variance. With discrete outcome data, chi-square tests compared percentage at criteria across the three groups. Significant chi-square results were followed by the Levy (1975) test for pair-wise proportions.

Table 1
Baseline sample description by treatment group

Variable	Whole sample	HRI group	MI group	TTM group	Test[a]
N	1400	464	433	503	$p > .01$
Gender					
% Female	78.9	77.6	79.0	80.1	
Age (years) *M* (SD)	41.63 (10.63)	41.06 (10.55)	41.83 (10.47)	41.98 (10.85)	$p > .01$
Racial/Ethnic group					$p > .01$
% White	87.1	87.1	85.9	88.2	
% Black	1.9	1.9	1.8	2.0	
% Hispanic	4.1	3.7	4.4	4.4	
Years of school completed					$p > .01$
% <12	0.4	0.4	0.2	0.4	
% 12	6.9	7.5	6.5	6.8	
% 13–14	16.3	16.8	16.9	15.4	
% 15–16	36.0	39.0	32.7	37.5	
% >17	40.3	38.6	42.7	39.8	
% Current smoker	9.7	10.3	9.2	9.5	$p > .01$
% Stressed[b]	35.6	36.2	33.0	37.4	$p > .01$
% Sedentary	71.1	70.7	72.1	70.8	$p > .01$
BMI category					$p > .01$
% <18	1.3	1.5	1.4	1.0	
% 18–25	31.6	32.8	31.9	30.2	
% 26–30	36.1	35.3	35.8	37.2	
% >30	31.0	30.4	30.9	31.6	
Number risks[c]					$p > .01$
% One	38.4	39.4	37.6	38.2	
% Two	41.5	39.9	45.3	39.8	
% Three	18.1	19.0	15.5	19.5	
% Four	2.0	1.7	1.6	2.6	

[a] χ^2 tested categorical variables, ANOVA tested continuous variables.
[b] Eligible for stress if in PC, C, or PR for effective stress management.
[c] Number of behavioral risks including exercise, stress, smoking, and BMI >25.

Table 2
Baseline stages of change by risk behavior and treatment group

Variable	Sample	HRI group	MI group	TTM group	χ^2
Smoking stage[a]	(*N*=136)				$p > .01$
%PC	33.8	29.2	37.5	35.4	
%C	52.2	56.3	50.0	50.0	
%PR	14.0	14.6	12.5	14.6	
Exercise stage[b]	(*N*=996)				$p > .01$
%PC	8.7	7.0	9.9	9.3	
%C	40.4	43.0	45.2	33.7	
%PR	50.9	50.0	44.9	57.0	
Stress management stage[c]	*N*=499				$p > .01$
%PC	12.2	11.9	9.8	14.4	
%C	41.9	42.9	49.7	35.1	
%PR	45.9	45.2	40.6	50.5	

[a] Among current smokers.
[b] Among sedentary.
[c] Eligible for stress if in PC, C, or PR for effective stress management.

Results

Participants

After random assignment to recruitment/treatment groups, the following sample was recruited. Approximately $N = 1730$ employees responded to the letters/emails and $N = 1400$ were eligible and completed the online baseline assessment. A total of 25% of eligible employees were recruited across the three additive recruitment strategies (Butterworth et al., 2007). A total of 23.3% ($N = 464$) were recruited to the HRI only condition, 21.7% ($N = 433$) to the MI treatment, and 25.2% ($N = 504$) to the online TTM-tailored treatment.

Table 1 presents the percent at risk for each of the four targeted health risks and the number of risk behaviors in the baseline sample. The sample of 1400 had a mean age of 41.6 years with 79% female and nearly 87% non-Hispanic Caucasian (Butterworth et al., 2007). Consistent with the university setting, less than 8% of this sample reported high school or fewer years of education.

Table 1 describes the distribution of risk behaviors across the sample and across treatment groups. No differences between treatment groups were observed on any sample characteristics. In order of decreasing prevalence, 71.1% were sedentary, 67.1% overweight or obese, 35.6% not managing stress effectively, and 9.7% were current smokers. Table 1 demonstrates that nearly 80% of the sample were at risk for one or two behavioral risks ($M = 1.8$), with 18% at risk for three behavioral risks and a very small number at risk for all four risks. Number of risk behaviors at baseline did not vary significantly by treatment group ($\chi^2(6) = 6.075$, $p > .05$).

Table 2 shows the baseline stage of change for each risk behavior for the total sample and for each treatment group. No

Table 3
Percent reaching criterion at 6 months by treatment groups

	N	HRI	HRI+MI	HRI+TTM
Stress	358	61.6[a]	78.2[b]	73.9[b]
Exercise	747	35.1[a]	46.0 [b]	45.2[b]
Smoking	101	16.7	34.6	21.1
BMI*	702	10.7	12.1	8.0

Percentages with different letter superscripts are significantly different ($p<.01$).
*Not a risk behavior, but a risk category.

significant differences were found between the treatment groups for baseline stage of change for any of the three risk behaviors. Across the three risks, about 50% to 85% of the participants would be considered as unmotivated as measured by not being prepared to take action.

Initial treatment utilization

Of baseline participants enrolled in the MI treatment, 73% ($N=316$) called to set up an MI appointment. Of baseline participants enrolled in the TTM treatment, 83.7% ($N=422$) went online again to participate in at least one TTM-tailored treatment session.

Six-month outcomes

Table 3 presents the 6-month outcomes for the percent at criteria by treatment group for each behavioral risk. There were significant differences between the three groups for both effective stress management ($\chi^2(2)=8.913$, $p<.05$) and exercising moderately 30 min/day for at least 5 days/week ($\chi^2(2)=8.195$, $p<.05$). Table 3 also shows that the MI and TTM groups had significantly ($p<.01$) greater proportions at criteria at 6 months for both stress and exercise compared to the HRI only group. There were no significant differences ($p>.05$) between the MI and TTM groups for stress and exercise. For smoking, where only 9.8% were smoking at baseline, we saw a non-significant trend favoring the MI and TTM groups, but lacked the sample size to find significant differences. There were no significant differences in percent at criteria for BMI (<25) by treatment groups at 6 months.

An ANOVA on mean number of risk behaviors at 6 months was significantly different by treatment group ($F(2,975)=4.086$, $p<.05$). An ANCOVA on mean number of risks at 6 months by treatment group, including baseline mean number of risk behaviors as a covariate, retained statistical significance ($F(2,975)=4.494$, $p<.05$). At 6 months, the HRI group ($M=1.445$) had a significantly greater ($p<.05$) mean number of risks than the MI ($M=1.254$) and the TTM ($M=1.319$) groups.

Discussion

This study generated a series of important results. It is the first study we could find demonstrating MI to produce significant efficacy on at least two behaviors when simultaneously treating multiple behaviors within a population. The results are particularly important given how widely MI has been disseminated and the fact that it has been found to be more effective with less ready and less motivated participants as well as those prepared to act. It is also worthy to note that there were only three coaching sessions that were time limited. These results suggest that MI counselors can be more ambitious and simultaneously target multiple and not just single behavior risks in a population.

Secondly, the results replicated the multiple behavior changes within a target population that have been generated by TTM-tailored interventions (Johnson et al., in press; Jones et al., 2003; Prochaska et al., 2004, 2005). More innovatively, this is the first study with adults to demonstrate such results when the TTM tailoring was delivered online. In previous projects, the TTM assessments were done by mail or telephone and TTM print communications were generated by computer and mailed to participants. Given the much lower cost and higher convenience of online programs, these results are particularly promising in a worksite setting.

Informal comparisons across studies add to the importance of these results. The 6-month outcomes for effective stress management of 61.6% for the HRI minimal treatment replicate the 60% found at 6 months with TTM tailoring delivered by mail and telephone with a national sample of 1035 participants (Evers et al., 2006). The level of stress in the national sample would predict that this population would be highly likely to seek medical care in the next 2 weeks. Managing such stress effectively would clearly impact on health care costs. In the national population trial funded by NIH, there was a true no treatment control group that showed only 40% progressing to effective stress management at 6 months. Furthermore, the outcomes for both the TTM tailoring and control groups were maintained at 12 and 18 months follow-up (Evers et al., 2006).

In this Oregon Worksite Wellness study, the TTM tailoring (73.9%) and the MI Coaching (78.2%) had even greater efficacy than before (Evers et al., 2006). These results are important in their own right given the effects of stress on personal well-being, health, health care utilization, and productivity. These results, if maintained as in the Evers et al. (2006) study, are also important for the maintenance of other health behavior changes since stress is such a common cause of relapse.

The percentage (35.1%) of the HRI group reaching criterion for exercise was below what has been found in other studies with TTM tailoring (40%, Johnson et al., in press). On the other hand, the percentages for the TTM tailoring (45.2%) and MI Coaching (46%) were higher. The BMI results at 6 months are consistent with no significant effects at 6 months in a national Randomized Clinical Trial (RCT) with TTM tailoring for multiple behavior change for healthy weight management. At 24 months, however, significant effects were found for participants treated for exercise and/or diet (Johnson et al., in press).

While the smoking sample was too small to find statistical significance, the results are surprisingly similar to much larger samples. Across a growing range of population trials, the control groups attained abstinence rates of 16% to 19%, while the TTM tailoring produced 22% to 26% abstinence at longer

term follow-up (Prochaska et al., 1993, 2001a,b, 2004, 2005). The abstinence rates with MI (34.6%) were higher than the 24% found with MI by Carpenter et al. (2004), but that study limited their sample only to unmotivated smokers in the precontemplation or contemplation stages.

The lack of significant outcome differences at 6 months between MI and TTM tailoring is also important since this study is the first to compare these two widely used treatment modalities. Longer term follow-ups will be essential, including comparisons of impacts on multiple behaviors, cost-effectiveness, effects on productivity and quality of life and process to outcome evaluations.

Limitations

This study is limited by targeting a single large employer, and a sample that was highly educated, Caucasian, and non-representative. The sample was also limited by the recruitment (25%) and retention (70%) rates. These limitations are mitigated somewhat by the fact that the stage distributions of the present sample were comparable to what is typically found in more general populations for smoking and physical activity. The stage distribution for effective stress management, however, indicates that a more prepared or motivated sample was recruited for this behavior. These limitations are also mitigated somewhat by the fact that the study was an RCT with both the three treatments and three recruitment strategies being randomly applied. Still greater generalization will require further replications with more diverse and representative employee populations with higher recruitment and retention rates.

This report is limited to the initial efficacy at 6 months, and long-term follow-ups will need to demonstrate the treatment trajectories over time. To date, the two most common trajectories with TTM tailoring have been either stable (e.g., with stress effects at 6 months remaining stable at 12 and 18 months (Evers et al., 2006)) or increasing (e.g., with smoking cessation in the treatment group increasing over 18 months compared to the assessment only condition (Prochaska et al., 2001a,b, 2004, 2005)).

Another limitation is the reliance on self-reports. This limitation is mitigated some by findings that, in population trials, self-reports for behaviors like smoking cessation have been highly valid (Velicer et al., 1992). It would be better if more objective measures could be used for risks like exercise and BMI. With population trials, however, the physical demands of objective measures add serious complications to proactive recruitment and retention.

Another limitation is that, when participants were randomized to the three recruitment strategies, they were informed of which treatment they were being recruited to. While this represents a real-world approach where people are not recruited blindly to programs, it does raise concerns that participants might have differentially self-selected into a preferred treatment. If so, the treatment assignment would not have been fully random. This concern is mitigated somewhat by the fact that there were no significant differences on any of the baseline demographics and baseline behavioral risk variables. The lack of significant differences suggests that the treatments were sampled from the same subpopulations. If there were no sampling differences, then informing people about which treatment they were being recruited to may have been unnecessary.

Finally, these results may lead some to conclude that more treatment is better since both MI and TTM treatment groups had better 6-month outcomes than the HRI only condition. This concern is mitigated somewhat by studies that did not find a dose–response relationship for TTM-tailored print interventions (Velicer et al., 1999) and by studies where more treatment was clearly not better (Prochaska et al., 2001b). Nevertheless, future studies should assess components of both MI and TTM-tailored treatments, including contact time.

Future research

Future reports will include analyses of outcomes over longer term follow-ups. These reports will include outcomes based on recent advances in assessing impact for multiple behavior change (Prochaska et al., 2007). Such impact analyses take into account recruitment, participation, and efficacy rates summed across all treated behaviors. Such impact analyses are best applied over longer term follow-ups to take into account treatment trajectories on different risk behaviors that may be increasing, decreasing, or remaining stable.

Future studies will examine process to outcome analyses to identify moderating and mediating variables, including the number of TTM and MI sessions completed, the time spent in each session, and the use of change variables like processes of change in the TTM treatments. The present outcome results indicated significant treatment effects of MI and TTM tailoring, but future studies will need to assess what treatment variables were producing significant outcomes.

Future research will also focus on dissemination factors that include not only recruitment but retention or program adoption as well. Such research will be based on the RE-AIM model (Glasgow et al., 2003) that requires at a minimum adequate recruitment and initial efficacy. The present report demonstrates initial efficacy and future studies will analyze impacts and other factors related to dissemination from research to practice.

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