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EXPLORING PREDICTORS OF RELAPSE AND MAINTENANCE AMONG

SMOKERS

BY

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OF

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ABSTRACT

Little is known about the mechanisms behind relapse to different pre-Action stages of the Transtheoretical Model of Behavior Change (TTM) among ex-smokers. This study provides a preliminary investigation of the possible role static and dynamic variables, including demographic characteristics, smoking behavior and severity, and TTM effort variables, have in two ways: 1) As potential predictors of relapse to Precontemplation/Contemplation stages vs. Preparation; and 2) as potential predictors of relapse to any pre-Action stage vs. maintenance at follow-up. The study sample was derived from an integrated dataset of four TTM population-based smoking cessation interventions conducted in the United States. Unlike forward movement between adjacent stages, participants appeared to be equally likely to relapse to all three pre-Action stages. Being part of a treatment group was a salient predictor of being a maintainer at follow-up. Scoring higher on certain components of the Situational Temptations and Processes of Change measures differentiated those who relapsed from those who maintained at follow-up. Implications towards improving interventions and research concerning backward stage transitions are discussed.

ACKNOWLEDGMENTS

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INTRODUCTION

Cigarette smoking continues to be the leading cause of preventable disease, general morbidity, and mortality in the United States (Centers for Disease Control and Prevention, 2010; Lindson, Aveyard, & Hughes, 2010). Smoking and its consequences are a significant public health concern given the multiple negative effects they impose on an individual and population level. It accounts for almost half a million deaths each year in the U.S. and 30% of all cancer deaths (CDC, 2002). Specifically, smoking has been highly linked to numerous physical conditions such as heart disease, at least fifteen types of cancer (American Cancer Society, 2010), and chronic lung disease among numerous other acute and chronic maladies (USDHHS, 2010). Furthermore, smoking costs American citizens $193 billion in healthcare and lost productivity at the workplace (CDC, 2010).

It is still estimated that, approximately, 1 in 5 adults continue to smoke (CDC, 2010; Saad, 2010) yielding no significant changes in smoking prevalence among American adults over the past five years (Dube, McClave, James, Caraballo, Kaufmann, & Pechacek, 2010; Saad, 2010). On a positive note, it is estimated that 53.1% of smokers report that they have tried to quit smoking and stopped smoking for at least 24 hours in the previous year (CDC, 2008). However, before becoming completely abstinent, most smokers make a number of quit attempts (usually between 4 and14) (Kaida et al., 2004; Communiquenz, 2007). This implies that relapse is a common factor; much more so than complete abstinence after the first quit attempt in the behavior change process (DiClemente, 2006; Piasecki, Fiore, McCarthy, and Baker, 2002). It is also estimated that approximately 75% of those who become

abstinent eventually relapse (Agboola, Coleman, Leonardi-Bee, McEwen, & McNeill, 2010; Brownell, Marlatt, Lichtenstein, & Wilson, 1986; Miller & Hester, 1980) days or weeks after the first quit attempt (Garvey, Bliss, Hitchcock, Heinoldr, & Rosner, 1992).

Relapse can be defined as "the return to the problematic *pattern* of behavior" (DiClemente, 2006). Based on the Transtheoretical Model of Behavior Change (TTM) (Prochaska & DiClemente, 1983), relapse is better defined as "recycling" in which an individual transitions backwards through the pre-Action Stages of Change (SOC; Precontemplation, Contemplation, or Preparation) before moving forward to the Action stage again (DiClemente, 2006) where one quits smoking. Relapse is defined as a type of regression in which an individual moves back from the Action or Maintenance stages to any pre-Action stage, whereas, regression takes place when an individual moves back to an earlier SOC from any stage. In an action paradigm most relapsers are considered the same, as failures to take effective action. In the TTM, relapse to the Preparation stage where smokers are immediately preparing to take action again would be qualitatively and quantitatively different from relapse to Precontemplation where smokers can become demoralized about their abilities to quit. Quantitatively, relapse to Preparation involves less stage regression than relapse to Precontemplation.

Transtheoretical Model of Behavior Change

All TTM measures have been developed and initially applied to smoking cessation (Prochaska & DiClemente, 1983; Velicer, DiClemente, Prochaska, & Brandenberg, 1985; Prochaska, Velicer, DiClemente, & Fava, 1988; Velicer,

DiClemente, Rossi, & Prochaska, 1990). In addition, TTM-based stage-matched smoking cessation interventions have been shown to be effective (Prochaska, DiClemente, Velicer, & Rossi, 1993). The evidence has revealed that TTM-based interventions applied to smoking cessation can lead to forward stage progression and/or increased commitment to quitting, a key finding.

The Transtheoretical Model of Behavior Change (TTM) is a comprehensive model which lays out a blueprint for intentional behavior change (Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1992; Prochaska & Velicer, 1997). Stage of Change, one of the core constructs of the TTM, provides a useful approach to conceptualizing readiness to change any particular behavior (Prochaska & Velicer, 1997). The SOC construct for smoking cessation is used to assess an individual's readiness to quit smoking. In the Precontemplation stage (PC), individuals are not intending to take action to change a given behavior in the next six months. Their reluctance may be due to unawareness, misinformation, or resistance to change. In the next stage, Contemplation (C), individuals tend to be ambivalent about change but at the same time are intending to take action in their behavior in the next six months. In Preparation (PR), individuals have a clear intention of changing their behavior in the next 30 days and may have even started taking steps towards behavior change. In the action stage (A), individuals are in the process of changing their behavior for at least 24 hours but have done so for less than six months. In the Maintenance (M) stage, individuals work on maintaining the acquired healthy behavior which they have managed for at least 6 months whilst also focusing on curtailing setbacks. Transitions between stages are variable as some individuals stay in

certain stages for some time while others move backwards (regress) or recycle through earlier stages before moving forwards and becoming abstinent (Sun et al., 2007; Velicer, Norman, Fava, & Prochaska, 1999).

Another construct within the TTM is Decisional Balance (DB), which is derived from Janis and Mann (1977). It was adapted and initially applied to smoking cessation (Velicer et al., 1985). SOC is linked to an individual's weighing of the benefits (Pros) and costs (Cons) of smoking (Velicer et al., 1985). DB has been found to be valuable in predicting transitions between stages and overall behavior change (Prochaska, Velicer, DiClemente, Guadagnoli, & Rossi, 1991).

Based on Bandura's theory (1977), the Self-Efficacy construct for smoking cessation represents the confidence in one's ability to manage and cope with situational temptations to smoke (Prochaska et al., 1997; Velicer et al., 1990). Temptations are manifested as the converse of confidence in the context of smoking cessation. In TTM-based studies, three factors emerge as reflecting the most common types of tempting situations: negative affect or emotional distress (Negative/Affective), positive social situations (Positive/Social), and craving (Habit Strength/Addictive). The Situational Temptations measure appears to be receptive to changes in forward transitions particularly through the later stages of change and is an effective predictor of relapse (Prochaska, DiClemente, Velicer, Ginpil& Norcross, 1985; Velicer, DiClemente, Rossi & Prochaska, 1990). For health behaviors, while confidence scores have been shown to increase from PC to M (Prochaska, Velicer, Guadagnoli, Rossi, & DiClemente, 1991; Velicer, Prochaska, Fava, Norman, &

Redding, 1998), temptation scores tend to decrease as stage transitions occur from PC to M (Prochaska & DiClemente, 1984; Velicer et al., 1990).

Lastly, Processes of Change (POC) encompass covert and overt strategies individuals utilize to move forward through SOC (Prochaska & DiClemente, 1983). In this case, the processes assess *how* people proceed to smoking cessation. Each process consists of a variety of techniques that are linked to different theoretical orientations (Prochaska, DiClemente, & Norcross, 1992). TTM research suggests that successful self-changers utilize different processes at each SOC. The processes are categorized under two higher order factors, experiential and behavioral, each consisting of five subscales (Prochaska, Velicer, DiClemente, & Fava, 1988). While the experiential POC consist of Consciousness Raising (CR), Dramatic Relief (DR), Social Liberation (SO), Self-Reevaluation (SR) and Environmental Reevaluation (ER; Prochaska, Velicer, DiClemente, & Fava, 1988), the behavioral POC include Stimulus Control (SC), Helping Relationships (HR), Reinforcement Management (RM), Self Liberation (SL) and Counter Conditioning (CC; Prochaska, Velicer, DiClemente, & Fava, 1988).

It has been found that each POC is highly linked to an individual's SOC (DiClemente et al., 1991; Prochaska et al., 1991). In other words, some processes are used more often within certain SOC. As such, experiential processes are typically used more often in earlier pre-Action stages while behavioral processes are used more often in Action and Maintenance (Prochaska & Velicer, 1997). In regards to smoking cessation, process use increases while moving forward and decreases as one moves backwards through the SOC. Those in Precontemplation are found to use processes the

least compared to individuals in other stages. Behavioral processes are found to be utilized the most in Action and tend to decrease as one regresses back to earlier stages.

Existing Research on Relapse and Maintenance among Smokers

The literature suggests that relapse prevention efforts have had 'modest' success and fall short of laying out a consistent formula to curb any and all types of relapse (DiClemente, 2006). Some suggest that efforts need to focus less on relapse prevention and more on "promoting recycling" which can yield important information regarding what smokers learn during their relapse that may provide insight into their long-term abstinence (DiClemente, 2006). As such, it is important to examine all patterns of individuals' change over time (Sun, Prochaska, Velicer & Laforge, 2007). There is little research on types of relapse and their predictors to pre-Action stages compared to those of forward transitions from pre-Action stages.

More specifically, most TTM-based stage sequence studies focus on forward transitions within the pre-Action stages and from the pre-Action stages to the Action stage. One study (Sun, Prochaska, Velicer & Laforge, 2007) looked at patterns of the 14 TTM variables among three identified groups defined by their pattern of change over time (stable quitter, relapsers, and stable smokers). Relapsers, on average, were found to use five of the Processes of Change the most (Dramatic Relief, Self Reevaluation, Environmental Reevaluation, Helping Relationships and Self Liberation). The authors concluded that relapsers were in fact working hard, or just as much as maintainers, but rather may have lacked adequate preparation for long-term cessation. In contrast to maintainers, relapsers did not decrease their use of SR and did not increase reliance on SC and CC. Relapsers also failed to reduce the utilization of

the Pros and Cons of smoking and their overall Situational Temptations cues which reiterates the "successive approximation" or trial-and-error approach to learning to sustain behavior that occurs in recycling (DiClemente, 2006).

Using the same smoking cessation data as Sun et al. (2007), Blissmer et al. (2010) found no significant evidence for effects of demographic characteristics on long-term changes among smokers. The largest effect sizes were found for Stage of Change. Furthermore, Situational Temptation scores were significantly higher at baseline for stable smokers. Problem severity baseline scores were lower for those who were in the Action and Maintenance stages at 24-months. For the latter group of participants, the Pros of smoking were significantly lower as well.

No studies could be found that assessed regression from Action and Maintenance to specific pre-Action stages. One study (Hoving, Mudde, & deVries, 2006) focused just on regression within the pre-Action stages. Overall, Hoving and colleagues found that smokers were more likely to move to an adjacent stage rather than skipping over a stage, yet cited their limitation in testing the differences due to a limited sample size. They also reported that they did not find any evidence to confirm their hypothesis on lower perception of Pros of smoking predicting a backward transition from the Contemplation stage. Specifically, per the authors, at 3-months post-baseline, smokers moving backwards from Contemplation to Precontemplation were more likely to be male (OR = 0.3, 95% CI 0.12–0.77, $p<0.05$). Backward transition from Preparation to Contemplation or Precontemplation was predicted by a smaller number of previous quit attempts (OR = 0.84, 95% CI 0.74–0.96, $p<0.01$). At

12-months post-baseline, backward transition from Preparation was predicted by a smaller number of previous quit attempts (OR = 0.89, 95% CI 0.80–0.98, $p < 0.05$).

Within the TTM framework, significant predictors of successful cessation or abstinence have been found to include problem severity, age, education (Velicer, Redding, Sun, & Prochaska, 2007), and Stage of Change and TTM effort (Decisional Balance, Situational Temptations, Processes of Change) variables (Blissmer et al., 2010; Velicer et al., 2007; Prochaska, Velicer, Prochaska, & Johnson, 2004).

There are no studies looking at predictors of relapse from the Action/Maintenance stages to specific pre-Action stages within TTM framework. This is pertinent information to be aware of because the lack of such research in this area provides a large gap in our understanding of relapse. If we know that each stage holds unique characteristics that pertain to the use of TTM variables, then looking at differences between the stages that pertain to relapse is imperative to our overall understanding of relapse and long-term abstinence. Consequently, we need to better understand the variable patterns of change individuals exhibit over time (Sun et al., 2007).

The Present Study

While TTM has primarily been used to look at forward transitions from the pre-Action stages to Action and Maintenance, to our knowledge, there appears to be no literature on relapse from the latter two stages to pre-Action stages. Looking at such transitions would be valuable given that the Action and Maintenance stages hold valuable information about what smokers are doing that can lead to long-term compared to relapse to pre-Action stages. Furthermore, transitions through the Stages

of Change reflect differences in cognition, experience, and behavior which suggest that each of these is used at different times throughout the "change process" (Heckhausen, & Gollwitzer, 1987).

Relapse and maintenance patterns are important to assess simultaneously as they each contribute different, though equally important information about the behavior change process. Given that most smoking research focuses on the transition from being a smoker to a non-smoker, relapse tends to be viewed as a failure (Redding, Prochaska, Paiva, Rossi, Velicer, Blissmer et al., 2011). Relapse is a natural part of the quitting process and the goals of the present study are to elucidate potential patters of relapse and maintenance and, hence, are two-fold: 1) To identify variables that are more likely to predict relapse to specific pre-Action stages, PC/C vs. PR; and 2) to explore variables that differentiate those who relapse (to any pre-Action stage) from those who remain quit. The current study recruited only current smokers (in the pre-Action stages) at baseline, therefore we focus on the participants who reported being smoke-free (in A/M) at 12-months post-baseline and who went on to complete the 24-month follow-up assessment.

METHOD

Intervention

This study involved secondary data analysis on a combined dataset of four population-based studies collected between September 1990 and May 1991. Each study involved multiple intervention groups. Of the four samples, one (*Random Digit Dial* (RDD) intervened on a single behavior, smoking, while the other datasets (*Parent*, *Patient*, and *Employee*) intervened on multiple risk behaviors including smoking. For the *RDD* study, random digit dialing survey methodology was utilized to recruit a sample of 4,144 smokers, representing 82% of approximately 5000 eligible smokers. Smokers were randomly assigned to: Assessment Only and Expert System (ES) on a 2 to 1 ratio, respectively. Additional study details can be found in Prochaska, Velicer, Fava, Rossi, & Tsoh, 2001.

For the *Parent* sample, participants consisted of parents of adolescents who participated in a school-based study. The 22 schools involved provided lists of parents. Based on these lists, a total of 3507 eligible households of students were identified. A total of 2931 households were contacted by telephone. One parent was recruited from each household. Of these, 2460 parents agreed to participate and completed the baseline survey. Additional study details can be found in Prochaska, Velicer, Rossi, Redding et al., 2004.

For the *Patient* sample, a health insurance provider supplied a list of 19,696 patient names for an expert system intervention study. Initial screening identified a total of 12,978 eligible households who were contacted by phone. One patient was

recruited from each household. Additional study details can be found in Prochaska, Velicer, Redding, Rossi, Goldstein, DePue et al., 2005.

The *Employee* sample was part of a larger multiple level study on smoking, diet, sun exposure, and exercise. A total of 22 worksites provided lists of employees were recruited the study. Additional study details can be found in Velicer, Prochaska, Redding, Rossi, Sun, Rossi et al., 2004.

Participants were assessed at 6 month intervals post-baseline through 30 months. The sample, recruitment, inclusion and exclusion criteria, and outcomes for all samples were determined by principal investigators for each study.

Participants

Since all participants were current smokers at baseline (in the pre-Action stages at baseline), therefore, this study includes participants who were in the Action/Maintenance stages at 12 months post-baseline (N=661) and who had complete data at 24-months post-baseline (N=521). Participants who reported that they were in any of the pre-Action stages (PC, C, or PR) at 24-months were classified as relapsers, and those who were in Action/Maintenance were classified as maintaining/maintainers.

Measures

Demographics. Single items were used to assess age, gender, race, ethnicity, education, and marital status.

Severity of Smoking. Severity of smoking for participants were assessed by the number of cigarettes they smoked daily and time until first cigarette, two main parts of the Fagerstrom index that reflect the degree of addiction (Fagerstrom, Heaherton, &

Kozlowski, 1990). In addition to these items, previous longest quit attempt in months and number of quit attempts in the past year were also assessed.

Intervention Group. All four studies used a common TTM-tailored expert system intervention that was printed and delivered to participants' homes. Participants also received stage-matched self-help manuals. Control groups received assessments only.

Stage of Change. Stage of Change was measured by a staging algorithm that assessed their readiness to quit smoking, with response options of 1= Precontemplation (not intending to quit smoking within the next six months), 2=Contemplation (intending to use the quit smoking within the next 6 months), 3= Preparation (intending to use the quit smoking within the next 30 days), 4= Action (quit smoking within the last six months), and 5=Maintenance (quit smoking more than six months ago).

Decisional Balance. An 8-item decisional balance measure (Appendix A) assessed the relative importance of various advantages (Pros) and disadvantages (Cons) in an individual's decision to smoke. This measure assessed Pros of smoking with 4-items (α=.87) and Cons of smoking with 4-items (α=.90). Participants were asked to rate the importance of each item on a 5-point Likert scale, ranging from 1 = "*Not At All Important*" to 5 = "*Extremely Important*" (Velicer, DiClemente, Prochaska, & Brandenburg, 1985).

Situational Temptation. A 9-item measure (Appendix B) assessed the intensity of urges to engage in a specific behavior when faced with difficult situations. Participants rated their confidence to be able to quit smoking in the presence of temptations on a 5-point Likert scale ranging from 1= "*Not At All Tempted*" to 5="*Extremely Tempted*" (Velicer, DiClemente, Rossi, & Prochaska, 1990; DiClemente, 1986, 1981).

Processes of Change. A 20-item measure (Appendix C) assessed the ten Process of Change. Participants rated their frequency of process use in the past 30 days on a 5-point Likert scale ranging from 1= *"Never"* to 5=*"Repeatedly"* (Fava, Rossi, Velicer, & Prochaska, 1991).

Demographic Characteristics

Overall Sample. Table1 summarizes the demographic characteristics of participants at baseline. All study participants (N = 661) at 12-months were in the Action and Maintenance (A/M, "maintainer") Stages of Change. Of these, 78.8% (n = 521) completed the follow-up assessment at 24-months. Approximately half of the sample was female (58.7 %), with a mean age of 41.45 (SD = 13.45). The majority of the sample was White (95.9%) and married or living with a partner (65.9 %), with about half of the sample having some high school education or holding a high school diploma (52.4%). With regards to smoking behavior and severity (Table 2), 33.4% smoked between 10-19 and 30.6% smoked between 20-29 cigarettes a day, and 32.2% made 1-2 and 28.4% made 3-10 quit attempts and 35.1% made no quit attempt in the past year prior to assessment at baseline. Furthermore, 36.1% of participants waited 1-10 hours, 24.4% waited 15 minutes, 17.1% waited 30 minutes, and 17.7% waited 60 minutes after waking up to smoke. In terms of previous longest quit attempt, 32.3% had been quit 2-12 months, 32.0% had been quit for one month, and 24.7 had been quit 12-36 months. Specifically, participants smoked an average of 15.92 (SD = 10.62) cigarettes a day, made an average of 3.16 quit attempts, and did not smoke for an average of 130.75 (SD = 663.73) months in the past.

Relapsers. Table 3 summarizes the demographic characteristics of all relapsers at 24-months (n=149). The relapse rate was low (22.5%) compared to being a maintainer at 24-months. Of the relapsers, 89 participants were female (68.2%). The mean age was 38.70 (SD = 13.13). Similar to the overall sample, the majority of the

sample was White (93.9%) and married or living with a partner (69.2%), with about half of the sample having some high school education or holding a high school diploma (54.5%). With regards to smoking behavior and severity (Table 4), 35.9% smoked 20-29 cigarettes a day and 32.9% made 3-10 quit attempts in the past year prior to assessment at baseline. Furthermore, 29.9% of participants waited 1-10 hours, 23.8% waited 15 minutes, 22.4% waited 30 minutes, and 19.0% waited 60 minutes after waking up to smoke. In terms of previous longest quit attempt, 36.2% had been quit for one month, 30.4% had been quit for 2-12 months, and 26.1% had been quit 12-36 months. Specifically, relapsers smoked an average of 17.05 (SD = 10.95) cigarettes a day, made an average of 3.40 quit attempts, and did not smoke for an average of 105.66 (SD = 614.83) months in the past.

Hypotheses and Findings

Hypothesis 1: Based on the assumption that self-changers typically move one stage, participants in the treatment group are expected to relapse to PR (85%) vs. PC/C (15%) at 24-months post-baseline more so than those in the control group.

Analysis 1a: Crosstabs were conducted to compare those who relapsed to PR vs. PC/C at follow-up.

Results 1a. Overall, crosstabs indicated that 36.9% of the relapsers regressed to the PR stage, while 63.1% relapsed to the PC/C stages at 24-months. Of the relapsers in the treatment group (n = 44), 29.5% relapsed to PR and 40.0% of participants in the control group (n = 105) relapsed to PR at 24-months. There was no statistically significant difference between the treatment and control groups relapsing to PR vs. PC/C at 24-months (χ^2 (1) = 1.46, *p* = .23) (Table 5).

Analysis 1b: Logistic regression analysis was conducted to determine the likelihood of regression to PR vs. PC/C between control and treatment group participants.

Results 1b: Logistic regression analysis indicated that participants in the treatment group were not more likely to relapse to PR vs. PC/C at 24-months compared to participants in the control group (OR = 1.60, p = .23) (Table 5).

Hypothesis 2: Participants in the control group will be more likely to relapse (regress to any pre-Action stage) vs. maintain at 24-months compared to participants in the treatment group.

Analysis 2a: Crosstabs were conducted to compare those who relapsed vs. maintained at follow-up.

Results 2a: Crosstabs indicated that 35.0% of the control group participants relapsed to any pre-Action stage, while 19.9% of the treatment group participants relapsed to any pre-Action stage at 24-months. There was a statistically significant relationship between being in the treatment group and relapsing vs. maintaining at 24-months (χ^2 (1) = 14.19, p = .00) (Table 6).

Analysis 2b: Logistic regression analysis was conducted to determine the likelihood of relapse vs. maintenance among control and treatment group participants.

Results 2b: Logistic regression analysis indicated that participants in the control group were more than twice as likely to relapse (OR = 2.17, p = .00) to any pre-Action stage vs. maintain at 24-months compared to participants in the treatment group (see Table 12).

Hypothesis 3: In both the treatment and control groups, participants who reported higher Pros of smoking, lower Cons of smoking, and higher Temptations to smoke at 12-months post-baseline will be more likely to relapse vs. maintain at 24-months.

Analysis 3: Two logistic regression analyses were conducted, one including Pros and Cons and the other including Situational Temptations) at 12-months, to determine the likelihood of being a relapser vs. a maintainer at 24-months.

Results 3:

Decisional Balance (Pros and Cons). Participants who reported higher on the Pros of smoking and lower Cons of smoking at 12-months were not significant at the .05 level set for predicting the likelihood of relapse vs. maintenance at 24-months. Odds ratios were 1.03, $p = .16$ for Pros and 1.00, $p = .94$ for Cons (see Table 7).

Situational Temptations. Participants who reported higher Habit Strength scores were more likely to relapse vs. maintain at 24-months (OR = 1.05, $p = .02$) (see Table 7).

Hypothesis 4: Hypothesis 4 was a repeat of Hypothesis 1 in the Thesis Proposal; as a result, it has been eliminated from the Thesis due to redundancy.

Hypothesis 5: If regression works the way it is expected with forward transitions, then participants who reported higher Pros of smoking, lower Cons of smoking, and higher Temptations to smoke at 12-months will be more likely to regress back to PC/C rather than PR at 24-months.

Analysis 5a: Two logistic regression analyses were conducted, one including Pros and Cons and the other including Situational Temptations)at 12-months, to determine the likelihood of regression to PC/C vs. PR.

Results 5a:

Pros, Cons, and Situational Temptations were converted into T-scores (M = 50, SD=10), and then entered into two separate logistic regression analyses.

Decisional Balance (Pros and Cons). Reporting higher Pros of smoking (OR = .90, p = .06), and lower Cons of smoking (OR = .99, p = .71) at 12-months were not statistically significant predictors of relapse to PC/C vs. PR at 24-months (Table 8).

Situational Temptations. In the logistic regression analyses conducted on the three subscales of Situational Temptations, Positive Social (OR = 1.00, p = .95), Negative Affect (OR = 1.00, p = .98), and Habit Strength (OR = .92, p = .12) at 12-months, none of the variables were statistically significant predictors of relapse to PC/C vs. PR at 24-months. Similarly, the Total score for Situational Temptations (OR = .94, p = .05) was not a statistically significant predictor of relapse to PC/C vs. PR at 24-months (Table 8).

Exploratory Analyses

The final step of the study consisted of exploratory analyses evaluating findings on the Processes of Change construct of TTM, and across different demographic groups and smoking behaviors and severity.

Processes of Change. Based on Sun et al.'s findings (2007), all Processes of Change items were evaluated to see whether using DR, SR, ER, HR, and SL processes at 12-months would increase the likelihood of relapse vs. maintenance at 24-months. It was predicted that those who use less DR, SR, ER, HR, and SL processes at 12-months would relapse to the earlier stages, PC/C vs. PR, at 24-months.

Separate scores for the ten Processes of Change (CR, CC, DR, ER, HR, RM, SC, SL, SO, SR), the Experiential subscale score, the Behavioral subscale score, and

the Total Processes of Change score at 12-month were converted into T-scores ($M =$ 50, $SD = 10$) and entered into logistic regression analyses. Next, to avoid collinearity between the subscales and the total scores for Processes of Change variables, three separate logistic regression analyses were conducted for all ten Processes, the Experiential and Behavioral subscale scores and the Total Processes of Change score at 12-months.

Two of the Processes of Change were significant predictors of relapse to PC/C vs. PR at 24-months at the .05 level: CR (OR = 1.17, $p = .03$) and SR (OR = .79, $p =$ .03). Specifically, those who had higher scores of CR were more likely to relapse to PC/C compared to PR. Those who had higher scores of SR were less likely to relapse to PC/C compared to PR. The remaining eight processes were not found to be significant predictors (Table 9).

Two of the Processes of Change were significant predictors of relapse vs. maintenance at 24-months at the .05 level: RM (OR = 1.05, $p = .04$) and SR (OR = 1.08, $p = .01$). Specifically, those who had higher scores of RM were more likely to relapse compared to maintain, and those who had higher scores of SR were more likely to relapse compared to maintain. The remaining eight processes were not found to be significant predictors (Table 10).

Demographic Variables. None of the baseline demographic variables were significant at the .05 level set for predicting the likelihood of relapsing to PR vs. PC/C at 24-months. Furthermore, their corresponding confidence intervals were fairly wide (Table 11).

With regards to baseline demographic variables as predictors of relapse to any pre-Action stage vs. maintenance at 24-months (Table 11), in addition to being in the treatment group (Hypothesis 2, OR = 2.17, p = .00), those who were aged 25-44 and 45-64 (OR = .43, p = .01 and OR = .40, p = .01, respectively) compared to being aged 18-24 were less likely to relapse vs. maintain. The remaining baseline demographic variables were not significant at the .05 level set for predicting the likelihood of relapse vs. maintenance.

Severity of Smoking Variables. None of the baseline smoking behavior or severity variables including the time to first cigarette of the day, the number of quit attempts, and the longest time being quit were significant at the .05 level set for predicting the likelihood of relapsing to PR vs. PC/C at 24-months (Table 13).

In contrast, participants who had a previous longest quit attempt last between 36-72 months compared to one month were less likely to relapse vs. maintain (OR = 0.42, p = .02). In addition, participants who had made 3-10 quit attempts compared to no attempts prior to baseline were more likely to relapse vs. maintain (OR = 1.70, p = .03). Participants who had been quit 36-72 months at some point pre-baseline compared to one month in the past were less likely to relapse vs. maintain (OR = .42, p = .02) (Table 14) during this timeframe.

Other Study Timepoints. For further data exploration, all aforementioned static and dynamic independent variables were evaluated at between 6-18 months and 18-30 months of the larger study. Logistic regressions performed at these timepoints; however, due to small sample sizes did not have adequate power to detect significant

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findings (Wright, 1995). Therefore, meaningful comparisons between timepoints

could not be made.

DISCUSSION

Most smoking relapse research has focused on static individual factors (i.e. demographics and smoking severity) (Ockene et al., 2000; Swan, Jack, & Ward, 1997 in Shiffman, 2005). Given that such characteristics are unchangeable and only provide information regarding *who* tends to relapse, looking at dynamic variables can also provide valuable information on *when* and *why* relapse occurs. To that end, the primary goal and strength of this study was to explore static as well as dynamic variables including demographic characteristics, smoking behavior and addiction severity, and three of the TTM effort variables (Decisional Balance, Situational Temptations, Processes of Change) as potential predictors of relapse to pre-Action stages within a multivariate and longitudinal study design.

Preliminary findings indicated that the majority of participants (71.4%) maintained at follow-up. Disconfirming Hypothesis 1, the majority of relapsers moved back to PC/C (n = 94) vs. PR (n = 55). So, at first glance, those who relapsed tended to relapse to earlier stages where they were not intending to quit again in the next six months or were intending to quit in the next six months but were not actively preparing to engage in the cessation process. However, when participants in PC and C were separated, relapsers were, in fact, fairly equally distributed between all three pre-Action stages: PC (n = 51; 34.2%), C (n = 43; 28.9%), and PR (n = 55; 36.9%). As such, it is clear that relapse to pre-Action stages does not entail a similar process to forward transitions between adjacent stages.

As expected, confirming Hypothesis 2, being in a treatment group appeared to be a very salient predictor of differentiating relapsers from maintainers. However, the

latter predictor did not show the same significance in differentiating those who

relapsed to PC/C vs. PR. Yet, its effect size suggests that those in the treatment group

are potentially about half as likely to relapse to the earlier two stages vs. PR. Again, as

expected, none of the demographic variables including gender, age, race, education

level, and marital status were predictors of PR vs. PC/C. Similarly, with the exception

of age, all other demographic variables were not predictors of relapse vs. maintenance.

Participants aged 25-64 were less likely to relapse maintain compared to participants

aged 18-24. One interpretation is that even though young adulthood is a time of many

transitions, including changes in smoking behavior in which initiation of smoking as

well as relapse are common (Tercyak, Rodriguez, & Audrain-McGovern, 2007) most

adults who have been longer-term smokers are at increased risk to relapse. This is

corroborated by the fact that the older people get, they are more likely to have more

quit attempts which increases the likelihood of relapse. In line with previous findings

(Velicer et al., 1990) the psychological and physiological aspects of smoking behavior

assessed by Habit Strength items as well as the Total Situational Temptations scores

predicted that those who scored higher on those items were more likely to relapse vs.

maintain at follow-up. This discrepancy in findings between the two sets of measures

of addiction severity indicate that a more comprehensive way of assessing addiction

via immediate emotional and social factors, also termed as "process-situational," an

approach pioneered by Martlatt and Gordon (1985), may be able to better capture the

"process" of relapse. Furthermore, this finding adds to one assumption that relapsers

tend to relapse not solely due to smoking addiction severity, necessarily, but due to

immediate precursor factors such as emotional distress (Shiffman & Waters, 2004;

Shiffman, Paty, Gnys, Kassel, & Hickox, 1996). In addition, although psychological as well as physical repercussions of nicotine withdrawal is an established barrier to quitting smoking, it may not play the same role among individuals who have already quit smoking given that the intensity of withdrawal symptoms typically decrease during the first month of quitting (Hatsukami, Stead, & Gupta, 2008). Based on the significance of the Total Situational Temptations score finding, it is also possible that positive social experiences related to smoking, in which a positive affective component is present, also can instigate relapse (Velicer, DiClemente, Rossi, & Prochaska, 1990).

Surprisingly, Pros and Cons did not differentiate between those who relapsed vs. maintained or between those who relapsed to PR vs. PC/C at follow-up. One possible interpretation is that perhaps even though ex-smokers are aware of the Pros and Cons of smoking, they do not find them helpful when faced with situational distress.

Consciousness Raising (CR) and Self-Reevaluation (SR) were two significant predictors of regression to PC/C vs. PR. CR is a key process for self-changers to utilize as they transition from Precontemplation to later pre-Action stages while acquiring new information regarding quitting smoking. The use of the latter process was found to be predictive of relapsing to the earlier Stages of Change. Similarly, SR is also a key experiential process for self-changers to utilize as they transition forward from a non-Action stage to a more action-oriented stage. Similar to what we have observed in previous two studies (Redding et al., 2011; Sun et al., 2007) SR was a key process that differentiated relapsers from maintainers in the present study. In this case,

however, we also found that those relapsers were less likely to move back to PC/C compared to PR. So in fact, those who do use SR are more likely to move back only one stage; to PR in which they are still working towards quitting again. As such, once individuals enter the Action and Maintenance stages, they would benefit from decreasing their reliance on SR and increasing their utilization of Behavioral Processes such as Helping Relationships for potential stress management and support, and Stimulus Control for alteration of environmental cues to maintain the cessation process.

Overall, when a continuous measure (e.g. Reinforcement Management) is used, the score range is wider and therefore the interpretation of the odds ratio is different from a dichotomous predictor variable. The odds ratio for RM was 1.05 which means that there was a 5% increase in relapse for each one unit increase in Temptations, and the range for this variable is from 2-10. As a result, even though 5% appears to be a small increase, it is, in fact, larger if a change from, for example, a sum score of 2 to 10 is being considered. In such a case, the odds of relapse would be 40% greater. This suggests that the aforementioned Processes of Change, including SR (OR=1.08) may have a bigger effect in predicting relapse vs. maintenance among such a population than the odds ratio itself reflects. Similarly, Habit Strength (OR=1.05) and the Total Situational Temptations Score (OR=1.06), also continuous measures, are important in differentiating relapsers from maintainers despite what seems like a relatively small Odds Ratio.

Limitations

This study had several limitations. First, all analyses were based on a predominantly White and female sample. Although sample characteristics were representative of the larger population-based clinical trial, homogeneity of race and gender limit generalizability of findings. Second, the long recall period between baseline and prior year allows for potential recall bias about quit attempts and prior smoking behavior (Gilpin & Pierce, 1994). Although efforts were made in both studies to recruit proactively from the general population, study participants had to be willing to engage in the intervention related to smoking cessation. Also, given fairly small samples, differentiating predictors between pre-Action stages was not robust. It is also important to note that given that an odds ratio is reflective of a one unit increase in the dependent variable, dichotomization may have inflated classification (e.g. treatment vs. control group).

Future Directions

The traditional view has been that biological addiction severity accounts for most of the barriers to quitting smoking. However, we now have preliminary evidence to suggest that this is not entirely true for relapse. Specifically, our findings add to the literature that relapse may be much more of an affective and situational process among ex-smokers. Studies suggest that nicotine craving, an intense desire to smoke, typically lasts around 5-12 minutes, and that cravings, as well as increases in smoking rate and nicotine intake are highly related to acute physical or psychological stress (al'Absi,Wittmers, Erickson, Hatsukami, & Crouse, 2003; al'Absi, Amunrud, &Wittmers, 2002). As such, it is imperative that ex-smokers have the tools to be able to manage stress effectively.

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The interaction between craving and stress is important to examine, since stress-induced craving states have been associated with relapse vulnerability (Ng & Jeffery, 2003). As such, one promising approach would be to provide additional expert guidance on how ex-smokers can manage stress effectively when they enroll in treatment at any Stage of Change. If resources are limited, tailored guidance can be provided for those who enter the Action stage given that underlying withdrawal symptoms including anxiety, anger, and irritability (Hughes, 2007) in addition to the physical symptoms appear to most prevalent and severe closer to the time of quitting.

In addition, future research needs to find ways to capitalize on TTM variables over the course of the intervention, as well as after treatment ends given that smoking cessation is a lifelong behavior change. In Sun et al.'s study (2007), relapsers were using five of the processes the most: Dramatic Relief, Self-Revaluation, Environmental Revaluation, Helping Relationship, and Self-Liberation (Sun et al., 2007). In the present study, the relapsers were using CR and SR more than the maintainers. As proposed in the latter study, relapsers did not increase their use of Behavioral Processes such as Counterconditioning and Stimulus Control. Furthermore, future research could build upon these findings by tailoring interventions and encouraging evaluating the Cons of smoking when contemplating smoking again. Another area that may need further exploration is the quantitative and qualitative investigation of the specific decision-making process that goes on between being tempted to smoke and actually lighting up a cigarette as well as the time it takes between those two timepoints. Looking at relapsers over time at more than two timepoints in future studies may provide additional pertinent information about

relapse. And finally, the preliminary findings in the present study need further evaluation when data are adequately powered.

Table 1.

Baseline descriptives of demographic variables among total sample across treatment and control groups.

	Treatment (n=273)		Control (n=386)		Total (N=661)	
Gender	**n**	**%**	**n**	**%**	**n**	**%**
Female	168	61.1	220	57.0	388	58.7
Male	107	38.9	166	43.0	273	41.3
Age						
18-24	19	6.9	43	11.1	62	9.4
25-44	149	54.2	186	48.2	335	50.7
45-64	69	25.1	104	26.9	173	26.2
65+	38	13.8	53	13.7	91	13.8
Race						
White	262	96.0	368	95.8	630	95.9
Black	5	1.8	9	2.3	14	2.1
Asian/Pacific Islander	2	0.7	1	0.3	3	0.5
American Indian/ Alaskan	2	0.7	2	0.5	4	0.6
Other	2	0.7	4	1.0	6	0.9
Hispanic or Not						
Hispanic	2	0.7	7	1.8	9	1.4
Non-Hispanic	271	99.3	377	98.2	648	98.6
Education						
Up to High School	146	53.3	198	51.7	344	52.4
College and Graduate School	128	46.7	185	48.3	313	47.6
Marital Status						
Married or Living with Partner	174	66.4	239	65.5	413	65.9
Not Married	30	11.5	67	18.4	97	15.5
Separated or Divorced	56	21.4	56	15.3	112	17.9
Widowed	2	0.8	3	0.8	5	0.8

Table 2.

Baseline descriptives of smoking severity variables among total sample across treatment and control groups.

	Treatment (n=273)		Control (n=386)		Total (N=661)	
Daily Cigarette Use	N	%	n	%	n	%
≤9	68	25.3	83	21.8	151	23.2
10-19	87	32.3	130	34.1	217	33.4
20-29	82	30.5	117	30.7	199	30.6
30+	32	11.9	51	13.4	83	12.8
Number of Quit Attempts in the Past Year						
None	95	34.8	136	35.2	231	35.1
1-2	88	32.2	124	32.1	212	32.2
3-10	81	29.7	106	27.5	187	28.4
11-98	9	3.3	20	5.2	29	4.4
Time Until First Cigarette						
15 minutes	64	23.6	96	24.9	160	24.4
30 minutes	38	14.0	74	19.2	112	17.1
60 minutes	49	18.1	67	17.4	116	17.7
1-10 hours	98	36.2	139	36.1	237	36.1
10-1000 hours	22	8.1	9	2.3	31	4.7
Longest Quit Attempt						
1 Month	70	27.8	123	35.0	193	32.0
2-12 Months	77	30.6	118	33.6	195	32.3
12-36 Months	61	24.2	88	25.1	149	24.7
36-72 Months	44	17.5	22	6.3	66	10.9

Table 3.

Baseline descriptives of demographic variables among relapsers, only, across treatment and control groups.

	Treatment (n=44)		Control (n=105)		Total (N=149)	
Gender	**n**	**%**	**n**	**%**	**n**	**%**
Female	59	68.2	30	56.2	89	59.7
Male	14	31.8	46	43.8	50	40.3
Age						
18-24	9	20.5	13	12.4	22	14.8
25-44	20	45.5	52	49.5	72	48.3
45-64	9	20.5	25	23.8	34	22.8
65+	6	13.6	15	14.3	21	14.1
Race						
White	41	93.2	97	94.2	138	93.9
Non-White	3	6.8	6	5.8	9	6.1
Hispanic or Not						
Hispanic	43	97.7	100	97.1	143	2.7
Non-Hispanic	1	2.3	3	2.9	4	97.3
Education						
Up to High School	26	59.1	54	52.4	80	54.5
College and Graduate School	18	40.9	49	47.6	67	45.6
Marital Status						
Married or Living with Partner	27	62.8	72	72.0	99	69.2
Not Married	8	18.6	15	15.0	23	16.1
Separated or Divorced	8	18.6	13	13.0	21	14.7

Table 4.

Baseline descriptives of smoking severity variables among relapsers, only, across treatment and control groups.

	Treatment (n=44)		Control (n=105)		Total (N=149)	
Daily Cigarette Use	N	%	n	%	n	%
≤9	9	20.9	16	15.7	25	17.2
10-19	8	18.6	39	38.2	47	32.4
20-29	18	41.9	34	33.3	52	35.9
30+	8	18.6	13	12.7	21	14.5
Number of Quit Attempts in the Past Year						
None	13	29.5	29	27.6	42	28.2
1-2	17	38.6	34	32.4	51	34.2
3-10	12	27.3	37	35.2	49	32.9
11-98	2	4.5	5	4.8	7	4.7
Time Until First Cigarette						
15 minutes	10	23.8	25	23.8	35	23.8
30 minutes	8	19.0	25	23.8	33	22.4
60 minutes	5	11.9	23	21.9	28	19.0
1-10 hours	14	33.3	30	28.6	44	29.9
10-1000 hours	5	11.9	2	1.9	7	4.8
Longest Quit Attempt						
1 Month	11	28.2	39	39.4	50	36.2
2-12 Months	14	35.9	28	28.3	42	30.4
12-36 Months	8	20.5	28	28.3	36	26.1
36-72 Months	6	15.4	4	4.0	10	7.2

Table 5.

Hypothesis 1 – Stage distribution of relapsers, only, and Odds Ratios across treatment and control groups evaluating the chances of participants who relapsed to PC/C vs. PR.

Regression Distribution of Relapsers at 24 Months	Treatment (n=44)	Control (n=105)		Total (N=149)
	n(%)	n(%)	Odds Ratio	n(%)
PC/C	31(70.5)	63(60.0)	1.60	94(63.1)
PR	13(29.5)	42(40.0)		55(36.9)

Table 6.

Hypothesis 2 – Stage distribution across treatment and control groups at 24-months.

		Treatment (n=221)		Control (n=300)		Total (N=521)	
A/M		n	%	n	%	n	%
	Relapse (PC/C/P)	44	19.9	105	35.0	149	28.6
A/M							
	Maintenance (A/M)	177	80.1	195	65.0	372	71.4

Table 7.

Hypothesis 3 - Odds Ratios for TTM effort variables evaluating the chances of participants who relapsed to any pre-Action stage vs. maintained.

TTM Effort Variables	p	Odds Ratio	95% CI Lower	Upper
Decisional Balance				
Pros	0.16	1.03	0.99	1.06
Cons	0.94	1.00	0.97	1.03
Situational Temptations				
Positive Social	0.77	1.01	0.96	1.06
Negative Affect	0.75	1.01	0.96	1.06
Habit Strength	0.02	**1.05***	1.01	1.10
Total	0.00	**1.06****	1.03	1.10

Note. CI = confidence interval. *p<.05, **p<.001

Table 8.

Hypothesis 5 - Odds Ratios for TTM effort variables evaluating the chances of participants who relapsed to PC/C vs. PR.

TTM Effort Variables	p	Odds Ratio	95% CI Lower	Upper
Decisional Balance				
Pros	0.06	0.90	0.81	1.00
Cons	0.71	0.99	0.91	1.07
Situational Temptations				
Positive Social	0.95	1.00	0.91	1.11
Negative Affect	0.98	1.00	0.89	1.13
Habit Strength	0.12	0.92	0.83	1.02
Total	0.05	0.94	0.87	1.00

Note. CI = confidence interval. *$p< .05$.

Table 9.

Exploratory - Odds Ratios for Processes of Change evaluating the chances of participants who relapsed to PC/C vs. PR.

	p	Odds Ratio	95% CI Lower	95% CI Upper
CC	0.43	0.95	0.84	1.08
CR	0.03	**1.17***	1.01	1.35
DR	0.21	1.13	0.93	1.36
ER	0.19	1.13	0.94	1.34
HR	0.39	0.94	0.81	1.08
RM	0.77	1.01	0.92	1.12
SC	0.24	1.11	0.94	1.31
SL	0.88	1.01	0.88	1.17
SO	0.93	0.99	0.87	1.14
SR	0.03	**0.79***	0.64	0.98
Experiential	0.12	1.08	0.98	1.19
Behavioral	0.74	0.99	0.90	1.08
Total	0.14	1.06	0.98	1.14

Note. CI = confidence interval. *$p< .05$.

Table 10.

Exploratory - Odds Ratios for Processes of Change evaluating the chances of participants
who relapsed to any pre-Action stage vs. maintained.

	p	Odds Ratio	95% CI Lower	Upper
CC	0.76	0.99	0.95	1.04
CR	0.50	0.98	0.92	1.04
DR	0.09	0.95	0.90	1.01
ER	0.19	1.04	0.98	1.09
HR	0.13	0.96	0.92	1.01
RM	0.04	1.05*	1.00	1.10
SC	0.18	0.97	0.92	1.02
SL	0.72	0.99	0.94	1.04
SO	0.90	1.00	0.95	1.05
SR	0.01	1.08*	1.02	1.13
Experiential	0.49	1.02	0.97	1.07
Behavioral	0.31	0.97	0.92	1.03
Total	0.63	0.96	0.96	1.03

Note. CI = confidence interval. *$p< .05$.

Table 11.

Exploratory - Odds Ratios for baseline demographics evaluating the chances of participants who relapsed to PR vs. PC/C.

| | *p* | **Odds Ratio** | **95% CI** | |
			Lower	**Upper**
Treatment Group	0.23	1.60	0.75	3.39
Female	0.18	0.63	0.32	1.24
Non-White	0.62	1.41	0.36	5.49
Education				
College and/or Graduate School	0.06	1.89	0.96	3.73
Marital Status				
Married or Living with Partner	0.82	-	-	-
Not Married	0.53	1.35	0.54	3.38
Separated or Divorced	0.89	1.08	0.41	2.84
Age				
18-24	0.40	-	-	-
25-44	0.35	1.62	0.59	4.45
45-64	0.79	1.17	0.37	3.66
65+	0.10	0.67	0.17	2.57

Note. CI = confidence interval. **p*< .05.

Table 12.

Exploratory - Odds Ratios for baseline demographics evaluating the chances of participants who relapsed to any pre-Action stage vs. maintained.

			95% CI	
	P	**Odds Ratio**	**Lower**	**Upper**
Treatment Group	0.00	**2.17***	1.44	3.25
Female	0.86	1.04	0.70	1.53
Non-White	0.10	2.14	0.87	5.27
Education				
College and/or Graduate School	0.17	0.76	0.52	1.12
Marital Status				
Married or Living with Partner	0.82	-	-	-
Not Married	0.56	1.18	0.68	2.04
Separated or Divorced	0.51	0.83	0.48	1.44
Widowed	1.00	0.00	0.00	
Age				
18-24	0.05	-	-	-
25-44	0.01	**0.43***	0.23	0.81
45-64	0.01	**0.40***	0.20	0.80
65+	0.08	0.51	0.24	1.09

Note. CI = confidence interval. ***p<.001, p< .05.

Table 13.

Exploratory - Odds Ratios for severity of smoking variables evaluating the chances of participants who relapsed to PR vs. PC/C.

	p	Odds Ratio	95% CI	
			Lower	Upper
Time to First Cigarette of the Day				
15 minutes	0.96	-	-	-
30 minutes	0.57	0.75	0.28	2.02
60 minutes	0.95	0.97	0.35	2.68
1-10 hours	0.59	0.78	0.31	1.95
10-1000 hours	0.89	1.13	0.22	5.82
Number of Quit Attempts				
None	0.18	-	-	-
1-2	0.08	0.46	0.19	1.10
3-10	0.85	1.09	0.47	2.49
11-98	0.48	0.53	0.09	3.07
Longest Time Being Quit				
1 month	0.22	-	-	-
2-12 months	0.09	2.12	0.90	4.99
12-36 months	0.96	1.03	0.40	2.61
36-72 months	0.23	2.33	0.59	9.27

Note. CI = confidence interval. **p* < .05.

Table 14.

Exploratory - Odds Ratios for severity of smoking variables evaluating the chances of participants who relapsed to any pre-Action stage vs. maintained.

	p	Odds Ratio	95% CI Lower	Upper
Time to First Cigarette of the Day				
15 minutes	0.42	-	-	-
30 minutes	0.33	1.34	0.75	2.38
60 minutes	1.00	1.00	0.55	1.81
1-10 hours	0.35	0.78	0.46	1.31
10-1000 hours	0.74	0.85	0.33	2.19
Number of Quit Attempts				
None	0.19	-	-	-
1-2	0.16	1.41	0.87	2.26
3-10	0.03	**1.70***	1.05	2.77
11-98	0.37	1.56	0.56	4.07
Longest Time Being Quit				
1 month	0.15	-	-	-
2-12 months	0.30	0.77	0.47	1.26
12-36 months	0.59	0.87	0.52	1.46
36-72 months	0.02	**0.42***	0.20	0.89

Note. CI = confidence interval. **p*< .05.

Decisional Balance (Pros and Cons) items.

Pros	The advantages of smoking
Pros1	Smoking cigarettes relieves tension.
Pros 2	Smoking helps me concentrate and do better work.
Pros 3	I am relaxed therefore more pleasant when smoking.
Pros 4	Smoking cigarettes is pleasurable.
Cons	The disadvantages of smoking
Cons 1	I'm embarrassed to have to smoke.
Cons 2	My cigarette smoking bothers other people.
Cons 3	People think I am foolish for ignoring the warnings about cigarette smoking.
Cons 4	Smoking cigarettes is hazardous to my health.

APPENDIX B

Situational Temptations items.

	Confidence that one can avoid temptations to smoke across different challenging situations
Temptation 1	With friends at a party.
Temptation 2	When I first get up in the morning.
Temptation 3	When I am very anxious and stressed.
Temptation 4	Over coffee while talking and relaxing.
Temptation 5	When I feel I need a lift.
Temptation 6	When I am very angry about something or someone.
Temptation 7	With my spouse or close friend who is smoking.
Temptation 8	When I realize I haven't smoked for a while.
Temptation 9	When things are not going my way and I am frustrated.

Processes of Change items.

Processes of Change	Description	Item on Survey
Consciousness Raising	Finding and learning new facts, ideas, and tips that support the healthy behavior change.	1. I notice that nonsmokers are asserting their rights. 2. I think about information from articles and ads on how to stop smoking. 3. I recall information people have given me on the benefits of quitting smoking.
Dramatic Relief	Experiencing the negative emotions (fear, anxiety, worry) that go along with unhealthy behavioral risks	1. Warnings about the health hazards of smoking move me emotionally. 2. I get upset when I think about my smoking. 3. My need for cigarettes makes me feel disappointed in myself. 4. I react emotionally to warnings about smoking cigarettes.
Self-Reevaluation	Realizing that the behavior change is an important part of one's identity as a person.	1. My dependency on cigarettes makes me feel disappointed in myself. 2. I get upset when I think about my smoking.
Environmental Reevaluation	Realizing the negative impact of the unhealthy behavior.	1. I stop to think that smoking is polluting the environment. 2. I consider the view that smoking can be harmful to the environment.
Self-Liberation	Making a firm commitment to change.	1. I tell myself I can quit smoking if I want to. 2. I tell myself that if I try hard enough I can keep from smoking.
Helping Relationships	Seeking and using social support for the healthy behavior change.	1. I have someone who listens when I need to talk about my smoking. 2. I have someone I can count on when I'm having problems with smoking.
Counterconditioning	Substitutions of healthier alternative behaviors and/or cognitions for the unhealthy behavior.	1. When I am tempted to smoke, I think about something else. 2. I do something else instead of smoking when I need to relax.
Reinforcement Management	Increasing the rewards for the positive behavior change and/or decreasing the rewards of the unhealthy behavior.	1. I can expect to be rewarded by others if I don't smoke. 2. I am rewarded by others if I don't smoke.
Stimulus Control	Removing reminders or cues to engage in the unhealthy behavior and/or adding cues or reminders to	1. I remove things from my home or place of work that remind me of smoking. 2. I keep things around my home or place of

	engage in the healthy behavior.	work that remind me not to smoke.
Social Liberation	Realizing that the social norms are changing in the direction of supporting the healthy behavior change.	1. I find society changing in ways that make it easier for nonsmokers.

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