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Mechanisms of change in extended cognitive behavioral treatment for tobacco dependence[☆]

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Abstract

Aim—To evaluate potential mediators of an extended cognitive behavioral smoking cessation intervention.

Design—Analysis of data from a randomized clinical trial of smoking cessation.

Setting—The Habit Abatement Clinic, University of California, San Francisco.

Participants—Participants were older cigarette smokers (≥ 50 years old). Those receiving Standard Treatment ($N = 100$) were compared to those receiving extended cognitive behavioral treatment ($N = 99$).

Measurements—Negative affect was measured with the Profile of Mood States (POMS), the Medical Outcome Studies 36-item Short-Form Health Survey (SF-36), and the Perceived Stress Scale (PSS). Abstinence-specific social support was measured with the Partner Interaction Questionnaire (PIQ). Motivation to quit and abstinence self-efficacy were measured on 1–10 scales with the Thoughts about Abstinence Questionnaire. All were measured at the beginning of treatment and week 52.

Results—Analyses revealed that extended CBT increased abstinence self-efficacy over the first 52 weeks postcessation. This effect, in turn, was positively associated with 7-day point prevalence abstinence at week 64 while controlling for treatment condition, and eliminated the independent effect of treatment condition on abstinence. The test of mediation indicated a significant effect, and abstinence self-efficacy accounted for 61% to 83% of the total effect of treatment condition on smoking abstinence. Results failed to support a mediational role of negative affect, abstinence-specific social support, or motivation to quit.

Conclusions—The results of the present study are consistent with theories of relapse and studies of more time-limited interventions, and underscore the importance of abstinence self-efficacy in achieving long-term abstinence from cigarettes.

[☆]This trial is registered with the National Institutes of Health (NIH), and can be accessed at <http://clinicaltrials.gov>; “Maintaining Nonsmoking: Older Smokers” (identifier: NCT00086385).

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Contributors

Dr. Hendricks conceived the principal aim of the study, planned and conducted the data analyses, and composed the first draft of the manuscript. Dr. Delucchi helped plan and conduct the data analyses, and contributed to results interpretation and manuscript preparation. Dr. Hall designed the parent study and contributed to results interpretation and manuscript preparation. All authors contributed to and have approved the final manuscript.

Conflicts of interest

The authors have no conflicts of interest to declare.

Keywords

Smoking; Tobacco dependence; Treatment; Cessation; Mediation; Self-efficacy

1. Introduction

Addiction is widely recognized as a chronic and relapsing disorder (e.g., Brandon et al., 2007). This recognition has prompted extended and intensive treatments for a number of addictive drugs (see McKay, 2005). Yet, despite the recognition that addiction is an enduring disorder, interventions for cigarette smoking have been time-limited and less intensive. It is not surprising that long-term abstinence rates for even the most rigorous of these treatments range between 20% and 35% (Hall et al., 1998, 2002; Hurt et al., 1997; Jorenby et al., 1999).

Two studies by Hall et al. (2004, 2009) are among the few to examine extended pharmacotherapy and psychological treatment for tobacco dependence. In the first of these investigations (Hall et al., 2004), smokers ($N = 160$) were randomly assigned to one of the four treatment conditions in a two-by-two design (nortriptyline vs. placebo by standard vs. extended treatment). Extended treatment consisted of active drug or placebo and individual cognitive behavioral counseling sessions through 52 weeks. At week 52, abstinence rates among those who received extended treatment plus nortriptyline (56%) and extended treatment plus placebo (57%) were superior to those who received brief treatment plus nortriptyline (21%) and brief treatment plus placebo (32%). In the second of these studies, an extended treatment model was tested in older cigarette smokers. In this clinical trial (Hall et al., 2009), smokers 50 years of age and older ($N = 402$) were randomly assigned to one of the four treatment conditions: (1) Standard Treatment (ST); (2) Extended Nicotine Replacement Therapy (E-NRT; nicotine gum availability through 52 weeks); (3) Extended Cognitive Behavioral Therapy (ECBT; group cognitive behavioral sessions through 52 weeks); and (4) E-CBT plus E-NRT (E-Combined; group cognitive behavioral sessions and nicotine gum availability through 52 weeks). E-CBT produced high abstinence rates across the study period (55% abstinence at weeks 52, 64, and 104) and was more efficacious than ST (33%, 34%, and 36% abstinence at weeks 52, 64, and 104, respectively), E-NRT (41%, 46%, and 40% abstinence at weeks 52, 64, and 104, respectively) and E-Combined (48%, 51%, and 45% abstinence at weeks 52, 64, and 104, respectively).

The results of these two studies lend support to the chronic disorder model of cigarette smoking and demonstrate that long-term treatment for tobacco dependence can produce abstinence rates markedly higher than standard interventions. Long-term cognitive behavioral therapy therefore appears to be a potent intervention for cigarette smoking. However, little is known about the mechanisms that mediate treatment effects. This is significant because delineating the processes underlying therapeutic change can direct more efficacious smoking cessation interventions (Johansson and Høglend, 2007; Kazdin, 2007). Indeed, it has been offered that determining how or why an intervention works represents the most important objective for addiction treatment researchers (Witkiewitz and Marlatt, 2008).

A few studies have examined mediating mechanisms of pharmacotherapy (i.e., bupropion, nicotine replacement therapy, and bupropion combined with nicotine replacement therapy) for tobacco dependence (e.g., Ferguson et al., 2006; Lerman et al., 2002; McCarthy et al., 2008; Piper et al., 2008). The results of these investigations have been somewhat inconsistent, but indicate that pharmacotherapy may improve treatment outcome by reducing negative affect, withdrawal symptoms, and craving; and by enhancing positive affect, motivation to quit, and abstinence self-efficacy. Other studies have explored mediators of novel smoking cessation treatment modalities (i.e., internet and cell phone interventions; e.g., Brendryen and Kraft,

2008; Vidrine et al., 2006). Findings indicate that these innovative approaches may contribute to abstinence by reducing negative affect and increasing abstinence self-efficacy. Nevertheless, no prior study has examined mechanisms of change in conventional cognitive behavioral psychotherapy for tobacco dependence, extended or otherwise.

In the present investigation, we tested for evidence of change in negative affect, abstinence-specific social support, motivation to quit, and abstinence self-efficacy as mediators of Hall et al.'s (2009) extended cognitive behavioral psychotherapy for older smokers. These variables are believed to be important determinants of treatment outcome (Fiore et al., 2008), and have been shown to either predict cessation (abstinence-specific social support; e.g., Cohen and Lichtenstein, 1990; Lawhon et al., 2009) or mediate the effects of smoking cessation treatment approaches (negative affect, motivation to quit, abstinence self-efficacy). To isolate the effects of extended cognitive behavioral therapy, we compared those in the ST condition to those in the E-CBT condition. We selected these two conditions so as to avoid the potentially confounding effects of NRT, which was used in the other two conditions. Using established analyses to detect and test mediational relationships (MacKinnon et al., 2002, 2007), we tested the following tandem hypotheses: (1) Participants in the ECBT condition would demonstrate greater decreases in negative affect, greater increases in positive abstinence-specific social support and greater decreases in negative abstinence-specific social support, and greater increases in motivation to quit and abstinence self-efficacy across the treatment period; (2) Decreases in negative affect, increases in positive abstinence-specific social support and decreases in negative abstinence-specific social support, and increases in motivation to quit and abstinence self-efficacy would be associated with higher rates of abstinence while controlling for treatment condition; (3) Accounting for these changes in negative affect, abstinence-specific social support, motivation to quit, and abstinence self-efficacy would reduce or eliminate the independent effect of treatment condition on abstinence.

2. Methods

This study used participants from the ST and E-CBT conditions found in Hall et al. (2009). A more detailed description of the methods is included in this publication. We briefly summarize the methods here.

2.1. Participants

As summarized in an earlier publication (Hendricks et al., 2008), participants were recruited by advertising, public service announcements, and flyers. They were required to be at least 50 years of age, smoke least 10 cigarettes per day, and have the intention to quit smoking. Exclusion criteria were inability to speak English, use of psychiatric drugs, the presence of a condition that contraindicated use of pharmacological treatments, or the presence of conditions that might interfere with compliance with protocol or greatly complicate treatment.

Participants who met the screening criteria during a telephone interview were provided with an overview of the program and invited to the project offices to complete a pretreatment baseline assessment and screening physical. Pretreatment baseline assessments revealed that participants randomized to the ST condition ($N = 100$) were 59% male with a mean age of 56.2 years ($SD = 5.4$). Of these participants, 77% were White, Non-Hispanic/Latino. ST participants averaged 38.0 years of smoking ($SD = 6.8$); 20.2 cigarettes smoked per day ($SD = 8.0$), a Fagerström Test of Nicotine Dependence (FTND) score of 5.0 ($SD = 2.0$), and a breath carbon monoxide (CO) reading of 23.6 ppm ($SD = 11.4$). Pretreatment baseline assessments further revealed that participants randomized to the E-CBT condition ($N = 99$) were 58.6% male with a mean age of 56.9 years ($SD = 6.8$). Of these participants, 73.5% were White, Non-Hispanic/Latino. E-CBT participants averaged 38.6 years of smoking ($SD = 6.8$); 20.1 cigarettes smoked per day ($SD = 8.2$), an FTND score of 4.9 ($SD = 2.2$), and a CO reading of 19.6 ppm ($SD =$

9.5). ST and E-CBT participants did not differ significantly on any demographic or smoking history characteristic.

2.2. Treatment conditions

All participants were provided with 12 weeks of sustained release bupropion initiated during the first week of treatment, 10 weeks of nicotine gum initiated at the quit date during the third week of treatment, and five 90-min group counseling sessions based on *Clear Horizons* (Orleans et al., 1997), a manual originally designed as a self-help aid for smokers 50 years of age and older. Group counseling sessions were held at weeks one, three (two sessions), five, and eight, with an average size of approximately six participants per session. At week eight, independent of smoking status, participants were randomized to the experimental treatment conditions. Those assigned to the ST condition received no further treatment after week 12.

Participants assigned to the E-CBT condition received bupropion, nicotine gum, and group counseling during the first 12 weeks of treatment as in the ST condition. Extended treatment consisted of 11 individual treatment sessions provided after the five group sessions included in the ST protocol, from weeks 10 to 52. Individual counseling sessions were held at weeks 10, 12, 14, 16, 20, 24, 28, 32, 36, 44, and 52. Sessions lasted 20–40 min.

The E-CBT intervention was a standardized treatment designed to be self-directed with assistance from the therapist, and targeted five content areas derived from the 2000 Clinical Practice Guidelines for treating tobacco dependence (Fiore et al., 2000). Specifically, the E-CBT intervention focused on (1) enhancing motivation to quit/remain abstinent by identifying cues to elicit motivation, using a decisional balance chart to emphasize the benefits of quitting and the costs of smoking, and requesting that participants make a repeated commitment to abstinence; (2) managing mood by providing a self-administered mood management guide, instructing participants to increase pleasant activities, and providing ideas for increasing pleasant activities; (3) controlling weight by monitoring physical activity with the use of pedometer and gradually increasing activity to reach the goal of 30 min of moderate exercise most days of the week; (4) augmenting social support networks by building a larger nonsmoking network and learning how to elicit positive support and manage negative support from others; and (5) developing strategies for coping with withdrawal symptoms. Although the E-CBT condition was directed at relapse prevention, E-CBT participants received the intervention whether they were smoking or not, and those who relapsed were provided treatment to restore abstinence. Copies of the treatment manual are available upon request from Dr. Hall.

2.3. Assessments

Data were collected at baseline and weeks 12, 24, 52, 64, and 104. All participants were contacted for each assessment whether they continued in treatment or not. They were paid \$25 for completing each assessment.

2.4. Outcome measure

The primary outcome measure in this study was biochemically verified 7-day point prevalence abstinence at week 64. This was indicated by self-reported abstinence (“no smoking, not even a puff”), CO levels of less than 10 ppm, and anatabine/anabasine levels of less than 2 ng/ml. Missing participants were omitted from the analyses. We selected abstinence at week 64 as the primary outcome variable because it allowed 3 months between the measurement of the mediator variables and the outcome. Using week 104 as our primary dependent variable would have resulted in a longer (9 months) time span.

2.5. Mediator variables

2.5.1. Negative affect—Negative affect was assessed with the Profile of Mood States (POMS; McNair et al., 1992), the Medical Outcome Studies 36-item Short-Form Health Survey (SF-36; Ware and Sherbourne, 1992), and the Perceived Stress Scale (PSS; Cohen et al., 1983).

The POMS assesses affective states over the past 7 days. It provides six sub-scale scores and a Total Mood Disturbance (TMD) score. TMD scores have been shown to predict smoking relapse (e.g., Hall et al., 1994). The SF-36 is a widely-used instrument that measures eight areas of health including general mental health functioning (i.e., the Mental Component Scale; MCS). The PSS measures the degree to which situations in one's life are appraised as stressful. The PSS has been used successfully in several studies with differing patient populations (e.g., Koopman et al., 2000).

2.5.2. Abstinence-specific social support—Abstinence-specific social support was measured with the 20-item Partner Interaction Questionnaire (PIQ; Cohen and Lichtenstein, 1990). Participants indicate on a 4-point scale how frequently their spouse, partner, or close friend provided positive support (e.g., “Helped me think of substitutes for smoking”) and negative support (e.g., “Criticized my smoking”) in the past 7 days. This measure yields summary scores for positive support, negative support, and the ratio of positive to negative support.

2.5.3. Motivation to quit—Motivation to quit was measured by an item on the four-item Thoughts about Abstinence Questionnaire (Hall et al., 1990). Participants indicate on a 10-point scale their desire to quit smoking (1 = “no desire to quit,” 10 = “full desire to quit”).

2.5.4. Abstinence self-efficacy—Abstinence self-efficacy was measured by an item on the four-item Thoughts about Abstinence Questionnaire (Hall et al., 1990). Participants indicate on a 10-point scale how successful they expect to be quitting smoking (1 = “lowest expectation of success,” 10 = “highest expectation of success”).

2.6. Test for mediation

As reported by Hall et al. (2009), it was established that E-CBT produced significantly higher week 64 abstinence rates (55%) than ST (34%). We were interested in determining the degree to which change in negative affect, abstinence-specific social support, motivation to quit, and abstinence self-efficacy mediated the effects of treatment on outcome. Change in each variable was computed by subtracting scores at baseline from scores at week 52. Change scores could not be computed among participants with missing data for any potential mediator variable at either baseline or week 52, and in these cases the data were coded as missing.

We tested whether negative affect, abstinence-specific social support, motivation to quit, and abstinence self-efficacy mediated the effect of extended cognitive behavioral therapy on treatment outcome. Data were analyzed with Mplus v5.2 software (Muthén and Muthén, 1998–2007), which uses the Delta method to compute standard errors for the indirect effects. Each hypothesized mediator was evaluated independently of one another.

Each hypothesized mediator was regressed on treatment condition using linear regression. The purpose of this analysis was to determine if the two treatment conditions produced differential effects on the hypothesized mediator variables. Next, abstinence at week 64 was regressed on treatment condition and each of the hypothesized mediators that was significantly related to treatment condition using logistic regression. The aim of this analysis was to determine whether the hypothesized mediator variables predicted outcome independent of treatment condition,

and to determine whether the hypothesized mediator variables reduced or eliminated the independent effect of treatment condition on outcome. Mediation was tested using the INDIRECT command in Mplus.

Although separate from the mediation analysis, abstinence at week 64 was regressed on each hypothesized mediator variable without controlling for treatment condition using logistic regression. The purpose of this predictor analysis was to identify cessation process variables that may provide direction with regard to the enhancement of future tobacco dependence interventions.

3. Results

3.1. Primary analyses

The means of the hypothesized mediator variables measured at baseline for the two treatment conditions are presented in Table 1. Baseline negative affect, abstinence-specific social support, motivation to quit, and abstinence self-efficacy did not differ significantly between the two groups. Attrition rates did not differ significantly between the two groups and were low through week 64 (week 64 attrition rate = 10.2%).

Results of the regressions of each hypothesized mediator variable on treatment condition are presented in Table 2. These results indicate that participants in the E-CBT condition experienced significantly greater increases in abstinence self-efficacy than participants in the ST condition. There was a near-significant trend for participants in the E-CBT condition to experience greater increases in the ratio of positive to negative abstinence-specific social support than participants in the ST condition. Change in negative affect variables and motivation to quit did not differ significantly between the two groups.

Table 3 shows the results of the regressions of abstinence at week 64 on treatment condition, treatment condition and change in abstinence self-efficacy, and treatment condition and change in the ratio of positive to negative abstinence-specific social support. These results indicate that change in abstinence self-efficacy was significantly related to treatment outcome when controlling for treatment condition. Treatment condition was no longer significantly related to outcome when controlling for change in abstinence self-efficacy. The test of mediation for change in abstinence self-efficacy indicated a significant effect ($b = .42$, $SE = .14$, $p = .003$). For binary outcomes, there is no well-established measure of the proportion of mediated effect, especially for sample sizes of less than 500 (MacKinnon et al., 2007). Nevertheless, based on the methods found in MacKinnon et al. (2007), we obtained estimates of the proportion of mediated effect ranging from .61 to .83. This suggests that abstinence self-efficacy accounted for 61% to 83% of the total effect of treatment condition on abstinence at week 64.

Change in the ratio of positive to negative abstinence-specific social support was significantly related to outcome when controlling for treatment condition. Treatment condition remained significantly related to treatment outcome when controlling for change in the ratio of positive to negative abstinence-specific social support. The test of mediation for change in the ratio of positive to negative abstinence-specific social support indicated a nonsignificant effect ($b = .14$, $SE = .12$, $p = .22$).

Change in abstinence self-efficacy was therefore the only significant mediator of the effect of extended cognitive behavioral treatment on outcome. Abstinence self-efficacy was measured before abstinence at week 64. However, it is possible that increased self-efficacy was a consequence of participants' achieving abstinence before week 64. That is, they could have felt more efficacious because they stopped smoking at some point before week 64. To explore for this possibility, abstinence at week 64 was regressed on treatment condition and change in

abstinence self-efficacy while controlling for smoking status at weeks 12 and 24 using logistic regression. Change in abstinence self-efficacy remained a significant predictor of abstinence at week 64 while controlling for abstinence at weeks 12 and 24 ($b = .55$, $SE = .15$, $p = .0004$). These results lend support to the notion that abstinence self-efficacy mediated treatment outcome and was not merely a consequence of earlier abstinence.

Results of the regressions of abstinence at week 64 on each hypothesized mediator variable (i.e., the predictor analysis) are presented in Table 4. These results indicate that decreases in negative affect, decreases in negative abstinence-specific social support and increases in the ratio of positive to negative abstinence-specific social support, increases in motivation to quit, and increases in abstinence self-efficacy were associated with an increased probability of abstinence at week 64.

For all of the primary analyses, the data also were analyzed while coding participants with missing outcome data at week 64 as smoking, and while controlling for a number of baseline demographic and smoking history characteristics (e.g., age, gender, cigarettes smoked per day, tobacco dependence). Results were not significantly altered by these analyses.

3.2. Exploratory analyses

We also explored whether baseline demographic variables (e.g., gender, age, ethnoracial status), smoking history characteristics (e.g., FTND, cigarettes smoked per day), and psychological variables (e.g., negative affect, abstinence self-efficacy) moderated the effect of treatment on abstinence at week 64. The main purpose of these analyses was to determine for whom E-CBT may be especially efficacious. To test for moderation, we examined if interaction terms between treatment condition and potential moderators were associated with abstinence at week 64. We found no significant results.

4. Discussion

The main objective of the current study was to identify mediators of extended cognitive behavioral treatment for tobacco dependence. To our knowledge, no previous studies have investigated mechanisms of change for such interventions. Analyses revealed that extended cognitive behavioral therapy increased participants' abstinence self-efficacy across the treatment period, and that this effect was positively associated with posttreatment abstinence. Change in abstinence self-efficacy across treatment was a robust mediator of treatment effects, accounting for 61% to 83% of the total effect of treatment on abstinence.

These findings are consistent with theoretical models of drug relapse (Marlatt and Gordon, 1985; Niaura, 2000) that feature abstinence self-efficacy as a key determinant of drug use. For instance, Niaura (2000) proposed that abstinence self-efficacy represents the final pathway through which drug use is actuated. Although abstinence self-efficacy is less prominent in more contemporary models of relapse (Witkiewitz and Marlatt, 2004), it is nevertheless considered an important facet of the relapse process.

The results of the current investigation are also consistent with a substantial body of research linking abstinence self-efficacy to outcomes for a number of addictive substances (e.g., Project MATCH Research Group, 1997; Sklar et al., 1999) including tobacco (e.g., Gwaltney et al., 2001, 2005a; Shiffman et al., 2000). Furthermore, this study joins a base of evidence indicating that abstinence self-efficacy is a mediator of pharmacological (McCarthy et al., 2008) and non-conventional smoking cessation interventions (Brendryen and Kraft, 2008; Vidrine et al., 2006), as well as cognitive behavioral treatments for smokeless tobacco (Danaher et al., 2008) and cannabis use (Litt et al., 2008). Interventions for addiction may produce abstinence in part by increasing individuals' confidence in their ability to quit.

Analyses further revealed that while extended cognitive behavioral intervention increased the ratio of positive to negative abstinence-specific social support during treatment and this effect was associated with a higher likelihood of abstinence, change in abstinence-specific social support was nevertheless not a significant mediator of treatment outcome. This result may have stemmed from the relatively weak association between treatment condition and change in abstinence-specific social support, as the relationship between this variable and abstinence was strong. Although this finding supports the notion that abstinence-specific social support is an important determinant of smoking cessation outcome (e.g., Cohen and Lichtenstein, 1990; Lawhon et al., 2009), it is consistent with a review (Park et al., 2004) indicating that treatment-facilitated social support does not aid smoking cessation. This finding also is consistent with the recommendations of the 2008 Clinical Practice Guidelines (Fiore et al., 2008).

Finally, the present investigation indicated that whereas extended cognitive behavioral therapy had no effect on negative affect or motivation to quit during the treatment period, decreases in negative affect and increases in motivation to quit were associated with higher rates of abstinence. These findings are consistent with negative reinforcement models of addiction that posit that drug use is motivated by the regulation of negative affect (see Piper et al., 2008) and the finding that motivation to quit predicts smoking cessation (Abrams et al., 2000). Nevertheless, these results suggest that extended cognitive behavioral interventions may not be augmenting individuals' mood management skills or motivation to quit as intended.

4.1. Implications

The current research has implications for clinical practice. Most important, maximizing abstinence self-efficacy may represent the principal route for enhancing the efficacy of addiction treatments. According to theory, "mastery experiences" (e.g., successfully resisting an urge to smoke) are predominant in forming the basis of self-efficacy (Bandura, 1977, 1997). In the current study, E-CBT may have enhanced self-efficacy by providing participants with simple, concrete skills to use during smoking cessation. However, this explanation is not consonant with the finding that treatment condition had little or no effect on negative affect, abstinence-specific social support, or motivation to quit. Of course, this lack of differences may reflect weak measurement instruments or poor timing of assessments. Still, it may be that the provision of an alternative response in problem situations is sufficient to give participants a sense of control, even if it does not produce measurable outcomes. Tobacco dependence and other addiction interventions may therefore be enhanced by providing individuals with uncomplicated skills in which they can engage during a quit attempt. However, future investigations are needed to elucidate those factors that occasion change in abstinence self-efficacy.

Although treatment appeared to have little or no effect on affect, abstinence-specific social support, or motivation to quit, change in these variables nevertheless predicted treatment outcome. These variables remain important to the treatment of tobacco dependence, and extended cognitive behavioral treatments may require modification to ensure that these areas are indeed being targeted and bolstered.

4.2. Limitations and future directions

The results of this study may not generalize to the younger population of cigarette users. Furthermore, because participants were treatment-seeking, had high levels of baseline motivation to quit and abstinence self-efficacy, and were subjected to a somewhat demanding research protocol, the generalizability of this investigation is further limited. Future studies should seek to replicate our findings among more heterogeneous samples of smokers in real-world settings.

The present study did not include an exhaustive assessment of potential mediator variables. For instance, withdrawal symptoms, craving, positive affect, and in-treatment social support were not measured. Future investigations should incorporate measures of these and other potential mediators to elucidate mechanisms of change.

This study was only able to examine change in the hypothesized mediators between two time points. Understanding the time course of changes in mediators by assessing multiple time points is an important area for future research. For instance, abstinence self-efficacy can vary on a daily basis, and daily variation in abstinence self-efficacy is a significant predictor of relapse (see Gwaltney et al., 2005b). It is possible that smoking cessation treatments are mediated by daily or weekly feelings of abstinence self-efficacy. Future investigations making use of real-time techniques such as Ecological Momentary Assessment (Shiffman et al., 2008) can evaluate for these and other time-related trends.

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Table 1Means (*SDs*) of hypothesized mediator variables at baseline by treatment condition.

Hypothesized mediator variables	Treatment group		
	ST	E-CBT	<i>p</i> -Value
Negative affect			
POMS Total Mood Disturbance score	10.3 (25.3)	13.8 (28.2)	.37
SF-36 Mental Component Scale	50.5 (8.3)	51.4 (8.3)	.49
Perceived Stress Scale	18.9 (7.3)	18.8 (7.7)	.91
Abstinence-specific social support			
Positive support	15.7 (6.9)	15.5 (7.3)	.85
Negative support	15.3 (6.9)	15.5 (8.2)	.79
Positive/negative support	1.3 (1.2)	1.1 (.4)	.23
Motivation to quit	8.3 (1.6)	8.1 (1.6)	.46
Abstinence self-efficacy	7.7 (1.9)	7.7 (2.0)	.87

Note: ST = Standard Treatment; E-CBT = extended cognitive behavioral treatment; POMS = Profile of Mood States; SF-36 = Medical Outcomes Scale, Short-Form; positive/negative support = the ratio of positive to negative abstinence-specific social support.

Table 2

Results of the regressions of each hypothesized mediator variable on treatment condition.

Hypothesized mediator	<i>b</i>	<i>SE</i>	<i>p</i> -Value
Change in negative affect			
POMS Total Mood Disturbance score	-4.2	5.9	.47
SF-36 Mental Component Scale	1.4	2.06	.49
Perceived Stress Scale	.09	1.33	.94
Change in abstinence-specific social support			
Positive support	2.3	1.76	.19
Negative support	-.08	1.48	.95
Positive/negative support	.38	.20	.06
Change in motivation to quit	.48	.41	.25
Change in abstinence self-efficacy	1.64	.53	.002

Note: POMS = Profile of Mood States; SF-36 = Medical Outcomes Scale, Short-Form; positive/negative support = the ratio of positive to negative abstinence-specific social support; *b* = regression coefficient; *SE* = standard error. Regression coefficients with *p*-values of less than .05 are presented in bold.

Results of the regressions of abstinence at week 64 on treatment condition, treatment condition and change in abstinence self-efficacy, and treatment condition and change in the ratio of positive to negative abstinence-specific social support.

Table 3

Variable	<i>b</i>	<i>SE</i>	<i>p</i> -Value	OR	95% CI
Treatment condition alone	.90	.31	.003	2.47	1.34–4.54
Change in abstinence self-efficacy controlling for treatment condition	.63	.12	<.0001	1.89	1.48–2.41
Treatment condition controlling for change in abstinence self-efficacy	.49	.46	.29	1.63	.65–4.1
Change in positive/negative support controlling for treatment condition	.77	.33	.019	2.15	1.13–4.09
Treatment condition controlling for change in positive/negative support	.87	.42	.038	2.38	1.05–5.41

Note: Positive/negative support = the ratio of positive to negative abstinence-specific social support; *b* = regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval. Regression coefficients with *p*-values of less than .05 are presented in bold.

Table 4

Results of the regressions of abstinence at week 64 on each hypothesized mediator.

Hypothesized mediator	<i>b</i>	<i>SE</i>	<i>p</i> -value	OR	95% CI
Change in negative affect					
POMS Total Mood Disturbance score	-.02	.008	.016	.98	.96-.99
SF-36 Mental Component Scale	.04	.018	.026	1.04	1.00-1.08
Perceived Stress Scale	-.09	.028	.001	.91	.86-.96
Change in abstinence-specific social support					
Positive support	.01	.02	.42	1.01	.97-1.06
Negative support	-.07	.03	.016	.93	.88-.98
Positive/negative support	.82	.32	.01	2.3	1.2-4.3
Change in motivation to quit	.55	.13	<.0001	1.7	1.3-2.2
Change in abstinence self-efficacy	.66	.12	<.0001	1.94	1.52-2.47

Note: POMS = Profile of Mood States; SF-36 = Medical Outcomes Scale, Short-Form; positive/negative support = the ratio of positive to negative abstinence-specific social support; *b* = regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval. Regression coefficients with *p*-values of less than .05 are presented in bold.