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A Mechanistic Test of Nicotine Replacement Therapy Sampling for Smoking Cessation Induction

Jessica L. Burris^{1,*}, Bryan W. Heckman^{2,3}, Amanda R. Mathew⁴, and Matthew J. Carpenter^{2,3}

¹University of Kentucky Department of Psychology

²Medical University of South Carolina Department of Psychiatry and Behavioral Sciences

³Medical University of South Carolina Hollings Cancer Center

⁴Medical University of South Carolina Department of Neurosciences

Abstract

Studies that explore the mechanisms of treatment effect are needed in the area of smoking cessation induction, the primary goal of which is to promote the occurrence of a quit attempt among individuals who report little interest in smoking cessation. This study tested the mediational effect of five psychological variables (motivation to quit, abstinence self-efficacy, knowledge of nicotine replacement therapy (NRT), and both positive and negative attitudes toward NRT) on the relationship between NRT sampling and smoking outcomes. Adults who reported low levels of intention to quit in the next month (n=593) were recruited for a nationwide randomized clinical trial of NRT sampling. Participants provided self-report data via telephone interview on multiple occasions, with the final follow-up at six months. Motivation to quit, and to a lesser degree, abstinence self-efficacy at the end of the six-week intervention best accounted for the effect of NRT sampling as a promoter of quit attempts, smoking reduction, and 7-day point prevalence abstinence. Providing smokers with free NRT samples, in addition to encouraging them to engage in temporary abstinence, results in meaningful change in motivation and self-efficacy, which in turn influence smoking outcomes. Cessation induction interventions should aim to increase motivation to quit and abstinence self-efficacy, above and beyond any efforts to increase knowledge or prompt attitudinal shifts.

Keywords

cessation induction; mediation; nicotine replacement therapy; smoking; smoking cessation

The prevalence of cigarette smoking among adults in the United States (U.S.) has not dropped at a rate sufficient to meet the benchmarks set for *Healthy People 2020* (<http://>

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Correspondence concerning this article should be address to: Matthew J. Carpenter, Medical University of South Carolina, Hollings Cancer Center – Cancer Control Program, 86 Jonathan Lucas St., MSC 955, Charleston, South Carolina 29425, USA; 843-876-2436 (Phone); 859-876-2344 (Fax); carpente@musc.edu.

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healthypeople.gov/2020/topicsobjectives2020). Recent estimates suggest 18.1% of U.S. adults report current smoking (Centers for Disease Control and Prevention, 2014). The slow decline in the prevalence of smoking in recent years is attributable to at least two factors: 1) only 40–50% of smokers make a quit attempt in any given year (Borland, Partos, Yong, Cummings, & Hyland, 2012; Centers for Disease Control and Prevention, 2011) and 2) very few quit attempts result in long-term abstinence (Hughes, Keely, & Naud, 2004; Zhu, Melcer, Sun, Rosbrook, & Pierce, 2000). Given this, interventions that promote the occurrence of a quit attempt (i.e., cessation induction) are just as important as interventions that promote abstinence once a quit attempt is made (i.e., cessation efficacy), and may have a larger impact on smoking prevalence at the population level. Despite this, few smoking cessation treatments focus exclusively on cessation induction as the primary goal (Aveyard et al., 2009; Carpenter, Hughes, Solomon, & Callas, 2004; Jardin et al., 2014).

NRT Sampling for Cessation Induction

Although nicotine replacement therapy (NRT) is a proven, user-friendly, and over-the-counter smoking cessation treatment (Fiore et al., 2008; Stead et al., 2008), smokers underutilize it (Shiffman, Brockwell, Pillitteri, & Gitchell, 2008; Zhu et al., 2000). Plausible reasons for this include, but are not limited to, the following: 1) concerns of safety, 2) lack of knowledge, 3) doubt of efficacy, and 4) persistent belief in the merit of unassisted versus assisted smoking cessation (Balmford & Borland, 2008; Ferguson et al., 2011; Mooney, Leventhal, & Hatsukami, 2006; Shiffman, Ferguson, Rohay, & Gitchell, 2008; Vogt, Hall, & Marteau, 2008). Furthermore, failed quit attempts that involve NRT could undermine subsequent NRT use, creating a future cycle of haphazard, unassisted quit attempts (Borland et al., 2012; Partos, Borland, Yong, Hyland, & Cummings, 2013). To increase the likelihood of future quit attempts and combat misconceptions about NRT, it might be advantageous to encourage brief trials of NRT (i.e., NRT sampling). Within this framework, Carpenter and colleagues recently conducted a randomized clinical trial (RCT) of NRT sampling for cessation induction among smokers with little or no intention to quit in the near future (Carpenter et al., 2011). In combination with practice quit attempts, NRT sampling increased the likelihood of both quit attempts and “floating abstinence” (i.e., any period of prolonged abstinence that occurs within a specific time-frame; see Aveyard et al., 2009 for further discussion). A separate, smaller RCT compared outcomes among and between smokers with and without immediate plans to quit (Jardin et al., 2014), and found smokers who received NRT sampling were more likely to report 1) at least a 50% reduction in cigarettes per day and 2) the occurrence of a quit attempt than smokers who did not receive this intervention. A key finding therein was that NRT sampling’s treatment effect existed for smokers both motivated and unmotivated to quit. Thus, NRT sampling has promise as an effective method of cessation induction.

While the results of Carpenter et al.’s (2011) RCT provide evidence in support of NRT sampling, the mechanisms by which treatment effects occurred are not yet clearly understood. Formal exploration of the mechanisms by which NRT sampling yields change in smoking behavior could lead to treatment advances insofar as it is possible to focus future cessation induction strategies on the select group of constructs most strongly linked to quit attempt and/or abstinence outcomes. The current study consists of a secondary analysis of

data from the aforementioned RCT of NRT sampling, testing five putative mediators of treatment effects. The variables we examine as mediators focus exclusively on psychological variables that might underlie changes in smoking behavior, as the physiological and biological mechanisms of NRT itself are well established (George & O'Malley, 2004; Molyneux, 2004).

Method

Overview of the Parent Study

The parent study was a nationwide RCT wherein U.S. smokers unmotivated to quit were randomized to either NRT sampling + practice quit attempts or practice quit attempts only. Details about the design (Carpenter, Alberg, Gray, & Saladin, 2010) and outcome (Carpenter et al., 2011) of the parent study are available elsewhere. In brief, participants were proactively recruited and screened for eligibility through online channels, with assistance from a market research firm. Eligibility criteria included: 1) age of 18 years or greater, 2) current smoker of at least 10 cigarettes per day, 3) no more than monthly use of non-cigarette tobacco products, 4) no quit attempt lasting longer than one week in the past year, 5) no previous NRT use, 6) no FDA-suggested precautions for nicotine lozenge use, and 7) reliable telephone access. In addition, participants had to self-select participation in a study for smokers who want to quit at some point in the future, just not in the next 30 days (Burris, Wahlquist, & Carpenter, 2013). Upon receipt of written informed consent, participants were randomized to one of 2 treatment groups (see description below). All study variables were measured by self-report. The parent study included a total of 849 participants, with no baseline differences in the demographics or smoking history between treatment groups. Participants completed a maximum of six assessments (all by phone) during the study, with final follow-up at six months post-treatment. Retention was very high for both treatment groups, with 90.0% of assessments finished. The Institutional Review Board at the Medical University of South Carolina approved the parent study.

Treatment Groups

Practice quit attempts—Participants in this group received a series of three calls, spaced equally over a six-week period. In the first call, participants were encouraged to think of a practice quit attempt as a rehearsal exercise, wherein they could familiarize themselves with the process of smoking cessation, without undue pressure to quit permanently. Strategies to achieve temporary abstinence, for however long (i.e., range of a few minutes vs. days), were discussed. Each participant was prompted, but not required, to make a practice quit attempt prior to the next call. In the second call, participants' practice quit attempts (if any) were reviewed, with a focus on lessons learned. Participants were encouraged to make another practice quit attempt prior to the next call. At the third and final treatment call, participants' general experience with practice quit attempts was discussed and any period of temporary abstinence was reinforced. Participants were then prompted to make an attempt to quit for good, consistent with the 5 A's (Fiore et al., 2008). Written materials on the rationale for practice quit attempts, smoking cessation strategies, cravings, withdrawal, etc. were mailed to each participant as a complement to the phone-based intervention.

NRT sampling + practice quit attempts—Participants in this group received the same series of calls as described above, but with complementary discussion of NRT, the goals of which were to 1) address misconceptions about NRT's safety, efficacy, and tolerability and 2) increase familiarity with smoking cessation aids in general. Participants received (via mail) a box of 2- or 4-mg Nicorette lozenges (72 count; GlaxoSmithKline, Brentford, Middlesex, England), with the dose dependent upon their time to first cigarette. Akin to practice quit attempts, participants were encouraged, but not required, to use NRT. In the second call, participants' practice quit attempt(s) and/or NRT use was discussed, after which another box of nicotine lozenges was mailed. The third and final call matched that in the practice quit attempts group. Written materials similar to those described above were mailed to these participants, with additional information on the use of nicotine lozenges for smoking cessation.

Measures

At baseline (i.e., before the first treatment call) and the end of treatment, participants answered questions to assess psychological variables that might explain smoking outcomes in the context of NRT sampling. Potential mediators included: 1) motivation to quit smoking in the next month, measured on a scale from 0 = *very definitely no* to 10 = *very definitely yes* (Biener & Abrams, 1991; Prochaska, Velicer, DiClemente, & Fava, 1988); 2) abstinence self-efficacy (i.e., confidence in one's ability to quit or remain quit), measured on a scale from 0 = *not at all confident* to 10 = *extremely confident* (Sanderson et al., 2009; Woods et al., 2002); 3) knowledge of NRT, measured as the sum of 10 items (e.g., "These products help people to cope with the craving for cigarettes"), each scored as either 0 = incorrect or 1 = correct (Etter & Perneger, 2001); and 4) attitudes toward NRT (e.g., "These products help people to quit smoking" and "I am wary of these products"), measured on a scale from 1 = *strongly disagree* to 4 = *strongly agree*, with separate scores for positive and negative attitudes computed as the average of 8 and 4 items, respectively (Etter & Perneger, 2001).

Smoking outcomes included several indicators of behavior change. In order to establish the temporal precedence required for mediation, all smoking outcomes occurred at or after the end of treatment. Outcomes include: 1) any attempt to quit smoking for good, regardless of the length of abstinence, 2) any quit attempt where abstinence lasted at least 24 hours, 3) percent reduction in the average number of cigarettes smoked per day from the week prior to the end of treatment to the week prior to the 6-month follow-up, and 4) 7-day point prevalence abstinence at the 6-month follow-up.

Sample Selection and Characteristics

Complete data necessary to conduct multiple mediation analyses were provided by 593 of the 849 participants that took part in the parent study (69.8% of the full sample); there were no significant differences on any study variable between the full and reduced sample (all p 's > .10). Treatment groups had similar baseline characteristics (see Table 1), although the practice quit attempts group reported a higher level of education ($p = .02$). When education was entered as a covariate in the mediation analyses, it did not influence the results; therefore, the unadjusted analyses are reported below.

Statistical Analyses

In all analyses, we coded the variables as follows: 1) treatment group: 0 = practice quit attempts and 1 = NRT sampling + practice quit attempts; 2) potential mediators: higher scores indicate a more favorable condition, with the exception of negative attitudes toward NRT; and 3) smoking outcomes: 0 = no quit attempt/smoking and 1 = quit attempt/abstinence, with percent reduction in cigarettes per day treated as a continuous variable where higher scores are indicative of greater reduction.

Preliminary analyses involved the use of 1) descriptive analyses (e.g., mean (*M*), standard deviation (*SD*)) to describe the sample and key study variables, 2) Independent samples *t*-tests, chi-square tests, and logistic regressions to compare the two treatment groups, and 3) correlational analyses to assess the relationships among the potential mediators. Results of these analyses are shown in Tables 1, 2, and 3, with the main findings summarized in the text.

The primary analyses tested the mechanism(s) by which NRT sampling may influence smoking outcomes. In line with contemporary thinking on mediation (Hayes, 2009, 2013; LeBreton, Wu, & Bing, 2009; MacKinnon, 2008; Rucker, Preacher, Tormala, & Petty, 2011; Shrout & Bolger, 2002; Zhao, Lynch, & Chen, 2010), indirect effects were explored herein regardless of the presence or absence of a significant treatment effect. Mediation analyses were conducted with SPSS 21 using the PROCESS bootstrapping technique, with replacement set at 10,000 (Hayes, 2013). An iterative process of testing the mediation models was conducted for each of the four dependent variables, and in all cases, a variable was determined to be a statistically significant mediator if its 95% bias-corrected confidence interval did not include zero. First, putative mediators were tested individually in simple mediation models with use of participants' absolute score at the end of the treatment. Then, all significant mediators identified via the simple mediation analyses were included in a parallel multiple mediator model. Multiple mediator models provide tests of each independent indirect effect, in addition to their cumulative or total indirect effect. These models also allow one to directly compare the magnitude of indirect effects relative to one another via inferential statistics. In other words, multiple mediation models allow one to 1) test whether an observed simple indirect effect is retained when examined in the context of other significant indirect effects and 2) compare the relative influence of significant indirect effects. In all cases, indirect effects can range from -1 to 1, with larger absolute values indicating greater magnitude. Results of the primary analyses are summarized in the text, with details shown in Table 4.

Results

Putative Mediators and Smoking Outcomes

The two groups did not differ on any of the potential mediator variables at baseline, but at the end of treatment, the NRT sampling + practice quit attempts group reported more favorable results on all variables when compared to the practice quit attempts group (all *p*'s < .01). For the four smoking outcomes, there was only 1 occasion where a statistically significant treatment group difference existed. Specifically, the NRT sampling + practice

quit attempts group reported a greater reduction in cigarettes per day at the 6-month follow-up than the practice quit attempts group (in percent: $M, SD = 41.3 (40.6)$ vs. $32.3 (42.1)$, $p = .01$). Results for the other smoking outcomes are as follows: 1) any quit attempts during follow-up: treatment = 47.1% vs. control = 41.0%, $p = .14$; 2) 24-hour quit attempts during follow-up: treatment = 42.8% vs. control = 36.1%, $p = .10$; and 3) 7-day point prevalence abstinence at the 6-month follow-up: treatment = 19.0% vs. control = 14.3%, $p = .13$. Despite minor differences in the smoking outcomes of interest, the pattern of results found for this subsample of 593 participants are consistent with those found for the parent sample of 849 participants (Carpenter et al., 2011).

Simple Mediation

Point estimates and 95% CIs for the putative mediators are presented in Table 4. A robust pattern was observed for both motivation to quit and abstinence self-efficacy, as they had statistically significant indirect effects on all smoking outcomes. That is, NRT sampling increased the likelihood of quit attempts (any and 24-hour), decreased the number of cigarettes smoked, and increased the likelihood of abstinence through its positive influence on motivation and self-efficacy. In addition, positive attitudes towards NRT had a statistically significant indirect effect on any quit attempt and reduction in cigarettes per day. There were no indirect effects for knowledge of, or negative attitudes towards, NRT.

Multiple Mediation

Any quit attempt during follow-up—Although motivation to quit, abstinence self-efficacy, and positive attitudes toward NRT mediated the influence of NRT sampling on any quit attempt in the univariate analyses (i.e., simple effects), only motivation and self-efficacy remained statistically significant when entered into a multiple mediation model. Furthermore, the effect of motivation was significantly larger than that of self-efficacy (point estimate = $-.21$; 95% CI = $-.38 - -.08$).

Any 24-hour quit attempt during follow-up—Motivation to quit and abstinence self-efficacy were significant mediators in the univariate analyses for 24-hour quit attempts and both remained significant in the multivariate analyses. Again, motivation was found to have a significantly larger effect relative to self-efficacy (point estimate = $-.18$; 95% CI = $-.35 - -.06$).

Reduction in cigarettes per day at the 6-month follow-up—When entered in a multiple mediation model, motivation to quit, abstinence self-efficacy, and positive attitudes toward NRT all remained significant mediators for reduction in cigarettes per day. The indirect effect of motivation was significantly larger than self-efficacy (point estimate = $-.02$; 95% CI = $-.05 - -.002$), but not positive attitudes (point estimate = $.02$; 95% CI = $-.01 - .05$).

7-day point prevalence abstinence at the 6-month follow-up—Both motivation to quit and abstinence self-efficacy functioned as statistically significant mediators when tested in a multiple mediation model. Consistent with all other behavioral outcomes, the indirect

effect of motivation was significantly larger than that of self-efficacy (point estimate = $-.16$; 95% CI = $-.35 - -.01$).

Discussion

As researchers and clinicians strive to refine cessation induction treatments, and ultimately achieve cessation efficacy for smokers who make a quit attempt, it is imperative that the mechanisms of treatment effect are identified. To our knowledge, this is the first study to examine the mechanisms that underlie behavioral interventions for cessation induction. In a large sample of adult smokers with little intention to quit in the near future, this study tested five potential mediators of the overall treatment effect of NRT sampling on quit attempts, reduction in cigarettes per day, and point prevalence abstinence. A key finding herein is that the total indirect effect of motivation to quit, abstinence self-efficacy, and positive attitudes toward NRT accounted for the non-significant direct effect of the intervention on smoking outcomes.

NRT sampling holds promise as a means of cessation induction, and there is now evidence that its treatment effect is primarily attributable to an increase in motivation to quit. Indeed, we found the mediational effect of motivation to quit was significantly larger than that for abstinence self-efficacy and positive attitudes toward NRT in 4/5 cases. The exact mechanism by which NRT sampling enhances motivation to quit is unknown, but there are likely many factors at play. Concurrent with change in perceived difficulty of quitting, for example, it is possible short-term use of NRT is associated with a level of cognitive dissonance (Festinger, 1957) (e.g., “I am a smoker who is *not* interested in quitting, *yet* I am willing to try a smoking cessation treatment.”) that spurs a change in smokers’ readiness to quit. Consequently, provision of treatment exclusively to smokers with clear intention to quit might be ill advised. Rather, it may be advantageous to offer NRT and/or other evidence-based treatment to all smokers—*independent of their ratings of motivation to quit* (Jardin et al., 2014). If provision of free NRT samples increases motivation to quit, which in turn increases the likelihood of quit attempts, smoking reduction, and/or abstinence, then it represents a favorable means of tobacco control for the large group of smokers unmotivated to quit.

Despite its clear influence on behavior change, motivation to quit did not act in isolation. Abstinence self-efficacy was another consistent mediator of the positive effect of NRT sampling on the smoking outcomes explored herein. NRT sampling may attenuate withdrawal and craving, which then lead to increased confidence in ability to resist temptation to smoke, which in turn, leads to a greater likelihood of quit attempts and/or smoking reduction. In support of this chain of events, there is evidence that 1) NRT use blunts withdrawal and craving (Bolt, Piper, Theobald, & Baker, 2012; Ferguson, Shiffman, & Gwaltney, 2006; Shiffman, Ferguson, Gwaltney, Balabanis, & Shadel, 2006) and 2) abstinence self-efficacy mediates the inverse relationship between craving and abstinence (Berndt et al., 2013). It is equally plausible that NRT sampling leads to smoking reduction (a treatment effect we document here), and the realization of this small achievement makes smokers to feel more confident about their ability to achieve eventual abstinence, which in turn motivates them to make additional behavior change. However, a meta-analysis of “NRT

preloading” (i.e., NRT use in the weeks before and after a quit attempt) found inconclusive evidence that the effect of NRT preloading on smoking reduction results in a subsequent increase in abstinence self-efficacy (Lindson & Aveyard, 2011). Nonetheless, the current study is among several others to find abstinence self-efficacy as a mediator of NRT’s treatment effect (Hughes, Solomon, Livingston, Callas, & Peters, 2010; Stanton, Lloyd-Richardson, Papandonatos, de Dios, & Niaura, 2009), and these results point to its potential to foster behavior change, even among those smokers who initially have little intention to quit.

Neither knowledge of, nor attitudes toward, NRT evidenced a robust mediational influence in the context of NRT sampling. In a prior smoking cessation study with college students, smoking-specific knowledge failed to function as a mediator, despite a significant treatment effect on knowledge (Simmons & Brandon, 2007). While knowledge and attitudes may or may not account for a direct change in smoking behavior, they should not be ignored in future studies. Some smokers harbor incorrect information about NRT (Mooney et al., 2006; Schneider et al., 2008; Vogt et al., 2008) and their misconceptions likely contribute to low utilization (Shiffman, Brockwell, et al., 2008; Zhu et al., 2000). Thus, education about NRT has merit in future RCTs, as it may increase uptake of, and compliance with, NRT and other evidence-based treatments. An experimental study found provision of NRT-specific education yielded improvements in smokers’ knowledge of, and attitudes toward, NRT and the addition of a 1-time, 4-minute NRT sampling period enabled smokers to make even more informed decisions about product selection (Schneider et al., 2008). Our finding that brief experience with NRT engenders positive change in smokers’ knowledge and attitudes has precedent (Schneider et al., 2006, 2008), and highlights the potential for NRT sampling to increase the likelihood of future NRT use and eventual smoking cessation.

In general, the findings we report are consistent with some prominent health behavior change theories (e.g., Theory of Planned Behavior; (Ajzen, 1991)), in which improvements in an individual’s motivation and self-efficacy are hypothesized to exert a powerful influence on future behavior change (Brewer & Rimer, 2008; Mantano & Kasprzyk, 2008). Thus, the conceptual underpinning of this study, in combination with its focus on cessation induction, large sample of unmotivated smokers, diverse array of mediators, and use of appropriate smoking outcomes, is a strength. An additional strength is the use of modern mediation models that can detect indirect effects, even in the absence of direct effects (Hayes, 2013). This is an important methodological feature, given that only one of our 4 dependent variables showed an intervention effect directly. It is common practice to forego tests of mediation in such instances when tested via a causal steps approach (Baron & Kenny, 1986), however, many now argue that a direct effect is not a necessary precursor to test, or detect, mediation (Hayes, 2009, 2013; LeBreton et al., 2009; MacKinnon, 2008; Rucker et al., 2011; Shrout & Bolger, 2002; Zhao et al., 2010). There are at least two instances where the direction and/or magnitude of indirect effects may account for the absence of a direct effect; a situation that becomes clear when one looks at the sum of the indirect effects. For example, if one indirect effect is negative (i.e., reduces the outcome) and another is positive (i.e., increases the outcome), then the sum of these effects may equate to zero direct effect. Alternatively, if indirect effects account for a large proportion of the variance for the effect of treatment on outcome, the direct effect may be negligible.

Additional advantages to the mediation analyses used here are the ability to directly estimate the magnitude of indirect effects, compare indirect effects using inferential statistics, and increase power to detect such effects (Hayes, 2013).

In addition to its strengths, this study has its limitations. First, the smokers under investigation are those who initially reported little motivation to change their smoking behavior. While these individuals represent the bulk of smokers in the general population (Wewers, Stillman, Hartman, & Shopland, 2003), the results we report may not generalize to smokers who report immediate readiness to quit and seek out treatment. Second, it is possible smokers who elect participation in cessation induction trials such as this one are somehow different from “unmotivated smokers” in the general population. If this is the case, then the generalizability of these study findings is further limited. Third, our use of a smaller sample and slightly different smoking outcomes than in the parent study (Carpenter et al., 2011) likely hampered our ability to demonstrate a significant treatment effect. Fourth, it is possible the naturalistic process of psychological/behavioral change was partly altered as a consequence of repeat assessment, as may be the case with self-monitoring. This possibility might explain, in part, why a fair number of smokers who initially reported little to no interest in smoking cessation later reported that they were abstinent. Finally, as we were limited by the data available from the parent study, we did not test all possible mediators of NRT sampling (e.g., withdrawal symptoms, craving intensity, perceived reward from smoking), which leaves open the possibility that its effects are mediated by variables other than motivation to quit, abstinence self-efficacy, and positive attitudes toward NRT.

In conclusion, this study highlights the central roles of motivation to quit and to a lesser degree abstinence self-efficacy as mediators of the potential effect of NRT sampling on smoking outcomes among smokers with little initial motivation to quit. Despite strong correlational evidence of a positive relationship between the likelihood of a quit attempt and both motivation to quit and abstinence self-efficacy (for examples, see (Berndt et al., 2013; Borland et al., 2010; Cinciripini et al., 2003; Hyland et al., 2006; Zhou et al., 2009)), to date, very few studies test the ability of these variables to mediate the effect of NRT (Etter, Huguelet, Perneger, & Cornuz, 2009; Hughes et al., 2010; Stanton et al., 2009). Since NRT’s effectiveness cannot be explained in its entirety by reductions in withdrawal and craving (Ferguson et al., 2006), we believe future RCTs should explore motivation to quit and abstinence self-efficacy as mediators of treatment effect. In addition, research should investigate select groups of smokers for whom motivation to quit and abstinence self-efficacy play a larger versus smaller role in the process of smoking cessation, as at least one RCT found differential effects across various racial and ethnic groups (Stanton et al., 2009). In sum, this study underscores the clinical and public health importance of cessation induction strategies that effectively promote smokers’ motivation to quit and abstinence self-efficacy, an area of inquiry that should garner more research attention in the future.

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Table 1

Sample Characteristics at Baseline

Variable	NRT Sampling + Practice Quit Attempts (n = 327) ^a	Practice Quit Attempts (n = 266) ^a
<u>Demographics</u>		
Age in years	50.5 (11.5) ^b	50.3 (10.9) ^b
Female sex	61.8	67.3
Race		
White or Caucasian	87.9	87.9
Black or African American	7.1	8.7
Other	5.0	3.4
Educational Attainment [*]		
Less than or equal to high school	29.4	19.2
Some college	46.5	49.2
College graduate	24.2	31.6
Presence of other smokers in residence		
Lives alone	24.4	20.8
Lives with others, none of whom smoke	30.9	34.1
Lives with others, including a smoker	44.8	45.1
<u>Smoking History</u>		
At least one prior quit attempt	83.7	85.4
Nicotine dependence ^c	5.1 (2.3) ^b	5.1 (2.1) ^b
Cigarettes per day	18.1 (8.6) ^b	19.1 (8.0) ^b

Note.

^{*}
 $p < .05$.

^aData shown are percent unless otherwise noted.

^bData shown are means (standard deviations).

^cFagerström Test for Nicotine Dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991) total score.

Table 2

Descriptive Information for Potential Mediators by Time and Treatment Group

Variable ^b	<u>Baseline</u>		<u>End of Treatment</u> [*]	
	NRT Sampling + Practice Quit Attempts (n = 327) ^a	Practice Quit Attempts (n = 266) ^a	NRT Sampling + Practice Quit Attempts (n = 327) ^a	Practice Quit Attempts (n = 266) ^a
Motivation to Quit ^c	2.4 (2.8)	2.6 (2.9)	4.1 (3.4)	3.0 (2.9)
Abstinence Self-Efficacy ^c	4.0 (3.0)	3.9 (3.0)	5.0 (3.2)	4.2 (3.1)
Knowledge of NRT ^c	4.7 (2.4)	4.9 (2.4)	6.7 (1.7)	5.9 (1.9)
Positive Attitudes toward NRT ^d	3.0 (0.4)	3.0 (0.4)	3.2 (0.4)	3.0 (0.4)
Negative Attitudes toward NRT ^d	2.8 (0.7)	2.6 (0.8)	2.0 (0.7)	2.6 (0.8)

Note. NRT = Nicotine replacement therapy.

^{*} All p 's < .01.

^a Data shown are mean (standard deviation).

^b All variables scored such that higher scores reflect more favorable condition, with the exception of negative attitudes toward NRT.

^c Scores range from 0 to 10.

^d Scores range from 1 to 4.

Table 3**Bivariate Correlations among Potential Mediators at Baseline**

Variable ^a	1	2	3	4	5
1 Motivation to Quit	-				
2 Abstinence Self-Efficacy	0.46 **	-			
3 Knowledge of NRT	0.10 *	0.07	-		
4 Positive Attitudes toward NRT	0.18 **	0.14 **	0.60 **	-	
5 Negative Attitudes toward NRT	-0.14 **	0.02	-0.40 **	-0.30 **	-

Note. NRT = Nicotine replacement therapy.

* $p < .05$.

** $p < .01$.

^a All variables scored such that higher scores reflect more favorable condition, with the exception of negative attitudes toward NRT.

Table 4

Indirect Effects of NRT Sampling on Smoking Outcomes Through Potential Mediators

	Any Quit Attempt During Follow-Up	Any 24-hour Quit Attempt During Follow- Up	Reduction in Cigarettes per Day at 6 Month Follow-Up	7 Day Point Prevalence Abstinence at 6 Month Follow-Up
	Point Estimate (95% CI)	Point Estimate (95% CI)	Point Estimate (95% CI)	Point Estimate (95% CI)
<u>Simple Mediation</u> ^a				
Motivation to Quit	0.29 (0.15–0.45) *	0.26 (0.13–0.40) *	0.04 (0.02–0.07) *	0.27 (0.14–0.45) *
Abstinence Self-Efficacy	0.13 (0.05–0.24) *	0.12 (0.04–0.22) *	0.02 (0.01–0.05) *	0.15 (0.05–0.29) *
Knowledge of NRT	0.03 (–0.10–0.15)	0.01 (–0.11–0.14)	0.01 (–0.01–0.04)	–0.001 (–0.16–0.16)
Positive Attitudes toward NRT	0.10 (0.02–0.21) *	0.06 (–0.02–0.15)	0.03 (0.01–0.05) *	0.11 (–0.001–0.27)
Negative Attitudes toward NRT	0.01 (–0.14–0.17)	–0.01 (–0.17–0.14)	0.001 (–0.03–0.03)	–0.04 (–0.23–0.16)
<u>Multiple Mediation</u> ^b				
Motivation to Quit	0.26 (0.13–0.41) *	0.23 (0.12–0.37) *	0.04 (0.02–0.06) *	0.23 (0.11–0.40) *
Abstinence Self-efficacy	0.05 (0.003–0.13) *	0.05 (0.002–0.13) *	0.01 (0.003–0.03) *	0.07 (0.01–0.19) *
Positive Attitudes toward NRT	0.05 (–0.04–0.16)	--	0.02 (0.001–0.03) *	--
<u>Total Indirect Effect</u> ^c				
	0.36 (0.18–0.57)	0.27 (0.14–0.43)	0.06 (0.04–0.10)	0.30 (0.16–0.50)

Note. 95% CI = 95% confidence interval.

*
 $p < .05$.

^a Simple mediation model includes the respective mediator in a univariate analysis.

^b Multiple mediation model includes all significant univariate mediators in a parallel multivariate analysis.

^c Total indirect effect for the multiple mediation model.