ORIGINAL INVESTIGATION

Evaluating the Effect of Access to Free Medication to Quit Smoking: A Clinical Trial Testing the Role of Motivation

Bianca F. Jardin PhD¹, Karen L. Cropsey PsyD², Amy E. Wahlquist MS^{3,4}, Kevin M. Gray MD¹, Gerard A. Silvestri MD⁵, K. Michael Cummings PhD, MPH^{1,3}, Matthew J. Carpenter PhD^{1,3}

¹Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, Charleston, SC; ²Department of Psychiatry and Behavioral Neurobiology, University of Alabama at Birmingham, Birmingham, AL; ³Hollings Cancer Center, Medical University of South Carolina, Charleston, SC; ⁴Department of Public Health Sciences, Medical University of South Carolina, Charleston, SC; ⁵Department of Medicine, Division of Pulmonary/Critical Care Medicine, Medical University of South Carolina, Charleston, SC

Corresponding Author: Matthew J. Carpenter, PhD, Medical University of South Carolina, MSC 955, 68 President Street, Charleston, SC 29425, USA. Telephone: 843-876-2436; Fax: 843-876-2344; E-mail: carpente@musc.edu

Received October 21, 2013; accepted February 1, 2014

ABSTRACT

Introduction: Although the majority of smokers are ambivalent about quitting, few treatments specifically target smokers lacking motivation to quit in the near future. Most existing interventions are instead predicated on the belief that active treatments should only be distributed to smokers interested in quitting, a largely untested assumption.

Methods: In the current clinical trial ($N = 157$), motivated smokers wanting to quit in the next 30 days were given a 2-week nicotine replacement therapy (NRT) sample and a referral to a quitline (Group MNQ), while unmotivated smokers were randomized to receive the same treatment (Group UNQ) or a quitline referral only (Group UQ). Participants were tracked via telephone for 3 months to assess quitting behaviors and smoking reduction.

Results: Groups significantly differed across all comparisons with regard to incidence of any quit attempt (MNQ: 77%, UNQ: 40%, UQ: 18%, $p < .05$) and any 24-hr quit attempts (62%, 32%, 16%, $p < .05$). Clinically meaningful differences emerged in the rates of floating (19%, 17%, 6%) and point prevalence abstinence (17%, 15%, 5%). Compared to participants in Group UQ (11%), a greater proportion of participants in Group MNQ (48%, $p = .01$) and Group UNQ (31%, $p = .01$) reduced their daily cigarette consumption by at least half. Proxy measures of cessation readiness (e.g., motivation) favored participants receiving active forms of treatment.

Conclusions: Providing NRT samples engaged both motivated and unmotivated smokers into the quitting process and produced positive changes in smoking outcomes. This suggests that motivation should not be considered a necessary precondition to receiving treatment.

INTRODUCTION

A broad array of effective behavioral and pharmacological services are available to help smokers successfully quit (Fiore et al., 2008). Delivery of these interventions is almost universally focused on those smokers who are planning and seeking assistance to quit, that is, motivated smokers (Velicer et al., 1995). However, since less than 10% of smokers are ready to quit in the near future (Wewers, Stillman, Hartman, & Shopland, 2003), the delivery of active treatments to motivated populations exclusively results in a significant missed opportunity to capture the remaining, majority of smokers who are not planning quit attempts. Expanding the scale of these same treatments through flexible delivery of cessation services to

smokers across the motivational spectrum could carry important public health implications.

The stages-of-change model remains the most prevalent framework for conceptualizing readiness to quit. According to this model, smokers are categorized into one of several discrete stages, for example, precontemplation, contemplation, preparation, or action (Prochaska & DiClemente, 1983; Prochaska, DiClemente, Velicer, Gimpil, & Norcross, 1985). Smokers within each stage are believed to be influenced by different types of treatments, with the most effective interventions being those that are matched to a smoker's current stage of change (Prochaska et al., 1985; Prochaska, Velicer, Fava, Rossi, & Tsoh, 2001). Matching treatment to motivation generally implies that active forms of treatment (e.g., pharmacotherapy)

doi:10.1093/ntr/ntu025

Advance Access publication March 7, 2014

© The Author 2014. Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com.

are assigned to motivated populations only, that is, those preparing or taking action to quit. A number of studies have shown improved outcomes for this approach (Prochaska et al., 2001; Prochaska, Velicer, Prochaska, & Johnson, 2004). This model, however, does not always take into account the fluctuating nature of motivation (Larabie, 2005), as evidenced by the growing body of literature demonstrating that many smokers make spontaneous quit attempts (Ferguson, Shiffman, Gitchell, Sembower, & West, 2009; Larabie, 2005; Murray, Lewis, Coleman, Britton, & McNeill, 2009).

An alternative framework may be an approach proposed by West and Sohal (2006) that is based on “catastrophe theory” (Brown, 1995), in which motivation is conceptualized as a dynamic process influenced by internal and external factors operating within an individual’s environment and producing frequent shifts in quitting momentum. Catastrophe theory postulates that a combination of beliefs, past experiences, and current situations produce fluctuating levels of motivational tension, which in the presence of even small triggers can produce efforts to attempt quitting (West and Sohal, 2006). As a result, quitting opportunities can occur at any time, thus facilitating seemingly spontaneous quitting behaviors (Ferguson et al., 2009; Larabie, 2005; Murray et al., 2009).

Ensuring that cessation services are more adaptable to the fluctuating, dynamic nature of motivation could improve the reach of smoking interventions and lower smoking rates (Larabie, 2005; Murray et al., 2009). For example, this could be achieved by removing the widely held notion that active treatments only be distributed to smokers planning on quitting (Ferguson et al., 2009). One potential concern is that delivery of active treatments to unmotivated smokers will result in haphazard quit attempts that will lead to failure, and further undermine interest in future quitting, though some studies suggest this fear may be unfounded (Dijkstra, De Vries, Roijackers, & van Breukelen, 1998). On the contrary, one interpretation consistent with West and Sohal (2006) may be that offering active treatments to smokers low in readiness to quit may produce motivational tension and serve as a trigger to quit. Evidence in support of this stems from both behavioral (Quinlan & McCaul, 2000) and pharmacotherapy “mismatching” trials (Carpenter et al., 2011), which found that the provision of active treatments to unmotivated samples can produce favorable changes in smoking behaviors. For example, we have shown (Carpenter et al., 2011) that provision of 2-week samples of nicotine replacement therapy (NRT) in the context of a practice quit attempt to unmotivated smokers can produce significant increases in quit attempts and some measures of abstinence. While our prior trial tested the effect of NRT sampling among unmotivated smokers, it did not examine if and how these effects would compare to smokers who did want to quit, if given the same treatment.

Clinical evidence is emerging to suggest that active treatments can be successfully delivered to (pre)contemplative smokers. To further explore this, we conducted a randomized trial directly comparing outcomes among and between smokers planning to quit versus not. In a three-group design, we compared smokers wanting to quit and provided with cessation medication (Group MNQ) to smokers not wanting to quit and provided with same cessation medication (Group UNQ) as well as to smokers not wanting to quit but not provided cessation medication (Group UQ). We hypothesized ordinal relationships for all outcomes (e.g., quit attempts, cessation) such that $MNQ > UNQ > UQ$.

METHODS

Participant Recruitment and Eligibility

All participants were recruited through advertisements placed in major media outlets (e.g., newspapers) across South Carolina. The content of these advertisements varied across time and outlets, so as to recruit both motivated (e.g., study for smokers wanting to quit) and unmotivated smokers (e.g., study for smokers not yet ready to quit). Participants were eligible to participate in the study if they met the following criteria, determined through a telephone screening session: (a) age 18 or above, (b) English speaking, (c) resident of South Carolina (treatment intervention for all groups included a quitline referral, and we wished to stay consistent with one quitline only), (d) current cigarette smoker of at least 10 cigarettes per day, (e) accessible by phone for a 3-month study period, (f) no previous use of quitline services or NRT for >1 day in the past 6 months, and (g) no Food and Drug Administration contraindication for NRT use. Eligible participants consisted of smokers wanting to quit in the next 30 days (i.e., 8–10 on a 0–10 contemplation ladder) and smokers not wanting to quit in the next 30 days (i.e., ≤7 on a 0–10 contemplation ladder); the motivational cut-offs were based on prior literature (Amodei & Lamb, 2004). We recruited unmotivated:motivated smokers on a 2:1 basis. Upon confirmation of eligibility, potential participants were mailed a study consent and baseline questionnaire, which assessed demographics, smoking history, and psychological constructs including confidence, social support, and motivation. Approximately 75% of eligible participants returned consents and questionnaires in the preaddressed, prestamped envelope we provided, after which they were randomized/assigned to treatment groups, described below.

Eligible participants were assigned to one of three treatment groups. One consisted of motivated smokers wanting to quit in the next 30 days, all of whom (nonrandomized) were given a 2-week sample of NRT and a referral to a quitline (hereafter referred to as Group MNQ: Motivated, NRT, Quitline referral). The other two groups consisted of unmotivated smokers not wanting to quit in the next 30 days, who were randomized to receive the same treatment (Group UNQ: Unmotivated, NRT, Quitline referral) or a quitline referral only (Group UQ: Unmotivated, Quitline referral only).

Treatment

All participants completed a baseline telephone call, which served as the single point (<15 min) of treatment delivery for all groups. Participants assigned to Groups MNQ and UNQ were informed that they would receive a one-time mailing of a 2-week supply of both 14 mg nicotine patch and 4 mg lozenge. All participants were provided with information about patch and lozenge and evidence for their use. Instructions for use were minimal so as to enhance the translational potential. Nonetheless, participants were encouraged to try these products either individually or combined within the context of a trial period of abstinence, that is, a few hours or days without smoking, so as to better familiarize themselves with how these products work. We did not give a full-course duration of NRT (e.g., 12 weeks) because we explicitly wanted to make treatment comparisons to unmotivated smokers given the same intervention. Also, some studies suggest that brief provision of NRT can be as cost-effective as long duration treatment

(Cummings et al., 2011) particularly when offered in combination format (Smith et al., 2013). The decision to offer combined NRT products was also guided by findings from a recent review of clinical trials focused on alternative methods of NRT uptake so as to enhance efficacy. This review demonstrated that compared to single formulations, combined NRT more effectively targeted withdrawal and craving (Carpenter et al., 2013). Moreover, we rationalized that smokers could benefit from NRT formulations that provided nicotine via different routes and mechanisms of delivery.

Additionally, at the baseline call, all participants were provided information and referral to the South Carolina state quitline. Research staff discussed the benefits of quitlines (e.g., anonymous, free) and provided specific information about the services offered by the South Carolina state quitline: number to call, hours of operation, and additional services provided. Participants were mailed promotional materials to further supplement quitline information presented over the telephone and were subsequently encouraged to initiate contact on their own with the quitline.

Among participants assigned to Group UQ, the baseline telephone was equivalent for time duration (<15 min) but consisted merely of a brief quitline referral.

Outcomes

Following the baseline call, participants entered a 3-month follow-up period, during which follow-up phone contacts were made at Week 4, Week 8, and Week 12 for purposes of data collection only and to monitor the occurrence of any adverse events. Across 628 (157×4) scheduled telephone calls, 96% were completed, and 92% of participants completed all 4 telephone calls. During each of the three follow-up telephone calls, research staff collected data on several primary measures of interest, including reduction in cigarette smoking as well as actual quitting behaviors. Smoking reduction was defined as 50% reduction in the number of cigarettes smoked per day, compared to baseline, for the 7 days immediately prior to the final follow-up assessment, that is, Week 12. Quit outcomes included (a) any self-defined quit attempt; (b) any 24-hr quit attempt, as per Centers for Disease Control and Prevention definition (USDHS, 2011); (c) floating abstinence, that is, any 7-day period of abstinence (Carpenter et al., 2011); and (d) 7-day point prevalence abstinence at Week 12. We did not employ biological verification of abstinence because research suggests it is unnecessary in studies of minimal intervention (Hughes et al., 2003).

Secondary measures of interest included process measures of cessation: (a) confidence to quit, (b) motivation to quit, (c) the use of NRT provided by us or independently purchased as well as other cessation pharmacotherapy (yes or no), and (d) use of behavioral support (e.g., quitline [yes or no], counseling [yes or no]) and associated barriers. We assessed barriers to calling a quitline using an abbreviated 12-item scale adopted from prior literature (Solomon et al., 2009). Self-efficacy was assessed using a single-item 0–10 measure of confidence toward quitting in the next month, as this single-item measure is highly related to other confidence questionnaires (Borrelli & Mermelstein, 1994). Similarly, for motivation, we utilized a modified version of the contemplation ladder (Biener & Abrams, 1991) to measure readiness to quit in the next month.

Statistical Analysis

Chi-square analyses were used to examine the hypothesized ordinal comparisons (MNQ > UNQ > UQ) for the following outcomes: (a) 50% reduction in the number of cigarettes per day, (b) any quit attempt during the course of the study, (c) any 24-hr quit attempt, (d) 7-day point prevalence abstinence at any time during the study (i.e., floating abstinence), and (e) 7-day point prevalence abstinence at the final follow-up assessment. Generalized estimating equation (GEE) models were used to examine main effects for group and time, as well as the group × time interaction, for each of the following process measures of cessation readiness: (a) motivation to quit in the next month and (b) confidence to quit in the next month. Each of the GEE models controlled for the baseline levels of the respective cessation readiness process measure. Bonferroni adjusted pairwise comparisons based on estimated marginal means were used to examine specific group differences for those effects (i.e., main effects and the two-way interaction) found to be significant in each of the overall models. If interaction terms were found to be significant, then main effects were not examined. All analyses were based on an intent-to-treat approach (i.e., participants with missing data were treated as continued smokers). We considered all clinically meaningful differences and not just statistically significant ones.

RESULTS

Sample Characteristics

Table 1 presents a summary of baseline characteristics for each group. By design, there were significant differences between groups on baseline motivation and confidence; otherwise, the groups were comparable on all examined demographic, psychosocial, and smoking history variables.

Smoking Reduction and Quitting Behaviors

Compared to participants in Group UQ (11%), a greater proportion of participants in Group MNQ (48%, $p = .01$) and Group UNQ (31%, $p = .01$) reported reducing their daily cigarette consumption by at least half over the 3-month study period. No significant differences emerged between participants in Groups MNQ and UNQ.

Across the follow-up period, the proportion of participants reporting quit attempts (self-defined and 24-hr) followed the predicted sequence, that is, Group MNQ > UNQ > UQ, with significant pairwise comparisons throughout (Figure 1). While not all differences were statistically significant, for both floating and point prevalence abstinence, a clear trend emerged showing that participants in Group UQ reported lower rates than participants in Groups MNQ and UNQ (Figure 1).

Measures of Cessation Readiness

Figure 2 displays changes in motivation and confidence between groups across time. Controlling for baseline differences in motivation, GEE analyses showed a significant group × time interaction for motivation to quit (Wald $\chi^2 = 9.68$, $df = 4$, $p = .04$), with the only pairwise differences in motivation scores emerging between Groups MNQ and UQ at both the first ($M = 6.9$ vs. 4.9, respectively, $p = .04$) and final follow-up

Table 1. Baseline Characteristics of Participants

	MNQ (<i>N</i> = 53)	UNQ (<i>N</i> = 53)	UQ (<i>N</i> = 51)
Demographics			
Age (<i>M</i> , <i>SD</i>), years	47.8 (13.1)	44.6 (13.3)	43.9 (10.7)
% female	59	59	53
Ethnic/racial status			
% Caucasian	70	81	78
% African American	28	17	22
Education			
% ≤High school	45	53	37
% some college	49	34	47
% college graduate	6	13	16
Relationship status			
% single	66	71	61
% married or partnered	34	28	39
Smoking variables			
Average cigarettes per day	20.8 (11.6)	21.3 (8.2)	22.4 (8.9)
% made a quit attempt in past 6 months	25	17	14
Age started smoking, years	16.9 (4.8)	16.1 (3.7)	17.9 (5.5)
Intent to quit in next month ^a (<i>M</i> , <i>SD</i>)	6.9 (2.4) ^b	3.9 (2.9) ^c	3.8 (3.1) ^c
Confidence to quit in next month ^a (<i>M</i> , <i>SD</i>)	5.5 (3.0) ^b	3.4 (2.6) ^c	3.2 (3.0) ^c

^aOn a scale of 0–10.^{b,c}Nonlike superscripts within row reflect significant pairwise differences between groups ($p < .05$).

assessment ($M = 7.3$ vs. 4.5 , respectively, $p < .01$). No other pairwise comparisons were significant for motivation. A similar GEE testing changes in confidence found a significant main effect for group (Wald $\chi^2 = 12.55$, $df = 2$, $p < .01$), with significant pairwise differences in average scores over time between Groups MNQ ($M = 5.80$) versus UNQ ($M = 4.58$, $p = .03$) and MNQ versus UQ ($M = 4.02$, $p < .01$). The main effect for time was also significant (Wald $\chi^2 = 12.45$, $df = 2$, $p < .01$), indicating a significant increase in confidence scores from the first to the final follow-up assessment ($M = 4.37$ vs. 5.27 , respectively, $p < .01$). The group $\times$ time interaction was not significant for confidence to quit.

Significant group differences in medication use emerged across the follow-up period. As expected, the predominant medications used were nicotine patches and lozenges, and largely among participants in Groups MNQ and UNQ only. Despite baseline differences in motivation, both of these groups reported high rates of use. Specifically, within group MNQ, 92% of participants reported using the patch or lozenge. The mean (*SD*) number of days per week of nicotine lozenge use following the sampling period was 3.7 (2.5), and the mean number of nicotine lozenges used per day of use was 3.1 (2.4). The mean (*SD*) number of days per week of nicotine patch use was 4.1 (2.4). Within UNQ, usage of patches or lozenge was slightly lower than MNQ (80%) but still high overall. On average, participants in this group reported using the patch 3.8 (2.2) days per week, while they reported using the lozenge 3.2 (1.9) days per week. The mean number of nicotine lozenges used per day of use was 2.9 (2.6). In comparison, among UQ participants, only 9% reported independently purchasing and using NRT products. Very few participants (less than 10%) reported using other pharmacological assistance (e.g., varenicline and bupropion) or behavioral support (e.g., counseling), with no between-group differences. The latter was also inclusive of quitline services, of which only 9% of all participants reported using during the follow-up period (MNQ: 9%, UNQ: 8%, UQ: 10%; $p = .91$). Across all groups, barriers to calling the quitline

thematically clustered around (a) concerns for privacy (e.g., I don't like the idea of asking for help, 53%), (b) low appraisal for quitline services (e.g., I don't think talking about quitting will help solve my smoking, 67%), and (c) a belief that one should be able to quit without assistance (e.g., If other smokers can quit on their own, I should be able to as well, 70%).

DISCUSSION

This study represents one of the first randomized trials to directly compare a novel cessation-based strategy among and between smokers planning to quit versus not. The findings revealed that regardless of whether smokers were initially motivated (Group MNQ) or unmotivated to quit (UNQ), when provided with a 2-week supply of cessation medication, many smokers reported high rates of uptake. Compared to smokers not given medication (Group UQ), smokers provided with these 2-week samples reported more quit attempts, greater reduction in smoking, and higher rates of abstinence from smoking. Together, this suggests that while baseline motivation may facilitate some treatment outcomes, it should not be considered a necessary precondition to receiving treatment.

Current clinical practice remains highly influenced by the stages-of-change model, which suggests that smokers transition through several discrete motivational stages and only make efforts to quit once they reach the "preparatory" or "action" stage of change. The underlying assumption is that smokers only initiate a quit attempt when they are motivated to do so. While the results do not dispute the well-established finding that motivation facilitates quitting behavior (Jardin & Carpenter, 2012; Vangeli, Stapleton, Smit, Borland, & West, 2011), they do suggest a reconsideration of the quitting process that better accounts for the fluctuating nature of motivation (Larabie, 2005). Specifically, the findings presented herein suggest that stopping smoking is a more dynamic process, characterized by occasional or perhaps even frequent shifts in

Evaluating the effect of access to free medication to quit smoking

Figure 1. Percentage of participants reporting quit attempts and abstinence^a across postintervention follow-up period.

Note. ^aFloating abstinence refers to 7-day point prevalence abstinence at any time during the study. ^bMNQ versus UNQ, $p < .01$; MNQ versus UQ, $p < .01$; UNQ versus UQ, $p = .01$. ^cMNQ versus UNQ, $p < .01$; MNQ versus UQ, $p < .01$; UNQ versus UQ, $p = .05$. ^dMNQ versus UQ, $p = .04$.

Figure 2. Changes in mean motivation and confidence scores for each group across time.

quitting momentum that may be more penetrable to external cues than previously perceived. Although changes in internal motivational states have traditionally been perceived as the main catalyst responsible for shifting this momentum, the current findings demonstrate that exposure to external cues may also effectively trigger such shifts. Cues to action have long been recognized as important determinants of behavior change and broadly refer to any external (e.g., mass-media campaign) or internal cue (e.g., health scares) that triggers action (Janz & Becker, 1984). Within the current study, the receipt of treatment, that is, samples of NRT, served as a sufficient cue to facilitate movement toward quitting. This could imply that unmotivated smokers may be closer to being on the cusp of quitting than previously realized, suggesting that they may

only need an “extra push” to trigger actual movement toward quitting (Brown, 1995; Larabie, 2005; West & Sohal, 2006). Making cessation medications more readily available to all smokers regardless of their willingness to quit may provide that sufficient “push” to propel many smokers toward quitting.

A few studies have examined ways in which access to cessation interventions can be made more accessible to all smokers. These studies have included working with primary care providers, who inarguably have high rates of access to smokers (Pleis, Ward, & Lucas, 2010). While the delivery of cessation services, for example, brief advice, by physicians has shown some promise (Stead et al., 2013), the delivery of these services has been inconsistent due to a number of barriers including lack of confidence to counsel cessation and inadequate time, resources,

and skills (Blumenthal, 2007; Cabana et al., 1999; Garg et al., 2007). Since the health care setting represents a prominent point of health care contact for so many smokers, identifying strategies that are more clinically feasible is critical. NRT sampling may represent such an approach, particularly given the brief and easy nature of this intervention. Similarly, given their reach, studies have focused on the use of quitlines as a way to deliver cessation resources to a wide range of smokers. In this study, approximately 9% of participants reported calling the quitline throughout the follow-up period. Whether this is a glass half full or half empty is unclear. Quitline contact was very low within our study but much higher than our state average (<1%) (Centers for Disease Control and Prevention, 2011). There is still much room for improvement and a clear need to determine innovative strategies for increasing awareness and actual use of quitlines. At present, several studies have shown that delivering medications significantly increases call volume compared to quitlines not offering free medication (Cummings et al., 2006; Maher et al., 2007; Miller et al., 2005; Miller & Sedivy, 2009; Schillo et al., 2007; Tinkelman, Wilson, Willett, & Sweeney, 2007). This could suggest that the delivery of our sampling-based intervention may be especially well suited to quitlines.

This study has a number of limitations inherent in the design, such as a fairly short follow-up period and a small sample size consisting predominately of Caucasian smokers. Expanding the reach of our sampling-based intervention to racial and ethnic minority smokers of low socioeconomic status is important given that tobacco-related health disparities persist and are partly driven by the low rates of use of cessation medication (Fu et al., 2008; Houston, Scarinci, Person, & Greene, 2005; Levinson, Pérez-Stable, Espinoza, Flores, & Byers, 2004). Similarly, applying this intervention to smokers with co-occurring psychiatric disorders and/or chronic illnesses holds great promise. Additionally, well-powered studies, incorporating larger sample sizes, are needed to focus on more rigorous outcomes (e.g., prolonged abstinence) as well as to elucidate the exact mechanism(s) through which NRT sampling works. The inclusion of biochemical verification in these studies will also further bolster conclusions about the effectiveness of this approach.

In order to produce meaningful changes in cessation rates at the population level, a smoking intervention must not only be efficacious but must demonstrate potential for reaching a significant portion of the smoking population (Zhu, Lee, Zhuang, Gamst, & Wolfson, 2012). The current trial provides further evidence that the provision of NRT samples can be effectively delivered to smokers across the motivational spectrum. Specifically, when unmotivated smokers were offered active forms of treatment typically reserved for motivated populations only, these smokers used these cessation aids at a similar rate and reported nearly identical abstinence outcomes. The observed rates of abstinence are especially impressive when considering that they are similar to population-based studies incorporating larger sample sizes and more intense, lengthier forms of treatment (Heckman, Egleston, & Hofmann, 2010; Jolicoeur, Richter, Ahluwalia, Mosier, & Resnicow, 2003). Moreover, while we did not conduct a formal cost effectiveness evaluation of our intervention, we believe that doing so would show a high return of treatment investment. Brief supply of pharmacotherapy, particularly NRT, incurs nominal costs. It is also minimally invasive as we delivered this

intervention via mail and in the absence of any structured face-to-face intervention. In summary, the minimal costs and absence of intensive behavioral counseling suggests that this novel cessation induction approach may carry significant translational potential to numerous clinical settings (e.g., primary care and community mental health settings) by any number of personnel.

FUNDING

This study was supported by the Hollings Cancer Center and National Institute on Drug Abuse grants R01 CA141663 (PI: Cropsey) and K23 DA020482 (PI: Carpenter).

DECLARATION OF INTERESTS

KMG has received funding from Merck Inc. and Supernus Pharmaceuticals for unrelated research. KMC serves as a paid expert witness in litigation against the tobacco industry. He also has received funding support from Pfizer Corporation to build a hospital-based cessation service.

ACKNOWLEDGMENTS

Bianca F. Jardin is now with Roper St. Francis Hospital. The authors thank Amy Boatright and Easha Tiwari for their valued role in data collection and general study management.

REFERENCES

- Amodei, N., & Lamb, R. J. (2004). Convergent and concurrent validity of the Contemplation Ladder and URICA scales. *Drug and Alcohol Dependence*, 73, 301–306. doi:10.1016/j.drugalcdep.2003.11.005
- Biener, L., & Abrams, D. B. (1991). The Contemplation Ladder: Validation of a measure of readiness to consider smoking cessation. *Health Psychology*, 10, 360–365.
- Blumenthal, D. S. (2007). Barriers to the provision of smoking cessation services reported by clinicians in underserved communities. *Journal of the American Board of Family Medicine*, 20, 272–279. doi:10.3122/jabfm.2007.03.060115
- Borrelli, B., & Mermelstein, R. (1994). Goal setting and behavior change in a smoking cessation program. *Cognitive Therapy and Research*, 18, 69–83.
- Brown, C. (1995). *Chaos and catastrophic theories: Quantitative applications in the social sciences*. London, UK: Sage.
- Cabana, M. D., Rand, C. S., Powe, N. R., Wu, A. W., Wilson, M. H., & Abboud, P. A. (1999). Why don't physicians follow clinical practice guidelines? A framework for improvement. *The Journal of the American Medical Association*, 282, 1458–1465.
- Carpenter, M. J., Hughes, J. R., Gray, K. M., Wahlquist, A. E., Saladin, M. E., & Alberg, A. J. (2011). Nicotine therapy sampling to induce quit attempts among smokers unmotivated to quit: A randomized clinical trial. *Archives of Internal Medicine*, 171, 1901–1907. doi:10.1001/archinternmed.2011.492
- Carpenter, M. J., Jardin, B. F., Burris, J. L., Mathew, A. R., Schnoll, R. A., & Rigotti, N. A. (2013). Clinical strategies to enhance the efficacy of nicotine replacement therapy for smoking cessation: A review of the literature. *Drugs*, 73, 407–426. doi:10.1007/s40265-013-0038-y

- Centers for Disease Control and Prevention. (2011). Smoking & tobacco use: State highlights, South Carolina. Retrieved from www.cdc.gov/tobacco/data_statistics/state_data/state_highlights/2012/states/south_carolina/index.htm
- Cummings, K. M., Hyland, A., Carlin-Menter, S., Mahoney, M. C., Willett, J., & Juster, H. R. (2011). Costs of giving out free nicotine patches through a telephone quit line. *Journal of Public Health Management and Practice*, 17, E16–E23. doi:10.1097/PHH.0b013e3182113871
- Cummings, K. M., Hyland, A., Fix, B., Bauer, U., Celestino, P., & Carlin-Menter, S. (2006). Free nicotine patch giveaway program 12-month follow-up of participants. *American Journal of Preventive Medicine*, 31, 181–184. doi:10.1016/j.amepre.2006.03.027
- Dijkstra, A., De Vries, H., Roijackers, J., & van Breukelen, G. (1998). Tailoring information to enhance quitting in smokers with low motivation to quit: Three basic efficacy questions. *Health Psychology*, 17, 513–519.
- Ferguson, S. G., Shiffman, S., Gitchell, J. G., Sembower, M. A., & West, R. (2009). Unplanned quit attempts—Results from a U.S. sample of smokers and ex-smokers. *Nicotine & Tobacco Research*, 11, 827–832. doi:10.1093/ntr/ntp072
- Fiore, M. C., Jaen, C. R., Baker, T. B., Bailey, W. C., Benowitz, N. L., & Curry, S. J. (2008). *Treating tobacco use and dependence: 2008 update. Clinical practice guideline*. Rockville, MD: US Public Health Service.
- Fu, S. S., Kodl, M. M., Joseph, A. M., Hatsukami, D. K., Johnson, E. O., & Breslau, N. (2008). Racial/ethnic disparities in the use of nicotine replacement therapy and quit ratios in lifetime smokers ages 25 to 44 years. *Cancer Epidemiology Biomarkers & Prevention*, 17, 1640–1647. doi:10.1158/1055-9965.EPI-07-2726
- Garg, A., Serwint, J. R., Higman, S., Kanof, A., Schell, D., & Colon, I. (2007). Self-efficacy for smoking cessation counseling parents in primary care: An office-based intervention for pediatricians and family physicians. *Clinical Pediatrics*, 46, 252–257. doi:10.1177/0009922806290694
- Heckman, C. J., Egleston, B. L., & Hofmann, M. T. (2010). Efficacy of motivational interviewing for smoking cessation: A systematic review and meta-analysis. *Tobacco Control*, 19, 410–416. doi:10.1136/tc.2009.033175
- Houston, T. K., Scarinci, I. C., Person, S. D., & Greene, P. G. (2005). Patient smoking cessation advice by health care providers: The role of ethnicity, socioeconomic status, and health. *American Journal of Public Health*, 95, 1056–1061. doi:10.2105/AJPH.2004.039909
- Hughes, J. R., Keely, J. P., Niaura, R. S., Ossip-Klein, D. J., Richmond, R. L., & Swan, G. E. (2003). Measures of abstinence in clinical trials: Issues and recommendations. *Nicotine & Tobacco Research*, 5, 13–25.
- Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A decade later. *Health Education and Behavior*, 11, 1–47.
- Jardin, B. F., & Carpenter, M. J. (2012). Predictors of quit attempts and abstinence among smokers not currently interested in quitting. *Nicotine & Tobacco Research*, 14, 1197–1204. doi:10.1093/ntr/nts015
- Jolicoeur, D. G., Richter, K. P., Ahluwalia, J. S., Mosier, M. C., & Resnicow, K. (2003). Smoking cessation, smoking reduction, and delayed quitting among smokers given nicotine patches and a self-help pamphlet. *Substance Abuse*, 24, 101–106. doi:10.1080/08897070309511538
- Larabie, L. C. (2005). To what extent do smokers plan quit attempts? *Tobacco Control*, 14, 425–428. doi:10.1136/tc.2005.013615
- Levinson, A. H., Pérez-Stable, E. J., Espinoza, P., Flores, E. T., & Byers, T. E. (2004). Latinos report less use of pharmaceutical aids when trying to quit smoking. *American Journal of Preventive Medicine*, 26, 105–111.
- Mahe, J. E., Rohde, K., Pizacani, B., Dent, C., Stark, M. J., & Dilley, J. A. (2007). Does free nicotine replacement therapy for young adults prompt them to call a quitline? *Tobacco Control*, 16, 357–358. doi:10.1136/tc.2006.019398
- Miller, C. L., & Sedivy, V. (2009). Using a quitline plus low-cost nicotine replacement therapy to help disadvantaged smokers to quit. *Tobacco Control*, 18, 144–149. doi:10.1136/tc.2008.026492
- Miller, N., Frieden, T. R., Liu, S. Y., Matte, T. D., Mostashari, F., & Deitcher, D. R. (2005). Effectiveness of a large-scale distribution programme of free nicotine patches: A prospective evaluation. *Lancet*, 365, 1849–1854. doi:10.1016/S0140-6736(05)66615-9
- Murray, R. L., Lewis, S. A., Coleman, T., Britton, J., & McNeill, A. (2009). Unplanned attempts to quit smoking: Missed opportunities for health promotion? *Addiction (Abingdon, England)*, 104, 1901–1909. doi:10.1111/j.1360-0443.2009.02647.x
- Pleis, J. R., Ward, B. W., & Lucas, J. W. (2010). Summary health statistics for U.S. adults: National Health Interview Survey, 2009. *Vital and Health Statistics*, 10, 1–207.
- Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51, 390–395.
- Prochaska, J. O., DiClemente, C. C., Velicer, W. F., Gimpil, S., & Norcross, J. C. (1985). Predicting change in smoking status for self-changers. *Addictive Behaviors*, 10, 395–406.
- Prochaska, J. O., Velicer, W. F., Fava, J. L., Rossi, J. S., & Tsoh, J. Y. (2001). Evaluating a population-based recruitment approach and a stage-based expert system intervention for smoking cessation. *Addictive Behaviors*, 26, 583–602.
- Prochaska, J. O., Velicer, W. F., Prochaska, J. M., & Johnson, J. L. (2004). Size, consistency, and stability of stage effects for smoking cessation. *Addictive Behaviors*, 29, 207–213.
- Quinlan, K. B., & McCaul, K. D. (2000). Matched and mismatched interventions with young adult smokers: Testing a stage theory. *Health Psychology*, 19, 165–171.
- Schillo, B. A., Wendling, A., Saul, J., Luxenberg, M. G., Lachter, R., & Christenson, M. (2007). Expanding access to nicotine replacement therapy through Minnesota's QUITLINE partnership. *Tobacco Control*, 16(Suppl. 1), i37–i41. doi:10.1136/tc.2007.020180
- Smith, S. S., Keller, P. A., Kobinsky, K. H., Baker, T. B., Fraser, D. L., & Bush, T. (2013). Enhancing tobacco quitline effectiveness: Identifying a superior pharmacotherapy adjuvant. *Nicotine and Tobacco Research*, 15, 718–728. doi:10.1093/ntr/nts186
- Solomon, L. J., Hughes, J. R., Livingston, A., Naud, S., Callas, P. W., & Peters, E. N. (2009). Cognitive barriers to calling a smoking quitline. *Nicotine and Tobacco Research*, 11, 1339–1346. doi:10.1093/ntr/ntp143
- Stead, L. F., Buitrago, D., Preciado, N., Sanchez, G., Hartmann-Boyce, J., & Lancaster, T. (2013). Physician advice for smoking cessation. *The Cochrane Database of Systematic Reviews*, 5, CD000165. doi:10.1002/14651858.CD000165.pub4
- Tinkelman, D., Wilson, S. M., Willett, J., & Sweeney, C. T. (2007). Offering free NRT through a tobacco quitline: Impact on utilisation and quit rates. *Tobacco Control*, 16(Suppl. 1), i42–i46. doi:10.1136/tc.2007.019919
- USDHS. (2011). Cigarette smoking—United States, 1965–2008. *Morbidity and Mortality Weekly Report*, 60, 109–113.
- Vangeli, E., Stapleton, J., Smit, E. S., Borland, R., & West, R. (2011). Predictors of attempts to stop smoking and their success in adult general population samples: A systematic review. *Addiction (Abingdon, England)*, 106, 2110–2121. doi:10.1111/j.1360-0443.2011.03565.x
- Velicer, W. F., Fava, J. L., Prochaska, J. O., Abrams, D. B., Emmons, K. M., & Pierce, J. P. (1995). Distribution of

- smokers by stage in three representative samples. *Preventive Medicine*, 24, 401–411. doi:10.1006/pmed.1995.1065
- West, R., & Sohal, T. (2006). “Catastrophic” pathways to smoking cessation: Findings from national survey. *British Medical Journal*, 332, 458–460. doi:10.1136/bmj.38723.573866.AE
- Wewers, M. E., Stillman, F. A., Hartman, A. M., & Shopland, D. R. (2003). Distribution of daily smokers by stage of change: Current Population Survey results. *Preventive Medicine*, 36, 710–720.
- Zhu, S. H., Lee, M., Zhuang, Y. L., Gamst, A., & Wolfson, T. (2012). Interventions to increase smoking cessation at the population level: How much progress has been made in the last two decades? *Tobacco Control*, 21, 110–118. doi:10.1136/tobaccocontrol-2011-050371