Brief Report

Predictors of Early Versus Late Smoking Abstinence within a 24-month Disease Management Program

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Abstract

Introduction: Standard smoking cessation treatment studies have been limited to 6- to 12-month follow-up, and examination of predictors of abstinence has been restricted to this timeframe. The *KanQuit* study enrolled 750 rural smokers across all stages of readiness to stop smoking and provided pharmacotherapy management and/or disease management, including motivational interviewing (MI) counseling every 6 months over 2 years. This paper examines differences in predictors of abstinence following initial (6-month) and extended (24-month) intervention.

Methods: Baseline variables were analyzed as potential predictors of self-reported smoking abstinence at Month 6 and at Month 24. Chi-square tests, 2-sample *t* tests, and multiple logistic regression analyses were used to identify predictors of abstinence among 592 participants who completed assessment at baseline and Months 6 and 24.

Results: Controlling for treatment group, the final regression models showed that male gender and lower baseline cigarettes per day predicted abstinence at both 6 and 24 months. While remaining significant, the relative advantage of being male decreased over time. Global motivation to stop smoking, controlled motivation, and self-efficacy predicted abstinence at 6 months but did not predict abstinence at Month 24. In contrast, stage of change was strongly predictive of 24-month smoking status.

Conclusions: While the importance of some predictors of successful smoking cessation appeared to diminish over time, initial lack of interest in cessation and number of cigarettes per day strongly predicted continued smoking following a 2-year program.

Introduction

Tobacco use is largely driven by nicotine dependence, characterized as commonly involving cycles of repeated quit attempts and relapse

(Fiore et al., 2008). Traditional models of nicotine dependence treatment offer only a single short-term (i.e., 1–12 weeks) intervention and do not include a mechanism for assisting those not interested in quitting, those not responsive to treatment, or those who relapse (Fiore et al., 2008). Evaluation of these interventions is commonly limited to 6- or 12-month follow-up.

KanQuit was designed to provide the support systems needed to address nicotine dependence as a chronic disease, using the Chronic Care Model (Ellerbeck et al., 2009). The study enrolled rural smokers from primary care practices, independent of interest in stopping smoking, and compared varying intensities of disease management (pharmacotherapy alone or with disease management and motivational counseling). The program offered repeated intervention every 6 months over the course of 2 years. *KanQuit* demonstrated that supplementing pharmacotherapy management (PM) with disease management support was associated with higher levels of abstinence during the first 18 months of the program but with no significant differences in treatment condition at 24 months (Ellerbeck et al., 2009).

The objective of the current study was to examine predictors of smoking abstinence among *KanQuit* participants following initial versus extended intervention. Treatment outcomes may be improved tailoring treatment to address factors most likely to impede or facilitate treatment success. While multiple demographic, smoking, and psychosocial factors have been associated with increased risk for relapse (e.g., Augustson et al., 2008; Dale et al., 2001; Ferguson et al., 2003; Grandes, Cortada, Arrazola, & Laka, 2003; Harris et al., 2004; Nollen et al., 2006), most previous findings have been based on single interventions with smokers interested in stopping smoking and have been limited to follow-up at 6 or 12 months. The current study contributes to existing literature by extending evaluation to include long-term abstinence following repeated intervention and by including smokers across the spectrum of stage of readiness to stop smoking. We compared predictors of self-reported smoking

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abstinence at the end of the initial cycle of treatment intervention (6 month) with predictors of abstinence following completion of the disease management program (24 months—following four cycles of intervention). Because *KanQuit* employed motivational interviewing (MI) counseling, we hypothesized that the smoker's initial stage of change would be a less salient predictor of smoking cessation after repeated interventions.

Methods

Study Design

The study utilized a randomized, single-blinded three-arm design with intervention occurring over the course of 24 months. Treatment involved four 6-month cycles within each arm. Participants were randomized to either (a) PM receiving health educational mailings and an offer for free nicotine patch therapy (21 mg/day for 6 weeks) or bupropion (300 mg/day for 7 weeks) every 6 months, (b) moderate-intensity disease management (MDM) receiving the same interventions as PM with up to two telephone counseling sessions every 6 months, or (c) high-intensity disease management (HDM) receiving PM and up to six telephone counseling sessions every 6 months. Both MDM and HDM included MI counseling (Rollnick, Miller, Butler, & Aloia, 2008) and progress reports faxed to participants' physicians to facilitate coordination of care. Study procedures, measures, and abstinence outcomes are described in detail elsewhere (Cox et al., 2008). Procedures were approved by the University of Kansas Medical Center Human Subjects Committee.

Participants

Participants were ≥ 18 years, smoked ≥ 10 cigarettes/day, had a working telephone, and were patients within participating rural primary care practices. Individuals were excluded from study participation if they were pregnant, planning to become pregnant in the next 2 years, or lived with a smoker already enrolled in the study. Smokers were recruited independent of interest in stopping smoking.

Measures

Demographics

Baseline assessment of demographic information included gender, age, marital status, education level, and income.

Smoking Characteristics

Smoking history included current cigarettes per day, number of years smoked, longest period of abstinence, and number of quit attempts in the past six months. The 6-item Fagerström Test for Nicotine Dependence (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) assessed level of nicotine dependence and included a single item assessing time-to-first cigarette. Two items were used to assess stage of readiness to stop smoking (DiClemente et al., 1991; Fava, Velicer, & Prochaska, 1995). Environmental smoking factors included other smokers in the home and existence of home smoking restrictions.

Psychosocial Characteristics

Global motivation and confidence for quitting were assessed using single 10-point Likert scale items. The 12-item Smoking Self-Efficacy Questionnaire (SEQ-12; Etter, Bergman, Humair, & Perneger, 2000) measured confidence in the ability to refrain

from smoking. The 15-item Treatment Self-Regulation Questionnaire (TSRQ; Williams et al., 2002) assessed autonomous and controlled motivation for stopping smoking. The 9-item Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001) assessed symptoms of depression.

Smoking Abstinence

We examined self-reported 7-day point prevalence smoking abstinence reported within telephone surveys at 6 and 24 months. Verification of smoking status using salivary cotinine and proxy report was conducted on 24-month self-reported data; no difference in rate of validation was found across treatment groups (Ellerbeck et al., 2009). Because no verification was conducted on 6-month data, we used self-reported abstinence for both the 6- and 24-month assessments within the current analyses.

Statistical Analysis

Analysis was confined to data from participants who completed assessments at baseline, Month 6, and Month 24. Categorical variables (Table 1) were summarized by frequencies and percentages, and associations with abstinence used the chi-square test. Continuous-level variables (Table 1) were summarized by means and SDs, and associations with abstinence used the two-sample *t* test. Stepwise multiple logistic regression, controlling for treatment condition, was used to identify predictors of self-reported 7-day point prevalence abstinence from smoking at 6 months and 24 months (Table 2). Covariates considered in the models included those identified as statistically significant from bivariate assessments and any interaction effects relevant to our hypotheses. Covariates identified as statistically significant by the stepwise procedure in either the 6-month or the 24-month model were included in both final abstinence models. A comparison of the 24-month self-report model with a 24-month model using verified smoking abstinence (using proxy and salivary cotinine) found similar trends.

Results

Of the 750 participants enrolled in the *KanQuit* study, 592 participants completed assessment at baseline, Month 6, and Month 24. Of these 592 participants, 60.0% were female, 51.4% had at least a high school education, and mean age was 47.6 (*SD* = 12.8) years. Participants self-reported race and ethnicity. Our sample was 90.4% White, 1.0% Black, 0.8% Native American, and 0.5% Asian/Pacific Islander; 7.3% endorsed "other" or multiple categories. Overall, 1.2% of participants reported Hispanic ethnicity. On average, participants smoked 23.3 (*SD* = 10.4) cigarettes/day, had smoked for 29.5 (*SD* = 13.1) years, and had made 0.7 (*SD* = 1.3) 24-hr quit attempts in the past year. Reported abstinence at 6 and 24 months was 15.9% and 28.7%, respectively. Participants excluded from analyses because they did not complete assessment at both 6 and 24 months were younger (43.6 vs. 47.6 years), less likely to complete high school (41.0% vs. 51.4%), and were more likely to have additional smokers in the home (56.0% vs. 45.1%) compared with those included in analyses: there was no difference in baseline readiness to stop smoking.

Predictors of Smoking Abstinence at 6 Months

Table 1 presents bivariate predictors of smoking abstinence at Month 6. Age, marital status, income, years smoked, longest

Table 1. Bivariate Analysis of Baseline Predictors of Self-Reported Smoking Abstinence at Months 6 and 24

Categorical variables	N	Month 6		Month 24	
		% Abstinent	OR (95% CI)	% Abstinent	OR (95% CI)
Gender					
Male	237	21.9	2.09 (1.34–3.27)	32.5	1.36 (0.95–1.94)
Female (referent)	355	11.8	—	26.2	—
High school graduate					
Yes	304	15.5	0.94 (0.6–1.46)	28.1	1.06 (0.74–1.51)
No (referent)	288	16.3	—	29.3	—
Smokes within 30 min of waking					
No	123	22.0	1.69 (1.02–2.78)	35.8	1.52 (0.99–2.31)
Yes (referent)	469	14.3	—	26.9	—
Other smokers in the household					
No	325	18.5	1.55 (0.98–2.45)	31.4	1.34 (0.93–1.92)
Yes (referent)	267	12.7	—	25.5	—
Home smoking restrictions					
Smoking restricted	335	17.0	1.22 (0.78–1.91)	24.5	1.45 (1.0–2.08)
No restrictions (referent)	257	14.4	—	31.9	—
Randomization arm					
LDM	190	16.8	1.55 (0.88–2.75)	28.4	1.19 (0.76–1.86)
HDM	194	19.6	1.87 (1.07–3.25)	33.0	1.48 (0.96–2.28)
Control (referent)	208	11.5	—	25.0	—
Stage of change					
Precontemplation	48	4.2	0.15 (0.04–0.65)	8.3	0.14 (0.05–0.42)
Contemplation	360	14.2	0.58 (0.37–0.91)	26.4	0.57 (0.39–0.83)
Preparation (referent)	184	22.3	—	38.6	—

Continuous variables	Month 6			Month 24		
	Abstinent, mean (SD)	Smoker, mean (SD)	p value	Abstinent, mean (SD)	Smoker, mean (SD)	p value
Cigarettes per day	20.8 (8.5)	23.8 (10.6)	.003	21.02 (9.2)	24.3 (10.7)	.0002
Motivation to quit	9.3 (1.3)	8.5 (2.1)	<.0001	9.1 (1.7)	8.5 (2.1)	.0003
Confidence to quit	6.7 (2.6)	6.04 (2.7)	.03	6.7 (2.5)	5.9 (2.7)	.002
Number of 24-hr quit attempts in past six month.	0.8 (1.04)	0.7 (1.4)	.63	0.9 (1.5)	0.6 (1.3)	.03
Nicotine dependence (FTND)	4.7 (2.3)	5.2 (2.2)	.05	4.7 (2.2)	5.2 (2.2)	.01
Self-efficacy (SEQ)	36.4 (11.4)	32.4 (10.4)	.002	34.7 (11.6)	32.3 (10.2)	.02
Autonomous motivation (TSRQ)	38.7 (4.3)	36.6 (6.8)	<.0001	38.03 (5)	36.4 (7)	.002
Controlled motivation (TSRQ)	25.2 (10.6)	21.4 (9.7)	.001	23.2 (10.3)	21.5 (9.7)	.06

Note. FTND = Fagerström Test for Nicotine Dependence; HDM = high-intensity disease management; LDM = low-intensity disease management; OR = odds ratio; SEQ = Self-Efficacy Questionnaire; TSRQ = Treatment Self-Regulation Questionnaire.

quit attempt, and depression were not significant contributors. As shown in the final regression model in Table 2, controlling for treatment group, male gender, greater SEQ self-efficacy, greater TSRQ-controlled motivation, and greater motivation to quit increased the probability of being abstinent at Month 6. A greater number of cigarettes smoked per day was associated with a reduced odds of quitting. A precontemplation stage and a contemplation stage of readiness showed nonsignificant trends toward a reduced odds of quitting.

Predictors of Smoking Abstinence at 24 Months

Bivariate predictors of smoking abstinence at 24 months are presented in Table 1. Age, marital status, income, years smoked,

longest quit attempt, and depression were not statistically significant. In the final regression model (Table 2), controlling for treatment group, male gender predicted abstinence at Month 24, while baseline contemplation or precontemplation stage of readiness and a greater number of cigarettes smoked per day reduced the odds of long-term abstinence. SEQ self-efficacy, TSRQ-controlled motivation, and baseline motivation to quit showed no significant relationship with long-term abstinence.

Discussion

The current study identified individual characteristics associated with smoking abstinence within a 2-year disease management program. Male gender and lower baseline cigarettes per

Table 2. Final Logistic Models of Baseline Variables Predicting Abstinence at Months 6 and 24

Baseline variable	Month 6 Model		Month 24 Model	
	OR (95% CI)	p value	OR (95% CI)	p value
Treatment arm				
Pharmacotherapy management (referent)	—	—	—	—
Moderate-intensity disease management	1.563 (0.854–2.859)	.6389	1.150 (0.723–1.829)	.8947
High-intensity disease management	1.923 (1.072–3.448)	.0794	1.396 (0.890–2.189)	.1810
Gender				
Female (referent)	—	—	—	—
Male	2.940 (1.790–4.828)	<.0001	1.682 (1.137–2.487)	.0092
Stage of change				
Preparation (referent)	—	—	—	—
Contemplation	0.736 (0.453–1.196)	.7007	0.650 (0.439–0.961)	.3683
Precontemplation	0.387 (0.077–1.944)	.3248	0.238 (0.073–0.776)	.0375
Self-efficacy (SEQ)	1.023 (1.001–1.045)	.0446	1.012 (0.994–1.030)	.1894
Controlled motivation (TSRQ)	1.034 (1.010–1.060)	.0058	1.009 (0.990–1.029)	.3495
Motivation to quit	1.257 (1.036–1.524)	.0202	1.096 (0.963–1.247)	.1646
Number of cigarettes per day	0.960 (0.932–0.989)	.0064	0.964 (0.943–0.986)	.0013

Note. OR = odds ratio; SEQ = Self-Efficacy Questionnaire; TSRQ = Treatment Self-Regulation Questionnaire.

day were associated with a significantly higher probability of being abstinent at both 6 and 24 months. Global motivation to stop smoking, TSRQ-controlled motivation, and SEQ self-efficacy predicted initial abstinence at 6 months but did not predict abstinence following repeated intervention. In contrast, stage of change was strongly predictive of long-term abstinence at 24 months such that smokers initially not considering stopping smoking (smokers in precontemplation) were unlikely to be abstinent even following repeated intervention.

In this study, the constructs of precontemplation, contemplation, and preparation (DiClemente & Prochaska, 1998) were used as categorical descriptors to indicate intention to stop smoking at baseline. Participants who were “not seriously considering stopping smoking” in the next 6 months (i.e., precontemplation) were unlikely to be abstinent two years later, even when offered repeated treatment. Even individuals interested in stopping smoking in the foreseeable (6 month) but not immediate (1 month) future (i.e., contemplation) benefited from repeated intervention but not to the same degree as those reporting plans to quit within the first cycle of treatment (i.e., preparation). Of note, the *KanQuit* disease management intervention was not designed as a stage-matched process-of-change intervention (Prochaska & DiClemente, 1984; Prochaska, DiClemente, Velicer, & Rossi, 1993): the offer of pharmacotherapy to all current smokers is contrary to a stage-based intervention. However, MI counseling is intended to facilitate resolution of ambivalence among smokers not thinking about quitting and to enhance motivation among smokers to consider quitting (Miller & Rose, 2009); therefore, repeated cycles of MI intervention would be expected to promote abstinence among smokers not ready to quit. Interestingly, both contemplators and precontemplators were willing to enroll and continue participation in a 2-year program. While clinicians may anticipate extended intervention for these persistent smokers, further study is needed to identify how best to support and sustain abstinence.

Findings suggest that the role of gender in treatment response may be complex. Many studies suggest that women may have greater risk of relapse following a single intervention compared with men (e.g., Dale et al., 2001; Ferguson et al., 2003; Perkins & Scott, 2008). Within the current study, men demonstrated higher rates of abstinence following the initial cycle of intervention. However, while the differences remain statistically significant, the relative advantage of being male in responding to treatment decreased with repeated intervention. Previous studies on recycling recalcitrant smokers (Tonnesen, Mikkelsen, Norregaard, & Jorgensen, 1996; Tonnesen, Norregaard, Sawe, & Simonsen, 1993), offering repeated intervention within the context of disease management (Hall, Humfleet, Reus, Munoz, & Cullen, 2004), and following smokers more than a decade after intervention (Hyland et al., 2004) have not identified significant gender effects on abstinence. The current study suggests that, compared with men, women may show an added benefit to participating in a disease management strategy to treating chronic tobacco use.

Limitations in methodology should be considered. This evaluation is limited to those participants who completed assessments at baseline, 6, and 24 months. Those who declined continued assessment may have a greater likelihood of persisting in smoking. Furthermore, analyses of independent variables are limited to baseline factors and do not provide a dynamic evaluation of change in these independent variables over time. However, a major strength of the *KanQuit* trial is the ability to provide insight into smoking behavior change following repeated intervention over an extended period, contributing to a literature largely limited in the past to single interventions.

Because most smokers will not achieve sustained abstinence following a single intervention, it is important to increase understanding of factors associated with quitting after more than one course of treatment. Identification of individual risk and protective factors contributes to enhancing tailored intervention

with the goal of facilitating smoking abstinence (Dijkstra, De Vries, & Roijackers, 1998; Prochaska et al., 1993; Shiffman, Paty, Rohay, Di Marino, & Gitchell, 2001). While gender, initial motivation, and self-efficacy diminished in importance following repeated intervention, smoking level and stage of readiness persisted as important predictors of abstinence. Further study is required to establish how best to treat heavier smokers and those not interested stopping and to identify whether the current findings would apply in the context of other intervention.

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Declaration of Interests

Dr. JSA serves as a consultant to Pfizer Pharmaceuticals, Inc. All other authors have no conflicts of interest.

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