



Do environmental cues prompt attempts to stop smoking? A prospective natural history study



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ABSTRACT

Introduction: We prospectively tested whether environmental cues prompts attempts to stop smoking.

Methods: We recruited 134 smokers who intended to quit in the next 3 months to complete nightly calls to report cues as well as smoking status, intentions to smoke or not on the next day, and quit attempts over 12 weeks. We provided no treatment.

Results: Participants averaged 6.5 cues/week. The most common cues were embarrassment, cost of cigarettes and messages in the media. The number of cues over a 7-day period predicted the incidence of a quit attempt on the eighth day (e.g. from 1.5% when no cues occurred to 3% when 7 cues occurred during the 7 days). This effect was dose-dependent and was due to both between and within-subject predictors. Five cues predicted quit attempts. A cue that made smokers concerned about the cost of cigarettes appeared to be the strongest cue. Cues on the day prior were not more powerful predictors than more distal cues. Intention to not smoke the next day on the evening prior to the eighth day was a partial mediator of the effect of cues on quit attempts. Retrospective recall of cues was poor.

Conclusions: Our results suggest the occurrence of cues may be a cause of quit attempts and that programs to increase the frequency of cues may increase quit attempts. Further research should examine whether environmental cues and introspective states (e.g. self-efficacy) interact to prompt quit attempts.

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1. Introduction

To stop smoking requires two processes: making a quit attempt and then remaining abstinent (Zhu et al., 2012). Several tobacco control interventions (e.g., increased taxes, worksite restrictions and counter-marketing; Warner and Tam, 2012) and several clinical interventions (e.g., physician advice, stage of change interventions, and motivational interviewing; Zhu et al., 2012) prompt quit attempts. However, despite the implementation of many of these interventions only 53% of US smokers try to quit in a calendar year (Jamal et al., 2014). Thus, new strategies to prompt quit attempts are needed. To develop these, we need a better understanding of what triggers quit attempts (Zhu et al., 2012). For example, if being embarrassed by smoking is a strong predictor of a quit attempt but hearing that a friend is suffering

from a smoking-related illness is not, then media messages should focus on the former rather than the latter.

Although many studies have examined factors that influence remaining abstinent after a quit attempt (Piasecki, 2006), few have explored the processes that influence making a quit attempt (Zhu et al., 2012). Most of the empirical descriptions of what leads to quit attempts are based on retrospective studies that ask about reasons for wanting to quit and suffer from the well-documented attribution, recall and forgetting biases common in retrospective studies (Shiffman, 2009). The few prospective studies have focused on predictors that are not modifiable (e.g., demographics), and gather data only at 3–12 month intervals. Prior studies have focused mostly on introspective states such as intention to quit, self-efficacy, and motivation (Piasecki, 2006). These studies often imply a slow, gradual increase in cognitive factors leads to a clear decision to quit, followed by preparatory actions, and the setting of a future quit date (Noar and Zimmerman, 2005). However, more recent studies suggest many quit attempts are sudden, spontaneous, and largely devoid of anticipatory planning (Larabie, 2005; West and Sohal, 2006). These descriptions often imply that some proximal event may trigger a quit attempt (Larabie, 2005).

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The purpose of the current study was to provide a prospective, near real-time, description of the processes leading up to a quit attempt. Our prior published analyses of a pilot study (Hughes et al., 2014) and of the current data set (Hughes et al., 2014) reported on the role of intentions and setting a quit date as predictors of quit attempts and abstinence, and thus, these outcomes will not be repeated in this paper. Instead, the current analysis focuses on whether external cues related to stopping smoking prompt a quit attempt.

2. Methods

2.1. Overview of study design

We recruited adult daily smokers who were interested in quitting at some point in the next 3 months into a prospective, observational, cohort study. Participants called an Interactive voice response (IVR) system (Corkrey and Parkinson, 2002) nightly for 12 weeks and completed longer questionnaires at baseline, and then every 4 weeks for a second 12 weeks. The nightly IVR recorded tobacco use, intentions to quit, and external cues. No intervention occurred. Our major hypotheses for the current analysis were that the number of cues and the type of cue would prospectively predict the occurrence of a quit attempt. The University of Vermont Committees on the Use of Human Participants approved the study and we registered the study at www.clinicaltrials.com (NCT00995644).

2.2. Development of list of cues related to stopping smoking

We initially reviewed the published literature and developed a list of possible cues related to quit attempts. We also recruited 27 current daily smokers or ex-smokers who had made an attempt to stop smoking in the last month. Two of us (JRH and LS) conducted semi-structured interviews that asked the participant to describe cues that prompted the most recent quit attempt. From these two procedures, we developed a list of several cue categories along with operational definitions and exemplars. To further confirm our categories, we sent a list of cues to eight smoking experts and asked them to identify the most important ones and sort them into categories. The experts suggested minor changes that were incorporated into a list of 13 cue titles and descriptions. Next we recruited 40 participants into a one-month pilot test of the protocol, and its quitting outcomes are described elsewhere (Hughes et al., 2014). In this pilot we included a “don’t know/unclear” option for cue questions to assess question clarity. We also conducted a qualitative interview at the end of the first 2 weeks of their participation to determine feasibility of the IVR, ask about difficulties with assigning cues to categories and suggestions for wording of the cues. Minor methodological changes to cue descriptions were made based on this pilot study. In addition, we found some cues were highly correlated because they referred to similar events; thus, we reduced the 13 cues into 9 categories: “something happened to make you embarrassed about your smoking, media mentioned harm from or treatment for smoking, someone asked you to quit or mentioned harm from smoking, cue that made you concerned about the cost of cigarettes, new or worsening symptom, smoker you know quit smoking, smoker you know has a new tobacco-related symptom, MD asked you to quit or mentioned harm from smoking, and non-smoker has a symptom related to your smoking (Table 1).”

2.3. Recruitment

In 2010–11, we recruited participants using Internet advertisements that appeared when smokers entered phrases such as “quit smoking” into search engines. We also posted our study on research study websites (e.g., www.clinicaltrials.gov) and Craig’s List (www.craigslist.org). A typical message was “Daily smokers who want to quit wanted for University of Vermont research study. No need to leave home. This study does not offer treatment.” There was no mention of reimbursement in the ads.

Major inclusion criteria were a) ≥ 18 years old, b) smoke cigarettes daily for at least 1 year, c) smoke at least 10 cigarettes per day, d) have not used oral tobacco, pipes or cigars in the last 2 weeks, e) probably or definitely intend to quit in the next 3 months, f) own a touch-tone phone, g) does not work a night shift and typically goes to bed between 2100 and 0200, and h) is fluent in English. We required high intentions to quit to increase the probability that most participants would make a quit attempt within the next 3 months. Our sample of smokers intending to quit in the next 3 months probably represents about half of US smokers (Tobacco Use in Canada: 2014, www.tobaccoreport.ca). We screened 1013 participants and excluded 809. The major reason for initial exclusion was low intention to quit in the next 3 months. Among the 204 eligible, 193 consented and began the study. We a priori decided to exclude participants who did not complete ≥ 5 IVR calls in the first week) because our prior experience is that such participants are likely to have significant amounts of missing data during the study. This excluded 41 participants, leaving 152 enrolled participants. We asked about cues for quit attempts only on days of smoking. To obtain a sufficient sample of cues, we only included participants who had a minimum of 7 consecutive days of smoking (i.e., excluded those

who became abstinent early on). This decreased the sample to 134 participants who contributed a total of 10,062 days of IVR data. Among the 134 who entered the study, few (6%) dropped out during the study. Few (5%) calls were missed; half (51%) of the participants did not miss any calls.

These 134 participants averaged 45 years old (standard deviation = 13), and 68% were women, 94% high school graduates, and 77% non-Hispanic Whites. They smoked an average of 19 cigarettes/day (sd = 10) and had an average Fagerstrom Test for Tobacco Dependence score of 5.4 (2.2). Our sample was generally similar to the average US smoker trying to quit but had more women, were more educated and were heavier smokers; it included less heavy, less dependent smokers than treatment seeking smokers (Hughes et al., 2014).

2.4. Interactive voice recording (IVR)

The IVR is a system in which participants call a number which directs them to enter data using the phone keypad (Corkrey and Parkinson, 2002). IVR has many of the assets of computer-assisted telephone interviewing; e.g., automatic skips, branching options, prohibition of illogical responses and outliers, standardized questioning, and direct data entry. IVR’s major assets are the increased confidentiality and the ability to prompt participants to call (Corkrey and Parkinson, 2002). Drug use outcomes are more accurately reported in IVR studies compared to in-person phone interviews, computer assessments, written questionnaires, or in-person interviews (Corkrey and Parkinson, 2002). IVR appears to produce little reactivity and less volunteer bias (Corkrey and Parkinson, 2002). The IVR asked smoking status, intention to smoke or not the next day, and cigarettes/day nightly for 12 weeks (i.e. 84 days). If the participant smoked that day, the IVR also asked whether the different cues occurred that day. To detect quit attempts that lasted less than an entire day, each week the IVR asked the number of such brief quit attempts that occurred in the prior week and when the most recent brief attempt occurred.

2.5. Post quit attempt interview

To compare retrospective recall of cues with cues reported on the IVR, we conducted a phone interview among the first 42 smokers who made a quit attempt, within a week after their quit attempt, and asked them whether any of the cues occurred in the last week.

2.6. Data analysis

Like most natural history studies, we had little information to use to estimate a sufficient sample size. We chose a sample size of 200 because, with dichotomous outcome, it will produce a 95% CI of no wider than $\pm 7\%$. For descriptive statistics (e.g. the incidence of quit attempts or cues), to ensure each participant contributed equally to the outcomes, we first averaged results within each participant and then averaged across participants. Most of the results had skewed outcomes; thus, we often report medians and interquartile range (i.e. 25th and 75th percentiles).

Our major dependent variable was the incidence of a quit attempt. Our major independent variable was the number of cessation-related cues over the 7-day period prior to the day of interest. We chose 7 days because it would allow us to examine not only the total number of cues but also the dose-dependency of number of cues and whether more proximal cues were more robust predictors of quit attempts. We allowed overlap in time periods when testing the effect of cues. For example, we tested whether cues occurring on a Sunday through Saturday predicted quitting on Sunday, and examined whether cues occurring on Monday through Sunday of that same week predicted quitting on Monday. These criteria produced a total of 5081 epochs to test. We used multilevel logistic regression with a random-intercept (Hox, 2002) to predict quit attempts via the Proc GLIMMIX, SAS v9.4, (SAS Institute Inc., Cary, NC) statistical software. This approach is appropriate when there are a large number of repeated measures and when there are varying numbers of records per participant.

Secondary analyses examined a) the different types of cues (e.g., concern about cost of cigarettes vs. advice from a health care provider) as predictors, and b) the incidence of attempts lasting ≥ 1 day as an outcome. Because of reports that many quit attempts are impulsive, we also examined whether the number of cues on a prior day predicted quitting on the next day, plus we examined whether baseline characteristics were moderators of any cue effects. A final secondary analysis examined whether intention to quit on the evening prior to the eighth day was a mediator via a multilevel mediation analysis (Hayes, 2009; Preacher and Hayes, 2004). Because the distribution of the indirect (i.e., mediation) effect would probably not be normally distributed, a bootstrap approach was used. For each sample, three separate multilevel logistic regression models were run: (a) a model estimating the direct effect, namely cues predicting quit attempt; (b) the mediator added to the model as a second predictor; and (c) number of cues predicting the mediator. The mediation effect was calculated for each sample as the product of the relevant coefficients from the second and third models.

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