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Short Communication

Sex differences in affect-triggered lapses during smoking cessation: A daily diary study

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HIGHLIGHTS

- Men reported greater positive-affect-induced smoking lapses than women
- Effects of negative-affect-induced lapses subsided over time in men, but persisted in women.
- Results further underscore the need to address sex-specific affective triggers when developing smoking cessation strategies.

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ABSTRACT

Introduction: Smoking lapses during a cessation attempt are common and are thought to be a key predictor of full relapse. Positive and negative affective states have been hypothesized as important precipitants of lapses during quit attempts, although findings have been mixed. Accumulating evidence suggests that women may smoke more when experiencing negative affective states, while men may smoke more when experiencing positive affective states. The possibility that these sex differences may play a role in predicting lapses during a smoking cessation attempt, however, has not been well-investigated. In this study, we hypothesized that, during a quit attempt, negative affect would be more strongly associated with lapses among women, and positive affect would be more strongly associated with lapses among men.

Method: We conducted a prospective study in which male and female nicotine-dependent smokers (n = 60) made an unaided, 'cold-turkey' quit attempt. For fourteen days following the initiation of the quit attempt, participants completed daily diaries in which they recorded the degree to which states of 'good mood' and 'bad mood' preceded smoking lapses.

Results: Consistent with the study hypothesis, findings indicated that men reported higher good-mood-induced smoking lapses than women across the 14-day study interval. Conversely, while levels of bad-mood-induced smoking subsided over the 14-day interval among men, levels persisted among women.

Discussion: Results further underscore the need to address sex-specific affective triggers when developing smoking cessation strategies.

1. Introduction

Cigarette smoking is the leading cause of preventable death; there are nearly 6 million individuals globally who die from smoking-related diseases annually and 556,000 within the U.S. alone (Carter, Abnet, Feskanich, et al., 2015). Despite efforts to develop and enhance methods of smoking cessation, fewer than 6% of those who attempt to quit smoking are successful in quitting for longer than one month (Babb, Malarcher, Schauer, Asman, & Jamal, 2017). As a result, there have been intense efforts to better understand predictors of smoking cessation failure.

Smoking lapses during a cessation attempt are common and are thought to be a key predictor of full relapse. Smoking lapses, characterized by episodes of smoking during an ongoing quit attempt, have been shown to be predictive of both subsequent lapses, as well as full relapse, or resumption to regular smoking (Ferguson, Gitchell, & Shiffman, 2012; Kenford et al., 1994; US Public Health Service Report, 2008). There are a wide variety of potential triggers of lapses when

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trying to quit smoking cigarettes. Some include addiction to the nicotine itself and its attendant withdrawal symptoms (Perkins, Karelitz, Giedgowd, & Conklin, 2013), socioeconomic factors (Smith, Bessette, Weinberger, Sheffer, & Sherry, 2016), psychosocial factors (Puente et al., 2011), craving reactions to external stimuli (Dunbar, Shiffman, Kirchner, Tindle, & Scholl, 2014), and both negative and positive affective states (Norregaard, Tonnesen, & Petersen, 1993).

Among the most important precipitants of a lapse is momentary affective state. This can include both positive and negative mood sates. Indeed, recent work has demonstrated that negative affective states are related to cigarette cravings and subsequent lapses (Ferguson & Shiffman, 2014). Berlin et al. (2003) found that acute positive affect was related to increased smoking and risk of relapse (Shiffman et al., 2015). Findings overall have been mixed, with the majority of studies suggesting that lapses are related to negative affective states (e.g., Ameringer & Leventhal, 2010), while still others have found that lapses are more closely related to positive affective states, including good mood and relaxation (e.g., Vinci et al., 2017). One possible explanation for this discrepancy is that there are individual differences in the relative strength of positive and negative affective states as predictors of lapse. An intriguing possibility is that the relationship between affective state and lapse is sex-specific. Indeed, research has demonstrated that women are more likely to report negative affect as a driver of motivation to smoke (Perkins et al., 2013; Weinberger & McKee, 2012), whereas men are more likely to report positive affect as motivation for smoking and other drug use (Robinson et al., 2007). For example, in a study conducted by Syamlal, Mazurek, and Malarcher (2014), female smokers self-reported having higher rates of negative affect, than did men. In another study, women reported greater relief from a negative affective state when resuming smoking after overnight abstinence, compared to men (Perkins et al., 2013). Women also reported a desire to quit smoking as a way of coping with stress, compared to men (Perkins et al., 2013). Also not well studied is the degree to which smokers actually attribute their lapses to affective states. Such momentary awareness of lapse triggers may be critical in pinpointing loci of intervention.

The possibility that acute affective states are related to lapses in real time has received less attention. One study that did use real-time data to assess craving and lapses found that acute negative affect was predictive of lapses among smokers enrolled in a nicotine replacement trial (Ferguson & Shiffman, 2014). The possibility that the effects of such states are sex-specific remains largely unknown, yet vital to investigate. The purpose of this study, therefore, was to identify sex differences in relapse triggers during a quit attempt. We predicted that women would be more likely to attribute their lapses to negative affect, and men would be more likely to attribute a lapse to good mood and/or relaxation.

2. Methods

2.1. Participants

Participants were healthy adult smokers (n = 60) who responded to an ad requesting volunteers to make an unaided, 'cold-turkey' smoking cessation attempt as part of a larger research study (Erblich & Bovbjerg, 2004). To be eligible, participants were required to be current smokers of at least 5 cigarettes per day for at least 5 years, and at least 18 years of age. In addition, participants were required to score at least 8 out of 10 on a motivation to quit scale (Biener & Abrams, 1991). Finally, all participants met DSM-IV-TR criteria for current nicotine dependence. Participants were excluded if they reported: current ongoing treatment for nicotine dependence, current other substance abuse, history of hospitalization for a major mental illness, or current pregnancy. Because these criteria were listed in the recruitment advertisement, 96% of respondents were eligible for the study. The Institutional Review Board approved all investigative procedures.

2.2. Procedure

All participants came to the study site and provided written informed consent prior to engaging in study procedures. During this visit, they completed background questionnaires and scheduled a mutually-agreed upon target quite date within the next two weeks. Participants were asked to initiate a quit attempt on their quit date and reminded to do so on that day. For the first fourteen days, participants were asked to fill out a daily diary, recording smoking lapses, as well the triggers that precipitated the smoking episode. Participants were given $100 for their time when they returned to the lab to submit their diaries at the end of this two-week period. In addition, all participants received smoking cessation resources and referrals to encourage continued work toward cessation.

2.3. Measures

2.3.1. Background measures

Participants completed demographic and smoking history questionnaires as well as the Fagerstrom Test of Nicotine Dependence (FTND) (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). The FTND is a well-established six-item scale that assesses the strength of nicotine dependence and evidences excellent psychometric properties. The FTND was considered a potential covariate in the primary analysis. Two-thirds (n = 40) of the sample was male and one-third (n = 20) was female. The mean age of the sample was 41.3 years (SD = 6.4), 32 participants reported African American ethnicity, 12 reported Caucasian ethnicity, 10 reported Latino ethnicity, and 6 reported other ethnicities. Mean age at smoking initiation was 17.3 (SD = 5.8). Participants smoked an average of 17.7 (SD = 8.3) cigarettes per day for an average of 21.2 (SD = 9.4) years. The mean FTND score was 6.0 (SD = 1.8). No sex differences were observed in these variables.

2.3.2. Lapse triggers

Each participant was given a daily diary questionnaire to assess their smoking behavior through the first fourteen days of their quit attempt. Questions in the lapse daily addressed whether or not the participants smoked, the number of cigarettes smoked during the lapse, and the degree to which a series of seven common triggers precipitated the lapse. Triggers were: smoking cues, stress, bad mood, good mood, relaxing, boredom, and food. For each trigger, participants indicated on a scale of 0–10 to what degree their smoking episode was triggered by that item. Trigger questionnaires have also been successful in previous research (Ferguson & Shiffman, 2014; Shiffman et al., 2006). To reduce burden, for days with multiple lapses, participants were instructed to report on the first lapse of the day.

2.4. Data analysis

To address the study hypotheses, we conducted hierarchical linear modeling (HLM) analyses to evaluate the effects of sex on lapse triggers during the 14-day diary interval. In addition to allowing for random effects on intercepts and slopes, HLM provided the benefit of preventing listwise deletion of data from participants (n = 16) who sporadically did not have complete diary data across all 14 days, and provided a more flexible model without unrealistic variance assumptions (e.g., compound symmetry). Repeated measures were included in Level 1 and sex was included in Level 2. Cross-level interactions (i.e., Sex by Day) were explored as well.

3. Results

3.1. Background variables

Background variables were not found to be related to study outcomes (p's > 0.15). Not surprisingly, all participants reported smoking