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Predicting smoking relapse with a multidimensional versus a single-item tobacco craving measure

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ABSTRACT

Background: Research suggests that craving is a predictor of smoking relapse. Craving can be assessed by multiple item or multifactorial scales or by single items. However, no systematic comparisons of their prognostic validity or accuracy have been published.
Methods: The French versions of the 12-item Tobacco Craving Questionnaire (FTCQ-12) and the single craving item on the Minnesota Nicotine Withdrawal Scale (MNWS) are brief, valid, and reliable self-report measures of tobacco craving. In this secondary study, we analyzed data from French smokers with health-related problems enrolled in the Adjustment of DOses of NIcotine in Smoking (ADONIS) cessation trial. We estimated prediction models for each measure and compared their ability to distinguish correctly participants who relapsed from those who did not at 1–8 weeks after their quit date.
Results: Adjusted for all potential confounders FTCQ-12 risk score (RS; Factor 2, Expectancy plus Factor 4, Purposefulness) and MNWS craving were valid predictors of smoking relapse at endpoints measured 1–7 weeks apart. Prognostic accuracy of FTCQ-12 RS was greatest at 1–2 weeks follow-up compared to only 1 week for MNWS craving. Sensitivity for FTCQ-12 RS and MNWS craving was 85% and 53%, respectively.
Conclusions: FTCQ-12 RS suggests a relapse process involving urges and desires in anticipation of the positive benefits of smoking linked with intent and planning to smoke. Findings also suggest that FTCQ-12 RS may be a better predictor instrument for smoking relapse than MNWS craving.

1. Introduction

Cigarette smoking is a chronic disorder characterized by periods of abstinence and relapse. The prognosis of relapse after quitting is common (Shiffman et al., 2008). Trials of relapse prevention have been discouraging, although findings are strongest for interventions that attenuate craving and other withdrawal symptoms (Hajek et al., 2009). Considerable research also has tested the proposition that craving is a robust predictor of smoking relapse.

Depending on theoretical perspective, craving has been variously described as wanting to re-experience the effects of drug, strong subjective desires, irresistible urges, obsessive thoughts, relief from unpleasant withdrawal symptoms, the incentive motivation to self-administer a drug, expectation of positive outcomes, and nonautomatic cognitive processes. These distinct conceptualizations of craving have resulted in, not surprisingly, inconsistent approaches to measurement. Because drug addiction is a multiply determined disease and craving is one aspect of addiction, it follows that craving is best conceptualized as also multi-dimensional. Our empirical studies of alcohol (Tiffany et al., 2000), marijuana (Heishman et al., 2001; Singleton et al., 2002; Heishman et al., 2009), and tobacco (Heishman et al., 2003; Singleton et al., 2003; Heishman et al., 2008) craving suggest that tobacco craving is a complex admixture of (1) anticipation of relief from withdrawal or negative mood, (2) expectation of positive outcomes from smoking, (3) compulsive desire to smoke, and (4) intention and planning to smoke for positive outcomes.

A recent review concluded that there is a sufficient number of studies with positive results to support future studies of the prognostic utility of craving, but empirical support for craving as a predictor of relapse is weak and craving is neither a necessary nor sufficient condition of relapse (Tiffany and Wray, 2012). Inconsistency of results is complicated by lack of consensus on the operational definition of craving, defined variously as like, want, need, and desire as well as any urge or only a strong urge to use drugs (Kozlowski and Wilkinson, 1987; Sayette et al., 2000). Despite the distinctions, there is the general supposition that craving is indistinct from desire or wanting to use a drug (Tiffany and Wray,

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2012). Additional complications arise as the result of marked variability in craving across quitters over time (Shadel et al., 2011). Research has consistently demonstrated that craving is a powerful predictor of relapse at proximal follow-up assessments (Killen et al., 1991; Doherty et al., 1995; Swan et al., 1996; Killen and Fortmann, 1997; Shiffman et al., 1997; Etter and Hughes, 2006; McCarthy et al., 2006; Heffner et al., 2010; Powell et al., 2010; Cofta-Woerpel et al., 2011), but data are scarce concerning its predictive value for more distal follow-ups.

Smokers who relapse during the first week of a quit attempt may experience different types or intensities of urge to smoke than those relapsing at 1 month (Cofta-Woerpel et al., 2011). Accuracy can be further compromised by lapses because previously abstinent smokers who lapse are at risk for increased cigarette cravings (Shadel et al., 2011). Moreover, the prognostic utility of craving for cigarettes may vary across different population of smokers such as adolescents (Bagot et al., 2007), pregnant smokers (Oncken et al., 2009), or smokers with medical (Berlin and Singleton, 2008) or psychiatric comorbidities (Lo et al., 2011). Thus, whether craving is a clinically credible, consistent, and accurate predictor of smoking relapse is an important issue to resolve (Harrington, 1978; Hughes, 1987; Tiffany and Wray, 2012).

Although the statistical significance of predictive models is important to researchers, it will not benefit developers of relapse prevention interventions or clinicians needing a credible prognosis unless the association is strong and replicable (Tiffany and Wray, 2012). Beyond ordinary statistical significance, the following criteria also should be met: (a) data should be easy to obtain in a timely manner to make a prognosis, (b) calculations should be simple, and (c) accuracy should be demonstrated (Wyatt and Altman, 1995; Harrell et al., 1996; Vogenberg, 2009).

Several brief and valid measures of craving exist that fit the criteria including single item (Hughes and Hatsukami, 1986), multiple item (Welsch et al., 1999; Shiffman et al., 2000; West and Hajek, 2004; Etter, 2005), and multifactorial scales (Cox et al., 2001; Heishman et al., 2008). With rare exception (West and Ussher, 2010) there have been few studies of the potential advantages of multiple-item or multifactorial scales over single items (Tiffany and Wray, 2012), and no systematic comparisons of predictive validity have been published (West et al., 2006).

The quantification of a prognostic model is important because it narrows the error levels of clinical decisions, which might increase its use. Quantification, however, requires determination of an absolute threshold (cut-off) that accurately discriminates the presence or absence of smoking following a quit attempt (Shadel et al., 2011). We know of only one prognostic model that demonstrated adequate evidence of accuracy, although it involved methamphetamine (Galloway et al., 2009). Galloway et al. (2009) assessed craving weekly using a single item on a 0–100 scale ("*no craving*" to "*most craving ever experienced*"). Craving and relapse (biochemically validated self-reported methamphetamine use) was assessed weekly for follow-up periods ranging from 1 to 7 weeks. At a cut-off of 25, sensitivity or the probability that a person who actually relapsed had a positive screening test result was 47%. Accuracy was greatest 1–2 weeks subsequent to craving assessment, although elevated craving scores indicated a worse prognosis for as long as 2 months.

In this secondary analysis we aimed to compare a multifactorial measure with a single item measure of craving and to identify the best predictor(s) of smoking relapse or abstinence. To do this, we replicated the methods of Galloway et al. (2009) using data from the Adjustment of DOses of NIcotine in Smoking (ADONIS) study (Berlin et al., 2011). We compared a multifactorial measure of craving to smoke, the French brief version of the Tobacco Craving Questionnaire (FTCQ-12; Berlin et al., 2010), to an instrument with the single craving item of the Minnesota Nicotine Withdrawal Scale (MNWS; Hughes et al., 1994; Hughes and Hatsukami, 1986). We developed screening models for both measures to compare the relationship between craving and relapse across proximal to distal follow-up periods, ranging 1–8 weeks post-assessment. Prognostic accuracy was evaluated by how well the models discriminated participants who relapsed from those who did not.

2. Methods

2.1. Participants

We analyzed data from 310 smokers who participated in the Adjustment of DOses of NIcotine in Smoking (ADONIS) cessation trial. The trial took place at 21 smoking cessation outpatient sites in France. Smokers aged 18 years and over and reporting smoking at least 10 cigarettes per day for at least 5 years were included. None had been able to quit smoking previously. All had a history of smoking related diseases including coronary heart disease: history of stable or unstable angina pectoris, acute myocardial infarction; stroke, chronic obstructive pulmonary disease, peripheral arterial atherosclerosis, and upper and lower respiratory tract malignancies. Following written informed consent, participants were assigned randomly to either standard care or dose adaptation. The study was approved by the Ethics Committee of the Pitié-Salpêtrière Hospital, Paris, France.

The standard care group received nicotine patches with monthly dose decreases and buccal absorption nicotine replacement therapy (NRT) could be co-administered at the discretion of the investigator. In the dose adaptation group, the aim was a 100 percent (±5%) nicotine substitution with respect to the determination of saliva cotinine concentrations when the participants still smoked, i.e., before quit date and NRT daily doses were prescribed according to the previous week's saliva cotinine concentrations. Saliva cotinine concentrations were blinded in the standard care group. Participants also received counseling for at least 10 min at each weekly visit. Despite differences in daily nicotine dose and saliva cotinine concentrations, prolonged abstinence rates defined as continuous abstinence during the last month of the 3-month NRT administration were similar for both groups. Compliance with prescribed NRT dose was 94.6% in the dose adaptation group and 96.7% in the standard care group. Full details of the ADONIS study have been published elsewhere (Berlin et al., 2011).]

All measures reported in this paper were collected after a predefined quit date. Measures were completed on a paper and pencil data sheet, then entered by local investigators into web-based electronic charts and verified by research assistants. Consistent with Galloway et al. (2010) and others (Killen et al., 1991; Killen and Fortmann, 1997) that examined proximal assessment of factors affecting relapse, analyses were restricted to weekly assessments during an eight-week treatment period starting on quit date. Craving and smoking status were assessed simultaneously once weekly.

2.2. Measures

2.2.1. Smoking. Outcome was self-reported smoking status (abstinent = 0, smoking = 1) verified at weekly assessments by breath carbon monoxide (CO ≤ 8 ppm; Smokeanalyzer; Bedfont Scientific Ltd, Rochester, Kent, UK). Consistent with standards for intent-to-treat analyses, participants lost to follow-up were considered smoking, and missing data were counted as smoking.

2.2.2. Craving. Craving was assessed by the FTCQ-12 (Berlin et al., 2010) and the French version of the MNWS (Hughes and Hatsukami, 1986). The FTCQ-12 is a valid and reliable 12-item self-report instrument that assesses four dimensions of tobacco craving: Factor 1, *emotionnalité* (emotionality); Factor 2, *attente* (expectancy);

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