METACOGNITIVE PROCESSES IN SMOKING CESSATION: APPLYING LESSONS LEARNED FROM OBSESSIONS

by

ELIZABETH B. A. NOSEN

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Abstract

Cognitive theories of obsessions propose that unwanted thoughts become frequent, intense and persistent when people interpret them in overly meaningful ways and attempt to control them using problematic strategies. The present study examined the generalizability of this model to another form of unwanted, actively resisted intrusion—nicotine cravings. In this investigation, 178 individuals attempting to quit smoking completed several online questionnaires. Most participants were female (70.2%) and between the ages of 20 and 64. Analyses revealed that individuals who appraised their cravings in more catastrophic and personally significant ways experienced more severe problems with craving-related thoughts and were more likely to be smoking one month later. Use of suppression, punishment or worry control strategies did not contribute appreciably. Overall, findings support the hypothesized role of appraisals of the meaning of unwanted thoughts in the development of problematic intrusions. Results also suggest that maladaptive appraisals may contribute to difficulties in smoking cessation over and above established cognitive factors.
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Metacognitive processes in smoking cessation:

Applying lessons learned from obsessions

Introduction

The majority of people experience occasional unwanted thoughts, images and impulses that intrude into consciousness (Rachman & de Silva, 1978; Salkovskis & Harrison, 1984). While many individuals are able to quickly dismiss and forget these thoughts, others find them highly distressing and difficult to control. Particularly intense, recurrent and disturbing intrusive thoughts are referred to as obsessions and are a key feature of obsessive compulsive disorder (OCD; American Psychiatric Association (APA), 2000). Recent cognitive theories attempt to explain the development of obsessions and have helped psychologists develop new interventions to reduce the intrusiveness and distress associated with unwanted thoughts. Briefly, these theories suggest that the way people appraise unwanted intrusions determines how problematic these thoughts become; unwanted intrusions judged as important and personally relevant are theorized to be more distressing and more likely to recur (Rachman, 1997, 1998; Salkovskis, 1985).

Many obsessions take the form of repugnant and socially unacceptable types of thoughts (e.g., aggressing towards a vulnerable person, blaspheming in church). However, other kinds of unwanted intrusions can also become frequent, intense, and distressing. Clark and Rhyno (2005) defined an intrusive thought, image or impulse as “any distinct, identifiable, cognitive event that is unwanted, unintended, and recurrent. It interrupts the flow of thought, interferes in task performance, is associated with negative affect, and is difficult to control” (p. 4). Notably, this definition does not stipulate the content an intrusive thought must have. In line with this conceptualization, researchers have begun to investigate intense, recurrent and disturbing intrusive thoughts as elements of several psychological disorders, including insomnia (Harvey,
2001, 2005), generalized anxiety disorder (Wells, 2005), psychosis (Morrison, 2005), PTSD (Falsetti, Monnier, Davis, & Resnick, 2002; Falsetti, Monnier, & Resnick, 2005), depression (Wenzlaff, 2002, 2005) and addictions (Reynolds, Valmana, Kouimtsidis, Donaldson, & Ghodse, 2005; Salkovskis & Reynolds, 1994). Clark (2005) argues that the basic form of these cognitions is analogous across diagnoses, in accordance with Clark and Rhyno’s (2005) definition. The specific content of the intrusive thoughts varies considerably, however. For example, the intrusive thoughts in depression take the form of negative, self-referential thoughts (e.g., “I’m worthless”), while the cognitions in addictions take the form of cravings—intrusive urges regarding substance use (e.g., an image of lighting a cigarette).

Though designed to explain the distressing intrusions in OCD, cognitive theories of obsessions may also help explain the development of persistent and upsetting cognition in these other forms of psychopathology. Because the key element in these theories is appraisal of the meaning of an intrusive thought, the same processes that occur for obsessions should also occur for other types of unwanted, distressing, and actively resisted thoughts. Testing this possibility is important both for determining the validity of cognitive theories of obsessions and more broadly for understanding how unwanted thoughts become disturbing and persistent across psychological disorders. Accordingly, the purpose of the present study is to investigate the applicability of cognitive theories of obsessions to a different type of unwanted intrusive thought—specifically, the craving-related thoughts, images, and impulses experienced by individuals attempting to quit smoking cigarettes.

I chose to examine the generalizability of these theories to nicotine cravings for several reasons. First, cravings and obsessions share several important features: both involve intrusive unwanted ideation that is recurrent, distressing and actively resisted by the individual. The content of the respective intrusions, however, is dissimilar. Second, identifying and locating
individuals who are likely to be experiencing nicotine craving-related thoughts is straightforward, making cravings a practical type of unwanted thought to study. Finally, nicotine addiction is an important health issue in need of further research. Cigarette smoking causes the deaths of more than 45,000 Canadians each year (Illing & Kaiserman, 2004). Quitting smoking, however, is exceedingly difficult; only about 5% of smokers achieve long-term abstinence with a given quit attempt (Hughes, Keely, & Naud, 2004).

Research suggests that severity of cravings immediately after quitting is predictive of later smoking cessation relapse (Killen & Fortmann, 1997). Momentary assessment studies have supported this finding, and suggest that smokers are more likely to lapse following cravings experienced as more intense, persistent, and distressing (Shiftman, Engberg et al., 1997; Shiftman, Gnys et al., 1996; Shiftman, Hickcox et al., 1997). Despite this fact, researchers know relatively little about the psychological factors that affect the frequency and distress associated with cravings. Evidence suggests that individuals are more likely to lapse when they are less confident about their ability to successfully abstain from substance use, when they perceive more positive effects of use, and when they experience greater negative affect (Gwaltney, Shiftman, Balabanis, & Paty, 2005; Niaura et al., 2001; Shadel & Cervone, 2006; Shadel, Niaura, Goldstein, & Abrams, 2001; Shiftman, Paty, Gnys, Kassel, & Hickcox, 1996). However, further research is required to understand the dynamic processes underlying the regulation and function of these and other cognitive variables in cessation difficulty and relapse. Examining the applicability of cognitive theories of obsessions to craving-related thoughts may improve understanding of cravings and the mechanisms underlying cessation relapse.

Cravings: Unwanted Thoughts, Images and Impulses

Consensus on an appropriate definition of cravings has been difficult to achieve. The World Health Organization (WHO) defines craving as a strong desire or compulsion to take a
substance (WHO, 2006). Craving has also been conceptualized as a subjective motivational state similar to hunger (Shiffman, 2000), a behavioural intention to use a drug (Buydens-Branchey, Branchey, Fergeson, Hudson, & McKernin, 1997), the desire for the effects of a drug, independent of intention (Marlatt, 1985), or as a broad combination of these emotional, behavioural and cognitive motivations (Tiffany & Drobes, 1991). Conceptualizing cravings as a form of intrusive cognition may be a useful way to unite these various viewpoints, and may be particularly relevant for describing the unwanted and frustrating cravings that arise during substance use cessation. Researchers have conceptualized cravings as a form of intrusive thought not only in nicotine research (e.g., Salkovskis & Reynolds, 1994), but also in research investigating cravings for alcohol (Anton, Moak, & Latham, 1996; Malcolm, Herron, Anton, Roberts, & Moore, 2000), opiates (Reynolds et al., 2005), cocaine (Tunis, Delucchi, & Hall, 1994) and food (May, Andrade, Panabokke, & Kavanagh, 2004; Tiggemann & Kemps, 2005).

In a content analysis of smoker’s reports of their typical cravings, Shadel, Niaura, Brown, Hutchison, and Abrams (2001) confirmed that many smokers report a cognitive component to cravings, characterized by a thought, thought process, or an expectation of the consequences of smoking or not smoking. Individuals attempting to reduce their smoking frequently report experiencing distinct, intrusive thoughts like, “I would enjoy a cigarette right now” or “I can’t cope without a cigarette” and images like picturing oneself lighting up (Salkovskis & Reynolds, 1994). In online support forums for people attempting to quit smoking, cravings are often described as frequent, fleeting thoughts that “pop into the head”. Research has found that like other types of intrusions, cravings come and go over the course of the day (Shiffman, Engberg et al., 1997; Shiffman, Gnys et al., 1996) and are spontaneously evoked by environmental cues (Shadel, Niaura, & Abrams, 2004). Indeed, the conceptualization of cravings as intrusive thoughts is congruent with emerging dynamic models of the role of cravings in smoking lapse
and relapse (e.g., Gwaltney et al., 2005)

Many people attempting to quit smoking are bothered by intrusive craving-related thoughts, with the thoughts experienced as extremely difficult to ignore or control (Salkovskis & Reynolds, 1994). Indeed, urges to smoke appear to interfere with several cognitive processes (Cepeda-Benito & Tiffany, 1996; Zwaan, Stanfield, & Madden, 2000). Researchers have found, for example, that smoking urges are associated with reductions in working memory and information processing performance on both language comprehension and mental arithmetic tasks (Madden & Zwaan, 2001; Sayette & Hufford, 1994; Zwaan et al., 2000; Zwaan & Truitt, 1998).

Not surprisingly, nicotine cravings are distressing for smokers attempting to quit. In fact, cigarette cravings have been reported to be the most troubling withdrawal symptom for people during a four week smoking abstinence period (West, Hajek, & Belcher, 1989). Though people report that cravings decrease over time in both intensity and frequency, individuals who have been abstinent for months, and even years, report experiencing occasional distressing and intrusive urges to smoke (Daughton et al., 1999; Gritz, Carr, & Marcus, 1991).

In sum, cravings are distressing and recurrent and they interfere with cognitive processes. Further, severity of cravings is predictive of relapse. These features fit the Clark and Rhyno (2005) definition of unwanted intrusive cognition, and suggest that cognitive theories of obsessions may provide insight into cravings and smoking cessation. The discussion that follows will describe these theories in greater detail and discuss how these theories might apply to cravings.

Cognitive Theories of Obsessions

Cognitive theories of obsessions suggest that the process by which unwanted thoughts become problematic begins with the occurrence of a single intrusive unwanted thought. In obsessions, this would be a disturbing, socially unacceptable type of thought, such as a sudden
impulse to steer into oncoming traffic. In nicotine addiction, this would be a craving-related thought, such as an impulse to buy a pack of cigarettes. Cognitive theories of obsessions suggest that the meaning ascribed to this initial intrusive thought determines whether the thought will be transient or more persistent. Three types of appraisals are thought to be particularly maladaptive: overestimations of the importance of the thought, inflated sense of responsibility for the intrusion and predicted outcomes, and the desirability of maintaining perfect control over the thought.

Appraisals of importance. Cognitive theories of obsessions suggest that unwanted thoughts that are interpreted as revealing something significant about a person’s character will be more distressing and persistent. In an obsessional example, an individual who has an unwanted intrusive thought of hurting an innocent child might appraise this thought as meaning that he or she is an evil or uncontrollable person. Relative to cravings, an individual who has an intrusive impulse to ask a nearby smoker for a cigarette might also interpret this urge in a personal way, as an indicator that he or she is weak willed, out of control, or destined to fail in their attempt to quit smoking.

According to theory (Rachman, 1997, 1998), such negative self-reflections are inherently disturbing and motivate individuals to watch apprehensively for any recurrence of the original intrusion. In theory, monitoring for the presence of a particular thought unfortunately makes it more likely to be found. Reappearance of the thought reinforces appraisals of the importance of the cognition, confirming suspicions that the thought really is meaningful. This recurrence in turn makes the unwanted thought even more upsetting, beginning an escalating cycle of vigilance, thought recurrence and distress, that ultimately produces more frequent and disturbing intrusions.

These ideas have been supported by empirical research on obsessional types of unwanted intrusive thoughts in both clinical and non-clinical samples. Correlational studies confirm that
intrusions judged as more personally meaningful are more distressing (Rowa & Purdon, 2003; Rowa, Purdon, Summerfeldt, & Antony, 2005) and that more upsetting intrusive thoughts are judged to contradict important aspects of the self to a greater degree than less distressing thoughts (Rowa & Purdon, 2003). In an experimental study, Teachman, Woody and Magee (2006) found that participants who were (mis-) informed that unwanted thoughts are important and personally meaningful subsequently implicitly evaluated themselves as more dangerous. This suggests that beliefs about the meaning of unwanted thoughts can directly influence self-perception and evaluation. Appraisals of the importance of intrusive thoughts have also been correlated with intrusion frequency and controllability (Clark, Purdon, & Byers, 2000; Freeston, Ladouceur, Thibodeau, & Gagnon, 1992; Purdon & Clark, 1994a, 1994b).

Unfortunately, no research is available on appraisals of the personal meaning of cravings for individuals who are attempting to quit smoking. While many people likely view cravings as a mundane or natural consequence of smoking cessation, others may interpret them in overly personal and significant ways. Beliefs that craving-related thoughts mean that one is weak or out of control or that one’s efforts are futile may make people feel worse about both themselves and their attempt to quit smoking. According to cognitive theories, distress caused by these types of appraisals would foster the development of more frequent, intense, and distressing cravings. Further, previous research has associated depressive symptoms with poorer cessation outcome (Niaura et al., 2001; Shiffman, Paty et al., 1996). As such, these appraisals may also impact cessation success through their relationship with mood.

**Appraisals of responsibility and thought-action fusion.** Appraisals of responsibility refer to dysfunctional and unrealistic beliefs about the perceived consequences of having an unwanted intrusive thought, as well as one’s accountability for these consequences (Salkovskis & Forrester, 2002). Thought-action fusion (TAF) is one of the most widely researched forms of
these dysfunctional beliefs. TAF describes beliefs that having a thought about an action is morally equivalent to actually performing the action or that thinking about negative events makes them more likely to occur (Shafran & Rachman, 2004). In an obsessional example, a person plagued by the persistent image of his or her house burning down may believe that having this thought increases the probability of a house fire. In relation to smoking cessation, some people may believe that the occurrence of an intrusive image of lighting a cigarette increases the likelihood that they will actually lapse and be unsuccessful in their quit attempt, or they may believe that having the intrusive thought about smoking is almost as bad as actually smoking.

Appraisals of responsibility for an intrusion are closely tied to appraisals of the significance of the thought. In theory, individuals who believe their thoughts influence the outcome of external events are likely to also believe that their thoughts are inherently meaningful and important (Rachman, 1997, 1998). As with appraisals of importance, responsibility appraisals are thought to cause considerable distress and lead to vigilance for thought recurrence as well as actions taken to prevent the feared outcome. In a congruent, cyclical fashion, distress is theorized to increase the frequency, intensity, and persistence of the thoughts (Salkovskis & Forrester, 2002).

Individuals who believe that negative consequences result from uncontrolled intrusive thought have been found to experience more frequent intrusions (Clark, Purdon, & Wang, 2003). While most commonly implicated in OCD (Amir, Freshman, Ramsey, Neary, & Brigidi, 2001), TAF is also associated with other problems characterized by negative affect, such as depression and anxiety (Abramowitz, Whiteside, Lynam, & Kalsy, 2003; Muris, Meesters, Rassin, Merckelbach, & Campbell, 2001) and also occurs in normal samples (Rachman, Shafran, Mitchell, Trant, & Teachman, 1996). These findings support the conceptualization of TAF as a metacognitive process relevant to several domains of thought content.
Research on nicotine addiction suggests that some individuals attempting to quit smoking do perceive a strong connection between craving-related thoughts and actual relapse. Shiffman (1984) found that individuals who face a relapse crisis and are tempted to smoke, but do not actually end up smoking, experience significant drops in quitting self-efficacy and feelings of failure similar to those who actually do lapse. This supports the idea that a form of thought-action fusion may occur in some individuals whereby cravings are appraised similarly to actually smoking and that relapse is seen as more likely to occur as a direct result of having the craving-related thought, image or impulse. Indeed, these appraisals may influence (and be influenced by) confidence in one’s ability to abstain from smoking, which has been associated with both craving severity (Shadel & Cervone, 2006) and poorer cessation outcome (Garvey, Bliss, Hitchcock, Heinold, & Rosner, 1992; Shiffman et al., 2000).

Appraisals of control. Cognitive theories of obsessions propose that appraisals of importance and responsibility create an urge to try to control the thoughts. According to theory, individuals who believe their unwanted and upsetting thoughts mean something important about them, or that thoughts increase the probability of a feared event occurring, will also likely feel it is important to control such thoughts as a means of reducing distress and preventing undesirable outcomes (OCCWG, 1997). Cognitive theories of obsession suggest that efforts to control thoughts contribute to the persistence of unwanted thoughts in several ways. In particular, attempts to control intrusive thoughts are theorized to increase the probability that the unwanted thoughts will come to mind, resulting in preoccupation with the thoughts and strengthened beliefs in the meaning of the thoughts (Purdon & Clark, 1999).

Research suggests that several specific thought control techniques may be particularly unhelpful, including worry, punishment, and suppression strategies. Worry (i.e., ruminating, focusing attention on lesser concerns) and punishment (i.e., criticizing oneself for experiencing
intrusions) have been correlated with symptoms of OCD (Abramowitz, Whiteside, Kalsy, & Tolin, 2003; Amir, Cashman, & Foa, 1997), PTSD (Roussis & Wells, 2006), GAD (Coles & Heimberg, 2005), and schizophrenia (Morrison & Wells, 2000). Following successful treatment for OCD, individuals show significant decreases in use of punishment as a thought control strategy (Abramowitz, Whiteside, Kalsy et al., 2003). No research to date has investigated the relationship between worry and punishment strategies and difficulties in smoking cessation.

Thought suppression, which involves an effort to control unwanted thoughts by actively trying not to think the thought, is also problematic and has been documented to produce a paradoxical increase in the occurrence of intrusive thoughts (Abramowitz, Tolin, & Street, 2001). Wegner, Schneider, Carter, and White (1987) first demonstrated the problems with this thought control strategy in their classic “white bear” studies. In this paradigm, researchers instructed participants to think of anything except a white bear. As anyone who tries this activity quickly sees, participants think of lots of white bears. As maybe evident, researchers believe that thought suppression contributes to the development of a frequent and persistent unwanted thoughts (Rachman, 1997, 1998; Salkovskis, Richards, & Forrester, 1995). In addition to fostering recurrence of unwanted cognitions, suppression strategies are thought to have the additional negative effects of increasing vigilance and thought monitoring, and strengthening maladaptive appraisals of the meaning of thoughts. See Purdon (2004) for review. Further, failure to control one’s thoughts can be a significant source of distress for individuals who believe the thoughts are inherently meaningful and that they should be able to control them (Purdon & Clark, 1999; Tolin, Abramowitz, Hamlin, Foa, & Synodi, 2002).

Not surprisingly, numerous empirical studies have associated use of suppression strategies with severity of OCD symptoms (Rassin, Muris, Schmidt, & Merckelbach, 2000; Smári & Hólmsteinsson, 2001; Tolin, Abramowitz, Przeworski, & Foa, 2002). Correlational
studies have found that negative appraisals of unwanted thoughts predict use of thought suppression, which in turn predicts OCD symptoms (Rassin et al., 2000; Smári & Hólmsteinsson, 2001). Experimental studies have found that thought action fusion and responsibility appraisals predict discomfort with thought recurrences in both normal samples (Purdon, 2001) and individuals with OCD (Purdon, Rowa, & Antony, 2005). Indeed, individuals with OCD judge their failure to control their thoughts as more personally meaningful than do other individuals (Tolin, Abramowitz, Hamlin et al., 2002). Use of thought suppression has also been correlated with symptoms of PTSD (Ehlers, Mayou, & Bryant, 1998), specific phobia (Muris, Jongh, Merckelbach, Postema, & Vet, 1998), depression (Wenzlaff & Luxton, 2003), and insomnia (Harvey, 2001; Ree, Harvey, Blake, Tang, & Shawe-Taylor, 2005).

With regards to cigarette smoking, empirical studies suggest that people trying to quit smoking do attempt to control their craving-related thoughts, but the relationship between use of specific control strategies, problematic cravings, and difficulties quitting smoking is unclear. Salkovskis and Reynolds (1994) found that all individuals attempting to reduce their smoking reported trying to suppress smoking-related intrusive thoughts or images to some extent over the previous month. They relied on a single retrospective item in this assessment, however, which may have questionable reliability. This same study found that individuals instructed to suppress intrusive thoughts about smoking subsequently experienced more frequent intrusions than individuals instructed to either monitor their thoughts or monitor and relax.

Reynolds et al. (2005), in contrast, failed to replicate this finding in a sample of opiate or multi-substance dependent inpatients; they found that deliberate thought suppression did not increase the frequency of substance-related intrusions. Based on the idea that using thought suppression techniques would make quitting smoking more difficult, Toll, Sobell, Wagner, and Sobell (2001) found that current smokers (i.e., unsuccessful quitters) scored higher on a general
measure of thought suppression than ex-smokers (i.e., successful quitters). The cross-sectional formulation of current and ex-smokers as unsuccessful and successful quitters respectively is somewhat debatable, however. Contributing to the uncertainty of these findings, Haaga and Allison (1994) found no association between the use of thought suppression strategies and maintenance of non-smoking over a one-year period. Further research on this issue is required to clarify these discrepancies.

In line with cognitive theories of obsessions, failures in thought control may be particularly distressing for individuals who believe it is both important and possible to control their cravings perfectly. Indeed, some individuals trying to quit smoking may view their inability to fully control craving related thoughts as an indication that they will be unable to successfully quit. Shiffman’s (1984) previously discussed finding supports this possibility by suggesting that cognitive indications of control failure (i.e., smoking urges) elicit feelings of failure and decreases in self-efficacy similar to overt behavioural failures (i.e., smoking lapse). This may be particularly problematic given the strong relationship between poor confidence in one’s ability to maintain abstinence and subsequent relapse (Garvey, Bliss, Hitchcock, Heinold, & Rosner, 1992; Shiffman, Balabanis, & Paty, 2000).

In summary, cognitive theories of obsessions suggest that individuals who appraise unwanted intrusions in maladaptive ways (e.g., place excessive importance on thoughts, fuse thoughts with actions, believe it is both important and possible to exert complete control over thoughts), and who use dysfunctional thought control strategies (e.g., suppression, punishment, worry), will experience more recurrent, distressing and persistent intrusive thoughts. Empirical evidence from the study of obsessions is supportive of these suppositions. As this model is not explicitly dependent on thought content, however, similar processes should also operate with regards to other types of intrusive thoughts that are distressing, unwanted, and actively resisted.
(i.e., cravings). Because of the role that cravings appear to play in difficulty quitting smoking, maladaptive appraisals and thought control strategies would also be expected to be associated with the success people experience with their cessation effort.

Very little research has examined these issues. No studies to date have explicitly investigated the generalizability of cognitive theories of obsessions. As well, little is known about how individuals attempting to quit smoking appraise craving related thoughts, images and impulses or whether these appraisals are related to relapse. Whether individuals who are struggling with cravings use thought suppression or other maladaptive control strategies to cope with the thoughts and whether these strategies are successful also remains unclear. Accordingly, the present research will explore these preliminary questions in an online, questionnaire-based study.

Method

Procedure

Participants completed all questionnaires over the internet, facilitated by a Web-based survey development and hosting service (SurveyMonkey.com). Questionnaires were protected with SSL encryption. Informal pilot testing was conducted with volunteers from the university and community to ensure survey functionality across browsers and operating platforms. Participants were recruited through links placed on smoking cessation websites and postings in online discussion forums, and through advertisements placed in transit stations, universities, hospitals and health centers in the Vancouver area. In the early stages of data collection, participants were informed that they would be entered into a draw for a $200 gift certificate in appreciation for their time \((n = 87)\). In the later stages of data collection, participants received an honorarium for their participation, in the form of a $20 cheque mailed to their home \((n = 94; \$15\) for completion of main study questionnaires, \$5 for follow-up). Small procedural differences
existed between the draw and $20 honorarium incentive conditions; these are described in more
detail below.

In both conditions, eligible participants clicked on a hyperlink to access the survey through their internet connection. Clicking the link opened the survey in their browser. Before completing the questionnaires, participants were asked if they had one hour available at present to complete the survey. If they clicked on the "yes" response, the survey directed them to the informed consent page; the survey asked individuals clicking the "no" response to please return when they had more time available to complete the survey. The informed consent page provided information about the purpose of the study, participation requirements, and confidentiality. This page informed participants that the survey would take approximately 45 minutes and that they should begin the survey only when they had enough time to complete it. The consent also informed participants that questionnaire responses would be stored in a secure, encrypted database, and that their answers would remain confidential and would be presented in aggregate format only. Participants were instructed that they could complete the survey as many times as they liked, but that they would be entered into the draw or receive the honorarium one time only.

After clicking the "next" button at the bottom of the informed consent page, participants were directed to a page assessing demographic questions, followed by the questionnaires. Much like a paper-based survey, each individual questionnaire (e.g., the Thought Control Questionnaire) occupied its own page, with questionnaire-specific instructions provided at the top of each page. The number of items on each page corresponded to the number of items in each measure. Participants selected their answers to multiple-choice questions by clicking on a box positioned just below their chosen response; a check mark appeared to indicate the participant's answer. A small percentage of questions required a typed response. Participants continued through the survey by clicking a "next" button at the bottom of each page. Participants were not
permitted to continue to the proceeding page if any responses were missing; at the end of each page, a notification would inform participants exactly which questions, if any, remained unanswered. Participants were not allowed to return to a previous page once they had moved on to the next. A heading at the top of each page informed participants how far they had progressed through the survey (e.g., page 6/11).

Questionnaires were presented in one of three counterbalanced orders (see Measures section for orders). Counterbalancing was accomplished by creating three separate surveys (one for each order), with each survey associated with a unique web address. Versions were identical, and only the order in which questionnaires were presented varied.

Upon completion of all the questionnaires, a question asked participants if they would like their data to be used in study analyses. This question informed participants of the importance of using valid data for the research, and asked participants to indicate not to use their data if they thought, for any reason, that their answers did not accurately reflect their true opinions (e.g., did not actually read the questions, answered randomly, filled it out pretending to be someone else). This page also informed participants that they would be entered into the draw or receive $15 for their completion of the study thus far, regardless whether they indicated their data should be used. Following this question, a debriefing page appeared which described the study (without revealing hypotheses) and listed some commonly available smoking cessation resources. This debriefing informed participants that they would receive an email with a link to the brief follow-up survey one month later.

The procedures differed slightly between the draw and honorarium incentives, as follows.

Draw incentive. Under the draw incentive, recruitment advertisements directed interested individuals to the study website, where they could learn more about the research and participate by clicking on a direct link to the study. Upon following the website link, participants responded
to several multiple-choice eligibility-screening questions. After clicking the "next" button at the bottom of the screening page, participants who met study eligibility requirements proceeded to the informed consent form, while ineligible individuals advanced to a page informing them of their ineligibility and thanking them for their time. The consent form under the draw incentive asked participants to provide both their email and home mailing addresses, but not their name. The consent form justified this request by explaining that the winner of the draw would be contacted via email and mailed the gift certificate. This explanation also stressed the confidentiality and security of all personal information. The questionnaires followed the consent page. In the draw condition, I counterbalanced questionnaire order versions by rotating the survey link placed on the study website between orders once every three days. As such, the order of the questionnaires completed by a respondent depended on the particular day the participant elected to fill out the survey. Participants in the draw condition received an additional entry into the draw for completing the follow-up survey. Including the screening, consent, questionnaires and debriefing pages, individuals completing the survey under the draw incentive proceeded through a total of 19 web screens. In this incentive condition, 65% of participants completing the first page of the survey \( (n = 156) \) finished the questionnaires \( (n = 102) \). Of these individuals, 100 \( (98\%) \) asked that the researchers use their data; 84 of these participants were used in final analyses (see inclusion/exclusion criteria for details). Follow-up data were available for 69\% \( (n = 58) \) of these participants.

**$20 incentive.** Under the $20 incentive condition, more stringent screening methods were implemented to ensure participant validity. Advertisements instructed interested individuals to call or email the investigators for more information and to participate. Upon contacting the lab, research assistants screened participants via telephone or email using the same eligibility questions asked online in the draw incentive. At the time of the screen, all participants provided
their first and last name, email address, telephone number and mailing address. The researchers justified this request by explaining that the honorarium cheque would be mailed to participants and that their information would be completely confidential and secure. The researchers subsequently sent an email with a link to the study to eligible participants. In this incentive condition, participants were randomly assigned to receive one of the three counterbalanced questionnaire orders. The consent form informed participants that they would receive the full $20 for completing both the main study and the one-month follow up. Including the consent, questionnaires and debriefing pages, individuals completing the $20 incentive version proceeded through a total of 17 web screens. Under the $20 incentive condition, 97% of participants completing the first page of the survey finished the questionnaires. Of these individuals, 111 (99%) asked that the researchers use their data; 94 of these analyses were used in final analyses (see inclusion/exclusion criteria for details). Follow-up data were available for 96% (n = 90) of these participants.

Inclusion criteria. Participants were required to be 19 years of age or older and currently engaged in a serious effort to quit smoking (with either gradual or complete reduction in reported cigarette use). Participants were only included in the sample if they had reduced their smoking by at least five cigarettes per day. Participants were also excluded if they had smoked for less than one year prior to the current attempt to quit, smoked less than 10 cigarettes per day (on average) during their most recent year of regular smoking, or had initiated their current quit attempt more than six months ago. Participants were also required to be fluent in English.

Case exclusion. A total of 210 individuals completed the survey and asked that the researchers use their data. As questionnaires were completed online, several extra precautions were taken to ensure the validity of data. Prior to analyses, cases were first examined for adherence with the aforementioned eligibility criteria; participants whose subsequent responses
did not match the screening criteria were excluded from analyses \((n = 18)\).

In addition, cases were screened for repeat participation by examining the IP addresses associated with responses. Under the draw incentive, two IP addresses occurred more than once: one address associated with two cases and one address associated with three cases. As I did not have the names of these participants, I was not able to tell if these were individuals participating multiple times or different people from the same household. As such, all five of these cases were removed from further analyses. Two duplicate IP addresses were found in the $20 incentive group. Examination of names and home addresses suggested that these participants were different people from the same household. These cases were retained for analyses.

As well, in the interests of excluding participants who appeared unlikely to have read all of the questionnaire items, the amount of time taken by participants to complete the survey was examined. This feature of the survey software records the time elapsed between the minute an individual first opens the survey and the moment all pages of the survey are completed. As such, it can accurately identify the amount of time taken to complete a survey when the survey was completed in one sitting. During pilot testing, individuals who were highly educated and also very familiar with the questionnaires took approximately 35-40 minutes to complete the full survey while skimming questions and selecting random answers (to test the programming).

Not including participants with abnormally long completion times (i.e., over two hours, \(n = 20\)), participants in the current study completed the survey in an average of 46.14 minutes \((SD = 15.30)\). Only 5% of participants completed the survey in less than 25 minutes. As such, completion times of less than 25 minutes were taken to indicate individuals unlikely to have read and adequately considered all the questions. These cases were discarded from subsequent analyses \((n = 7)\).
Participants

After removal of invalid cases, the final sample was comprised of 178 participants. The average age of participants was 38.77 years (SD = 10.22). The majority of the sample was female (70.2%), Caucasian (94.4%), and employed full-time (55.6%). Most participants had completed a post-secondary degree (45.5%), and resided in Canada (37.1%), the United States (32.6%) or the United Kingdom (23.6%).

Prior to their current attempt to quit smoking, participants had smoked fairly heavily (Mdn = 20 cigarettes per day, range = 10 - 50 cigarettes) and for a long period of time (Mdn = 19.50 years, range = 1 – 48 years). Nearly everyone (97%) had seriously attempted to quit smoking at least once before (Mdn = four times, range = 0 – 100 times), with their longest previous quit attempt lasting a median of 3 months (range = < 1 day - 14 years). Participants initiated their current attempt to quit smoking a median of 21 days before participation (range = 1 – 190 days), and had reduced their smoking by an average of 20.66 cigarettes per day (SD = 8.19, range = 5 - 50 cigarettes). At the time of the first assessment, most participants (80.9%) were fully abstinent from smoking (Mdn = 0 cigarettes per day, range = 0 - 10).

The most commonly reported cessation method among participants was a complete, abrupt stop in cigarette use (i.e., quitting “cold turkey”; endorsed by 49.4% of sample). Many participants also reported using nicotine replacement aids (42.7%), participating in an online, telephone or in-person support group (24.2%), gradually reducing the amount they smoked (19.1%), using prescription (12.4%) or non-prescription (3.9%) medication, or receiving acupuncture (1.1%), hypnosis (1.7%) or psychotherapy (0.6%)¹.

Measures

Appraisals of Cravings Questionnaire (ACQ). This self-report measure contains 17 items

¹ 45.5% of participants reported using more than one cessation method.
reflecting maladaptive appraisals of the meaning of unwanted and intrusive nicotine craving-related thoughts, images or impulses. Respondents are provided with a definition of intrusive craving-related thoughts, images and impulses and examples of craving themes and content. Participants are asked to provide examples of two intrusive nicotine craving-related thoughts, images or impulses that they have recently experienced. Respondents then complete single-item ratings of the distress, intensity of the urge to smoke, frequency and recency of the intrusions. For the purposes of the current study, participants also rated the extent to which their craving-related thoughts were intrusive, unwanted, unintended, and difficult to control. Following this, respondents rate their level of belief (0 - 100) within the past 2 weeks for each statement, as related to the two intrusions they recorded on the questionnaire. Generally, statements assess degree of belief that craving-related thoughts are personally significant (e.g., “These thoughts reveal something important about me”), directly tied to the success of one’s attempt to quit smoking (e.g., “Having this unwanted thought means I will act on it”) and need to be controlled (e.g., “It is important for me to cancel out or block the craving-related thoughts”). The ACQ was developed for the purposes of the current study, to assess problematic appraisals of the meaning of craving-related thoughts. This measure is based on the Interpretations of Intrusions Inventory (III; OCCWG, 1997, 2003), which assesses interpretations or appraisals that can be made of obsessional types of intrusive thoughts. The III has shown good internal consistency, test-retest reliability and convergent validity (OCCWG, 2003). The III was modified to be more applicable to nicotine craving-related intrusions in several ways. To begin, the obsessional themes and content provided in the III instructions were replaced with nicotine craving-related themes and content generated through pilot testing and consultation of past research on craving-related thoughts (Salkovskis & Reynolds, 1994). Several minor wording modifications were also made throughout (e.g., replacing “intrusive thought” with “intrusive
craving-related thought”), and the single item rating of urge intensity was added. Other than this, the basic design of the ACQ is identical to that of the III, including response format and wording of instructions and items.

In developing the ACQ, several waves of pilot testing were conducted with colleagues, undergraduate volunteers, and anonymous individuals recruited through an online smoking cessation forum. As a part of this testing, respondents were asked to report any questions, comments or confusion they had about survey items. Piloting suggested that several III items were confusing and unclear when applied to typical nicotine craving related thoughts (e.g., “this thought could harm people” and “now that I’ve thought of something bad that could go wrong, I have a responsibility to make sure it doesn’t happen”). These items were subsequently removed from the scale, leaving 21 of the original 31 III items in the measure. After psychometric evaluation (see Results section), 10 of these items were retained for the final ACQ.

To ensure that items covered an adequate range of appraisals, 11 items derived from the 18-item Personal Significance Scale (PSS; Rachman, 2001) were also added. The PSS is another measure used in OCD research and treatment, and is designed to identify inferences individuals make about themselves based on an unwanted intrusive thought. The wording of these items was modified to fit the format of the III items. For example, the PSS item, “Is it important for you to cancel out or block the thoughts?” was changed to “It is important for me to cancel out or block the craving related thoughts.” I also modified the content of some of the items to be more relevant to craving-related thoughts. For example, the item, “Do these thoughts mean that you might lose control and do something awful?” was changed to “These thoughts mean that I might lose control and act on the thought”. Following psychometric evaluation, four PSS items were retained for the final measure.

Finally, eight appraisal items with smoking specific content were added (e.g., “If I don’t
control this thought, I am likely to start smoking again”, “Even if I quit, I am never going to stop craving cigarettes”). Two of these items were retained for the final ACQ following psychometric evaluation. Please see the Results section for further information on the derivation of final ACQ items and available psychometrics.

Catastrophic Appraisals Index (CAI). The CAI is an empirically derived scale comprised of 10 items that were initially part of the ACQ, but that are analyzed separately due to infrequent endorsement. Compared to the items of the ACQ, CAI items reflect more extreme, catastrophic interpretations of cravings (e.g., “I will go crazy if I do not stop thinking these thoughts”, “If I don’t control these thoughts I will be punished”). Though participants rated these items on the same scale as the rest of the ACQ items, CAI items were rendered dichotomous for analysis (0 = did not believe this idea at all, 1 = some degree of belief in this idea). Total scale scores reflect frequency of endorsement of extreme appraisals of craving-related thoughts. Further information on the development and the psychometric properties of the CAI is presented in the Results section. Please see Appendix for the complete ACQ and CAI; the scale to which each item belongs is indicated in parentheses.

White Bear Suppression Inventory (WBSI; Wegner & Zanakos, 1994). The WBSI is a 15-item self-report questionnaire that measures individuals’ general tendency to suppress intrusive thoughts. Items are answered on a five-point Likert-type scale. The WBSI has demonstrated good internal consistency, test-retest reliability, and convergent validity (Muris, Merckelbach, & Horselenberg, 1996). Though designed to be used as a unidimensional scale, recent evidence suggests that the WBSI is actually comprised of two factors—one assessing use of thought suppression and the other assessing the experience of intrusive thoughts (Höping & de Jong-Meyer, 2003; Rassin, 2003). Researchers have recommended measuring these constructs separately to avoid biasing assessment towards failure in thought control (Höping & de Jong-
Meyer, 2003; Rassin, 2003). As such, only the six items loading on the thought suppression factor as identified in Höping and de Jong-Meyer’s (2003) study were used in the current analyses. Scores are obtained by summing across items, with higher scores indicating stronger tendencies to suppress unwanted intrusive thoughts. Cronbach’s alpha for the suppression subscale was .83 in the current sample, suggesting good internal consistency.

Thought Control Questionnaire (TCQ; Wells & Davies, 1994). The TCQ is a 30-item self-report measure designed to assess use of five strategies of controlling unwanted intrusive thoughts: distraction, punishment, reappraisal, social control, and worry. Each subscale consists of six items. Participants rate how often they use particular strategies when experiencing unwanted thoughts on a four-point scale ranging from never to almost always. Only the punishment and worry subscales, thought to represent dysfunctional control strategies (McKay & Greisberg, 2002), were used in the current study. The TCQ has demonstrated good test-retest reliability and convergent validity (Wells & Davies, 1994). In the current sample, Cronbach’s alphas for the worry and punishment subscales were .79 and .61 respectively, suggesting adequate internal consistency.

Obsessional Beliefs Questionnaire (OBQ; Obsessive Compulsive Cognitions Working Group (OCCWG), 1997, 2003). The OBQ is a self-report measure of beliefs that characterize obsessive thinking in three highly correlated domains: Importance of Controlling Thoughts, Perfectionism, and Inflated Responsibility. The beliefs measured by this scale are intended to represent “enduring trait-like conceptions about the role and function of unwanted distressing intrusive thoughts, images or impulses” (OCCWG, 2003, p. 875). Appraisals, on the other hand, such as those measured by the ACQ, are thought to reflect the “immediate, situational cognitive processing of specific intrusions into consciousness” (OCCWG, 2003, p. 875). The OBQ was therefore used in the current study to examine the relationship the ACQ, CAI and broader, trait-
like obsessional types of beliefs. In this measure, participants rate the extent to which a given statement is typical of their way of looking at things on a Likert scale ranging from 1 (disagree very much) to 7 (agree very much). The OBQ has demonstrated excellent internal consistency, test-retest reliability and convergent validity (OCCWG, 2003; Woods, Tolin, & Abramowitz, 2004). In the current sample, Cronbach’s alpha for the three subscales ranged from .85 to .90, suggesting good internal consistency.

Thought–Action Fusion Scale-Revised (TAF-R; Shafran, Thordarson, & Rachman, 1996)
The TAF-R was included as an independent measure of the tendency to fuse thoughts and actions. This instrument is composed of 19 items, each rated on a 5-point Likert-type scale. Items reflect beliefs that thoughts are morally equivalent to action and directly increase the likelihood of events occurring. Items are summed to create a total scale score. The TAF-R has demonstrated good reliability and validity in both obsessional and non-obsessional samples (Rassin, Merckelbach, Muris, & Schmidt, 2001; Shafran et al., 1996). Cronbach’s alpha was .92 in the current sample, suggesting excellent internal consistency.

Obsessive Compulsive Drinking Scale-Revised, Smoking Version (OCDS-RS; Morgan, Morgenstern, Blanchard, Labouvie, & Bux, 2004). The OCDS-R is a 10-item self-report measure originally adapted from the Yale-Brown Obsessive Compulsive Scale (Goodman et al., 1989), and is designed to assess obsessive compulsive dimensions of alcohol and drug use urges. Questions are answered on a 0-4 Likert-type scale. Participants in the present study answered questions in reference to their experience with cigarette craving-related thoughts, images or impulses; minor wording modifications (e.g., substituted “smoking” for “drinking/using”) were made. Only the 6-item subscale assessing “obsessional” aspects of cravings (Anton, Moak, & Latham, 1995) was used in analyses. Items on this subscale assess the frequency, distress, controllability, persistence, and interference associated with craving-related thoughts. Items are
summed to create an index of craving severity. The OCDS obsessional subscale has
demonstrated excellent internal consistency, test-retest reliability and concurrent validity (Anton
et al., 1995). Cronbach’s alpha in the current sample was .85, suggesting good internal
consistency.

*Center for Epidemiological Studies Depression Scale–Short Form* (CES-DS; Kohout,
Berkman, Evans, & Cornoni-Huntley, 1993). The short form of the CES-D is an 11-item self-
report measure designed to assess depressive symptoms in non-psychiatric community samples.
Participants rate how often they have experienced symptoms during the past week on a three
point scale (*hardly ever or never, some of the time, much or most of the time*). This version of the
CES-D has obtained stable and desirable psychometrics across multiple samples (Carpenter et
al., 1998). Cronbach’s alpha was .84 in the current sample, suggesting good internal consistency.

*The Smoking Self-Efficacy Questionnaire* (SSEQ; Etter, Bergman, Humair, & Perneger,
2000). The SSEQ is a 12-item instrument used to estimate an individual’s confidence in his or
her ability to abstain from smoking in a variety of potentially high-risk situations. Individuals
indicate their level of temptation to smoke in these situations on a five-point scale ranging from 1
(*not at all sure that I would not smoke*) to 5 (*absolutely sure that I would not smoke*). Items are
summed to create an index of cessation self-efficacy. This measure has shown good internal
consistency and test-retest reliability (e.g., Webb, Simmons, & Brandon, 2005) and has
demonstrated good content, construct and predictive validity (Etter et al., 2000). Cronbach’s
alpha in the current sample was .95, suggesting excellent internal consistency.

*The Smoking Effects Questionnaire* (SEQ; Rohsenow et al., 2003). The SEQ assesses
participants’ positive and negative expectations of the consequences of smoking cigarettes. The
33 items are comprised of two higher-order factors reflecting positive and negative expectations
about the effects of smoking. The positive expectations scale (SEQ-pos) assesses beliefs that
smoking will reduce negative affect, provide stimulation, control weight, and have desirable social effects. The negative expectations scale (SEQ-neg) assesses beliefs that smoking will have negative physical effects, undesirable psychosocial effects, and elicit concern over future health. Respondents rate their belief that smoking will have a particular effect on a 0 (false), 1 (true and not at all important), 2 (true and moderately important), 3 (true and very important) scale. Subscales are calculated by averaging relevant item ratings. The SEQ shows good psychometric properties among adults currently smoking as well as those attempting to quit; the scales have high internal consistency and show good convergent validity (Rohsenow et al., 2003). Cronbach’s alphas for the SEQ-positive and SEQ-negative subscales were .88 and .84 respectively, suggesting good internal consistency.

The Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). This measure assesses physiological nicotine dependence on a six-item scale. Generally, items assess the number of cigarettes smoked per day, difficulty refraining from smoking and smoking in the morning. Participants completed the FTND with reference to their pattern of smoking prior to quitting. The FTND has demonstrated satisfactory internal consistency, retest reliability, and convergent validity (Heatherton et al., 1991; Pomerleau et al., 1994). Participants provided details of their current and past cigarette smoking (e.g., duration of regular smoking, quit methods) alongside the FTND. Cronbach’s alpha in the current sample was .65, suggesting acceptable internal consistency.

Questionnaire orders. Questionnaires were administered in one of three counterbalanced orders, as follows: Order 1: Demographics, FTND and smoking history, OBQ, TAFS, SEQ, CES-DS, WBSI, TCQ, SSEQ, ACQ and CAI, OCDS-RS; Order 2: Demographics, ACQ and CAI, OCDS-RS, SSEQ, SEQ, TCQ, WBSI, CES-DS, TAFS, OBQ, FTND and smoking history; Order 3: Demographics, CES-DS, OBQ, ACQ and CAI, TAFS, OCDS-RS, SEQ, WBSI, FTND.
and smoking history, TCQ, SSEQ. As preliminary analyses revealed no order effect, questionnaire order was not included as a covariate in reported analyses.

Follow-up questionnaire. Participants completed a brief follow-up survey one month after completing the other questionnaires. Items assessed details of participants' recent smoking habits, including self-reported cessation status and use of cigarettes, cigars, other tobacco products and nicotine replacement aids over the past week. If applicable, participants also completed single item ratings of the difficulty of quitting smoking over the past week and 1-week and 1-year confidence in ability to abstain from smoking. For the purposes of the current study, participants were classified as “smoking” if they reported smoking any cigarettes over the past week and “not smoking” if abstinent.

Results

All control and study variables were first examined through various SPSS programs for missing values, outliers, and fit with the assumptions of multivariate analysis. No cases had missing data. One extreme value for the number of cigarettes smoked since the participant began his or her quit attempt was recoded as a missing data point. Two responses on number of years of education completed were incongruent with other information provided by the participants; these scores were replaced with the mean number of years of schooling reported by people attaining similar educational achievement levels. The remaining univariate outliers, all extremely high scores, were replaced with scores one point greater than the next adjacent value. This procedure affected four scores on the OBQ importance/control subscale, two scores on TAF- Likelihood-Self subscale, one score on the TCQ punishment subscale, and four responses for the number of times a participant had previously attempted to quit smoking.

Cases were screened for multivariate outliers through SPSS regression. Based on Mahalanobis distances at $p < .01$, two cases were identified as multivariate outliers and removed.
from the sample, leaving 178 cases for analyses.

**Differences between incentive conditions.** Individuals participating under the draw incentive had quit smoking more recently than had people participating under the $20 incentive ($M = 23.42$ days, $SD = 29.81$ vs. $M = 42.90$ days, $SD = 43.23$, $t(176) = -4.44, p < .01, d = -0.67$). There were also fewer females in the draw incentive (62% vs. 78%; $\chi^2(1, N = 178) = 5.25, p < .05$), fewer people on antidepressant medication (6% vs. 26%; $\chi^2(1, N = 178) = 12.47, p < .05$), more people living outside North America (60% vs. 4%; $\chi^2(1, N = 178) = 64.12, p < .01$), and fewer people not currently working or attending school (12% vs. 31%; $\chi^2(1, N = 178) = 9.31, p < .01$). As there were no significant differences between groups on any of the other measures ($t$'s (176) < 1.82, $p$'s > .05), the samples were combined for analyses.

**Factors associated with follow-up completion.** Respondents were significantly more likely to complete the follow-up when participating under the $20 incentive (96% vs. 69%; $\chi^2(1, 148) = 22.57, p > .01$). Participants who did not complete the follow-up had quit smoking more recently ($M = 13.37, SD = 13.10$ vs. $M = 37.83$ days, $SD = 40.79$; $t(176) = -3.45, p < .01, d = -0.52$) and had attempted to quit fewer times in the past ($M = 4.27, SD = 4.36$ vs. $M = 7.03$ times, $SD = 10.53$; $t(176) = -2.01, p < .05, d = -0.30$). Participants who did not complete the follow-up were also more likely to live outside North America (56% vs. 25%; $\chi^2(1, n = 148) = 11.84, p < .01$). Participants completing the follow-up did not score significantly different on any of the questionnaires than those who did not complete the follow-up, $t$'s (176) < 1.59, $p$'s > .05.

Provided in Table 1 are descriptive statistics for study questionnaires, calculated using both the full sample ($N = 178$) and only participants completing the follow-up ($n = 148$). All statistical analyses were conducted at a two-tailed alpha level of .05.

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2 Variable logarithmically transformed prior to analysis.

3 Variable corrected via square root transformation prior to analysis.
**ACQ and CAI Development**

*Appraisals of Craving Questionnaire (ACQ).* In selecting the final ACQ items, item distributions were first visually inspected. Items with restricted variability and/or extreme skew were removed from the scale (18 items; please see the section on CAI development for more information on some of these items). Items were also removed if they did not correlate strongly with total scale scores and their removal would not adversely affect the internal consistency of the scale (six items).

Next, an exploratory factor analysis was performed on the remaining 17 items. This analysis was conducted through SPSS 11.0 using a principal axis extraction. The aim was to estimate the dimensionality of the final ACQ and to identify any items to exclude on the basis of poor factor loadings (< .45). Kaiser’s Meyer Olkin measure of sampling adequacy was .92, suggesting that the analysis should yield reliable factors (Field, 2000). Bartlett’s test of sphericity was also significant ($\chi^2(136) = 1671.05, p < .01$), confirming the presence of a relationship between the variables.

Three factors with eigenvalues greater than one were extracted, accounting for a cumulative 63.59% of the scale variance. Eigenvalues were 7.75, 1.80 and 1.23, accounting for 45.6%, 10.61% and 7.38% of the variance in the ACQ respectively. Investigation of the scree plot confirmed a clear break between the 1st and 2nd factors, and all items loaded highly on the first factor. Based on this information, I chose to use the ACQ as a unidimensional scale. Item content, communalities and factor loadings are shown in Table 2.

Cronbach’s alpha for the final 17-item ACQ was .92, suggesting excellent internal consistency. The majority of participants believed (to at least some degree) that craving-related thoughts are personally significant, directly tied to the success of their quit attempt, and need to be controlled. Most participants only partially believed these appraisals, with an average rating
of 4.22 \((SD = 2.19)\) on the 10-point belief scale. Total scale scores ranged from 0 (indicating complete disbelief of all appraisals) to 170 (indicating complete belief in all appraisals).

**Catastrophic Appraisals Index (CAI).** Ten of the items removed from the ACQ due to infrequent endorsement appeared to share a common “catastrophic” theme (e.g., “I will go crazy if I do not stop thinking these thoughts”, “If I don’t control these thoughts I will be punished”). These items seemed to center on beliefs that cravings could lead to mental instability, punishment or condemnation, or suggest that one is a bad person, an impostor, or out of control. Given the extreme nature of these appraisals, low endorsement rates are not surprising. However, a substantial minority of participants appeared to believe these appraisals to at least some extent. In the interest of investigating the importance of these appraisals, I created an empirically derived index of the infrequently endorsed “catastrophic” items. Items selected for this scale were endorsed (to any degree) by less than 50% of participants. These items were rescored dichotomously: responses of “0 - I did not believe this idea at all” to were coded as a “0”, while any other ratings (scores of 10-100) were coded as a “1”. Total scale scores reflect frequency of endorsement of extreme appraisals of craving-related thoughts.

Cronbach’s alpha for the CAI was .88, suggesting good internal consistency. Scores ranged from 0 (indicating complete disbelief of all appraisals) to 10 (indicating some degree of belief in all appraisals). On average, participants endorsed some degree of belief in approximately four catastrophic appraisals \((SD = 3.24)\). CAI scores correlated strongly with ACQ scores \((r = .61, p < .01)\).

**Concurrent validity.** To investigate the convergent validity of the ACQ and CAI, correlations with other measures of obsessive types of beliefs were examined. Bivariate correlations between the ACQ, CAI and the OBQ and TAFS are presented in Table 3. As anticipated, all measures were positively related. Correlations were generally moderate in size.
Generalizability of Cognitive Theories of Obsessions

The main purpose of this study was to examine the generalizability of cognitive theories of obsessions. In investigation of this question, I examined the characteristics of participants’ intrusive craving-related thoughts and the relationships between appraisals of cravings, thought control strategies, and severity of problems with craving-related thoughts.

Characteristics of craving-related thoughts. All participants were able to provide at least one example of a craving-related thought they had experienced since beginning their quit attempt. Commonly reported intrusions included images of oneself or others enjoying a cigarette, urges to light up in characteristic situations (e.g., after eating), thoughts that smoking would help one cope with negative affect, ideas that smoking would be acceptable under certain circumstances (e.g., if kept to a puff or two), and impulses to buy a pack or ask a nearby smoker for a cigarette. On 6-point scales ranging from “not at all” to “extremely”, participants reported that craving-related thoughts were “greatly” unwanted and unintended ($M = 4.50, SD = 1.25; M = 4.75, SD = 1.20$, respectively), and “moderately” upsetting, difficult to control and intrusive ($M = 3.71, SD = 1.54; M = 4.01, SD = 1.44; M = 4.06, SD = 1.45$, respectively).

Craving-related thoughts were typically accompanied by a “moderate” intensity urge to smoke ($M = 4.20, SD = 1.24$). The majority of participants experienced an intrusive craving-related thought in the past 24 hours (71.3%) and experienced these types of thoughts several times per day (60.1%). The intensity of the accompanying urge to smoke was strongly related to how distressing ($r = .73, p < .01$), difficult to control ($r = .66, p < .01$) and intrusive ($r = .63, p < .01$) craving-related thoughts were perceived to be, and modestly associated with how unwanted ($r = .32, p < .01$) and unintended they were ($r = .17, p < .05$). Urges to smoke were stronger when craving-related thoughts were more frequent ($r = .40, p < .01$) and more recent ($r = .34, p < .01$).
Problematic appraisals and thought control strategies. Cognitive theories of obsessions suggest that individuals who interpret unwanted thoughts in more negative, personally significant ways try to control their thoughts using unhelpful strategies. To examine whether this is true with regards to craving-related thoughts, I examined the relationship between appraisals of craving-related thoughts (ACQ and CAI scores) and use of thought suppression (WBSI), worry (TCQ) and punishment (TCQ) control strategies. Results revealed small to moderate correlations between measures. Individuals who appraised craving-related thoughts as more negative and personally meaningful (as indicated by higher ACQ scores) tended to respond to unwanted thoughts with more self-criticism (TCQ-punishment; \( r = .37, p < .01 \)), rumination (TCQ-worry; \( r = .20, p < .01 \)) and cognitive avoidance (WBSI-suppression; \( r = .34, p < .01 \)). Similarly, endorsement of more catastrophic interpretations of craving-related thoughts (as indicated by higher CAI scores) was associated with greater use of punishment (\( r = .32, p < .01 \)), worry (\( r = .22, p < .01 \)), and suppression (\( r = .27, p < .01 \)) control strategies.

Metacognition and concurrent problems with craving-related thoughts. Cognitive theories of obsessions posit that unwanted thoughts will be more frequent, distressing and intense for individuals who appraise them in overly meaningful ways and respond to them with unproductive control strategies. In investigating whether this was true for craving-related thoughts, I initially examined several study variables for possible inclusion as control variables.

Three smoking history variables were transformed to reduce the number of outliers and improve their distributions. Duration of the current and longest previous quit attempt were both strongly positively skewed; logarithmic transformations corrected these distributions. The frequency of previous quit attempts was positively skewed and corrected through a square-root transformation.

Severity of craving-related thoughts (OCDS-RS scores) correlated significantly with two
smoking history variables: (log of) the number of days ago a participant quit smoking \( (r = -0.36, p < .01) \), and (square root of) frequency of previous quit attempts \( (r = 0.19, p < .05) \). Greater frequency, distress and intensity of craving-related thoughts (OCDS-RS scores) was also associated with more positive expectations about the effects of smoking (SEQ-pos; \( r = 0.33, p < 0.01 \)), more negative mood (CES-DS; \( r = 0.37, p < .01 \)) and poorer cessation self-efficacy (SSEQ; \( r = -0.50, p < .01 \)). OCDS-RS scores were unrelated to gender, years of education, use of antidepressant medication, duration of regular smoking, nicotine dependence score (FTND), (log of) duration of longest previous quit attempt, negative expectations about smoking (SEQ-neg), or incentive, \( r^2 \leq 0.09, p^2 > 0.05 \). Between-subjects analyses of variance revealed that there were no significant differences in severity of craving-related thoughts based on country of residence or employment status, \( F^2 (3, 174) \leq 0.44, p > .05 \).

Using relevant control variables, I examined partial correlations in investigation of the main study hypotheses. Table 4 shows the relationship between metacognitive variables, control variables and the frequency, distress and persistence of craving related thoughts. Both zero-order and partial correlations controlling for the time elapsed since participants began the current quit attempt, frequency of previous quit attempts, negative mood (CES-DS), positive expectations about effects of smoking (SEQ-pos) and cessation self-efficacy (SSEQ) are presented. After taking other predictors of craving severity into account, problems with craving-related thoughts were associated with more maladaptive appraisals (higher ACQ scores), more catastrophic appraisals (higher CAI scores) and greater use of punishment thought control strategies. In other words, people experiencing more frequent, intense and distressing craving-related thoughts interpreted their cravings in more negative, personally significant ways and felt it was important to try and perfectly control their cravings. These same individuals tended to try to control unwanted thoughts using punishment strategies. Despite small but significant zero-order
correlations, use of thought suppression and worry control strategies were not related to severity of craving-related thoughts after accounting for other control variables.

Thought control strategies as mediators of appraisal effect. Researchers theorize that part of the mechanism by which maladaptive appraisals lead to more frequent, distressing and intrusive unwanted thoughts is through use of problematic thought control strategies. Failure in these control strategies is presumed to strengthen maladaptive appraisals of the meaning of the thoughts and efforts to control thoughts, which ultimately produces more frequent and distressing intrusions. Thus, in application to the current study, these theories predict that use of problematic thought control strategies would at least partially mediate the relationship between negative interpretations of the meaning of craving-related thoughts and severity of problems with craving-related thoughts.

Of the thought control variables measured for this study, only punishment was significantly related to craving severity after accounting for control variables. As such, a mediation analysis was undertaken to investigate the extent to which punishment strategies explain the relationship between appraisals (ACQ and CAI scores) and craving severity (OCDS-RS scores). This analysis was conducted using standardized residual scores; that is, the effects of cessation duration, frequency of previous quit attempts, negative mood (CES-DS), positive expectations about effects of smoking (SEQ-pos) and self-efficacy (SSEQ) were removed from all variables prior to analysis.

Analyses were conducted in accord with established principles for testing mediation models (Baron & Kenny, 1986; Preacher & Hayes, 2001). The first step is to test whether the predictor is significantly associated with the dependent variable. As indicated earlier, strong positive correlations were found between maladaptive appraisals (ACQ scores) and craving severity (OCDS-RS scores), $B = 0.33$, $SE = 0.07$, $t (178) = 4.57$, $p < .01$. Findings were
congruent when using CAI scores as the measure of problematic appraisals, $B = 0.17$, $SE = 0.07$, $t (178) = 2.34$, $p < .05$. The second step of mediation analysis is to test whether the predictor is significantly associated with the hypothesized mediator. As previously mentioned, moderate correlations were found between ACQ scores and punishment ($B = 0.33$, $SE = 0.07$, $t (178) = 4.64$, $p < .01$) and between CAI scores and punishment ($B = 0.27$, $SE = 0.07$, $t (178) = 3.68$, $p < .01$). In the third step of mediation, the hypothesized mediator must be related to the dependent variable after controlling for the predictor. However, analyses revealed that punishment was not significantly associated with OCDS-RS scores after partialling out ACQ scores, $B = 0.08$, $SE = 0.08$, $t (178) = 0.99$, $p > .05$. Results were the same when CAI scores were used as the predictor variable, $B = 0.14$, $SE = 0.08$, $t (178) = 1.79$, $p > .05$. Thus, as this step is required for both full and partial mediation, these data do not support the mediational model.

**Metacognitive Factors in Cessation Outcome**

The second purpose of the current study was to examine whether cognitive theories of obsessions could contribute to understanding difficulties in smoking cessation. Because of the hypothesized relationship between metacognitive responses to cravings and craving severity, I anticipated that both maladaptive appraisals and thought control strategies would predict future smoking after controlling for known predictors of cessation difficulty. In investigation of this possibility, the prospective relationship between appraisals of cravings, thought control strategies and one-month cessation status was examined. Individuals reporting any recent cigarette use at follow-up were classified as “smoking” (47.3% of sample), while individuals not smoking over the previous week were classified as “abstinent” (52.7% of sample).

**Differences between smoking and abstinent participants at follow-up. Before**

investigating the relationship between metacognitive variables and cessation outcome, study variables were examined for possible inclusion as control variables. Compared to abstinent
individuals, t-tests revealed that participants smoking at the one-month follow-up had been regular smokers for a shorter period of time before quitting ($M = 18.60$ years, $SD = 1.24$ vs. $M = 22.66$ years, $SD = 11.33$; $t (146) = 2.26, p < .05, d = .37$), and had quit smoking more recently ($M = 31.31$ days, $SD = 44.10$ vs. $M = 43.68$ days, $SD = 36.87$; $t (146) = 3.54, p < .01, d = .61$).

Individuals smoking at follow-up had also attempted to quit more times in the past ($M = 8.22$ times, $SD = 12.96$ vs. $M = 5.96$ times, $SD = 7.68$; $t (146) = -2.15, p < .05, d = -.36$), and were less confident in their ability to abstain from smoking (as indicated by SSEQ scores). Statistics comparing smoking and abstinent individuals at follow-up on study questionnaires are available in Table 1. There were no significant differences between individuals smoking or maintaining abstinence on years of education, nicotine dependence score (FTND), (log of) duration of longest previous quit, positive or negative expectations about smoking (SEQ), or negative mood, $t$'s ($146) \leq 1.52, p$'s $>.05, d$'s $\leq .25$. Chi-squared analyses revealed no significant differences between smoking and abstinent individuals with regards to survey incentive version, gender, country of residence, employment status, or anti-depressant medication use, $\chi^2$'s ($n = 148) \leq 1.22; p$'s $>.05$.

**Prediction of cessation outcome.** Interpretation of the role of individual predictors in logistic regression is problematic when predictors are highly correlated (Tabachnick & Fidell, 2001). In this case, ACQ and CAI scores are highly correlated ($r = .61$) and are hypothesized to be related to the criterion in similar ways. As such, to gain the clearest understanding of the role of maladaptive appraisals in cessation outcome, analyses were run separately for the ACQ and the CAI.

Two sequential logistic regression analyses were performed in examination of predictors of 1-month smoking status (smokers: smoking any amount over previous week vs. non-smokers: abstinent during past week). In both analyses, relevant control variables (length of time smoking
before quit, duration of quit attempt, frequency of previous quit attempts, SSEQ scores) were entered as predictors in the first step, with problematic control strategies (TCQ-punishment, TCQ-worry, WBSI-suppression) entered in the second step in prediction of smoking outcome. In both analyses, appraisals were entered in the third step, with one analysis including the ACQ and the other analysis including the CAI as measures of maladaptive appraisals. Analyses were performed using SPSS 11.0 Binary Logistic Regression.

A test of the first step (with control variable predictors) against a constant-only model was statistically reliable, \( \chi^2 (4, n = 148) = 42.03, p < .01 \), indicating that the control variable predictors reliably distinguished between individuals smoking or abstinent at one-month follow-up. The control variables accounted for approximately 33% of the variance in cessation outcome (-2 Log likelihood = 162.71; Cox and Snell \( R^2 = .25 \); Nagelkerke \( R^2 = .33 \)), and correctly predicted cessation outcome for 74.3% of participants. Table 5, Step 1 provides the regression weights and errors, Wald statistics and odds ratios for this step of the analysis. According to the Wald criterion, significant control variable predictors of smoking status were number of years smoking regularly before attempting to quit, (log of) duration of quit attempt and SSEQ scores.

Punishment, worry and suppression, introduced in the second step, did not explain a significant proportion of variance in smoking status incremental to control variables, \( \chi^2 (3, n = 148) = 3.72, p > .05 \), though a test of the full model (with both control and problematic control strategies together) against a constant-only model was statistically significant, \( \chi^2 (7, n = 148) = 45.74, p < .01 \). At this point, the model accounted for approximately 36% of the variance in cessation outcome (-2 Log likelihood = 159.00; Cox and Snell \( R^2 = .27 \); Nagelkerke \( R^2 = .36 \)) and correctly predicted cessation outcome for 72.3% of participants. Based on the Wald criterion (see Table 5, Step 2), the significance of individual control predictors did not change with the addition of the thought control strategies. Significant predictors of smoking status at this stage of
analysis were the number of years participants had been smoking regularly before attempting to quit, the duration of the participants' quit attempt (log of) and SSEQ scores. Use of worry, punishment or suppression did not contribute significantly to the prediction of cessation outcome.

**Using ACQ as indicator of maladaptive appraisals.** Maladaptive appraisals (ACQ scores), introduced together in the third step, explained a significant proportion of variance in smoking status incremental to control variables and thought control strategies, $\chi^2 (1, n = 148) = 5.41, p < .05$. A test of the full model (with both control and metacognitive variables together) against a constant-only model was statistically significant, $\chi^2 (8, n = 148) = 51.16, p < .01$. Thus, the predictors as a set reliably distinguished between participants smoking or abstinent at one-month follow-up. Together, the predictors accounted for 39% of the variance in smoking status, (-2 Log likelihood = 153.58; Cox and Snell $R^2 = .29$; Nagelkerke $R^2 = .39$). The analysis correctly classified 79.5% of individuals not smoking and 70.0% of individuals smoking at follow-up, for an overall success rate of 75.0%. Hosmer and Lemeshow's goodness-of-fit test for this analysis was not statistically significant ($\chi^2 (8, n = 148) = 5.06, p > .05$), suggesting the model adequately fits these data.

Statistics for the full ACQ model can be found in Table 5, Step 3. According to the Wald criterion, significant predictors of smoking status when all variables were entered were number of years smoking before attempting to quit, (log of) duration of quit attempt, SSEQ scores and maladaptive appraisals of cravings (ACQ). As such, participants were more likely to be smoking at the one-month follow-up if they had smoked regularly for fewer years ($OR = 0.96$), quit smoking more recently ($OR = 0.42$), were less confident about their ability to successfully abstain ($OR = 0.95$) and believed that craving-related thoughts meant something negative and personally significant ($OR = 1.02$). When entered with the other predictors, use of thought
control strategies (worry, punishment, suppression) did not contribute significantly to the prediction of cessation outcome.

Using CAI as indicator of maladaptive appraisals. In a separate analysis, CAI scores were entered in the third step of the logistic regression as the measure of maladaptive appraisals. Results were nearly identical to the previous analysis (using the ACQ). Catastrophic appraisals (CAI scores) explained a significant proportion of variance in smoking status incremental to control variables and thought control strategies, $\chi^2 (1, n = 148) = 5.57, p < .05$. A test of the full model (with both control and metacognitive variables together) against a constant-only model was statistically significant, $\chi^2 (8, n = 148) = 51.31, p < .01$, indicating that the predictors as a set reliably distinguished between participants smoking or abstinent at one-month follow-up.

Together, the predictors accounted for 39% of the variance in smoking status, (-2 Log likelihood $= 153.43$; Cox and Snell $R^2 = .29$; Nagelkerke $R^2 = .39$). Compared to when the ACQ was used, the analysis using the CAI correctly classified slightly fewer individuals not smoking (78.2% vs. 79.5%) and slightly more individuals smoking at follow-up (74.3% vs. 70.0%), for an overall success rate of 76.4%. As before, Hosmer and Lemeshow's goodness-of-fit test for this model was not statistically significant ($\chi^2 (8, n = 148) = 6.89, p > .05$), suggesting an adequate fit to these data.

When using the CAI, the contribution of individual predictors was very similar to the analysis using the ACQ (see Table 5, Step 3). According to the Wald criterion, participants were significantly more likely to be smoking at the one-month follow-up if they had smoked regularly for fewer years ($OR = 0.96$), quit smoking more recently ($OR = 0.38$), attempted to quit more frequently in the past ($OR = 1.58$), were less confident about their ability to successfully abstain ($OR = 0.95$) and believed that craving-related thoughts meant something catastrophic ($OR = 1.18$). As before, when entered with the other predictors, thought control strategies (worry,
punishment, suppression) did not contribute significantly to the prediction of cessation outcome.

Discussion

The present study supports the generalizability of key aspects of metacognitive theories and implicates maladaptive appraisals in smoking cessation difficulty. Analyses revealed that individuals who interpreted their cravings as more catastrophic, personally significant and tied to cessation failure and who felt their cravings needed to be perfectly controlled experienced more severe problems with craving-related thoughts and were more likely to be smoking one month later. Punishment was the only thought control strategy associated with concurrent craving severity; this relationship disappeared after partialling out maladaptive appraisals. Use of suppression, punishment or worry control strategies did not contribute appreciably to the prediction of one-month cessation outcome.

Maladaptive Appraisals of Cravings

Characteristics of craving-related thoughts. As anticipated, all participants were able to provide examples of craving-related thoughts they had personally experienced since beginning their quit attempt. Congruent with Clark and Rhyno's (2005) definition of intrusive thoughts, the majority of participants experienced their craving-related thoughts as unwanted, unintended, intrusive, distressing, and difficult to control. Thus, while the content of craving-related thoughts is clearly distinct from obsessional types of intrusions, these forms of cognition share several important characteristics.

Types of appraisals. Theory and research from the field of obsessions suggest that unwanted intrusive thoughts become problematic when people interpret them in negative, overly personal and significant ways (Purdon & Clark, 1994a; Rachman, 1997). In obsessions, these maladaptive appraisals consist of beliefs that intrusive thoughts mean something important about oneself (e.g., I am dangerous or out of control), have direct external consequences (i.e., make it
more likely that something undesirable will occur), and need to be controlled. While previously considered a relatively unique facet of obsessions, the present study suggests that people make similar types of appraisals about intrusive craving-related thoughts.

The majority of participants believed (to at least some extent) that craving-related thoughts mean that they are weak, that their attempt to quit smoking is destined to fail, and that they need to cancel out or block the thoughts. While most individuals only partially believed these ideas (with an average belief rating of 4.2 on a 0 - did not believe this idea at all to 10 - was completely convinced this idea was true scale), a small proportion of individuals believed these ideas quite strongly. A substantial minority of individuals took it even further, endorsing beliefs that craving-related thoughts mean that they are out of control, or that the thoughts will lead to insanity, punishment or condemnation. Indeed, participants endorsed some degree of belief in an average of four catastrophic-type appraisals. Overall, these findings are intriguing, because they suggest that these types of negative appraisals are not exclusive to traditional obsessional thought content. In other words, intrusive thoughts do not need to be bizarre or socially unacceptable for people to overestimate their power or personal significance. This is an important prerequisite to establish when investigating the generalizability of cognitive theories of obsession to other types of unwanted intrusive thoughts.

*Maladaptive appraisals, craving severity and cessation outcome.* Cognitive theories of obsessions suggest a reciprocal relationship between appraisals and intrusions (i.e., maladaptive appraisals encourage thought recurrence, reoccurrences strengthen appraisals). Ultimately, this cycle is thought to produce more frequent, intense, persistent and distressing intrusions. In support of these theories, empirical studies of obsessions have demonstrated a correlational relationship between intrusion frequency, distress and controllability and appraisals of importance, responsibility and need for control (Clark et al., 2000; Clark et al., 2003; Freeston et
al., 1992; Purdon & Clark, 1994a, 1994b). As the key element in these theories is appraisal of the meaning of an intrusive thought, not specific thought content, then the same processes that occur for obsessions should also occur for other types of unwanted, distressing, and actively resisted thoughts.

Results of the current study support this tenet. People who interpreted their craving-related thoughts as indicating something negative or catastrophic about themselves or their quit attempt and who felt that cravings need to be perfectly controlled experienced more frequent, distressing, and persistent craving-related thoughts. As another way to think about it, the more people struggled with craving-related thoughts, the more they believed that these intrusions meant something significant and unpleasant. This relationship remained after accounting for several other predictors of craving frequency and intensity (including the duration of participants’ quit attempt). The fact that this finding was replicated in a study of craving-related thoughts speaks strongly to the relationship between maladaptive appraisals and the persistence of distressing, intrusive thoughts. Indeed, results support the veracity of this important element of cognitive theories of obsessions.

In the prospective component of the study, individuals who interpreted their cravings as more catastrophic, personally significant and tied to cessation failure and who felt a stronger need to control these thoughts were more likely to be smoking one month later than individuals who endorsed fewer of these meaningful appraisals. This relationship held up even after accounting for use of problematic thought control strategies and several well known predictors of cessation success (including time elapsed since quitting smoking and cessation self-efficacy). Results did not differ appreciably when using ACQ or CAI scores in assessment of maladaptive appraisals. These findings are particularly noteworthy as they suggest that maladaptive appraisals of the meaning of cravings have important repercussions for smoking cessation outcome.
As predicted by cognitive theories, maladaptive appraisals of cravings may influence cessation success through their impact on the frequency, distress and persistence of cravings. Indeed, previous research has demonstrated a relationship between craving severity and subsequent cessation outcome (Killen & Fortmann, 1997; Shiffman, Hickcox et al., 1997). While the current results provide preliminary support for this mode of action, further studies capable of establishing a causal relation are necessary. A strength of the current study lies in its prospective design; thus, the temporal order of the appraisal-smoking outcome relationship is clear. While this is an important prerequisite of causality, experimental evidence is required to rule out the possibility that the effects of maladaptive appraisals are actually secondary to craving severity, cessation difficulty or another variable.

Indeed, participants were already actively engaged in their attempt to quit smoking. To varying degrees, they were already experiencing urges to smoke, nicotine withdrawal and episodes of successful and unsuccessful abstinence. It is very likely that these experiences affect appraisals of cravings. For example, persistent, intense craving-related thoughts are likely to elicit more negative, personally meaningful appraisals than are fleeting, infrequent thoughts of smoking. Conceptually then, maladaptive appraisals not only influence, but also are influenced by, experiences with cravings and cessation difficulty. Disentangling the specific causal actions underlying these reciprocal relationships is not possible in correlational designs. Researchers have noted this problem in the obsessional literature as well (e.g., Teachman et al., 2006).

Nevertheless, results of the current study suggest that examination of appraisals may contribute to understanding difficulties in smoking cessation over and above several established cognitive factors. Accordingly, it may be useful to consider the role of problematic appraisals in cognitive models of substance use relapse. Several empirically supported models of addiction and relapse suggest that individuals are more likely to lapse when they are less confident about
their ability to successfully abstain from substance use, when they perceive more positive effects of use, and when they experience greater negative affect (Marlatt, 1996; Niaura, 2000). Moderate to strong relationships were found between these factors and maladaptive appraisals of the meaning of craving-related thoughts. Individuals who appraised cravings as meaning something negative about themselves or their likelihood of success and who believed their craving-related thoughts needed to be controlled felt more depressed and less confident in their ability to abstain from smoking. They also expected that smoking would have more positive effects. While the source and casual directionality of these relationships is unknown, these findings merit further research. Maladaptive appraisals of cravings may contribute to the development of poorer mood, self-efficacy or expectations (and vice versa). As such, problematic appraisals of cravings may represent a useful point of intervention for cognitive-behavioural relapse prevention strategies targeted at modification of self-efficacy, mood or expectations about smoking.

Indeed, exploring the utility of targeting maladaptive appraisals in smoking cessation treatment programs may be useful. Current psychological cessation treatments tend to address cravings from a problem-solving and skills-training perspective. Individuals are typically instructed in behavioural techniques to avoid and alter smoking triggers and in basic cognitive strategies to counteract the effects of these thoughts. Cognitive strategies include confronting or challenging thoughts about smoking, bringing the benefits of non-smoking and the unpleasant aspects of smoking to mind, diverting attention from smoking and focusing on one’s successes and strengths (Abrams et al., 2003). Appraisals of the meaning of craving-related thoughts, as investigated in the current study, are not explicitly targeted.

Cognitive theories of obsessions, however, have helped psychologists develop new interventions to reduce the intrusiveness and distress associated with unwanted thoughts. A key component of these therapies involves challenging maladaptive appraisals of the meaning of
intrusions (Clark, 2000). It may be beneficial to apply these techniques to the cravings experienced during smoking cessation. This may involve, for example, examining evidence for beliefs that cravings need to be perfectly controlled, that they are directly linked to smoking behaviour, that they reflect poorly on one’s character, and that terrible things could occur as a result of experiencing them. Certainly, this type of intervention strategy would be easily integrated into existing treatment modules focused on challenging thoughts about smoking. Targeting problematic appraisals of craving-related thoughts may help reduce the frequency, intensity and distress associated with cravings and consequently improve chances of cessation success.

**Measurement of Appraisals.** To date, there are no other published self-report measures assessing appraisals of the meaning of cravings. As such, it is important to note that the psychometric properties of the ACQ and CAI have not been adequately demonstrated. In particular, further research is required to investigate the content and concurrent validity of these measures.

While the ACQ and CAI correlated positively with measures assessing obsessional types of beliefs, these correlations were relatively small. Research suggests that the Interpretations of Intrusions Inventory (III; OCCWG, 2001, 2003), upon which the appraisals of craving measures were based, correlates with the OBQ subcales at r’s ranging from .35 to .63 in OCD and non-OCD samples (Steketee, 2005). In the current study, correlations between the measures of appraisals of cravings and the OBQ subscales ranged from .29 to .39. It is likely that the relationship between ACQ, CAI and obsessional types of beliefs is subdued by differences in target thought content. Nevertheless, further investigation of the convergent (and divergent) validity of these measures is necessary.

Because the ACQ and CAI were derived from measures of obsessional types of
appraisals, it is also important to keep in mind that these measures do not cover all content areas relevant to smoking cessation. Future research investigating the utility of the ACQ and CAI for smoking cessation may wish to broaden their scope to include other types of smoking-specific appraisals. Several participants, for example, described craving-related thoughts like "I’m going to crave cigarettes for the rest of my life", "I won’t be able to cope with work or marital stress without smoking" and "happiness and joy are unattainable without cigarettes." Others expressed ideas that their identity had changed in some meaningful, negative way, or that cravings interfere with their ability to regulate their emotions or function well cognitively. As with the appraisals assessed in the current study, these beliefs may be associated with craving severity and cessation difficultly. Future research should consider adding these and other problematic appraisals to those already addressed by the ACQ and CAI.

**Suppression, Punishment and Worry Control Strategies**

*Thought control strategies and maladaptive appraisals.* Cognitive theories of obsessions predict that individuals who appraise their craving-related thoughts in negative, overly significant ways will try to avoid or control their thoughts as a means of reducing distress and preventing undesirable outcomes (OCCWG, 1997). The current study supports this hypothesis: more negative and personally significant interpretations of cravings were associated with greater use of thought suppression, punishment and worry control strategies. These correlations were generally moderate in size, with a rather weak relationship observed between maladaptive appraisals and worry.

These results are fairly consistent with research from the field of obsessions, which has demonstrated a correlational relationship between negative appraisals of unwanted thoughts and thought suppression (Rassin et al., 2000; Smári & Hólmsteinsson, 2001). Unfortunately, no research to date has directly examined the relationship between obsessional appraisals and use of
punishment or worry control strategies; as such, is not clear how the current results directly compare to the processes occurring in obsessions.

*Thought control strategies, craving severity and cessation outcome. *Cognitive theories of obsessions posit a causal role for thought control strategies in the escalation of problematic intrusions (OCCWG, 1997; Purdon & Clark, 1999). In theory, failure to control unwanted thoughts strengthens maladaptive beliefs about the meaning of the thought, increases distress and enhances thought control efforts, ultimately producing more frequent and distressing intrusions (Purdon & Clark, 2002). Previous research has demonstrated a relationship between use of thought suppression, punishment and worry control strategies and symptoms of several forms of psychopathology (Abramowitz et al., 2001; Abramowitz, Whiteside, Kalsy et al., 2003; Morrison & Wells, 2000; Ree et al., 2005).

Results of the current study, however, did not support the role of maladaptive thought control strategies in problems with craving-related thoughts or with smoking cessation. Small but significant zero-order correlations were observed between suppression, worry and punishment and craving frequency, persistence and distress. Given the size of these correlations, however, these relationships do not appear to be particularly meaningful or important. Indeed, after considering relevant control variables, only punishment was significantly related to concurrent problems with craving-related thoughts. Though the effect size of this finding was fairly small, it is consistent with research showing that use of punishment strategies is more common among individuals experiencing symptoms of OCD, PTSD, GAD and schizophrenia (Amir et al., 1997; Coles & Heimberg, 2005; Morrison & Wells, 2000; Roussis & Wells, 2006). Congruent with the relatively weak relationships observed between thought control strategies and craving severity, use of punishment, worry and suppression did not contribute to the prediction of one-month cessation outcome after accounting for control variables.
Empirical studies of obsessional types of thoughts have found suppression to be a significant mediator of the relationship between appraisals and problematic intrusion (Rassin et al., 2000; Smári & Hólmsteinsson, 2001). The present study, in contrast, did not support a mediational role for problematic thought control strategies. Use of punishment did not explain the relationship between maladaptive appraisals and the frequency, persistence and controllability of craving-related thoughts. Indeed, the relationship between punishment and craving severity was not significant after controlling for maladaptive appraisals. Although a mediational model would also have been predicted with regards to suppression and worry, these variables did not explain craving severity above and beyond control variables (negating the possibility of mediation).

While these findings contrast with theory and research from the field of obsessions, they are consistent with several studies from the substance dependence literature. Certainly, addictions research has produced mixed results with regards to the paradoxical effects of thought suppression. The current results run counter to Salkovskis and Reynolds’ (1994) experimental finding that suppression increased the frequency of smoking-related thoughts, but they are congruent with Reynolds et al.’s (2005) recent failure to replicate in a sample of substance dependent inpatients. As the present study is correlational, not experimental, it is not immediately clear why results align more closely with the finding from Reynolds et al. (2005). As one possible factor, the Salkovskis and Reynolds’ (1994) study was conducted in a more carefully controlled environment than both the current research and the Reynolds et al. (2005) study. The absence of naturally occurring substance use cues and reminders (as in a laboratory environment) may help clarify differences between individuals suppressing and not suppressing craving-related thoughts. Thus, while suppression may be associated with increased intrusion frequency in controlled laboratory environments, its effect in more convoluted, real-life
environments may be more complicated.

In a similar fashion, the current results conflict with the relationship Toll and colleagues (2001) found between thought suppression and current smoking status, but are consistent Haaga and Allison’s (1994) finding that use of thought suppression was unrelated to maintenance of smoking abstinence. One important difference between these studies lies in their delineation of smoking status. Toll et al. (2001) assessed smoking status cross-sectionally, with current smokers being classified as “unsuccessful quitters” and ex-smokers as “successful quitters”. In contrast, both the current research and Haaga and Allison’s (1994) study assessed smoking status prospectively, providing what is likely to be a more accurate measure of cessation outcome. Differences in measurement of self-reported thought suppression may have also affected results. While Haaga and Allison (1994) assessed thought suppression by recoding articulated thought transcripts, both Toll et al. (2001) and the current study assessed suppression using an endorsement-style questionnaire—the White Bear Suppression Inventory (WBSI). Unlike the current study, however, Toll et al. (2001) used the full scale WBSI (i.e., using both the suppression and intrusion subscales). Use of the intrusion subscale (which assesses the occurrence of unwanted thoughts; Höping & de Jong-Meyer, 2003) may have capitalized on any existent relationship between current smoking status and the experience of intrusive thoughts. Taken together then, evidence favours the absence of a correlational relationship between suppression and cessation outcome.

It is likely that the relationship between maladaptive thought control strategies and the persistence of unwanted intrusions is complex and dependent on several factors. To begin, these forms of thought control may not be overly maladaptive in the context of coping with craving-related thoughts. Some evidence suggests that suppression of depressive or worry-related thoughts may even be beneficial under certain conditions, with expression associated with poorer
mood and rumination later on (Borkovec, Wilkinson, Folensbee, & Lerman, 1983; Roemer & Borkovec, 1994). A similar phenomenon may occur for craving-related thoughts: postponing thoughts of smoking or redirecting one’s thoughts towards less significant concerns may be adaptive at times when attempting to quit. Consistent with this idea, current smoking cessation treatments encourage people to divert their attention away from urges to smoke (Abrams et al., 2003). It may also be that suppressing or worrying in response to craving-related thoughts is only detrimental for some individuals or under certain circumstances. These strategies may only become problematic when they fail, for example, or when individuals appraise failures in thought control in overly significant ways. Indeed, evidence suggests that individuals who believe that they should be able to perfectly control obsessional types of thoughts are more upset by suppression failure (Purdon et al., 2005).

Another possibility is that people use different strategies to control different types of thoughts. While participants completed the appraisal measures in reference to craving-related thoughts, the measures assessing thought control strategies are not specific to cravings. That is, the thought control measures ask participants how they respond to unwanted thoughts in general, not how they respond to craving-related thoughts. Completing the measures of thought control strategies with different kinds of unwanted thoughts in mind may have obscured relationships specific to craving-related thoughts. It may be useful for future studies to ask participants about their responses to specific types of unwanted thoughts.

Similarly, it is possible that individuals respond to craving-related thoughts differently depending on situational context, the presence of cues, or the accessibility of cigarettes. Some people may suppress the fleeting idea that they would enjoy a cigarette after a meal, but actively punish themselves for an impulse to ask a friend or nearby smoker for a cigarette. Later, they may worry about how close they came to lapsing. How productive or maladaptive these
strategies prove to be may depend on the context in which they are used. Investigating this possibility may be useful for understanding the role of thought control in relation to both craving-related thoughts and other forms of unwanted intrusions.

**Limitations**

Several limitations of the current study are important to consider when interpreting the results. To begin, all variables were assessed via self-report questionnaires. Some individuals may have experienced difficulty recognizing and reporting on the strategies they typically use to control unwanted thoughts. Momentary, *in vivo* assessment of coping strategies may improve reliability of results. Similarly, given the difficulty some individuals may have identifying appraisals of craving-related thoughts, replication using implicit measures of cognition is also encouraged. Finally, though research suggests that assessment of smoking via self-report is generally accurate (Patrick et al., 1994), confirmation with biochemical assessment would improve confidence in results.

Caution is further warranted in considering the representativeness of the sample. Participants in the current study all had access to a computer and had reliable email addresses to which researchers could send the follow-up questions. Thus, the current results may not generalize well to individuals without regular computer or internet access (e.g., people of lower socioeconomic status or older individuals). Cultural diversity of the current sample was also limited; participants in the current study were mainly of a Caucasian or Western European ethnic background. Finally, participation was restricted to regular smokers who had recently begun an attempt to quit. In defining this sample, several subsets of relevant individuals were naturally excluded (e.g., light smokers). Indeed, our sample appears to have smoked more heavily before quitting (M = 21.6 cigarettes per day) than average daily smokers in Canada (M = 15.7 per day; Health Canada, 2005). If there were differences in appraisals of cravings due to SES, culture, or
heaviness of smoking, they would not have been apparent in this study due to low variability on these constructs.

It is also unclear what effect, if any, a higher follow-up response rate under the draw condition would have had on results. Individuals who did not complete the follow-up had quit smoking more recently (predictive of poorer one-month outcome) and attempted to quit fewer times in the past (predictive of better one-month outcome). It is encouraging that nearly all individuals participating under the $20 incentive version completed the follow-up; nevertheless, the extent to which these individuals are representative of individuals quitting smoking as a whole is uncertain.

In summary, the current study supports the application of principles derived from cognitive theories of obsessions to the understanding of nicotine cravings during smoking cessation. More catastrophic and personally significant appraisals of cravings were associated with greater craving severity and poorer one-month cessation outcome. As such, this study showed that the same processes that occur for obsessions also occur for other types of unwanted, distressing, and actively resisted thoughts. Suppression, worry and punishment thought control strategies did not contribute appreciably to understanding craving severity or cessation difficulty. Overall, findings support the hypothesized role of appraisals of the meaning of unwanted thoughts in the development of problematic intrusions. Results also suggest that maladaptive appraisals may contribute to difficulties in smoking cessation over and above established cognitive factors. Indeed, targeting maladaptive appraisals may be a useful addition to existing smoking cessation treatment programs.
Table 1

Means and Standard Deviations for Study Questionnaires: Relation to Smoking Status at Follow-Up

<table>
<thead>
<tr>
<th>Measure</th>
<th>Full sample</th>
<th>Smoking (n = 70)</th>
<th>Abstinent (n = 78)</th>
<th>t</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fagerström Test for Nicotine Dependence (pre-quit)</td>
<td>5.65</td>
<td>5.69</td>
<td>5.72</td>
<td>.09</td>
<td>.01</td>
</tr>
<tr>
<td>Smoking Effects Questionnaire: Positive Expectancies</td>
<td>1.29</td>
<td>1.33</td>
<td>1.29</td>
<td>-0.43</td>
<td>-.07</td>
</tr>
<tr>
<td>Smoking Effects Questionnaire: Negative Expectancies</td>
<td>1.92</td>
<td>1.88</td>
<td>2.00</td>
<td>.120</td>
<td>.20</td>
</tr>
<tr>
<td>Center for Epidemiological Studies Depression Scale -Short Form</td>
<td>7.96</td>
<td>8.59</td>
<td>7.51</td>
<td>-1.52</td>
<td>-.25</td>
</tr>
<tr>
<td>Smoking Self-Efficacy Questionnaire</td>
<td>39.84</td>
<td>33.86</td>
<td>44.51</td>
<td>5.56**</td>
<td>.92</td>
</tr>
<tr>
<td>White Bear Suppression Inventory: Suppression</td>
<td>20.81</td>
<td>21.33</td>
<td>20.40</td>
<td>-1.21</td>
<td>-.20</td>
</tr>
<tr>
<td>Thought Control Questionnaire: Punishment</td>
<td>9.12</td>
<td>9.47</td>
<td>8.71</td>
<td>-2.16*</td>
<td>-.37</td>
</tr>
<tr>
<td>Thought Control Questionnaire: Worry</td>
<td>9.78</td>
<td>10.03</td>
<td>9.40</td>
<td>-1.45</td>
<td>-.24</td>
</tr>
<tr>
<td>Catastrophic Appraisals Index</td>
<td>3.83</td>
<td>5.17</td>
<td>2.86</td>
<td>-4.48**</td>
<td>-.74</td>
</tr>
<tr>
<td>Appraisals of Craving Questionnaire</td>
<td>71.81</td>
<td>88.29</td>
<td>58.69</td>
<td>-5.20**</td>
<td>-.86</td>
</tr>
<tr>
<td>Obsessive Compulsive Drinking Scale - Revised, Smoking Version</td>
<td>9.34</td>
<td>11.21</td>
<td>8.08</td>
<td>-4.86**</td>
<td>-.80</td>
</tr>
</tbody>
</table>

*p < .05. **p < .01.
Table 2

*Principal Axis Factor Analysis of Appraisal of Craving Questionnaire (N = 178)*

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor loading</th>
<th>Extraction communality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having this craving related thought means that my attempts to quit smoking are destined to fail.</td>
<td>.64</td>
<td>.40</td>
</tr>
<tr>
<td>The more I think about these things, the greater the risk they will come true.</td>
<td>.68</td>
<td>.47</td>
</tr>
<tr>
<td>If I don’t control this thought, I am likely to start smoking again.</td>
<td>.65</td>
<td>.43</td>
</tr>
<tr>
<td>Having this unwanted thought means I will act on it.</td>
<td>.68</td>
<td>.47</td>
</tr>
<tr>
<td>I would be a better person if I gained more control over this thought.</td>
<td>.68</td>
<td>.46</td>
</tr>
<tr>
<td>It is important for me to cancel out or block the craving related thoughts.</td>
<td>.59</td>
<td>.35</td>
</tr>
<tr>
<td>Quitting smoking would be much easier if I gained control over this thought.</td>
<td>.66</td>
<td>.44</td>
</tr>
<tr>
<td>I should be able to rid my mind of this thought.</td>
<td>.62</td>
<td>.38</td>
</tr>
<tr>
<td>Thinking this thought could make it happen.</td>
<td>.72</td>
<td>.52</td>
</tr>
<tr>
<td>I must have control over this thought.</td>
<td>.61</td>
<td>.38</td>
</tr>
<tr>
<td>These thoughts mean that I might lose control and act on the thought.</td>
<td>.742</td>
<td>.55</td>
</tr>
<tr>
<td>I am irresponsible if I don’t resist this unwanted thought.</td>
<td>.707</td>
<td>.50</td>
</tr>
<tr>
<td>Because I can't control this thought, I am a weak person.</td>
<td>.52</td>
<td>.27</td>
</tr>
<tr>
<td>I should not be thinking this kind of thing.</td>
<td>.65</td>
<td>.42</td>
</tr>
<tr>
<td>These thoughts mean that one day I may actually carry out some actions related to the thoughts.</td>
<td>.60</td>
<td>.36</td>
</tr>
<tr>
<td>I must regain control of this thought.</td>
<td>.71</td>
<td>.50</td>
</tr>
<tr>
<td>I feel responsible for these thoughts.</td>
<td>.55</td>
<td>.31</td>
</tr>
</tbody>
</table>
Table 3

Concurrent Validity of ACQ and CAI

<table>
<thead>
<tr>
<th>Measure</th>
<th>Appraisals of Craving Questionnaire</th>
<th>Catastrophic Appraisals Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thought-Action Fusion Scale-Revised</td>
<td>.31</td>
<td>.39</td>
</tr>
<tr>
<td>Obsessive Beliefs Questionnaire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility / Threat</td>
<td>.35</td>
<td>.28</td>
</tr>
<tr>
<td>Perfectionism / Certainty</td>
<td>.36</td>
<td>.31</td>
</tr>
<tr>
<td>Importance / Control of Thoughts</td>
<td>.39</td>
<td>.38</td>
</tr>
</tbody>
</table>

*Note: N = 178. All correlations are significant at p < .01.*
Table 4

Correlations between Metacognitive Variables, Control Variables and Craving Severity (N = 178)

<table>
<thead>
<tr>
<th>Metacognitive Variables</th>
<th>Other Predictors of Craving Severity</th>
<th>Craving Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Duration (log)</td>
<td>Times quit in past</td>
</tr>
<tr>
<td>White Bear Suppression Inventory: Suppression</td>
<td>.20**</td>
<td>-.01</td>
</tr>
<tr>
<td>Thought Control Questionnaire: Worry</td>
<td>.04</td>
<td>-.04</td>
</tr>
<tr>
<td>Thought Control Questionnaire: Punishment</td>
<td>.04</td>
<td>-.07</td>
</tr>
<tr>
<td>Catastrophic Appraisals Index</td>
<td>-.01</td>
<td>.02</td>
</tr>
<tr>
<td>Appraisals of Craving Questionnaire</td>
<td>-.14</td>
<td>.07</td>
</tr>
</tbody>
</table>

Note: N = 178. Craving severity assessed using the Obsessive Compulsive Drinking Scale obsessional subscale (smoking version). Positive expectancies, depression and self-efficacy assessed with the Smoking Effects Questionnaire positive expectations subscale, the Center for Epidemiological Studies Depression Scale – Short Form and the Smoking Self-Efficacy Questionnaire, respectively.

a controlling for time elapsed since beginning quit attempt, frequency of previous quit attempts, positive expectancies, symptoms of depression and cessation self-efficacy.

*p < .05. **p < .01
Table 5

*Sequential Logistic Regression of Metacognitive Variables on 1-month Smoking Status*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>(OR)</th>
<th>95% CI for ORs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years smoking before quit</td>
<td>-0.04</td>
<td>0.02</td>
<td>4.46*</td>
<td>0.96</td>
<td>0.93 - 1.00</td>
</tr>
<tr>
<td>(log) Days into quit attempt</td>
<td>-0.85</td>
<td>0.38</td>
<td>5.01*</td>
<td>0.43</td>
<td>0.21 - 0.90</td>
</tr>
<tr>
<td>(√) Times quit</td>
<td>0.39</td>
<td>0.21</td>
<td>3.39</td>
<td>1.48</td>
<td>0.98 - 2.26</td>
</tr>
<tr>
<td>Self-efficacy (SSEQ)</td>
<td>-0.07</td>
<td>0.02</td>
<td>17.91**</td>
<td>0.93</td>
<td>0.90 - 0.96</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years smoking before quit</td>
<td>-0.04</td>
<td>0.02</td>
<td>4.39*</td>
<td>0.96</td>
<td>0.93 &lt;1.00</td>
</tr>
<tr>
<td>(log) Days into quit attempt</td>
<td>-0.97</td>
<td>0.39</td>
<td>6.20*</td>
<td>0.38</td>
<td>0.18 - 0.81</td>
</tr>
<tr>
<td>(√) Times quit</td>
<td>0.41</td>
<td>0.22</td>
<td>3.59</td>
<td>1.51</td>
<td>0.99 - 2.31</td>
</tr>
<tr>
<td>Self-efficacy (SSEQ)</td>
<td>-0.07</td>
<td>0.02</td>
<td>15.22**</td>
<td>0.94</td>
<td>0.91 - 0.97</td>
</tr>
<tr>
<td>Worry (TCQ)</td>
<td>-0.01</td>
<td>0.08</td>
<td>0.03</td>
<td>0.99</td>
<td>0.84 - 1.16</td>
</tr>
<tr>
<td>Suppression (WBSI)</td>
<td>0.03</td>
<td>0.05</td>
<td>0.44</td>
<td>1.03</td>
<td>0.94 - 1.13</td>
</tr>
<tr>
<td>Punishment (TCQ)</td>
<td>0.14</td>
<td>0.10</td>
<td>1.89</td>
<td>1.15</td>
<td>0.94 - 1.40</td>
</tr>
<tr>
<td><strong>Step 3 (using ACQ)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years smoking before quit</td>
<td>-0.04</td>
<td>0.02</td>
<td>4.91*</td>
<td>0.96</td>
<td>0.92 &lt;1.00</td>
</tr>
<tr>
<td>(log) Days into quit attempt</td>
<td>-0.86</td>
<td>0.40</td>
<td>4.69*</td>
<td>0.42</td>
<td>0.19 - 0.92</td>
</tr>
<tr>
<td>(√) Times quit</td>
<td>0.42</td>
<td>0.22</td>
<td>3.57</td>
<td>1.52</td>
<td>0.99 - 2.35</td>
</tr>
<tr>
<td>Self-efficacy (SSEQ)</td>
<td>-0.05</td>
<td>0.02</td>
<td>6.46*</td>
<td>0.95</td>
<td>0.92 - 0.99</td>
</tr>
<tr>
<td>Worry (TCQ)</td>
<td>-0.01</td>
<td>0.09</td>
<td>0.01</td>
<td>0.99</td>
<td>0.84 - 1.17</td>
</tr>
<tr>
<td>Suppression (WBSI)</td>
<td>0.00</td>
<td>0.05</td>
<td>0.01</td>
<td>&lt;1.00</td>
<td>0.90 - 1.10</td>
</tr>
<tr>
<td>Punishment (TCQ)</td>
<td>0.06</td>
<td>0.11</td>
<td>0.30</td>
<td>1.06</td>
<td>0.86 - 1.31</td>
</tr>
<tr>
<td>Maladaptive Appraisals (ACQ)</td>
<td>0.02</td>
<td>0.01</td>
<td>5.13*</td>
<td>1.02</td>
<td>1.00 - 1.03</td>
</tr>
<tr>
<td>Variable</td>
<td>$B$</td>
<td>SE</td>
<td>Wald</td>
<td><strong>OR</strong></td>
<td>95% CI for ORs</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----</td>
<td>-----</td>
<td>------</td>
<td>--------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower     Upper</td>
</tr>
<tr>
<td>Duration smoking</td>
<td>-0.04</td>
<td>0.02</td>
<td>4.45*</td>
<td>0.96</td>
<td>0.93 &lt;1.00</td>
</tr>
<tr>
<td>(log) Days into quit attempt</td>
<td>-0.96</td>
<td>0.40</td>
<td>5.93*</td>
<td>0.38</td>
<td>0.18 0.83</td>
</tr>
<tr>
<td>(√) Times quit</td>
<td>0.46</td>
<td>0.22</td>
<td>4.23*</td>
<td>1.58</td>
<td>1.02 2.44</td>
</tr>
<tr>
<td>Self-efficacy (SSEQ)</td>
<td>-0.05</td>
<td>0.02</td>
<td>9.12**</td>
<td>0.95</td>
<td>0.92 0.98</td>
</tr>
<tr>
<td>Worry (TCQ)</td>
<td>-0.03</td>
<td>0.09</td>
<td>0.11</td>
<td>0.97</td>
<td>0.82 1.15</td>
</tr>
<tr>
<td>Suppression (WBSI)</td>
<td>0.02</td>
<td>0.05</td>
<td>0.10</td>
<td>1.02</td>
<td>0.93 1.12</td>
</tr>
<tr>
<td>Punishment (TCQ)</td>
<td>0.08</td>
<td>0.11</td>
<td>0.58</td>
<td>1.08</td>
<td>0.88 1.33</td>
</tr>
<tr>
<td>Maladaptive Appraisals (CAI)</td>
<td>0.16</td>
<td>0.07</td>
<td>5.35*</td>
<td>1.18</td>
<td>1.03 1.35</td>
</tr>
</tbody>
</table>

*Note: $N = 148$.  
*p <.05. **p < .01
References


Appendix 1
ACQ/CAI

We are interested in your experiences with cravings that take the form of unpleasant and unwanted smoking related thoughts or images or impulses that pop into your mind unexpectedly. Nearly everyone attempting to quit smoking has such experiences, but people vary in how frequently these occur and how intense and distressing they are. Some examples of the many possible negative craving related intrusions are given below:

- an impulse to ask another nearby smoker for a cigarette
- the thought that you would really enjoy a cigarette
- the idea that you can’t cope without a cigarette
- an image of yourself smoking
- the thought that there’s no point trying to relax without a cigarette
- the idea that there’s nothing wrong with having just one cigarette
- an image of yourself in a relaxed place, enjoying a cigarette
- the thought that you wish someone would offer you a cigarette
- the idea that it’s not a problem to smoke if you look after yourself in other ways
- the thought that you will put on weight if you stop smoking
- an image of other people smoking and enjoying it
- the thought or idea that there are plenty of places where you could buy cigarettes
- the urge to go buy a pack of cigarettes
- the thought that it’s not fair that other people can enjoy cigarettes and you can’t
- an image of yourself under stress, having a cigarette to help calm you down or cope
- the thought that smoking is not bad if you don’t do it too much
- the idea that if you don’t smoke now, something else will start it later, so why not now?
- the thought the physical discomfort and withdrawal symptoms will stop if you have a smoke

We are interested in smoking or craving related thoughts, mental images, impulses, or urges that pop into your mind and that you experience as intrusive and inappropriate.

In the spaces below please write down two unwanted smoking or craving related mental intrusions that you have experienced:

(1) ________________________________________________
(2) ________________________________________________

Using the rating scales provided below, please answer the following questions about these and other similar intrusions. Please circle the appropriate number for the following questions:

A. When did you last experience an intrusion of this kind?

<table>
<thead>
<tr>
<th>Within the last year</th>
<th>Within last 6 months</th>
<th>Within last 4 weeks</th>
<th>Within last 2 weeks</th>
<th>Within last Week</th>
<th>Within last 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

B. In the last 6 months, how frequently did you experience an intrusion of this kind?

<table>
<thead>
<tr>
<th>Less than once a month</th>
<th>About once a month</th>
<th>About once a week</th>
<th>A few times per week</th>
<th>About once a day</th>
<th>Several times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

C. On average, how much distress do you usually experience when you have an intrusion of this kind?
D. On average, how intense is the urge to smoke when you have an intrusion of this kind?

When you were bothered by intrusive thoughts like the ones you described above, rate how much you believed each of the ideas listed below. Circle the number that best represents your belief when an intrusion is occurring.

Use the following scale:

<table>
<thead>
<tr>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>I did not believe this idea at all</td>
<td>I was moderately convinced this idea was true</td>
<td>I was completely convinced this idea was true</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Having this thought means that my attempts to quit smoking are destined to fail. (ACQ)

0 10 20 30 40 50 60 70 80 90 100

2. Other people would think that I am crazy or mentally unstable if they knew about my thoughts. (CAI)

0 10 20 30 40 50 60 70 80 90 100

3. The more I think about these things, the greater the risk they will come true. (ACQ)

0 10 20 30 40 50 60 70 80 90 100

4. Other people would condemn or criticize me if they knew about my thoughts. (CAI)

0 10 20 30 40 50 60 70 80 90 100

5. If I don’t control this thought, I am likely to start smoking again. (ACQ)

0 10 20 30 40 50 60 70 80 90 100

6. Because I’ve had this intrusive thought, what I’m doing will be ruined. (CAI)

0 10 20 30 40 50 60 70 80 90 100

7. Having this intrusive thought means that I could lose control of my mind. (CAI)

0 10 20 30 40 50 60 70 80 90 100

8. Having this unwanted thought means I will act on it. (ACQ)

0 10 20 30 40 50 60 70 80 90 100

9. I would be a better person if I gained more control over this thought. (ACQ)

0 10 20 30 40 50 60 70 80 90 100

10. It is important for me to cancel out or block the thoughts. (ACQ)

0 10 20 30 40 50 60 70 80 90 100

11. Quitting smoking would be much easier if I gained control over this thought. (ACQ)

0 10 20 30 40 50 60 70 80 90 100

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12. It is important for me to keep these thoughts secret from most or all of the people I know. (CAI)

13. I should be able to rid my mind of this thought. (ACQ)

14. These thoughts mean that I am really an impostor or a phony. (CAI)

15. Thinking this thought could make it happen. (ACQ)

16. I must have control over this thought. (ACQ)

17. These thoughts mean that I might lose control and act on the thought. (ACQ)

18. I must regain control of this thought. (ACQ)

19. I am irresponsible if I don’t resist this unwanted thought. (ACQ)

20. Because I can’t control this thought, I am a weak person. (ACQ)

21. I should not be thinking this kind of thing. (ACQ)

22. Having this intrusive thought means I’m out of control. (CAI)

23. I will go crazy if I do not stop thinking these thoughts. (CAI)

24. If I don’t control this thought, I’ll be punished. (CAI)

25. These thoughts mean that one day I may actually carry out some actions related to the thoughts. (ACQ)

26. I feel responsible for these thoughts. (ACQ)

27. Having this intrusive thought means I am a bad person. (CAI)
Appendix 2

UBC Behavioural Research Ethics Board Certificate of Approval