



UNIFORMED SERVICES UNIVERSITY, SCHOOL OF MEDICINE GRADUATE PROGRAMS
Graduate Education Office (A 1045), 4301 Jones Bridge Road, Bethesda, MD 20814



DISSERTATION APPROVAL FOR THE DOCTORAL DISSERTATION IN THE DEPARTMENT OF
MEDICAL AND CLINICAL PSYCHOLOGY

Title of Dissertation: "Brief Mindfulness Meditation Training in Smokers"

Name of Candidate: Aimee C. Ruscio
Doctor of Philosophy Degree
March 11, 2013

DISSERTATION AND ABSTRACT APPROVED:

Dr. Tracy Sbrocco
DEPARTMENT OF MEDICAL AND CLINICAL PSYCHOLOGY
Committee Chairperson

DATE:
3/27/13

Dr. Andrew Waters
DEPARTMENT OF MEDICAL AND CLINICAL PSYCHOLOGY
Dissertation Advisor

3/11/13

Dr. Marian Tanofsky-Kraff
DEPARTMENT OF MEDICAL AND CLINICAL PSYCHOLOGY
Committee Member

3/11/13

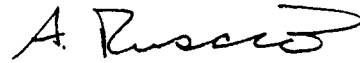
Dr. Cara Olsen
DEPARTMENT OF PREVENTIVE MEDICINE AND BIOMETRICS
Committee Member

3/11/13

The author hereby certifies that the use of any copyrighted material in the thesis manuscript entitled:

"Brief Mindfulness Meditation Training in Smokers"

is appropriately acknowledged and, beyond brief excerpts, is with the permission of the copyright owner.



Aimee C. Ruscio
MEDICAL AND CLINICAL PSYCHOLOGY
Uniformed Services University
04/03/2013

TITLE: Brief Mindfulness Meditation Training in Smokers

BY: Aimee Catherine Ruscio, M.S.

2013

DIRECTED BY: Andrew J. Waters, Ph.D.

Associate Professor, Medical and Clinical Psychology

ABSTRACT

Tobacco use remains the leading cause of preventable death in the United States. Despite the availability of efficacious pharmacological and behavioral treatments, 85% of quit attempts end in failure. Mindfulness meditation training may be useful in smoking cessation. This study was a parallel group randomized controlled trial of a brief mindfulness meditation (Brief-MM) intervention delivered to smokers on a Personal Digital Assistant (PDA) in the field. Adult community smokers (N = 44) were randomly assigned to a Brief-MM (n = 24) or Control (sham meditation training; n = 20) group. All participants carried a PDA for two weeks and were instructed to initiate 20 minutes of meditation (or control) training on the PDA once per day and to complete an assessment of cognitive and affective processes immediately afterwards. Additionally, they were prompted to complete assessments at random times up to four times per day. Smokers were instructed to smoke as much or as little as they liked during the study. Thirty-two participants (Brief-MM = 18; Control = 14) completed the study; 37 participants provided at least one EMA data point and completed in total 1874 assessments. Brief-MM was determined to be feasible and acceptable with 82.87% (95% CI [71.19%, 94.55%]) adherence to home meditation practice. Linear mixed model (LMM) analyses revealed that Brief-MM increased

state, but not trait, mindfulness over time. LMMs also indicated that Brief-MM reduced cigarettes smoked per day over time more than the Control group (Group x Day interaction, $F[1, 436] = 6.02$, $PE = -0.30$, $SE = 0.12$, $p = .01$); reduced craving post-meditation, Group x Assessment Type interaction ($F[2, 1728] = 5.78$, $PE = 0.80$, $SE = 0.26$, $p = .003$); and reduced negative affect ($F[1, 1728] = 15.7$, $PE = -2.93$, $SE = 0.74$, $p < .001$). Hypothesized changes to positive affect, a decentered perspective, and attentional bias were not supported. In sum, Brief-MM reduced craving, negative affect, and self-reported cigarette use, suggesting it may be a useful adjunct treatment. More research is needed to replicate results with a larger sample and to determine the mechanisms of action.

BREIF MINDFULNESS MEDITATION TRAINING IN SMOKERS

by

Aimee Catherine Ruscio

Dissertation submitted to the Faculty of the
Department of Medical and Clinical Psychology
Graduate Program of the Uniformed Services University
of the Health Sciences in fulfillment of the
requirements for the degree of Doctor of Philosophy

2013

Table of Contents

Abstract	i
Title Page	ii
Table of Contents	iii
List of Tables	vi
List of Figures	vii
List of Appendices	viii
List of Acronyms and Definitions.....	ix
Introduction	1
Preliminary Data	21
Rationale	25
Specific Aims and Hypotheses	26
Methods	28
Procedures	28
Measures	36
Analytic Plan	46
Results.....	52
Discussion	62
Limitations	68
Strengths and Implications	71
References	75
Tables	90
Figures	113

Appendices 128

List of Tables

Table 1: Summary of the Mindfulness Intervention for Cigarette-Smoking Cessation

Literature

Table 2: Summary of the Brief Mindfulness Intervention Literature

Table 3: Summary of Study Procedures

Table 4: Implicit Association Test

Table 5: Compensation Procedures

Table 6: Estimated Sample Sizes

Table 7: Participant Characteristics at Baseline

Table 8: Comparison of Completers and Non-completers at Baseline

Table 9: Summary Statistics on Dependent Variables by Group and Day

Table 10: Summary Statistics on Dependent Variables by Group and Assessment

Type

Table 11: Results of LMMs for Laboratory data

Table 12: Results of LMMs for EMA data

List of Figures

Figure 1: Conceptual Model

Figure 2: Timeline with Major Study Milestones.

Figure 3: Screenshots of an Individual Completing the Visual Probe Task.

Figure 4: Representation of the Implicit Association Test (IAT): Task 1.

Figure 5: Representation of the Implicit Association Test (IAT): Task 2.

Figure 6: Conceptual Depiction of a Positive D-score on the Depression Implicit Association Test

Figure 7: Conceptual Depiction of a Negative D-score on the Depression Implicit Association Test and the Accompanying Decentered Perspective.

Figure 8: Project Brief-MM CONSORT Flow Diagram

Figure 9: TMS-Curiosity scores by Group and Day

Figure 10: TMS-Decentering scores by Group and Day

Figure 11: PANAS-Negative Affect scores by Group and Assessment Type

Figure 12: Cigarettes smoked by Group and Day

Figure 13: Craving by Group and Assessment Type

List of Appendices

Appendix A: Laboratory Self Report Measures

Appendix B: USUHS IRB Approval Letter

Appendix C: Informed Consent Document

Appendix D: Brief-MM and Control Scripts

List of Acronyms and Definitions

a path = proposed causal relationship between an independent variable and a mediator variable

ACT = Acceptance and Commitment Therapy

Attentional Bias = the tendency to automatically attend to, and to maintain attention on, certain stimuli

b path = proposed causal relationship between a mediator variable and a dependent variable

Brief-MM = self-administered mindfulness-based treatment for smoking cessation, consisting of five twenty-minute meditations

c path = proposed causal relationship between an independent variable and a dependent variable

DBT = Dialectical Behavior Therapy

D-IAT = score on the depression IAT, interpreted as a measure of decentered perspective to depressogenic stimuli

Dispositional Mindfulness = “everyday” mindfulness, refers to the amount of present-focused attention and awareness an individual uses throughout their day

EMA = Ecological Momentary Assessment, a research methodology that involves collecting data in the participant’s natural environment

Executive Attention = the ability to voluntarily control the focus of attention

IAT = Implicit Association Test, a commonly used measure of automatic associations in memory

ICC = Intraclass correlation coefficient, a measure of the strength of correlation within repeated measures data

ITT analyses = Intent-to-treat analyses, a statistical analysis that uses data from all participants who are randomized to treatment condition, even if they do not adhere to the study protocol

LMM = Linear Mixed Model, a statistical model that is commonly used to analyze EMA data, and that incorporates fixed and random effects

MAAS = Mindful Attention Awareness Scale, a measure of dispositional (trait) mindfulness

MBCT = Mindfulness-Based Cognitive Therapy

MBSR = Mindfulness-Based Stress Reduction

Mediator = A variable that explains the relationship between an independent variable and a dependent variable

Mindfulness = Paying attention on purpose, in the present moment, and non-judgmentally (Kabat-Zinn, 2003)

PANAS = Positive and Negative Affect Schedule

PE = point estimate

Random effect = an effect in a statistical model that is assumed to vary across participants, e.g., different participants may have different means and slopes on a dependent variable over time

SE = standard error

State Mindfulness = a measure of the mindfulness an individual experienced during a discrete amount of time or a single sitting practice

TMS-Curiosity = A subscale measuring curiosity, acceptance, and openness to experience

TMS Decentered = A subscale measuring a shift toward relating to thoughts and feelings as transient mental events rather than accurate reflections of self, other, or the world

VP task = Visual-probe task, a commonly used task to measure attentional bias

Introduction

According to the 2010 US Surgeon General's Report, "Tobacco use *remains* the leading preventable cause of premature death in the United States" (U.S. Department of Health and Human Services, 2010). Over 65 million (one in five) Americans smoke cigarettes (Sondik, Madans, & Gentleman, 2010). Pharmacological, motivational, and cognitive-behavioral interventions have been developed. As many as 70% of smokers report the desire to quit. Yet 85% of quit attempts end in failure (Cinciripini & McClure, 1998; U.S. Department of Health and Human Services, 2000, 2010). Therefore researchers have turned to the study of Mindfulness Based Therapies, in search of effective tobacco cessation treatments that may offer routes to tobacco cessation not currently used by conventional treatments (Bowen & Marlatt, 2009; Cropley, Ussher, & Charitou, 2007; Davis, Fleming, Bonus, & Baker, 2007; Gifford et al., 2004; Leigh, Bowen, & Marlatt, 2005; Vidrine et al., 2009; Waters et al., 2009).

Origins of Mindfulness

Mindfulness originated in Siddharta Gautama's, also known as the Buddha's, teachings dating from the sixth century B.C.E. in India. In these teachings, he outlined Four Noble Truths that state: (1) suffering is universal and unavoidable; (2) suffering is caused, not by experience, but by our need to have experience a certain way; (3) the cessation of suffering is possible; and (4) cessation can be achieved by practicing the Noble Eightfold Path. Right mindfulness is one element of the Noble Eightfold Path. Other elements include right view, right intention, right speech, right action, right livelihood, right effort, and right concentration (Kumar, 2002; Teasdale &

Chaskalson, 2011). The Buddhist concept of mindfulness has been defined as “bare attention...the mind is trained to remain in the present, open, quiet, and alert, contemplating the present event” (Bodhi, 2011).

Contemporary Conceptualizations in Cognitive Psychology

Recently, Western practitioners and psychologists have begun to examine mindfulness. Two psychological processes, attention and awareness, are repeatedly identified in theoretical definitions of mindfulness (Bishop et al., 2004; Brown & Ryan, 2003; Brown, Ryan, & Creswell, 2007; Shapiro, Carlson, Astin, & Freedman, 2006). Brown & Ryan (2003; Brown, et al., 2007) defined mindfulness as “a receptive attention to and awareness of present events and experiences.” Awareness was described as the conscious registration of internal and external stimuli, prior to any cognitive processing. Attention was referred to as the initial taking notice of or turning toward an object, also occurring prior to any more elaborate cognitive processing. Bishop et al. (2004) provided a similar two-component model comprised of maintaining attention on the present moment and an orientation to present moment experience characterized by curiosity, openness, and acceptance. Shapiro, Carlson, Astin, and Freedman (2006) described similar processes referred to as axioms of attention and attitude. The authors also added an axiom of intention, referring to the reasons why an individual chooses to practice mindfulness. Mindfulness has also been described as an inherent feature of human consciousness that can vary markedly between and within individuals, ranging from a highly mindful state to a highly habitual, automatic, or mindless state. Dispositional mindfulness refers to an individual’s natural level of trait mindfulness (Brown & Ryan,

2003).

For the purpose of the current study, mindfulness was conceptualized as a form of cognitive retraining that affects attentional processes and that fosters a decentered perspective to emotional stimuli. Cognitive retraining describes the repeated performance of a cognitive task (e.g., meditation) which results in the improvement of cognitive processes (e.g., attention or a decentered perspective). Taken together, maintaining attention in the present moment with a detached perspective results in changes in the subsequent processing of cognitive and affective stimuli (Waters, et al., 2009).

Mindful vs. Mindless Processing

To understand the difference between “mindless” and “mindful” processing, compare a hypothetical “mindless” individual with a hypothetical “mindful” individual experiencing depressive thoughts and emotions. The mindless individual is riding a subway home and begins to think about a presentation that did not go well earlier in the day. He or she has thoughts such as “I should have prepared more” and “I’m such a failure.” The individual experiences feelings of worthlessness. Lacking the decentered perspective described above, he or she does not separate the contents of consciousness from his or her sense of self, resulting in an increasingly negative view of the self that exacerbates his or her depression. The individual replays the memories of the presentation, focusing on everything that did not go well. So much of his or her attention is focused on past events that he or she does not attend to the current location of the subway train, causing the individual to miss his or her stop.

In contrast, the mindful individual experiencing similar depressive thoughts

and emotions has the cognitions “I am having the thought that I should have prepared more”; “I am having the thought that I’m a failure” and “I feel worthless.” He or she identifies both thoughts and feelings as transient mental events and experiences separation between these events and his or her more stable sense of self. He or she notices the thoughts and feelings without getting caught up in a train of ruminative thought. He or she maintains attention on what is happening in the present moment rather than past events. He or she notices the sounds of the subway car, sights such as other people in the car or the reflection of light on the window, and other thoughts and emotions as they arise. The mindful individual can experience depressive thoughts and emotions without engaging in depressive rumination (Brown, et al., 2007; Teasdale, 2004; Waters, et al., 2009).

Mindfulness-Based Treatments and Psychopathology

Western psychological interventions that use mindfulness-based treatments fall into two broad categories: consciousness-based treatments and skills-based treatments. Consciousness-based treatments use daily meditative practices to promote change and include Mindfulness Based Stress Reduction (MBSR) and Mindfulness Based Cognitive Therapy (MBCT). MBSR consists of an eight week course of group therapy, originally developed in 1979 to reduce stress, pain, and illness in medical patients in a hospital setting (Kabat-Zinn, 2003). MBCT, modeled after MBSR, also consists of eight weeks of group therapy designed as a cognitive-behavioral approach for preventing relapse in depression (Teasdale et al., 2000). Skills-based treatments such as Acceptance and Commitment Therapy (ACT) and Dialectical Behavior Therapy (DBT) place emphasis on teaching mindfulness and

acceptance skills, among other skills, that can be incorporated into a patient's life without daily meditative practice.

Consciousness-based mindfulness treatments have been reported to reduce symptoms in anxiety disorders and binge eating disorder and to prevent depressive relapse (Baer, 2003). Hofmann, Sawyer, Witt, and Oh (2010) reported large pre-post effect size estimates in studies involving patients with anxiety disorders (Hedges's $g = .97$) and depressive disorders (Hedges's $g = .95$). The authors found moderate pre-post effect size estimates for anxiety symptoms (Hedges's $g = 0.63$) and depressive symptoms (Hedges's $g = 0.59$). The effect sizes reported included studies in which mood and anxiety were the targeted disorders, and studies in which MBSR and MBCT were used as an adjunct treatment in a physical illness (cancer, fibromyalgia, traumatic brain injury, heart disease, and diabetes). While there is evidence to support the efficacy of mindfulness-based treatments for anxiety and depression, the research literature has been criticized for having a large number of uncontrolled studies (Toneatto & Nguyen, 2007).

Skills-based treatments, such as ACT and DBT, have a stronger evidence base than the pure form consciousness-based treatments, such as MBSR and MBCT. ACT was reported to be effective for a wide range of psychopathologies, including social phobia, agoraphobia, depression, psychosis, borderline personality disorder, and trichotillomania (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). Comparisons between ACT and structured interventions designed to impact the problem resulted in a weighted average effect size of moderate magnitude at follow-up (Cohen's $d = .63$). Comparisons between ACT and wait list, treatment as usual,

or placebo conditions resulted in a large weighted average effect size at post-treatment (Cohen's $d = .99$) and a moderate-to-large weighted average effect size at follow-up (Cohen's $d = .71$). Published randomized controlled trials (RCTs) indicated the efficacy of DBT when applied to Borderline Personality Disorder (BPD), comorbid BPD and substance abuse disorder, and binge eating disorder (Hayes, Masuda, Bissett, Luoma, & Guerrero, 2004).

Intensive Smoking Cessation Programs

The latest Tobacco Use and Dependence Guidelines conducted a series of meta-analyses of smoking-cessation interventions to determine which components were considered to be best practices across tobacco cessation programs. These components are described in order to provide a context for the mindfulness-based treatments for smoking literature reviewed below (Tobacco Use and Dependence Guideline Panel, 2008). A key component of intensive treatments included an assessment of a smoker's willingness to make a quit attempt using an intensive treatment. Using a multi-disciplinary team to deliver the intervention was recommended. A strong dose-response relationship between treatment length and outcome has been identified. Four or more sessions lasting greater than ten minutes each were recommended, with the highest abstinence rates in interventions with greater than eight sessions. Programs may be delivered in individual, group, or telephone format. Supplementary self-help materials or web-based materials are optional. Active ingredients of counseling are thought to be problem solving, skills training, and social support. Studies using a combination of medication and counseling resulted in increased abstinence rates (22%), compared to counseling

alone (14.6%) (Tobacco Use and Dependence Guideline Panel, 2008).

Mindfulness-Based Treatments and Smoking

Changes in cognitive and emotional processing resulting from greater mindfulness may reduce smokers' dependence on tobacco. Consider a mindless cigarette smoker attempting to quit who encounters smoking stimuli (e.g., a smoking advertisement or someone else smoking). He or she may experience the cognition "I want a cigarette" and subsequently experience craving. Without a decentered perspective, both the thought and the emotion are associated with the individual's sense of self, resulting in more craving and smoking-related cognitions and placing the individual at greater risk of relapse after cessation of smoking. In contrast, a more mindful smoker also attempting to quit smoking experiences the same smoking-related stimuli differently. The mindful smoker who is abstaining notices the subsequent thought ("I am having the thought that I want a cigarette") and emotion ("I am craving a cigarette, but the craving will pass") as transient mental phenomena distinct from his or her sense of self, leaving him or her able to encounter the smoking cue with less impact on the quit attempt than the mindless smoker.

Mindfulness-based treatments for cigarette smoking have yielded promising but mixed results. Eleven studies examined mindfulness-based treatments or dispositional mindfulness in the context of smoking cessation or tobacco use and dependence. Four studies, including two RCTs, showed that mindfulness-based interventions improved abstinence rates following a quit attempt (Altner, 2002; Brewer et al., In press; Davis, et al., 2007; Gifford, et al., 2004). Two cross-sectional studies of dispositional mindfulness showed negative associations with dependence

and negative affect, and positive associations with positive affect and a decentered perspective (Vidrine, et al., 2009; Waters, et al., 2009). In contrast, one cross-sectional study of dispositional mindfulness reported correlations between dispositional mindfulness and self-identifying as a smoker (vs. non-smoker) and self-identifying as a binge-drinker (vs. non-binge drinker) (Leigh, et al., 2005). The literature is promising; however, large, well-controlled studies and studies providing information about mechanisms of action are needed to determine when and for whom mindfulness meditation may be an effective treatment. Table 1 contains a summary of the pertinent literature.

Two RCTs provide evidence that multi-week mindfulness- or acceptance-based treatments result in higher abstinence rates when compared with pharmacological or behavioral interventions (Brewer et al., 2011; Gifford, et al., 2004). Brewer et al. (2011) randomly assigned 88 treatment-seeking, nicotine dependent adults to Mindfulness Treatment (MT) or the American Lung Association's Freedom From Smoking (FFS) intervention. Both groups attended eight hour-and-a-half sessions, twice-weekly over the course of four weeks. The MT group (vs. FFS) displayed greater reductions in cigarette use, a trend towards greater abstinence rates immediately following treatment, and significantly greater abstinence rates at the 17-week follow-up (Brewer, et al., 2011). Gifford et al. (2004) reported robust effects of an ACT intervention (vs. Nicotine Replacement Therapy [NRT]) for smoking cessation in an RCT (N = 76). The intervention consisted of seven weeks of group and individual therapy. The authors reported significantly greater abstinence rates at one year in the experimental group (vs. NRT; Gifford, et

al., 2004). Taken together, the RCT's provide evidence of the efficacy of mindfulness- and acceptance-based treatments when compared to both behavioral (FFS) and pharmacological interventions.

Further, Gifford et al. (2004) examined negative affect, withdrawal symptoms, and avoidance/inflexibility as possible mediators of the relationship between condition and smoking outcomes. Negative affect and withdrawal symptoms are pathways targeted by NRT. Level of avoidance/inflexibility, the pathway targeted by ACT, was measured via self-report and described the use of avoidant strategies towards internal experiences and inflexible links between internal experiences and relapse. Endorsing the beliefs that negative affect invariably leads to smoking and that one must avoid negative affect is one example of avoidance and inflexibility. Avoidance and inflexibility was a significant partial mediator of the association between group and smoking outcome. Participants in the ACT group had lower avoidance and inflexibility scores, which resulted in higher rates of abstinence at one year (Gifford, et al., 2004).

Two additional studies showed increased abstinence rates following multi-week mindfulness-based interventions; however, these studies lack the methodological rigor of an RCT (Altner, 2002; Davis, et al., 2007). Altner (2002) presented a controlled, non-randomized longitudinal study (N = 117) of the effectiveness of MBSR when used in conjunction with nicotine replacement therapy (MBSR +NRT vs. NRT) in a workplace smoking intervention. MBSR consisted of a standard eight week course. NRT consisted of nicotine patches, nicotine gum, and/or nicotine nasal spray. The author reported lower abstinence rates in the

MBSR+NRT group at 15 months than in the NRT group (MBSR + NRT = 32.6% vs. NRT = 24.6%); however, no test of statistical significance was used to examine the difference (Altner, 2002). Davis, Fleming, Bonus, and Baker (2007) reported the results of an uncontrolled nonrandomized pilot study (N=18) of MBSR in a community sample. Achieving a 55% point prevalence abstinence rate at six weeks, they concluded that MBSR was a promising intervention that warranted further inquiry (Davis, et al., 2007).

Three cross-sectional studies examined associations between mindfulness and smoking behavior or risk factors for smoking relapse. Vidrine et al. (2009) documented a negative association between dispositional (or trait) mindfulness and dependence on tobacco, such that more mindful individuals were less dependent on tobacco. Additionally, they reported that dispositional mindfulness was negatively associated with withdrawal and positively associated with agency (confidence in one's ability to cope during high-risk situations without relapse). Waters et al. (2009) reported that dispositional mindfulness was positively associated with positive affect and a decentered perspective to depression-related stimuli and negatively associated with perceived stress, negative affect, and symptoms of depression. Taken together, the two studies provide a pattern of associations that suggest that dispositional mindfulness should be beneficial to smokers trying to quit (Vidrine, et al., 2009; Waters, et al., 2009). Leigh, Bowen, and Marlatt (2005) provided exceptions to these positive findings. In a cross-sectional analysis of mindfulness, smoking, binge-drinking, and spirituality, Leigh and colleagues found that mindfulness was positively associated with being a smoker (vs. being a non-smoker)

in a college sample (Leigh, et al., 2005).

The literature reviewed contained the promising finding of increased abstinence rates in several studies of multi-week mindfulness-based interventions (Altner, 2002; Brewer, et al., In press; Davis, et al., 2007; Gifford, et al., 2004). At the same time, drawing definitive conclusions from these data is premature due to small sample size (Davis, et al., 2007) and lack of experimental controls and/or randomization (Altner, 2002; Davis, et al., 2007). The majority of the evidence from cross-sectional studies of dispositional mindfulness and smoking behavior, nicotine dependence, and risk- and protective-factors during a quit attempt provide positive evidence (Vidrine, et al., 2009; Waters, et al., 2009), with one notable exception (Leigh, et al., 2005). Compelling but methodologically limited evidence exists for the benefit of multi-week mindfulness-based interventions and dispositional mindfulness.

Mindfulness Training and Cognition

As noted earlier, theorists assume that mindfulness training impacts cognitive processing, particularly attention and a decentered perspective. A review of the effect of mindfulness training on cognitive processes revealed limited, and at times contradictory, evidence that 8 week or shorter courses of mindfulness training significantly altered attentional processes including sustained attention, selective attention, executive attention, and attention switching. Conversely, studies that compared long-term meditators to non-meditators provided overwhelming evidence for improved attention in the long-term meditator group. These results suggest that mindfulness may in fact alter attentional processes; however, greater than eight weeks are needed to reliably attain these results (Chiesa, Calati, & Serretti, 2011).

A decentered perspective refers to viewing negative thoughts and feelings as temporary and transient mental events rather than as valid reflections of reality or central aspects of the self (Teasdale, 2004). While cognitive psychology has provided an arsenal of commonly used tasks that measure different attentional processes, measurement of a decentered perspective is a relatively new and less well-defined endeavor. The decentered perspective has been measured with the Measure of Awareness and Coping in Autobiographical Memory (MACAM), self-report decentering subscales of the Experiences Questionnaire (EQ) and the Toronto Mindfulness Scale (TMS), and through use of the Depression Implicit Association Test (D-IAT) (Fresco et al., 2007; Lau et al., 2006; Teasdale et al., 2002; Waters, et al., 2009). Decentered perspective scores measured by the MACAM and the EQ increase with mindfulness training (Carmody, Baer, Lykins, & Olendzki, 2009; Teasdale, et al., 2002). A decentered perspective measured with the D-IAT (which will be described in detail later) was shown to be significantly associated with dispositional mindfulness (Waters, et al., 2009).

Brief Mindfulness Interventions

Standard mindfulness-based interventions often require weekly one-and-a-half hour groups and up to forty-five minutes of practice a day, a significant time-burden for participants that may pose a barrier to care. While the multi-week mindfulness-based interventions presented above provide evidence of efficacy for a wide range of psychopathology and reduced abstinence rates in smoking, several investigators have begun examining the effect of brief mindfulness-based interventions or inductions on cognitive and emotional processes (see Table 2 for

summary of studies). Effects have been found on self-reported mindfulness (Moore, 2008; Zeidan, Gordon, Merchant, & Goolkasian, 2009; Zeidan, Johnson, Diamond, Zhanna, & Goolkasian, 2010), cognitive processes (Zeidan, et al., 2010), affective processes (Arch & Craske, 2006; Broderick, 2005), perception of experimentally induced pain (Zeidan, et al., 2009), and habitual responding (Wenk-Sormaz, 2005).

Three studies reported increases in self-reported mindfulness following a ten-minute intervention administered weekly for fourteen weeks (Moore, 2008) or twenty-minute interventions administered daily for three to four days (Zeidan, et al., 2009; Zeidan, et al., 2010). Zeidan et al. (2010) also reported that three twenty-minute sessions of mindfulness meditation training resulted in increased speed on a symbol-digit coding task, suggesting at least short term improvements in visuospatial functioning. They also showed increased extended hit-rates on a sustained attention task, suggesting some improvement in sustained attention following mindfulness training.

Changes in affective processing were reported by Broderick (2005) who showed less negative mood during a negative mood induction in the meditation condition (vs. distraction, rumination) following an eight-minute intervention. Similarly, Arch and Craske (2006) reported lower levels of negative affect and emotional volatility while viewing emotionally-valenced slides and more willingness to view negative slides after a fifteen minute mindfulness exercise (vs. worry, unfocussed attention). Reductions in habitual responding on both implicit and explicit measures was reported following one to three twenty minute mindfulness exercises (Wenk-Sormaz, 2005). Wenk-Sormaz (2005) specifically showed that participants

had increased ability to produce atypical responses during a word production task when instructed to do so following a mindfulness exercise. This benefit of mindfulness could be especially important to smokers trying to respond to challenging situations without smoking (an atypical response).

Brief Mindfulness Interventions and Smoking

Brief mindfulness interventions have also been studied in the context of smoking (see Table 2). Four studies provide contradictory evidence of the effect of an urge-surfing technique (Bowen & Marlatt, 2009; Rogojanski, Vettese, & Antony, 2011) or a body-scan (Cropley, et al., 2007; Ussher, Cropley, Playle, Mohidin, & West, 2009) on smoking behavior, nicotine dependence, withdrawal symptoms, and negative affect.

Two studies provide mixed evidence for the efficacy of an “urge-surfing” technique. The urge surfing intervention used in both studies coached participants to picture urges and cravings as waves and to attend to and “ride” their normal fluctuations during a cue-exposure exercise lasting approximately 20 minutes. Bowen and Marlatt (2009) reported reductions in cigarettes smoked per day over the course of seven days following the intervention. They reported negative (null) findings for negative affect and urges; however, mindfulness was a significant moderator of the association between negative affect and urges (Bowen & Marlatt, 2009). In an attempt to replicate Bowen and Marlatt (2009), Rogojanski, et al., (2011) reported a study with a very different pattern of results. In contrast to Bowen and Marlatt, they did not show an effect of urge-surfing on cigarettes smoked per day; however, they did show reduced negative affect following the intervention.

Similar to Bowen and Marlatt, they showed no difference in urges following the intervention. Additionally, they reported that the intervention reduced nicotine dependence and symptoms of depression (Rogojanski, et al., 2011). The differences in the patterns of results reported preclude definitive conclusions concerning the efficacy of urge-surfing as an intervention.

Another brief mindfulness exercise, a body scan, has been examined for use in reducing withdrawal symptoms. Similar to the urge-surfing technique, two studies reporting contradictory results have been published. A body scan is a guided relaxation routine that instructs participants to pay attention to the sensations they feel (pain, fatigue, heat, cold, tightness, relaxation, etc.) throughout their bodies. Cropley et al. (2007) presented the results of an RCT (N = 30) of the efficacy of a ten-minute “body scan” (vs. control) in reducing tobacco withdrawal symptoms and strength of desire to smoke. The intervention significantly reduced strength of desire to smoke, but did not significantly reduce irritability, tension, or restlessness (Cropley, et al., 2007). Ussher, Cropley, Playle, Mohidin, and West (2009) examined the effects of a similar ten-minute body scan (BS) (vs. isometric exercise (IE), control; N = 48) on withdrawal symptoms in the lab and in the natural environment. Both BS and IE resulted in significant or marginally significant reductions in strength of desire to smoke, irritability, restlessness, tension, difficulty concentrating, and stress in either the lab or the natural environment. Taken together, the studies do not provide a clear pattern of results.

In summary, studies of brief mindfulness interventions did not offer a clear pattern of results. Two studies provided support for brief mindfulness interventions

reducing smoking behavior with an urge-surfing intervention (Bowen & Marlatt, 2009) and withdrawal symptoms with a body scan (Ussher, et al., 2009). In contrast, two studies did not find significant effects for urge-surfing on smoking (Rogojanski, et al., 2011) or a body scan on withdrawal symptoms (Cropley, et al., 2007). The benefit of brief mindfulness based interventions for smokers remains unclear.

The brief mindfulness meditation literature provides evidence that brief mindfulness meditation exercises can affect measurable changes in a wide range of psychological processes in a laboratory setting. In contrast, the brief mindfulness studies for smoking behavior, dependence, and/or withdrawal did not yield a clear pattern of results. Several notable questions remain. The first is a question of how much meditation is necessary to achieve therapeutic effects. The effects of standard mindfulness interventions, interventions that last eight weeks and require up to 45 minutes of practice daily, have been documented. The acute effect on a wide range of psychological processes of brief interventions, one to three days of ten to twenty minutes of practice a day, have also been documented in the laboratory. But it is not clear if these interventions provide a “therapeutic dose” of mindfulness. Do the effects generalize to a natural setting? Also, are the changes large enough and durable enough to be of clinical significance? Additionally, the conflicting results for brief mindfulness interventions for smoking require further examination and clarification.

The Proposed Model

The mindfulness and smoking literature, brief or otherwise, lacks comprehensive investigations of the effect of mindfulness training on psychological

mechanisms. For the current study, a conceptual model is proposed that includes both cognitive and affective mechanisms (See Figure 1). Theoretically, it is expected that mindfulness training will cause an increase a decentered perspective and positive affect, and cause a decrease in attentional bias (described later) to smoking related stimuli and negative affect. Changes in these psychological processes will cause subsequent reductions in smoking dependence and smoking behavior.

Mechanisms of Mindfulness in Smoking Cessation

Decentered Perspective and Smoking

A decentered perspective to smoking and negative affective stimuli may reduce smokers' dependence on tobacco by increasing their tolerance for negative affective or smoking related cues, enabling them to experience but not react to these cues. While a decentered perspective is central to achieving a mindful state, very few attempts have been made to measure the construct directly. Waters, et al. (2009) examined the association between mindfulness and a decentered perspective to depression, anxiety, and smoking cues using the self-identification Implicit Association Test (IAT, described in more detail later). They found that mindfulness was negatively associated with a decentered perspective to depression cues in a sample of smokers. No associations were found between mindfulness and a decentered perspective to anxiety or smoking cues. The study marked the first use of an implicit cognitive task to try to measure a decentered perspective (Waters, et al., 2009).

Attentional Bias and Smoking

Some theorists have argued that attentional bias is an important cognitive

mechanism in drug addiction (e.g., Field & Cox, 2008; Franken, 2003; Robinson & Berridge, 1993). Attentional bias is a conditioned “wanting” response to drug cues that reflects the “incentive salience” of the cues (Robinson & Berridge, 1993). Individuals with a high attentional bias to drug cues will experience the automatic capture of their attention by drug-related stimuli. The “wanting” response has been suggested to mediate attention to drug cues, craving, and approach behavior. Franken’s (2003) model describes a causal association between attentional bias and craving such that high attentional bias will result in attending to drug cues, which increases craving. Attentional bias increases “exposure” to drug cues.

The visual probe (VP) task and the modified Stroop task (e.g., Waters & Sayette, 2006), among other cognitive tasks, have been used to measure attentional bias. A meta-analysis revealed that attentional bias is associated with craving (Field, Munafò, & Franken, 2009), and studies have reported that attentional bias prospectively predicts outcomes in smoking addiction (e.g., Janes et al., 2010; Powell, Dawkins, Pickering, West, & Powell, 2010; Waters, 2003). Both theory and data suggest that reducing attentional bias may reduce craving and relapse.

As described earlier, a recent review suggested that eight week mindfulness training courses were largely ineffective in changing attention processes; however, comparisons of attention in experienced meditators and novice- or non-meditators repeatedly showed significant differences (Chiesa, et al., 2011). Attentional bias has been reduced using brief cognitive interventions (Field & Eastwood, 2005; Field, et al., 2009), suggesting that it may be more easily manipulated with a brief intervention than other attentional processes.

Marlatt and Ostafin (2006, p. 491) theoretically predicted that the attention training in mindfulness “would reduce attentional bias to substance use cues and suggest this could be examined with methods such as the visual probe task.” To date, however, no studies have examined associations between dispositional mindfulness or mindfulness training and attentional bias to smoking cues, assessed using the visual probe task. Two studies examined mindfulness and attentional bias in alcohol addiction. Dispositional mindfulness has been shown to be associated with lower attentional biases to alcohol related stimuli (Garland, Gaylord, Boettiger, & Howard, 2010). Additionally, mindfulness training has been shown to reduce attentional bias to alcohol cues in individuals with positive attentional biases when the stimuli were presented for 200ms but not when presented for 2000ms (Garland, Boettiger, Gaylord, Chanon, & Howard, 2011). The finding suggests that mindfulness training reduces the initial alerting and orienting process of attention.

Positive Affect and Smoking

Positive affect has been described as “the extent to which a person feels enthusiastic, active, and alert” (Watson, Clark, & Tellegen, 1988, p.1063). While the association between negative affect, stress, and smoking is well-established, less information is available on the role of positive affective states and smoking. Both intravenous and smoking administration of nicotine have been shown to result in mild euphoriant or hedonic effects (Glautier, 2004; Pomerlau & Pomerlau, 1992; Soria et al., 1996). Dvorak and Simon (2008) found that daily tobacco use in a college sample was negatively associated with positive affect and positively associated with increased affective reactivity. Leventhal (2010) found that

reinforcement smoking, a tendency to smoke in order to regulate affect, moderated the relationship between positive affect and urge to smoke such that the negative association between positive affect and urge to smoke was significant in smokers high in reinforcement smoking but not significant in smokers low in reinforcement smoking.

Negative Affect, Craving, and Smoking

Negative affect is defined as “a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of mood states including anger, contempt, guilt, fear, and nervousness” (Watson, et al., 1988, p. 1063). The smoking literature revealed some evidence of a moderate association between negative affect and relapse. Specifically, Shiffman, Paty, Gyns, Kassel, and Hickcox (1996) found that acute increases in negative affect preceded approximately 30% of smoking lapses during a quit attempt. Testing the theory that negative affect increases lapses by increasing smoking-cue reactivity, Shiffman and Gwaltney (2008) found that negative affect increased the likelihood of smoking temptations and lapses during a quit attempt, independent of the presence or absence of smoking cues. In a review of the smoking, stress, and negative affect literature, Kassel, Stroud, and Paronis (2003) showed that smoking status (smoker vs. non-smoker) covaried with stress, negative life events, and negative affect.

Craving has been described as the defining characteristic of addiction and has been included in all major theories of drug use (Drummond, 2001; Robinson & Berridge, 1993). Most smokers experience craving and that experience persists long after a smoker has quit (Hughes, 2010; Tiffany & Wray, 2009). Craving

manifests as general craving or cue-provoked craving. General craving describes a baseline level of craving that a smoker experiences throughout the day. General craving changes slowly and is easily controlled with self-administration of nicotine. Cue-provoked craving describes a person's reactivity to smoking-related cues in the environment (Wray, Gass, & Tiffany, 2013).

Preliminary Data

To determine the mechanisms which explain the negative association between dispositional mindfulness and tobacco dependence in smokers, we examined baseline data from a smoking cessation trial. The results of this study are summarized here.

The primary aim of the study was to examine positive affect, negative affect, perceived stress, and a decentered perspective as mediators of the negative association between mindfulness and dependence, using a multiple mediator model. We used data from a mindfulness-based smoking cessation trial (N=140). All measures (Mindful Attention Awareness Scale (MAAS), Positive and Negative Affect Schedule (PANAS-PA, PANAS-NA), Perceived Stress Scale (PSS), Depression Implicit Association Test (D-IAT), and Wisconsin Inventory of Smoking Dependence Motives (WISDM)) were administered at baseline. We used Bias-Corrected Bootstrapping with 5000 bootstraps to estimate 95% confidence intervals around each specific indirect effect. PANAS-PA (95% CI = -2.83, -0.39) and D-IAT (95% CI = -1.72, -0.12) were significant partial mediators of the association between MAAS and WISDM scores. PANAS-NA (95% CI = -2.32, 0.58) and PSS (95% CI = -0.42, 3.12) were not significant mediators.

The main limitations of the study were the use of a cross-sectional design for testing mediation and measuring dispositional mindfulness rather than manipulating mindfulness as an independent variable. Using cross-sectional data to study what is by definition a longitudinal process often results in biased - potentially greatly biased - estimates of longitudinal mediation parameters (Maxwell & Cole, 2007). In other words, if a significant indirect effect in a cross-sectional study were observed, this does not necessarily mean that a significant indirect effect would be present in a longitudinal dataset. Similarly, if a non-significant indirect effect in a cross-sectional study were observed, it is still possible that a significant indirect effect would be present longitudinally. Without an experimental manipulation of mindfulness, causal relationships cannot be determined.

The current proposal will improve upon both of these limitations, providing an experimental manipulation of mindfulness and tracking cognition and affect over time. It will test the feasibility of a self-administered brief mindfulness intervention for smoking. It will also test whether mindfulness training changes attentional bias to smoking stimuli in smokers. Finally, it will improve on the earlier (laboratory) study through the use of EMA methodology.

Ecological Momentary Assessment and the Use of Mobile Technology

EMA involves assessing phenomena at the moment they occur in a person's natural environment. Assessments may be done at random times ("random assessments"; RAs), and/or when participants experience heightened emotions or motivational states (e.g., temptations), and/or after having performed certain tasks. Data from EMA studies are highly detailed and can reveal longitudinal patterns of

change within a few hours (e.g., Epstein et al., 2009; Shiffman & Waters, 2004).

The development of hand-held computers (PDAs) has facilitated the collection of EMA data. PDAs can be programmed to randomly prompt the person (e.g., through beeping). Compliance can be closely monitored (Stone, Shiffman, Schwartz, Broderick, & Hufford, 2002). Most relevant here, cognitive tasks, including measures of attention and detached perspective, can be administered on a PDA in an EMA study (Shiffman, Paty, Gnys, Kassel, & Elash, 1995; Waters & Li, 2008; Waters, Marhe, & Franken, 2011; Waters, Miller, & Li, 2010).

Rationale for using EMA

Using an EMA methodology will provide three distinct advantages: greater precision in measuring psychological constructs, easier distribution of a mindfulness-based treatment, and the potential to develop an intervention in which researchers can deliver treatment as it is needed in real time.

From the perspective of advancing scientific understanding of mechanisms of mindfulness, EMA will provide the ability to repeatedly measure the psychological constructs of interest, specifically, attentional bias, a decentered perspective, positive affect, and negative affect. Using conventional laboratory measurements would result in three measures over the course of a two week study, whereas EMA will provide several measurements of key variables each day, resulting in a much more fine-grained “lens” through which to view processes as they are changing.

Clinically, administering a mindfulness-based intervention on a PDA provides the potential to introduce mindfulness-based therapies to a much wider audience. Currently, eight week courses are expensive, and time and labor intensive, reducing

their access to consumers. The recent proliferation of mobile technology, especially smartphones and tablet computers, provides a soon-to-be ubiquitous platform that can be leveraged to introduce mindfulness-based interventions to a wider audience. While self-administered brief interventions probably do not confer as strong a benefit as training in a group setting, they may result in smaller benefits for a greater number of people. Further, people who have experience positive benefits from a brief intervention may seek out more extensive mindfulness training.

Measuring psychological variables using EMA is the first step in moving towards an ecological momentary intervention (EMI). Although beyond the scope of this study, analysis of EMA data could result in the development of algorithms that could be used to intervene via mobile devices “just in time.” If a unique constellation of acute changes in psychological processes, identified through EMA, tended to precede relapses and an intervention (mindfulness-based or otherwise) could be administered via mobile devices to target those processes, then mobile devices could be used to prevent the otherwise likely relapse.

Feasibility of Mindfulness-Based Interventions

A recent review paper of full-scale mindfulness-based interventions showed that only 15% of studies used a measure of mindfulness. Less than one-quarter of studies examined associations between practice and clinical outcome. Further, studies that did examine associations between practice and outcome used a correlational rather than experimental approach (Vettese, Toneatto, Stea, Nguyen, & Wang, 2009).

In the current study, several metrics of feasibility were used to address the

limitations described above. Metrics will be used to determine: (1) if participants are adhering to the protocol; (2) if the PDA measurements are capturing the acute effects of the intervention in the natural environment; and (3) if the intervention is changing measures of mindfulness. Participant adherence to the protocol was measured using a 75% completion rate of mindfulness trainings and a thirty second cutoff between the end of meditation training and the participant beginning a post-meditation assessment. A 75% completion rate of trainings will indicate that the intervention was well-received by participants. The thirty-second cutoff was used in a previous study of a brief-mindfulness intervention for smokers (Ussher, et al., 2009). In addition to adherence, the study will measure the extent to which post-training assessments capture the acute effects of the intervention. Measures of both state and trait mindfulness will also be used to determine the intervention's effect.

Rationale for the Current Proposal

Mindfulness-based interventions have been shown to be a promising approach for the treatment of psychopathology, including addiction. A growing body of research supports the efficacy of mindfulness-based interventions for tobacco addiction; however, these studies require large time commitments and often do not examine the mechanisms by which mindfulness operates in smokers.

A primary aim of the study is to determine the feasibility of a self-administered, brief, consciousness-based mindfulness intervention, using several indices. We will also determine the efficacy of the intervention in changing cognitive and affective processes related to smoking behavior and relapse. Concurrently, we will measure these variables on a PDA in a real-world setting to better understand

how the intervention affects the variables over time. Our population will be a sample of smokers who report smoking 10+ cigarettes per day. Smokers who are seeking to quit or cut down on smoking, as well as smokers who are not intending to quit or cut down, will be eligible.

Specific Aims and Hypotheses

Specific Aim 1. To determine the feasibility of a Brief Mindfulness Meditation (Brief-MM) delivered on a PDA for smoking.

Hypothesis 1.1. Brief-MM participants' percentage of completed mindfulness trainings will not be significantly lower than 75%.

Hypothesis 1.2. Brief-MM participants will begin post-training assessments with a delay that is not significantly longer in duration than thirty seconds between the end of mindfulness training and the beginning of the post-training assessment.

Hypothesis 1.3. Brief-MM (vs. control) will increase trait mindfulness measured by the Mindful Attention and Awareness Scale (MAAS) during laboratory assessments.

Hypothesis 1.4. Brief-MM (vs. control) will increase state mindfulness measured by the Toronto Mindfulness Scale.

Specific Aim 2. To examine the effect of BRIEF-MM on cognitive processes, affective processes, nicotine dependence, and smoking behavior.

Hypothesis 2.1. Brief-MM (vs. control) will decrease attentional bias to smoking related stimuli measured by the visual probe task.

Hypothesis 2.2. Brief-MM (vs. control) will increase a decentered perspective

to negative affective stimuli measured by the depression IAT and self-report.

Hypothesis 2.3. Brief-MM (vs. control) will increase positive affect measured by the Positive and Negative Affect Schedule.

Hypothesis 2.4. Brief-MM (vs. control) will decrease negative affect measured by the Positive and Negative Affect Schedule.

Hypothesis 2.5. Brief-MM (vs. control) will decrease smoking behavior measured by daily smoking logs.

Hypothesis 2.6. Brief-MM (vs. control) will decrease smoking behavior measured by salivary cotinine.

Hypothesis 2.7. Brief-MM (vs. control) will decrease nicotine dependence measured by the Wisconsin Inventory of Smoking Dependence Motives.

Specific Aim 3. To examine attentional bias, a decentered perspective, positive affect, and negative affect as mediators of the relationship between Brief-MM (vs. control) and tobacco dependence and smoking behavior.

Hypothesis 3.1. The effect of Brief-MM (vs. control) on tobacco dependence and smoking behavior will be partially mediated by attentional bias.

Hypothesis 3.2. The effect of Brief-MM (vs. control) on tobacco dependence and smoking will be partially mediated by a decentered perspective.

Hypothesis 3.3. The effect of Brief-MM (vs. control) on tobacco dependence and smoking behavior, will be partially mediated by positive affect.

Hypothesis 3.4. The effect of Brief-MM (vs. control) on tobacco dependence and smoking behavior, will be partially mediated by negative affect.

Methods

Participants

Participants were adult community-based smokers in the Washington D.C. metropolitan area recruited via local advertisements for smokers interested in meditation. Participants were paid \$50 for their initial laboratory visit, \$15 for each follow-up visit, \$5 for each meditation, and \$1 for each PDA assessment that they completed. To qualify, participants had to be current smokers, smoke 10 or more cigarettes per day for the past two years, and be aged 18 – 65. Federal civilian employees or members of the military needed their supervisor's approval for participation and were not compensated in accordance with current laws. Exclusion criteria included expired breath carbon monoxide levels lower than 10 ppm, tobacco use other than cigarettes, current smoking cessation treatment (counseling and/or medication) or any other factor that, in the judgment of the investigators, would likely preclude completion of the protocol.

Participant recruitment was accomplished by advertising for smokers age 18 – 65 on local mass transportation, the Express Paper, Craigslist.com, and through the use of flyers. Smokers were accepted regardless of their intentions to quit or cut down on smoking.

Procedures

The First Session

Figure 2 provides the timeline for the study. Participants first contacted the researchers by leaving a phone message expressing interest in the study and leaving their contact information. Research staff returned participants' phone calls

and conducted telephone screenings to ensure participants met criteria for inclusion. Participants eligible to participate in the study were invited to attend an initial orientation session. The orientation visit also served as the first laboratory visit. At this first laboratory visit, study personnel provided a detailed description of the study, answered questions, confirmed eligibility, and obtained written informed consent (see Appendix B). Individuals who declined to participate or were ineligible were given self-help materials and a list of local smoking cessation programs (if interested).

Next, participants provided a breath sample by blowing through a carbon monoxide (CO) monitor. If the CO monitor indicated that a participant's expired CO level was very low (less than 10 parts per million [ppm]), the participant was excluded from the study. This is because, if the participant's expired CO level is below 10 ppm, there is serious doubt as to whether the individual actually smokes at a rate of 10+ cigarettes per day (SRNT Subcommittee on Biochemical Verification, 2002).

After signing the consent form, the participants were randomly assigned to the Brief-MM or Control condition stratified by gender according to a randomization list. Randomization.com was used. The randomization consisted of four blocks of 10 participants. Within each block, 5 participants were assigned to the Brief-MM condition and 5 to the Control condition. Two blocks were used for men and two blocks for women. An additional three blocks of two participants each were added to each gender list later in the study after recruitment was expanded to offset loss of data due to attrition. In total, 24 participants (12 males, 12 females) were assigned to

the Brief-MM condition and 20 to the Control condition (10 males, 10 females). The study was designed to be double-blinded with participants and researchers blinded to condition assignment. The participant blind was successful with 11 of 18 Brief-MM participants and 8 of 13 Control participants reporting that they believed themselves to be in the meditation group at the end of the study.

Eligible participants provided a saliva sample for analysis of cotinine levels. (Cotinine is a metabolite of nicotine). Participants then completed the Outcome Rating Scale (Miller, Duncan, Brown, Sparks, & Claud, 2003) on paper, followed by a demographic questionnaire, a smoking history questionnaire, the Mindful Attention and Awareness Scale (Brown & Ryan, 2003), the Toronto Mindfulness Scale (Lau, et al., 2006), the Wisconsin Inventory of Smoking Dependence Motives (WISDM; Piper et al., 2007), the Positive and Negative Affect Schedule (Watson, et al., 1988), the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004), and the Experiences Questionnaire (Fresco, et al., 2007), using the Questionnaire Development System (QDS) computerized questionnaire delivery system. Participants also completed a standard Visual Probe (VP) task (Waters, 2003), a modified Visual Probe (VP) task (modified from Waters, 2003), and the Depression Implicit Association Test (Greenwald, Nosek, & Banaji, 2003).

Participants were given psychoeducational material to read describing mindfulness (See Appendix C). Participants were instructed to read the materials and laboratory personnel answered any questions related to the materials.

Laboratory personnel instructed the participants in how to use the PDA to complete their daily meditation training. They also instructed participants to complete

a meditation assessment immediately following each meditation training session. After receiving instructions, participants completed a meditation session consisting of sitting quietly and listening to taped meditation (Brief-MM) or sham-meditation (Control) instructions administered over the PDA for approximately twenty minutes. Immediately following meditation practice they completed a post-meditation assessment on the PDA, consisting of a craving item, a measure of state mindfulness, a brief measure of positive and negative affect, and the D-IAT or modified-VP task. Research staff verified the completion of the assessment and gave participants feedback on the time between the completion of the meditation and the beginning of the post-meditation assessment.

Participants were given a paper and pencil smoking diary. They were asked to make an entry each day before they went to bed indicating how many cigarettes they had smoked on that day. Participants were told that they could smoke as much or as little as they like during the study. These diaries were collected from the participants at the second and third laboratory visits. Laboratory personnel scheduled two follow-up laboratory visits at one week and two weeks later.

EMA Procedures

In the EMA portion of the study participants carried the PDA around with them as they went about their daily lives. The PDA was programmed to prompt the participants at random times four times per day to complete assessments. Participants were instructed to initiate one assessment per day following their Brief-MM or control training. At each assessment (Brief-MM, Control, and random) participants would complete a single-item measuring craving, a measure of state

mindfulness, a measure of positive and negative affect, and one implicit measure (D-IAT or modified-VP). The implicit measures were counterbalanced throughout the EMA portion of the study.

All EMA procedures were implemented on a HP iPAQ running the Microsoft Windows Pocket PC operating system. Application programming was done in C#.NET by Terminal C, a Houston-based company. The PDA used a stylus-based, touchscreen system and was extremely user-friendly. Participants were able to navigate through the software and enter data simply by touching the stylus or their finger to the screen. Participants completed EMA questions in the same way as they would a pen-and-paper questionnaire (i.e., using the stylus to mark the appropriate answer). There was no keyboard and only a few external buttons. To use the program, participants do not need to possess any computer skills or know how to type. As in previous studies, participants were locked out of all functions other than the program. The PDAs were essentially worthless for anything but delivering the study application. Because of its small size (i.e., roughly equivalent in size to a pack of cigarettes), the PDA was easy to carry in a pocket or purse. Participants were offered use of an additional carrying case to protect the PDA and to facilitate their carrying the PDA at all times as supplies of cases allowed. Table 3 lists all study procedures and measures.

The Second Session

After one week, participants returned to the laboratory with their PDAs for the second laboratory visit. Participants again completed the following measures: ORS, MAAS, TMS, PANAS, EQ, WISDM, DERS, D-IAT, and modified-VP task. They also

provided a breath sample for post-training CO analysis, and a saliva sample for post-training cotinine analysis. They listened to a twenty-minute meditation or sham-meditation recording, followed by an assessment on the PDA.

The Third Session

After an additional week (two weeks from the beginning of participation in the study), participants returned to the laboratory with their PDA for the third laboratory visit. Participants again completed the following measures: ORS, MAAS, TMS, PANAS, EQ, WISDM, DERS, D-IAT, and modified-VP task. They completed an Acceptability Questionnaire (see Appendix A). They also provided a breath sample for post-training CO analysis, and a saliva sample for post-training cotinine analysis. They listened to a twenty-minute meditation or sham-meditation recording, followed by an assessment on the PDA. Participants in both conditions were reminded that the study involved two groups. Researchers explained that one group was a focused attention or mindfulness meditation group while the other group was given mind-wandering instructions. Participants were told that we expected the mindfulness meditation recordings to be more helpful to smokers than the mind-wandering recordings; however, that expectation was an informed guess rather than a known fact. All participants were told which group they were in and given a CD with the Brief-MM recordings and smoking cessation resources.

Training Conditions

Brief- MM Condition

Participants in the Brief-MM condition were instructed to meditate once per day, using their PDA. Brief-MM consisted of five tracks loaded onto the PDA. Four

tracks were structured around a progressive four-week format commonly used in Vipassana insight meditation: Week 1: mindfulness of breathing; Week 2: mindfulness of body; Week 3: mindfulness of emotions; Week 4: mindfulness of thoughts (Moore, 2008). The first track consisted of an “urge-surfing” technique obtained through personal communication with the author. It was developed to teach smokers mindfulness of urges and cravings during a progressive cue-exposure exercise (Bowen & Marlatt, 2009, original script obtained through personal communication). The other four tracks (mindfulness of the breath, mindfulness of the body, mindfulness of thoughts, and mindfulness of emotions) were adapted from meditations previously used in a mindfulness-based intervention for smoking study (Brewer, Bowen, & Chawla, 2010; Brewer, et al., 2011). The mindfulness of thoughts track was also informed by a brief mindfulness procedure published elsewhere (Papies, Barsalou, & Custers, 2012). The meditation adapted for the mindfulness of emotions track originally incorporated the RAIN (Recognize, Accept, Investigate, Non-identification) technique. The original author’s work also informed the final recorded track (Brach, 2012). Dr. Judson Brewer, Assistant Professor of Psychiatry; Medical Director, Yale Therapeutic Neuroscience Clinic; and principal investigator for an RCT of Mindfulness Training for smoking cessation (Brewer, et al., 2011) reviewed scripts for both the Brief-MM condition and the Control condition. His comments were incorporated in the final product. All meditation and control recordings lasted 20 minutes. Twenty minutes is the modal length of interventions in the brief mindfulness-based intervention literature (Bowen & Marlatt, 2009; Rogojanski, et al., 2011; Wenk-Sormaz, 2005; Zeidan, et al., 2009; Zeidan, et al.,

2010). Additionally, previous studies have reported effects of 10-minute meditations on variables related to smoking (Cropley, et al., 2007; Ussher, et al., 2009); however, there are no data currently that document effects of shorter meditations on cognitive variables. One study reported effects of 20-minute meditations on cognitive performance (Zeidan, et al., 2010).

Control Condition

Participants in the control condition were also instructed to meditate once per day, while listening to a pre-recorded track on their PDA at the time of their choice. PDAs were loaded with five tracks, mirroring the Brief-MM group. The first track consisted of instructions to manage cravings using whatever techniques they would normally use during a progressive cue-exposure exercise (Bowen & Marlatt, 2009, original script obtained through personal communication). The other four tracks were modified from the Brief-MM scripts (Brach, 2012; Brewer, et al., 2010; Papies, et al., 2012). Specifically, where Brief-MM instructed participants to focus their attention, control scripts instructed participants to think about whatever comes to mind without trying to focus on anything in particular (Arch & Craske, 2006).

In both groups, one track was available each day. Participants could listen to the recording multiple times a day if they chose. If a participant did not complete a meditation recording, they would repeat the track on the following day rather than progressing to a new track. Participants progressed through track one through five in order two times. After day ten, meditation tracks were counter-balanced. Randomized lists of the five recordings were created using Randomization.com and

used to construct latin rectangles. The counterbalanced presentation of files was matched between groups.

Measures

Implicit Measures.

Standard visual probe task. Participants were instructed that they would perform a quick task assessing reaction times. They were instructed that a dot will be presented on the left or right hand side of the PDA screen. They were required to indicate the position of the dot as quickly as possible by pressing a “Left” or “Right” button on a PDA screen using their thumbs (Figure 3).

The PDA standard VP task was based on that used by Kerst (2011) and consisted of 80 experimental trials, presented in a new random order for each assessment. At the start of each trial, a fixation cross was displayed in the center of the screen for 500 ms. The picture pair was then presented for 500 ms, one picture on each side of the central position. The dot probe was displayed immediately after the offset of the pictures (see Figure 3 for an example of the task with times). It remained on the screen until the participant made a response. After the participant responded, the fixation cross for the next trial was presented.

Stimulus materials. The picture set used was taken from Kerst (2011). It consisted of 80 images (20 smoking-human, 20 nonsmoking-human, 20 no-human-smoking, 20 no-human-nonsmoking) randomly paired, human-smoking with human-nonsmoking images and no-human-smoking with no-human-nonsmoking images. Each picture pair was presented eight times. Each smoking-related picture appeared once in each of four conditions, reflecting the combination of two within-subject

variables of picture location (smoking-related picture on the left versus right of the screen), and probe location (probe on left versus right of screen). Thus, on half the trials, the probe replaced the smoking pictures, and on the other half, the probe replaced the neutral pictures. The assessment task will take around 5 minutes to complete.

Reaction times were computed from trials with correct responses. To reduce the influence of reaction time outliers (Ratcliff, 1993), reaction times less than 100 ms were discarded. AB index scores were computed as the difference in median RTs on trials where the probe replaced the smoking picture vs. trials where the probe replaced the neutral picture. Faster RTs on the former reflected an attentional bias towards the smoking picture, or vigilance. Faster RTs on the latter reflected an attentional bias away from the smoking pictures, or avoidance. This formula yielded an attentional bias index score with high numbers corresponding to an attentional bias toward smoking stimuli and a low value corresponding to an attentional bias away from smoking stimuli and toward neutral stimuli.

Modified Visual Probe Task. The modified-VP task was the same as the standard visual probe task with two exceptions. First participants were told that in each pair of pictures, one picture was a smoking picture and one picture was a neutral picture. They were asked to consciously try to attend away from the smoking picture during the task. Immediately following the task, they were asked to estimate on what percentage of trials they were successful in attending away from the smoking picture. The modified instruction set was believed to more closely mimic the conscious attentional control fostered during mindfulness practice. Bias scores

greater than 259 ms (1% of assessments) were excluded from analyses, as were bias scores less than -222 ms (1%).

Decentered Perspective. The Depression Implicit Association Test (D-IAT) is a computerized reaction time task used to assess the strength of mental associations. Specifically, participants sorted stimuli based on two concepts: “me” vs. “not me”, and “DEPRESSED” vs. “NOT DEPRESSED”. One block of critical trials (Task 1) presented participants with the task of sorting stimuli as “DEPRESSED or me” or “NOT DEPRESSED or not me” (Figure 4). Another block (Task 2) required participants to sort stimuli as “NOT DEPRESSED or me” or “DEPRESSED or not me” (Figure 5). As discussed below, the relative strengths of automatic mental associations can be inferred from the difference in response times on Task 1 and Task 2.

D-IAT Stimuli. The depressed words were sad, lonely, hopeless, guilty, unhappy, discouraged, gloomy, low, depressed, failure. The not depressed words were content, joyful, happy, cheerful, pleased, fun, merry, funny, excited, positive. Me/not me words were derived from previous IAT research (Brown & Ryan, 2003). Me words included I, me, mine, myself, and my. Not me words included they, them, their, it and other.

IAT Procedure. The traditional IAT consists of three practice blocks and four experimental blocks (see Table 4). Similar to Waters et al. (2011), the PDA version of the IAT consisted of only the four experimental blocks in order to reduce the duration of the assessments in the field. Practice blocks 1 and 2 were administered via paper. Participants were given 24 cards with either a DEPRESSED or a NOT-

DEPRESSED word on each. They were presented with a standard letter size paper with category labels of DEPRESSED and NOT-DEPRESSED in the top left-hand corner and top right-hand corner, respectively. They were asked to sort the cards into two piles using the category labels as quickly and accurately as possible. The researcher monitored the sorting and corrected them as necessary. Next they repeated the procedure with 24 cards with me or not-me words and a piece of paper with corresponding category labels.

Once the practice blocks were completed, they were presented with a PDA. On each trial, a stimulus (word) was presented in the center of the PDA screen (Figures 4 and 5). On the top of the screen were labels (on each side of the screen) to remind participants of the categories assigned to each key for the current task. Participants responded to the categorization task by pressing either an “L” key or the “R” key on the response device (PDA). They were instructed to respond as quickly and as accurately as possible. Only blocks 3, 4, 6 and 7 were presented. The program randomly selected items under the constraint that the sequence of trials alternated between the presentation of a depressed/not depressed word and the presentation of a me/not me word (Table 4). If the participant responded correctly the program proceeded to the next trial, after an inter-trial interval of 150 ms. If the participant made an error, a red “X” appeared below the stimulus and remained there until the participant responded correctly. Participants were instructed to correct their errors as quickly as possible.

IAT Scoring. We used the scoring algorithm recommended by Greenwald et al. (2003) to derive the IAT effect (See Table 4). All data from blocks 3, 4, 6, and 7

were used. This scoring algorithm involved computing the difference score between mean response times per trial on Task 1 and Task 2, and dividing the difference score by the pooled standard deviation of response times. The resulting IAT effect, D , is similar to an effect-size measure. This scoring counteracts a “cognitive skill” artifact that had been observed with earlier scoring algorithms (Greenwald et al., 2003); the new IAT effect, D , is generally not correlated with overall mean reaction time (RT) (an index of general processing ability). The algorithm also eliminated 1) assessments on which a participant had response times of less than 300 ms on more than 10% of the trials (9.5% of IAT assessments), and 2) all response times > 10,000 ms. RTs on incorrect responses were replaced by the block mean (correct responses) + 600ms (Greenwald, et al., 2003).

The IAT effect, as measured by the IAT D -score, captured whether mental associations were stronger between “DEPRESSED” and “me”, and “NOT DEPRESSED” and “not me”, (Task 1) compared to “NOT DEPRESSED” and “me”, and “DEPRESSED” and “not me” (Task 2) (De Houwer, 2002). In the present conceptualization, stronger mental associations between “DEPRESSED” and “me” and “NOT DEPRESSED” and “not me” represented a mindless state where little distance existed between an individual’s sense of self and negative (specifically depressive) contents of consciousness (Figure 6). Stronger mental associations between “NOT DEPRESSED” and “me” and “DEPRESSED” and “not me” represented a mindful state, characterized by a decentered perspective to negative (specifically depressive) contents of consciousness (Figure 7).

Laboratory self-report measures.

Appendix A lists the self-report measures that were used in this study. Laboratory self-report measures include a demographics questionnaire which asks participants to provide their age, gender, race/ethnicity, income, and other demographic data. The smoking history questionnaire contains questions relating to the participants' current and past smoking behavior. Questions include how long they have been smoking, how much they smoke on average, and what kind of cigarettes they smoke (i.e. menthol or regular).

Subjective Distress. The Outcome Rating Scale (ORS) will be used to assess subjective distress. The ORS is a four item visual analog scale with demonstrated reliability (Cronbach's $\alpha = .93$). The participant marks each of four ten-centimeter lines, indicating how they feel about four areas of their life. Individual item scores are the distance in centimeters from the beginning of the line and range from 0 (high distress) to 10 (low distress). The scale has a minimum score of 0, indicating high distress, and a maximum score of 40, indicating low distress (Miller, et al., 2003).

Trait Mindfulness. The Mindful Attention Awareness Scale (MAAS) was used to assess trait mindfulness. The MAAS is a 15-item self-report questionnaire with demonstrated reliability (Cronbach's $\alpha = .82$). Each item is rated on a six point Likert scale ranging from 1 = "almost always" to 6 = "almost never". An example item from the MAAS is "I could be experiencing some emotion and not be conscious of it until some time later".

The MAAS total score was calculated as a mean of the 15 items with a minimum score of 1 and a maximum score of 6. Mindfulness as measured by the

MAAS has been shown to correlate with several well-being constructs, discriminate between individuals who practice meditation and those who do not, and predict well-being outcomes in a clinical sample (Brown & Ryan, 2003).

State Mindfulness. The Toronto Mindfulness Scale (TMS) was used to assess state mindfulness. The TMS is a 13-item self-report questionnaire with two subscales: curiosity (Cronbach's $\alpha = .93$) and decentering (Cronbach's $\alpha = .91$). Each item was rated on a five point Likert scale ranging from 0 = "Not at all" to 4 = "Very much". An example item from the TMS is "I was more concerned with being open to my experiences than controlling or changing them".

The TMS subscale scores were calculated as a sum of the items assigned to each subscale. The TMS-Curiosity subscale consists of six items (3, 5, 6, 10, 12, 13; Appendix A) and ranges from a minimum of zero to a maximum of 24. The TMS-Decentering subscale consists of seven items (1, 2, 4, 7, 8, 9, 11) and ranges from a minimum of zero to a maximum of 28. TMS subscale scores were shown to increase with increasing mindfulness meditation experience and during the course of an 8-week Mindfulness-Based Stress Reduction Course. TMS-Decentering scores were shown to predict clinical outcome (Lau, et al., 2006).

Positive and Negative Affect. The Positive and Negative Affect Schedule (PANAS) was used to measure both positive (PANAS-PA) and negative affect (PANAS-NA). The PANAS is comprised of two 10-item scales that measure positive and negative affect. The items are scored using a six point Likert scale ranging from 1 = "very slightly or not at all" to 6 = "extremely." In the laboratory, the PANAS asked about experiences "in the last week." Total scores for each subscale range from a

minimum of 10 to a maximum of 60, with higher scores indicating greater levels of affect. Example items include “hostile” for the PANAS-NA and “excited” for the PANAS-PA. The scales independently demonstrated adequate internal reliability, with Cronbach’s α ranging from .86 - .90 for Positive Affect and .84 - .87 for Negative Affect depending on the time period identified in the instructions. The scales are largely uncorrelated and scores demonstrated stability over a two month period (Watson & Clark, 1988). Scores were recalculated using a shortened version of the PANAS (Mackinnon et al., 1999) after data collection in order to make comparisons between laboratory and PDA measurements easier.

Self-Report Decentered Perspective. The 11-item Decentering Subscale from the Experiences Questionnaire was used to measure self-reported decentering or disidentification with content of negative thinking. The scale was designed with two subscales: decentering and rumination. Analyses indicated that a single factor solution (decentering) provided better fit than the proposed two-factor solution (Fresco, et al., 2007). The 11-item Decentering Subscale demonstrated adequate internal consistency (Cronbach’s $\alpha = .83$). It correlated positively with cognitive reappraisal and negatively with depressive rumination, experiential avoidance, emotion suppression, and symptoms of depression. The items are scored using a five point Likert scale ranging from 1 = “never” to 5 = “all the time.” Total scores for each subscale may range from a minimum of 11 to a maximum of 55, with higher scores indicating greater levels of decentered perspective. Example items include “I can separate myself from my thoughts and feelings” and “I can observe unpleasant feelings without being drawn into them” (Fresco, et al., 2007).

Emotion Regulation. The Difficulties in Emotion Regulation Scale (DERS) is a 36-item multidimensional questionnaire that measures emotion regulation. Items are scored on a five point Likert scale ranging from 1 = “almost never” to 5 = “almost always.” Several items are reverse scored in order to have higher scores indicate greater difficulty in emotion regulation. The total DERS score ranges from 36 to 180, with higher scores indicating greater difficulty in emotion regulation. Example items include “When I'm upset, I have difficulty thinking about anything else” and “When I'm upset, I believe that I will remain that way for a long time.” Internal consistency for the total scale is excellent (Cronbach's $\alpha = .93$) (Gratz & Roemer, 2004).

Dependence. The Wisconsin Inventory of Smoking Dependence Motives (WISDM-68) is a 68-item multidimensional questionnaire that measures tobacco dependence. Items are scored using a seven point Likert scale ranging from 1 = “not true of me at all” to 7 = “extremely true of me.” The total WISDM score ranges from 13 to 91 with higher scores indicating greater levels of dependence. Example items from the WISDM include “I frequently smoke to keep my mind focused” and “Smoking helps me deal with stress.” Internal consistency for the total scale is excellent (Cronbach's $\alpha = .97 - .99$) (Piper et al., 2004).

Acceptability. Acceptability was assessed at Visit 3 using an author-constructed questionnaire designed for this study.

Biological measures.

Salivary cotinine. A saliva sample was taken at each laboratory visit for the assessment of salivary cotinine. Salivary cotinine is considered the “gold standard” for measuring nicotine exposure (Ossip-Klein et al., 1986).

Exhaled carbon monoxide. Exhaled CO levels were measured with a CO monitor (Vitalograph, Lexena, KS) and provided an additional measure of exposure (SRNT Subcommittee on Biochemical Verification, 2002). The participant's CO level was obtained at the beginning of each experimental session. The CO monitor was calibrated from a cylinder of research gas with a known CO concentration (about 50 ppm) regularly.

PDA self-report assessments

Participants completed a craving measure, a brief PANAS, and the TMS on the PDA during random and meditation assessments. A single item measured craving for cigarettes on a 7-point Likert-type scale (1 = Strongly Disagree, 7 = Strongly Agree) according to how they feel "right now." A 10-item version of the PANAS (distressed, excited, upset, scared, enthusiastic, inspired, alert, nervous, determined, afraid) was administered; this abbreviated version is psychometrically sound (Mackinnon, et al., 1999). The full 13-item TMS was also administered on the PDA. Like the QDS version, items will be rated on a 5-point Likert scale ranging from 0 = "not at all" to 4 = "very much" (Lau, et al., 2006).

Order of PDA assessments. After each meditation, the participant interacted with the PDA to initiate a meditation assessment. At each assessment (RA or participant-initiated), the self-report questions preceded the cognitive task. Self-report measures included a craving item, the brief PANAS, and the TMS. The implicit tasks were the D-IAT or modified-VP.

Analytic Plan

Overall Analytic Approach. We used linear mixed models (LMM) (PROC MIXED in SAS) for the primary analyses. These analyses allow for the fact that subjects differ in the number of observations available for analysis, and take into account the clustering of data within subjects. All tests were 2-tailed, and alpha was set to .05 for analyses unless otherwise stated.

To analyze variables assessed during EMA, Day in study (a within-subject variable) was entered as a continuous variable, along with Group (a between-subject categorical variable with two levels, Brief-MM vs Control) and Assessment Type (a within-subject categorical variable). As described in more detail later, Assessment Type had three levels: RA vs. valid MA vs. invalid MA. Valid MAs were participant-initiated assessments that were completed within 60 seconds of the completion of training, and invalid MAs were participant-initiated assessments that were completed more than 60 seconds from the completion of training. The Group by Day and Group by Assessment Type interaction terms were tested for all variables. Each dependent variable was analyzed in a separate model. Baseline (pre-intervention) measures of each dependent variable were included in each model. For EMA data, for all models we used a random (subject-specific) intercept and an autoregressive model of order 1 for the residuals within subjects. The within-subject variable, Day, was treated as a random effect in the model if the p -value for the covariance parameter estimate (for Day) was less than .1 (Fitzmaurice, Laird & Ware, 2011). The same was true for Assessment Type.

To analyze cigarettes smoked per day, which was assessed daily on the smoking diary, Day in study was entered as a continuous variable, along with Group, and the Group by Day interaction term. As before, we used a random (subject-specific) intercept and an autoregressive model of order 1 for the residuals within subjects.

To analyze variables assessed during laboratory visits, Visit in study was entered as a categorical variable with 2 levels (Visit 2 vs. Visit 3), along with Group, and the Group by Visit interaction term. As with the EMA data, each dependent variable was analyzed in a separate model, and baseline (pre-intervention) measures of each dependent variable were included in each model.

As noted later, there was a significant between-group difference in smoking rate at baseline (pre-intervention). In secondary analyses we recomputed all LMMs when including baseline smoking rate as an additional covariate; none of the findings from the primary analyses (presented in Tables 11 and 12) changed.

Aim 1. We computed 95% confidence intervals for the proportion of Brief-MM and Control trainings completed. If the proportion of completed trainings in the Brief-MM group was not significantly lower than 75%, this would indicate feasibility. We also computed the proportion of participants in each group who reached the 75% cutoff.

We also computed 95% confidence intervals for the duration between the completion of Brief-MM and initiation of a task assessment (MA). If the duration was not significantly longer than 30 seconds, this would indicate feasibility. As described

in more detail later, we also repeated the same analyses using 60 seconds as a cut-off.

For the analysis of the MAAS (assessed at laboratory visits), we tested the parameter estimate for the main effect of Group and the Group by Visit interaction term. A significant parameter estimate for the former would indicate that the two groups differed in post-intervention measures, and a significant parameter estimate for the latter would indicate that the effect of Group changed over time.

For the analysis of state mindfulness (assessed during EMA), a significant parameter estimate for the main effect of Group would reveal that, averaged over assessments and days, the Brief-MM group exhibited greater (or lower) state mindfulness than the Control Group. A significant parameter estimate for the Group by Day interaction would indicate that the effect of Group changed over time, and a significant parameter estimate for Group by Assessment Type interaction term would indicate that the effect of Training Group was different at the different Assessment Types.

Aim 2. For the analysis of attentional bias, a decentered perspective, negative affect, and positive affect (all assessed during EMA) a significant parameter estimate for the main effect of Group would reveal that, averaged over all assessments, the Brief-MM group exhibited lower (or higher) levels on the dependent variable than the Control Group. A significant parameter estimate for the Group by Day interaction would indicate that the effect of Group changed over time, and a significant parameter estimate for Group by Assessment Type interaction term

would indicate that the effect of Group was different at the different Assessment Types.

For the analysis of cigarettes per day (assessed daily), a significant parameter estimate for the main effect of Group would reveal that, averaged over days, the Brief-MM group exhibited a lower (or higher) smoking rate than the Control Group. A significant parameter estimate for the Group by Day interaction would indicate that the effect of Group on smoking rate changed over time.

For the analysis of the WISDM and cotinine levels and other laboratory assessments, a significant parameter estimate for the main effect of Group would indicate that the groups differed post-intervention, and the Group by Visit interaction would indicate that the effect of Group changed over time.

Aim 3. To test mediation hypotheses we used Baron and Kenny's (1986) causal steps (Fritz & MacKinnon, 2007). For conceptual simplicity, we focused on those cases where there was a significant effect of Group on the dependent variable (i.e., a significant c path). For reported smoking, mediation at $\alpha = .05$ was indicated if: a) the effect of Group (X) on a mediator (M) was significant ($\alpha = .025$; using LMM; a path); and b) the effect of a mediator on reported smoking was significant ($\alpha = .025$) when controlling for Group (b path). Complete mediation would be indicated if the effect of Group (c' path) is reduced to non-significance in this model. Baseline measures were included as a covariate in these analyses. The same approach was taken when WISDM scores were used as the dependent variable.

Power Analyses. Power Analyses were conducted using G*Power Version 3 (Faul, 2004). In the calculations described below, the power estimates account for

the fact that repeated observations from the same person will be correlated, indexed by the intraclass correlation coefficient (ICC). Power estimates depend on both the size of the ICC and the average number of observations per person. These two factors are used to determine the variance inflation factor (VIF). The VIF measures by how much the total number of assessments must be reduced to yield an estimate of the “effective sample size” prior to use of the usual approaches to compute power. The VIF equals: $1 + ((\text{average number of observations per person}) - 1) * \text{ICC}$. The effective sample size is calculated using an estimate of the total number of assessments (i.e., average number of observations per person multiplied by the number of study participants) divided by the VIF. Table 5 illustrates the estimated number of completed assessments, assuming that participants complete 75% of the RAs scheduled per day, and that 20 subjects are enrolled in each group.

As discussed previously, determining the feasibility of the intervention (Aim 1) is a primary aim of the study. The power to detect a main effect of Group (for both Aims 1 and 2) will decrease as a function of the correlation for the repeated measures. For dependent variables that are assessed at every assessment (state mindfulness, PANAS-NA, PANAS-PA), if the ICC = .1 (or .3), then the effective sample size would be $N = 341$ (or $N = 128$), and we would have power $1 - \beta = .99$ (.80) to detect an effect size, Cohen's $f = 0.25$ (a medium effect size) for the main effect of Group, and power $1 - \beta = .99$ (.80) to detect an Assessment Type difference score (score on valid MAs minus score on RAs), $f = 0.25$ (equivalent to a Group by Assessment Type interaction). For dependent variables that are assessed at every other assessment (attentional bias, decentered perspective), if the ICC = .1 (or .3),

then the effective sample size $N = 298$ (122), and we have power $1-\beta = .99$ (.78) to detect an effect size, $f = 0.25$, and power $1-\beta = .99$ (.78) to detect an Assessment Type difference score, $f = 0.25$ (equivalent to a Group by Assessment Type interaction). For the Group by Day interaction we have power $1-\beta = .80$ to detect a between-group difference in b coefficients (slopes) of 0.12 (in the population), assuming the ICC = .3, the SD of Day in the population = 4.18 and the SE of the Estimate (SD of residuals in the population) = 1.00.

For the mediation analyses (Aim 3), assuming the ICC = .3, the effective no. of days (taking into account the variance inflation factor) = 114. Under these conditions, we have $> .80$ power to detect an effect size of $f = .29$ for the effect of Group on the mediator ($\alpha = .025$) (a path) and $> .80$ power to detect an effect size of $f^2 = .11$ for the effect of the mediator on reported smoking when including Group ($\alpha = .025$) (b path).

Results

Descriptive Statistics

Forty-four participants were enrolled in the study. Two participants were assigned to a group without receiving the intervention (See Figure 8). As noted in Figure 8, one participant decided to discontinue the study during the baseline visit. The other participant had physical limitations that prevented her from completing PDA assessments.

Descriptive statistics for this sample are presented in Table 7. Brief-MM and Control participants did not differ by age, sex, or race. Brief-MM and Control participants did not differ in measures of baseline mindfulness including MAAS scores, TMS-Curiosity scores, and TMS-Decentering scores. Brief-MM participants (vs. Control) smoked more cigarettes per day, at a marginally significant level (See Table 7). A visual inspection of the data revealed that two participants in the Brief-MM group reported smoking 40 cigarettes per day at baseline. The groups did not differ in other measures of dependence and smoking history, including WISDM scores, age of smoking initiation, and lifetime quit attempts (see Table 7).

Completers vs. Non-completers

Of the 44 participants enrolled in the study, 32 successfully completed the study. Comparisons between Completers ($n = 32$) and Non-completers ($n = 12$) are presented in Table 8. Completers (vs. Non-completers) had significantly higher TMS – Decentering scores at baseline. Completers and Non-completers did not differ on baseline group assignment, age, sex, race, MAAS scores, TMS – Curiosity scores,

Cigarettes smoked per day, WISDM scores, Age when started daily smoking, or Lifetime quit attempts (see Table 8).

EMA Descriptive Statistics

Summary statistics on dependent variables by group and day are presented in Table 9. Summary statistics by group and assessment type are presented in Table 10.

Brief-MM participants completed assessments on the PDA for an average of 15.1 days ($SD = 4.91$) and Control participants completed assessments for an average of 14.5 days ($SD = 3.66$), $F(1, 35) = 0.13$, $p = .72$. Overall, participants completed an average of 66.4% ($SD = 22.9$) of the presented RAs (Median Compliance on RAs = 75.5%). During the study participants in the Brief-MM and Control groups completed an average of 32.8 RAs ($SD = 14.9$) and 25.8 RAs ($SD = 17.7$) respectively, $F(1, 35) = 1.70$, $p = .20$, and they completed an average of 24.0 MAs ($SD = 25.4$) and 17.8 MAs ($SD = 10.6$) respectively, $F(1, 35) = 0.88$, $p = .36$. In total, Brief-MM participants completed an average of 56.7 assessments ($SD = 28.2$) and Control participants completed an average of 43.5 assessments ($SD = 22.6$), $F(1, 35) = 2.39$, $p = .13$.

Participants in the Brief-MM and Control groups completed RAs on average at 3:15 pm ($SD = 3.93$ hours) and 3:37 pm ($SD = 4.03$) respectively, $F(1, 1056) = 1.25$, $p = .26$. Participants completed MAs at 12:53 pm ($SD = 5.34$ hours) and 2:26 pm ($SD = 5.27$) respectively, $F(1, 744) = 3.10$, $p = .07$. Overall, participants completed MAs 2 hours and 4 minutes earlier in the day than RAs, $F(1, 35) = 21.2$, $p < .0001$, but this difference did not vary by group, $F(1, 1800) = 1.61$, $p = .20$.

Specific Aim 1: Feasibility and Acceptability Analyses

Hypothesis 1.1 predicted that Brief-MM participants' percentage of completed mindfulness trainings would not be significantly lower than 75%. Non-laboratory assessment days from Day 1 to Day 15 were used for this analysis. Laboratory assessment days were excluded because participants were instructed to meditate in the laboratory. Including these days would result in artificially increasing the percentage of meditations completed. Days 16 and higher for all participants were also excluded, as the study was planned for 15 days. Some participants continued past day 15 due to participant difficulty in scheduling the last laboratory assessment. It is reasonable to assume that the randomness of the sample would be compromised past Day 15. Brief-MM participants who completed the study ($n = 18$) completed 82.87% (95% *CI* [71.19%, 94.55%]) of trainings on non-laboratory assessment days, supporting Hypothesis 1.1. Fifteen of the 18 Brief-MM participants (83.3%) completed at least 75% of trainings. Control participants completed a mean of 41.67% (95% *CI* [25.43%, 57.90%]) on non-laboratory assessment days. Including meditations conducted in the laboratory, Brief-MM participants completed an average of 13.1 trainings ($SD = 3.23$) and Control participants completed an average of 7.2 trainings ($SD = 4.44$), $F(1, 30) = 18.6$, $p < .001$.

Hypothesis 1.2 predicted that Brief-MM participants' percentage of Meditation Assessments (MAs) completed within 30 seconds of the end of mindfulness training in the field would not be significantly lower than 75%. Participants in the Brief-MM group ($n = 18$) completed 80.56% (95% *CI* [68.41%, 92.70%]) of MAs in the laboratory and 53.24% (95% *CI* [39.17%, 67.30%]) of MAs in the field within 30

seconds. The 30-second cutoff was used by Ussher et al. (2009) in a study with a single assessment in the natural environment. In retrospect, using the same cutoff in the current study may have been overly restrictive due to the differences in the durations of the studies. Notably, as stated above, compliance within 30 seconds was only around 80% even in the controlled laboratory setting. The analysis was repeated using 60 seconds as a cutoff. Participants in the Brief-MM group ($n = 18$) completed 92.59% (95% CI [83.50%, 100.00%]) of MAs in the laboratory and 65.57% (95% CI [51.07%, 80.06%]) of MAs in the field within 60 seconds. All additional analyses in the study used 60 seconds as a cutoff between valid MAs and invalid MAs. Control participants ($n = 13$, laboratory; $n = 12$, field) completed 64.10% (95% CI [40.18%, 88.02%]) of MAs in the laboratory and 58.39% (95% CI [36.76%, 80.03%]) of MAs in the field within 30 seconds. Control participants ($n = 13$, laboratory; $n = 12$, field) completed 78.21% (95% CI [60.10%, 96.31%]) of MAs in the laboratory and 70.62% (95% CI [50.52%, 90.72%]) of MAs in the field within 60 seconds. In sum, hypothesis 1.2 was not supported using the 30 second cutoff; however, it was supported using the 60 second cutoff.

Hypothesis 1.3 predicted that Brief-MM (vs. Control) would increase trait mindfulness measured by the MAAS during laboratory assessments. LMM analyses conducted on MAAS scores yielded a non-significant effect of Group and a non-significant Group x Visit interaction (See Table 11). Hypothesis 1.3 was not supported.

Hypothesis 1.4 predicted that Brief-MM (vs. Control) would increase state mindfulness measured by the Toronto Mindfulness Scale. For TMS-Curiosity (TMS-

Cur) scores, LMM analyses in the laboratory yielded a non-significant effect of Group and a non-significant Group x Visit interaction (See Table 11). However, LMM analyses conducted on EMA data revealed a significant Group x Day interaction (see Table 12, Figure 9). For TMS-Cur, there was no significant effect of Day for the Brief-MM group, $F(1, 19) = 1.86$, $PE = 0.07$, $SE = 0.05$, $p = .19$, or for the Control group, $F(1, 16) = 2.03$, $PE = -0.12$, $SE = 0.09$, $p = .17$. When analyzing data from days 9 and greater, there was a significant main effect of group, $F(1, 739) = 4.32$, $PE = 2.90$, $SE = 1.39$, $p = .04$, with higher scores in the Brief-MM group.

For TMS-Decentering (TMS-Decen) scores, LMM analyses in the laboratory yielded a non-significant effect of Group and a non-significant Group x Visit interaction (see Table 11). However, LMM analyses conducted on EMA data revealed a significant Group x Day interaction (see Table 12, Figure 10). For TMS-Decen, there was a significant effect of Day for the Brief-MM group, $F(1, 19) = 9.43$, $PE = 0.20$, $SE = 0.07$, $p = .006$, meaning that TMS-Decen scores increased over time in the Brief-MM Group, but not for the Control group, $F(1, 16) = 0.64$, $PE = -0.07$, $SE = 0.09$, $p = .44$. When analyzing data from days 9 and greater, there was a significant main effect of Group, $F(1, 739) = 3.86$, $PE = 2.96$, $SE = 1.51$, $p = .05$, with higher scores in the Brief-MM group.

Participant responses to the acceptability questions indicated that the intervention was well-received by both groups. When asked "Overall, did you like this program, meaning you found it acceptable," 16 of 18 Brief-MM participants and 13 of 13 control participants responded either "3 - Somewhat acceptable" or "4 - Very acceptable." When asked "Was meditating 20 minutes per day reasonable," 17

of 18 Brief-MM participants and 10 of 13 Control participants responded either “3 – a little reasonable” or “4 – very reasonable.” 15 of 18 Brief-MM participants and 12 of 13 Control participants reported that they were “3 – quite likely” or “4 - very likely” to recommend the program to a friend. (Interestingly, control participants (vs. Brief-MM) had higher mean ratings on this item, $F(1, 29) = 6.36, p = .02$; a non-parametric test, Wilcoxon’s test, also revealed a significant difference, $p = .01$). 16 of 18 Brief-MM participants and 11 of 13 Control participants indicated that they were “3 - quite likely” or “4 – very likely” to volunteer for a similar program that would continue up to one month.

Specific Aim 2: Effects of Group on cognition, affect, craving, and smoking

Hypothesis 2.1 predicted that Brief-MM (vs. Control) would decrease attentional bias to smoking-related stimuli measured by the visual probe task. LMM analyses on laboratory and EMA attentional bias scores revealed non-significant main effects of Group in the lab and field, as well as non-significant Group x Visit (See Table 11) and Group x Day (See Table 12) interactions, respectively. Hypothesis 2.1 was not supported.

Hypothesis 2.2 predicted that Brief-MM (vs. Control) would increase a decentered perspective to negative affective stimuli measured by the D-IAT and self-report. LMM analyses on laboratory and EMA D-IAT scores yielded a non-significant main effect of Group in the lab and field, as well as non-significant Group x Visit (See Table 11) and Group x Day (See Table 12) interactions, respectively. LMM analyses on EQ-Decentering scores yielded a non-significant main effect of Group and a non-significant Group x Visit interaction (See Table 11). As described above,

analysis of EMA TMS-Decen scores showed a significant Group x Day interaction (See Table 12). Hypothesis 2.2 was partially supported.

Hypothesis 2.3 predicted that Brief-MM (vs. Control) would increase positive affect measured by the Positive and Negative Affect Schedule. LMM analyses on laboratory and EMA PANAS – PA scores yielded a non-significant main effect of Group in the lab and field, and non-significant Group x Visit (See Table 11) and Group x Day (See Table 12) interactions, respectively. Hypothesis 2.3 was not supported.

Hypothesis 2.4 predicted that Brief-MM (vs. Control) would decrease negative affect measured by the Positive and Negative Affect Schedule. LMM analyses on laboratory and EMA PANAS – NA scores showed non-significant Group x Visit (See Table 11) and Group x Day (See Table 12) interactions, respectively. However, LMM analyses of EMA data did reveal a main effect of Group on PANAS-NA scores (See Table 12, Figure 11) (in the absence of a Group x Day interaction). Averaged over days, negative affect was lower in the Brief-MM group. Hypothesis 2.4 was partially supported.

Hypothesis 2.5 predicted that Brief-MM (vs. Control) would decrease smoking behavior measured by daily smoking logs. LMM analyses on smoking log data revealed a significant Group x Day interaction (See Table 12, Figure 12). There was a significant effect of Day for the Brief-MM group, $F(1, 19) = 19.1$, $PE = -0.38$, $SE = 0.09$, $p = .0003$, indicating that smoking declined over time in this group, but not for the Control group, $F(1, 15) = 1.13$, $PE = -0.08$, $SE = 0.08$, $p = .30$. Hypothesis 2.5 was supported. Recall that smoking rate was marginally higher in Brief-MM

participants at baseline. This may have made it easier for those participants to reduce their smoking rate. However, there was no correlation between smoking rate at baseline and the slopes of cigarettes smoked per day over time, $r(35) = .07$, $p = .70$.

Hypothesis 2.6 predicted that Brief-MM (vs. Control) would decrease smoking behavior measured by salivary cotinine. LMM analyses on salivary cotinine data yielded a non-significant main effect of Group and a non-significant Group x Visit interaction (see Table 11). Hypothesis 2.6 was not supported.

Hypothesis 2.7 predicted that Brief-MM (vs. Control) would decrease nicotine dependence measured by the Wisconsin Inventory of Smoking Dependence Motives. LMM analyses on WISDM scores a non-significant main effect of Group and a non-significant Group x Visit interaction (see Table 11). Hypothesis 2.7 was not supported. However, when analyses were restricted to visit 3 (end of treatment) then there was a trend toward a main effect of Group on WISDM scores, $F(1, 29) = 3.58$, $PE = -6.35$, $SE = 3.35$, $p = .07$.

Although craving was not identified as a primary outcome measure, the effects of the intervention on craving were explored. LMM analyses on laboratory measures of craving indicated a non-significant effect of Group and a non-significant Group x Visit interaction (See Table 11). However, when analyses were restricted to visit 3 (end of treatment) then there was a main effect of Group on craving, $F(1, 29) = 4.27$, $PE = -0.80$, $SE = 0.39$, $p = .04$. LMM analyses on EMA measures of craving indicated a significant Group x Assessment Type interaction (See Table 12, Figure 13) and a non-significant Group x Day interaction (See Table 12). The effect of

Group on craving was significant at valid MAs, $F(1, 228) = 9.79$, $PE = -1.12$, $SE = 0.36$, $p = .002$, and invalid MAs, $F(1, 417) = 5.41$, $PE = -0.87$, $SE = 0.37$, $p = .02$, but not at RAs, $F(1, 1021) = 0.08$, $PE = -0.11$, $SE = 0.38$, $p = .77$. Participants in the Brief-MM group reported lower craving ratings at Valid MAs than RAs, $F(1, 19) = 6.25$, $PE = 0.44$, $SE = 0.17$, $p = .02$, whereas participants in the Control group reported (non-significantly) higher craving ratings at Valid MAs than RAs, $F(1, 15) = 1.53$, $PE = -0.38$, $SE = 0.31$, $p = .24$. Following the recommendations of Hedeker, Mermelstein, Berbaum, and Campbell (2009), the analyses on assessment type differences were recomputed when controlling for participants' proportion of valid MAs and RAs. The effects persisted when controlling for this covariate, bolstering the conclusions that the observed effects are truly within-subject effects.

Specific Aim 3: Mediation Analyses

As noted earlier, the effect of Group on WISDM scores at visit 3 did not quite reach statistical significance (Hypothesis 2.7). Therefore, the c path for a mediation model involving WISDM as the dependent variable was not significant. Therefore a formal mediation analysis for this outcome variable (WISDM) was not computed.

For cigarettes smoked per day, as noted earlier, although the main effect of Group was not significant, the Group by Day interaction was significant (Table 12, Figure 12). The effect of the Group by Day interaction on cigarettes smoked per day could not be mediated by Negative or Positive Affect, because the Group by Day interaction was not significant for these measures. The same was true for attentional bias and the IAT effect. Stated another way, the a path was not significant for any of these potential mediators.

The Group by Day interaction was significant for TMS-Decen and TMS-Cur (See Table 12). Although not originally planned, we therefore tested whether TMS-Decen or TMS-Cur mediated the effect of the Group by Day interaction on cigarettes smoked per day. This required testing the significance of the b path. A significant b path would mean that individuals who had more positive slopes for TMS-Decen (or TMS-Cur) over days would have more negative slopes for cigarettes smoked per day over days (controlling for Group). Subject-specific slopes (for Day) were computed for TMS-Decen (and TMS-Cur) and cigarettes smoked per day. Using multiple regression analysis, neither the TMS-Decen slope, $F(1, 34) = 0.32$, $PE = 0.05$, $SE = 0.09$, $p = .58$, nor the TMS-Cur slope, $F(1, 34) = 0.05$, $PE = 0.05$, $SE = 0.14$, $p = .83$, predicted the slope for cigarettes smoked per day (controlling for Group). Therefore, there was no evidence that the effect of Group on cigarettes smoked over time (the Group by Day interaction) was mediated by changes in state mindfulness over time.

Discussion

The main findings of the study were as follows. First, the intervention was demonstrated to be feasible. There was good adherence to home meditation practice in the mindfulness group and high ratings on acceptability questions in both groups. Second, as predicted, the intervention reduced negative affect and smoking. The intervention also reduced craving, at least immediately following trainings. Third, the intervention did not influence positive affect or the cognitive measures. Moreover, there was no evidence that the effect of the intervention on smoking was mediated by its effects on affect and cognition. These findings are discussed in more detail below.

Feasibility and Acceptability of Intervention

As noted earlier, adherence to at home meditation was good in the Brief-MM group. Interestingly, adherence was poorer in the Control group. This was true even though the Control group reported that the control intervention was acceptable. The meaning of these data is not clear. The difference in adherence between the two groups may be due to differences between the first meditation and control recording. In the Brief-MM group, the urge-surfing meditation involved teaching participants to monitor their cravings mindfully without reacting while manipulating cigarettes. Making a strong initial connection between mindfulness and smoking was thought to be important to gaining buy-in. Conversely, Control participants began with the same cue-provoked craving exercise, but were coached to manage cravings as they normally would. Urge-surfing was arguably the strongest manipulation in the Brief-MM group and the weakest manipulation in the Control group. Speculatively, this

difference may have influenced subsequent adherence to the daily meditation practice.

Effect of Intervention on Mindfulness

The intervention increased state mindfulness (TMS – Curiosity score and TMS- Decentering score) in the Brief-MM group (vs. Control) over time, but did not increase trait mindfulness (MAAS score). Due to the relatively constant nature of traits, it is unsurprising that a two-week intervention did not alter trait mindfulness. Additionally, this finding fits well with other studies that have used both measures. Independent studies reported non-significant correlations between trait mindfulness and state mindfulness (Ortner, Kilner, & Zelazo, 2007; Thompson & Waltz, 2007). A third study reported pre-post changes in both state and trait mindfulness following an eight week Mindfulness-Based Stress Reduction course, yet still did not find a correlation between the two constructs (Carmody, Reed, Kristeller, & Merriam, 2008).

One explanation for the finding that the intervention changed state, but not trait mindfulness is that state and trait mindfulness exist on a continuum with state mindfulness being easier to change. It is possible that the experimental manipulation was strong enough to change state mindfulness but not trait mindfulness. A stronger experimental manipulation may be required to change both. This idea still does not adequately explain why measures of state and trait mindfulness are not correlated.

State and trait mindfulness may be conceptually distinct. Conceptual differences between the two scales are clear. The MAAS items focus on measuring a single factor that broadly captures the degree to which one is attentive and aware

of one's experiences or surroundings regardless of conceptual or experiential exposure to mindfulness (e.g. "I tend to walk quickly to get where I'm going without paying attention to what I experience along the way"; Brown & Ryan, 2003). The TMS measures a two-factor construct, including decentering (e.g. "I was more concerned with being open to my experiences than controlling or changing them") and curiosity (e.g. "I was curious about my reactions to things"; Lau, et al., 2006). The intervention may have been unintentionally better suited to change state (vs. trait) mindfulness. Participants were led through formal sitting meditations. Participants were not explicitly instructed to apply skills cultivated during meditation practice to their daily lives. Because the urge-surfing meditation included the use of cigarettes to provoke cravings, it arguably had the clearest application to daily living. Nonetheless, even in that recording, participants were taught urge-surfing without being explicitly encouraged to practice it in their lives. Changing the intervention to teach and encourage participants to use smaller moments of mindfulness throughout the day in addition to formal sitting practice may yield changes to trait mindfulness in addition to state mindfulness.

More broadly, Grossman (2008) argued that paper-and-pencil measures of mindfulness are of questionable validity. He identified several problems that exist to varying degrees across measures. Authors of mindfulness scales had differing understanding and experience of Buddhist meditative practices and thinking. They may not have had the expertise needed to capture mindfulness in a measure. Personal mindfulness practice may change how respondents semantically interpret items on mindfulness scales, resulting in counter-intuitive findings of higher levels of

mindfulness in naïve (vs. expert) meditators. There also may be differences in respondents' level of reported mindfulness and their actual mindfulness. Qualitative assessment and greater weight on the distal outcomes of meditation practice were suggested as possible solutions (Grossman, 2008). The current study proposed another solution: greater understanding and measurement of changes in cognitive and affective processing following meditation training.

Effect of Intervention on Affect, Cognition, and Smoking

The intervention yielded a main effect of group on negative affect in the field. The results indicated that the Brief-MM group experienced significantly lower levels of negative affect aggregated over the course of the study; however, Brief-MM did not result in greater reductions in negative affect over time (no Group by Day interaction). Similarly, negative affect did not differ between groups by assessment type, meaning that the Brief-MM group did not experience greater training-induced reductions in negative affect compared to the control group. Rogojanski, Vetesse, and Antony (2011) reported significant acute reductions in negative affect following an urge-surfing intervention (vs. suppression). On the other hand, Bowen and Marlatt (2009) reported a non-significant Group x Time interaction using a seven day follow-up after twenty-minutes of urge-surfing training (vs. Control), but this may not be surprising given the lag between the intervention and assessment. In the current study, a floor effect may be complicating interpretation, with the mean scores in the Brief-MM group close to the scale minimum (Figure 11). Further analyses (see Future Directions, p 69) are required to better understand the relationship between Brief-MM training and negative affect.

Smoking rate decreased over time in the Brief-MM group but not in the control group. This is a potentially important finding, and is consistent with the findings of Bowen and Marlatt (2009) who reported that a brief urge-surfing intervention resulted in significantly fewer cigarettes smoked per day over a seven day follow-up in the experimental (vs. control) group in a college sample. An interpretative complication is that the Brief-MM group smoked marginally more cigarettes per day at baseline. However, there was little evidence that the between-group imbalance in baseline smoking contributed to the observed data. It might be argued that the cotinine and CO data did not support the self-reported smoking data, and therefore undermine their import. However, (non-significant) between-group differences in cotinine levels in the expected direction were observed at visits 2 and 3, and there was presumably greater power to detect a difference in daily smoking than in cotinine levels, which were only assessed in the laboratory. Another potential concern with the data is that changes in mindfulness over time were not associated with reductions in smoking over time which would be expected if the intervention works by elevating mindfulness. However, as noted earlier, serious concerns have been raised against the validity of the self-report measures of mindfulness (Grossman, 2008). In sum, the effect of the intervention on smoking rate is potentially important but should be treated with caution pending replication.

Analyses did not support hypothesized changes in cognition, including attentional bias and a decentered perspective to depression-related stimuli. This is a relatively new area of study with only one study providing evidence of changes to attentional bias to alcohol-related stimuli in alcohol dependent individuals following a

longer course of mindfulness training (Garland, et al., 2010) and no studies currently available that document the effect of mindfulness training on the depression-IAT. Cross-sectional associations between trait mindfulness and both cognitive measures have been documented (Garland, et al., 2011; Waters, et al., 2009). Associations between trait mindfulness and cognition may be stronger than associations between state mindfulness and cognition. In particular, a mindfulness intervention that was strong enough to affect both state and trait mindfulness may have been able to cause cognitive changes.

Effect of Intervention on Craving

The effect of group on craving emerged as among the strongest and most interesting finding in the study. While not hypothesized as a primary outcome variable in the current study, craving is widely recognized as an important variable in studies of addictions. Theoretically, it plays a key role in nearly all comprehensive theories on drug abuse (Drummond, 2001; Tiffany & Wray, 2012). A recently convened panel of substance abuse treatment and research experts identified craving as one of five primary outcome domains that should be included in future clinical trials of substance abuse treatments (Tiffany, Friedman, Greenfield, Hasin, & Jackson, 2011). Laboratory data revealed a main effect of group on craving, while EMA data indicated a Group x Assessment interaction, with lower craving scores in the mindfulness group during assessments that immediately followed meditation practice. The Group x Time interaction was not significant, suggesting that mindfulness practice reduced craving acutely without necessarily reducing average levels of craving or levels of craving over time.

Our findings are similar to two studies that also identified acute reductions in craving immediately following ten-minute body-scan exercises (Cropley, et al., 2007; Ussher, et al., 2009). Three studies provided evidence that mindfulness training moderated associations between craving and symptoms of depression, negative affect, or cigarette use (Bowen & Marlatt, 2009; Elwafi, Witkiewitz, Mallik, Thornhill, & Brewer, 2012; Witkiewitz & Bowen, 2010). Bowen and Marlatt (2009) reported that a 20-minute urge-surfing intervention did not reduce craving, but did reduce the association between negative affect and craving at a seven day follow-up. A 4-week mindfulness intervention moderated the association between craving and smoking (Elwafi, et al., 2012). Similarly, Witkiewitz and Bowen (2010) reported that a Mindfulness-Based Relapse Prevention course attenuated the association between post-intervention depression and craving in a post-intensive treatment substance abusing population. That association predicted substance use at a four month follow-up (Witkiewitz & Bowen, 2010). One study reported non-significant effects of mindfulness training on craving without testing a moderation hypothesis (Rogojanski, et al., 2011). Despite the two studies to the contrary, the majority of studies presented supported mindfulness as an effective intervention for reducing or attenuating the impact of craving in substance use.

Limitations

This study was primarily a feasibility study. Given the relatively small sample size, there was low power to detect small and small-to-medium effect sizes in the population. This was especially true for the laboratory data, where, notably, very few significant effects were observed. However, effect sizes for the laboratory data may

be of use in the planning of future studies. While not reaching the threshold for significance, there was a non-significant medium-to-large effect size in the hypothesized direction for a laboratory measure of dependence (see Table 11). Analyses of laboratory data also indicated a small-to-medium effect of Brief-MM training on salivary cotinine in the hypothesized direction (see Table 11).

Great emphasis has been placed on teachers of mindfulness training having a well-established, daily personal mindfulness practice (Kabat-Zinn, 2003), in order for the intervention to be effective. Audio recordings used in this study were created by an individual with knowledge of mindfulness, but without a well-established personal daily practice. Mindfulness scripts for the current study were reviewed by an established mindfulness researcher and suggestions were incorporated into the final product. The effects of Brief-MM were less robust than effects garnered by longer courses for smokers that used trained mindfulness instructors (Brewer, et al., 2011; Davis, et al., 2007). It is possible that having audio files recorded by a seasoned mindfulness practitioner would have provided a stronger experimental manipulation of mindfulness and greater effects on outcome measures in a similar amount of time; however, testing this hypothesis was beyond the scope of the current study. Although the PDAs were used to monitor the frequency and duration of meditation trainings, it is still not possible to determine whether a participant was attempting to meditate in any given session versus playing the recording without attending to it or engaging in other tasks while listening. Future studies may consider asking participants to press a button during a meditation session to provide a better estimate of compliance.

Effects on cognition and positive affect were not documented in the current study. Greater power or a stronger experimental manipulation may be necessary to demonstrate the hypothesized changes. Without effects of training on cognitive and affective variables, the proposed mediation analyses could not be conducted as planned, limiting the ability of this study to add to the body of knowledge on mechanisms of mindfulness.

Twelve of 44 participants (27%) did not complete the study. We cannot rule out that subject attrition lead to subtle differences in the characteristics of the individuals in the two groups, and that these between-group differences may have contributed to the observed findings. Intent-to-treat (ITT) analyses are commonly used to protect against this problem. ITT analyses were beyond the scope of the current project but can be pursued in supplementary analyses. However, it is unlikely that ITT analyses would greatly affect results. The majority of findings emerged from the EMA data. Data could be imputed for laboratory assessments (for ITT analyses); however, it is not clear how one could impute missing data for ITT analyses on EMA data. Overall, the results must therefore be interpreted cautiously pending replication. Subject attrition may also reduce the generalizability of study findings. However, comparisons between Completers and Non-completers yielded only one significant difference at baseline (see Table 8) which is unlikely to severely compromise the external validity of the study.

As noted earlier, individuals differed in the number of trainings that they completed, and there was a between-group difference in number of completed trainings. It would be interesting to examine whether individuals who completed

more trainings had better outcomes, particularly in the Brief-MM group. These analyses were beyond the scope of the present study, as were analyses examining the interplay of compliance and the effects of the intervention. Similarly, we also did not examine whether the effects of Assessment Type became greater over time in the Brief-MM group (vs. the Control group). This would involve testing a Group by Day by Assessment Type interaction, and can be pursued in supplementary analyses. It may also be beneficial to match Brief-MM and Control participants based on the number of trainings completed and repeat the analyses in order to control for the difference in trainings conducted. Lastly, we cannot rule out the possibility that the control condition exerted a negative impact on the participants, which contributed to the observed between-group differences. However, there was no evidence that mood, craving or smoking changed over time in the control group

Strengths and Implications

The current study provided the first longitudinal study of Brief-MM administered via mobile device for smokers. If the observed effects of Brief-MM on craving and cigarette use are real, then they are clinically relevant. Smoking remains the greatest cause of premature death in the nation and the majority of quit attempts end in failure, even when receiving a combination of counseling and medication (Tobacco Use and Dependence Guideline Panel, 2008). Although determining the mechanisms of change was beyond the scope of the study, it is likely that mindfulness meditation helps smokers to manage craving through a pathway not currently affected by medication or skills-based counseling.

Using EMA provided a rich data set of psychological processes, especially

craving, changing in the natural environment throughout the Brief-MM intervention. While other studies have measured craving, no other study of a mindfulness-based intervention in a substance abuse population sampled craving and state mindfulness several times a day over the course of two weeks.

The finding that Brief-MM readily reduced acute craving in smokers during meditation practice added to a growing body of literature determining the relationship between mindfulness meditation training and craving (Bowen & Marlatt, 2009; Cropley, et al., 2007; Elwafi, et al., 2012; Rogojanski, et al., 2011; Ussher, et al., 2009; Witkiewitz & Bowen, 2010). The acute effects of Brief-MM together with an EMA platform is the first step in developing the knowledge base and technology necessary for using a similar intervention to tailor treatment as it is needed in real time based on fluctuations in craving or other psychological variables (ecological momentary intervention).

The study also provided a new data point on the “dose-response” curve of mindfulness-based interventions for smoking. Previously, effects of eight-week or brief interventions lasting ten minutes to three days have been documented. This study provided the first examination of the effect of a two week, daily intervention on state and trait mindfulness, smoking behavior, and dependence.

Future Directions

The current study provided a rich data set that will be used for additional analyses. First, it would be informative to examine the natural history of craving and negative affect after receipt of Brief-MM or control training. By calculating the time since last valid meditation for each assessment, it is possible to plot changes in

craving and negative affect over time in a more fine-grained manner than previously possible. Second, five different meditations were used in Brief-MM. The effects of different recordings on craving and negative affect can be explored. Third, the current study examined Mindfulness training as an independent variable, but Mindfulness training can also be studied as a moderator variable. It would be useful to examine if Mindfulness training moderates the associations between craving and smoking or negative affect and smoking. Fourth, Brief-MM training may have affected some dimensions of cigarette dependence (measured by the WISDM) but not others. The effect of group on WISDM subscales, especially the craving and automaticity subscales, can be explored. Last, the effect of Brief-MM trainings on negative affect may be more visible when participants are in a bad mood or in participants with higher levels of general distress. For example, it would be useful to identify assessments with high levels of negative affect and to observe the effect of the intervention on negative affect at the subsequent assessment.

More important, the effect of Brief-MM on craving and self-reported smoking warrants further study. Conducting this pilot trial resulted in several ideas for improving the Brief-MM intervention. Using a group in-person format, whether initially or once per week, would likely result in a more powerful initial experience of mindfulness and provide the opportunity to ask questions prior to home practice. As discussed above, having a more experienced meditator create the recordings would also likely increase the strength of the intervention. Meditations could also be augmented with suggestions for how to apply mindfulness to daily life. Future studies could also identify subgroups of smokers that may respond especially well to

a mindfulness-based intervention. Although speculative, mindfulness-based interventions may be particularly useful in helping people quit who are older, have a diagnosis of depression, are high in baseline trait mindfulness, or who are particularly interested in meditation. Finally, any intervention for smoking must eventually be tested to determine whether it can affect abstinence rates during a quit attempt.

References

- Altner, N. (2002). Mindfulness practice and smoking cessation: The Essen Hospital Smoking Cessation Study (EASY). *Journal for Meditation and Meditation Research, 1*, 9-18.
- Arch, J. J., & Craske, M. G. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behavior Research and Therapy, 44*, 1849-1858.
- Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice, 10*(2), 125-143.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.
- Bishop, S. R., Lau, M. A., Shapiro, S. L., Carlson, L. E., Anderson, N. D., Carmody, J., et al. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*(3), 230-241.
- Bodhi, B. (2011, June 16th, 2011). The Noble Eightfold Path: The way to the end of suffering Retrieved 13 October, 2011, from <http://www.accesstoinsight.org/lib/authors/bodhi/waytoend.html>
- Bowen, S., & Marlatt, A. (2009). Surfing the urge: Brief mindfulness-based intervention for college student smokers. *Psychology of Addictive Behaviors, 23*(4), 666-671.

- Brach, T. (2012). Working with difficulties: The blessings of RAIN Retrieved July 11th, 2012, from <http://www.tarabrach.com/articles/RAIN-WorkingWithDifficulties.html>
- Brewer, J. A., Bowen, S., & Chawla, N. (2010). *Mindfulness Training for Addictions: Smoking Edition*. Obtained through personal communication with the author.
- Brewer, J. A., Mallik, S., Babuscio, T. A., Nich, C., Johnson, H. E., Deleone, C. M., et al. (2011). Mindfulness training for smoking cessation: Results from a randomized controlled trial. *Drug and Alcohol Dependence*.
- Brewer, J. A., Mallik, S., Babuscio, T. A., Nich, C., Johnson, H. E., Deleone, C. M., et al. (In press). Mindfulness training for smoking cessation: Results from a randomized controlled trial. *Drug and Alcohol Dependence*.
- Broderick, P. (2005). Mindfulness and coping with dysphoric mood: Contrasts with rumination and distraction. *Cognitive Therapy and Research*, 29(5), 501-510.
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), 822-848.
- Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry*, 18(4), 211-237.
- Carmody, J., Baer, R. A., Lykins, E., & Olendzki, N. (2009). An empirical study of the mechanisms of mindfulness in a mindfulness-based stress reduction program. *Journal of Clinical Psychology*, 65, 613-626.

- Carmody, J., Reed, G., Kristeller, J., & Merriam, P. (2008). Mindfulness, spirituality, and health-related symptoms. *Journal of Psychosomatic Research, 64*, 393-403.
- Chisea, A., Calati, R., & Serretti, A. (2011). Does mindfulness training improve cognitive abilities? A systematic review of neuropsychological findings. *Clinical Psychology Review, 31*, 449-464.
- Cinciripini, P., & McClure, J. B. (1998). Smoking cessation: Recent developments in behavioral and pharmacological interventions. *Oncology, 12*(2).
- Cropley, M., Ussher, M., & Charitou, E. (2007). Acute effects of a guided relaxation routine (body scan) on tobacco withdrawal symptoms and cravings in abstinent smokers. *Addiction, 102*, 989-993.
- Davis, J. M., Fleming, M. F., Bonus, K. A., & Baker, T. B. (2007). A pilot study on mindfulness based stress reduction for smokers. *BMC complementary and alternative medicine, 7*(1), 2.
- De Houwer, J. (2002). The Implicit Association Test as a tool for studying dysfunctional associations in psychopathology: strengths and limitations. *Journal of Behavior Therapy and Experimental Psychiatry, 33*(2), 115-133.
- Drummond, D. C. (2001). Theories of drug craving, ancient and modern. *Addiction, 96*, 33-46.
- Dvorak, R. D., & Simon, J. S. (2008). Affective differences among daily tobacco users, occasional users, and non-users. *Addictive Behaviors, 33*(1), 211-216.
- Elwafi, H. M., Witkiewitz, K., Mallik, S., Thornhill, T. A., & Brewer, J. A. (2012). Mindfulness training for smoking cessation: Moderation of the relationship

- between craving and cigarette use. *Drug and Alcohol Dependence, In Press*, <http://dx.doi.org/10.1016/j.drugalcdep.2012.1011.1015>.
- Epstein, D. H., Willner-Reid, J., Vahabzadeh, M., Mezghanni, M., Lin, J.-L., & Preston, K. L. (2009). Real-time electronic diary reports of cue exposure and mood in the hours before cocaine and heroin craving and use. . *Archives of General Psychiatry, 66*(1), 88-94.
- Faul, F. (2004). G*Power 3 (Version 3.1.3) [computer program]. Retrieved from <http://www.psych.uni-duesseldorf.de/abteilungen/aap/gpower3/literature>
- Field, M., & Cox, W. M. (2008). Attentional bias in addictive behaviors: A review of its development, causes, and consequences. *Drug and Alcohol Dependence, 97*, 1-20.
- Field, M., & Eastwood, B. (2005). Experimental manipulation of attentional bias increases the motivation to drink alcohol. *Psychopharmacology, 183*(3), 350-357.
- Field, M., Munafò, M. R., & Franken, I. H. A. (2009). A meta-analytic investigation of the relationship between attentional bias and subjective craving in substance abuse. *Psychological Bulletin, 135*(4), 589-607.
- Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2011). *Applied longitudinal analysis* (Vol. 998). Wiley.
- Franken, I. H. A. (2003). Drug craving and addiction: Integrating psychological and neuropsychopharmacological approaches. *Progress in Neuro-psychopharmacology and Biological Psychiatry, 27*(4), 563-579.

- Fresco, D. M., Moore, M. T., van Dulmen, M. H. M., Segal, Z. V., Ma, S. H., Teasdale, J. D., et al. (2007). Initial psychometric properties of the Experiences Questionnaire: Validation of a self-report measure of decentering. *Behavior Therapy, 38*, 234-246.
- Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18*(3), 233-239.
- Garland, E. L., Boettiger, C. A., Gaylord, S. A., Chanon, V. W., & Howard, M. O. (2011). Mindfulness is inversely associated with alcohol attentional bias among recovering alcohol-dependent adults. *Cognitive Therapy and Research, Published online in advance of print*. doi: 10.1007/s10608-011-9378-7
- Garland, E. L., Gaylord, S. A., Boettiger, C. A., & Howard, M. O. (2010). Mindfulness training modifies cognitive, affective, and physiological mechanisms implicated in alcohol dependence: Results of a randomized controlled pilot trial. *Journal of Psychoactive Drugs, 42*(2), 177-192.
- Gifford, E. V., Kohlenberg, B. S., Hayes, S. C., Antonuccio, D. O., Piasecki, M. M., Rasmussen-Hall, M. L., et al. (2004). Acceptance-based treatment for smoking cessation. *Behavior Therapy, 35*(4), 689-705.
- Glautier, S. (2004). Measures and models of nicotine dependence: positive reinforcement. *Addiction, 99*(Suppl. 1), 30 - 50
- Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the

- Difficulties in Emotion Regulation Scale *Journal of Psychopathology and Behavioral Assessment*, 26(1), 41-54.
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Attitudes and Social Cognition*, 85(2), 197-216.
- Grossman, P. (2008). On measuring mindfulness in psychosomatic research. *Journal of Psychosomatic Research*, 64, 405-408.
- Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and Commitment Therapy: Model, processes and outcomes. *Behavior Research and Therapy*, 44(1), 1-25.
- Hayes, S. C., Masuda, A., Bissett, R., Luoma, J. B., & Guerrero, L. F. (2004). DBT, FAP, and ACT: How empirically oriented are the new behavior therapy technologies? *Behavior Therapy*, 35, 35-54.
- Hedeker, D., Mermelstein, R. J., Berbaum, M. L., & Campbell, R. T. (2009). Modeling mood variation associated with smoking: an application of a heterogeneous mixed-effects model for analysis of ecological momentary assessment (EMA) data. *Addiction*, 104, 297-307. doi: 10.1111/j.1360-0443.2008.02435.x
- Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of Mindfulness-Based Therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology*, 78(2), 169-183.
- Hughes, J.R. (2010). Craving among long-abstinent smokers: An internet survey. *Nicotine & Tobacco Research*, 12, 459-462. Doi: 10.1093/ntr/ntq009.

- Janes, A. C., Pizzagalli, D. A., Richardt, S., Frederick, B. d. B., Holmes, A. J., Sousa, J., et al. (2010). Neural substrates of attentional bias for smoking-related cues: An fMRI study. *Neuropsychopharmacology*, *35*, 2339-2345.
- Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, *10*(2), 144-156.
- Kassel, J., Stroud, L., & Paronis, C. (2003). Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. *Psychological Bulletin*, *129*(2), 270-304.
- Kerst, W. (2011). *Attention training in smokers (Manuscript in preparation)*. Doctoral Dissertation.
- Kumar, S. M. (2002). An introduction to Buddhism for the Cognitive-Behavioral therapist. *Cognitive and Behavioral Practice*, *9*, 40-43.
- Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L. E., et al. (2006). The Toronto Mindfulness Scale: Development and validation. *Journal of Clinical Psychology*, *62*(12), 1445-1467.
- Leigh, J., Bowen, S., & Marlatt, A. (2005). Spirituality, mindfulness, and substance abuse. *Addictive Behaviors*, *30*, 1335-1341.
- Leventhal, A. (2010). Do individual differences in reinforcement smoking moderate the relationship between affect and urge to smoke? *Behavioral Medicine*, *36*(1), 1-6.
- Mackinnon, A., Jorm, A. F., Christensen, H., Korten, A. E., Jacomb, P. A., & Rodgers, B. (1999). A short form of the Positive and Negative Affect Schedule: Evaluation of factorial validity and invariance across demographic

- variables in a community sample. *Personality and Individual Differences*, 27, 405-416.
- Marlatt, A., & Ostafin, B. D. (2006). Being mindful of automaticity in addiction: A clinical perspective. In R. W. Wiers & A. W. Stacy (Eds.), *Handbook of Implicit Cognition and Addiction* (pp. 489-506). Thousand Oaks, CA: Sage Publications.
- Maxwell, S. E., & Cole, D. A. (2007). Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods*, 12(1), 23-44.
- Miller, S. D., Duncan, B. L., Brown, J., Sparks, J. A., & Claud, D. A. (2003). The Outcome Rating Scale: A preliminary study of the reliability, validity, and feasibility of a brief visual analog measure. *Journal of Brief Therapy*, 2(2), 91-100.
- Moore, P. (2008). Introducing mindfulness to clinical psychologists in training: An experiential course of brief exercises. *Journal of Clinical Psychology in Medical Settings*, 15, 331-337.
- Ortner, C. N. M., Kilner, S., J., & Zelazo, P. D. (2007). Mindfulness meditation and reduced emotional interference on a cognitive task. *Motivation and Emotion*, 31, 271-283.
- Ossip-Klein, D. J., Bigelow, G., Parker, S. R., Curry, S., Hall, S., & Kirkland, S. (1986). Classification and assessment of smoking behavior. *Health Psychology*, 5, 3-11.

- Papies, E. K., Barsalou, L. W., & Custers, R. (2012). Mindful attention prevents mindless impulses. *Social Psychological and Personality Science*, 3(3), 291-299.
- Piper, M. E., McCarthy, D. E., Bolt, D. M., Smith, S. S., Lerman, C., Benowitz, N., et al. (2007). Assessing dimensions of nicotine dependence: An evaluation of the Nicotine Dependence Syndrome Scale (NDSS) and the Wisconsin Inventory of Smoking Dependence Motives (WISDM). *Nicotine & Tobacco Research*, 10(6), 1009-1020.
- Piper, M. E., Piasecki, T. M., Federman, E. B., Bolt, D. M., Smith, S. S., Fiore, M. C., et al. (2004). A Multiple Motives Approach to Tobacco Dependence Motives (WISDM-68). *Journal of Consulting and Clinical Psychology*, 72(2), 139-154.
- Pomerleau, C. S., & Pomerleau, O. F. (1992). Euphoriant effects of nicotine in smokers. *Psychopharmacology*, 108, 460-465.
- Powell, J. H., Dawkins, L., Pickering, A., West, R., & Powell, J. F. (2010). Relapse to smoking during unaided cessation: Clinical, cognitive, and motivational predictors. *Psychopharmacology*, 212(4), 537-549.
- Ratcliff, R. (1993). Methods for dealing with reaction time outliers. *Psychological Bulletin*, 114, 510-532.
- Robinson, T. E., & Berridge, K. C. (1993). The neural basis of drug craving: An incentive-sensitization theory of addiction. *Brain Research Reviews*, 18(3), 247-291.

- Rogojanski, J., Vettese, L. C., & Antony, M. M. (2011). Coping with cigarette cravings: Comparison of suppression versus mindfulness-based strategies. *Mindfulness, 2*, 14-26.
- Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 62*(3), 373-386.
- Shiffman, S., & Gwaltney, C. J. (2008). Does heightened affect make smoking cues more salient? *Journal of Abnormal Psychology, 117*(3), 618-624.
- Shiffman, S., Paty, J. A., Gnys, M., Kassel, J., & Elash, C. (1995). Nicotine withdrawal in chippers and regular smokers: Subjective and cognitive effects. *Health Psychology, 14*(4), 301-309.
- Shiffman, S., Paty, J. A., Gnys, M., Kassel, J. A., & Hickcox, M. (1996). First lapses to smoking: Within-subjects analysis of real-time reports. *Journal of Consulting and Clinical Psychology, 64*(2), 366-379.
- Shiffman, S., & Waters, A. J. (2004). The nicotine dependence syndrome scale: A multidimensional measure of nicotine dependence. *Nicotine & Tobacco Research, 6*(2), 327-348.
- Sondik, E. J., Madans, J. H., & Gentleman, J. F. (2010). *Vital and health statistics: Summary health statistics for U.S. adults: National Health Interview Survey, 2009*. Hyattsville, Maryland: DHHS.
- Soria, R., Stapleton, J. M., Gilson, S. F., Sampson-Cone, A., Henningfield, J. E., & London, E. D. (1996). Subjective and cardiovascular effects of intravenous nicotine in smokers and nonsmokers. *Psychopharmacology, 128*, 221-226.

- SRNT Subcommittee on Biochemical Verification. (2002). Biochemical verification of tobacco use and cessation. *Nicotine & Tobacco Research, 4*, 149-159.
- Stone, A. A., Shiffman, S., Schwartz, J. E., Broderick, J. E., & Hufford, M. R. (2002). Patient non-compliance with paper diaries. *British Medical Journal, 324*(1193-1194).
- Teasdale, J. D. (2004). Mindfulness-based cognitive therapy. In J. Yiend (Ed.), *Cognition, emotion, and psychopathology: theoretical, empirical, and clinical approaches* (pp. 270-289). Cambridge: Cambridge University Press.
- Teasdale, J. D., & Chaskalson, M. (2011). How does mindfulness transform suffering? I: The nature and origins of *dukkha*. *Contemporary Buddhism, 12*(1), 89-102.
- Teasdale, J. D., Moore, R. G., Hayhurst, H., Pope, M., Williams, S., & Segal, Z. V. (2002). Metacognitive awareness and prevention of relapse in depression: Empirical evidence. *Journal of Consulting and Clinical Psychology, 68*, 615-623.
- Teasdale, J. D., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in Major Depression by Mindfulness-Based Cognitive Therapy. *Journal of Consulting and Clinical Psychology, 68*(4), 615-623.
- Thompson, B. L., & Waltz, J. (2007). Everyday mindfulness and mindfulness meditation: Overlapping constructs or not? *Personality and Individual Differences, 43*, 1875-1885.

- Tiffany, S. T., Friedman, L., Greenfield, S. F., Hasin, D. S., & Jackson, R. (2011). Beyond drug use: A systematic consideration of other outcomes in evaluations of treatments for substance use disorders. *Addiction, 107*, 709-718.
- Tiffany, S. T., & Wray, J. M., (2009). The continuing conundrum of craving. *Addiction, 104*, 1618-1619. doi: 10.1111/j.1360-0443.2009.02588.x
- Tiffany, S. T., & Wray, J. M. (2012). The clinical significance of drug craving. *Annals of the New York Academy of Sciences, 1248*, 1-17.
- Tobacco Use and Dependence Guideline Panel. (2008). *Treating tobacco use and dependence: 2008 update*. Rockville, MD.
- Toneatto, T., & Nguyen, L. (2007). Does mindfulness meditation improve anxiety and mood symptoms? A review of the controlled research. *The Canadian Review of Psychiatry, 52*(4), 260-266.
- U.S. Department of Health and Human Services. (2000). Reducing tobacco use: A report of the surgeon general (S/N 017-001-00544-4). Atlanta, Georgia: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health
- U.S. Department of Health and Human Services. (2010). How tobacco smoke causes disease: The biology and behavioral basis for smoking-attributable disease- A report of the surgeon general (ISBN 978-0-16-084078-4). Atlanta, Georgia: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

- Ussher, M., Cropley, M., Playle, S., Mohidin, R., & West, R. (2009). Effect of isometric exercise and body scanning on cigarette cravings and withdrawal symptoms. *Addiction, 104*, 1251-1257.
- Vettese, L. C., Toneatto, T., Stea, J. N., Nguyen, L., & Wang, J. J. (2009). Do mindfulness meditation participants do their homework? And does it make a difference? A review of the empirical evidence. *Journal of Cognitive Psychotherapy: An International Quarterly, 23*(3), 198-225.
- Vidrine, J. I., Businelle, M. S., Cinciripini, P., Li, Y., Marcus, M. T., Waters, A. J., et al. (2009). Associations of mindfulness with nicotine dependence, withdrawal, and agency. *Substance Abuse, 30*, 318-327.
- Waters, A. J. (2003). Attentional bias predicts outcome in smoking cessation. *Health Psychology, 22*(4), 378-387.
- Waters, A. J., & Li, Y. (2008). Evaluating the utility of administering a reaction time task on a handheld computer in an Ecological Momentary Assessment study. *Psychopharmacology, 197*, 25-35.
- Waters, A. J., Marhe, R., & Franken, I. H. A. (2011). Attentional bias to drug cues is elevated before and during temptations to use heroin and cocaine. *Psychopharmacology, Advance online publication*, 1-13. doi: 10.1007/s00213-011-2424-z
- Waters, A. J., Miller, E. K., & Li, Y. (2010). Effect of extensive testing on the IAT effect assessed in an Ecological Momentary Assessment study. *Psychological Reports, 106*, 31-43.

- Waters, A. J., Reitzel, L. R., Cinciripini, P., Li, Y., Marcus, M. T., Vidrine, J. I., et al. (2009). Associations between mindfulness and implicit cognition and self-reported affect. *Substance Abuse, 30*, 328-337.
- Waters, A. J., & Sayette, M. A. (2006). Implicit cognition and tobacco addiction. In A. W. Stacy & R. W. Wiers (Eds.), *Handbook on implicit cognition and addiction*. Thousand Oaks, CA: Sage.
- Watson, D., & Clark, L. A. (1988). Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales. *Journal of Personality and Social Psychology, 54*(6), 1063-1070.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS Scales *Journal of Personality and Social Psychology, 54*(6), 1063-1070.
- Wenk-Sormaz, H. (2005). Meditation can reduce habitual responding. *Alternative Therapies, 2*(2), 42-58.
- Witkiewitz, K., & Bowen, S. (2010). Depression, craving, and substance use following a randomized trial of mindfulness-based relapse prevention. *Journal of Consulting and Clinical Psychology, 78*(3), 362-374.
- Wray, J. M., Gass, J. C., & Tiffany, S. T. (2013). A systematic review of the relationships between craving and smoking cessation. *Nicotine & Tobacco Research,*
- Zeidan, F., Gordon, N. S., Merchant, J., & Goolkasian, P. (2009). The effects of brief mindfulness meditation training on experimentally induced pain. *The Journal of Pain, 11*(3), 199-209.

Zeidan, F., Johnson, S. K., Diamond, B. J., Zhanna, D., & Goolkasian, P. (2010).

Mindfulness meditation improves cognition: Evidence of brief mental training.

Consciousness and Cognition, 19(2), 597-605.

Table 1

Summary of the Mindfulness Intervention for Cigarette-Smoking Cessation Literature

Study	Purpose of Study	Participants	Intervention	Independent Variables	Dependent Variables	Main Findings
Altner (2002)	controlled non-randomized longitudinal study of MBSR for smoking in a workplace	117 hospital employees	MBSR (8 week) course	Group (NRT, NRT + MBSR), time	Abstinence rates at 12 months	Abstinence: Lower abstinence rates at 12 months in the MBSR + NRT group: NRT = 24.6%; NRT + MBSR = 32.6%
Bowen & Marlatt (2009)	RCT of a brief mindfulness-based intervention (urge-surfing) on smoking behavior	123 (33 F, 90 M) nicotine deprived undergraduate students	Urge-surfing during cue exposure exercise (4 x 5 min)	Group (Urge-surfing, control), time	smoking rate at 7 day follow up	Cigarettes smoked per day for 7 days Significantly lower rates in the urge-surfing group (vs. control) Negative Affect No significant group x time interaction. Urges No significant group x time interaction. Moderation Analysis Mindfulness moderated the relation between negative affect and urge.

Brewer et al., (2011)	RCT of 4 week Mindfulness Treatment for smoking	87 (33 F, 54 M) treatment seeking smokers from the community	4 week course, two 1.5 hour sessions per week; 30 minute home practice	Group (MT, FFS), time	Smoking rate, Abstinence	<p>Smoking rate: MT group demonstrated greater reductions in cigarette use than control.</p> <p>Abstinence: MT group displayed trend towards greater abstinence immediately following treatment. Trend was significantly different at the 17 week follow-up. Point prevalence abstinence for MT was 30% vs. 5% in control.</p> <p>Home Practice: Home practice correlated with less cigarette use at the end of treatment.</p>
Cropley et al., (2007)	RCT of a brief mindfulness-based intervention (body scan) on desire to smoke	30 (12 F, 18 M) overnight abstinent smokers from the community	body scan (10 minute)	group (body scan, control); time (5, 10, 15 minutes)	strength of desire to smoke; irritability, restlessness, and tension	<p>Strength of desire to smoke: Significant group by time interaction.</p> <p>Irritability: Main effect of group. Main effect of time.</p> <p>Restlessness: Main effect of group. Main effect of time.</p> <p>Tension: Main effect of group. Main effect of time.</p>
Davis et al., (2007)	uncontrolled nonrandomized pilot study of MBSR for smoking cessation	18 (10 F, 8 M) community sample	MBSR (8 week) course	Meditation compliance, smoking, stress, affective distress,	Smoking abstinence	<p>Abstinence: 55% point-prevalence abstinence at 6 week follow up</p>

Gifford et al., (2004)	RCT of ACT vs. NRT for smoking cessation	76 (59% F, 41% M) community sample of smokers	ACT (seven week) (weekly individual and group therapy)	Group (ACT vs. NRT), Time	24 hour point prevalence smoking	Abstinence: ACT (vs. Control) significantly better abstinence rates at one year (Wald χ^2 (1, N = 55) = 4.07, $p = .04$). No difference at post, and six-month follow-up.
Leigh et al., (2005)	cross-sectional study of mindfulness, spirituality, alcohol, and tobacco use	196 (123 F, 70 M, 3 UNK) undergraduate students	N/A	smoking status (smoker, non-smoker) drinking status (frequent binge, non-drinker)	Mindfulness (FMI), Spirituality	Mindfulness: Smokers (vs. non-smokers) have significantly higher level of mindfulness. Frequent Binge Drinkers (vs. non-drinkers) have significantly higher levels of mindfulness.
Rogojanski, Vetesse, & Antony (2011)	RCT of urge-surfing vs. suppression	61 (25 F, 36 M)	Urge-surfing during cue exposure	Condition (mindfulness vs. suppression); time	Smoking, self-efficacy, craving, nicotine dependence, affect, and depression	Smoking amount: Main effect of time. No significant differences between study conditions. Self-efficacy: Main effect of time. No significant differences between study conditions. Craving: No significant differences. Negative Affect: Significantly reduced in the mindfulness condition. Depression: Significantly reduced in the mindfulness condition. Nicotine Dependence: Significantly reduced in the mindfulness condition.

Ussher et al., (2009)	RCT of body scan and isometric exercise vs. control	48 (17 F, 31 M) smokers from the community	Ten minute body scan in the lab; followed by another ten minute body scan in the natural environment within three hours	Group (BS, IE, control); Time (pre, post, 5 minute, ten minute); Location (lab, natural environment)	strength of desire to smoke; irritability, restlessness, tension, difficulty concentrating, stress	<p>Overall: No significant differences noted between BS and IE in the lab or the natural environment.</p> <p>Strength of desire to smoke: Significantly lower scores in BS and IE (vs. control) in lab and natural environment.</p> <p>Irritability: Significantly lower scores in BS and IE (vs. control) in lab. Significantly lower scores in BS (vs. control) and marginally significantly lower scores in IE (vs. control) in the natural environment.</p> <p>Restlessness: Significantly lower scores in BS and IE (vs. control) in natural environment (but not lab).</p> <p>Tension: No significant differences in lab; marginally lower scores in BS (vs. control) and significantly lower scores in IE (vs. control) in natural environment.</p> <p>Difficulty Concentrating: Significantly lower scores in BS and IE (vs. control) in lab and natural environment.</p> <p>Stress: Significantly lower scores in BS and IE (vs. control) in lab (but not natural environment).</p>
-----------------------	---	--	---	--	--	---

Vidrine et al., (2009)	Cross-sectional study of dispositional mindfulness, nicotine dependence, withdrawal, and agency	158 (45% F, 55% M)	N/A	Mindfulness (MAAS)	Nicotine Dependence, withdrawal, and agency	Mindfulness: negatively associated with nicotine dependence and withdrawal and positively associated with agency.
Waters et al., (2009)	Cross-sectional study of dispositional mindfulness, affect, attention, and decentered perspective	158 (45% F, 55% M)	N/A	Mindfulness (MAAS)	Positive Affect, Negative Affect, Perceived Stress, CESD, Smoking IAT, Anxiety IAT, Depression IAT, Smoking Stroop, Anxiety Stroop, Depression Stroop	Mindfulness positively associated with positive affect and negatively associated with negative affect, perceived stress, depression IAT, and CESD. Nonsignificant finding for smoking Stroop, anxiety Stroop, depression Stroop, smoking IAT, and anxiety IAT.

Note. ACT = Acceptance and commitment therapy; BS = body scan; CESD = Center for Epidemiological Studies Depression scale; F = female; FMI = Freiburg Mindfulness Inventory; FFS = freedom from smoking; IAT = Implicit Association Test; IE = Isometric Exercise; M = male; MBSR = Mindfulness-based stress reduction; MT = mindfulness training; NRT = Nicotine replacement therapy; RCT = Randomized controlled trial; SE= Standard error; UNK = unknown.

Table 2

Summary of the Brief Mindfulness Intervention Literature

Study	Participants	Intervention	Independent Variables	Dependent Variables	Main Findings
Arch & Craske (2006)	60 (41 F, 29 M) undergraduate and graduate students	15 minute recorded focused breathing induction	Group (focused breathing, worry, unfocused attention); Time (T1, T2, T3); Slide Type (Positive, negative, neutral)	Affect Scale; short PANAS; Willingness to view unpleasant slides; Heart rate measure	<p>Emotional Responding Focused breathing group rated affect following neutral slides more positively. No significant difference for affect following negative or positive slides.</p> <p>Positive Affect Non-significant group by slide type interaction.</p> <p>Negative Affect Focused breathing group showed a less varied profile in response to slides than the worry group.</p> <p>Willingness to view unpleasant slides Focused breathing condition was significantly more likely to view all slides than the unfocused attention condition.</p> <p>Heart Rate No significant group by slide type interaction.</p>
Bowen & Marlatt (2009)	123 (33 F, 90 M) nicotine deprived undergraduate students	Urge-surfing during cue exposure exercise (4 x 5 min)	Group (Urge-surfing, control), time	smoking rate at 7 day follow up	<p>Cigarettes smoked per day for 7 days Significantly lower rates in the urge-surfing group (vs. control)</p> <p>Negative Affect No significant group x time interaction.</p> <p>Urges No significant group x time interaction.</p> <p>Moderation Analysis Mindfulness moderated the relation between negative affect and urge.</p>
Broderick (2005)	177 (139 F, 38 M) undergraduate students	Mindfulness meditation focused on self-acceptance and mindfulness of the breath (8 minute)	Condition (rumination, distraction, meditation); Trials (baseline, postinduction)	PANAS, Thoughts listed	<p>PANAS: Participants in the meditation condition experienced less negative mood during a negative mood induction than distraction or rumination.</p> <p>Thoughts: No difference in positive or negative thoughts expressed. Participants in the distraction and meditation condition reported significantly more neutral thoughts than the rumination condition.</p>

Cropley et al. (2007)	30 (12 F, 18 M) overnight abstinent smokers from the community	body scan (10 minute)	group (body scan, control); time (5, 10, 15 minutes)	strength of desire to smoke; irritability, restlessness, and tension	<p>Strength of desire to smoke: Significant group by time interaction.</p> <p>Irritability: Main effect of group. Main effect of time.</p> <p>Restlessness: Main effect of group. Main effect of time.</p> <p>Tension: Main effect of group. Main effect of time.</p>
Moore (2008)	10 (9 F, 1 M) graduate students in psychology	Fourteen ten - minute sessions administered over the course of a month; script read by student volunteer	KIMS; NCS; PSS	KIMS; NCS; PSS	<p>Mindfulness Significant increase in overall KIMS score (pre-post).</p> <p>Self-Compassion No significant difference on the NCS. Significant increase on the Self-Kindness subscale.</p> <p>Perceived Stress No significant difference on the PSS.</p>
Ussher et al. (2009)	48 (17 F, 31 M) smokers from the community	Ten minute body scan in the lab; followed by another ten minute body scan in the natural environment within three hours	Group (BS, IE, control); Time (pre, post, 5 minute, ten minute); Location (lab, natural environment)	strength of desire to smoke; irritability, restlessness, tension, difficulty concentrating, stress	<p>Overall: No significant differences noted between BS and IE in the lab or the natural environment.</p> <p>Strength of desire to smoke: Significantly lower scores in BS and IE (vs. control) in lab and natural environment.</p> <p>Irritability: Significantly lower scores in BS and IE (vs. control) in lab. Significantly lower scores in BS (vs. control) and marginally significantly lower scores in IE (vs. control) in the natural environment.</p> <p>Restlessness: Significantly lower scores in BS and IE (vs. control) in and natural environment (but not lab).</p> <p>Tension: No significant differences in lab; marginally lower scores in BS (vs. control) and significantly lower scores in IE (vs. control) in natural environment.</p> <p>Difficulty Concentrating: Significantly lower scores in BS and IE (vs. control) in lab and natural environment.</p> <p>Stress: Significantly lower scores in BS and IE (vs. control) in lab (but not natural environment).</p>

Wenk-Sormaz (2005) Study 1	120 (44 M, 76 F) undergraduate students	Three 20 minute sessions	Group (meditation, cognitive control, rest); Time (Pre, post)	Stroop; Word Production; Arousal	<p>Arousal: Participants in the meditation group had reduced levels of arousal compared to rest and cognitive control</p> <p>Stroop effect: Meditation (vs. learning and rest) had reduced levels of Stroop interference.</p> <p>Word Production: No significant differences noted.</p>
Wenk-Sormaz (2005) Study 2	90 (33 M, 57 F) undergraduate students	One 20 minute session	Group (meditation, cognitive control, rest); Time (Pre, post)	Absorption; Word Production	<p>Absorption: Trend towards significance with the meditation group evincing higher levels of absorption.</p> <p>Word Production: No between group differences when participants asked to provide typical responses. Meditation (vs. cognitive control, rest) group provided significantly more atypical responses. Effect remained significant while controlling for absorption.</p>
Zeidan et al. (2009) Experiment 3	21 (13 F, 8 M) undergraduate students	Three days (20 min/day); instructor with 10 years of experience; groups of 3 to 8	Condition (MM, math distraction, relaxation), session (1,2,3), stimulus levels (low, high)	FMI, SAI, numerical pain ratings	<p>Mindfulness: Significant increase in mindfulness following training</p> <p>Pain ratings: Significant condition by stimulus level interaction; significant condition by session interaction</p> <p>State Anxiety: Pre-post by session interaction such that participants exhibited less anxiety after meditating.</p>
Zeidan et al. (2010)	63 (29 F, 27 M) undergraduate students	Four days (20 min/day); instructor with 10 years of experience; groups of 3 to 5 people	Group (Mindfulness Meditation, Control); Session (1, 2, 3, 4)	FMI, SAI, CESD, POMS, COWA, SDMT, DS, computer adaptive n-back task	<p>Mindfulness: Brief mindfulness training increased FMI score.</p> <p>POMS: Main effect of session. Both groups showed improved mood from session 1 to session 4.</p> <p>State Anxiety: Before/after by group interaction such that scores dropped after meditation but not after control reading.</p> <p>Visual Coding: Significant improvement in performance across session in the meditation group but not control.</p> <p>Fluency: Significant improvement in performance across session in the meditation group but not control.</p> <p>Sustained Attention: No significant difference in accuracy. Significant improvement in extended hit rate performance across session in the meditation group but not control.</p> <p>Working memory: Forward and backward digit span improved in both meditation and control group.</p>

Note. BS = body scan; CESD = Center for Epidemiological Studies Depression Scale; COWA = Controlled Oral Word Association; DS = Digit Span; F = female; FMI = Freiberg Mindfulness Inventory; IE = isometric exercise; KIMS =

Kentucky Inventory of Mindfulness Skills; M = male; MM = mindfulness meditation; NCS = Neff Compassion Scale; PANAS = Positive and Negative Affect Schedule; POMS = Profile of Mood States; PSS = Perceived Stress Scale; SAI = State Anxiety Inventory; SDMT = Symbol Digit Modalities Test.

Table 3

Summary of Study Procedures

	Phone Scr.	Visit 1 (Day 0)	Day +0 to Day +7	Visit 2 (Day +7)	Day +8 to Day +14	Visit 3 (Day +14)
Modality/Location of Contact	Phone	USU		USU		USU
Inclusion/Exclusion Criteria	X	X				
QUESTIONNAIRE ASSESSMENTS						
Demographics		X				
Smoking History		X				
Saliva Questionnaire		X				
ORS		X				
MAAS		X		X		X
PANAS		X		X		X
EQ		X		X		X
DERS		X		X		X
WISDM		X		X		X
TMS		X		X		X
Smoking Assessments (Diary)		X	X	X	X	X
BIOCHEMICAL ASSESSMENT						
Breath Sample for CO		X		X		X
Saliva Sample for Cotinine		X		X		X
INFORMED CONSENT						
		X				
RANDOMIZATION						
		X				
MINDFULNESS PSYCHOED.						
		X				
PDA TRAINING						
Participant receives training		X				
LAB ASSESSMENTS						
Depression IAT		X		X		X
Standard VP		X		X		X
PDA ASSESSMENTS						
4 RAs and one MA per day (D-IAT/VP, PA, NA, TMS, craving)		X	X	X	X	X
COMPENSATION*						
Laboratory Sessions		\$50		\$15		\$15
Each PDA assessment		\$1	\$1	\$1	\$1	\$1
Home Meditation Practice			\$5		\$5	
ESTIMATED DURATION						
Minutes**	10	120 (lab) + 30 (RAs)	40 (RA) + 10 (MA)	75 (lab) + 40 (RA)	40 (RA) + 10 (MA)	75 (lab) + 20 (RA)

Note. CO = carbon monoxide; EQ = Experiences Questionnaire; IAT = Implicit Association Test; MA = meditation assessment; MAAS = Mindful Attention and Awareness Scale; NA = negative affect; PA = positive affect; PANAS = Positive and Negative Affect Schedule; PDA = personal digital assistant; RA = random assessment; TMS = Toronto Mindfulness Scale; USU = Uniformed Services University; VP = Visual Probe; WISDM = Wisconsin Inventory of Smoking Dependence Motives.

Table 4

Implicit Association Test

Block	No. Trials	Items assigned to LEFT key response	Items assigned to RIGHT key response
1	24	DEPRESSED	NOT DEPRESSED
2	24	me	not me
3	24	DEPRESSED + me	NOT DEPRESSED + not me
4	48	DEPRESSED + me	NOT DEPRESSED + not me
5	48	NOT DEPRESSED	DEPRESSED
6	48	NOT DEPRESSED + me	DEPRESSED + not me
7	48	NOT DEPRESSED + me	DEPRESSED + not me

Note. This description of the IAT is taken from previous studies that have utilized the IAT in smoking cessation research (e.g. Waters et al., 2007). Blocks in red denote critical trial blocks (Tasks 1 and 2). The IAT consisted of seven blocks: (1) Practice of single categorization for the first concept (e.g., DEPRESSED / NOT DEPRESSED); (2) Practice of single categorization for the second concept (e.g., me / not me); (3) First block of the combined categorization task (Task 1) (e.g., DEPRESSED + me / NOT DEPRESSED + not me); (4) Second block of the combined categorization task (Task 1); (5) Practice of single categorization for the target concept but with the response keys reversed from the block 1 assignment (e.g., NOT DEPRESSED / DEPRESSED); (6) First block of Task 2 (e.g. NOT DEPRESSED + me / DEPRESSED + not me); (7) Second block of Task 2. The order of completion of the combined categorization blocks (i.e., 3, 4, and 6, 7) was counterbalanced across participants. IAT's completed in the laboratory will include the full presentation outlined above. IAT's administered on the PDA will only include the combined categorization blocks (i.e., 3, 4, and 6, 7).

Table 5

Compensation procedures

	Eligible to Participate	Statement of Approval Form Required	Eligible for Compensation
Non-federal Civilian	Yes	No	Yes
Federal Civilian	Yes	Yes	No
Military Personnel	Yes	Yes	No

Table 6

Estimated Sample Sizes

	BMM Group	Control Group	All
No. Subjects	20	20	40
No. Weeks with data	40	40	80
Estimated no. of days with data	280	280	560
Estimated no. of days per subject	14	14	14
“Effective” no. of days if ICC = .1	121	121	243
“Effective” no. of days if ICC = .3	57	57	114
Estimated no. of EMA assessments with data (75% compliance)	1050	1050	2100
Estimated no. of EMA assessments per subject (75% compliance)	52.5	52.5	52.5
“Effective” no. of EMA assessments if ICC = .1	170	179	341
“Effective” no. of EMA assessments if ICC = .3	64	64	128
Estimated no. of assessments with VP or IAT data (75% compliance)	525	525	1050
Estimated no. of assessments with VP or IAT data per subject (75% compliance)	26.25	26.25	26.25
“Effective” no. of EMA assessments with VP or IAT data if ICC = .1	149	149	298
“Effective” no. of EMA assessments with VP or IAT data if ICC = .3	61	61	122

Note: Data shown (bolded) are estimated “effective sample sizes” (for days and assessments) taking into account the intraclass correlation coefficient (ICC). Estimates are provided for ICC = .1 and ICC = .3. ICCs greater than these values will lead to smaller effective sample sizes.

Table 7

Participant Characteristics at Baseline

	Brief-MM (n = 24)	CON (n = 20)	F/ χ^2	p
Age	45.34 (11.84)	44.16 (13.64)	0.09	.76
Sex (%)			0.11	.74
Male	50.0%	45.0%		
Female	50.0%	55.0%		
Race (%)			1.47	.48
White	33.33%	25.0%		
Black	66.66%	70.0%		
Other	0.0%	5.0%		
MAAS (1 – 6)	3.96 (0.81)	4.21 (1.11)	0.75	.39
TMS-Cur (0 – 24)	12.17 (6.48)	13.50 (5.35)	0.54	.47
TMS-Decen (0 – 28)	11.63 (4.39)	13.65 (4.60)	2.22	.14
Cigarettes per day	18.00 (8.65)	13.85 (4.70)	3.68	.06
WISDM (13-91)	58.54 (14.01)	52.89 (15.47)	1.61	.21
Age when started daily smoking	20.04 (7.09)	20.85 (6.43)	0.15	.70
Lifetime quit attempts (+24 hrs)	3.13 (3.76)	1.50 (2.69)	2.62	.11

Note. Mean (SD) for Participant Demographics. F-values are derived from 1-way ANOVA conducted on continuous variables; Chi Square values are derived from Pearson's Chi Square test conducted on categorical variables, CON = control training, MAAS = Mindful Attention and Awareness Scale, MM = mindfulness

training, TMS-Cur = Toronto Mindfulness Scale- Curiosity, TMS-Decen = Toronto Mindfulness Scale- Decentering, WISDM = Wisconsin Inventory of Smoking Dependence Motives.

Table 8
Comparison of *Completers vs. Non-completers at Baseline*

	Completers (n = 32)	Non- Completers (n =12)	F/ χ^2	p
Group (%)			0.14	.71
Brief-MM	56.2%	50.0%		
CON	43.8%	50.0%		
Age	46.13 (10.78)	41.28 (16.43)	1.31	.26
Sex (%)			0.03	.85
Male	46.9%	50.0%		
Female	53.1%	50.0%		
Race (%)			0.46	.79
White	28.1%	33.3%		
Black	68.8%	66.7%		
Other	3.1%	0.0%		
MAAS (1 – 6)	4.01 (1.02)	4.24 (0.75)	0.51	.48
TMS-Cur (0 – 24)	13.59 (5.64)	10.58 (6.47)	2.29	.14
TMS-Decen (0 – 28)	13.50 (4.16)	10.00 (4.75)	5.73	.02
Cigarettes per day	16.53 (7.57)	15.00 (6.95)	0.37	.55
WISDM (13-91)	56.20 (15.59)	55.35 (13.02)	0.03	.87
Age when started daily smoking	20.78 (6.77)	19.42 (6.83)	0.35	.56
Life Quit Attempts (+24 hrs)	2.09 (2.68)	3.17 (4.84)	0.88	.35

Note. Mean (SD) for Participant Demographics. F-values are derived from 1-way ANOVA conducted on continuous variables; Chi Square values are derived from Pearson's Chi Square test conducted on categorical variables, CON = control training, MAAS = Mindful Attention and Awareness Scale, MM = mindfulness training, TMS-Cur = Toronto Mindfulness Scale- Curiosity, TMS-Decen = Toronto Mindfulness Scale- Decentering, WISDM = Wisconsin Inventory of Smoking Dependence Motives.

Table 9

Summary Statistics on Dependent Variables by Training Group and Day

		Day																
		Base	1	2	3	4	5	6	7	Visit 2	8	9	10	11	12	13	14	Visit 3
MM	TM-C (0 - 24)	12.5	13.8	13.1	12.7	13.0	12.7	11.4	13.5	14.1	14.0	13.9	14.3	13.3	14.1	14.1	13.7	14.2
		(6.4)	(5.2)	(5.40)	(5.3)	(4.9)	(5.1)	(5.1)	(4.5)	(6.3)	(4.9)	(5.5)	(5.6)	(5.1)	(4.9)	(5.0)	(5.2)	(5.7)
	TM-D (0 - 28)	11.9	13.4	13.5	12.8	13.7	13.2	13.0	14.5	13.8	15.3	14.3	15.5	14.5	15.4	15.4	14.9	15.0
		(4.3)	(4.4)	(5.1)	(5.1)	(4.8)	(5.3)	(5.1)	(4.7)	(4.7)	(4.9)	(5.3)	(5.5)	(4.7)	(4.5)	(4.7)	(4.2)	(5.1)
	PA (5 - 25)	15.7	17.8	16.8	16.2	16.8	15.9	16.7	16.2	15.4	17.4	15.8	16.4	15.6	16.6	16.2	15.6	16.6
		(3.3)	(4.3)	(5.2)	(5.1)	(5.2)	(5.1)	(5.3)	(4.7)	(4.5)	(4.8)	(5.3)	(5.3)	(5.1)	(5.4)	(4.6)	(4.9)	(4.7)
	NA (5 - 25)	11.8	7.3	6.2	6.5	6.4	6.5	7.3	7.6	8.5	6.7	7.1	6.6	7.1	6.7	7.1	7.1	7.8
		(4.4)	(3.0)	(2.0)	(2.7)	(2.5)	(3.0)	(4.0)	(4.4)	(4.5)	(3.3)	(4.4)	(4.2)	(4.0)	(3.9)	(4.3)	(4.5)	(4.3)
	Crav (1 - 7)	4.1	4.6	4.4	4.2	3.9	4.1	4.3	3.8	2.8	4.1	3.9	3.7	3.4	3.5	3.3	3.2	2.6
		(1.1)	(1.6)	(1.9)	(1.7)	(1.6)	(1.6)	(1.4)	(1.4)	(1.3)	(1.6)	(1.7)	(1.8)	(1.6)	(1.6)	(1.5)	(1.6)	(1.0)
	MAB (ms)	-52.7	-15.1	-30.3	-20.4	-5.5	5.2	-7.2	-27.6	-26.1	-10.3	14.6	-5.9	-28.2	10.0	-11.7	-4.3	-21.9
		(89.4)	(88.9)	(100.7)	(71.9)	(85.2)	(146.3)	(61.2)	(42.4)	(48.7)	(49.9)	(152.1)	(158.8)	(74.6)	(85.9)	(75.6)	(64.5)	(56.0)
	IAT (D)	-0.4	-0.5	-0.4	-0.2	-0.1	-0.2	-0.2	-0.0	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	-0.2	0.0	-0.1
		(0.5)	(0.5)	(0.4)	(0.5)	(0.4)	(0.5)	(0.4)	(0.4)	(0.4)	(0.3)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.3)
	No. Cigs (Diary)		15.6	16.2	15.5	15.8	14.3	14.8	13.9		12.5	12.3	11.4	11.8	12.2	11.3	11.8	
			(8.7)	(10.2)	(7.0)	(10.2)	(6.8)	(9.6)	(9.8)		(9.1)	(8.9)	(9.3)	(8.4)	(7.2)	(10.4)	(8.9)	
	MAAS (1 - 6)	3.9								4.0								4.2
		(0.8)								(0.8)								(0.7)
	EQ (11- 55)	25.1								23.8								25.6
(4.7)									(6.5)								(5.4)	
WIS (13 - 91)	59.1								50.5								46.6	
	(14.0)								(15.5)								(14.7)	
CO (ppm)	18.4								14.8								14.3	
	(9.8)								(7.7)								(8.2)	
Cot (ng/ml)	504.4								397.6								433.9	
	(300.3)								(233.0)								(257.1)	
CON	TM-C (0 - 24)	13.5	13.1	10.3	10.4	11.2	10.7	11.6	11.4	12.4	9.9	10.1	9.9	11.0	10.5	8.8	10.4	12.1
		(5.4)	(5.8)	(5.2)	(5.5)	(6.1)	(5.6)	(5.7)	(5.9)	(6.4)	(6.8)	(6.1)	(6.2)	(5.7)	(6.20)	(6.2)	(6.8)	(6.9)

TM-D (0 - 28)	13.7 (4.6)	14.4 (5.7)	12.7 (5.5)	12.0 (5.3)	13.2 (5.9)	12.1 (5.6)	13.7 (6.5)	14.3 (4.8)	14.9 (6.0)	12.4 (7.2)	12.7 (5.9)	12.2 (6.9)	12.7 (6.4)	13.3 (6.6)	11.9 (7.2)	12.9 (7.1)	14.0 (5.7)
PA (5 - 25)	17.3 (4.7)	16.7 (5.7)	17.9 (5.7)	18.0 (4.6)	17.7 (4.5)	17.6 (4.6)	18.2 (4.0)	17.6 (4.2)	17.6 (7.4)	16.2 (6.0)	17.5 (4.7)	17.0 (5.0)	17.6 (4.9)	16.9 (5.4)	16.5 (5.6)	17.7 (4.8)	18.1 (4.0)
NA (5 - 25)	10.1 (4.6)	8.7 (3.8)	9.2 (5.1)	8.3 (3.4)	8.7 (4.0)	7.2 (2.9)	8.6 (4.0)	8.4 (4.5)	7.4 (3.8)	8.3 (5.3)	7.5 (4.2)	7.7 (4.1)	7.8 (4.1)	6.6 (2.7)	6.5 (2.5)	7.5 (3.0)	6.9 (1.9)
Crav (1 - 7)	4.2 (1.1)	5.0 (2.0)	4.7 (2.0)	4.5 (2.0)	4.2 (2.0)	4.6 (1.9)	4.5 (2.1)	4.6 (1.9)	3.1 (1.3)	4.4 (2.0)	5.0 (2.0)	4.6 (2.1)	4.7 (2.1)	4.1 (2.1)	3.8 (2.1)	4.4 (1.9)	3.4 (1.4)
MAB (ms)	-27.6 (53.3)	-4.3 (52.7)	-2.4 (44.7)	-3.8 (32.2)	-7.5 (54.2)	-12.2 (49.2)	6.4 (54.8)	-11.4 (45.4)	-14.8 (37.0)	3.0 (39.3)	-18.2 (157.2)	31.2 (225.8)	15.5 (153.4)	11.6 (54.2)	-13.0 (29.6)	4.5 (41.9)	-19.6 (33.8)
IAT (D)	-0.7 (0.4)	-0.5 (0.6)	-0.2 (0.4)	-0.1 (0.5)	-0.1 (0.4)	-0.2 (0.5)	-0.2 (0.4)	-0.1 (0.4)	-0.2 (0.4)	-0.0 (0.4)	-0.1 (0.4)	-0.1 (0.3)	-0.2 (0.4)	-0.23 (0.5)	-0.2 (0.5)	-0.1 (0.4)	-0.0 (0.4)
No. Cigs (Diary)		10.5 (4.8)	13.2 (7.4)	13.1 (5.4)	11.8 (6.7)	11.8 (5.9)	13.0 (5.3)	9.6 (5.9)		11.0 (7.4)	11.3 (7.7)	10.9 (6.8)	10.1 (5.6)	10.5 (6.2)	12.1 (6.7)	11.3 (8.3)	
MAAS (1 - 6)	4.2 (1.1)								4.2 (0.8)								4.5 (1.0)
EQ (11 - 55)	27.9 (5.5)								28.4 (4.9)								27.0 (7.0)
WIS (13 - 91)	52.9 (15.5)								51.6 (16.1)								48.2 (17.2)
CO (ppm)	19.1 (6.7)								15.3 (4.7)								15.4 (5.0)
Cot (ng/ml)	452.9 (221.9)								412.7 (222.1)								482.8 (250.0)

Note. Mean (SD) for study measures. Data for Base, Visit 2, and Visit 3 are from laboratory sessions. Data from Days 1 - 14 derive from EMA assessments or smoking diaries. Base = baseline, CO = expired carbon monoxide, CON = control training, Cot = salivary cotinine, Crav = Craving, EQ = Experiences Questionnaire, IAT (D) = Implicit Association Test (D-score), MAAS = Mindful Attention and Awareness Scale, MAB = modified attentional bias, MM = mindfulness training, NA = Positive and Negative Affect Schedule – Negative Affect, No. cigs = number of cigarettes reported per day, PA = Positive and Negative Affect Schedule – Positive Affect, TM-C = TMS-Curiosity, TM-D = TMS-Decentering, WIS = Wisconsin Inventory of Smoking Dependence Motives.

Table 10

Summary Statistics on Dependent Variables by Training Group and Assessment Type

		Assessment Type		
		RA	MA - Valid	MA - Invalid
MM	TMS-Cur (0 - 24)	13.07 (5.35)	14.84 (4.97)	13.18 (4.20)
	TMS-Decen (0 - 28)	13.79 (4.90)	15.46 (4.88)	14.94 (4.58)
	PA (5 - 25)	15.73 (4.97)	17.20 (4.59)	17.13 (5.48)
	NA (5 - 25)	6.96 (4.10)	7.00 (3.79)	6.76 (2.75)
	Craving (1 - 7)	3.97 (1.71)	3.48 (1.67)	4.04 (1.56)
	MAB (ms)	-10.51 (101.90)	-11.93 (109.29)	-5.57 (55.93)
	IAT (D)	-0.13 (0.40)	-0.20 (0.40)	-0.28 (0.54)
	CON	TMS-Cur (0 - 24)	10.87 (5.85)	12.46 (6.70)
TMS-Decen (0 - 28)		13.22 (6.14)	13.33 (6.72)	12.64 (5.78)
PA (5 - 25)		17.50 (4.91)	17.61 (5.20)	16.99 (4.77)
NA (5 - 25)		8.07 (4.00)	7.78 (3.61)	8.11 (4.23)
Craving (1 - 7)		4.25 (2.00)	4.90 (1.84)	5.00 (1.97)
MAB (ms)		-1.30 (117.58)	-16.29 (45.31)	-3.68 (85.45)
IAT (D)		-0.23 (0.44)	-0.20 (0.47)	-0.08 (0.45)

Note. Data are Means (SD). CON = control training, IAT (D) = Implicit Association Test D-score, MA = meditation assessment, MAB = modified attentional bias, MM = mindfulness training, NA = PANAS – Negative Affect, PA = PANAS - Positive Affect, RA = random assessment, TMS-Cur = TMS-Curiosity, TMS-Decen = TMS-Decentering. RA = Random Assessment. MA - Valid = Participant-initiated occurring within 60 seconds of

the completion of mindfulness or control training. MA - Invalid = Participant-initiated occurring more than 60 seconds after the completion of mindfulness or control training.

Table 11

Results of LMMs for Laboratory data

	n_1	n_2	Group					Group x Visit					Cohen's <i>d</i>
			<i>df</i>	<i>PE</i>	<i>SE</i>	<i>F</i>	<i>p</i>	<i>df</i>	<i>PE</i>	<i>SE</i>	<i>F</i>	<i>p</i>	
TMS-Cur	64	34	1, 29	2.29	1.60	2.05	.16	1, 28	-0.04	1.31	0.00	.98	0.46 ^b
TMS-Decen	64	34	1, 29	0.71	1.69	0.18	.68	1, 28	-1.08	1.36	0.63	.43	0.32 ^b
PA	64	34	1, 29	-0.57	2.40	0.06	.81	1, 28	-1.93	1.70	1.29	.26	0.03 ^b
NA	64	34	1, 29	-0.02	1.60	0.00	.99	1, 28	2.43	2.20	1.23	.28	0.23 ^b
Craving	64	34	1, 29	-0.50	0.32	2.54^a	.12	1, 28	0.49	0.49	0.97	.33	0.77 ^b
Bias (ms)	63	33	1, 29	-0.01	12.0	0.00	.99	1, 28	12.6	22.6	0.31	.58	0.11
IAT effect (D)	61	33	1, 28	-0.12	0.11	1.22	.28	1, 27	-0.05	0.17	0.09	.76	0.43 ^b
MAAS	64	34	1, 29	-0.13	0.22	0.35	.56	1, 28	-0.06	0.17	0.12	.73	0.16
EQ – Decentering	64	34	1, 29	1.60	1.66	0.93	.34	1, 28	-3.32	1.71	3.79	.06	0.00
WISDM	64	34	1, 29	-4.98	3.10	2.59	.12	1, 28	1.80	1.76	1.05	.31	0.70 ^b
CO (ppm)	64	34	1, 29	0.55	1.71	0.09	.76	1, 28	-0.24	2.40	0.01	.92	0.11
Cotinine (ng/ml)	64	34	1, 29	-37.3	38.2	0.95	.34	1, 28	10.8	54.7	0.04	.84	0.36 ^b

Note. n_1 = no. of assessments; n_2 = number of subjects. Analyses included all subjects who participated in at least one visit post-treatment. The columns labeled Group show the results for the main effect of Group. The comparison category is Control. The column labeled Group x Visit show the results for the Group by Visit interaction term. Visit is a categorical variable with two levels (visit 2 vs. visit 3). All models include main effects for Group and Visit. In addition, the baseline (pre-intervention) measure for each dependent variable was included as a covariate. Cohen's *d* refers to the between-group difference in visit 3 scores (end of treatment), controlling for baseline measures (^bbetween-group difference in expected direction). Key: TMS-Cur = TMS-Curiosity. TMS-Decen = TMS-Decentered; PA = PANAS Positive Affect; NA = PANAS Negative Affect; IAT = Implicit Association Test; PE = (unstandardized) parameter estimate; SE = standard error; F = F value from mixed model.

^aIf this analysis is restricted to protocol completers, there is a significant main effect of Group, $F(1, 29) = 4.24$, $PE = -0.65$, $SE = 0.31$, $p = .04$.

Table 12

Results of LMMs for EMA data

	n_1	n_2	df	Group				df	Group x Day				df	Group x Assessment Type			
				PE	SE	F	p		PE	SE	F	p		PE	SE	F	p
TMS-Cur	1874	37	1, 1728	1.22	0.91	1.80	.18	1, 1728	0.20	0.10	4.05	.04	2,1728	0.84	0.61	1.01	.36
TMS-Decen	1874	37	1, 1728	-0.14	1.19	0.01	.90	1, 1728	0.27	0.11	6.10	.01	2,1728	0.62	0.66	1.41	.24
PA	1874	37	1, 1728	0.32	1.09	0.09	.77	1, 1728	-0.02	0.10	0.04	.84	2,1728	0.05	0.56	0.54	.58
NA	1874	37	1, 1728	-2.93	0.74	15.7	.0001	1, 1728	0.15	0.08	3.58	.06	2,1728	0.67	0.50	1.13	.32
Craving	1874	37	1, 1728	-0.52	0.38	2.40	.12	1, 1728	-0.03	0.04	0.44	.51	2,1728	0.80	0.26	5.78	.003
Bias (ms)	866	37	1, 826	-1.18	11.1	0.01	.92	1, 825	0.79	0.95	0.69	.41	2, 824	14.1	11.9	1.60	.20
IAT (D)	853	37	1, 813	-0.04	0.08	0.29	.59	1, 812	0.01	0.007	3.06	.08	2, 811	-0.02	0.08	1.81	.16
Cigs/Day	509	37	1, 436	1.17	2.04	0.33	.57	1, 436	-0.30	0.12	6.02	.01	N/A	N/A	N/A	N/A	N/A

Note. n_1 = no. of assessments or days (cigs per day); n_2 = number of subjects. Analyses included all subjects who provided EMA data. The columns labeled Group show the results for the main effect of Group. The comparison category is Control. The columns labeled Group x Day show the results for the Group by Day interaction term. The columns labeled Group x Assessment Type (3 levels) show the results for the Group by Assessment Type interaction term (3 levels: RAs, Valid MAs, Invalid MAs). The parameter estimate reports the comparison of valid MAs vs. RAs. All models include main effects of Group, Day, and Assessment Type. In addition, the baseline (pre-intervention) measure for each dependent variable was included as a covariate. Key: TMS Cur = TMS Curiosity. TMS Decen = TMS Decentered; PA = PANAS Positive Affect; NA = PANAS Negative Affect; IAT = Implicit Association Test; PE = (unstandardized) parameter estimate; SE = standard error; F = F value from mixed model; # $p < .1$; * $p < .05$; ** $p < .01$. All the significant results shown above persist when analyses are conducted on protocol completers, and all persist when controlling for baseline smoking rate. In addition, because the distribution of NA resembled a poisson (rather than normal) distribution, we recomputed the analyses for this variable using Generalized Linear Mixed Models (PROC GLIMMIX in SAS), using maximum likelihood with adaptive quadrature estimation and assuming a poisson distribution in the population. This analysis yielded similar results to those presented in the table, with a main effect of Group, $F(1, 1728) = 18.4$, $p < .0001$).

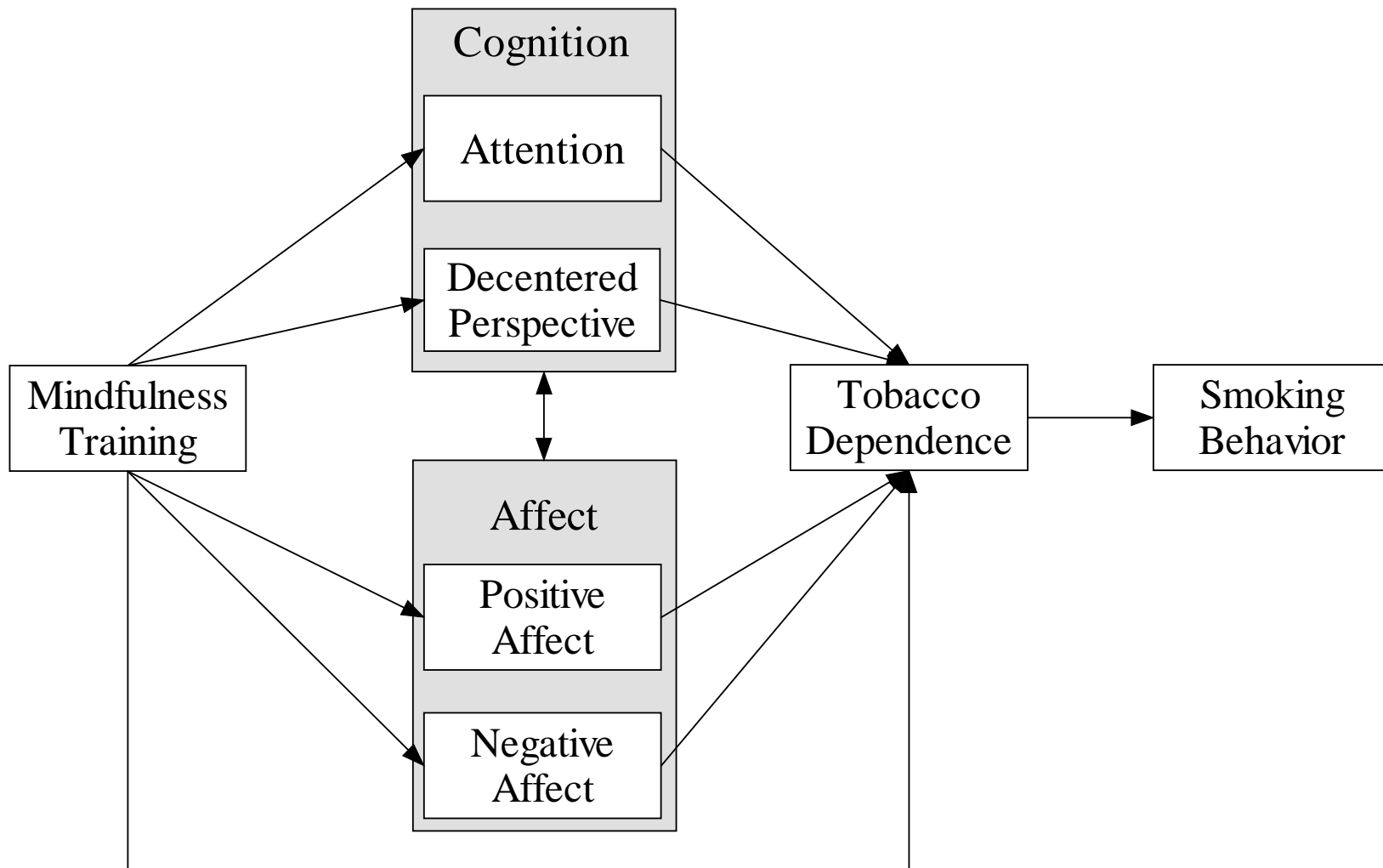


Figure 1: Conceptual Model. The independent variable, X, is Mindfulness Training (Group), a categorical variable with 2 levels. Using the terminology of Baron and Kenny (1986), the arrows from Mindfulness Training (X) to Attention, Decentered Perspective, Positive Affect, and Negative Affect (the mediators, M) represent the a paths. The arrows from the mediators to dependent variable (Y) represent the b paths. Mediation is indicated if both the a and b paths are significant for an individual mediator. The direct arrow from X to Y represents the c' path (a path between X and Y that is not

mediated by the mediators). Both WISDM scores and cigarettes smoked per day were considered as dependent variables (Y). The a, b, and c' paths are all considered to represent causal relationships. In Baron and Kenny's terminology, the c path (not shown in Figure) is the relationship between X and Y in the absence of the mediator variables.

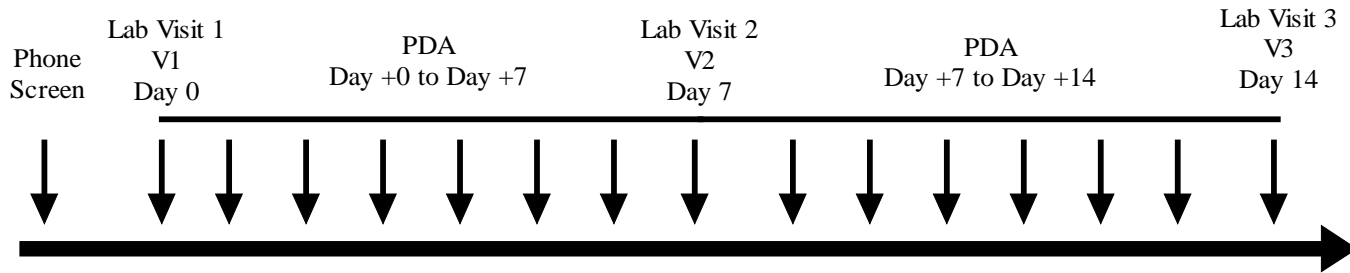


Figure 2: Timeline with Major Study Milestones

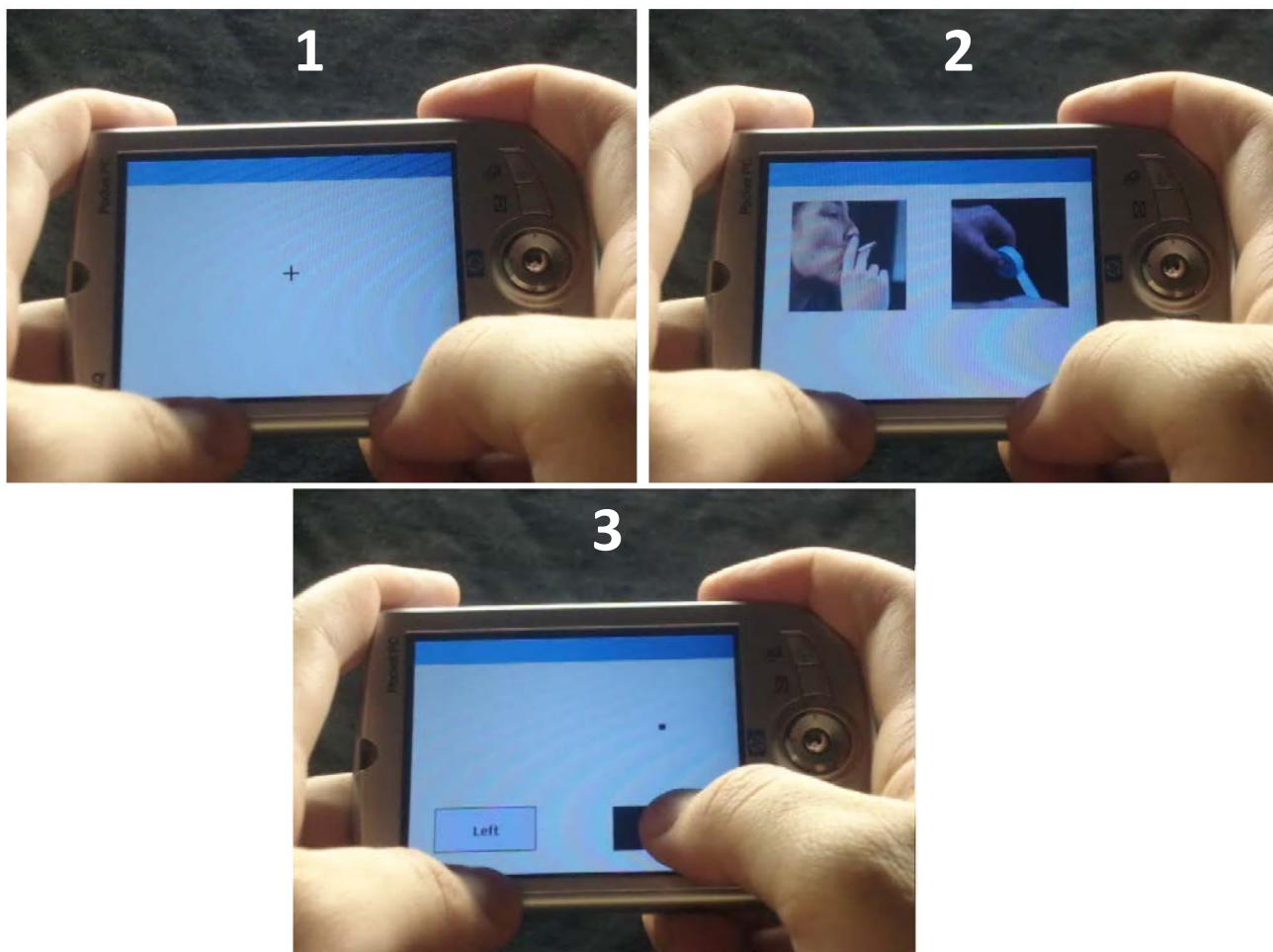


Figure 3: Screenshots of an individual completing the visual probe task. Diagram of sequence of events in a single VP trial. 1) The fixation cross is presented for 500ms, 2) the two pictures – one smoking and one neutral- are displayed (500 ms), and 3) the probe to which the participant must respond is presented.

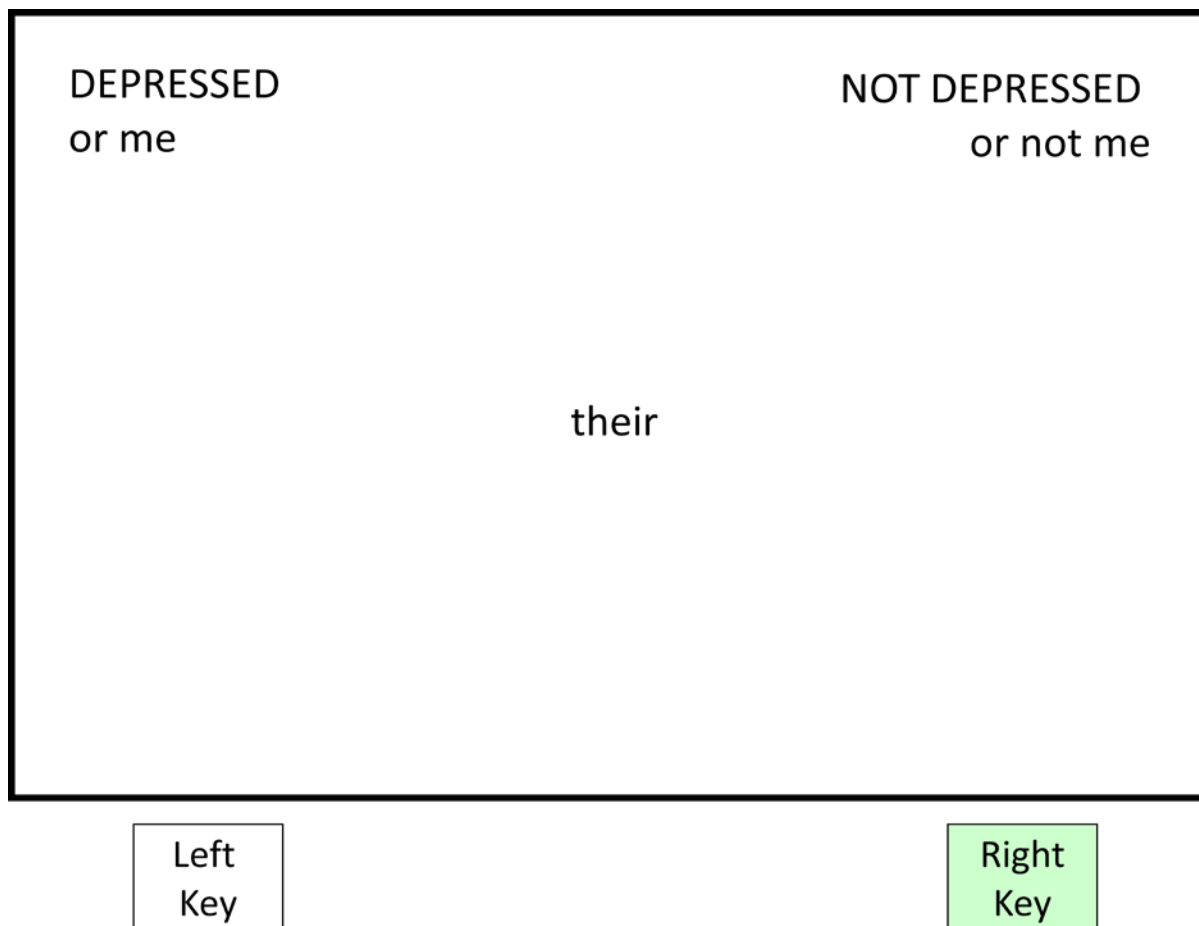


Figure 4. Representation of the Implicit Association Test (IAT): Task 1. Category labels appear on the upper left and upper right of the screen. The stimulus words to be categorized appear in the center of the screen. A participant would respond with a right key press because the stimulus word is in the “not me” category.

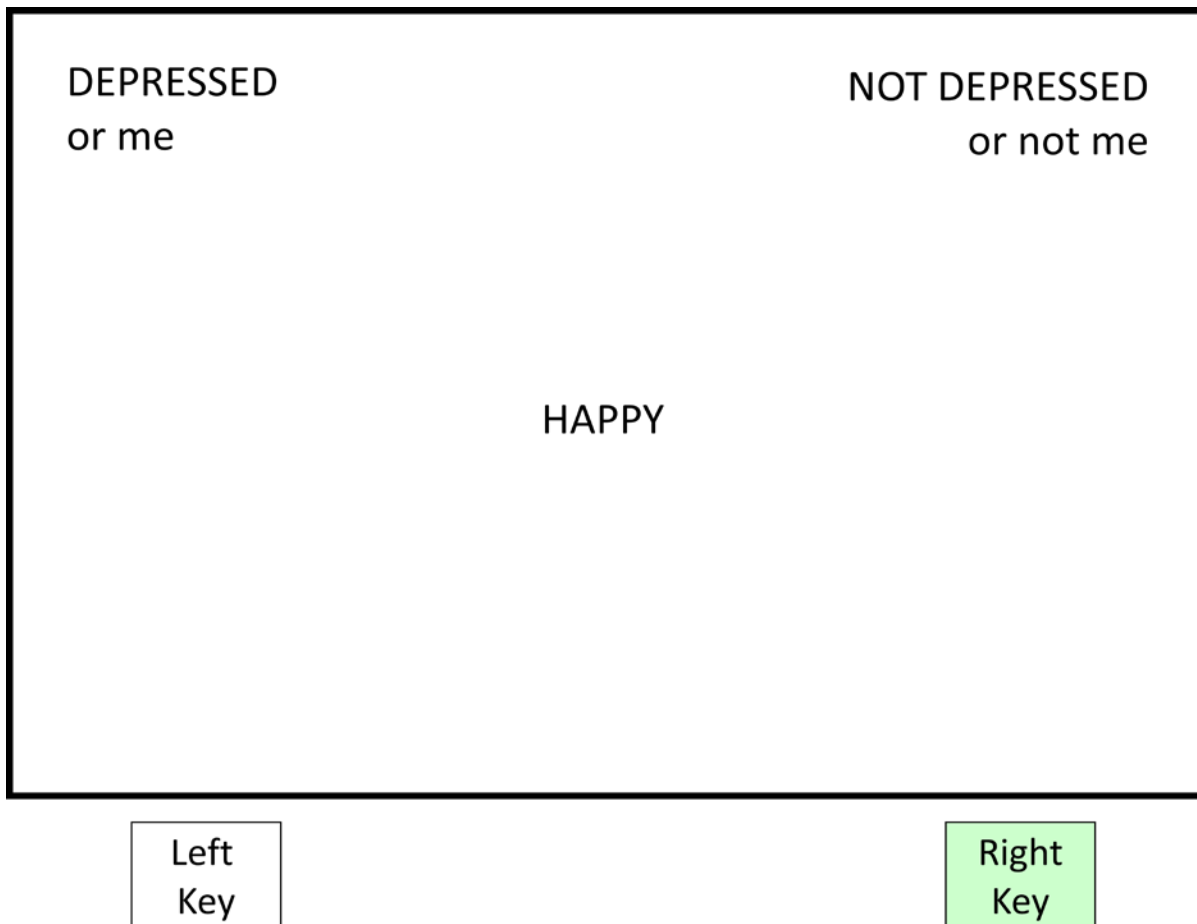


Figure 5. Representation of the Implicit Association Test (IAT): Task 2. In Task 2, the category labels “me” and “not me” are switched, changing the sorting task. Category labels appear at the top of the screen and the stimulus word appears in the center of the screen. A participant would respond with a right key press because “Happy” falls into the “NOT DEPRESSED” category of words.

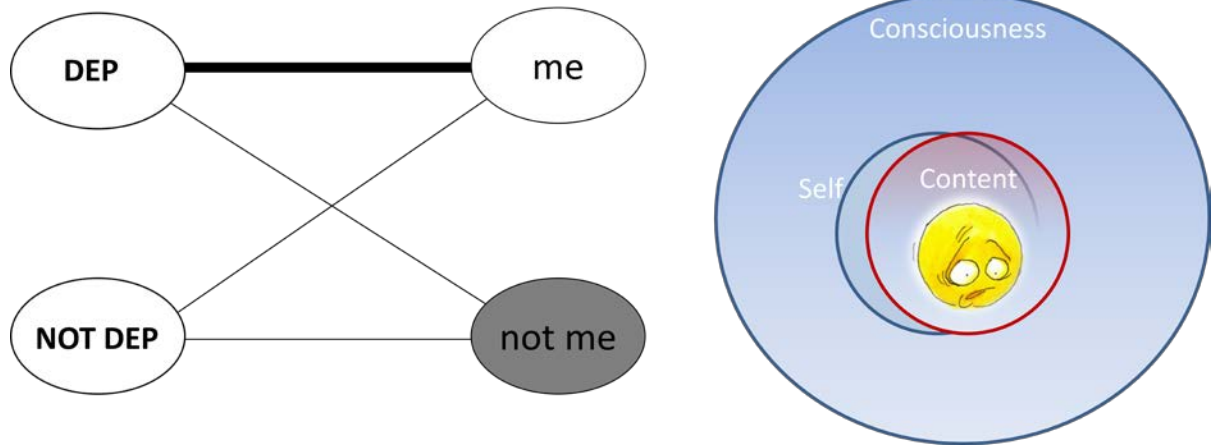


Figure 6. Conceptual depiction of a positive D-score on the Depression Implicit Association Test and the accompanying lack of a decentered perspective. A high (more positive) D-score represents a strong mental association between “DEPRESSION” and “me” (left). This pattern of results corresponds with a lack of a decentered perspective (right) resulting in an individual who does not effectively separate negative contents of consciousness from their sense of self.

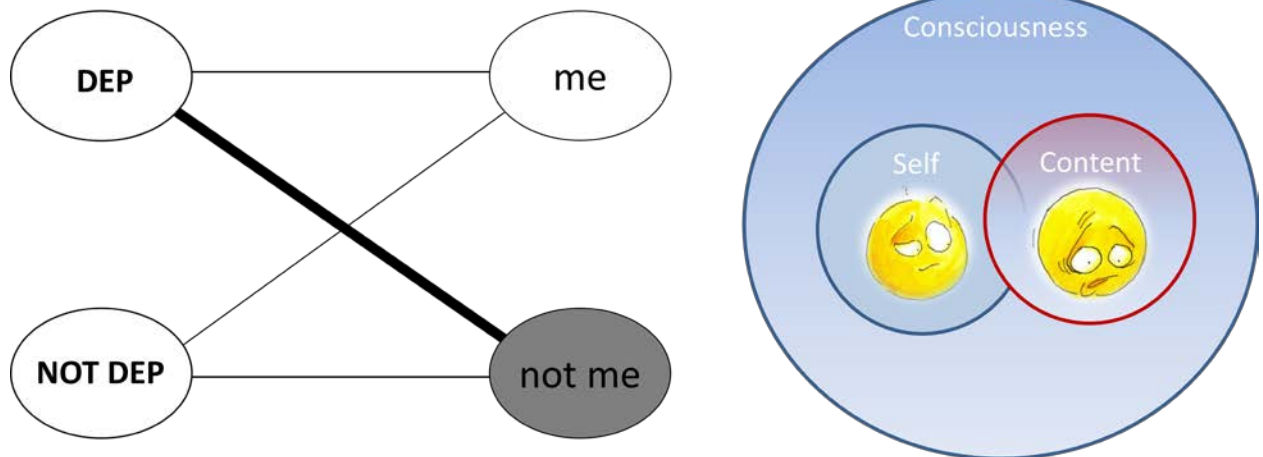


Figure 7. Conceptual Depiction of a Negative D-score on the Depression Implicit Association Test and the Accompanying Decentered Perspective. A low (more negative) D-score represents a strong mental association between “DEPRESSION” and “not me” (left). This pattern of results corresponds with a decentered perspective (right) resulting in an individual who effectively separates negative contents of consciousness from their sense of self.

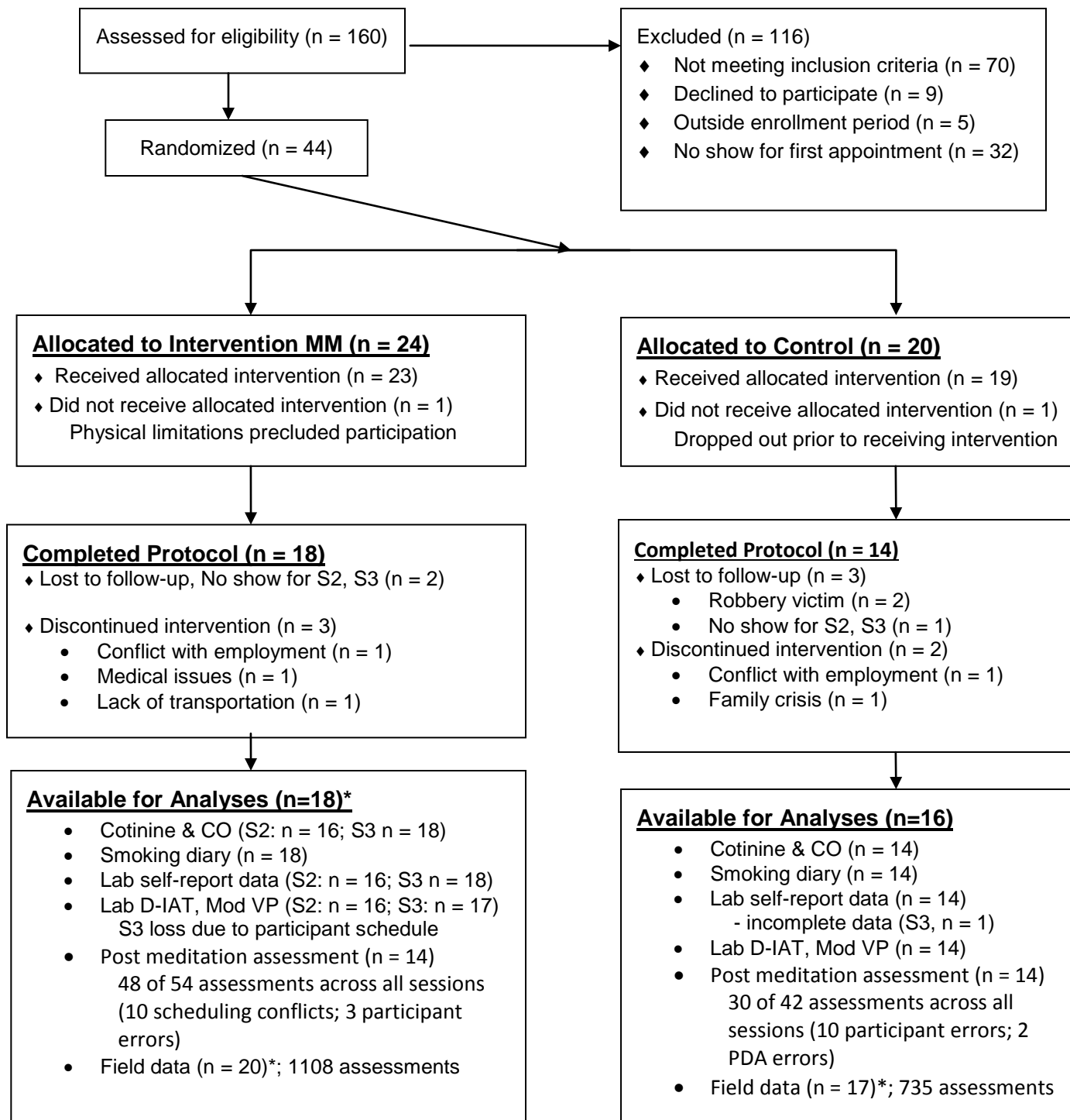


Figure 8. Project Brief-MM CONSORT Flow Diagram. CO = expired carbon monoxide, D-IAT = depression Implicit Association Test, MM = mindfulness training, Mod VP = modified visual probe, PDA = personal digital assistant, S2 = session 2, S3 = session 3. *Participants with data from session 2 or 3 were included in analyses of laboratory data. Participants with at least one PDA assessment were included in analyses of EMA data.

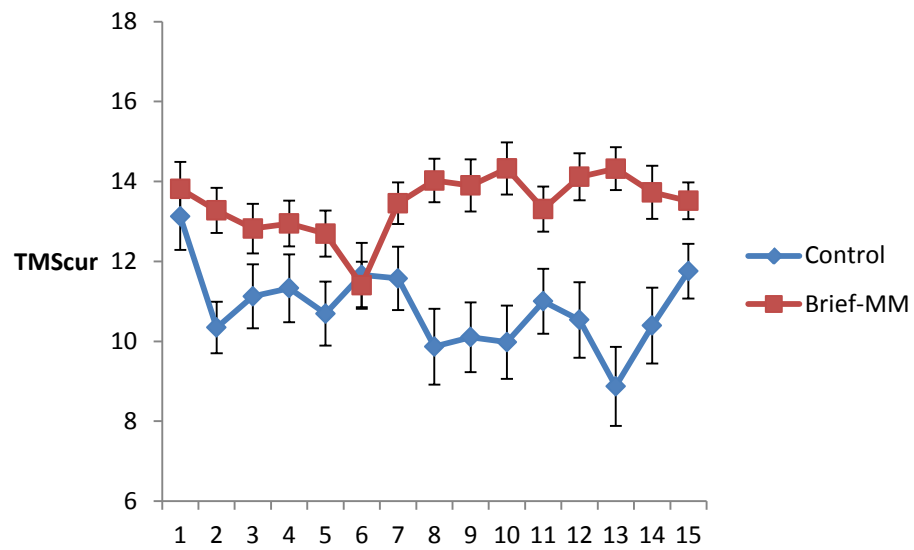


Figure 9. TMS-Curiosity scores by Group and Day. Data are Means (± 1 SE) aggregated over all assessments. MM = mindfulness training, TMScur = Toronto Mindfulness Scale- Curiosity.

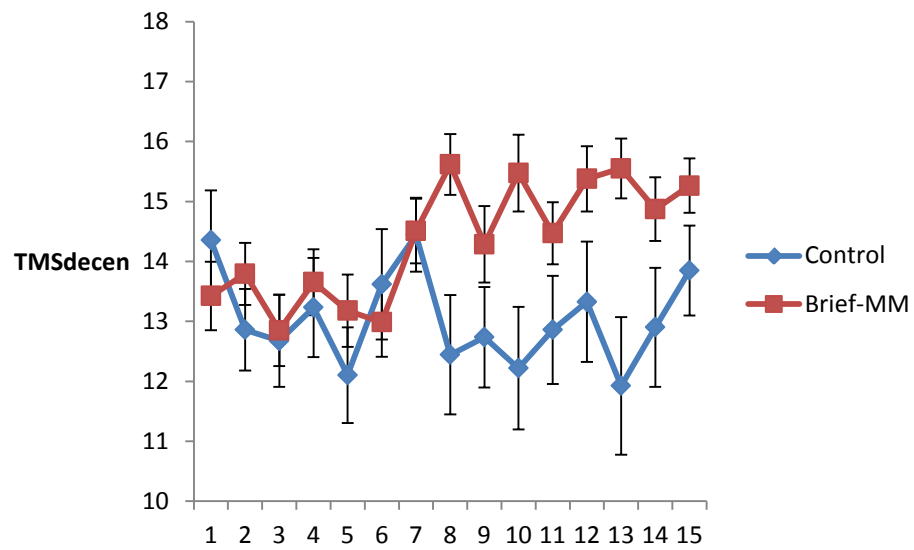


Figure 10. TMS-Decentering scores by Group and Day. Data are Means (± 1 SE) aggregated over all assessments. MM = mindfulness training, TMSdecen = TMS-Decentering scores.

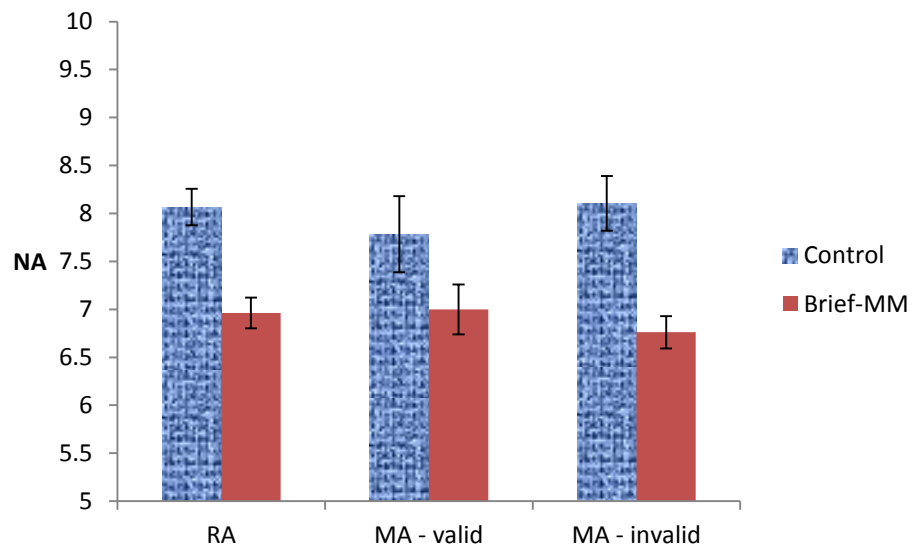


Figure 11. PANAS-Negative Affect scores by Group and Assessment Type. Data are Means (± 1 SE) aggregated over all assessments. MA = meditation assessment, MM = mindfulness training, NA = negative affect, RA = random assessment.

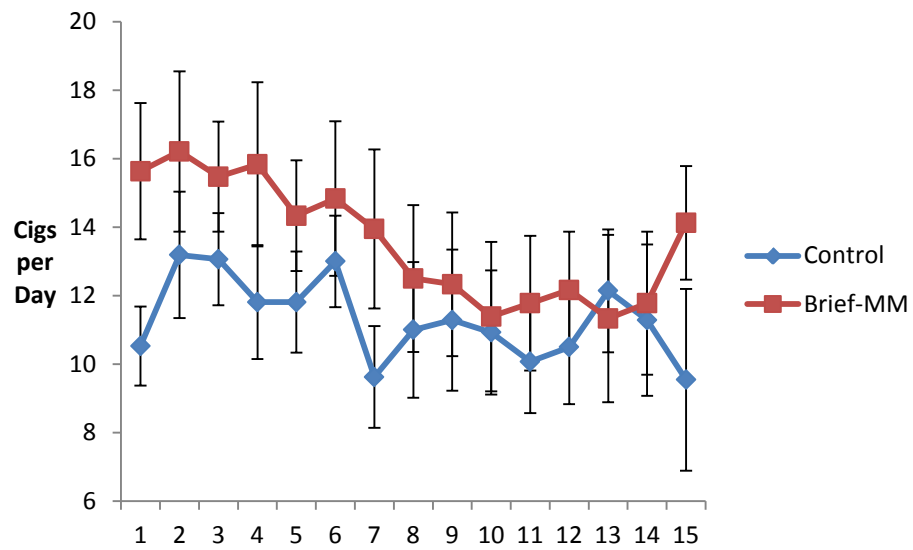


Figure 12. Cigarettes smoked by Group and Day. Data are Means (± 1 SE) aggregated over all assessments. Cigs = cigarettes, MM = mindfulness training.

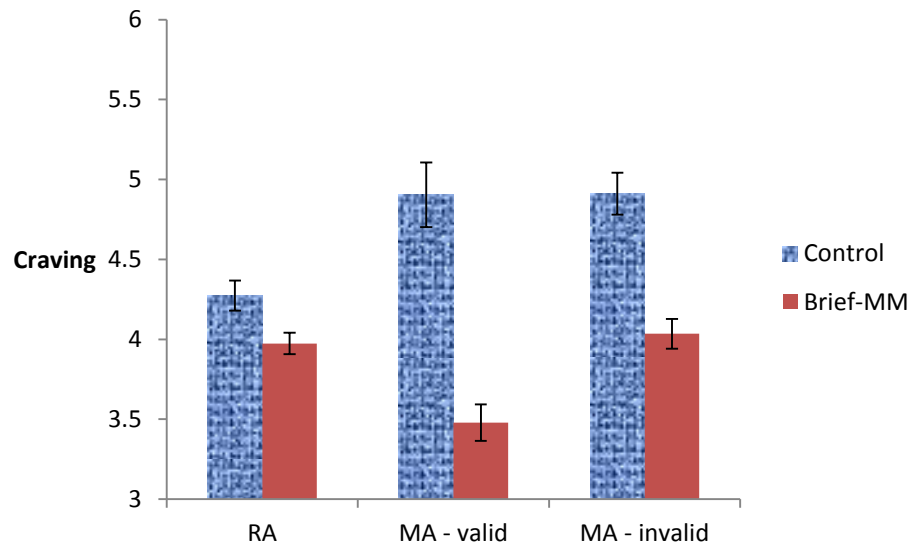


Figure 13. Craving by Group and Assessment Type. Data are Means (± 1 SE) aggregated over all assessments. MA = meditation assessment, MM = mindfulness training, RA = random assessment.

Appendices

Appendix A..... Self Report Measures.

Appendix B..... USUHS IRB Approval Letter

Appendix C..... Informed Consent Document.

Appendix D..... Brief-MM and Control Scripts

Q6. What category best describes your race? (Choose one)

- | | |
|---|--|
| 1 | Anglo American/Euro American/White |
| 2 | African American/Black |
| 3 | Asian American |
| 4 | Native of Hawaii or other Pacific Islander |
| 5 | Native American or Alaska Native |
| 6 | Mixed Race |
| 7 | Other |
| 8 | Refuse to Answer |

If Q6 is equal to 8 or Q6 is less than 7, then skip to Q8.

Q7. Please specify your race_ _ _ _ _

Q8. Do you receive Medicare, Medicaid, or Medical Assistance currently?

- | | |
|---|------------------|
| 1 | Yes |
| 0 | No |
| 7 | Don't Know |
| 8 | Refuse to Answer |

Q9. Do you have private insurance or group insurance?

- | | |
|---|------------------|
| 1 | Yes |
| 0 | No |
| 7 | Don't Know |
| 8 | Refuse to Answer |

Q10. What is your total family income per year, before taxes? (Choose one)

- | | |
|----|---|
| 01 | Less than \$10,000 per year or less than about \$833 per month |
| 02 | \$10,000 to \$19,999 per year or less than about \$1250 per month |
| 03 | \$20,000 to \$29,999 per year or less than about \$2083 per month |
| 04 | \$30,000 to \$39,999 per year or less than about \$2916 per month |
| 05 | \$40,000 to \$49,999 per year or less than about \$3750 per month |
| 06 | \$50,000 to \$59,999 per year or less than about \$4583 per month |
| 07 | \$60,000 to \$69,999 per year or less than about \$5416 per month |
| 08 | \$70,000 to \$79,999 per year or less than about \$6250 per month |
| 09 | \$80,000 to \$89,999 per year or less than about \$7083 per month |
| 10 | \$90,000 to \$99,999 per year or less than about \$7916 per month |
| 11 | \$100,000 or more per year or more than \$8333 per month |
| 98 | Refuse to Answer |

Q11. Generations in the U.S. Please choose the best response: (Choose one)

- | | |
|---|---|
| 1 | I'm an immigrant of the US |
| 2 | I was born in the US |
| 3 | One of my parents and I were born in the US (the other parent immigrated) |
| 4 | My parents and I were born in the US |
| 5 | My grandparents, my parents, and I were born in the US |
| 6 | My great-grandparents and ancestors were born in the US |
| 8 | Refuse to Answer |

If Q11 is greater than 1, then skip to Q13.

Q12. What year did you immigrate to the US?

— — — —

Refuse to Answer

Q13. Employment Status. Please choose the best response: (Choose one)

- 01 Regular full-time (30 or more hours per week)
- 02 Regular part-time (less than 30 hours per week)
- 03 Unemployed, currently *looking* for work
- 04 Unemployed, currently *NOT* looking for work
- 05 Homemaker
- 06 Student
- 07 Retired
- 08 Unable to work or disabled
- 09 Other
- 98 Refuse to Answer

If Q13 is less than 9, then skip to Q15.

Q14. Please specify your employment status.

Q15. In the past 30 days, what was the primary source of your income? (Choose one)

- 1 A job
- 2 Unemployment Benefits
- 3 VA/Disability/Social Security Income
- 4 Welfare/Food Stamps/Aid to Family with Dependent Children
- 5 Alimony or Child Support
- 6 Spouse/partner is main source of income
- 8 Refuse to Answer

Q16. Have you ever engaged in a daily mindfulness practice?

Q17. Have you ever been exposed to mindfulness meditation through cultural affiliation, religious affiliation, medical treatment, or any other method?

Please Specify and Describe:

Smoking History Questionnaire

About how old were you when you first started smoking at least _____ **years old**
1 cigarette a day?

About how old were you when you started smoking regularly _____ **cigarettes a**
everyday? **day**

How many cigarettes do you smoke on a **normal day**? _____ **cigarettes a**
day

	Definitely not	Probabl y not	Possibl y	Probabl y	Definitel y
Do you think you are addicted to smoking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Are you seriously thinking of quitting smoking?

Yes, within the next 30 days

Yes, within the next 6 months

No, not thinking of quitting

Have you used any other tobacco products (i.e., cigars, pipes, smokeless tobacco, bidis, cloves)?

Yes **No**

Describe:

Have you ever made a serious and deliberate attempt to **STOP SMOKING** cigarettes completely?

Yes **No**

If so, how many times?

_____ times

In the **last year**, how many times have you quit smoking for at least 24 hours?

_____ times

How hard was it for you to quit smoking on your most recent attempt?

**Easy Slightly
Difficult Difficult Very
Difficult**

How severely did you experience any of the following symptoms below in your most recent attempt to quit smoking? Choose the answer that most reflects the severity of each symptom.

	Not at all	Mild	Moderate	Severe	Very severe
Cravings for cigarettes	1	2	3	4	5
Irritability	1	2	3	4	5
Nervousness	1	2	3	4	5
Difficulty concentrating	1	2	3	4	5
Physical symptoms	1	2	3	4	5
Difficulty sleeping	1	2	3	4	5

Are you currently attempting to quit smoking?

Are you currently receiving any treatment for smoking? Please describe:

Outcome Rating Scale

Looking back over the last week (or since your last visit), including today, help us understand how you have been feeling by rating how well you have been doing in the following areas of your life, where marks to the left represent low levels and marks to the right represent high levels.

Low	Overall: (General sense of well-being)	High
Low	Individually: (Personal well-being)	High
Low	Interpersonally: Family, close relationships	High
Low	Socially: (Work, school, friendships)	High

Mindful Attention and Awareness Scale

Day-to-Day Experiences

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
It seems I am "running on automatic," without much awareness of what I'm doing.	1	2	3	4	5	6
I rush through activities without being really attentive to them.	1	2	3	4	5	6
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6

	1	2	3	4	5	6				
	Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never				
I drive places on 'automatic pilot' and then wonder why I went there.					1	2	3	4	5	6
I find myself preoccupied with the future or the past.					1	2	3	4	5	6
I find myself doing things without paying attention.					1	2	3	4	5	6
I snack without being aware that I'm eating.					1	2	3	4	5	6

Toronto Mindfulness Scale

4. I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things 'really' are.	0	1	2	3	4
5. I was curious to see what my mind was up to from moment to moment.	0	1	2	3	4
6. I was curious about each of the thoughts and feelings that I was having.	0	1	2	3	4
7. I was receptive to observing unpleasant thoughts and feelings without interfering with them.	0	1	2	3	4
8. I was more invested in just watching my experiences as they arose, than in figuring out what they could mean.	0	1	2	3	4
9. I approached each experience by trying to accept it, no matter whether it was pleasant or unpleasant.	0	1	2	3	4
10. I remained curious about the nature of each experience as it arose.	0	1	2	3	4
11. I was aware of my thoughts and feelings without overidentifying with them.	0	1	2	3	4
12. I was curious about my reactions to things.	0	1	2	3	4
13. I was curious about what I might learn about myself by just taking notice of what my attention gets drawn to.	0	1	2	3	4

Toronto Mindfulness Scale

Instructions: We are interested in what you just experienced. Below is a list of things that people sometimes experience. Please read each statement. Next to each statement are five choices: "not at all," "a little," "moderately," "quite a bit," and "very much." Please indicate the extent to which you agree with each statement. In other words, how well does the statement describe what you just experienced, just now?	Not at all	A little	Moderately	Quite a bit	Very much
1. I experienced myself as separate from my changing thoughts and feelings.	0	1	2	3	4
2. I was more concerned with being open to my experiences than controlling or changing them.	0	1	2	3	4
3. I was curious about what I might learn about myself by taking notice of how I react to certain thoughts, feelings or sensations.	0	1	2	3	4

Experiences Questionnaire

Instructions: We are interested in your recent experiences. Below is a list of things that people sometimes experience. Next to each item are five choices: "never", "rarely", "sometimes", "often", and "all the time". Please darken one of these to indicate how much you currently have experiences similar to those described.

Please do not spend too long on each item—it is your first response that we are interested in. Please be sure to answer every item.

	Never	Rarely	Sometimes	Often	All the time
1. I think about what will happen in the future.	①	②	③	④	⑤
2. I remind myself that thoughts aren't facts.	①	②	③	④	⑤
3. I am better able to accept myself as I am.	①	②	③	④	⑤
4. I notice all sorts of little things and details in the world around me.	①	②	③	④	⑤
5. I am kinder to myself when things go wrong.	①	②	③	④	⑤
6. I can slow my thinking at times of stress.	①	②	③	④	⑤
7. I wonder what kind of person I really am.	①	②	③	④	⑤
8. I am not so easily carried away by my thoughts and feelings.	①	②	③	④	⑤
9. I notice that I don't take difficulties so personally.	①	②	③	④	⑤
10. I can separate myself from my thoughts and feelings.	①	②	③	④	⑤
11. I analyze why things turn out the way they do.	①	②	③	④	⑤
12. I can take time to respond to difficulties.	①	②	③	④	⑤
13. I think over and over again about what others have said to me.	①	②	③	④	⑤
14. I can treat myself kindly.	①	②	③	④	⑤
15. I can observe unpleasant feelings without being drawn into them.	①	②	③	④	⑤
16. I have the sense that I am fully aware of what is going on around me and inside me.	①	②	③	④	⑤
17. I can actually see that I am not my thoughts.	①	②	③	④	⑤
18. I am consciously aware of a sense of my body as a whole.	①	②	③	④	⑤
19. I think about the ways in which I am different from other people.	①	②	③	④	⑤
20. I view things from a wider perspective.	①	②	③	④	⑤

Positive and Negative Affect Schedule

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

Difficulties in Emotion Regulation Scale (DERS)

Response categories:

- 1 Almost never (0-10%)
- 2 Sometimes (11-35%)
- 3 About half the time (36-65%)
- 4 Most of the time (66 – 90%)
- 5 Almost always (91-100%)

1. I am clear about my feelings.
2. I pay attention to how I feel.
3. I experience my emotions as overwhelming and out of control.
4. I have no idea how I am feeling.
5. I have difficulty making sense out of my feelings.
6. I am attentive to my feelings.
7. I know exactly how I am feeling.
8. I care about what I am feeling.
9. I am confused about how I feel.
10. When I'm upset, I acknowledge my emotions.
11. When I'm upset, I become angry with myself for feeling that way.
12. When I'm upset, I become embarrassed for feeling that way.
13. When I'm upset, I have difficulty getting work done.
14. When I'm upset, I become out of control.
15. When I'm upset, I believe that I will remain that way for a long time.
16. When I'm upset, I believe that I'll end up feeling very depressed.
17. When I'm upset, I believe that my feelings are valid and important.
18. When I'm upset, I have difficulty focusing on other things.
19. When I'm upset, I feel out of control..
20. When I'm upset, I can still get things done.
21. When I'm upset, I feel ashamed with myself for feeling that way.
22. When I'm upset, I know that I can find a way to eventually feel better.
23. When I'm upset, I feel like I am weak.
24. When I'm upset, I feel like I can remain in control of my behaviors.
25. When I'm upset, I feel guilty for feeling that way.
26. When I'm upset, I have difficulty concentrating.
27. When I'm upset, I have difficulty controlling my behaviors.
28. When I'm upset, I believe there is nothing I can do to make myself feel better.
29. When I'm upset, I become irritated with myself for feeling that way.
30. When I'm upset, I start to feel very bad about myself.
31. When I'm upset, I believe that wallowing in it is all I can do.
32. When I'm upset, I lose control over my behaviors.
33. When I'm upset, I have difficulty thinking about anything else.
34. When I'm upset, I take time to figure out what I'm really feeling.
35. When I'm upset, it takes me a long time to feel better.
36. When I'm upset, my emotions feel overwhelming.

Wisconsin Inventory of Smoking Dependence Motives-68

Below are a series of statements about cigarette smoking. Please rate your level of agreement for each using the following scale:

	1	2	3	4	5	6	7
	Not True of Me At All					Extremely True of Me	
1. I enjoy the taste of cigarettes most of the time.	1	2	3	4	5	6	7
2. Smoking keeps me from gaining weight.	1	2	3	4	5	6	7
3. Smoking makes a good mood better.	1	2	3	4	5	6	7
4. If I always smoke in a certain place it is hard to be there and not smoke.	1	2	3	4	5	6	7
5. I often smoke without thinking about it.	1	2	3	4	5	6	7
6. Cigarettes control me.	1	2	3	4	5	6	7
7. Smoking a cigarette improves my mood.	1	2	3	4	5	6	7
8. Smoking makes me feel content.	1	2	3	4	5	6	7
9. I usually want to smoke right after I wake up.	1	2	3	4	5	6	7
10. Very few things give me pleasure each day like cigarettes.	1	2	3	4	5	6	7
11. It's hard to ignore an urge to smoke.	1	2	3	4	5	6	7
12. The flavor of a cigarette is pleasing.	1	2	3	4	5	6	7
13. I smoke when I really need to concentrate.	1	2	3	4	5	6	7
14. I can only go a couple hours between cigarettes.	1	2	3	4	5	6	7
15. I frequently smoke to keep my mind focussed.	1	2	3	4	5	6	7
16. I rely upon smoking to control my hunger and eating.	1	2	3	4	5	6	7
17. My life is full of reminders to smoke.	1	2	3	4	5	6	7
18. Smoking helps me feel better in seconds.	1	2	3	4	5	6	7
19. I smoke without deciding to.	1	2	3	4	5	6	7
20. Cigarettes keep me company, like a close friend.	1	2	3	4	5	6	7
21. Few things would be able to replace smoking in my life.	1	2	3	4	5	6	7
22. I'm around smokers much of the time.	1	2	3	4	5	6	7
23. There are particular sights and smells that trigger strong urges to smoke.	1	2	3	4	5	6	7
24. Smoking helps me stay focussed.	1	2	3	4	5	6	7
25. Smoking helps me deal with stress.	1	2	3	4	5	6	7
26. I frequently light cigarettes without thinking about it.	1	2	3	4	5	6	7
27. Most of my daily cigarettes taste good.	1	2	3	4	5	6	7
28. Sometimes I feel like cigarettes rule my life.	1	2	3	4	5	6	7
29. I frequently crave cigarettes.	1	2	3	4	5	6	7
30. Most of the people I spend time with are smokers.	1	2	3	4	5	6	7
31. Weight control is a major reason that I smoke.	1	2	3	4	5	6	7
32. I usually feel much better after a cigarette.	1	2	3	4	5	6	7
33. Some of the cigarettes I smoke taste great.	1	2	3	4	5	6	7
34. I'm really hooked on cigarettes.	1	2	3	4	5	6	7
35. Smoking is the fastest way to reward myself.	1	2	3	4	5	6	7
36. Sometimes I feel like cigarettes are my best friends.	1	2	3	4	5	6	7

37. My urges to smoke keep getting stronger if I don't smoke.	1	2	3	4	5	6	7
38. I would continue smoking, even if it meant I could spend less time on my hobbies and other interests.	1	2	3	4	5	6	7
39. My concentration is improved after smoking a cigarette.	1	2	3	4	5	6	7
40. Seeing someone smoke makes me really want a cigarette.	1	2	3	4	5	6	7
41. I find myself reaching for cigarettes without thinking about it.	1	2	3	4	5	6	7
42. I crave cigarettes at certain times of day.	1	2	3	4	5	6	7
43. I would feel alone without my cigarettes.	1	2	3	4	5	6	7
44. A lot of my friends or family smoke.	1	2	3	4	5	6	7
45. Smoking brings me a lot of pleasure.	1	2	3	4	5	6	7
46. Cigarettes are about the only things that can give me a lift when I need it.	1	2	3	4	5	6	7
47. Other smokers would consider me a heavy smoker.	1	2	3	4	5	6	7
48. I feel a strong bond with my cigarettes.	1	2	3	4	5	6	7
49. It would take a pretty serious medical problem to make me quit smoking.	1	2	3	4	5	6	7
50. When I haven't been able to smoke for a few hours, the craving gets intolerable.	1	2	3	4	5	6	7
51. When I do certain things I know I'm going to smoke.	1	2	3	4	5	6	7
52. Most of my friends and acquaintances smoke.	1	2	3	4	5	6	7
53. I love the feel of inhaling the smoke into my mouth.	1	2	3	4	5	6	7
54. I smoke within the first 30 minutes of awakening in the morning.	1	2	3	4	5	6	7
55. Sometimes I'm not aware that I'm smoking.	1	2	3	4	5	6	7
56. I'm worried that if I quit smoking I'll gain weight.	1	2	3	4	5	6	7
57. Smoking helps me think better.	1	2	3	4	5	6	7
58. Smoking really helps me feel better if I've been feeling down.	1	2	3	4	5	6	7
59. Some things are very hard to do without smoking.	1	2	3	4	5	6	7
60. Smoking makes me feel good.	1	2	3	4	5	6	7
61. Smoking keeps me from overeating.	1	2	3	4	5	6	7
62. My smoking is out of control.	1	2	3	4	5	6	7
63. I consider myself a heavy smoker.	1	2	3	4	5	6	7
64. Even when I feel good, smoking helps me feel better.	1	2	3	4	5	6	7
65. I reach for cigarettes when I feel irritable.	1	2	3	4	5	6	7
66. I enjoy the sensations of a long, slow exhalation of smoke.	1	2	3	4	5	6	7
67. Giving up cigarettes would be like losing a good friend.	1	2	3	4	5	6	7
68. Smoking is the easiest way to give myself a lift.	1	2	3	4	5	6	7

Smoking Log

Tobacco Use Record Form**Instructions for Patient:**

- **Complete this form each day.**
- **Just before going to sleep, indicate how many cigarettes you have smoked that day.**
- **Be honest... Accurate information is important to success!**

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 1							
Week 2							

Positive and Negative Affect Schedule – Short Form

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

1. Inspired
2. Enthusiastic
3. Alert
4. Excited
5. Determined
6. Afraid
7. Upset
8. Nervous
9. Scared
10. Distressed

Post-Treatment Interview Questions

Please answer these questions that deal with your reactions to the training program. Circle the response that best describes your reactions.

- | | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | Definitely | Probably | | Probabl | Definitely |
| | not | not | Possibly | y | |
| 1. Do you think you are addicted to smoking? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
2. Are you seriously thinking of quitting?
- Yes, within the next 30 days
- Yes, within the next 6 months
- No, not thinking of quitting
3. There were two conditions in this study. In one condition, participants were asked to meditate by focusing their attention on what was around them, on how they were feeling, and on what they were thinking. In the other condition, participants were asked to let their minds wander. What condition do you believe you were in?
- a. Meditation condition
- b. Mind wandering condition
4. Overall, did you like this program, meaning you found it acceptable?
- a. Completely unacceptable
- b. Somewhat unacceptable
- c. Neither acceptable nor unacceptable (neutral)
- d. Somewhat acceptable
- e. Very acceptable

5. If this intervention was not acceptable, why?
-
6. Did the program change how you experience internal events (thoughts, emotions or sensations)?
- Did not change at all
 - Changed a little
 - Changed somewhat
 - Changed a lot
 - Completely changed
7. Did the program change how you experience external events (situations in your life)?
- Did not change at all
 - Changed a little
 - Changed somewhat
 - Changed a lot
 - Completely changed
8. Did the program change your desire to smoke?
- Did not change at all
 - Changed a little
 - Changed somewhat
 - Changed a lot
 - Completely changed
9. Did the program change your smoking habits?
- Did not change at all
 - Changed a little
 - Changed somewhat

- d. Changed a lot
 - e. Completely changed
10. Was meditating 20 minutes per day reasonable?
- a. Very unreasonable
 - b. A little unreasonable
 - c. Not reasonable, but not unreasonable
 - d. A little reasonable
 - e. Very reasonable
11. How likely are you to recommend this program to a friend?
- a. Very unlikely
 - b. Quite unlikely
 - c. Not unlikely but not likely
 - d. Quite likely
 - e. Very likely
12. How likely would you be to volunteer for a similar program that continues for up to one month?
- a. Very unlikely
 - b. Quite unlikely
 - c. Not unlikely but not likely
 - d. Quite likely
 - e. Very likely
13. Please indicate any suggestions you have for improving the course.

14. Please provide any other thoughts, comments, or reactions that you would like to add.

Appendix B USUHS IRB Approval Letter



UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES

4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND 20814-4799
www.usuhs.mil



March 14, 2012

MEMORANDUM FOR CPT AIMEE RUSCIO, MS, USA, MEDICAL AND CLINICAL PSYCHOLOGY

SUBJECT: USUHS IRB #1 (FWA 00001628; DoD Assurance P60001) Approval of TO72MR for Human Subjects Participation

Congratulations! The *Initial Review* for your no more than minimal risk human subjects research protocol TO72MR, entitled "Brief Mindfulness Meditation Training in Smokers," was reviewed and approved for execution on March 14, 2012 by Edmund Howe, M.D., J.D., Chair IRB #1 under the provision of 32 CFR 219.110(b)(1)Suppl.F(7). This approval will be reported to the USU IRB #1 scheduled to meet on April 12, 2012.

The purpose of this behavioral research study is to evaluate the effect of Brief Mindfulness Meditation (BMM) administered via PDA on thoughts and emotions related to smoking. The specific aims of the project are to determine the feasibility of a BMM delivered on a PDA for smoking, examine the effect of BMM on cognitive processes, affective processes, nicotine dependence, and smoking behavior, and examine attentional bias, a decentered perspective, positive affect, and negative affect as mediators of the relationship between BMM (vs. control) and tobacco dependence and smoking behavior. Up to 40 participants recruited from the Washington, D.C. metropolitan area will take part in this study.

Authorization to conduct protocol TO72MR will automatically terminate on March 13, 2013. If you plan to continue data collection or analysis beyond this date, IRB approval for continuation is required. Please submit a USU Form 3204 A/B, application for continuing approval 60 days prior to your termination date. You will receive a reminder from IRBNet.

You are required to submit amendments to this protocol, changes to the informed consent document (if applicable), adverse event reports, and other information pertinent to human research for this project in IRBNet. No changes to this protocol may be implemented prior to IRB approval. If you have questions regarding this IRB action or questions of a more general nature concerning human participation in research, please contact Micah Stretch at 301-295-0819 or mstretch@usuhs.mil.

This document has been signed electronically.

"Electronic Signature Notice: In accordance with the "Government Paperwork Elimination Act" (GPEA) (Pub.L. 105-277; codified at 44 USC 3504); Federal and DOD applicable instructions, directives and regulations, documents have been electronically signed and authorized by all who have been required to do so. These signatures have the same effect as their paper-based counterparts. Verification is retained within our protected electronic records and audit trails."

Appendix C Informed Consent Document



UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND 20814-4712
www.usuhs.mil



1

UNIFORMED SERVICES UNIVERSITY
BETHESDA, MARYLAND

This consent form is valid only if it contains the "USUHS IRB Approved" stamp. Do not sign this form or participate in this research if the IRB stamp is not present or if it has expired.

USUHS IRB APPROVED
 11/25/14
 Expires: 11/25/15

Consent for Voluntary Participation in a Non-Clinical Research Study

1. INTRODUCTION OF THE STUDY

You are being asked to be in a research study entitled "Brief Mindfulness Training in Smokers" at the Uniformed Services University of the Health Sciences (USUHS), Bethesda, Maryland. You have been asked to take part in this study because you are a smoker. Your participation is voluntary. Refusal to participate will not result in any punishment or loss of benefits to which you are otherwise permitted. Please read the information below, and ask questions about anything you do not understand, before deciding whether to take part in the study.

2. PURPOSE OF THE STUDY

The purpose of this behavioral research study is to evaluate the effect of mindfulness meditation on thoughts and emotions related to smoking. Results from this study may help researchers create more effective cessation (quitting) programs in the future. If you agree to be part of the study, and you are eligible, you will be randomly assigned to one of two training conditions. You will not know which condition you are in. This is the normal procedure in this type of study. In previous research by other investigators, the mindfulness training has been delivered in a group setting over the course of several weeks. This research has shown that mindfulness training can influence smokers' withdrawal symptoms, tobacco dependence, and smoking. In this study, we want to see if a self-administered, brief version of mindfulness training will effectively influence attention, perspective towards negative emotions, positive and negative emotions, and smoking. We are also interested in measuring these processes using a Personal Digital Assistant (PDA).

3. PROCEDURES TO BE FOLLOWED

If you are eligible, you will attend up to 3 laboratory sessions in Building 28 at USUHS over the course of two weeks. The first laboratory session will last about 120 minutes. The second and third laboratory sessions will last about 75 minutes. You first attend an orientation session (today's session). Research staff will answer any questions you may have. If you are eligible and you agree to be in this study, a research staff member will give you informational material describing mindfulness. You will be asked to complete some brief questionnaires assessing your demographics (such as your age and income), your smoking, and your personality. A research assistant will show you how to use the PDA. You will practice meditating while listening to a recording for approximately 20 minutes. You will complete an assessment on the

Subject's initials _____ Date _____
 Witness initials _____ Date _____

PDA. You will be given a smoking diary and asked to record the number of cigarettes you smoke each day for the next two weeks. You can smoke as much or as little as you like during the two weeks.

You will be asked to carry a PDA around with you for two weeks. The PDA will beep you at random times during the day (about 4 times each day). After the PDA beeps you, you will be asked to respond to a series of questions which ask you how you are feeling at that time. You will perform a reaction time task on the PDA. Each PDA assessment should last about 10 minutes in total.

You will be asked to practice meditation for twenty minutes each day for two weeks. The meditation recordings will be on the PDA. A research assistant will explain how to access the recordings. You may meditate at a time of your choosing. Following each meditation session, you will indicate that you have completed your meditation for the day on the PDA. After making that indication, you will complete a ten minute assessment similar to the assessment described above.

After one week, you will be asked to attend a second session at which time you will bring the PDA and the smoking diary. You will complete a series of reaction-time tasks and answer a series of questions in the laboratory. The session will last approximately one hour and fifteen minutes.

After an additional week, you will be asked to attend a third session at which time you will return the PDA and the smoking diary. You will again complete a series of reaction-time tasks and answer a series of questions in the laboratory. The session will last approximately one hour and fifteen minutes.

At each laboratory session, you will be asked to provide a breath sample and a saliva sample. The breath sample and the saliva sample will help the researchers find out how much you have smoked. At the orientation (first) session, the level of carbon monoxide in your breath must be above a certain level in order for you to be eligible for the study. Your craving for cigarettes will also be assessed.

When your participation in the study is over, you will be offered self-help materials for quitting smoking and a referral to smoking cessation programs.

4. NUMBER OF PEOPLE THAT WILL TAKE PART IN THIS STUDY

Up to 50 individuals are expected to participate in this study.

5. AMOUNT OF TIME FOR YOU TO COMPLETE THE STUDY

Participation of this study will require in total about 16 hours of your time over a period of about 2 weeks.

6. ELIGIBILITY AND PAYMENT FOR BEING IN THIS STUDY

Criteria: To qualify, you have to be current smokers, report smoking 10 or more cigarettes per day

USUHS IRB APPROVED
 11/01/01
 Expires: 11/01/03

Subject's initials _____ Date _____
 Witness initials _____ Date _____

for the past two years, and be aged 18 – 65. If you are a federal civilian employee or member of the military you must have your supervisor's approval for participation. Exclusion criteria are: expired breath carbon monoxide levels lower than 10 ppm; regular use of tobacco products other than cigarettes; current use of smoking cessation medications (bupropion, varenicline, or nicotine products); currently engaged in other treatment for tobacco cessation; or any other factor that, in the judgment of the investigators, would likely preclude completion of the protocol.

Participation:

Civilians and military personnel may participate in this study. Federal civilians and military personnel must provide the investigators with a signed Statement of Approval form.

Compensation:

Non-federal civilians may receive compensation for their participation in this study. Federal employees, military or civilian, cannot receive compensation for their participation.

Eligible non-federal civilians will receive \$50 for the orientation session and \$15 for the second laboratory session and the third laboratory session. Non-federal civilians will receive \$5 for each home meditation practice they complete and \$1 for each PDA assessment that they complete. If a non-federal civilian completes all scheduled PDA assessments, they will receive approximately \$215 (\$50 (orientation session) + \$15 (second laboratory session) + \$15 (third laboratory session) + (\$5 x 12) (home meditation practice) + (\$1 x 75) (PDA assessments)). Ineligible non-federal civilians will receive \$25.

A check will be mailed to civilians following completion of the study. Checks may take 4 to 6 weeks to be mailed.

7. POSSIBLE RISKS OR DISCOMFORTS FROM BEING IN THIS STUDY

The risks or discomforts from being in this study are expected to be minimal. There are no known risks associated with practicing meditation, completing the laboratory assessments, or the PDA assessments. There is no reason to believe that your smoking will be increased by participation in the study.

You may refuse to answer any question that makes you feel uncomfortable.

8. POSSIBLE BENEFITS FROM BEING IN THIS STUDY

There are no direct benefits associated with participating in this study. The information we learn may help develop better smoking cessation programs."

9. CONFIDENTIALITY/PRIVACY AND HOW YOUR IDENTITY AND YOUR RESEARCH RECORDS WILL BE MAINTAINED

All information you provide as part of this study will be confidential and will be protected to the fullest extent provided by law. Your responses to our laboratory and PDA assessments will be

Subject's initials _____ Date _____
 Witness initials _____ Date _____

USUHS IRB APPROVED
 14 JUL 2012
 Expires: 14 AUG 2012

maintained in a locked filing cabinet or on a password-protected computer in lab offices in the Department of Medical and Clinical Psychology. All records related to this study will be accessible to those persons directly involved in conducting this study and members of the USUHS Institutional Review Board (IRB), which provide oversight for protection of human research volunteers. In addition, the IRB at USUHS and other federal agencies that help protect people who are involved in research studies, may need to see the information you give us. Other than those groups, records from this study will be kept private to the fullest extent of the law. Scientific reports that come out of this study will not use your name or identify you in any way.

10. CONDITIONS WHICH YOUR PARTICIPATION IN THIS STUDY MAY BE STOPPED WITHOUT YOUR CONSENT

The investigator may stop you from taking part in this study if being in the study is unsafe or dangerous to you. The investigator may also stop you participating if you experience difficulty in following the procedures.

11. IF YOU DECIDE TO STOP TAKING PART IN THIS STUDY AND THE INSTRUCTIONS FOR STOPPING EARLY

You have the right to withdraw from this study at any time. If you decide to stop taking part in this study, you should tell the principal investigator as soon as possible. You may request that experimenters destroy all data and biological samples that you have submitted upon withdrawal. Data and samples submitted prior to withdrawal will be maintained and included in study analyses, unless destruction is requested upon withdrawal.

12. RECOURSE IN THE EVENT OF INJURY

If at any time you believe you have suffered an injury or illness as a result of participating in this research project, you should contact the Director of Human Research Protections Programs at the Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814-4799 at (301) 295-9534. This office can review the matter with you, can provide information about your rights as a subject, and may be able to identify resources available to you. If you believe the government or one of the government's employees (such as a military doctor) has injured you, a claim for damages (money) against the federal government (including the military) may be filed under the Federal Torts Claims Act. Information about judicial avenues of compensation is available from the University's General Counsel at (301) 295-3028.

CONTACT FOR QUESTIONS OR PROBLEMS

If you have questions about this research, you should contact Aimee Ruscio, the person in charge of the study. Aimee's number at USUHS is 301 295-0802. Even in the evening or on weekends, you can leave a message at that number. If you have questions about your rights as a research subject, you should call the Director of Human Research Protections Programs at USUHS at (301) 295-9534. She is your representative and has no connection to the researcher conducting this study.

SIGNATURE OF RESEARCH PARTICIPANT OR LEGAL REPRESENTATIVE

You have read (or someone has read to you) the information in this consent form. You have

Subject's initials _____ Date _____
 Witness initials _____ Date _____

USUHS IRB APPROVED
 14 JULY 2012

Expires: 14 MARCH 2013

5

been given a chance to ask questions and all of your questions have been answered to your satisfaction.

BY SIGNING THIS CONSENT FORM, YOU FREELY AGREE TO TAKE PART IN THE RESEARCH IT DESCRIBES.

Participant's Signature

Date

Participant's Printed Name

USUHS IRB APPROVED
 1/3/2017
 Expires: 1/31/2018

SIGNATURE OF INVESTIGATOR/RESEARCH TEAM MEMBER

You have explained the research to the participant, or his/her legal representative, and answered all of his/her questions. You believe that the volunteer subject understands the information described in this document and freely consents to participate.

Investigator's/Research Team Member's Signature Date (must be the same as the participant's)

Investigator's/ Research Team Member's Printed Name

SIGNATURE OF WITNESS

Your signature as witness is intended to attest that the information in the consent document and any other information was explained to and apparently understood by the participant, or the participant's legal representative, that questions and concerns were addressed and that informed consent was freely given.

Witness' Signature

Date (must be the same as the participant's)

Witness' Printed Name

Subject's initials _____ Date _____
 Witness initials _____ Date _____

Appendix D Brief-MM and Control Scripts

Experimental 1: Urge-surfing

While listening to today's meditation, you will need a pack of cigarettes, a lighter and a paper, and a pencil. Please pause this recording and go get these items. Once you have the items, restart the recording from the beginning.

Imagine that you have made the decision not to smoke. Think of things that have made you consider cutting down or quitting. What are the reasons that you would decide to change your smoking? Take a moment to briefly write down a few of those reasons on the paper in front of you. When you have finished, put your pen down. Now take a moment to read over those reasons. Remember, for today, we are asking you to imagine that you have made the decision to substantially cut down or quit smoking.

We are going to ask you to do several tasks involving the cigarettes in front of you. During those tasks, you will hear some instructions about what to do with any thoughts and feelings that you have about smoking. Please listen to the instructions carefully. There will be four sets of them, each lasting only a few minutes.

Exposure 1

Please open your pack of cigarettes, but do not remove one from the pack. Place the opened pack on the table in front of you and look at it. Keep your eyes on the pack of cigarettes throughout the next few minutes.

Instruction 1.

During the next few minutes, you might notice thinking about smoking or cravings for cigarettes. Sometimes it is possible to change these thoughts, or push them away, and sometimes that isn't possible. Sometimes trying to get rid of a thought actually makes it stronger. Consider that you might be thinking about wanting to smoke. Regardless of the content of your thinking, you don't have to allow your thinking to control your actions. You can just notice "thinking" and continue to stay in the room, listening to the instructions. For example, you can think, "I can't stand this craving. I have to smoke a cigarette," and still stay right here and continue listening, without needing to change your thinking or make it go away. So if thoughts arise, try noticing them, being curious about them, and accepting them without any judgment of their being good or bad; right or wrong. Don't fight them; just relax, noticing

them as they come and go, and continuing to stay in the room, refraining from smoking and paying attention to the instructions.

Exposure 2

Now I would like you to take a cigarette from the pack in front of you. Hold it for a few seconds in your hand, then place the cigarette on the table in front of you, continuing to look at it.

Instruction 2

During the next task, notice whatever thoughts or sensations show up, observe them, become interested in them, and let them stay with you; you don't need to try to make them go away. Try to experience thoughts and sensations as neither good nor bad, but just as events that will arise and pass. Notice all the thoughts and sensations that show up and let them stay with you or pass as they please. [pause] Remember that having thoughts or sensations doesn't mean you have to act on them; you can make room for your thoughts and sensations, and still remain here, relaxing, and paying attention to these instructions. Staying with any thoughts you are having, and any emotions or physical sensations as they arise and grow in intensity. Being curious about them.– what are the thoughts? What do the sensations feel like? If your mind wanders, just gently bring it back to what you are experiencing right now. Allowing any craving or discomfort to be present, noticing it, exploring it, and accepting it without judgment.

Exposure 3

Please pick up the cigarette in front of you and hold it in your hand as though you were about to put it into your mouth. Do not bring it to your lips; just hold it between your fingers. (10 second pause)

Instruction 3

During your next your experience, see how closely you can pay attention to what you are thinking and feeling. Notice each thought that comes into your head, then let it pass. Observing it. Being interested in it. Trying not to label it as good or bad; just letting it be. Noticing what kind of thoughts you are having. It's possible that thoughts such as "I can't stand this. This is unbearable. It's stupid. It's not worth the effort" will show up. Or maybe, "I really want to smoke." Noticing all those thoughts and the distress they carry with them and just letting them be and observing them while you hold the cigarette and listen to what I am saying. Staying open, aware of, and curious about all the thoughts that show up and any associated discomfort that might accompany them. Remembering that you can have whatever thoughts and feelings you have, and still act differently than what you think or feel.

Experiencing craving, frustration or discomfort, and just observing it without acting on it or trying to make it go away.

Exposure 4

Please pick up the cigarette again, and this time place it in your mouth. Pick up the lighter, and bring it to the tip of the cigarette. I am going to ask you to ignite the lighter, but please do not light the cigarette. Hold the flame at least one inch from the end of the cigarette. Now, please put the lighter down, while keeping the cigarette in your mouth.

Instruction 4

Remember that for the purposes of this study, we are asking you to imagine that you have decided not to smoke. During the next few minutes, paying attention to any thoughts that might arise. Maybe you are thinking this is silly. Maybe you are thinking about how badly you would like to smoke. Again, noticing any thoughts arising, and bringing interest and close attention to them. Also noticing any physical sensations or changes in your body. Feeling your mouth watering, or your heart beat speeding up. Noticing these thoughts and sensations, and just letting them pass through your mind and your body. Remembering that you can be with any thoughts or feelings and still stay right here and be perfectly okay; they are only thoughts and feelings. Continue to stay here, relaxing and refraining from smoking. These feelings will arise, perhaps grow stronger, and then they will eventually pass.

Please put the cigarette down.

Thank you for practicing today.

Adapted from instruction set used in:

Bowen, S. & Marlatt, A. (2009). Surfing the urge: Brief mindfulness-based intervention for college student smokers. *Psychology of Addictive Behaviors, 23*(4), 666-671. Obtained through personal communication with the author.

Experimental 2: Mindfulness of the Breath

Settle into a comfortable sitting position, place your feet flat on the floor. It may be helpful to sit away from the back of the chair, so that your spine is self-supporting.

You can keep your eyes open or closed, whichever feels comfortable to you. You might want to experiment with both keeping your eyes open and allowing them to close for these exercises. Sometimes it is best to start with eyes closed to better focus your attention on your experience of what's going on in your mind and body. If you feel sleepy, keep the eyes open. If you keep your eyes open, let your gaze fall on a spot a few feet in front of you on the floor or on a wall or perhaps on a table.

Sit in any way that is comfortable to you. We want a relaxed posture, with our spine straight and our head resting easily on top of the spine. The head should be looking straight ahead, not leaning or turned to the right or left. The head can be tilted a little down so the eyes, if open, are aimed at a spot a few feet in front of the body. The idea is to sit in a posture that brings energy...that brings dignity to the practice, while still remaining relaxed, not stiff.

So just taking a moment now to find that posture.

10 sec

Take a few moments to release any tension you may feel in your face or in your body. Notice the tension around your eyes or in your forehead and allow it to release. Notice any tension in other parts of your body, your arms and legs, your back and again allow the tension to release. Allow yourself to settle into practice today.

Now, check in with yourself to see what the motivation is that brought you here, whether to improve your health, decrease your stress, perhaps to develop kindness for yourself or others. Just notice what it is. Now take a moment and just thank yourself for making the effort to be here right now. Notice what this feels like in the body. Now thank someone else, maybe family or a friend, for being there to support you in your journey. Again, notice what this feels like in the body.

Now bring your attention to the breath flowing in and out of your body. Notice the physical sensations that accompany the breath. Maybe a sensation at the tip of your nose or the gentle rise and fall of your abdomen. If it is helpful, you can inhale and exhale quickly through the nose to get a sense of where you feel the breath most strongly at your nostrils. Gently rest your

attention where you feel the breath the most, whether the nostrils or the abdomen. Simply rest your attention the breath. See if you can bring a curiosity to the sensations there -as if you're feeling them for the first time. What do they feel like?

1 min

If your attention wanders, gently bring it back. Over and over again, whenever the mind wanders, bring it back to the breath.

Focusing your attention on the sensations of each inbreath, and of gentle falling with each outbreath. As best you can, gently placing the attention on the beginning, middle and end of each inbreath and outbreath. Not trying to make the breath be a certain way or control it. Not commenting or judging how you are doing. Simply resting the attention on the breath. Notice how the breath breathes itself –you don't have to do anything but notice. Being curious and interested in the physical sensations of the breath each moment. What do they feel like? (pause) What do they feel like now?

Seeing if you can notice the slight pauses between the inbreath and the outbreath. Being inquisitive.

When you notice that the mind has wandered to something else, be it a thought, sound or body sensation, simply note where it has gone off to, and gently but firmly bring the attention back to the touch sensation of the breath wherever you feel it most strongly in the body. Notice how being curious about the sensations helps you stay naturally focused.

10 sec

If you notice a thought, just note to yourself "thinking", if you notice a sound just note "hearing" if you notice a body sensation, just note "feeling" etc., and then gently but firmly bring the attention back to noticing the touch sensation of the breath at the tip of your nose...or at the back of your throat...or in your abdomen. Simply, rest your attention on the breath in this moment.

1 min

Check in from time to time to see if your eyes and face are relaxed or if tension has built up.

Notice what these feel like and just let them relax and simply return to the breath. Resting your attention on the gentle rising of each inbreath and the gentle falling of each outbreath. What are the sensations that let you know that you are breathing? What do they feel like right now? Being playfully curious.

1min

If you find that it is difficult to keep the attention on the breath, just pay attention to one breath at a time. Just this one breath. When the mind wanders, note where it has gone off to and simply begin again. Gently bringing your attention back to the breath and noticing what it feels like in this moment.

30 sec

Notice how easy it is to pay attention to something you are interested in. You don't have to force your attention. This is where curiosity comes in: just relax and become fascinated with the physical sensations of the breath.

30 sec

Notice that the mind wanders. Its not a problem; it is simply what the mind does. Sometimes people are surprised at how busy their minds are...how challenging it is to keep the mind on the breath. It is entirely normal for the mind to wander. The important thing is to notice the difference from having been lost and being aware. And the moment that you notice that your mind has wandered is the same moment that awareness returns –delight in this, notice what it feels like to awaken. Each time you pay attention to this waking up to the moment and gently guide it back to the breath you strengthen the habit of paying attention. You strengthen your mindfulness.

1 min

If you notice that you are judging yourself for your mind wandering, or not doing a better job, or judging the experience because it isn't what you expect, just notice these as "thinking" and gently but firmly bring the attention back to the touch sensation of the breath. Again, being fascinated with the physical sensations of the breath.

1 min

If notice the mind has wandered. Delight in awakening to this moment and simply begin again. Just this one breath. Just this moment...just this breath. Resting attention on the breath. The gentle rising of each inbreath and the gentle falling of each outbreath...just this moment...just this breath. Curious. What does it feel like now?

3 min

In these last few moments, remind yourself that the practice is simply to be aware of your experience in this moment and to be curious and interested in it, as best you can, using the breath as an anchor to gently reconnect with what is arising right now. (pause)

Take a moment to reconnect with the intention that you set at the beginning of your practice.

Now gently expanding your focus to include the room around you. When you are ready, very gently allow your eyes to open.

Thank you for practicing today.

Adapted from:

Brewer, J., Bowen, S., & Chawla, N. (2010) *Mindfulness Training for Addictions: Smoking Edition*. Obtained through personal communication with the author.

Experimental 3: Mindfulness of the body

Allow your eyes to close gently. Taking a few moments to get in touch with the movement of your breath. When you are ready, bringing your attention to the physical sensations in your body, especially to the sensations of touch or pressure, where your body makes contact with the chair and the floor. On each outbreath, allowing yourself to let go, to sink a little deeper into your chair.

The intention of this practice is not to change anything or to feel different, relaxed, or calm; this may happen or it may not. Instead, the intention of the practice is, as best you can, bringing awareness and curiosity to any sensations you feel, as you focus your attention on each part of the body. Exploring the physical sensations in each moment, with a sense of wonder. If you find your mind wandering, gently notice the wandering and return to awareness of your body.

Check in with yourself to see what the motivation is that brought you here, whether to improve your health, decrease your stress. Just notice what it is. Now take a moment and thank yourself for making the effort to be present in this moment. What does it feel like in the body to be present in this moment?

Now bringing your awareness to the physical sensations in your abdomen, becoming aware of the sensations there as you breathe in, and as you breathe out. (pause) Taking a few minutes to feel the changing sensations, how they are different as you breathe in and then as you breathe out? Being curious and interested in the physical sensations of the breath each moment. What do they feel like? (pause) What do they feel like now?

Having connected with the sensations in the abdomen, bringing the focus of your awareness to the toes of the left foot. Focusing on each of the toes of the left foot in turn, bringing a gentle curiosity to the quality of sensations you find, **just noting what they feel like**: a sense of tingling, warmth, pressure, pulsing, or no particular sensation. If there are areas you can't feel, just keeping your focus there, bringing interest to whatever you can about how that area feels.

When you are ready, letting go of awareness of the toes, and bringing your awareness to the sensations on the bottom of your left foot, bringing a gentle, curious awareness to the sole of the foot, feeling all the sensation there. Now bringing your attention to the top of the foot, (pause), then to the ankle. Now moving it up to the calf, the knee. **Simply noting** as best you can all the sensations in these areas. You might think of your awareness as a spotlight, moving slowly through the body, bringing into focus any sensations in that area. Again, if there are areas where it is difficult to detect sensations, just bring a gentle curiosity to as much as you

can. Now bringing your attention to the left thigh. Noticing, with wonder, the sensations there. Maybe feeling the pressure of your leg against the chair.

Notice how easy it is to pay attention to something you are interested in. You don't have to force your attention. This is where curiosity comes in: just relax and become fascinated with the physical sensations of the body.

Throughout this exercise, the mind will inevitably wander away from the breath and the body from time to time. That is entirely normal. It is what minds do. When you become aware that the mind has wandered, , gently acknowledge it, noticing where the mind has gone off to, and then gently returning your attention to the physical sensations of the body. Awakening to the feelings in this moment. What do they feel like? (pause) What do they feel like now?

Now sending your attention down to the right foot, and to the right toes. Continue bringing awareness, and gentle curiosity, to the physical sensations, allowing whatever sensations are here to be here just as they are. **Noticing** what you are feeling in the bottom of your right foot, in the top of the foot, and the ankle (**pulsing, pressure, tingling, warmth** etc). Bringing your awareness, curiously exploring, your calf and noticing the sensations there. Now gently noticing the sensations in your knee.

If you feel any pain or discomfort in any of these areas, just be aware of it, and practice sending the breath there, and as best you can, letting the sensations be as they are. Bringing an open and accepting curiosity to the discomfort. Now gently guiding your awareness into your right thigh, noticing the sensations. Then to your hips and waist. Feel your weight on the chair, and all the sensations. Now move your focus slowly up to your abdomen. Feeling it rising and falling with each breath. Now move your awareness into your ribcage. Just feel as many sensations as you can. Now up to your chest and your shoulders.

If you notice your thoughts wandering, or if you become distracted by a sound or get restless, just **note this to yourself** as “thinking”, “hearing”, “restlessness” and gently guide your attention aback to the sensations in your body.

Guide your attention now to the fingers of your left hand. Feeling each finger and the places where they contact the chair or your body. Now up into your wrist and forearm. Bringing interest to all the sensations here. In your elbow, upper arm, to your shoulder. Notice any tension, tightness.

Now gently guide your attention now to the fingers of your right hand. Feeling each of them separately. Notice any tingling or urges to move them. Notice if there are fingers you are unable to feel as well as others. Now guiding your attention into the palm of your hand, and the wrist, the forearm and elbow. Now focusing on your upper arm and shoulder.

Let your attention now come into your neck. With curiosity, notice if there is tightness or tension. Be aware of areas in which it is harder to detect sensation. Now bringing your focus up the back of your head. See if you can feel the hair on your head. Bringing awareness and interest to your left ear, then over to the right ear. Now into your forehead.

Focus now on the sensations in your face. Your eyes, your cheeks, your nose. See if you can feel the temperature of the breath and if that changes when you breathe in and out. Feeling any sensation in your lips, your chin, any tightness in your jaw. Bringing awareness to the very top of your head.

Now, after you have “scanned” the whole body in this way, spend a few minutes being aware of and interested in the body as a whole, and of the breath flowing freely in and out of the body.
(pause)

Now very slowly and gently, while still maintaining an awareness of your body, when you are ready, gently open your eyes and allow your awareness to include the room.

Thank you for practicing today.

Adapted from:

Brewer, J., Bowen, S., & Chawla, N. (2010) *Mindfulness Training for Addictions: Smoking Edition*.
Obtained through personal communication with the author.

Experimental 4: Mindfulness of thoughts

Settle into a comfortable sitting position, place your feet flat on the floor. It may be helpful to sit away from the back of the chair, so that your spine is self-supporting.

You can keep your eyes open or closed, whichever feels comfortable to you. Throughout the course, you might want to experiment with both keeping your eyes open and allowing them to close for these exercises. Sometimes it is best to start with eyes closed to better focus your attention on your experience of what's going on in your mind and body. If you feel sleepy, keep the eyes open. If you keep your eyes open, let your gaze fall on a spot a few feet in front of you on the floor or on the wall/table.

How we sit during meditation is very important. We want a relaxed posture, with our spine straight and our head resting easily on top of the spine. The head should be looking straight ahead, not leaning or turned to the right or left. The head can be tilted a little down so the eyes, if open, are aimed at a spot a few feet in front of the body. The idea is to sit in a posture that brings energy to the practice, while still remaining relaxed, not stiff.

So just taking a moment now to find that posture.

Now, check in with yourself to see what the motivation is that brought you here, whether to improve your health, decrease your stress, whatever. Just notice what it is. Now take a moment and just thank yourself for making the effort to be here right now. Notice what this feels like in the body.

Now bringing your awareness to the sensations in your abdomen or your nostrils as the breath moves in and out of your body. If it is helpful to find the spot where you feel it most strongly. You can also pick a spot on your abdomen that rises and falls with each breath.

Focusing your attention on the sensations of each inbreath, and of gentle falling with each outbreath. As best you can, gently resting the attention on the beginning, middle and end of each inbreath and outbreath. Not trying to make the breath be a certain way or control it. Not commenting or judging how you are doing. Simply resting the attention on the breath.

Bringing curiosity and a sense of interest to each breath. Seeing if you can even notice the slight pauses between the inbreath and the outbreath.

When you notice that the mind has wandered to something else, be it a thought, sound or body sensation, note where it has gone off to, and gently rest the attention on the touch sensation of the breath wherever you feel it most strongly in the body. If it's a thought, just note "thinking", if it's a sound just note "hearing" if it's a body sensation, just note "feeling" etc., and then gently but firmly bring the attention back to noticing the touch sensation of the breath.

Check in from time to time to see if your eyes and face are relaxed or if tension has built up. Just let them relax and simply return your awareness to the breath.

If you find that it is difficult to keep the attention on the breath, just pay attention to one breath at a time. Just this one breath. When the mind wanders, note where it's gone off to and simply begin again.

Now let the breath fade into the background, and direct the attention to noticing thoughts as they arise. Like the breath, just notice them with openness and curiosity about what is happening in each moment.

Something you might try here is bringing awareness and interest to thoughts as they arise. Maybe they are judgments of yourself, or your experience right now. If so, just note that thought as "judging" and let it pass. If a memory arises, just note it as "remembering." If plans come to mind about what you are going to do later, just note that as "planning". Just gently note the thoughts as judgments, memories, plans, fantasies or any labels that work for you, and allow the thoughts to pass. If this feels too complicated you can simply note each thought as "thinking". If no labels come to mind, that's okay, too. Just continue to notice each thought as it comes up and passes away.

Notice how easy it is to pay attention to something you are interested in. You don't have to force your attention. This is where curiosity comes in: just relax and become fascinated with the passing stream of thoughts.

Notice that you have no control over the mind wandering or becoming aware again. It just does. Each time you pay attention to this waking up to the moment and gently guide it back to noticing thoughts you strengthen the habit of paying attention. You strengthen your mindfulness.

If you notice the mind has wandered. Delight in awakening to this moment and simply begin again.

If you notice body sensations that keep pulling the attention away from noticing thinking, you might bring some curious attention to these sensations. Like an explorer who has never mapped out these sensations before, see if you can detail what is arising in that part of the body right now. What are the raw sensations and what do they feel like? Do they change over time? Are there thoughts that arise that are associated with them? Is there any resistance to exploring them fully?

Now gently expanding your focus to include the room around you and the people here. When you are ready, very gently allow your eyes to open.

Thank you for practicing today.

Adapted from:

Brewer, J., Bowen, S., & Chawla, N. (2010) *Mindfulness Training for Addictions: Smoking Edition*. Obtained through personal communication with the author.

Experimental 5: Mindfulness of Emotions/RAIN

Settle into a comfortable sitting position, place your feet flat on the floor. It may be helpful to sit away from the back of the chair, so that your spine is self-supporting.

You can keep your eyes open or closed, whichever feels comfortable to you.

Find a relaxed posture, with our spine straight and our head resting easily on top of the spine. The idea is to sit in a posture that brings ardency/energy to the practice, while still remaining relaxed, not stiff.

So just taking a moment now to find that posture.

Now, check in with yourself to see what the motivation is that brought you here, whether to improve your health, decrease your stress, whatever. Just notice what it is. Now take a moment and just thank yourself for making the effort to be here right now. Notice what this feels like in the body.

Now bringing your awareness to the sensations in your abdomen or your nostrils as the breath moves in and out of your body.

Focusing your attention on the sensations of each inbreath, and of gentle falling with each outbreath. As best you can, gently placing the attention on the beginning, middle and end of each inbreath and outbreath. Not trying to make the breath be a certain way or control it. Not commenting or judging how you are doing. Simply encountering each breath with awareness and interest. Attending to the breath in each moment.

Seeing if you can even notice the slight pauses between the inbreath and the outbreath.

When you notice that the mind has wandered to something else, be it a thought, sound or body sensation, note where it has gone off to, and notice the return of awareness, as attention returns to the touch sensation of the breath wherever you feel it most strongly in the body. If it's a thought, just note "thinking", if it's a sound just note "hearing" if it's a body sensation, just note "feeling" etc., and then gently but firmly bring the attention back to noticing the touch sensation of the breath.

Check in from time to time to see if your eyes and face are relaxed or if tension has built up. Just let them relax and simply return to the breath.

If you find that it is difficult to keep the attention on the breath, just pay attention to one breath at a time. Just this one breath. When the mind wanders, note where it's gone off to and simply begin again.

Now let the breath fade into the background, and bring awareness and curiosity to noticing your emotions as they arise. Just like the breath, just notice them.

With a natural curiosity, allow your attention to rest on whatever is happening inside you right now. Try to let go of any thinking or judging about what is occurring and encounter your emotions as if you were feeling them for the first time. Asking yourself "what is the mind aware of right now?"

RECOGNIZing what is happening in this moment. As you begin to notice thoughts, feelings, emotions or sensations, **Recognize** them by allowing them to be just as they are. Without trying to change them. Without getting caught up in the good feelings or pushing away the bad feelings.

ALLOWing what is happening in this moment: Allowing feelings to be as they are is easy for good feelings yet it can be harder for difficult feelings. You may feel a desire to push difficult thoughts or feelings away. If you notice yourself trying to push away some feelings, ask yourself with kindness "Can I be with this just as it is?" It may help to remind yourself to "let it be."

INVESTIGATING what is happening in this moment: Allow yourself to **investigate** the emotions that you encounter. You may find that emotions build like a wave, crest, and then fall. You may notice thoughts, or sensations in your body that are linked to the emotion. Ask yourself "what is the mind aware of now?" Paying attention to whatever naturally arises without looking for different experiences.

NOTing what is happening in this moment: It may help to label whatever arises. If you notice a thought, label it "thinking." If you notice specific emotions arising, label them, such as "happy" or "sad" or "angry". If you notice an emotion, but are not sure what it is, simply label it "feeling" If you notice craving for a cigarette, label it "craving." For each of these experiences, notice them and allow them to be just as they are.

If you get distracted, or the mind shifts to something else, simply return to the investigation by repeating the question: "what is the mind aware of now?" See if you can ride it until it is completely gone. Ride it to shore.

This practice is also called RAIN. R for Recognizing, A for Allowing, I for Investigating, and N for Noting. It can be used to become aware of and explore difficult emotions or cravings in your day to day life. Remember to bring a gentle, kind curiosity to whatever is happening internally in this moment. It doesn't mean accepting the situations that caused the feelings, it simply means allowing the feelings...saying "yes!" to whatever you are experiencing right now.

Now gently expanding your focus to include the room around you and the people here. When you are ready, very gently allow your eyes to open.

Thank you for practicing today.

Adapted from:

Brewer, J., Bowen, S., & Chawla, N. (2010) *Mindfulness Training for Addictions: Smoking Edition*.
Obtained through personal communication with the author.

www.tarabrach.com

Control 1: Urge-surfing

While listening to today's meditation, you will need a pack of cigarettes and a lighter. Please pause this recording and go get these items. Once you have the items, restart the recording from the beginning.

Exposure 1

Please open your pack of cigarettes, but do not remove one from the pack. Place the opened pack on the table in front of you and look at it. Keep your eyes on the pack of cigarettes throughout the next few minutes.

Instruction 1.

During the next few minutes, you might have thoughts about smoking and cravings for cigarettes. I'd like you to deal with these in whatever way you normally would where you were in a situation in which you had decided not to smoke, or you were not allowed to smoke. For example, if you start to have the thought, "I can't stand this craving. I have to smoke a cigarette," just deal with that thought in whatever way you have in the past, while continuing to stay in the room, refrain from smoking and pay attention to my words.

Exposure 2

Now I would like you to take a cigarette from the pack in front of you. Hold it for a few seconds in your hand, then place the cigarette on the table in front of you, continuing to look at it.

Instruction 2

During the next few minutes, again, if you have any sensations thoughts or about smoking, think of how you normally deal with this. Whatever ways you usually use to cope with thoughts or cravings - that is what I want you to do now. In other situations you have been in where you have felt this way, what have you done to deal with it? How have you reacted to it? Do whatever you would usually do to deal with these thoughts or cravings. (pause) Remember, if you are having thoughts or sensations that are uncomfortable, just do what you usually do to deal with these. Whatever ways you think are most helpful, or whatever ways you have used in the past in similar situations, use those strategies now.

Exposure 3

Please pick up the cigarette in front of you and hold it in your hand as though you were about to put it into your mouth. Do not bring it to your lips; just hold it between your fingers. Just keep it in your hand for the next few minutes, keep your eyes on the cigarette. (10 second pause)

Instruction 3

During the next few minutes, again if you have any thoughts or feelings that come up about smoking, just deal with these as you usually would. For example, if you find yourself thinking, “I can’t stand this. This is unbearable.” Or “This is stupid. It’s not worth the effort,” think of other times you’ve felt that way, and how you’ve dealt with it. Use whatever techniques or attitudes you normally would. Similarly, if you start to feel anxious or uncomfortable, or if you experience craving, frustration or discomfort, just react to those feelings however you want to, doing whatever you usually would do.

Exposure 4

Please pick up the cigarette again, and this time, place it in your mouth. Pick up the lighter, and bring it to the tip of the cigarette. I am going to ask you to ignite the lighter, but please do not light the cigarette. Hold the flame at least one inch from the end of the cigarette again without lighting the cigarette. Now, please put the lighter down, while keeping the cigarette in your mouth. Now you can remove the cigarette from your mouth but please keep it on your hand throughout the next few minutes

Instruction 4

During the next few minutes, thoughts and physical sensations might arise. Again, if you have thoughts about smoking, any sensations that are uncomfortable, just deal with these however you normally would if you were in a sit where you had decided not to smoke or were not allowed to smoke. Think about how you’ve dealt with these thoughts and sensations in the past, different techniques you might have used, and just do that now. Again if thoughts come up about how this is silly or how much you’d like to smoke, just deal with those however you usually would. Think about what techniques you’ve used in the past or what ways might be helpful to deal with these thoughts and feelings, and try using those now.

Please put the cigarette down on the table.

Thank you for practicing today.

Adapted from instruction set used in:

Bowen, S. & Marlatt, A. (2009). Surfing the urge: Brief mindfulness-based intervention for college student smokers. *Psychology of Addictive Behaviors, 23*(4), 666-671. Obtained through personal communication with the author.

Control 2: Breath

Settle into a comfortable sitting position, place your feet flat on the floor. It may be helpful to sit away from the back of the chair, so that your spine is self-supporting.

You can keep your eyes open or closed, whichever feels comfortable to you. You might want to experiment with both keeping your eyes open and allowing them to close for these exercises. Sometimes it is best to start with eyes closed to better focus your attention on your experience of what's going on in your mind and body. If you feel sleepy, keep the eyes open. If you keep your eyes open, let your gaze fall on a spot a few feet in front of you on the floor or on a wall or perhaps on a table.

Sit in any way that is comfortable to you. We want a relaxed posture, with our spine straight and our head resting easily on top of the spine. The head should be looking straight ahead, not leaning or turned to the right or left. The head can be tilted a little down so the eyes, if open, are aimed at a spot a few feet in front of the body. The idea is to sit in a posture that brings energy...that brings dignity to the practice, while still remaining relaxed, not stiff.

So just taking a moment now to find that posture.

10 sec

Take a few moments to release any tension you may feel in your face or in your body. Notice the tension around your eyes or in your forehead and allow it to release. Notice any tension in other parts of your body, your arms and legs, your back and again allow the tension to release. Allow yourself to settle into practice today.

Begin by paying attention to the breath flowing in and out of your body. Notice anything that comes into your attention. You may find yourself having thoughts or feelings about a situation in your life or physical sensations that you are experiencing in your body. Follow those thoughts and feelings wherever they lead you.

1 min

If your attention wanders, follow it. Spend this time considering whatever seems to be most important to you right now.

1 min

Try not to control your attention, let it wander to whatever seems most important to you right now.

Think about your breath. Are you breathing deeply enough? Is it slow and steady? Seeing if you can notice the slight pauses between the inbreath and the outbreath.

1 min

When you notice that the mind has wandered to something else, be it a thought, sound or body sensation, note where it has gone off to, and follow the thoughts or feelings.

10 sec

If you notice a thought, see where it leads; if you notice a sound consider what it sounds like and whether it is pleasant or unpleasant. If you notice a body sensation, think about it. What does it feel like? What might be causing it? Let your mind wander freely and see where it goes. Spend a few more cycles of your breath letting your mind wander freely.

1 min

Check in from time to time to see if your eyes and face are relaxed or if tension has built up.

Just let them relax and simply return to whatever you were thinking about. Letting your mind wander freely to whatever seems most important.

1min

Remember to let you mind wander freely and follow those thoughts.

1 min

Keep allowing your mind to wander to whatever seems to be most important to you at the time. Follow those thoughts and feelings.

1 min

Remember to let you mind wander freely and follow your thoughts and feelings.

1 min

If you notice that you are judging yourself or judging the experience because it isn't what you expect, follow that train of thought.

1 min

Keep allowing your mind to wander to whatever seems to be most important to you at the time. Follow those thoughts and feelings.

3 min

In these last few moments, remind yourself that the practice is simply to follow your thoughts and feelings, as best you can, using the breath as an anchor to gently reconnect with what is arising right now. (pause)

Now gently expanding your focus to include the room around you. When you are ready, very gently allow your eyes to open.

Thank you for practicing today.

Adapted from:

Brewer, J., Bowen, S., & Chawla, N. (2010) *Mindfulness Training for Addictions: Smoking Edition*. Obtained through personal communication with the author. Original instructions were a mindfulness exercise.

Control 3: Body Scan

Allow your eyes to close gently. Taking a few moments to get in touch with the movement of your breath. When you are ready, considering the physical sensations in your body, especially to the sensations of touch or pressure, where your body makes contact with the chair and the floor. On each outbreath, allowing yourself to let go, to sink a little deeper into your chair.

The intention of this practice is not to change anything or to feel different, relaxed, or calm; this may happen or it may not. Instead, the intention of the practice is, as best you can, to think about any sensations you feel, as you allow your mind to wander, considering your body. If you find your mind wandering, follow it. See where the train of thoughts leads.

Now bringing your awareness to the physical sensations in your abdomen, think about the sensations there as you breathe in, and as you breathe out. (pause) Taking a few minutes to feel the changing sensations, how they are different as you breathe in and then as you breathe out.

Having connected with the sensations in the abdomen, bringing your thoughts to the toes of the left foot. Consider each of the toes of the left foot in turn. What do they feel like? Do you find the sensations to be pleasant or unpleasant? Are they good or bad? If there are areas you can't feel, think about why you may not be feeling as much in that area.

When you are ready, think about the sensations on the bottom of your left foot, again judging the sensations you feel in the sole of the foot. Consider your entire left leg and the sensations you feel. What comes to mind as you consider this part of your body? Follow any particular train of thoughts, or let your mind wander freely. Think of your mind as a hummingbird, moving quickly from place to place, never stopping, slowing, or resting. Again, if there are areas where it is difficult to detect sensations, think about why that might be the case.

Throughout this exercise, the mind will inevitably wander away from the breath and the body from time to time. That is entirely normal. It is what minds do. When you notice it, follow it. Let your thoughts wander freely to whatever seems to be most important to think about right now. Eventually return your attention to the part of the body.

Now consider the right foot, and to the right toes. Continue to think about the physical sensations, judging whatever sensations are here. Consider any sensations in your right leg up to the knee. Let your mind wander around different parts of your leg. If you find yourself thinking about something, an event that happened yesterday or that will happen tomorrow, follow the thoughts. Maybe you have are having thoughts about what you are feeling in the leg or about the exercise. Follow those thoughts to see where they may lead.

If you feel any pain or discomfort in any of these areas, think about it, and try to change the feelings. Now gently guide your awareness into your right thigh, thinking about the sensations. Then consider your hips and waist. Feel your weight on the chair, and all the sensations. Now

think about your abdomen. Feeling it rising and falling with each breath. Now consider your ribcage. Thinking about as many sensations as you can. Now up to your chest and your shoulders.

If you notice your thoughts wandering, or if you become distracted by a sound or get restless, follow the train of thoughts, think about what the sound may be or why you are restless.

Consider the fingers of your left hand. Feeling each finger and the places where they contact the chair or your body. Now up into your wrist and forearm. Considering all the sensations here. In your elbow, upper arm, to your shoulder. Think about any tension, tightness.

Now think about your right hand. Feeling each finger separately. Notice any tingling or urges to move them. Think about why you may want to move. Consider any fingers you are unable to feel as well as others. Why might this be? Now thinking about the palm of your hand, and the wrist, the forearm and elbow. Now considering your upper arm and shoulder.

Let your thoughts come into your neck. Consider any tightness or tension. Think about any areas in which it is harder to detect sensation. Now letting your mind wander towards any thoughts or feelings that you may have as you think about your head and shoulders.

Consider now the sensations in your face. Your eyes, your cheeks, your nose. Follow any thoughts or feelings you may have about your face. Let your thoughts wander, considering whatever seems most important to think about right now.

Now, after you have “scanned” the whole body in this way, spend a few minutes letting your mind wander freely. (pause)

Now very slowly and gently, while still maintaining an awareness of your body, when you are ready, gently open your eyes and allow your awareness to include the room.

Adapted from:

Brewer, J., Bowen, S., & Chawla, N. (2010) *Mindfulness Training for Addictions: Smoking Edition*. Obtained through personal communication with the author. Original instructions were a mindfulness exercise.

Control 4: Thoughts

Settle into a comfortable sitting position, place your feet flat on the floor. It may be helpful to sit away from the back of the chair, so that your spine is self-supporting.

You can keep your eyes open or closed, whichever feels comfortable to you. Throughout the course, you might want to experiment with both keeping your eyes open and allowing them to close for these exercises. Sometimes it is best to start with eyes closed to better concentrate on where your mind is wandering. If you feel sleepy, keep the eyes open. If you keep your eyes open, let your gaze fall on a spot a few feet in front of you on the floor or on the wall/table.

How we sit during meditation is very important. We want a relaxed posture, with our spine straight and our head resting easily on top of the spine. The head should be looking straight ahead, not leaning or turned to the right or left. The head can be tilted a little down so the eyes, if open, are aimed at a spot a few feet in front of the body. The idea is to sit in a posture that brings energy to the practice, while still remaining relaxed, not stiff.

So just taking a moment now to find that posture.

Now thinking about the sensations in your abdomen or tip of the nose as the breath moves in and out of your body. If it is helpful to find the spot where you feel it most strongly, you can inhale and exhale quickly through the nose to get a sense of where you feel the breath most strongly at the tip of the nose. You can also pick a spot on your abdomen that rises and falls with each breath.

Thinking about each inbreath, and each outbreath. Considering the quality of the breath. Too fast? Too slow? Too shallow? Too deep? Changing the breath to make it better. Thinking about how you are doing. Judging your progress.

Allow your mind to wander freely to whatever seems most important to think about right now. Maybe a situation that happened yesterday or something that you are trying to get ready for tomorrow. Whatever it is, follow your thoughts and feelings about the topic wherever they lead.

Check in from time to time to see if your eyes and face are relaxed or if tension has built up.

Just let them relax and simply return to allowing your mind to wander.

If you are having a difficult time today, consider why that might be and go back to letting your mind wander freely.

Now notice your thoughts as they arise. Just like the breath, just think about whether they are good or bad and whether you should try to change them.

Follow your thoughts. Maybe they are judgments of yourself, or your experience right now. If so, concentrate on that judgment and follow any other thoughts and feelings that are connected to it. If a memory arises, think about whether it is a happy memory or a sad memory. When was the last time you thought about that particular memory? Do you want to be remembering that time right now? Think about the meaning of the memory. If plans come to mind about what you are going to do later, take a few moments to plan. Make a list in your head or think about anything that you have to remember to do once you are done meditating.

Follow your thoughts, judgments, memories, plans, or fantasies. See where the train of thought leads you. Allow yourself to get lost in the train of thought.

Allow your mind to wander freely to whatever seems most important to think about right now.

Follow your thoughts, judgments, memories, plans, or fantasies. See where the train of thought leads you. Allow yourself to get lost in the train of thought.

If you notice body sensations that keep pulling the attention away from your thoughts, consider why that might be happening. Think about the sensations and whether they are pleasant or unpleasant. What does it mean that you are having these sensations right now?

Allow your mind to wander freely to whatever seems most important to think about right now.

Now gently expanding your focus to include the room around you and the people here. When you are ready, very gently allow your eyes to open.

Adapted from:

Brewer, J., Bowen, S., & Chawla, N. (2010) *Mindfulness Training for Addictions: Smoking Edition*. Obtained through personal communication with the author. Original instructions were a mindfulness exercise.

Control 5: Emotions/RAIN

Settle into a comfortable sitting position, place your feet flat on the floor. It may be helpful to sit away from the back of the chair, so that your spine is self-supporting.

You can keep your eyes open or closed, whichever feels comfortable to you. Throughout the course, you might want to experiment with both keeping your eyes open and allowing them to close for these exercises. Sometimes it is best to start with eyes closed to better concentrate on where your mind is wandering. If you feel sleepy, keep the eyes open. If you keep your eyes open, let your gaze fall on a spot a few feet in front of you on the floor or on the wall/table.

How we sit during meditation is very important. We want a relaxed posture, with our spine straight and our head resting easily on top of the spine. The head should be looking straight ahead, not leaning or turned to the right or left. The head can be tilted a little down so the eyes, if open, are aimed at a spot a few feet in front of the body. The idea is to sit in a posture that brings energy to the practice, while still remaining relaxed, not stiff. So just taking a moment now to find that posture.

Now thinking about the sensations in your abdomen or tip of the nose as the breath moves in and out of your body. If it is helpful to find the spot where you feel it most strongly, you can inhale and exhale quickly through the nose to get a sense of where you feel the breath most strongly at the tip of the nose. You can also pick a spot on your abdomen that rises and falls with each breath.

Thinking about each inbreath, and each outbreath. Considering the quality of the breath. Too fast? Too slow? Too shallow? Too deep? Changing the breath to make it better. Thinking about how you are doing. Judging your progress.

Allow your mind to wander freely to whatever seems most important to think about right now. Maybe a situation that happened yesterday or something that you are trying to get ready for tomorrow. Whatever it is, follow your thoughts and feelings about the topic wherever they lead.

Check in from time to time to see if your eyes and face are relaxed or if tension has built up. Just let them relax and simply return to allowing your mind to wander.

If you are having a difficult time today, consider why that might be and go back to letting your mind wander freely.

Now let the breath fade into the background, and think about your emotions as they arise. Just like the breath, just try to figure out if they are good or bad, pleasant or unpleasant.

Evaluate whatever is happening inside you right now. Carefully examine what is occurring, bringing a sharp, discerning presence to the emotions you are feeling.

RECOGNIZE As you begin to notice thoughts, feelings, emotions or sensations, **Recognize** them by determining whether you like them or not. Try to change them in a way that will help you to feel better. Focus on the good feelings or push away the bad feelings.

Interrupt: Interrupting your feelings may be difficult. Feel free to use any strategy that you normally would to help yourself feel better. If you notice a difficult feeling, ask yourself “How can I change this to make it better?” Remind yourself “I can control my feelings.”

Investigate: investigate the emotions that you encounter. You may find that emotions build like a wave, crest, and then fall. You may notice thoughts, or sensations in your body that are linked to the emotion. Ask yourself “what do I most want to experience right now?” Consider whatever you think is most important. Follow the thoughts and feelings that grab your attention.

Note: Think about whatever arises. If you notice a thought, consider whether it is good or bad, helpful or not helpful. If you notice emotions arising, determine whether they are pleasant or unpleasant and whether you should try to change them. If you notice craving for a cigarette, think about what you should do with it. For each of these experiences, notice them and evaluate them carefully.

If you get distracted, or the mind shifts to something else, follow it wherever it goes. Allow yourself to get caught up in the stream of thoughts and feelings. Take an active role and challenge and change your experience wherever necessary.

This practice can be used in your daily life. Remember to Recognize, Interrupt, Investigate, Note. It can be used to become aware of and control difficult emotions or cravings . Remember to bring a thoughtful evaluation to whatever is happening internally. It doesn't mean accepting the situations that caused the feelings, it simply means controlling the feelings...saying “I decide!” to whatever you are experiencing right now.

Now gently expanding your focus to include the room around you and the people here. When you are ready, very gently allow your eyes to open.

Adapted from:

Brewer, J., Bowen, S., & Chawla, N. (2010) *Mindfulness Training for Addictions: Smoking Edition*. Obtained through personal communication with the author. Original instructions were a mindfulness exercise.